Outmigration and Human Capital:
Homeward Bound or Gone for Good?

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The Problem of Outmigration in Illinois

Illinois has a well documented history of exporting significantly more of its high school graduates to out-of-state colleges than Illinois higher education institutions are able to attract from outside the state.

The overall percentage of outmigrants in a given high school graduating cohort is impressive. In a study focusing on the Illinois high school graduating class of 2002, Smalley, Lichtenberger, and Brown (2010) established that 30% of the direct four-year college entrants from the cohort matriculated to out-of-state institutions. This equated to 11% of the entire cohort and nearly 18% of those initially enrolling in any college (two-year or four-year) the fall semester after high school graduation (Gong & Presley, 2006).

According to the National Center for Education Statistics (NCES), among the states and U.S. territories, Illinois was ranked second to last in terms of total net-migration or the comparison of outmigration relative to inmigration, experiencing a net loss of 10,972 students (NCES, 2010). New Jersey is ranked last with a net loss of 29,544. The state of Maryland is third from last with -9,298, followed by Texas at -8,369 (NCES, 2010).

In historical context, Illinois has maintained this negative net migration since the 1960s when Gossman, Nobbe, and Patricelli (1968) reported a net loss of 9,077 students. In a study that took place two decades later, Johns and Viehland (1989) reported a similar migration pattern for Illinois that held true irrespective of institutional sector (i.e. public vs. private). Studies in the 1990s and later demonstrate the apparent intractability of this pattern, with Illinois consistently showing a negative net migration (Barbett, 1998; Hsing & Mixon, 1996; U.S. Department of Education, 1998; U.S. Department of Education, 2010). Recently, an examination of the 2008 freshman migration results showed that 24% of the 2008 fall freshman class from Illinois outmigrated; this was six percentage points higher than the national average (18%) and equated to a net loss of roughly 3,000 students (U.S. Dept. of Education, 2010). Further, from 1996 to 2008, national averages in the rate of outmigration remained relatively unchanged while outmigration within Illinois increased significantly.

The net loss of 10,972 Illinois high school graduates is roughly the equivalent of the entire population of several well-sized municipalities within the state, such as Plano, Minooka, and Summit (U.S. Census Bureau, 2010).

Consequences of Outmigration

It has long been assumed that states with high outmigration rates suffer in the long term as, upon graduation, students who initially attend out-of-state higher education institutions are more likely to reside outside their state of origin than their counterparts who enrolled at in-state institutions. This represents a significant loss of tax revenue for the state (Smith & Wall, 2006). Research has also shown that the students most likely to outmigrate are those deemed most ready for college. Given the level of students' academic and workforce potential, outmigration represents a significant loss of human capital (Smalley et al., 2010).

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Who Outmigrates?

Previously, IERC research has established that Illinois outmigrants differ from students who opt to enroll at Illinois institutions of higher education in crucial ways (Gong & Presley, 2006; Manley, Dietrich, & Lichtenberger, 2013; Smalley et al., 2010). Race appeared to factor into one's likelihood of outmigration, as African Americans and Whites who directly entered four-year colleges had substantially higher rates of outmigration relative to their Asian American and Latino peers (Smalley et al., 2010). Also, when overall enrollment is considered (i.e., rate of outmigration among all college-going students), the rate of outmigration for African Americans slightly exceeded that of Whites (Gong & Presley, 2006; Manley et al., 2013).

> Factors related to financial need or the lack thereof were among the most significant predictors of outmigration.

Factors related to financial need or the lack thereof were among the most significant predictors of outmigration, as the students with less financial need (i.e., those falling in the upper income quartile, as well as those not expecting to work) were significantly more likely to enroll out-of-state (Gong & Presley, 2006; Manley et al., 2013; Smalley et al., 2010). Outmigrants from Illinois tended to be from wealthier families and were typically more college ready, particularly in math, than their counterparts who enrolled at in-state four-year institutions (Manley et al., 2013), as well as community colleges (Gong & Presley, 2006). In terms of academic preparation, the students deemed most ready for college—those with the highest grade point averages and highest ACT scores—generally had the highest rates of outmigration; even after taking into consideration family income (Gong & Presley, 2006; Manley et al., 2013).

High school characteristics also had an apparent impact on outmigration, as students who graduated from better funded schools had the highest rates of outmigration (Smalley et al., 2010). School-level academic performance on the ACT was a significant predictor of outmigration even after accounting for individual-level differences on the same test (Manley et al., 2013). Students from high schools with higher mean ACT composite scores were significantly more likely to outmigrate relative to their counterparts from lower performing schools.

> Students who graduated from better funded schools had the highest rates of outmigration.

Differences based on locale are somewhat more nuanced, as proximity to in-state four-year colleges appeared to have an impact for direct four-year college entrants outside of Chicago and its suburbs (Smalley et al., 2010). Among the regions outside of Chicago, students with greater access and closer proximity to in-state four-year colleges were less likely to outmigrate. Among the students from Chicago and the Northeast region, students from the Chicago suburbs were substantially more likely to enroll out-of-state than their counterparts from the City of Chicago.

Research Questions

Given the present and historical problem of outmigration, we are left with the following questions: Do outmigrants return home to work and find employment in Illinois? And if so, how long does this take? Further, to what extent do these outcomes vary from what we would have expected based on an observationally equivalent group of students who opted to attend Illinois-based colleges?

Methods

Propensity Score Approach

This current study seeks to determine the long-term Illinois employment trends for outmigrants. We take a quasi-experimental approach known as propensity score matching in an effort to contextualize the employment outcomes of the outmigrants. Propensity score matching allows us to determine the following counterfactual: what would have happened if the outmigrants had instead enrolled and earned their degrees at an Illinois-based higher education institution?

Propensity scores are conditional probabilities of exposure to a treatment given a particular set of observed characteristics (Joffe & Rosenbaum, 1999; Rosenbaum & Rubin, 1985). These scores are derived using a model that predicts membership in the treatment group. Typically, propensity scores are derived using logistic regression models (Stuart, 2010). For the purposes of this study, we consider the treatment to be earning a bachelor's degree at an out-of-state institution and potential comparison group members were baccalaureate earners from Illinois four-year institutions.

Once propensity scores are derived, propensity score matching is a process used to identify a group of outmigrants with a similar distribution of observable characteristics as those students who earned their degrees in Illinois institutions (stayers). In this study, matches between outmigrants and stayers using propensity scores helps isolate the effect of outmigration on subsequent employment within Illinois.

We argue that any differences in the Illinois-specific employment outcomes between the outmigrants and the stayers are representative of the treatment effect associated with outmigration. In other words, the outcomes specific to the stayers, or the comparison group, provide the answer to our counterfactual: what we would have expected if the outmigrants had instead attended Illinois-based colleges. The differences, if any, between the expected outcomes and the actual outcomes of the outmigrant group are attributable to the treatment, outmigration.

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Data

The data were made available to IERC researchers under shared data agreements with the Illinois Board of Higher Education, the Illinois Department of Employment Security, and ACT. The college enrollment and degree completion information was obtained from the National Student Clearinghouse, a national collaborative, covering 92% of college enrollments in the U.S. (National Student Clearinghouse, 2010).

Initial Study Sample and Delimitations

We initially drew from the entire population of bachelor's degree earners from the Illinois high school graduating class of 2003 (41,929 of 128,323), which included graduates of public and private high schools. Bachelor's degree completion was tracked until the end of

the spring semester of 2010 or seven years after high school graduation. As illustrated in Figure 1, the population of bachelor's degree earners equated to roughly 33% of the entire high school graduating class.
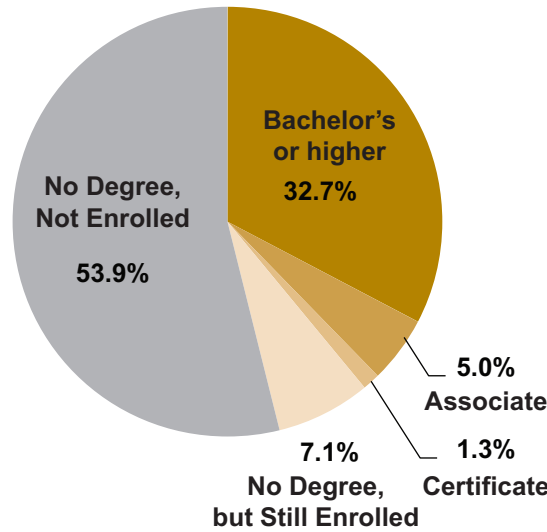

Figure 1. End of study status for the Illinois high school class of 2003 (N=128,323).

As shown in Figure 2, among our population of bachelor's degree earners (N=41,929), slightly more than two-thirds (68%) had earned their degree at an Illinois four-year institution (n=28,572), while the remaining 32% earned their degree outside of the state and were therefore considered outmigrants (n=13,357). The outmigrants, as defined in the current study, accounted for more than 10% of the Illinois High School Graduating Class of 2003, whereas stayers comprised slightly more than 22% of that cohort.

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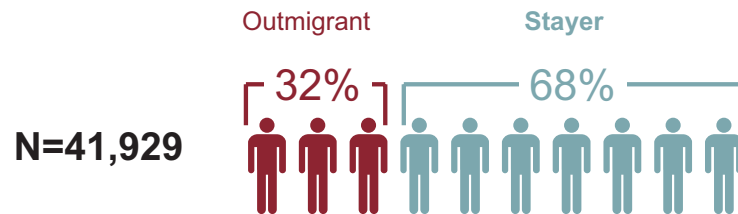
Figure 2. Outmigration status prior to delimitations.

Destination of Illinois Outmigrants

As illustrated on the map in Figure 3, Illinois outmigrants were a fairly well-traveled group. Members of the study group graduated from colleges in every U.S. state, in addition to Washington, DC. The highest proportions of Illinois outmigrants attended schools in nearby states, most notably Indiana, Iowa, Wisconsin, and Missouri (each accounted for at least 10% of the Illinois outmigrants). The aforementioned four states accounted for more than one-half of all Illinois outmigrants in the study group. Ohio and Michigan fell into the next grouping of states (5.0% to 9.9%) and together comprised roughly 11% of the Illinois outmigrants. Therefore, more than 60% of Illinois outmigrants attended college in six nearby but not necessarily neighboring (e.g., Ohio) states, all of which are considered midwestern.

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The next grouping (2.0% to 4.9%) included six states, all of which were located outside the Midwest. These states, such as Arizona and Colorado, in total accounted for approximately 15% of all Illinois outmigrants. Nine states fell into the 1.0% to 1.9% category, with only Kentucky and Tennessee (and to a lesser extent Kansas) in close geographic proximity to Illinois. Washington, DC fell into this grouping as well. More than half of the states fell into the bottom grouping (<1.0%); yet, in total these 27 states accounted for only slightly more than 8% of the Illinois outmigrants.
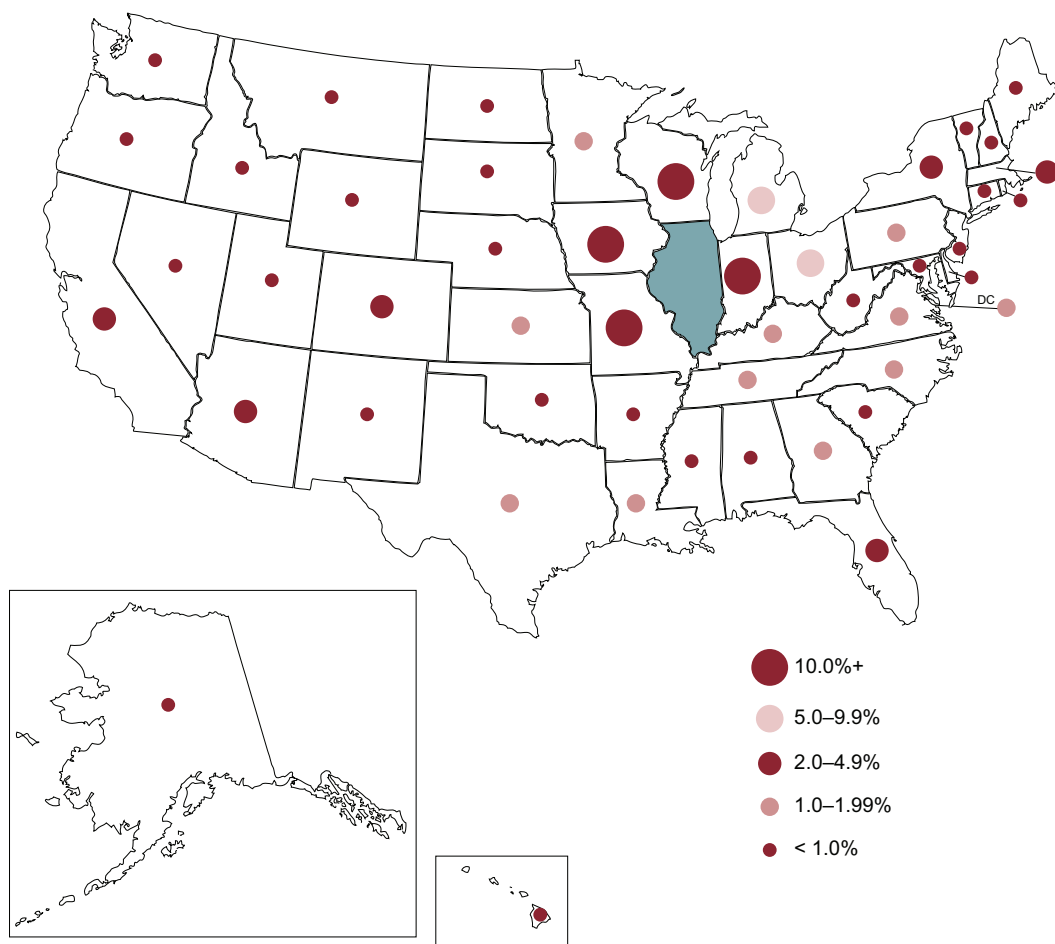

Figure 3. Destination of Illinois outmigrants (N=41,929).

Delimitations Prior to Matching

In an effort to better ensure that the study group members were fully "available" for employment, individuals with a record of enrollment after earning a bachelor's degree were excluded from the potential study group. We felt that it was important to exclude the employment outcomes of students who enrolled in college after earning a bachelor's degree, because their employment options and outcomes could be affected—negatively in the short-term and positively in the long-term—by their decision to further their education. We therefore limited the pool of study group members to those who had no record of post-bachelor's enrollment (graduate school). This delimitation is supported by the State Council for Higher Education in Virginia, as their analyses of employment outcomes typically "exclude the wages of individuals enrolled in higher-level programs since it seems likely those individuals are not trying to maximize their immediate wages, but instead focus on further study" (SCHEV, 2013). As illustrated in Figure 4, the overall rate of post-bachelor's enrollment was 38%. Also, 68% of those enrolling after earning a bachelor's degree were from Illinois-based institutions and 32% were outmigrants, indicating a roughly proportional distribution between outmigrants and stayers. This delimitation left us with 25,806 bachelor's degree earners.

Because we were using unemployment insurance wage records from the Illinois Department of Employment Security to track the Illinois-specific employment outcomes, only individuals with a valid social security number were included in the sample. Among the remaining potential study group members, 4,298 lacked such a unique identifier—72% were from Illinois-based colleges and 28% were outmigrants. After this delimitation, 21,508 potential study group members remained, with 67% emanating from Illinois higher education institutions and 33% coming from colleges outside of Illinois (outmigrants).

The next delimitation involved identifying potential study group members with a major associated with their degree. We felt it would be important to control for major when examining differences, given that college major affects both employment and earnings (Carnevale, Cheah, & Strohl, 2012). Therefore we excluded 2,005 potential study group members with missing information in the major field associated with their respective bachelor's degree. Fortunately, most (91%) of the remaining potential study group members had a record of degree completion with such information. In the end, and as shown in Figure 4, 19,503 potential study group members remained, including 13,416 bachelor's degree earners from Illinois-based institutions (69%) and 6,087 outmigrants (31%). After the delimitations, the proportion of stayers to outmigrants was nearly the same as in the entire sample of bachelor's degree earners (68% to 32%).

Outmigrant   **Stayer**

32%   **68%**

N=41,929

Post-Bachelor's
Enrollment

No Post-Bachelor's
Enrollment

38%   **62%**

31%   **68%**

n=25,806

No Valid
SSN

Valid
SSN

17%   **83%**

33%   **67%**

n=21,508

No Major
Indicated

Major
Indicated

91%

31%   **69%**

n=19,503
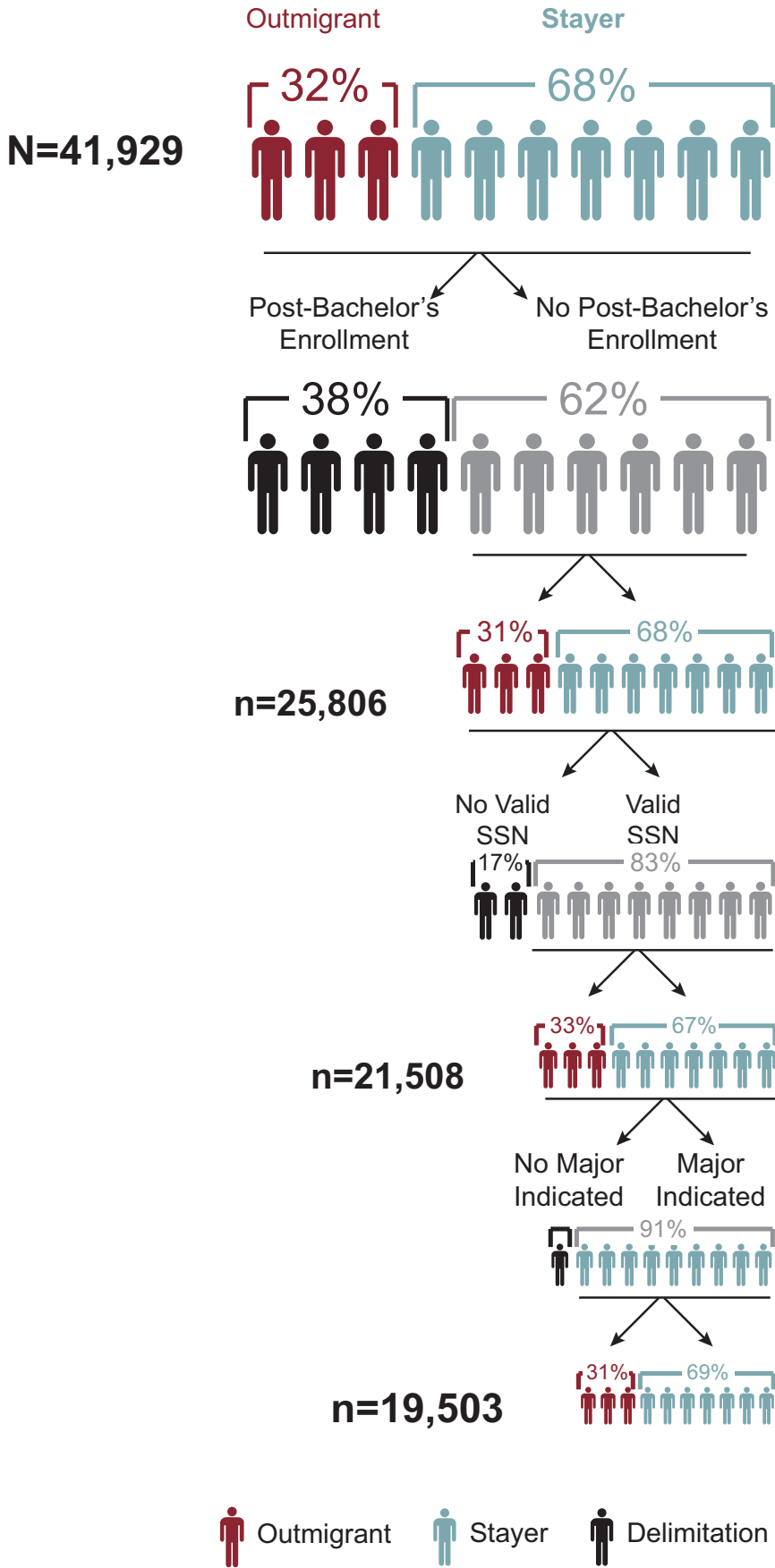
Outmigrant   Stayer   Delimitation

Figure 4. Study group composition prior to matching.

> Prior to the matching procedures, 6,087 outmigrants and 13,416 stayers were available for potential inclusion in our quasi-experimental study.

As illustrated in Figure 5, prior to the matching procedures, 6,087 outmigrants and 13,416 stayers were available for potential inclusion in our quasi-experimental study.
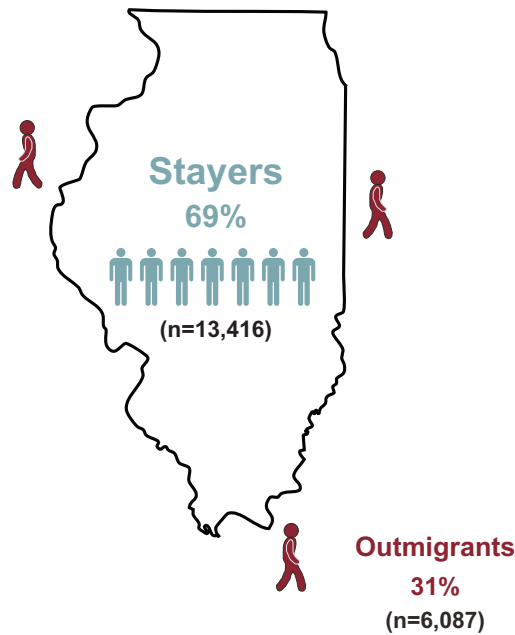

Stayers
69%
(n=13,416)

Outmigrants
31%
(n=6,087)

Figure 5. Study group after delimitations and prior to matching.

Definitions

Outmigrant. Members of the Illinois High School Graduating Class of 2003 who earned a bachelor's degree at an out-of-state baccalaureate granting institution prior to the end of the spring semester of 2010.

Stayer. Members of the Illinois High School Graduating Class of 2003 who earned a bachelor's degree at an Illinois-based baccalaureate granting institution prior to the end of the spring semester of 2010.

Institutional selectivity. TThis measure was created using Barron's Profile of American Colleges (2003). This edition was used because it was available to the study group members as they prepared to transition to college after high school graduation during 2003. We combined the two highest categories (most/highly competitive), as well as the bottom two categories (less/non competitive) to create five categories for the study. The middle two categories are very competitive and competitive. In addition, there were some students who earned degrees from colleges that lacked a selectivity ranking and they were categorized as not defined (the fifth category).

Locale. This was based on the location of the student's high school and was categorized as: urban, suburban, town, or rural.

Region. This was also based on the Regional Offices of Education in Illinois for which each student's respective high school is located. It was categorized as: Chicago, Northeast, Northwest, East Central, West Central, Southwest, and Southeast.

Classification of Instructional Programs (CIP). We used both the 2-digit and 6-digit CIP codes related to the major. The CIP categories based on 2-digit CIP codes were as follows: Agriculture and Natural Resources; Business, Marketing, and Management; Communications and Information Technology; Health Sciences; Human Sciences and Education; and Skilled and Technical Sciences.

Science, Technology, Engineering, and Mathematics (STEM). To operationalize STEM we used the 6-digit CIP codes included in the U.S. Department of Homeland Security's STEM designation (U.S. Immigration and Customs Enforcement, 2012). See Appendix A for more detail.

Non-STEM. Graduating with bachelor's degree that fell outside of the STEM definition as defined above.

Illinois Employment. Having at least one quarter of reportable wages in Illinois after graduation and prior to the end of the tracking period.

Creating the Comparison Group

Developing propensity scores

To obtain the propensity scores, we used a modification of a model that was used to test the determinants of initial outmigration (Manley et al., 2013). This model was conceptually based on Wang's (2009) model, which described factors related to postsecondary outcomes. We augmented the model tested by Manley et al. to include other factors related to the probability of outmigration. For example, and as shown in Figure 6, given the importance of geographic location on the likelihood of outmigration (Smalley et al., 2010; Tuckman, 1970), we added anticipated location of enrollment and the importance of location in college selection to this model. Furthermore, school-level variables also influence the likelihood of outmigrating (Manley et al.; Smalley et al.). To account for this influence, we included high school average performance on the ACT composite as well as the percentage of low income students at the high school, in addition to high school type, defined as public or non-public.
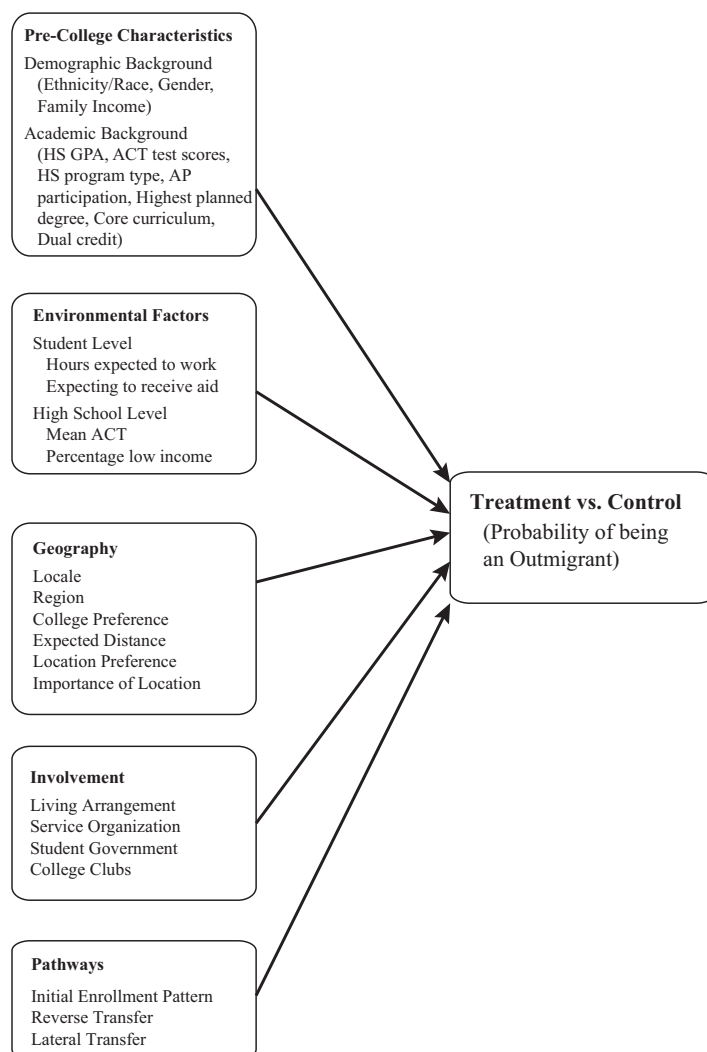
Pre-College Characteristics
Demographic Background (Ethnicity/Race, Gender, Family Income)
Academic Background (HS GPA, ACT test scores, HS program type, AP participation, Highest planned degree, Core curriculum, Dual credit)

Environmental Factors
Student Level
    Hours expected to work
    Expecting to receive aid
High School Level
    Mean ACT
    Percentage low income

Geography
Locale
Region
College Preference
Expected Distance
Location Preference
Importance of Location

Involvement
Living Arrangement
Service Organization
Student Government
College Clubs

Pathways
Initial Enrollment Pattern
Reverse Transfer
Lateral Transfer

Treatment vs. Control
(Probability of being an Outmigrant)

Figure 6. Conceptual model predicting outmigration.

We also considered degree of student involvement (Astin, 1984; Astin, 1993) in addition to predictors that might facilitate involvement, such as one's living arrangement (e.g., living on campus, as opposed to living off-campus). We also considered initial enrollment and transfer mobility patterns in our model. Transfer mobility refers to student transfer patterns throughout postsecondary education such as vertical transfer and reverse transfer (see Goldrick-Rab, 2006; Lichtenberger, 2011). Initial enrollment was measured by determining whether the student's first college was a four-year institution or community college.

Matching process

We used propensity score matching (PSM) while requiring an exact match on two geographic factors related to where the study group members graduated high school, namely region and locale. There were a few other factors related to geography that we could have used but did not, such as requiring an exact match on high school or the county in which the high school was located. After an initial screening of the potential matches using other factors related to geography we determined that our match rate would have been significantly lower.

We also required an exact match on the two-digit CIP code of their bachelor's degree program (e.g., political science to political science) and the selectivity of their bachelor's granting institution, assuming that employment opportunities would be fairly equivalent for students graduating from equally selective institutions with the same degree. Matching on both institutional selectivity and degree was considered a post-treatment adjustment and is theoretically supported by Flores and Flores-Lagunes (2009) and Fragakis and Rubin (2004).

After matching on those key characteristics, we used PSM to find the most suitable match in terms of the likelihood of being an outmigrant. The specific procedure we used was one-to-one nearest neighbor with replacement, allowing for stayers to be matched to more than one outmigrant. We also set a caliper of .25 standard deviation units. This means that only matches with an absolute difference between the propensity score of the stayer and the potential matched outmigrant of less than .25 of one standard deviation of the propensity score were included in the analysis (Rosenbaum & Rubin, 1985).

To retain as many cases as possible for the propensity score matching process, we used cases with missing information in one or more of the previously mentioned factors. Missing data were included in the logistic regression model using a dummy variable adjustment. This method is theoretically supported by previous research (Cohen & Cohen, 1975).

In the end we were left with matched pairs of outmigrants and stayers who were initially from the same geographic location within Illinois, with a similar likelihood or propensity of being an outmigrant, graduating from a similarly selective college with a degree with the same CIP code (2-digit). For somewhat less than three out of every four of the outmigrants (4,400 of 6,078), we were able to find a suitable match (see Appendix B for limitations). We then explored the Illinois-specific employment patterns between the treatment and comparison groups, which included 4,400 outmigrants and 4,400 stayers.

Creating Balance between the Outmigrants and Stayers

Balancing diagnostics

We used the standardized bias method for assessing balance (Austin & Mamdani, 2006). Standardized differences in the variables used to create the propensity scores of less than 10% provide evidence of balance (Cohen, 1977; Normand, Landrum, Guadagnoli, Ayanian, Ryan, Cleary, & McNeil, 2001), whereas standardized differences greater than 20% are considered large (Rosenbaum & Rubin, 1985). Tables 1 through 5 include the balancing diagnostics (standardized differences) both prior to and after our matching procedures for each set of factors: student pre-college demographic and academic; student-level and school-level environmental, involvement, geography, and pathways. Shaded cells are indicative of standardized differences greater than 10% and the darker the shading, the greater the difference. Outmigrants were used as the reference category and differences favoring the outmigrants were shaded with the red color and were positive, whereas differences favoring the stayers were shaded with the blue color and were negative.

Differences between Outmigrants and Stayers

In terms of academic background characteristics it was evident that the outmigrants had significantly higher ACT Math and ACT English scores. Whereas a slightly higher proportion of the outmigrants fell into the highest GPA category (3.5+), and slightly lower proportions were in the 2.5-2.9 and 2.0-2.4 categories, the differences were just over the 10% threshold and therefore not considered substantially large.

A similar pattern was evident with the ACT core curriculum variable—there was a slight imbalance indicating that a higher percentage of outmigrants completed a core curriculum during high school, but this was not a substantially large difference (over 20%). In terms of AP participation, the only large difference between the outmigrants and the stayers favored the outmigrants in the proportion taking AP social science. In terms of the other AP courses, higher proportions of outmigrants generally participated relative to stayers, and the differences were indicative of imbalance between the groups (above 10%) but did not meet the threshold for being large (20% or more). A somewhat larger proportion of the outmigrants had enrolled in college preparatory programs in high school, whereas a slightly larger proportion of the stayers had enrolled in general curriculum programs in high school.

Prior to matching, the two groups were imbalanced on race, but the differences were not considered large. Proportionally more of the outmigrants were Whites, whereas proportionally more of the stayers were Latinos. As previously mentioned, standardized differences shaded blue are differences favoring stayers from the context of the outmigrants. For example, in Table 1, as proportionally more of the stayers were Latino relative to the outmigrants and the standardized difference was greater than 10% (in absolute terms) it is shaded blue. One of the differences based on family income was considered large (over 20%), with a higher proportion of outmigrants falling within the high income category, hence shaded red. Somewhat lower proportions of outmigrants fell into the middle and low income categories indicating imbalance, but these differences were not substantially large.

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Table 1

Balancing Diagnostics: Pre-College Academic and Demographic Background Characteristics

Control	Prior to Matching			After Matching		
	Outmigrants (n=6,087)	Stayers (n=13,416)	Standardized Difference	Outmigrants (n=4,400)	Stayers (n=4,400)	Standardized Difference
Academic Background						
ACT Math	24.82	22.97	36.31	24.75	24.71	0.80
ACT English	24.69	22.78	40.47	24.38	24.17	4.32
Dual Credit CC	0.22	0.26	-5.69	0.18	0.21	-4.72
Dual Credit 4yr	0.04	0.03	3.52	0.04	0.04	0.00
HS GPA: 3.5+	0.41	0.34	13.58	0.38	0.36	6.70
HS GPA: 3.0-3.4	0.26	0.26	1.60	0.27	0.27	-1.92
HS GPA: 2.5-2.9	0.09	0.12	-11.08	0.10	0.10	-2.89
HS GPA: 2.0-2.4	0.03	0.05	-11.60	0.03	0.04	-5.80
HS GPA: <2.0	0.00	0.01	-13.65	0.01	0.02	-11.37
HS GPA: Missing	0.21	0.22	-2.43	0.22	0.22	1.70
ACT Core: Yes	0.61	0.57	7.06	0.61	0.60	1.45
ACT Core: No	0.29	0.34	-11.18	0.29	0.30	-3.13
ACT Core: Missing	0.10	0.09	6.20	0.11	0.10	2.27
AP English Participation: Yes	0.40	0.35	10.12	0.37	0.37	0.00
AP English Participation: No	0.39	0.43	-8.01	0.40	0.40	-1.45
AP English Participation: Missing	0.22	0.23	-1.92	0.23	0.23	2.01
AP Math Participation: Yes	0.42	0.36	13.91	0.41	0.40	0.58
AP Math Participation: No	0.36	0.42	-11.82	0.36	0.37	-2.65
AP Math Participation: Missing	0.22	0.23	-1.92	0.23	0.22	2.35
AP Social Science Participation: Yes	0.38	0.29	19.32	0.36	0.36	0.88
AP Social Science Participation: No	0.41	0.49	-15.35	0.41	0.42	-2.88
AP Social Science Participation: Missing	0.22	0.23	-2.41	0.23	0.22	2.35
AP Science Participation: Yes	0.40	0.32	17.43	0.38	0.36	3.79
AP Science Participation: No	0.38	0.46	-14.35	0.39	0.41	-5.80
AP Science Participation:Missing	0.22	0.23	-1.68	0.23	0.23	2.35
AP Foreign Language Participation: Yes	0.31	0.24	15.13	0.30	0.30	0.92
AP Foreign Language Participation: No	0.47	0.53	-11.47	0.46	0.48	-3.97
AP Foreign Language Participation: Missing	0.22	0.23	-1.68	0.24	0.23	3.34
HS Program Type: CTE	0.04	0.06	-10.84	0.04	0.05	-7.22
HS Program Type: College Prep	0.62	0.55	15.31	0.60	0.59	3.47
HS Program Type: General	0.13	0.16	-10.67	0.13	0.14	-3.78
HS Program Type: Missing	0.21	0.22	-2.42	0.23	0.22	2.36
Highest Planned Degree: Graduate Degree	0.54	0.46	17.12	0.53	0.53	-1.98
Highest Planned Degree: BA or Higher	0.25	0.31	-11.82	0.25	0.25	0.32
Highest Planned Degree: Less than BA	0.02	0.03	-7.25	0.02	0.03	-5.78
Highest Planned Degree: Missing	0.18	0.20	-4.06	0.20	0.19	4.26
Demographic Background						
Race: White	0.80	0.74	15.29	0.79	0.78	6.28
Race: African American	0.05	0.05	0.00	0.05	0.06	-8.78
Race: Latino	0.03	0.06	-14.36	0.03	0.03	1.69
Race: Asian	0.04	0.06	-9.13	0.05	0.05	0.66
Race: Other	0.05	0.05	0.00	0.05	0.06	-3.93
Race: Missing	0.03	0.04	-5.43	0.03	0.04	-1.56
Family Income: High	0.39	0.25	31.01	0.39	0.39	0.00
Family Income: Mid High	0.17	0.22	-13.23	0.16	0.16	1.54
Family Income: Mid Low	0.10	0.16	-17.23	0.09	0.10	-5.36
Family Income: Low	0.05	0.10	-17.79	0.05	0.05	2.62
Family Income: Missing	0.30	0.27	5.14	0.31	0.31	1.22
Gender: Male	0.48	0.47	2.42	0.48	0.50	-5.66
Gender: Female	0.52	0.53	-2.19	0.52	0.50	5.66
Gender: Missing	0.00	0.00	-3.66	0.00	0.00	-6.33

Cells are shaded according to their difference from zero

Difference favoring Stayers   Difference favoring Outmigrants

As shown in Table 1, our matching process greatly improved the balance between the outmigrants and stayers, as evidenced by nearly all of the academic and demographic background characteristics moving toward adequate balance, with the exception of one. After matching, a slightly lower proportion of stayers were within the low high school GPA category; however, both groups had a fairly low proportion in that category, which served to magnify the standardized difference.

Regarding school-level environmental factors prior to the match, there were large differences (over 20%) in terms of aggregate performance on the ACT and in terms of the percentage of low income students. Outmigrants tended to emanate from high schools with substantially higher mean ACT scores along with much lower percentages of low income students. Further, a slightly higher proportion of outmigrants were graduates of private rather than public high schools. The differences regarding high school type were indicative of imbalance (over 10%), but did not meet the threshold for being considered large (over 20%). In terms of student-level environmental factors, relative to stayers, fewer outmigrants expected to receive financial aid and substantially more did not plan to work during college. As shown in Table 2, sufficient balance between the two groups on both the school-level and student-level environmental factors was achieved after the match, as all of the standardized differences were under 10%.

> Outmigrants tended to emanate from high schools with substantially higher mean ACT scores along with much lower percentages of low income students.

Table 2

Balancing Diagnostics: High School and Student-Level Environment

Control	Prior to Matching			After Matching		
	Outmigrants (n=6,087)	Stayers (n=13,416)	Standardized Difference	Outmigrants (n=4,400)	Stayers (n=4,400)	Standardized Difference
High School Level						
HS Mean Composite ACT	22.31	21.10	51.86	22.41	22.28	5.50
HS Percentage Low Income	0.16	0.21	-38.40	0.15	0.15	-3.45
HS Type: Public	0.79	0.84	-12.30	0.79	0.78	2.08
HS Type: Non-Public	0.21	0.16	13.83	0.21	0.22	-2.08
Student Level						
Expected Financial Aid: Yes	0.58	0.67	-16.46	0.58	0.59	-2.01
Expected Financial Aid: No	0.23	0.14	24.29	0.21	0.22	-1.72
Expected Financial Aid: Missing	0.19	0.20	-1.77	0.21	0.19	4.20
Planned Work Hours: 0	0.23	0.14	23.65	0.22	0.22	-0.69
Planned Work Hours: 1-10	0.26	0.23	6.60	0.26	0.25	1.62
Planned Work Hours: 11-20	0.24	0.32	-17.56	0.24	0.24	0.33
Planned Work Hours: 21-30	0.05	0.09	-15.41	0.05	0.06	-7.21
Planned Work Hours: 31 or More	0.01	0.01	-5.15	0.01	0.01	-5.49
Planned Work Hours: Missing	0.22	0.21	2.44	0.23	0.22	3.35

Cells are shaded according to their difference from zero

Difference favoring Stayers   Difference favoring Outmigrants

In terms of factors related to involvement (Astin, 1984; Astin, 1993), there was imbalance between the two group in terms of where they planned to live during college. Proportionally more of the outmigrants intended to live on campus, and fewer planned to live off-campus or with their parents. As shown in Table 3, when compared with stayers, more of the outmigrants planned to participate in both service organizations and college clubs. After matching, sufficient balance was achieved between the outmigrants and stayers on all of the factors related to involvement.

> More of the outmigrants intended to live on campus, and fewer planned to live off-campus or with their parents.

Table 3

Balancing Diagnostics: Involvement

Control	Prior to Matching			After Matching		
	Outmigrants (n=6,087)	Stayers (n=13,416)	Standardized Difference	Outmigrants (n=4,400)	Stayers (n=4,400)	Standardized Difference
Involvement/Integration						
Live: Residence Hall	0.70	0.56	33.69	0.69	0.69	0.00
Live: Off-Campus	0.05	0.10	-19.71	0.05	0.05	-3.34
Live: Parent's House	0.03	0.12	-32.53	0.03	0.03	-2.62
Live: Married Housing	0.00	0.00	0.00	0.00	0.00	0.00
Live: Fraternity or Sorority	0.05	0.03	7.09	0.05	0.05	-1.31
Live: Missing	0.17	0.19	-5.91	0.19	0.18	2.91
Service Organization: Yes	0.52	0.41	23.29	0.50	0.48	6.51
Service Organization: No	0.27	0.37	-20.12	0.27	0.30	-9.55
Service Organization: Missing	0.21	0.23	-3.36	0.23	0.22	2.36
Student Government: Yes	0.17	0.14	7.80	0.16	0.15	5.41
Student Government: No	0.62	0.63	-3.47	0.61	0.64	-6.39
Student Government: Missing	0.22	0.23	-2.64	0.23	0.22	2.70
College Clubs: Yes	0.28	0.21	16.43	0.27	0.26	4.44
College Clubs: No	0.50	0.56	-11.47	0.50	0.52	-6.22
College Clubs: Missing	0.22	0.23	-2.40	0.23	0.22	2.35

Cells are shaded according to their difference from zero

Difference favoring Stayers   Difference favoring Outmigrants

As shown in Table 4, there were large differences between the groups in terms of the factors related to geography. As might be expected, a larger proportion of the stayers indicated a preference for an Illinois-based college, while more of the outmigrants indicated an early desire to enroll outside of Illinois. Also, a slightly larger proportion of the stayers mentioned an initial preference for enrolling at a community college. Relative to stayers, relatively more of the outmigrants expected to enroll farther from home and fewer expected to enroll less than 100 miles from home. A larger proportion of the outmigrants were from suburban locales, particularly the Chicago suburbs (Northeast region), whereas smaller proportions were from towns and rural locales. The matching model appeared to overcorrect in terms of location preference. After matching, a slightly larger percentage of the stayers had an initial preference to enroll outside the state. Other than that single over-correction that resulted in a standardized difference favoring the stayers just above the 10% threshold, sufficient balance was achieved on all other factors related to geography.

> More of the outmigrants indicated an early desire to enroll outside of Illinois.

Table 4

Balancing Diagnostics: Geography

Control	Prior to Matching			After Matching		
	Outmigrants (n=6,087)	Stayers (n=13,416)	Standardized Difference	Outmigrants (n=4,400)	Stayers (n=4,400)	Standardized Difference
Geography						
College Location Preference: Illinois	0.38	0.64	-46.40	0.41	0.39	8.33
College Location Preference: Outside of Illinois	0.39	0.14	60.36	0.34	0.37	-10.78
College Location Preference: Missing	0.24	0.22	4.32	0.25	0.24	2.29
College Preference: Four-Year	0.77	0.74	5.71	0.75	0.76	-1.97
College Preference: CC/Other	0.02	0.04	-14.21	0.02	0.02	-2.25
College Preference: Missing	0.22	0.22	0.00	0.23	0.22	2.35
Expected Distance from Home: <10	0.02	0.04	-13.30	0.02	0.02	-1.06
Expected Distance from Home: 10-25	0.02	0.08	-24.67	0.02	0.02	-1.01
Expected Distance from Home: 26-100	0.08	0.17	-27.02	0.08	0.08	-0.52
Expected Distance from Home: 100+	0.40	0.25	33.19	0.38	0.40	-4.36
Expected Distance from Home: No College In Mind Yet	0.28	0.25	6.66	0.28	0.27	3.15
Expected Distance from Home: Missing	0.20	0.21	-1.24	0.22	0.21	2.75
Location Most Important	0.12	0.15	-7.00	0.12	0.12	0.00
Location Not Most Important	0.65	0.63	4.86	0.63	0.64	-2.35
Location Missing	0.23	0.23	0.24	0.24	0.24	2.30
Locale: Urban	0.22	0.25	-5.39	0.19	0.19	0.00
Locale: Suburban	0.65	0.56	20.05	0.74	0.74	0.00
Locale: Town	0.05	0.08	-9.82	0.03	0.03	0.00
Locale: Rural	0.07	0.12	-15.12	0.05	0.05	0.00
Region: Chicago	0.09	0.11	-8.68	0.07	0.07	0.00
Region: Northeast	0.67	0.56	24.19	0.78	0.78	0.00
Region: Northwest	0.07	0.09	-5.55	0.05	0.05	0.00
Region: East Central	0.04	0.08	-15.37	0.03	0.03	0.00
Region: West Central	0.05	0.08	-12.53	0.02	0.02	0.00
Region: Southwest	0.06	0.06	0.41	0.04	0.04	0.00
Region: Southeast	0.02	0.02	-0.66	0.01	0.01	0.00

Cells are shaded according to their difference from zero

Difference favoring Stayers   Difference favoring Outmigrants

Regarding pathways, there were some large differences between the outmigrants and stayers prior to matching, most notably in terms of initial enrollment patterns. Relative to stayers, more of the outmigrants directly enrolled at four-year colleges and as a result, significantly fewer directly enrolled at community colleges. A slightly larger proportion of the stayers reverse transferred from a four-year college to a community college during the course of the study. These imbalances suggest that stayers were somewhat more likely to utilize a community college prior to degree completion. Outmigrants were much more likely to have earned degrees from very selective colleges, whereas stayers were somewhat more likely to have earned their degrees from less competitive institutions. Prior to matching, there was sufficient balance on the CIP cluster between outmigrants and stayers, with none of the standardized differences greater than 8.55%. It should be noted that institutional selectivity and classification of instructional program (CIP) were not used to develop the propensity scores. Because we required an exact match on those two factors due to our post-treatment adjustment, there was perfect balance after matching.

More of the outmigrants directly enrolled at four-year colleges and as a result, significantly fewer directly enrolled at community colleges.

As evidenced by Table 5, after matching, sufficient balance on all of the pre-treatment pathways factors was achieved with one exception. The matching model overcorrected for the lateral transferring enrollment pattern, and whereas there was sufficient balance prior to matching, there was a slight imbalance after matching (standardized difference of 17.22%). The difference indicated that outmigrants were somewhat less likely to have laterally transferred during the enrollment tracking period relative to stayers.

Table 5

Balancing Diagnostics: Pathways

	Prior to Matching			After Matching		
Control	Outmigrants (n=6,087)	Stayers (n=13,416)	Standardized Difference	Outmigrants (n=4,400)	Stayers (n=4,400)	Standardized Difference
Pathways						
Enrollment Pattern: Direct Entrant	0.89	0.78	**38.27**	0.89	0.89	2.26
Enrollment Pattern: CC Transfer	0.11	0.22	-29.86	0.11	0.12	-2.26
Reverse Transfer	0.04	0.08	-16.58	0.04	0.04	0.72
Lateral Transfer	0.13	0.16	-7.69	0.12	0.16	-17.22
Barron's: Most/Highly Competitive	0.19	0.20	-2.51	0.21	0.21	0.00
Barron's: Very Competitive	0.32	0.20	28.54	0.30	0.30	0.00
Barron's: Competitive	0.40	0.47	-13.32	0.44	0.44	0.00
Barron's: Not Competitive	0.07	0.11	-14.44	0.05	0.05	0.00
Barron's: Other	0.02	0.02	0.81	0.01	0.01	0.00
CIP Cluster						
Ag and Natural Resources	0.04	0.06	-7.45	0.03	0.03	0.00
Business, Marketing, and Management	0.25	0.23	5.22	0.30	0.30	0.00
Communicationas and IT	0.19	0.17	4.42	0.21	0.21	0.00
Health Sciences	0.04	0.05	-2.89	0.04	0.04	0.00
Human Sciences and Education	0.35	0.39	-8.55	0.33	0.33	0.00
Skilled and Technical Sciences	0.13	0.11	7.82	0.10	0.10	0.00

Cells are shaded according to their difference from zero.   Difference favoring Stayers   Difference favoring Outmigrants

The propensity score matching (PSM) procedure and post-treatment adjustment provided adequate balance on all of the factors used to predict one's likelihood of being an outmigrant with the exception of three comparisons. Yet, none of the remaining differences were considered large—defined as a standardized difference of 20% or greater. In fact, two of the imbalanced factors were just over the 10% threshold: <2.0 high school GPA, and initially preferring to enroll outside the state of Illinois and one somewhat approximated 20% at 17.22% (lateral transferring). Two of the imbalanced factors appeared to be over-corrections. After matching, a slightly higher proportion of the stayers maintained an initial preference to enroll outside the state of Illinois and a slightly higher proportion of stayers had engaged in the lateral transferring pattern, enrolling at more than one four-year college prior to bachelor's degree completion.

Results

The findings that follow are based on the outmigrants (n=4,400) and stayers (n=4,400) matched through the PSM process. Our counterfactual tests what would have happened to the outmigrants in terms of Illinois employment patterns had they instead enrolled at and completed their degree at an Illinois-based college. With our quasi-experimental approach, we would expect that outmigrants attain similar Illinois-based employment outcomes as the observationally equivalent group of stayers, and the differences, if any exist, represent the treatment effects specific to outmigration. Traditionally, any differences in terms of the outcomes between what we are considering the treatment group (outmigrants) and the observationally equivalent comparison group (stayers) are indicative of the treatment effect. *Therefore, any difference between the outmigrants and the stayers with respect to employment outcomes represents some of the economic impact outmigration has on the state of Illinois.*

First, we determine who gained post-bachelor's employment within the state of Illinois. Second, using survival analysis, we explore the length of time it takes to obtain such employment. We then utilize a series of quarterly wage thresholds ($5,000, $7,500, $10,000, $12,500, and $15,000) and examine the amount of time it took to meet each threshold with a similar survival analysis approach. We then explore the potential differences in quarterly wages between the stayers and outmigrants. Finally, we examine factors related to Illinois employment, overall, and then look for potential differences between outmigrants and stayers regarding how key factors, such as degree type, relate to Illinois employment outcomes. We feel this information could be useful to policymakers as they develop strategies to recruit the outmigrants back to the state, potentially prevent them from leaving in the first place, or make up for the loss by recruiting more high school graduates to Illinois colleges and/or more bachelor's degree completers.

Our counterfactual tests what would have happened to the outmigrants in terms of Illinois employment patterns had they instead enrolled at and completed their degree at an Illinois-based college.

Any difference between the outmigrants and the stayers with respect to employment outcomes represents some of the economic impact outmigration has on the state of Illinois.

Illinois Employment Outcomes

Relative to the outmigrants, a substantially larger proportion of the students who opted to attend college in Illinois gained employment in Illinois during the course of the study. As shown in Figure 7, more than nine out of every ten of the stayers had reported wages in Illinois for at least one quarter after earning their baccalaureate degree, whereas only two-thirds of the outmigrants met that same distinction. The tracking period for employment varied by the graduation date, so that those graduating earlier in the study had a longer period of time to gain employment, as measured by the current study. Despite more of the outmigrants graduating earlier, providing them with relatively more time to potentially move back to Illinois for employment, fewer returned to their state of origin for employment.

This difference does not equate to a smaller proportion of outmigrants being employed overall, as many are likely working for employers in the state in which they earned their degree. We argue this difference is indicative of the negative impact outmigration has an Illinois-specific employment. Further, because Illinois-based colleges are unable to recruit enough students from outside the state to make up for the loss of outmigrants (Barbett, 1998; Hsing & Mixon, 1996; U.S. Department of Education, 1998; U.S. Department of Education, 2010), it could leave the state of Illinois at a disadvantage in terms of human capital.
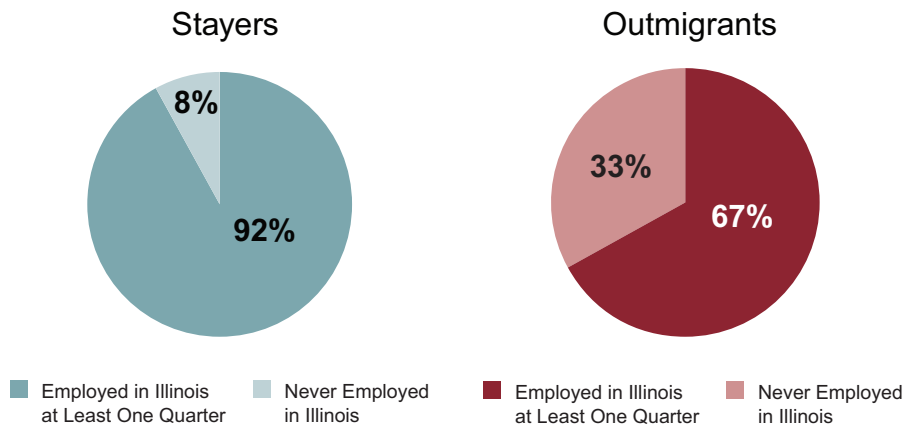
Figure 7: Overall rate of Illinois employment.

As a result of relatively fewer outmigrants gaining employment in Illinois, substantially smaller proportions met the various wages thresholds based on Illinois-specific employment. As illustrated in Figure 8, four of every five stayers (81%) had at least one quarter in which they earned over $5,000, whereas less than three of every five outmigrants (57%) met that same distinction.
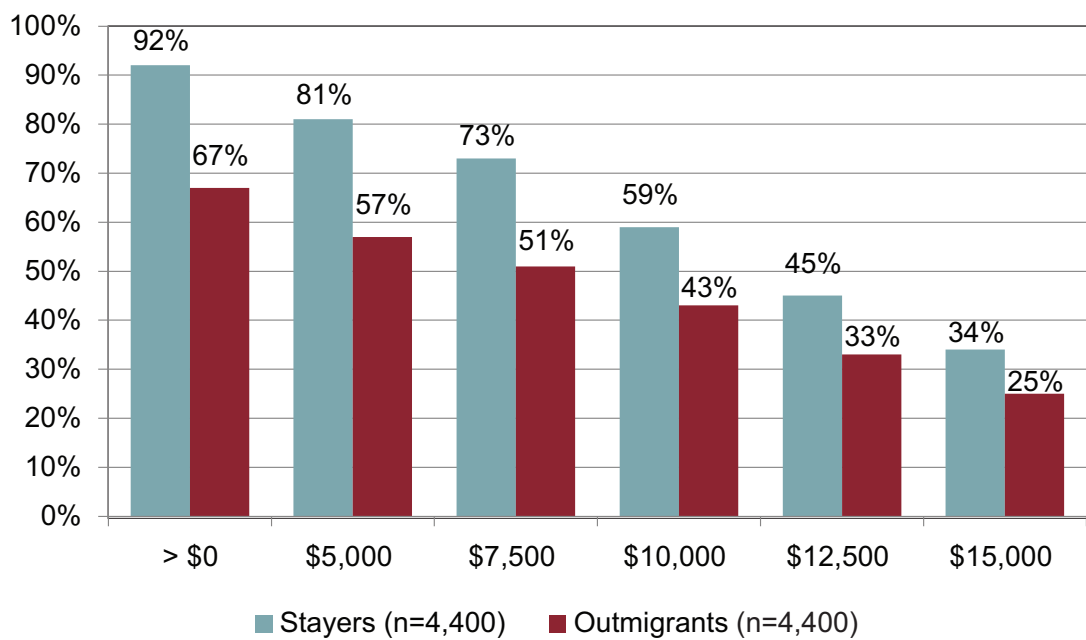
Figure 8. Wage threshold comparison for all study group members based on Illinois employment.

Exploring the same outcomes, conditional upon Illinois employment, revealed that when outmigrants return to Illinois for employment, nearly identical proportions meet each of the wage thresholds as the stayers (see Figure 9). In other words, the Illinois-specific earnings patterns for outmigrants and stayers are fairly similar among those gaining employment in Illinois. This allows us to argue that the overall differences (unconditional upon employment) between stayers and outmigrants represent what the expected Illinois-specific outcomes for the outmigrants would have been had they instead completed their degrees at Illinois-based colleges. For example, if the outmigrants had instead attended Illinois-based colleges, we could have reasonably expected over 33% to have met the $15,000 quarterly wage threshold in Illinois, rather than a 25% (see Figure 8).

Illinois-specific earnings patterns for outmigrants and stayers are fairly similar among those gaining employment in Illinois.

Figure 9. Wage thresholds conditional upon Illinois-based employment.

Time to Employment in the State of Illinois

As illustrated in Figure 10, although the curves are somewhat similar, both increasing and leveling out at parallel points, it is clear that the cumulative rate of employment in Illinois is substantially lower for the outmigrants throughout the entire study. This demonstrated that outmigrants are substantially less engaged with the Illinois workforce after degree completion when compared to stayers. However, the cumulative rate of employment in Illinois among outmigrants was somewhat higher than previous research indicated using a nationally representative sample (Adelman, 2004). Both groups experienced a sharp increase in their cumulative rates of Illinois employment moving from the quarter of graduation to the first quarter post graduation. From quarter eight to quarter twenty, the outmigrants experienced a larger increase relative to the stayers, indicating a slightly higher proportion of outmigrants returned later in the study period.

Based on the counterfactual for the study—what would have happened to outmigrants had they instead enrolled at a college located in Illinois—it is fairly evident that outmigration is related to a substantial decrease in the cumulative rate of Illinois employment. If outmigrants had instead enrolled at Illinois-based institutions, we would expect a rate that roughly equates to that of the stayers; therefore, the difference between the outmigrants and stayers is representative of the impact of outmigration on Illinois employment.

> Outmigration is related to a substantial decrease in the cumulative rate of Illinois employment.
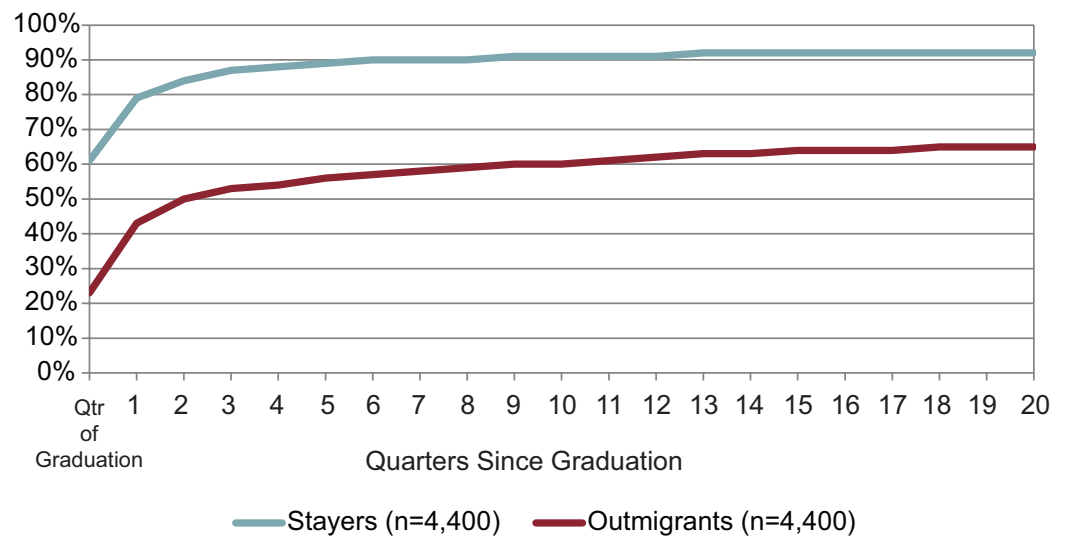
Figure 10. Cumulative rate of Illinois employment by outmigration status.

Illinois Wage Thresholds For the Entire Study Group

The next section explores the number of post-graduation quarters it takes to meet the following series of wage thresholds within Illinois: $5,000, $7,500, $10,000, $12,500, and $15,000. If annualized, the following thresholds would represent yearly wages in Illinois of $20,000, $30,000, $40,000, $50,000, and $60,000 respectively. These findings include all study group members regardless of whether Illinois employment was attained. We argue that differences in the survival curves are representative of the treatment effect, or the impact outmigration has on the amount of time it takes to meet each wage threshold in Illinois. Although we recognize that an equal number of outmigrants are likely meeting the aforementioned wage thresholds in other states, we present the following information to illustrate the negative impact outmigration has on Illinois-specific employment outcomes.

As illustrated in Figures 11-15, not only are substantially larger proportions of the stayers meeting each of the quarterly wage thresholds in Illinois, they are doing so in a much shorter time-frame (relative to their graduation date) than their counterparts who outmigrated. This suggests that the economic consequences of outmigration to the state of Illinois are both short-term and long-term in nature, with the long-term differences being somewhat greater.

> Not only are substantially larger proportions of the stayers meeting each of the quarterly wage thresholds in Illinois, they are doing so in a much shorter time-frame than outmigrants.
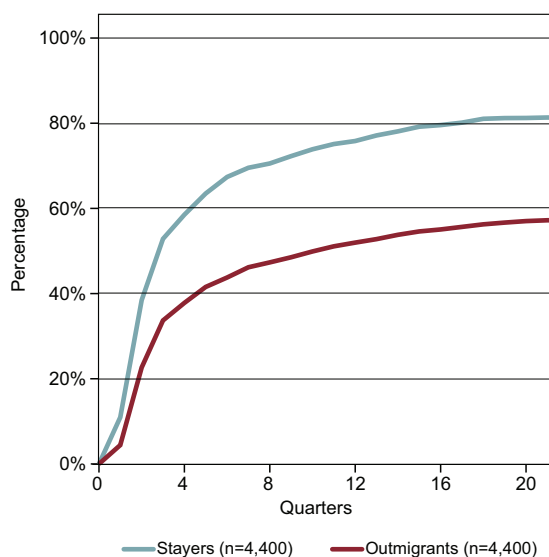
Figure 11. Number of quarters to $5,000 in Illinois by outmigration status.
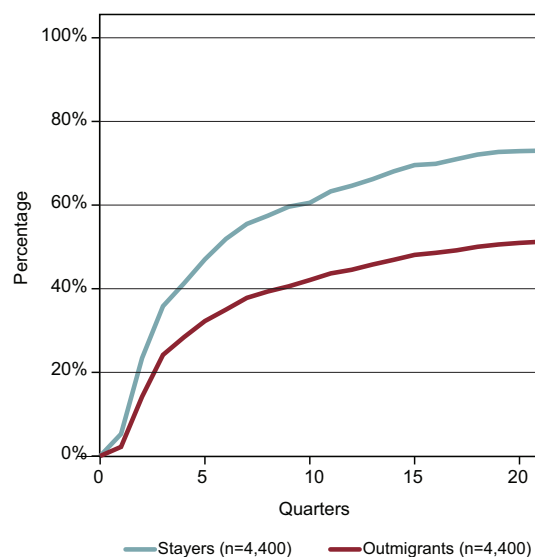
Figure 12. Number of quarters to $7,500 in Illinois by outmigration status.
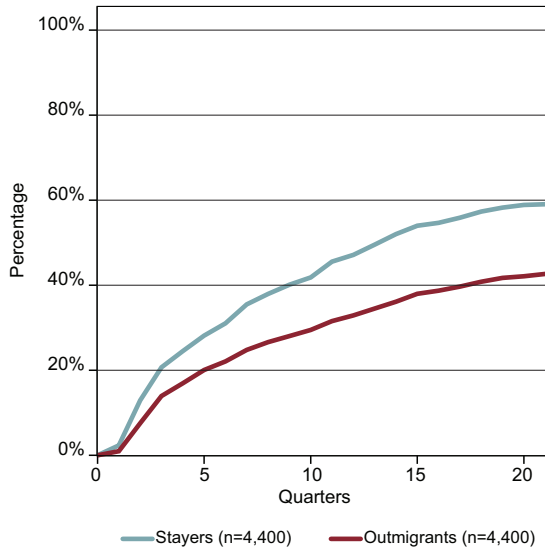
Figure 13. Number of quarters to $10,000 in Illinois by outmigration status.
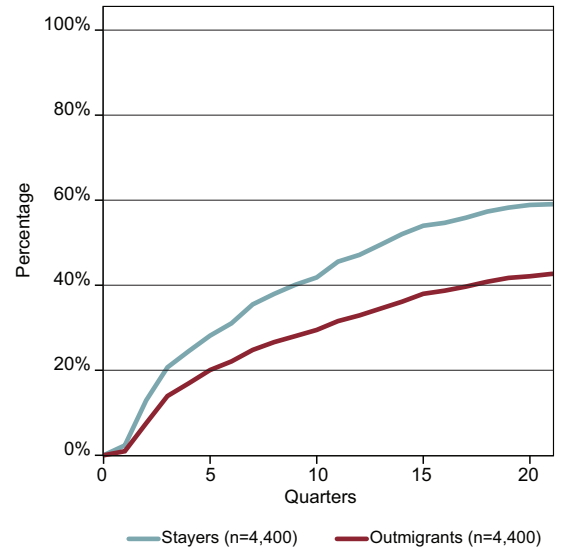
Figure 14. Number of quarters to $12,500 in Illinois by outmigration status.
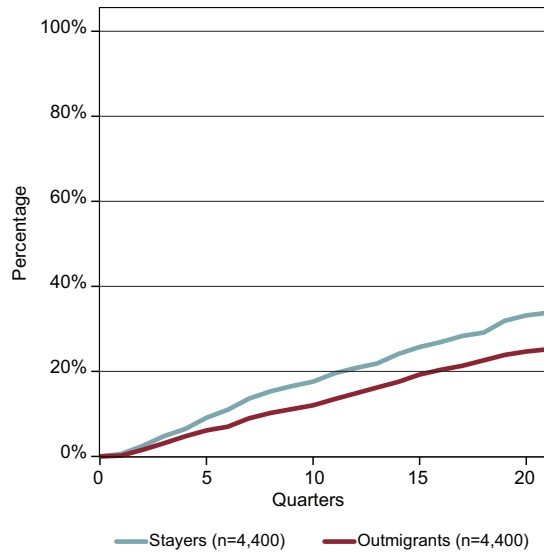
Figure 15. Number of quarters to $15,000 in Illinois by outmigration status.

Rates of Quarterly Employment in Illinois

As shown in Figure 16, the stayers maintained a relative advantage over the outmigrants in terms of quarterly employment rates in Illinois throughout the entire study period. The quarterly employment rates of the stayers started at slightly above 60% and quickly increased to 70%, and more or less stayed within a few percentage points of 70% for the remainder of the study, whereas the outmigrants started much lower (24%), experienced a sharper increase, but leveled out at 45% and increased to just under 50% towards the end of the tracking period. These rates only take into account study group members eligible for employment in the given quarter based on their graduation date. In other words, only those who have graduated in a timeframe that would have afforded them 16 quarters of potential post-graduation employment are included in the calculation for the 16th quarter. As previously explained, the expected quarterly employment rate in Illinois for outmigrants would arguably have been the same as that of the stayers if they had instead enrolled at an Illinois-based college. Therefore, differences in the rates represent the treatment effect associated with outmigration.

> The stayers maintained a relative advantage over the outmigrants in terms of quarterly employment rates in Illinois throughout the entire study period.
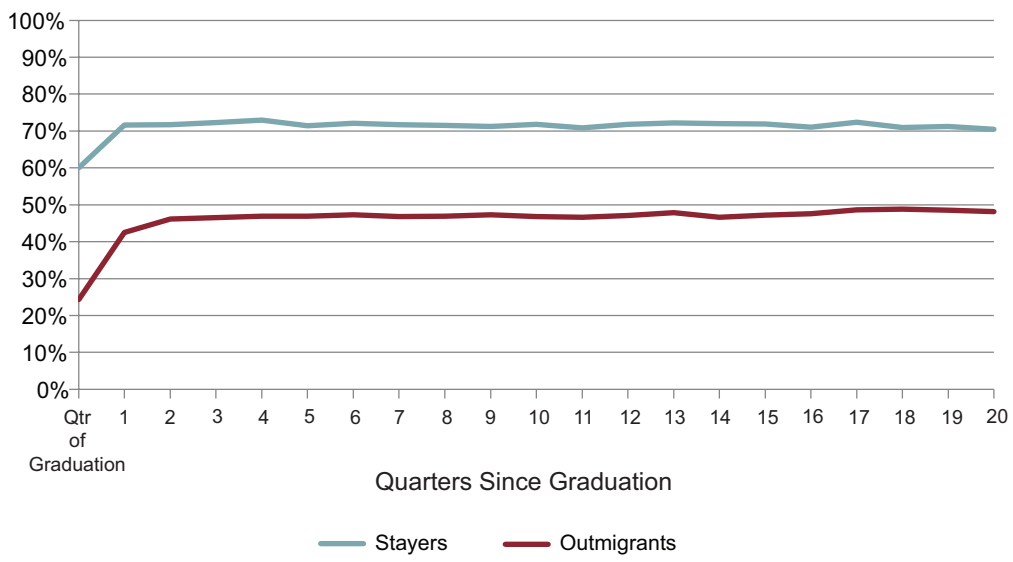
Figure 16. Percent of total employed in Illinois each quarter by outmigration status.

Quarterly Wages within Illinois

A comparison of the median quarterly wages for those employed in Illinois revealed that, for the most part, the median quarterly wages of the stayers mirrored those of the outmigrants throughout the tracking period, both increasing and leveling out at parallel times and with only minimal differences between the two groups, slightly favoring the outmigrants. As shown in Figure 17, both groups experienced a sharp increase in wages from the quarter of graduation to the second quarter after graduation, after which the growth somewhat leveled out. In fact, the growth in median wages for both groups was fairly minimal from the sixth quarter to the ninth quarter. Roughly four years upon college completion (quarter 16), the median quarterly wages (for those employed in Illinois) were slightly above $11,000 for both groups and at five years out the median quarterly wages of both groups was at roughly $13,000. Conditional upon employment in Illinois, quarterly wages, as well as wage growth, are fairly similar between outmigrants and stayers.

> The median quarterly wages of the stayers mirrored those of the outmigrants throughout the tracking period.
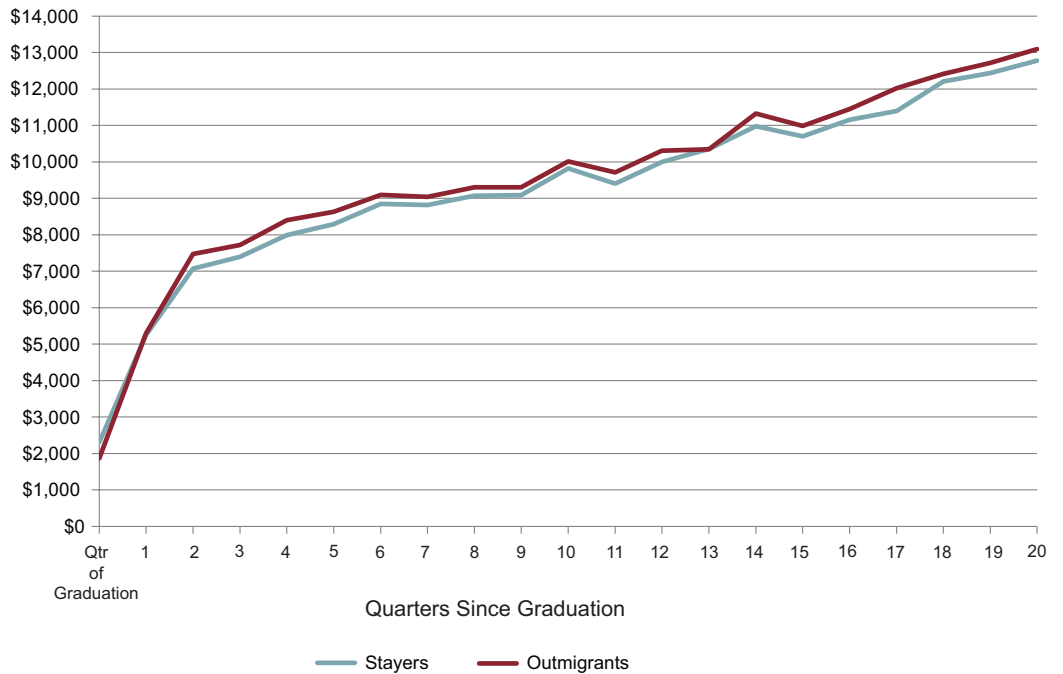
Figure 17. Median quarterly wages conditional upon employment in Illinois by outmigration status.

We also examined potential differences in Illinois-specific quarterly wages between outmigrants and stayers at the 25th and 75th percentiles, as suggested by Mullin (2013). We found similar patterns of growth in quarterly wages between the outmigrants and stayers during the employment tracking period. However, as shown in Figure 18, outmigrants at the 75th percentile maintained somewhat higher wages than their stayer counterparts following the sixth quarter after college graduation. For example, five years after college graduation, outmigrants at the 75th percentile had quarterly wages slightly less than $18,000, whereas stayers had quarterly wages at slightly less than $17,000. If annualized, the nearly $1,000 quarterly difference between the two groups would equate to about $4,000. The differences between the outmigrants and stayers at the 25th percentile were somewhat more muted, with slight differences favoring the outmigrants occurring between the seventh and thirteenth quarters and then again between the fourteenth and twentieth quarters.
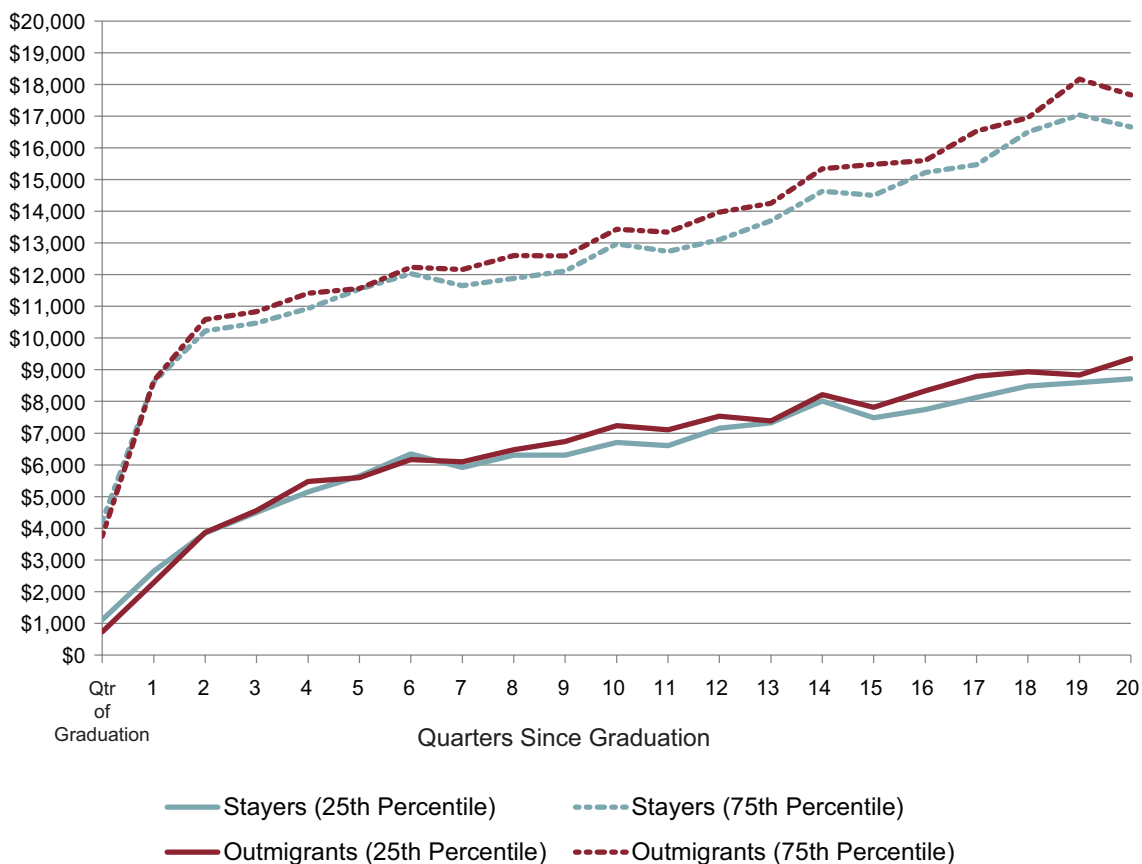
Figure 18. Quarterly wages in Illinois at the 25th and 75th percentiles by outmigration status.

State of Outmigration and Illinois Employment

The next set of maps shows the rate of Illinois employment by the location of the outmigrant's bachelor's degree granting institution. Darker shading within the state represents higher rates of Illinois employment for Illinois outmigrants in that state. As illustrated in Figure 19, outmigrants earning their degrees from colleges located in Wisconsin, South Dakota, Indiana, Ohio, Iowa, Kansas, Louisiana, and Hawaii experienced the highest overall rates of post-graduation Illinois employment (over 75% had gained employment in Illinois for at least one quarter after graduation). However, it should be noted that several of these states (South Dakota, Hawaii, and Louisiana) were very low destination states that graduated small proportions (less than 1%) of Illinois outmigrants.

Rate of Return to Illinois

- 75% +
- 60% - 74.99%
- 50% to 59.99%
- 35% to 49.99%
- < 35%
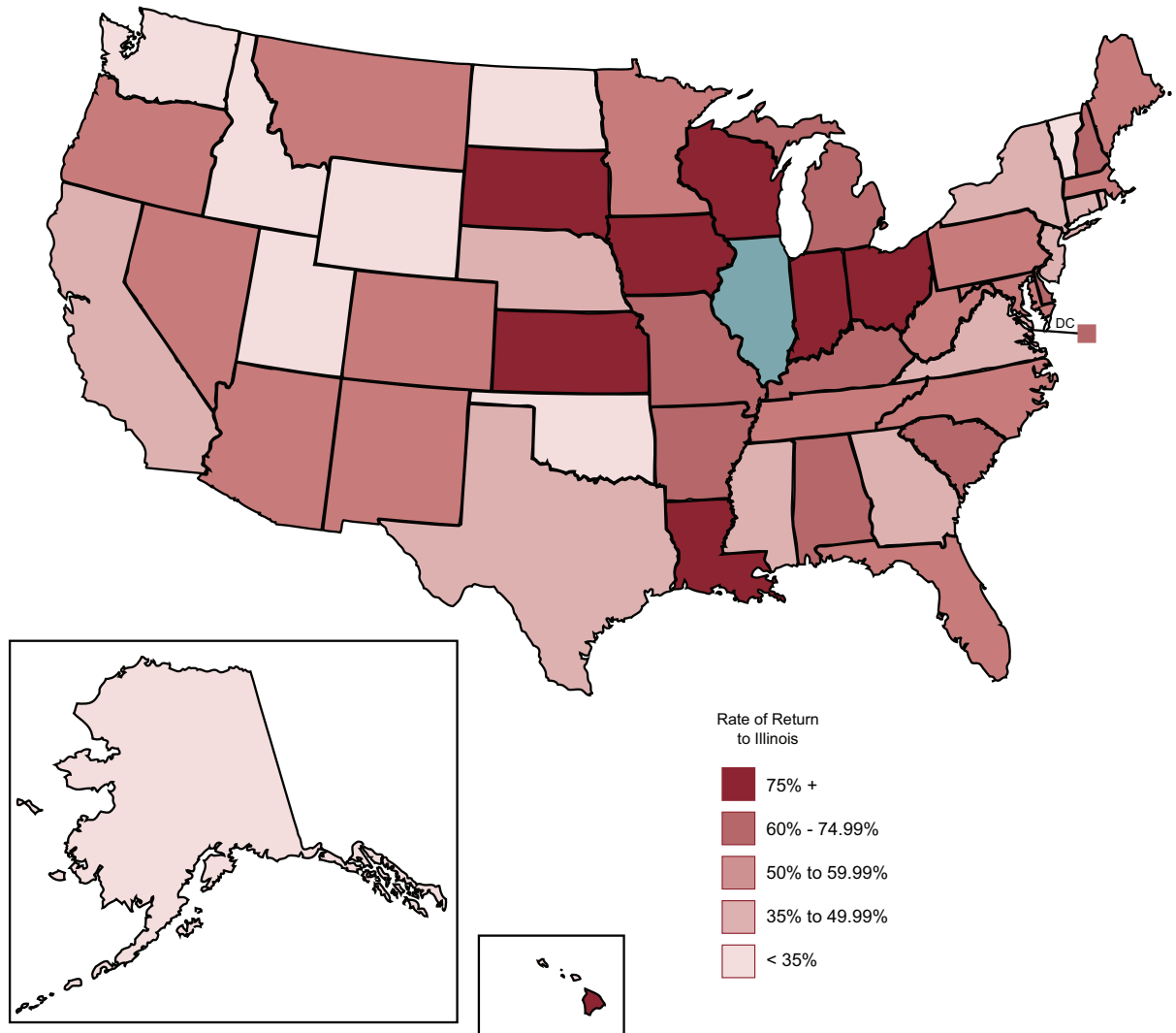
Figure 19. Rate of Illinois employment by graduation state for matched study group members (n=4,400).

When the rate of Illinois employment is combined with information regarding the proportion of Illinois outmigrants by state some interesting patterns arise. As shown in Figure 20, the three high destination states—Iowa, Wisconsin, and Indiana—that each accounted for at least 10% of Illinois outmigrants, had over 75% of the Illinois outmigrants in their state returning to Illinois for employment. There were three additional states that individually accounted for between 5% and 9.9% of the Illinois outmigrants— Ohio, Missouri, and Michigan. We consider the aforementioned six states the high destination states for Illinois outmigrants. Study group members graduating from colleges located in Ohio, Iowa, Wisconsin, and Indiana all had rates of Illinois employment that clustered within a couple of percentage points of 80%. As shown in Figure 21, outmigrants graduating from colleges located in Ohio exhibited the highest rate of post-graduation Illinois employment at slightly over 80%. Missouri was an interesting state in that it produced a fairly high proportion of the Illinois outmigrants used in the quasi-experimental part of this study (nearly 10%); however, these outmigrants exhibited the lowest rate of return among the high yield states (slightly less than 60%). Outmigrants to Michigan-based colleges had a cumulative rate of Illinois employment of roughly 70%, which placed them directly between the other high destination states that clustered around 80% (Ohio, Wisconsin, Indiana, and Iowa) and Missouri (slightly less than 60%).
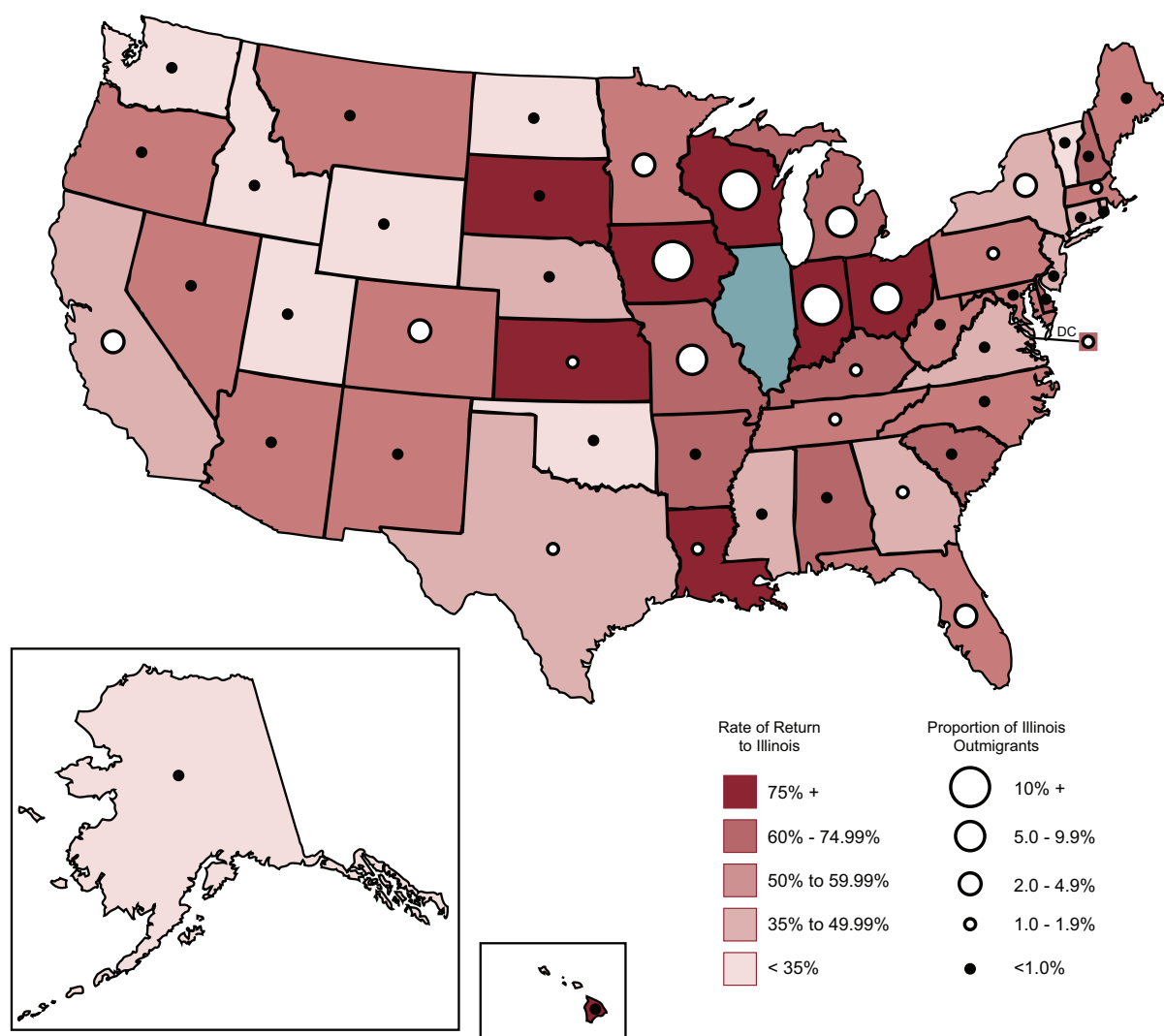
Figure 20. Rate of Illinois employment and proportion of Illinois outmigrants by state for matched study group members (n=4,400).

Missouri was an interesting state in that it produced a fairly high proportion of the Illinois outmigrants; however, these outmigrants exhibited the lowest rate of return among the high yield states (slightly less than 60%).
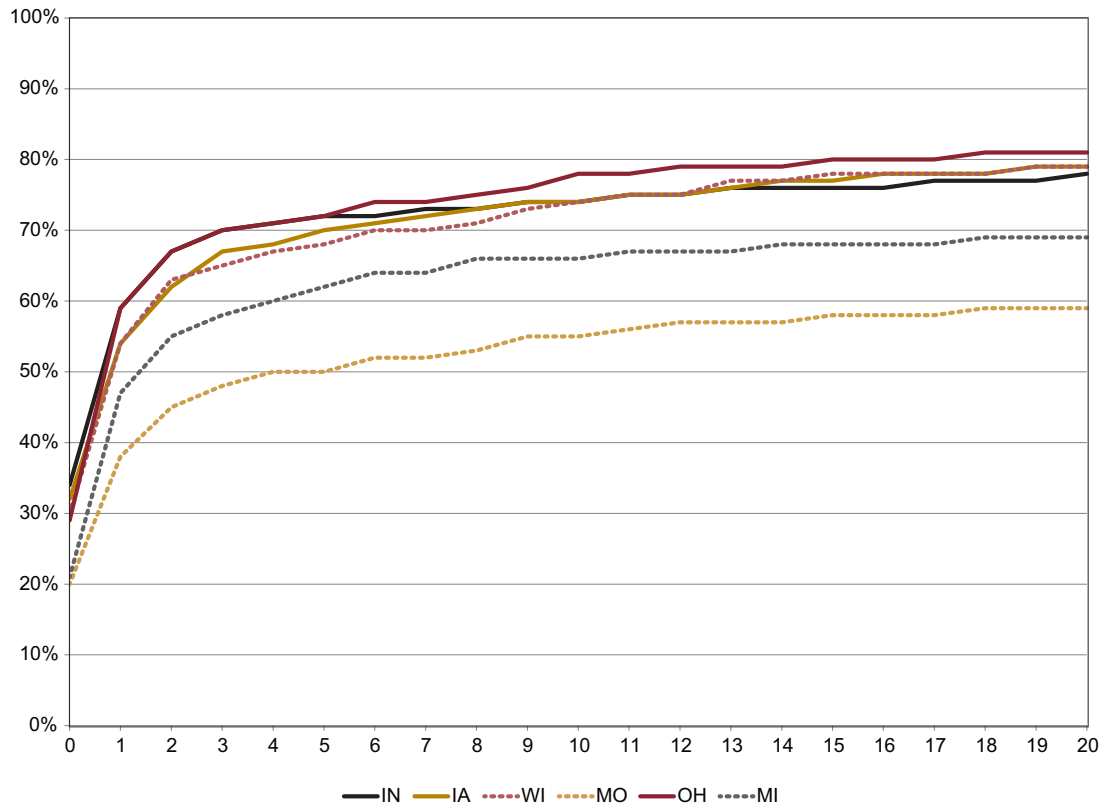
Figure 21. Cumulative rate of Illinois employment among the top-six high destination states.

Who Gains Employment in Illinois?

In the following section we provide an examination of select student-level and school-level characteristics associated with gaining employment in Illinois, first descriptively and then using binary logistic regression to control for other factors. We focus on outmigrants in this section, and on stayers in the section that follows.

Family income

Outmigrants from high income families had the highest rate of Illinois employment (68%), though there was not a great deal of variation between them and their middle-income counterparts (66%). However, their peers from the low income category had a somewhat lower rate of Illinois employment at 59%.

Institutional selectivity

Outmigrants graduating from highly competitive and less/non selective institutions, as measured by Barron's, had similar rates of Illinois employment. These aforementioned rates were somewhat lower relative to their counterparts who graduated from competitive and very competitive institutions.

Geography

As illustrated in Figure 22, outmigrants originally from suburban and urban locales in Illinois had the highest rates of Illinois employment, as opposed to outmigrants from rural or town locales. Regarding region, outmigrants emanating from the Chicago area (Chicago and its suburbs) experienced the highest Illinois-based employment rates relative to outmigrants emanating from the other regions in the state, but most particularly the West Central Region.

HIgh school sector

Outmigrants graduating from private high schools in Illinois had a somewhat higher rate of Illinois employment (72%) when compared with their public high school peers (65%). This could be related to the previously mentioned differences based on both locale and region, as proportionally more of the private high school graduates emanate from Chicago and its suburbs.

Student-level demographics

Asian American outmigrants (59%), as well as the outmigrants in the "other" race/ethnicity category (60%) had substantially lower rates of Illinois employment particularly when compared to African American outmigrants (72%). Latino and White outmigrants fell somewhere in between the previously mentioned racial/ethnic groups and experienced Illinois employment rates of 65% and 67% respectively. A slight gender difference (three percentage points) favoring male outmigrants was evident.

High school grade point average

Students with high school GPAs within the 'A' category had the lowest rate of Illinois employment (63%) by a fairly wide margin (four percentage points), and those in the lowest GPA category (<2.0) experienced the next lowest rate at 67%. Roughly three-quarters of the outmigrants falling into the 2.0-2.4 and 2.5-2.9 high school GPA categories had gained employment after earning their bachelor's degree.

College major and pathways

Business and communications majors had the highest rates of Illinois employment, whereas those earning a degree in one of the skilled and technical sciences (most of which are STEM programs) had the lowest rate of return. In fact, there was a six percentage point gap between the skilled and technical sciences and the next highest major grouping category, or Agriculture and Natural Resources (56% to 62%). These results held when we examined STEM degrees more specifically using the six-digit CIP code, as only 58% of outmigrants with STEM degrees eventually returned to Illinois for employment. This does not equate to STEM majors being less likely to gain employment, as most are likely employed in other states. The low rate of Illinois employment represents some of the loss of human capital that the state of Illinois experiences as a result of outmigration. In terms of pathways, both the direct four-year college entrants as well as the community college to four-year college transfer students returned to Illinois for employment at a rate of 67%.

Only 58% of outmigrants with STEM degrees eventually returned to Illinois for employment.

The low rate of Illinois employment among STEM majors represents some of the loss of human capital that the state of Illinois experiences as a result of outmigration.

Family Income

High	68%
Mid-High	66%
Mid-Low	66%
Low	59%
Missing	67%

CIP Cluster

Ag and Natural Resources	62%
Business, Marketing, and Management	71%
Communications and Information Systems	70%
Health Sciences	64%
Human Sciences and Education	65%
Skilled and Technical Sciences	56%

STEM

STEM	58%

Barron's Selectivity

Most/Highly	55%
Very	69%
Competitive	72%
Less/Non	56%
Not Defined	69%

Locale

Urban	66%
Suburban	68%
Town	57%
Rural	56%

Race

White	67%
African American	72%
Latino	65%
Asian	59%
Other	60%
Missing	66%

Enrollment Pattern for Outmigrants

Direct Four-Year Entrant	67%
Direct Two-Year Entrant	67%

Region

Chicago	73%
Northeast	68%
Northwest	62%
East Central	56%
West Central	46%
Southwest	54%
Southeast	52%

GPA

3.5 +	63%
3.0 - 3.4	71%
2.5 - 2.9	74%
2.0 - 2.4	75%
<2.0	67%
Missing	65%

Gender

Male	68%
Female	65%

High School Type

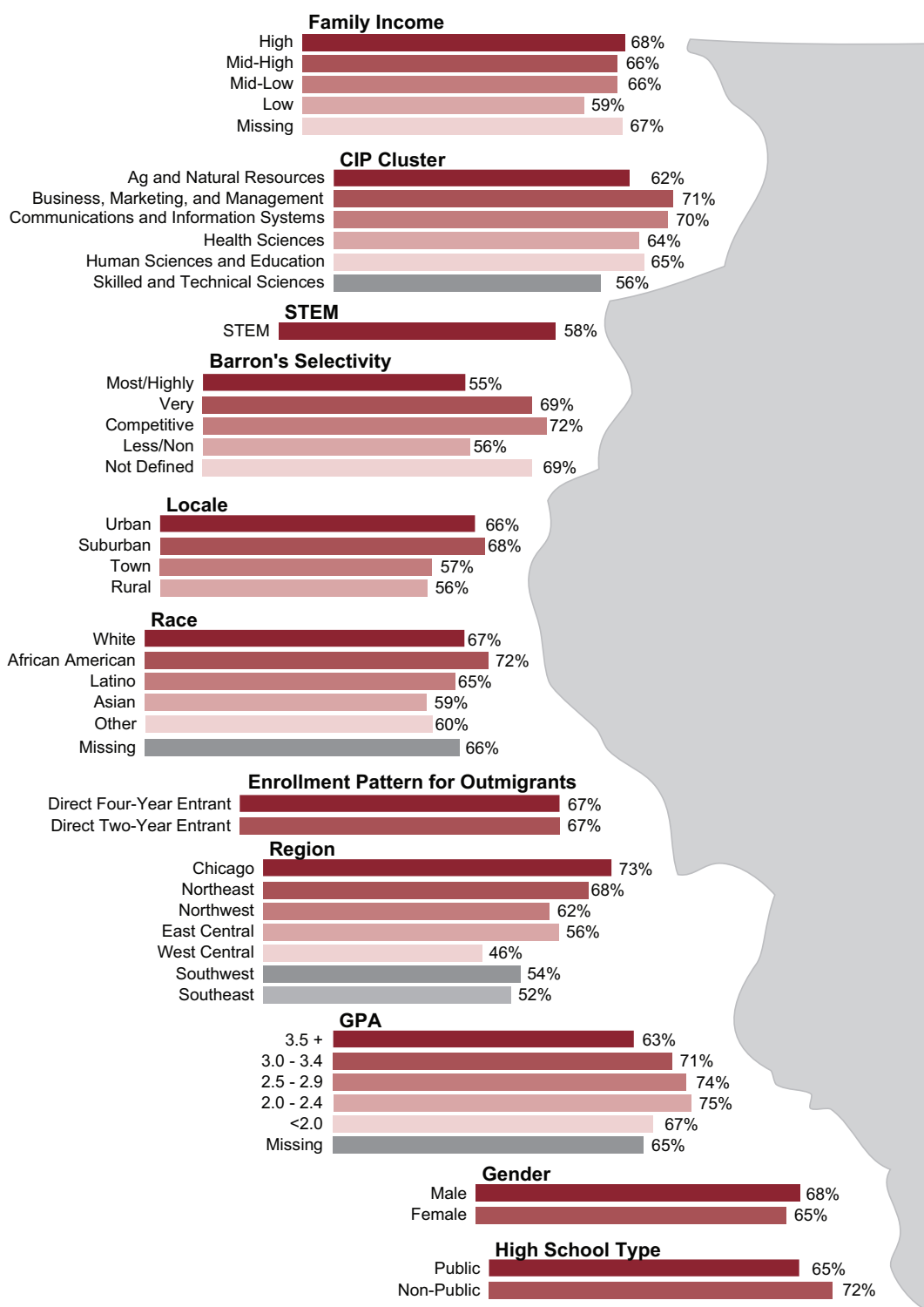|	
Public	65%
Non-Public	72%

Figure 22. Rate of Illinois employment for outmigrants by key factors (n=4,400).

Illinois Employment Rates among the Stayers

The entire study group (outmigrants and stayers combined) experienced an overall Illinois employment rate of 80%, whereas outmigrants and stayers maintained rates of 67% and 92%, respectively. As illustrated in Figure 23, there was substantially less variation in terms of Illinois employment among the stayers across the various student-level and school-level factors relative to the variation for the outmigrants. For example, while fifteen percentage points separated the highest and lowest CIP categories among the outmigrants, only nine percentage points separated the stayers. And as stated earlier, the stayers also maintained consistently higher rates of Illinois employment relative to the peers who outmigrated.

Student-level demographics

In terms of race/ethnicity and Illinois employment, only five percentage points separated the groups with the highest and lowest rates. White and Latino stayers had the highest rates; however, the rates of Illinois employment they experienced were only slightly higher than the other race/ethnicity groups. Among the stayers, a slight gender gap favoring female graduates was evident.

Institutional selectivity

Although the differences were more muted among the stayers, the patterns regarding institutional selectivity and Illinois employment were fairly similar to those of the outmigrants. For stayers and outmigrants alike, the students graduating from the most and least competitive institutions had the lowest rate of Illinois employment, whereas students graduating from competitive colleges had the highest rate.

High school grade point average

Stayers with the highest and lowest high school GPAs maintained the lowest Illinois employment rates (around 90%), whereas stayers within the middle high school GPA categories clustered within a percentage point of 95%.

College major

As was the case with the outmigrants, stayers earning degrees in the skilled and technical sciences (many of which are STEM) had the lowest rates of Illinois-based employment (87%), particularly when compared with those earning degrees in one of the health sciences. Nearly all of the stayers with a degree in one of the health sciences (96%) had gained employment in Illinois after graduation.

Region

Among the stayers, there was some variation based on one's region of origin. Stayers emanating from high schools in the West Central (83%) and Southwest (82%) regions had the lowest rates of Illinois employment. This could be related to nearby population centers that exist outside the state that might attract college graduates originally from those areas, such as St. Louis for those emanating from the Southwest region and the Iowa-portion of the Quad Cities[1] for those originally from the West Central region. Stayers from all other regions experienced a rate of Illinois employment within two percentage points of 91%.

_____

[1] The Quad Cities are defined at Davenport and Bettendorf, Iowa, and Rock Island and East Moline, Illinois

Family Income
- High —
- Mid-High — 92%
- Mid-Low — 88%
- Low — 92%
- Missing — 93%

CIP Cluster
- Ag and Natural Resources — 92%
- Business, Marketing, and Management — 92%
- Communications and Information Systems — 93%
- Health Sciences — 96%
- Human Sciences and Education — 93%
- Skilled and Technical Sciences — 87%

STEM
- STEM — 89%

Barron's Selectivity
- Most/Highly — 90%
- Very — 92%
- Competitive — 94%
- Less/Non — 89%
- Not Defined — 92%

Locale
- Urban — 89%
- Suburban — 93%
- Town — 88%
- Rural — 90%

Race
- White — 93%
- African American — 89%
- Latino — 92%
- Asian — 90%
- Other — 88%
- Missing — 94%

Enrollment Pattern for Outmigrants
- Direct Four-Year Entrant — 92%
- Direct Two-Year Entrant — 94%

Region
- Chicago — 89%
- Northeast — 93%
- Northwest — 90%
- East Central — 92%
- West Central — 83%
- Southwest — 82%
- Southeast — 90%

GPA
- 3.5+ — 90%
- 3.0 - 3.4 — 96%
- 2.5 - 2.9 — 94%
- 2.0 - 2.4 — 95%
- <2.0 — 89%
- Missing — 90%

Gender
- Male — 91%
- Female — 93%

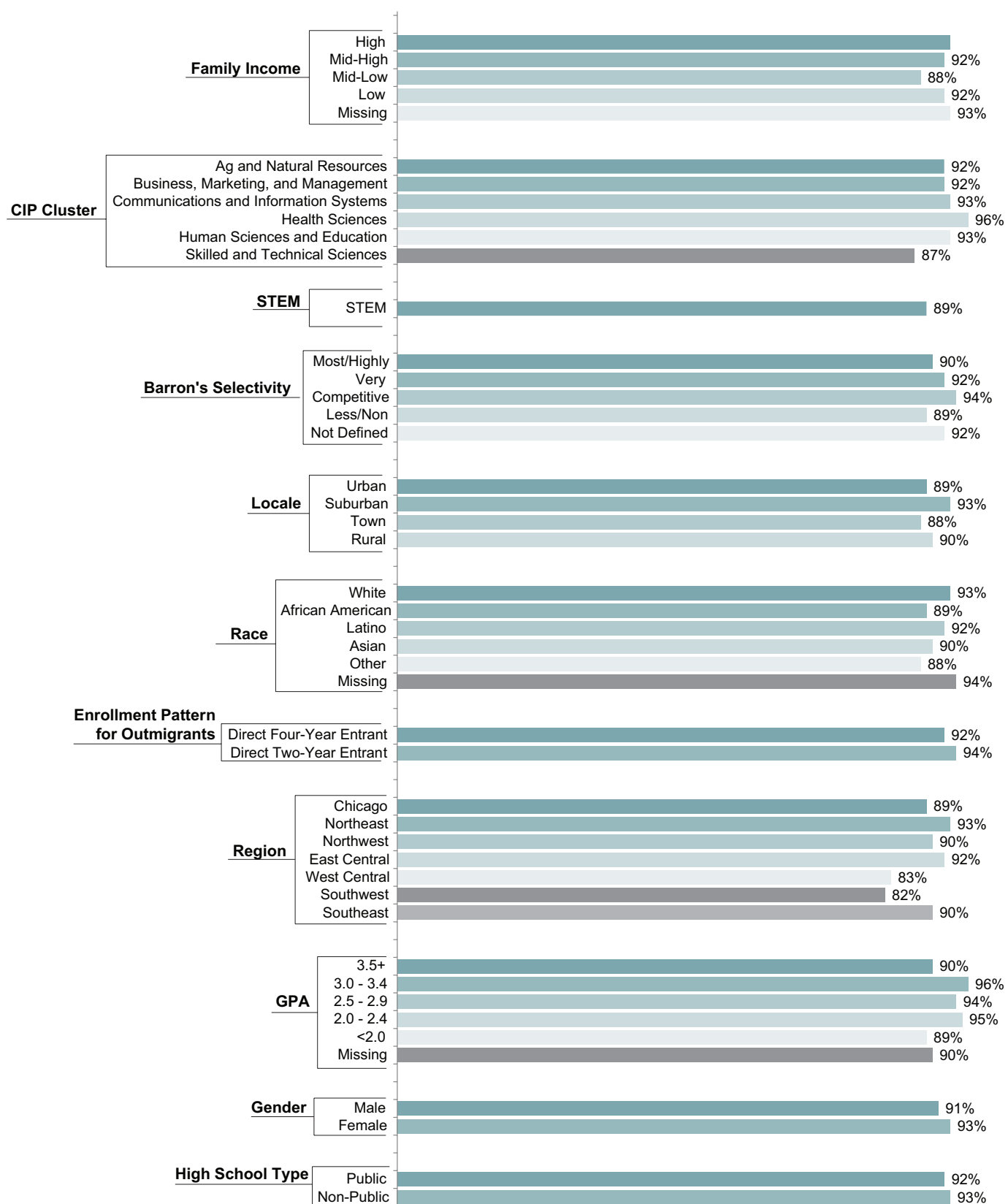**High School Type**
- Public — 92%
- Non-Public — 93%

Figure 23. Rate of Illinois employment for stayers by key factors (n=4,400).

Predicting Illinois Employment

In the following section we present a series of exploratory inferential analyses using the same student-level and school-level factors that were explored descriptively in the previous section. The analyses provide estimates of the independent importance of each factor in predicting the outcome (gaining employment in Illinois), in addition to the impact of each factor by outmigration status (e.g., Does family income have a similar relationship with Illinois employment for outmigrants as it does for stayers after holding the other factors constant?). For each group—outmigrants and stayers—we ran two binary logistic regression models predicting one's likelihood of gaining employment in Illinois after bachelor's degree completion. The first model includes a major categorization based on two-digit CIP codes and the second model removes the major categorization and instead uses a dichotomous STEM major variable based on six-digit CIP codes (see Definitions). The STEM major variable used in the second model for both the outmigrants and stayers is inclusive of at least a few of the majors in each of the larger CIP code categories used in the first model.

We developed these models to better pinpoint the types of college graduates that the state of Illinois is potentially losing (or at least not attracting back) due to outmigration. The separate models for the stayers are presented to provide context and to determine if the factors we explored had a substantially different association in terms of the likelihood of gaining Illinois-specific employment for outmigrants as opposed to stayers. Of particular interest to policymakers would be the relationship between particular majors and Illinois employment, as well as the academic qualifications of the graduates as proxied by the selectivity level of the bachelor's granting institution and their high school grade point average (college grade point average was not available). As noted in Smalley et al. (2010), the state of Illinois loses a substantially high proportion of its best and brightest students due to outmigration.

Major

As part of its performance-based funding formula, the state of Illinois provides additional financial incentives to its public four-year colleges for the completion of select college majors, particularly those included within STEM and health instructional areas. The rationale for providing greater weight in the performance-based funding for such degrees in the formula is two-fold. First, such degrees are generally more expensive to produce due to the heavy practical components (e.g., requirements for laboratory equipment). Second, and more related to the current study, is the fact that the production of those degrees is vital for the development of the Illinois workforce. As described by the Illinois Board of Higher Education (IBHE, n.d.), the rationale for performance-based funding is to spur the completion of "more degrees and college credentials that will pay dividends in increased income, more state and local tax revenue" and "to fuel the resurgence of the Illinois economy by training workers for the modern marketplace." It should be noted that performance-based funding comprises only a limited proportion of the total funding that higher education institutions receive from the state (currently set at 0.5% of the state's appropriated total budget).

In the context of the current study, we determined the extent to which outmigrants earning such degrees are more or less likely to gain Illinois employment relative to those earning degrees in alternative majors, such as business, agriculture, and education. This signifies some of the potential loss of human capital to the state of Illinois attributable to outmigration. In

other words, if the outmigrants earning degrees in STEM and/or health sciences had instead attended college in Illinois, we would expect their Illinois-specific employment outcomes to parallel those of the observationally-equivalent group of stayers. Because large overall differences in Illinois employment existed between the outmigrants and the stayers, this was not the case. Among the outmigrants, those earning degrees in STEM had the lowest rate of Illinois employment, exacerbating the negative impact associated with outmigration. In other words, as a direct result of outmigration, the state of Illinois is losing (not attracting back) a relatively higher proportion of college graduates with the exact type of degrees that some argue are vital to its economic future.

The degree-specific patterns relative to major varied for outmigrants and stayers. For the stayers, those earning degrees in the skilled and technical sciences were significantly less likely to be employed in Illinois than all other majors with the exception of agriculture. However, when we examined STEM more specifically, the comparison lacked statistical significance. That is, among stayers, STEM graduates were just as likely as graduates with non-STEM degrees to have been employed in Illinois during the study. The odds ratios also suggested that among stayers, those earning degrees in the health sciences had the highest rates of Illinois employment, echoing the descriptive results from the previous section. Among outmigrants, those with STEM degrees were significantly more likely to attain Illinois employment relative to outmigrants with non-STEM degrees.

Family income

As shown in Table 6, after controlling for differences in other factors, the comparison of high income and low income outmigrants yielded a statistically significant difference favoring those in the high income category in the first model only. Among the stayers, the comparison of the mid-low to high categories indicated a statistically significant difference favoring students in the high income category in the first model. The comparison of the missing and high categories were significant in both stayer models and indicated those in the high family income category had lower odds of being employed in Illinois than their peers with missing family income information.

High school grade point average

A few of the differences based on high school GPA were statistically significant and indicated that outmigrants in the 3.5+ category were significantly less likely to gain Illinois employment relative to the counterparts in the 3.0-3.4 and 2.5-2.9 high school GPA categories. Among the stayers, those in the top high school GPA category were significantly less likely to be employed in Illinois relative to those in the 3.0-3.4 category only.

Institutional selectivity

In the outmigrant models, students graduating from very competitive and competitive colleges were significantly more likely to return to Illinois relative to outmigrants graduating from highly selective institutions. The results specific to the outmigrant group reinforce the idea that the state of Illinois is losing more of its best and brightest students as a result of outmigration. First, outmigrants tend to have stronger academic background characteristics than their stayer counterparts and second, among outmigrants earning a bachelor's degree,

> The results specific to the outmigrant group reinforce the idea that the state of Illinois is losing more of its best and brightest students as a result of outmigration.

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Outmigration and Human Capital: Homeward Bound or Gone for Good?

> Even among stayers, those with more academic capital are somewhat less likely to have been employed in Illinois, suggesting they too may be exploring employment opportunities elsewhere

those with stronger academic backgrounds are less likely to return to Illinois for employment. This holds true in both stayer models as graduates of competitive colleges were significantly more likely to be employed in Illinois relative to students graduating from highly competitive institutions. Even among stayers, those with more academic capital (as proxied by the institutional selectivity of their four-year institution) are somewhat less likely to have been employed in Illinois, suggesting they too may be exploring employment opportunities elsewhere. However, the odds ratios related to institutional selectivity were much larger for outmigrants relative to the stayers.

Student-level demographics

Among outmigrants, no statistically significant gender difference was evident in either model; however, that was not the case for stayers. Female stayers were significantly more likely to have gained Illinois employment relative to their male counterparts. Once other factors were controlled, there were only limited differences in the likelihood of Illinois employment based on race/ethnicity. Using White students as the group of reference while exploring potential differences based on race/ethnicity yielded only a few significant comparisons. Stayers in the other race/ethnicity category were significantly less likely to have gained employment relative to their White counterparts based on both models. A similar relationship was evident among the outmigrants, but only in the second model.

Geography

After controlling for other factors, outmigrants emanating from Chicago were significantly more likely to gain Illinois employment relative to outmigrants from the Northeast region (the Chicago suburbs). However, the students from the Northeast region experienced significantly higher rates of Illinois employment relative to students from all other regions with the exception of the Southeast region (the comparative difference lacked statistical significance). The strength and direction of the relationships were fairly consistent for the outmigrants across both models. The region-specific patterns were somewhat different among the stayers, as stayers from the Northeast region had a significantly higher likelihood of Illinois employment relative to those from the East Central and West Central regions only. This held true in both models for the stayers.

Table 6

Predicting Illinois Employment by Outmigration Status

	Outmigrants Odds Ratio (n=4,400)	Outmigrants Odds Ratio (n=4,400)	Stayers Odds Ratio (n=4,400)	Stayers Odds Ratio (n=4,400)
	Model 1	Model 2	Model 1	Model 2
Major Grouping				
Ag and Natural Resource to Skilled and Technical Sciences	1.404		1.750	
Business and Marketing to Skilled and Technical Sciences	1.774***		1.503*	
Communications and Information to Skilled and Technical Sciences	1.698***		1.592*	
Health to Skilled and Technical Sciences	1.455		2.968*	
Human Sciences and Education to Skilled and Technical Sciences	1.368*		1.756**	
STEM to Non-Stem		0.701***		0.769
Gender: Male	1.086	1.107	0.718**	0.678**
Race				
African American to White	1.282	1.317	0.657	0.659
Latino to White	0.921	0.928	0.971	0.970
Asian to White	0.750	0.760	0.743	0.759
Other to White	0.750	0.712*	0.543**	0.546**
Missing to White	1.043	1.035	1.570	1.648
Family Income				
Mid-High to High	0.948	0.948	0.933	0.959
Mid-Low to High	0.986	0.965	0.692*	0.703
Low to High	0.699*	0.696	1.173	1.187
Missing to High	1.193	1.181	1.907**	1.909**
High School GPA				
3.0 - 3.4 to 3.5+	1.185*	1.181	2.715***	2.756***
2.5 - 2.9 to 3.5+	1.408**	1.379*	1.435	1.424
2.0 - 2.4 to 3.5+	1.512	1.479	1.646	1.639
<2.0 to 3.5+	1.221	1.237	0.732	0.761
Missing to 3.5+	0.889	0.883	0.595*	0.590*
HS Type: Public	0.830*	0.831*	0.997	0.990
Barron's Selectivity				
Very Competitive to Most/Highly Competitive	1.681***	1.749***	1.088	1.059
Competitive to Most/Highly Competitive	1.952***	2.018***	1.432*	1.443*
Not/Less Competitive to Most/Highly Competitive	0.932	0.979	0.770	0.760
Not Defined to Most/Highly Competitive	1.776	2.010	1.119	1.030
Direct Four-Year Entrants	0.972	0.976	0.785	0.745
Locale				
Urban to Rural	0.947	0.964	0.817	0.806
Suburban to Rural	1.157	1.150	1.034	1.012
Town to Rural	1.097	1.102	0.718	0.703
Region				
Chicago to Northeast	1.507*	1.466*	0.851	0.845
Northwest to Northeast	0.681*	0.686*	0.669	0.677
West Central to Northeast	0.585*	0.602*	0.929	0.901
East Central to Northeast	0.451***	0.455**	0.404**	0.407**
Southwest to Northeast	0.524***	0.537***	0.333***	0.326***
Southeast to Northeast	0.561	0.554	0.745	0.737

*p<.05, **p<.01, ***p<.001

Discussion

Who Outmigrates?

This research echoed previous studies regarding the academic profile and financial resources of outmigrants relative to those who stay in their home state to attend college. Outmigrants tended to demonstrate stronger academic qualifications than their peers who attended Illinois-based colleges. Relative to stayers, outmigrants had higher ACT scores, a somewhat higher proportion within the highest high school GPA category, a higher proportion participating in a college preparatory program, and a higher proportion participating in AP courses. Financial resources also factored into outmigration, as outmigrants were much more likely to be from high-income families when compared to stayers and, as a result, somewhat fewer of the outmigrants emanated from middle-to-low income families.

School-level characteristics were also important, as aggregate performance on the ACT and the percentage of students eligible for free and reduced priced lunch were associated with outmigration. Relative to students who attended Illinois-based colleges, outmigrants tended to be from high schools with stronger aggregate performance on the ACT, in addition to high schools with relatively fewer students eligible for free or reduced priced lunch. This too parallels previous research on Illinois outmigrants (Manley et al., 2013).

Many of the factors related to geography were associated with outmigration. As would be expected, more of the outmigrants expressed an initial desire to enroll outside of Illinois, and a larger proportion of stayers indicated Illinois as their state of choice for college. There was also an interesting relationship between outmigration and both preferred pathway and actual pathway. Fewer of the outmigrants anticipated enrolling at a community college and fewer actually took that postsecondary pathway, equating to more outmigrants directly entering four-year colleges. Further, more of the stayers reverse transferred to a community college or laterally transferred during the college enrollment tracking period, all suggesting that larger proportions of the stayers engaged in common transfer patterns (lateral and reverse transferring) as they progressed towards bachelor's degree completion.

Regarding the factors specific to Astin's (1984, 1993) involvement construct, larger proportions of the outmigrants indicated a desire to participate in service organizations and clubs as part of their college experience. By definition, most of the outmigrants were attending college a great distance away from their home area, which necessitates living on-campus or away from "home." Living on or near campus could arguably help facilitate a greater degree of involvement, as opposed to living off-campus with one's parents, as the stayers were more likely to do. Not having to work while attending college could also facilitate a higher degree of involvement. This also seemed to create a situation that allowed for a greater degree of involvement for the outmigrants. More of the outmigrants reported that they did not intend to work during school, whereas more of the stayers indicated that they anticipated working between 11 and 30 hours a week.

> Outmigrants tended to demonstrate stronger academic qualifications than their peers who attended Illinois-based colleges.

> Fewer of the outmigrants anticipated enrolling at a community college and fewer actually took that postsecondary pathway, equating to more outmigrants directly entering four-year colleges

Who Returns to Illinois for Employment?

Outmigrants from most high yield states had a relatively high likelihood of returning to Illinois for employment. A fairly high proportion of outmigrants from Ohio, Indiana, Wisconsin, and to a lesser extent Iowa, made their eventual return; nonetheless, these rates were still substantially lower than those of the observationally-equivalent group of stayers by more than ten percentage points. Missouri was a surprising case among the high yield states, in that Illinois outmigrants graduating from Missouri-based colleges had a considerably lower rate of return (around 60%). And because many of the Illinois outmigrants who attended college in Missouri emanated from Chicago and its suburbs, this low rate of return is not likely to be entirely explained by outmigrants actually returning to the Southwest region of Illinois, living fairly close to Missouri, and working in St. Louis. Even though outmigrants from Chicago and its suburbs had a somewhat higher rate of return relative to their peers originally emanating from other regions of the state of Illinois and particularly the downstate regions, it was still fairly low (66% among Missouri-based outmigrants from the Northeast region). Further, outmigrants graduating from Missouri-based institutions who emanated from the Southwest region in Illinois comprised roughly a one-third of all Missouri outmigrants and constituted about 30% of those gaining Illinois employment. So, although proportionally fewer of the outmigrants from the Southwest region who earned their bachelor's degree at a Missouri college returned to Illinois for employment, this slight imbalance could not entirely explain the low overall rate of return among all outmigrants with a Missouri-based degree.

Conditional upon employment in Illinois, many of the earnings-based outcomes were fairly similar, if not identical, between the outmigrants and the stayers. This, along with the quasi-experimental approach taken to create the comparison group of stayers, provides an indication of some of the economic consequences of outmigration to the state of Illinois. We can assume that differences in the rates of Illinois employment between the two groups provide the answer to our counterfactual, or what would have occurred if the outmigrants had instead enrolled at Illinois-based colleges. Therefore, we would expect the outmigrants to have a rate of Illinois employment that parallels that of the stayers, but that was not the case, as outmigrants were significantly less likely to gain employment in Illinois. As the Illinois-specific wages were fairly similar between the outmigrants and stayers condition upon employment, we argue that had the outmigrants been employed at the same rate as the stayers, the Illinois-specific earnings would have also been similar.

Consequences of Outmigration to Illinois

The difference in the quarterly Illinois employment rates can be attributed to the treatment effect associated with outmigration. It is highly likely that the outmigrants not working in Illinois are working in other states, earning wages and paying taxes similar to what their stayer counterparts and some of their outmigrant peers are experiencing within the Illinois workforce. In aggregate, and mostly due to outmigrants having a lower likelihood of gaining employment in Illinois, we would have expected the outmigrants as a group to have earned

> Conditional upon employment in Illinois, many of the earnings-based outcomes were fairly similar, if not identical, between the outmigrants and the stayers.

> The difference in the quarterly Illinois employment rates can be attributed to the treatment effect associated with outmigration.

We would have expected the outmigrants as a group to have earned *within Illinois* an additional $9.5 million in the fourth quarter, $10.1 million more in the eighth quarter, and $10.4 million more in the twelfth quarter following degree completion.

Not only is the state of Illinois initially losing a relatively high proportion of its best and brightest students to out-of-state colleges, but among the outmigrants who earn a bachelor's degree, those with stronger academic profiles were less likely to obtain Illinois employment upon graduation.

The outmigrants with the degrees deemed most important for the Illinois economy (namely STEM degrees), are the least likely to return to Illinois for employment.

within Illinois an additional $9.5 million in the fourth quarter, $10.1 million more in the eighth quarter, and $10.4 million more in the twelfth quarter following degree completion.[2] We reiterate that the outmigrants are not actually experiencing wage loss or employment loss, as they are most likely gaining parallel employment with similar wages outside the state of Illinois. As a result, the treatment effect—i.e., lower rates of Illinois-specific employment, resulting in lower aggregate Illinois wages among the outmigrant group—represents the negative economic impact that outmigration has on the state of Illinois, not on the outmigrants themselves.

Not only is the state of Illinois initially losing a relatively high proportion of its best and brightest students to out-of-state colleges, but among the outmigrants who earn a bachelor's degree, those with stronger academic profiles were less likely to obtain Illinois employment upon graduation. Perhaps the outmigrants with stronger academic backgrounds are afforded greater employment opportunities where they earn their degrees or elsewhere. Our results indicate that if the outmigrants had instead attended Illinois-based institutions (our counterfactual), we would expect more than nine out of every ten to eventually obtain employment in Illinois, yet only two-thirds do. Further, the outmigrants with the degrees deemed most important for the Illinois economy (namely STEM degrees), are the least likely to return to Illinois for employment.

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[2] Based on the difference in the quarterly rate of employment in Illinois between the stayers and the outmigrants multiplied by the mean quarterly wages of the stayers in the given quarter.

Recommendations for Further Investigation

1. Baccalaureate degree earners who attended graduate/professional school should be tracked and their eventual workforce outcomes should be examined in the context of outmigration. The eventual outcomes of the original outmigrants and stayers who attend graduate school could represent an even greater loss of human capital for the state of Illinois, as those with graduate and professional degrees generally have higher median salaries.

2. A longer time horizon, such as ten years after baccalaureate completion, should be considered in an effort to more adequately examine long term employment outcomes. This would not only allow us to more adequately track the employment outcomes of graduate/professional school completers (as previously mentioned), but also determine if those who return to Illinois (stayers and outmigrants alike) remain in Illinois as they advance in their careers and if those who have not yet returned after five years eventually come back.

3. Further, the rates of Illinois employment for graduates of Illinois institutions who originated from other states should be measured. This would allow us to establish the extent to which the state is able to make up for some of the loss of human capital due to outmigration (and the negative net-migration rate) by retaining graduates of Illinois-based colleges originally emanating from out-of-state high schools.

4. Additional geocoded information should be integrated into future studies to establish the geographic areas in which study group members are gaining Illinois-based employment. For the current study, we were only able to determine if study group members became employed in Illinois as a whole. It might be beneficial to determine the extent to which all graduates, stayers and outmigrants alike, return to their original home area for employment.

5. It would also be advantageous to track employment outcomes over a wider geographic area and not just focus on Illinois-specific employment (See Policy Recommendation #1).

Policy Recommendations

1. Illinois should enter into data sharing agreements with neighboring states to provide a more complete picture of the workforce outcomes of its high school graduates (outmigrants, stayers, and those who never enroll in college, alike), as well as those earning postsecondary credentials within the state of Illinois.

2. The inclusion of the graduates of private high schools from Illinois provided a more comprehensive picture of the outmigration issue. We felt it was important to include these students in the current study because they are somewhat more likely to outmigrate than their peers who graduate from public high schools. Unfortunately, in the future, the Illinois Longitudinal Data System (ILDS) will only include the graduates of private high schools if they enrolled at an Illinois postsecondary institution. Therefore, we recommend obtaining information from ACT (as was done in the current study) to supplement ILDS, allowing the state to track all outmigrants and their subsequent outcomes.

3. Illinois should consider developing policies to increase affordable postsecondary options for Illinois students as one way to help keep high school graduates in Illinois. Dean, Hunt, and Smith (2006) found that both parents and students believe that there are few Illinois institutions that provide affordable, quality education.

4. In terms of workforce development, the state should also consider developing policies focusing on the active recruitment of outmigrants so that they return to Illinois, particularly those with degrees in critical areas, such as STEM or Health Science.

References

Adelman, C. (2004). *Principal indicators of student academic histories in postsecondary education*. Washington, DC: U.S. Department of Education.

Astin, A. W. (1984). Student involvement: A developmental theory for higher education. *Journal of College Student Personnel, 25*(4), 297-308.

Astin, A. W. (1993). *What matters in college? Four critical years revisited*. San Francisco, CA: Jossey-Bass.

Austin, P. C., & Mamdani, M. M. (2006). A comparison of propensity score methods: A case-study illustrating the effectiveness of post-AMI statin use. *Statistics in Medicine, 25*, 2084-2106.

Barbett, S. (1998). *Residence and migration of first-time freshmen enrolled in degree-granting institutions, Fall 1996*. U.S. Department of Education, Office of Educational Research and Improvement, National Center for Education Statistics.

Barron's. (2003). *Profiles of American colleges*. Woodbury, NY: Barron's Education Series, Inc.

Carnevale, A. P., Cheah, B., & Strohl, J. (2012). *Hard times: College majors, unemployment and earnings: Not all college degrees are created equal*. Washington, DC: Georgetown University Center on Education and the Workforce. Retrieved from: http://cew.georgetown.edu/unemployment

Cohen, J. (1977). *Statistical power analysis for the behavioral sciences*. Toronto: Academic Press.

Cohen, J. & Cohen, P. (1975). *Applied multiple regression correlation analysis for the behavioral sciences*. New York, NY: Wiley.

Dean, D. R., Hunt, E. L., & Smith, R. (2006). *Committing to keep Illinois students in-state: Understanding college choice, student migration patterns, and retention strategies*. Normal, IL: Illinois State University Center for the Study of Education Policy.

Flores, C. A., & Flores-Lagunes, A. (2009). I*dentification and estimation of causal mechanisms and net effects of a treatment*. Retrieved from: http://ftp.iza.org/dp4237.pdf

Frangakis, C. E., & Rubin, D. B. (2004). Principal stratification in causal inference. *Biometrics, 58*(1), 21-29.

Goldrick-Rab, S. (2006). Following their every move: An investigation of social-class differences in college pathways. *Sociology of Education, 79*(1), 67-79.

Gong, Y. & Presley, J.B. (2006). *The demographics and academics of college going in Illinois* (IERC 2006-2). Edwardsville, IL: Illinois Education Research Council.

Gossman, C., Nobbe, C., & Patricelli, T. (1968). *Migration of college and university students in the United States*. Seattle: University of Washington Press.

Hsing, Y., & Mixon, F. G. (1996). A regional study of net migration rates of college students. *The Review of Regional Studies, 26*(2), 197-209.

Joffe, M. M., & Rosenbaum, P. R. (1999). Invited commentary: Propensity scores. *American Journal of Epidemiology, 150*(4), 327-333.

Johns, V., & Viehland, D. W. (1989). Migration patterns of first-time freshmen in the United States. *Research in Higher Education, 30*(5), 485-502.

Illinois Board of Higher Education. (n.d.). *Performance funding background information*. Retrieved on 6-3-2014 http://www.ibhe.state.il.us/PerformanceFunding/background.htm

Lichtenberger, E. J. (2011). *Reverse transfer students and postsecondary outcomes: A potential opportunity* (IERC 2011-5). Edwardsville, IL: Illinois Education Research Council.

Manley, R. A., Dietrich, C., & Lichtenberger, E. J. (2013). *Using hierarchical generalized linear modeling to establish the determinants of out-migration*. American Educational Research Association, April 28, 2013, San Francisco, CA.

Mixon, F. G., Jr., & Hsing, Y. (1994). The determinants of out-of-state enrollments in higher education: A tobit analysis. Economics of Education Review, 13(4), 329-335.

Mullin, C. M. (2013, July). Postcollege workforce outcomes measures: Issues facing policymakers, analysts, and researchers. Washington, DC: American Association of Community Colleges.

National Center for Education Statistics. (2010). Residence and migration of all first-time degree/certificate-seeking undergraduates in degree-granting institutions, by state or jurisdiction: Fall 2010. Washington, DC. Retrieved from: http://nces.ed.gov/programs/digest/d12/tables/dt12_258.asp

National Student Clearinghouse (2010). Frequently asked questions. Retrieved from http://www.studentclearinghouse.org/highschools/hs/faqs.htm

Normand, S. L. T., Landrum, M. B., Guadagnoli, E., Ayanian, J. Z., Ryan, T. J., Cleary, P. D., & McNeil, B. J. (2001). Validating recommendations for coronary angiography following acute myocardial infarction in the elderly: a matched analysis using propensity scores. Journal of Clinical Epidemiology, 54(4), 387-398.

Rosenbaum, P. R., & Rubin, D. B. (1985). Constructing a control group using multivariate matched sampling methods that incorporate the propensity score. The American Statistician, 39(1), 33-38.

Smalley, D., Lichtenberger, E. J., & Brown, K. S. (2010). A longitudinal study of the Illinois high school class of 2002: A six year analysis of postsecondary enrollment and completion (IERC 2010-3). Edwardsville, IL: Illinois Education Research Council.

Smith, R., & Wall, A. (2006). Estimating the economic impact of college student migration from Illinois (IERC 2006-1). Edwardsville, IL: Illinois Education Research Council.

State Council for Higher Education in Virginia (2013) Guide to the VLDS post-completion wages of graduates tool. Richmond, VA: SCHEV. Retrieved from http://research.schev.edu/eom/First-look-at-the-Post-Completion-Wage-of-Graduates.pdf

Stuart, E. A. (2010). Matching methods for causal inference: A review and a look forward. Statistical Science, 25(1), 1-21. doi: 10.1214/09-STS313

Tuckman, H. P. (1970). Determinants of college student migration. Southern Economic Journal, 184-189.

U.S. Census Bureau. (2010). State and county quick facts. Retrieved from http://www.census.gov/2010census/

U.S. Department of Education. (1998). Residence and migration of first-time freshman enrolled in degree-granting institutions: Fall 1996 (NCES 98-277). Retrieved from http://nces.ed.gov/pubs98/98277.pdf

U.S. Department of Education. (2010). Residence and migration of all freshman students in degree-granting institutions, by state or jurisdiction: Fall 2008. Retrieved from http://nces.ed.gov/programs/digest/d10/tables/dt10_230.asp

U.S. Department of Education. (2012). College navigator [data file]. Retrieved from http://nces.ed.gov/collegenavigator/?q=Northwestern+University&s=all&id=147767#expenses

U.S. Department of Immigration and Customs Enforcement. (2012). STEM-designated degree program list 2012 revised list. Retrieved from http://www.ice.gov/doclib/sevis/pdf/stem-list.pdf

Wang, X. (2009). Baccalaureate attainment and college persistence of community college transfer students at four-year institutions. Research in Higher Education, 50, 570–588. doi: 10.1007/s11162-009-9133-z

Appendix A

STEM-Designated Degree Program List
2012 Revised List

CIP Code Family	2010 CIP Code	Numeric Order CIP Code Title
1	1.0308	Agroecology and Sustainable Agriculture
1	1.0901	Animal Sciences, General
1	1.0902	Agricultural Animal Breeding
1	1.0903	Animal Health
1	1.0904	Animal Nutrition
1	1.0905	Dairy Science
1	1.0906	Livestock Management
1	1.0907	Poultry Science
1	1.0999	Animal Sciences, Other.
1	1.1001	Food Science
1	1.1002	Food Technology and Processing
1	1.1099	Food Science and Technology, Other
1	1.1101	Plant Sciences, General
1	1.1102	Agronomy and Crop Science
1	1.1103	Horticultural Science
1	1.1104	Agricultural and Horticultural Plant Breeding
1	1.1105	Plant Protection and Integrated Pest Management
1	1.1106	Range Science and Management
1	1.1199	Plant Sciences, Other
1	1.1201	Soil Science and Agronomy, General
1	1.1202	Soil Chemistry and Physics
1	1.1203	Soil Microbiology
1	1.1299	Soil Sciences, Other
3	3.0101	Natural Resources/Conservation, General
3	3.0103	Environmental Studies
3	3.0104	Environmental Science
3	3.0199	Natural Resources Conservation and Research, Other
3	3.0205	Water, Wetlands, and Marine Resources Management
3	3.0502	Forest Sciences and Biology
3	3.0508	Urban Forestry
3	3.0509	Wood Science and Wood Products/Pulp and Paper Technology
3	3.0601	Wildlife, Fish and Wildlands Science and Management
4	4.0902	Architectural and Building Sciences/Technology
9	9.0702	Digital Communication and Media/Multimedia
10	10.0304	Animation, Interactive Technology, Video Graphics and Special Effects

CIP Code Family	2010 CIP Code	Numeric Order CIP Code Title
11	11.0101	Computer and Information Sciences, General
11	11.0102	Artificial Intelligence
11	11.0103	Information Technology
11	11.0104	Informatics
11	11.0199	Computer and Information Sciences, Other
11	11.0201	Computer Programming/Programmer, General
11	11.0202	Computer Programming, Specific Applications
11	11.0203	Computer Programming, Vendor/Product Certification
11	11.0299	Computer Programming, Other
11	11.0301	Data Processing and Data Processing Technology/Technician
11	11.0401	Information Science/Studies
11	11.0501	Computer Systems Analysis/Analyst
11	11.0701	Computer Science
11	11.0801	Web Page, Digital/Multimedia and Information Resources Design
11	11.0802	Data Modeling/Warehousing and Database Administration
11	11.0803	Computer Graphics
11	11.0804	Modeling, Virtual Environments and Simulation
11	11.0899	Computer Software and Media Applications, Other
11	11.0901	Computer Systems Networking and Telecommunications
11	11.1001	Network and System Administration/Administrator
11	11.1002	System, Networking, and LAN/WAN Management/Manager
11	11.1003	Computer and Information Systems Security/Information Assurance
11	11.1004	Web/Multimedia Management and Webmaster
11	11.1005	Information Technology Project Management
11	11.1006	Computer Support Specialist
11	11.1099	Computer/Information Technology Services Administration and Management, Other
13	13.0501	Educational/Instructional Technology
13	13.0601	Educational Evaluation and Research
13	13.0603	Educational Statistics and Research Methods
14	14.0101	Engineering, General
14	14.0102	Pre-Engineering
14	14.0201	Aerospace, Aeronautical and Astronautical/Space Engineering

CIP Code Family	2010 CIP Code	Numeric Order CIP Code Title
14	14.0301	Agricultural Engineering
14	14.0401	Architectural Engineering
14	14.0501	Bioengineering and Biomedical Engineering
14	14.0601	Ceramic Sciences and Engineering
14	14.0701	Chemical Engineering
14	14.0702	Chemical and Biomolecular Engineering
14	14.0799	Chemical Engineering, Other
14	14.0801	Civil Engineering, General
14	14.0802	Geotechnical and Geoenvironmental Engineering
14	14.0803	Structural Engineering
14	14.0804	Transportation and Highway Engineering
14	14.0805	Water Resources Engineering
14	**14.0899**	Civil Engineering, Other
14	14.0901	Computer Engineering, General
14	14.0902	Computer Hardware Engineering
14	14.0903	Computer Software Engineering
14	**14.0999**	Computer Engineering, Other
14	14.1001	Electrical and Electronics Engineering
14	14.1003	Laser and Optical Engineering
14	14.1004	Telecommunications Engineering
14	14.1099	Electrical, Electronics and Communications Engineering, Other.
14	14.1101	Engineering Mechanics
14	14.1201	Engineering Physics/Applied Physics
14	**14.1301**	Engineering Science
14	14.1401	Environmental/Environmental Health Engineering
14	14.1801	Materials Engineering
14	14.1901	Mechanical Engineering
14	14.2001	Metallurgical Engineering
14	14.2101	Mining and Mineral Engineering
14	14.2201	Naval Architecture and Marine Engineering
14	14.2301	Nuclear Engineering
14	14.2401	Ocean Engineering
14	14.2501	Petroleum Engineering
14	14.2701	Systems Engineering
14	14.2801	Textile Sciences and Engineering
14	14.3201	Polymer/Plastics Engineering
14	14.3301	Construction Engineering
14	14.3401	Forest Engineering
14	14.3501	Industrial Engineering
14	14.3601	Manufacturing Engineering
14	14.3701	Operations Research
14	14.3801	Surveying Engineering

CIP Code Family	2010 CIP Code	Numeric Order CIP Code Title
14	14.3901	Geological/Geophysical Engineering
14	14.4001	Paper Science and Engineering
14	14.4101	Electromechanical Engineering
14	14.4201	Mechatronics, Robotics, and Automation Engineering
14	14.4301	Biochemical Engineering
14	14.4401	Engineering Chemistry
14	14.4501	Biological/Biosystems Engineering
14	14.9999	Engineering, Other
15	15.0000	Engineering Technology, General
15	15.0101	Architectural Engineering Technology/ Technician
15	15.0201	Civil Engineering Technology/Technician
15	15.0303	Electrical, Electronic and Communications Engineering Technology/Technician
15	15.0304	Laser and Optical Technology/Technician
15	15.0305	Telecommunications Technology/Technician
15	15.0306	Integrated Circuit Design
15	15.0399	Electrical and Electronic Engineering Technologies/Technicians, Other
15	15.0401	Biomedical Technology/Technician
15	15.0403	Electromechanical Technology/ Electromechanical Engineering Technology
15	15.0404	Instrumentation Technology/Technician
15	15.0405	Robotics Technology/Technician
15	15.0406	Automation Engineer Technology/Technician
15	15.0499	Electromechanical and Instrumentation and Maintenance Technologies/Technicians, Other
15	15.0501	Heating, Ventilation, Air Conditioning and Refrigeration Engineering Technology/ Technician
15	15.0503	Energy Management and Systems Technology/ Technician
15	15.0505	Solar Energy Technology/Technician.
15	15.0506	Water Quality and Wastewater Treatment Management and Recycling Technology/ Technician
15	15.0507	Environmental Engineering Technology/ Environmental Technology
15	15.0508	Hazardous Materials Management and Waste Technology/Technician
15	15.0599	Environmental Control Technologies/ Technicians, Other
15	15.0607	Plastics and Polymer Engineering Technology/ Technician
15	15.0611	Metallurgical Technology/Technician
15	15.0612	Industrial Technology/Technician

CIP Code Family	2010 CIP Code	Numeric Order CIP Code Title
15	15.0613	Manufacturing Engineering Technology/Technician
15	15.0614	Welding Engineering Technology/Technician
15	15.0615	Chemical Engineering Technology/Technician
15	15.0616	Semiconductor Manufacturing Technology
15	15.0699	Industrial Production Technologies/Technicians, Other
15	15.0701	Occupational Safety and Health Technology/Technician
15	15.0702	Quality Control Technology/Technician
15	15.0703	Industrial Safety Technology/Technician
15	15.0704	Hazardous Materials Information Systems Technology/Technician
15	15.0799	Quality Control and Safety Technologies/Technicians, Other.
15	15.0801	Aeronautical/Aerospace Engineering Technology/Technician
15	15.0803	Automotive Engineering Technology/Technician
15	15.0805	Mechanical Engineering/Mechanical Technology/Technician
15	15.0899	Mechanical Engineering Related Technologies/Technicians, Other
15	15.0901	Mining Technology/Technician
15	15.0903	Petroleum Technology/Technician
15	15.0999	Mining and Petroleum Technologies/Technicians, Other
15	15.1001	Construction Engineering Technology/Technician
15	15.1102	Surveying Technology/Surveying
15	15.1103	Hydraulics and Fluid Power Technology/Technician
15	15.1199	Engineering-Related Technologies, Other
15	15.1201	Computer Engineering Technology/Technician
15	15.1202	Computer Technology/Computer Systems Technology
15	15.1203	Computer Hardware Technology/Technician
15	15.1204	Computer Software Technology/Technician
15	15.1299	Computer Engineering Technologies/Technicians, Other
15	15.1301	Drafting and Design Technology/Technician, General
15	15.1302	CAD/CADD Drafting and/or Design Technology/Technician
15	15.1303	Architectural Drafting and Architectural CAD/CADD
15	15.1304	Civil Drafting and Civil Engineering CAD/CADD
15	15.1305	Electrical/Electronics Drafting and Electrical/Electronics CAD/CADD
15	15.1306	Mechanical Drafting and Mechanical Drafting CAD/CADD

CIP Code Family	2010 CIP Code	Numeric Order CIP Code Title
15	15.1399	Drafting/Design Engineering Technologies/Technicians, Other
15	15.1401	Nuclear Engineering Technology/Technician
15	15.1501	Engineering/Industrial Management
15	15.1502	Engineering Design
15	15.1503	Packaging Science
15	15.1599	Engineering-Related Fields, Other
15	15.1601	Nanotechnology
15	15.9999	Engineering Technologies and Engineering-Related Fields, Other
26	26.0101	Biology/Biological Sciences, General
26	26.0102	Biomedical Sciences, General
26	26.0202	Biochemistry
26	26.0203	Biophysics
26	26.0204	Molecular Biology
26	26.0205	Molecular Biochemistry
26	26.0206	Molecular Biophysics
26	26.0207	Structural Biology
26	26.0208	Photobiology
26	26.0209	Radiation Biology/Radiobiology
26	26.0210	Biochemistry and Molecular Biology
26	26.0299	Biochemistry, Biophysics and Molecular Biology, Other
26	26.0301	Botany/Plant Biology
26	26.0305	Plant Pathology/Phytopathology
26	26.0307	Plant Physiology
26	26.0308	Plant Molecular Biology
26	26.0399	Botany/Plant Biology, Other
26	26.0401	Cell/Cellular Biology and Histology
26	26.0403	Anatomy
26	26.0404	Developmental Biology and Embryology
26	26.0406	Cell/Cellular and Molecular Biology
26	26.0407	Cell Biology and Anatomy
26	26.0499	Cell/Cellular Biology and Anatomical Sciences, Other
26	26.0502	Microbiology, General
26	26.0503	Medical Microbiology and Bacteriology
26	26.0504	Virology
26	26.0505	Parasitology
26	26.0506	Mycology
26	26.0507	Immunology
26	26.0508	Microbiology and Immunology
26	26.0599	Microbiological Sciences and Immunology, Other
26	26.0701	Zoology/Animal Biology
26	26.0702	Entomology

CIP Code Family	2010 CIP Code	Numeric Order CIP Code Title
26	26.0707	Animal Physiology
26	26.0708	Animal Behavior and Ethology
26	26.0709	Wildlife Biology
26	26.0799	Zoology/Animal Biology, Other
26	26.0801	Genetics, General
26	26.0802	Molecular Genetics
26	26.0803	Microbial and Eukaryotic Genetics
26	26.0804	Animal Genetics
26	26.0805	Plant Genetics
26	26.0806	Human/Medical Genetics
26	26.0807	Genome Sciences/Genomics
26	26.0899	Genetics, Other
26	26.0901	Physiology, General
26	26.0902	Molecular Physiology
26	26.0903	Cell Physiology
26	26.0904	Endocrinology
26	26.0905	Reproductive Biology
26	26.0907	Cardiovascular Science
26	26.0908	Exercise Physiology
26	26.0909	Vision Science/Physiological Optics
26	26.0910	Pathology/Experimental Pathology
26	26.0911	Oncology and Cancer Biology
26	26.0912	Aerospace Physiology and Medicine
26	26.0999	Physiology, Pathology, and Related Sciences, Other
26	26.1001	Pharmacology
26	26.1002	Molecular Pharmacology
26	26.1003	Neuropharmacology
26	26.1004	Toxicology
26	26.1005	Molecular Toxicology
26	26.1006	Environmental Toxicology
26	26.1007	Pharmacology and Toxicology
26	26.1099	Pharmacology and Toxicology, Other
26	26.1101	Biometry/Biometrics
26	26.1102	Biostatistics
26	26.1103	Bioinformatics
26	26.1104	Computational Biology
26	26.1199	Biomathematics, Bioinformatics, and Computational Biology, Other
26	26.1201	Biotechnology
26	26.1301	Ecology
26	26.1302	Marine Biology and Biological Oceanography
26	26.1303	Evolutionary Biology
26	26.1304	Aquatic Biology/Limnology
26	26.1305	Environmental Biology

CIP Code Family	2010 CIP Code	Numeric Order CIP Code Title
26	26.1306	Population Biology
26	26.1307	Conservation Biology
26	26.1308	Systematic Biology/Biological Systematics
26	26.1309	Epidemiology
26	26.1310	Ecology and Evolutionary Biology
26	26.1399	Ecology, Evolution, Systematics and Population Biology, Other
26	26.1401	Molecular Medicine
26	26.1501	Neuroscience
26	26.1502	Neuroanatomy
26	26.1503	Neurobiology and Anatomy
26	26.1504	Neurobiology and Behavior
26	26.1599	Neurobiology and Neurosciences, Other
26	26.9999	Biological and Biomedical Sciences, Other
27	27.0101	Mathematics, General
27	27.0102	Algebra and Number Theory
27	27.0103	Analysis and Functional Analysis
27	27.0104	Geometry/Geometric Analysis
27	27.0105	Topology and Foundations
27	27.0199	Mathematics, Other.
27	27.0301	Applied Mathematics, General
27	27.0303	Computational Mathematics
27	27.0304	Computational and Applied Mathematics
27	27.0305	Financial Mathematics
27	27.0306	Mathematical Biology
27	27.0399	Applied Mathematics, Other
27	27.0501	Statistics, General
27	27.0502	Mathematical Statistics and Probability
27	27.0503	Mathematics and Statistics
27	27.0599	Statistics, Other.
27	27.9999	Mathematics and Statistics, Other
28	28.0501	Air Science/Airpower Studies
28	28.0502	Air and Space Operational Art and Science
28	28.0505	Naval Science and Operational Studies
29	29.0201	Intelligence, General
29	29.0202	Strategic Intelligence
29	29.0203	Signal/Geospatial Intelligence
29	29.0204	Command & Control (C3, C4I) Systems and Operations
29	29.0205	Information Operations/Joint Information Operations
29	29.0206	Information/Psychological Warfare and Military Media Relations
29	29.0207	Cyber/Electronic Operations and Warfare
29	29.0299	Intelligence, Command Control and Information Operations, Other

CIP Code Family	2010 CIP Code	Numeric Order CIP Code Title
29	29.0301	Combat Systems Engineering
29	29.0302	Directed Energy Systems
29	29.0303	Engineering Acoustics
29	29.0304	Low-Observables and Stealth Technology
29	29.0305	Space Systems Operations
29	29.0306	Operational Oceanography
29	29.0307	Undersea Warfare
29	29.0399	Military Applied Sciences, Other
29	29.0401	Aerospace Ground Equipment Technology
29	29.0402	Air and Space Operations Technology
29	29.0403	Aircraft Armament Systems Technology
29	29.0404	Explosive Ordinance/Bomb Disposal
29	29.0405	Joint Command/Task Force (C3, C4I) Systems
29	29.0406	Military Information Systems Technology
29	29.0407	Missile and Space Systems Technology
29	29.0408	Munitions Systems/Ordinance Technology
29	29.0409	Radar Communications and Systems Technology
29	29.0499	Military Systems and Maintenance Technology, Other
29	29.9999	Military Technologies and Applied Sciences, Other
30	30.0101	Biological and Physical Sciences
30	30.0601	Systems Science and Theory
30	30.0801	Mathematics and Computer Science
30	30.1001	Biopsychology
30	30.1701	Behavioral Sciences
30	30.1801	Natural Sciences
30	30.1901	Nutrition Sciences
30	30.2501	Cognitive Science
30	30.2701	Human Biology
30	30.3001	Computational Science
30	30.3101	Human Computer Interaction
30	30.3201	Marine Sciences
30	30.3301	Sustainability Studies
40	40.0101	Physical Sciences
40	40.0201	Astronomy
40	40.0202	Astrophysics
40	40.0203	Planetary Astronomy and Science
40	40.0299	Astronomy and Astrophysics, Other
40	40.0401	Atmospheric Sciences and Meteorology, General
40	40.0402	Atmospheric Chemistry and Climatology
40	40.0403	Atmospheric Physics and Dynamics
40	40.0404	Meteorology

CIP Code Family	2010 CIP Code	Numeric Order CIP Code Title
40	40.0499	Atmospheric Sciences and Meteorology, Other
40	40.0501	Chemistry, General
40	40.0502	Analytical Chemistry
40	40.0503	Inorganic Chemistry
40	40.0504	Organic Chemistry
40	40.0506	Physical Chemistry
40	40.0507	Polymer Chemistry
40	40.0508	Chemical Physics
40	40.0509	Environmental Chemistry
40	40.0510	Forensic Chemistry
40	40.0511	Theoretical Chemistry
40	40.0599	Chemistry, Other
40	40.0601	Geology/Earth Science, General
40	40.0602	Geochemistry
40	40.0603	Geophysics and Seismology
40	40.0604	Paleontology
40	40.0605	Hydrology and Water Resources Science
40	40.0606	Geochemistry and Petrology
40	40.0607	Oceanography, Chemical and Physical
40	40.0699	Geological and Earth Sciences/Geosciences, Other
40	40.0801	Physics, General
40	40.0802	Atomic/Molecular Physics
40	40.0804	Elementary Particle Physics
40	40.0805	Plasma and High-Temperature Physics
40	40.0806	Nuclear Physics
40	40.0807	Optics/Optical Sciences
40	40.0808	Condensed Matter and Materials Physics
40	40.0809	Acoustics
40	40.0810	Theoretical and Mathematical Physics
40	40.0899	Physics, Other
40	40.1001	Materials Science
40	40.1002	Materials Chemistry
40	40.1099	Materials Sciences, Other
40	40.9999	Physical Sciences, Other
41	41.0000	Science Technologies/Technicians, General
41	41.0101	Biology Technician/Biotechnology Laboratory Technician
41	41.0204	Industrial Radiologic Technology/Technician
41	41.0205	Nuclear/Nuclear Power Technology/Technician
41	41.0299	Nuclear and Industrial Radiologic Technologies/Technicians, Other
41	41.0301	Chemical Technology/Technician
41	41.0303	Chemical Process Technology

CIP Code Family	2010 CIP Code	Numeric Order CIP Code Title
41	41.0399	Physical Science Technologies/Technicians, Other
41	41.9999	Science Technologies/Technicians, Other
42	42.2701	Cognitive Psychology and Psycholinguistics
42	42.2702	Comparative Psychology
42	42.2703	Developmental and Child Psychology
42	42.2704	Experimental Psychology
42	42.2705	Personality Psychology
42	42.2706	Physiological Psychology/Psychobiology
42	42.2707	Social Psychology
42	42.2708	Psychometrics and Quantitative Psychology
42	42.2709	Psychopharmacology
42	42.2799	Research and Experimental Psychology, Other
43	43.0106	Forensic Science and Technology
43	43.0116	Cyber/Computer Forensics and Counterterrorism
45	45.0301	Archeology
45	45.0603	Econometrics and Quantitative Economics
45	45.0702	Geographic Information Science and Cartography
49	49.0101	Aeronautics/Aviation/Aerospace Science and Technology, General
51	51.1002	Cytotechnology/Cytotechnologist
51	51.1005	Clinical Laboratory Science/Medical Technology/Technologist
51	51.1401	Medical Scientist

CIP Code Family	2010 CIP Code	Numeric Order CIP Code Title
51	51.2003	Pharmaceutics and Drug Design
51	51.2004	Medicinal and Pharmaceutical Chemistry
51	51.2005	Natural Products Chemistry and Pharmacognosy
51	51.2006	Clinical and Industrial Drug Development
51	51.2007	Pharmacoeconomics/Pharmaceutical Economics
51	51.2009	Industrial and Physical Pharmacy and Cosmetic Sciences
51	51.2010	Pharmaceutical Sciences
51	51.2202	Environmental Health
51	51.2205	Health/Medical Physics
51	51.2502	Veterinary Anatomy
51	51.2503	Veterinary Physiology
51	51.2504	Veterinary Microbiology and Immunobiology
51	51.2505	Veterinary Pathology and Pathobiology
51	51.2506	Veterinary Toxicology and Pharmacology
51	51.2510	Veterinary Preventive Medicine Epidemiology and Public Health
51	51.2511	Veterinary Infectious Diseases
51	51.2706	Medical Informatics
52	52.1301	Management Science
52	52.1302	Business Statistics
52	52.1304	Actuarial Science
52	52.1399	Management Science and Quantitative Methods, Other

Appendix B

Limitations

We acknowledge that our conservative matching procedures—requiring an exact match on region, locale, two-digit CIP code, and the Barron's competitiveness ranking of the four-year college, in addition to the caliper—resulted in some sampling bias, particularly against outmigrants emanating from less populated geographic areas of the state and with less popular majors. By default, such outmigrants have a smaller pool from which to draw potential comparison group matches. However, the matching procedures served two main purposes. First, they resulted in sufficient balance between the two groups on the factors related to one's likelihood of being an outmigrant. This allowed us to make the argument that we isolated the impact of being a treatment group member, or an outmigrant as it relates to the outcome. Second, the matching procedures controlled for differences that could have an impact on the outcome (Illinois employment), such as geographic area of origin, major, and the competitiveness ranking of one's degree-granting institution. Our conservative matching approach necessarily introduces sampling bias given that students from specific groups, such as students from rural areas, are more difficult to match.

In terms of outcomes, prior to matching, the overall rate of Illinois employment for the outmigrants (n=6,087) was 63% and after matching (n=4,400) the rate increased to 67%. Our conservative matching approach resulted in a somewhat higher overall rate of Illinois employment among the outmigrant group, suggesting the results based on the match likely underestimate the negative consequences of outmigration. In others words, to create balance (making the comparison group of stayers more "like" the treatment group of outmigrants and vice versa) some sampling bias was introduced.

The Illinois Education Research Council at Southern Illinois University Edwardsville was established in 2000 to provide Illinois with education research to support Illinois P-20 education policy making and program development. The IERC undertakes independent research and policy analysis, often in collaboration with other researchers, that informs and strengthens Illinois' commitment to providing a seamless system of educational opportunities for its citizens. Through publications, presentations, participation on committees, and a research symposium, the IERC brings objective and reliable evidence to the work of state policymakers and practitioners.

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