



BUILDING STRONGER COMMUNITY COLLEGE TRANSFER PATHWAYS: EVIDENCE FROM MASSACHUSETTS

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ABOUT THE PROJECT

Educational Opportunity in Massachusetts

Educational Opportunity in Massachusetts is a research–practice partnership between researchers at Brown University and Harvard University and the Massachusetts Department of Elementary and Secondary Education and Department of Higher Education. We study the broad effects of educational reform in the commonwealth and the ways that the public PK–12 and higher education systems promote and constrain opportunity for students from all backgrounds. Using integrated data from several state agencies, we follow students’ progress through the educational pipeline and entry into the labor force. Our work focuses on educational inequality and the consequences of standards-based reform.

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EXECUTIVE SUMMARY

Most students who enroll in community colleges soon after high school do so with the intention of eventually transferring to a four-year institution and earning at least a bachelor's degree. However, few of these students achieve their original post-secondary goals. Responding to this problem, the Massachusetts Department of Higher Education (DHE) and the state's 28 public colleges and universities have collaborated over the last 15 years to make the transfer process easier and more transparent. In this report, we follow 10 cohorts of high-school graduates who entered Massachusetts community colleges (MACCs) from fall 2005 through fall 2014 and investigate two research questions:

1. Did the proportion of students who transferred and subsequently earned a bachelor's degree increase after the state began to initiate these collaborative MassTransfer initiatives in 2008?
2. Do recent cross-cohort trends in transfer and bachelor's degree receipt differ by recognized sources of educational inequality in the United States?

Our evidence is consistent with the conclusion that the first rounds of MassTransfer initiatives have contributed to an increase across cohorts in the proportion of students who transferred within six years and to an increase in four-year bachelor's degree completion for transferees.

Our findings include a mix of good news and troubling patterns:

Transfers

- Among the two-thirds of students in our sample whose family incomes were sufficiently high that they were not eligible for a free- or reduced-price lunch as 10th graders (designated as higher-income), the proportion who transferred within six years increased substantially beginning with the 2011 MACC entry cohort, especially for female students.
- Among the one-third of students eligible for a free- or reduced-price lunch as 10th graders (designated as low-income), the proportion of students who transferred within six years did not increase across cohorts.
- MACCs increasingly serve students from low-income families: 45% of the students in our 2014 MACC entry cohort compared to 21% of those in our 2005 entry cohort. This trend held down what would have been an upward trend in the proportion of students that transferred.
- The proportions of Black and Latinx students who transferred within six years are lower than the proportion of White students who did so. Statistical analyses show that most of these differences can

be accounted for by differences in family income and quality of academic preparation, as measured by 10th-grade MCAS mathematics test scores.

Bachelor's Degree Completion

- The proportion of transferring students who earned a bachelor's degree within the next four years increased by an average of more than 1 percentage point per cohort, from a base of 51% for the 2005 MACC entering cohort.
- A much higher proportion of students who had earned at least 60 credits before transferring earned a bachelor's degree within the next four years than the proportion of students who transferred after earning only 40 credits. Almost all students who earned 60 credits before transferring also earned an associate degree.
- For every cohort we studied, the proportion of students from low-income families who earned a bachelor's degree within four years after transferring was about 12 percentage points lower than the proportion of students from higher-income families who did so.

Drawing from a longitudinal dataset following students from high school through postsecondary studies, the research summarized in this report uncovers evidence consistent with the conclusion that the first rounds of MassTransfer initiatives have contributed to an increase across cohorts in the proportion of community college students from higher-income families who transfer within six years and in the proportion of transferring students who earn a bachelor's within the subsequent four years. It is important to keep in mind that the latest cohorts of students entering MACCs that we studied experienced the initial years of the ongoing effort to implement MassTransfer policies. Outcomes for more recent cohorts of students entering community colleges may show larger impacts of the MassTransfer policies.

So far, the MassTransfer initiatives have not enabled many of the increasing number of economically disadvantaged students served by MACCs to achieve their postsecondary aspirations. Positioning these students for success will require complementary approaches, such as the state's recent investments in comprehensive student support.



I. INTRODUCTION

Low-income students in Massachusetts are especially likely to enter higher education through a community college. Recent research shows that those who complete associate degrees enjoy significant earnings gains.¹ However, they could potentially realize far greater economic benefit by transferring and completing a four-year degree.² Indeed, more than three-quarters of the students in the US who enroll in public community colleges do so with the intention of eventually transferring to a four-year institution and earning at least a bachelor's degree.³ Unfortunately, fewer than 15% of these students achieve this aim within six years after initial community college enrollment.⁴

Responding to this problem, the Massachusetts Department of Higher Education (DHE) and the state's 28 public colleges and universities have collaborated over the last fifteen years to make easier and more transparent the process of transferring from a community college to a bachelor's degree program in one of the state's public colleges or universities. In this report, we follow 10 cohorts of Massachusetts high-school graduates who entered Massachusetts community colleges (MACCs) from fall 2005 through fall 2014. We track the students in each entry cohort over their academic careers.

In our research, we address two questions. The first is whether cross-cohort trends in the proportion of students who transferred and the proportion of transferring students who earned bachelor's degrees within the next four years are consistent with the hypothesis that the state's collaborative efforts successfully facilitated these events.⁵ Our second research question is whether trends in transfer and bachelor's degree receipt differ across recognized sources of educational inequality in the United States.

In the pages that follow, we provide evidence of trends across cohorts in the success of students with different characteristics in transferring to a four-year college or university and earning bachelor's degrees. For context, we begin with a short review of the literature concerning transfer from community colleges to four-year institutions and a description of the efforts Massachusetts higher education leaders have made in recent years in response to known barriers. We then provide a brief description of our analytic sample and methods. Next, we present results for transfer patterns and bachelor's degree completion trends. The report concludes with a discussion of key takeaways.

II. WHY DO SO FEW COMMUNITY COLLEGE STUDENTS TRANSFER AND EARN BACHELOR'S DEGREES?

The research literature identifies three reasons that students who enter a community college with the aim of transferring to a four-year school and subsequently earning a bachelor's degree fail to do so. The first are personal obstacles, including family obligations, financial pressures, and inadequate preparation for college.⁶ These obstacles make it difficult for students to devote the time to pass gateway courses and to take a large enough course load to make significant academic progress, often leading them to drop out without earning academic credentials.

A second reason concerns changes in academic plans. Some students who initially planned to transfer and earn a bachelor's degree find themselves attracted to shorter-term programs. Once they learn that they can complete an associate degree program in health care or technology that provides access to stable jobs that pay as much as 30%-40% more than they had been able to earn as high school graduates, they focus on this goal.⁷ Other students are motivated to drop out of college by the lure of high-wage jobs in fields such as construction.⁸

A third reason is institutional barriers that make it difficult for students to transfer from a community college to a four-year school and then complete a bachelor's degree efficiently.⁹ Many students find that the courses they have completed in a community college will not count toward a bachelor's degree in their chosen field.¹⁰ For example, students may find that the four-year university to which they would like to transfer does not accept the introductory biology course they completed at a community college for credit toward a bachelor's degree in biology. Or students may find that their community college English class will not count toward fulfilling elective requirements for a bachelor's degree.

Several factors contribute to the institutional barriers.¹¹ Many community colleges lack the resources to provide robust student advising. Also, historically, the content of courses with similar titles has differed widely among public two- and four-year colleges and universities. As a result, individual community colleges and four-year colleges and universities have been reluctant to grant credit toward degrees for courses completed at other institutions. In addition, many four-year colleges and universities have questioned the rigor of community college courses and have been reluctant to offer credit for completion of these courses. Finally, requirements for bachelor's degrees differ among public four-year colleges and universities and often change over time, making it difficult for community colleges to develop curricula that well serve students who would like to transfer.¹²

III. MASSACHUSETTS INITIATIVES

Historically, public higher education in Massachusetts has been decentralized, with each of the state's colleges and universities making quite independent decisions about degree-program requirements and course content. While decentralization often spurs innovation at individual institutions, it adds complexity to the decisions that students entering a community college with the intention of transferring must make.

Over the last several decades, Massachusetts community colleges and individual four-year colleges and universities in the state have negotiated many articulation agreements to facilitate student transfers. These agreements typically specify combinations of community college courses that the partnering four-year institution agrees to recognize as counting toward its requirements for earning a bachelor's degree in a particular field. As of 2022, Massachusetts community colleges had signed several thousand bilateral articulation agreements. These agreements strengthened relationships between individual MACCs and four-year institutions and helped some students to earn bachelor's degrees. However, the large number of agreements signed by each community college and the specificity of each, which typically pertained to a single academic major at a single four-year institution, were confusing to students and not helpful to many who wanted to change their plans about what and where to study.¹³

In 2007, the Massachusetts Board of Higher Education created the commonwealth Transfer Advisory Group (CTAG) and charged it with reviewing and evaluating the commonwealth's policies and practices on transfer from community colleges to four-year higher-education institutions and with making recommendations for improving them. In June 2008, the Board accepted CTAG's final report, which recommended the creation of a comprehensive integrated approach called MassTransfer that would facilitate transfers between the community colleges and the public colleges and universities in the state. In July 2009, DHE launched a public-facing MassTransfer website, which described a 34-credit General Education Foundation Block that would become part of the requirements for every associate and bachelor's degree offered in the

future by Massachusetts public colleges and universities.

Publication of the Gen Ed Block requirements, as they became known, led the state's community colleges to engage in inter-college discussions about which of their courses were equivalent in content and would satisfy Gen Ed Block requirements. This was an arduous endeavor that required considerable time and the goodwill of many faculty from all 15 MACCs. In 2012, DHE signaled its commitment to the development of MassTransfer by funding and supporting the creation of the MassTransfer Course and Equivalency database. Ultimately, this database specified which of the courses offered at each of the state's community colleges and public colleges and universities were equivalent and would contribute to completion of the Gen Ed Block requirements. The database also specified which courses would count toward fulfillment of the requirements for a bachelor's degree in a particular field at each of the state's four-year colleges and universities.

While the MassTransfer Course and Equivalency database was not posted on DHE's MassTransfer website until 2016, early versions became available to academic advisors in the community colleges in 2012. Several reported that it quickly became a valuable tool in guiding students in their course selection and choice of transfer paths. It is easy to see why the database matters. For example, a student at Bunker Hill Community College interested in earning a bachelor's degree in biology would need to decide whether to enroll in BIO 105 (Introduction to Biology and Lab) or BIO 195 (General Biology and Lab). From the Course and Equivalency database, the student or her advisor could learn that BIO 195 will be accepted as a traditional freshman General Biology I course for biology majors at all Massachusetts public community colleges, state colleges, and universities, and at the four UMass campuses. However, BIO 105 would only count toward satisfying the GenEd Foundation Block requirements at these institutions.

Over the last decade, in partnership with the state's 28 public colleges and universities, DHE has built on

existing articulation agreements and developed a growing number of transparent transfer pathways. These so-called MassTransfer A2B (Associate to Bachelor's) pathways specify sets of courses that satisfy requirements for an associate degree and are also guaranteed to count toward satisfying the requirements for bachelor's degrees in a particular field at particular public colleges and universities. Moreover, completion of an A2B pathway reduces the cost of transferring by eliminating application fees and essays. As stated on the MassTransfer website:

1. START AT A COMMUNITY COLLEGE

The new A2B maps lay out a set of freshman and sophomore courses in your major so that the credits you earn at your community college are guaranteed to transfer to a state college or university and count towards a bachelor's degree.

2. EARN AN ASSOCIATE DEGREE

Graduate from your community college with at least a B average and you'll have guaranteed admission to a state college or university to complete your junior and senior years—with no application fees or essays.

3. FINISH AT A STATE COLLEGE OR UNIVERSITY

With four UMass campuses and seven comprehensive state universities all around the state, plus two specialty colleges—Massachusetts College of Art and Design and Massachusetts Maritime Academy—the perfect place for you to finish your bachelor's degree is waiting.

4. LAUNCH YOUR CAREER WITH A BACHELOR'S DEGREE!

A2B maps are available in dozens of the most popular majors, including ones like STEM, Business, and Education that are in high demand among Massachusetts employers.

Earning a bachelor's degree in business administration is one example of successful A2B pathway development. There are well-defined pathways from all 15 MACCs to all four campuses of the University of Massachusetts, to six state universities, and to the Massachusetts College of Liberal Arts.

To provide another example, students who complete a well-defined, 60-credit associate degree program in computer science with a B average at Northern Essex Community College are guaranteed admission, with third-year (junior) status, to the computer-science bachelor's degree program at four Massachusetts public four-year institutions: Bridgewater State University, Fitchburg State University, the Massachusetts College of Liberal Arts, and the University of Massachusetts Amherst.¹⁴

The ongoing effort to develop A2B transfer pathways has a legal basis in Chapter 15A, Section 9 (v) of the General Laws of Massachusetts, which specifies that the Board of Higher Education should “develop and implement a transfer compact for the purpose of facilitating and fostering the transfer of students without the loss of academic credit or standing from one public institution to another.”¹⁵ However, the law does not specify details of the process, which necessitates detailed negotiations about academic standards and course content between departmental representatives of the individual community colleges and four-year colleges and universities. With facilitation from DHE consultants, the number of A2B transfer pathways has expanded and matured. However, there is still much work to be done. For example, as of July 2022, only one of the four-year public institutions

(Massachusetts College of Liberal Arts) offers a transfer pathway for students enrolled at Bunker Hill Community College who would like to earn a bachelor's degree in computer science. Also, as of this date, there are no A2B pathways in engineering.

During the same period that public educational institutions in Massachusetts have worked to establish and enhance MassTransfer policies, other events and policy changes that could have affected students' post-secondary educational decisions have also occurred. These include the Great Recession, followed by an increasingly strong Massachusetts labor market, increases in college tuition and fees, and the COVID-19" pandemic. Because of these irregular and unanticipated shocks, it is not possible to use available administrative data to develop convincing estimates of the causal impacts of MassTransfer initiatives on community college students' academic careers. However, the availability of detailed longitudinal data on the educational careers of 10 cohorts of Massachusetts high school graduates and the use of innovative statistical analysis allow us to document important descriptive trends in the probability of transferring to a four-year institution and of earning a bachelor's degree.

IV. STUDENTS WHOSE ACADEMIC EVENT HISTORIES WE FOLLOWED

As part of our research-policy partnership with the Massachusetts State Department of Elementary and Secondary Education (DESE) and Department of Higher Education (DHE), we have assembled a rich longitudinal dataset that contains information on the demographic and economic backgrounds, high-school records, and subsequent educational attainments of all students who enrolled in a Massachusetts public high school from the 2002–2003 (henceforth, 2003) through the 2021 school years.¹⁶

We use this longitudinal data to explore the academic trajectories of those Massachusetts public high-school graduates who first enrolled in a Massachusetts community college (MACC). For these students, we possess information on their post-secondary enrollment histories, credit acquisition and credentials earned in their respective community colleges, and the subsequent academic records in the four-year institutions to which they transferred, for those who transferred. Specifically, our analytic sample contains term-by-term longitudinal data on the 68,793 students who:

- Took the 10th-grade MCAS tests for the first time in a school year between 2003 and 2012.
- Graduated from a public high school in Massachusetts within three years of taking the 10th-Grade MCAS tests.
- Enrolled in an MACC in either the fall immediately following their high-school graduation or in the subsequent fall, thereby constituting what we refer to henceforth as the 2005 through 2014 MACC entry cohorts.¹⁷
- Enrolled either full-time in their first (fall) term on entry into an MACC or at least half-time in both the fall and spring terms immediately following entry.¹⁸
- Enrolled in an associate-degree program immediately on entry into an MACC.¹⁹
- Reported their race/ethnicity as Asian, Black, Latinx, or White.²⁰

Massachusetts community colleges certainly serve many students other than those in our analytic sample, including students from out of state or who attended a private high school, those who first enrolled long after they graduated from high school, and those who enrolled for purposes other than earning an associate degree (e.g., obtaining an industry-recognized certificate, or simply for personal interest and enrichment). However, our sample does include a large percentage of community college students. For example, in fall 2014, MACCs enrolled 14,472 first-time degree-seeking students. Of these, 68% had graduated from a Massachusetts public high school, and 62% had done so in the past two years.

In Table 1, we present statistics describing our analytic sample and contrasting it with two other relevant groups. In the column labeled “All High-School Graduates,” we list statistics on all Massachusetts public-school students who took the 10th-grade MCAS mathematics test in the 2003 through 2012 school years and who graduated from high school within the next three years. Finally, in the last column of the table (“Four-Year College Enrollees”), we list parallel statistics for all Massachusetts high-school graduates in those school years who enrolled in a four-year college within 15 months of high-school graduation.²¹

OUR SAMPLE OF MACC STUDENTS IS MORE DISADVANTAGED THAN AVERAGE MA PUBLIC HIGH-SCHOOL STUDENTS

STUDENT CHARACTERISTIC	GROUP		
	(a) ANALYTIC SAMPLE 68,793	(b) ALL HIGH SCHOOL GRADUATES 597,209	(c) FOUR-YEAR COLLEGE ENROLLEES 331,944
GENDER:			
Female	48.49%	50.55%	53.96%
RACE/ETHNICITY:			
Asian	3.56%	5.15%	6.18%
Black	9.19%	7.63%	5.52%
Latinx	14.70%	9.56%	5.25%
White	72.55%	77.65%	83.05%
FAMILY INCOME:			
Qualified for Free/Reduced-Price Lunch in 10th-Grade	32.15%	22.87%	13.69%
ACHIEVEMENT:			
Score on 10th-Grade MCAS Mathematics Test	-0.343	0.149	0.533

Table 1:

Selected average demographic, socioeconomic, and academic characteristics of students in the analytic sample (Column A), compared with all students who took the MCAS tests in 10th grade in the same years, then graduated from a Massachusetts public high school within the next three years (Column B), and all Massachusetts high-school graduates in those same school years who enrolled subsequently in a four-year college within 15 months of their high-school graduation (Column C).

Notice that the community college students in our analytic sample were economically disadvantaged, on average, in comparison to the general population of Massachusetts public high-school graduates and especially when compared to Massachusetts high-school graduates whose first post-secondary enrollment was in a four-year college or university. For instance, while almost a quarter (23%) of high-school graduates grew up in low-income families (as indicated by their eligibility for a free or reduced-price lunch as 10th graders), a third (32%) of our analytic sample of community college enrollees did so, compared to just over 14% of four-year college enrollees.

A similar pattern of disadvantage is evident in the corresponding average 10th grade MCAS mathematics scores, which can serve as an indicator of the quality of students' academic preparation for success in college courses. The MCAS scores that we report here were standardized to a mean of zero and a standard deviation of one, in the population of all Massachusetts high-school students who took the test in each year. Notice that the average standardized mathematics score of the community college students in our sample (-0.34) falls below the average score of all Massachusetts public high-school graduates (+0.15) and is far below the average for four-year college enrollees (+0.53).

Finally, the community college students in our analytic sample also differed in other important respects from all public high-school graduates and from those who enrolled in a four-year college or university soon after graduating. For instance, the students in our analytic sample were more likely than students in the other groups to be male, and were also more likely to be Latinx or Black. They were less likely to be of Asian heritage.

As noted above, it is critical to recognize that the demographic, socioeconomic, and academic composition of the Massachusetts public high-school graduates who entered a Massachusetts community college differed substantially from cohort to cohort. We illustrate some of the trends in the panels of Figure 1. Notice that, over these cohorts, the Massachusetts public high-school graduates who enrolled in Massachusetts community colleges were increasingly students of color; notably, 21% of students in the 2014 MACC entry cohort were Latinx compared to 9% in the 2005 entry cohort. Forty-five percent of students in the 2014 cohort came from low-income families, while 21% of students in the 2005 cohort did so. In addition, with only one exception (the 2012 entry cohort), the average 10th-grade MCAS mathematics scores declined steadily from the 2005 to the 2014 entry cohorts.

THE CHARACTERISTICS OF THE STUDENTS IN OUR SAMPLE CHANGED FROM THE 2005 THROUGH THE 2014 ENTRY COHORTS

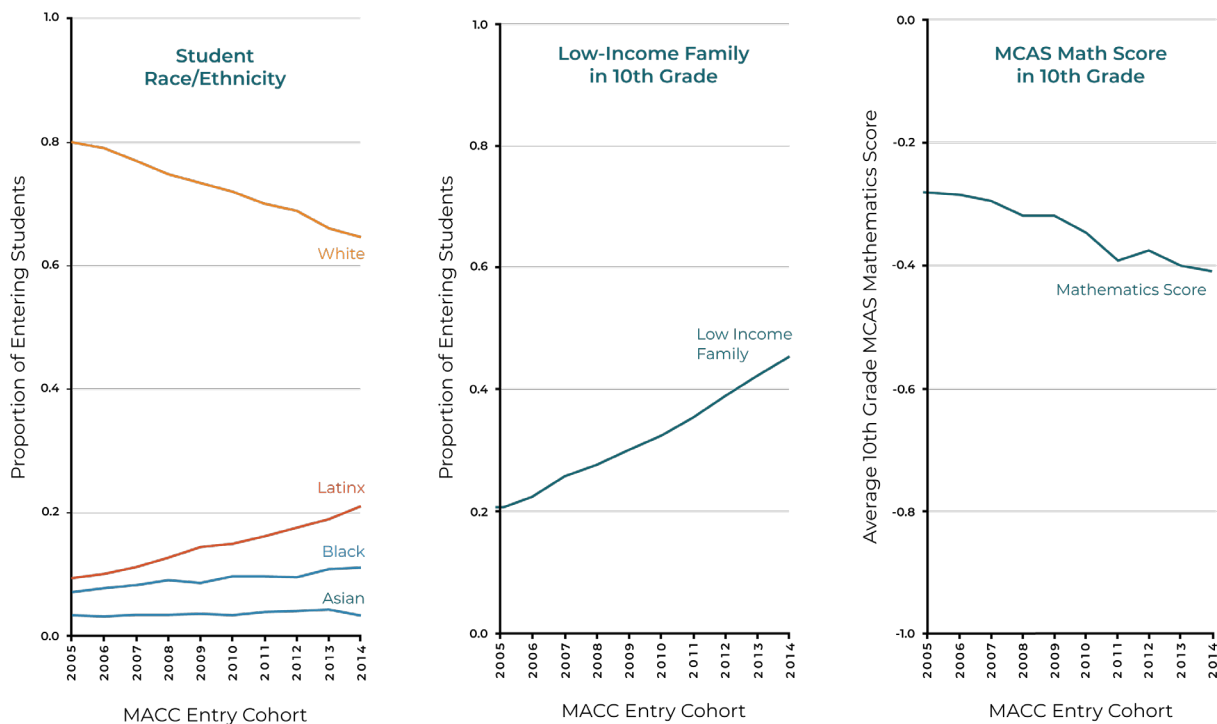


Figure 1 Cross-cohort trends in selected demographic, socioeconomic, and academic characteristics of public high-school graduates who entered a Massachusetts community college (MACC) in each academic year from 2005 through 2014. Left panel: proportion of entering students by self-declared race/ethnicity. Middle panel: proportion of entering students from low-income families. Right panel: entering students’ average 10th-grade MCAS mathematics score.

In one sense, these demographic and socioeconomic trends are praiseworthy because they indicate that Massachusetts community colleges are increasingly providing post-secondary educational opportunities to students who, had they been in earlier high school cohorts, would not have enrolled in college. However, they also are indicative of the challenge MACCs increasingly face because they are serving more and more students from groups that historically have not been served well in American public schools. Research has shown that students from these backgrounds take longer to earn post-secondary educational credentials than students with higher family incomes and stronger academic skills.²² We want to be clear that we do not view differences in the time it takes Massachusetts students from different backgrounds to earn an associate degree as reflecting differences

in their inherent abilities or motivations. Instead, we regard such differences as indicators of structural inequalities in the institutions that shape opportunities for young Americans from different backgrounds.²³ If students’ incentives and opportunities to transfer had remained stable from the 2005 through the 2014 entry cohorts, we would have expected the changing demographic characteristics of the entering student cohorts to have resulted in transfer and degree-attainment rates that declined from cohort to cohort. It is important to keep this in mind in interpreting the findings that we report below.

V. ANALYTIC METHODS

To investigate the occurrence and timing of the transfer of students and the subsequent attainment of a bachelor's degree for students who did transfer, we utilize a statistical technique known as discrete-time survival analysis.²⁴ This method allows us to model the probability that a student experienced the target event in each discrete time period, given that they had not experienced the event in an earlier period. Using a term from the statistics literature, "risk" describes this conditional probability. (Note that "risk" does not have a negative connotation in this context). The predictors in the two complex discrete hazard models that we fit (one for each outcome) include indicators of cohort; indicators of each term after a student's initial MACC enrollment or each term after transferring (which we call time); characteristics of the student; and a great many interactions of cohort, time, and student characteristics.

Examine the left panel of Figure 2, in which we display the risk that the average student in the 2005 MACC entry cohort transferred at the beginning of each discrete six-month time period as a function of time since initial enrollment in an MACC.²⁵ Notice that the risk of transfer alternates annually, being higher at the beginning of the fall/winter half of the academic year and lower at the beginning of the spring/summer half. In other words, it is more probable that a student transferred from an MACC to a four-year institution at the beginning of an academic year than in the middle of an academic year. In addition, the overall risk of transferring rises systematically to a risk of almost 8% at the beginning of the fourth academic year from entry into an MACC, and then declines over subsequent academic years, falling back to 1 percentage point by the spring term of the sixth year.

RISK PROFILE AND CUMULATIVE PROBABILITY OF TRANSFERRING FOR 2005 COHORT

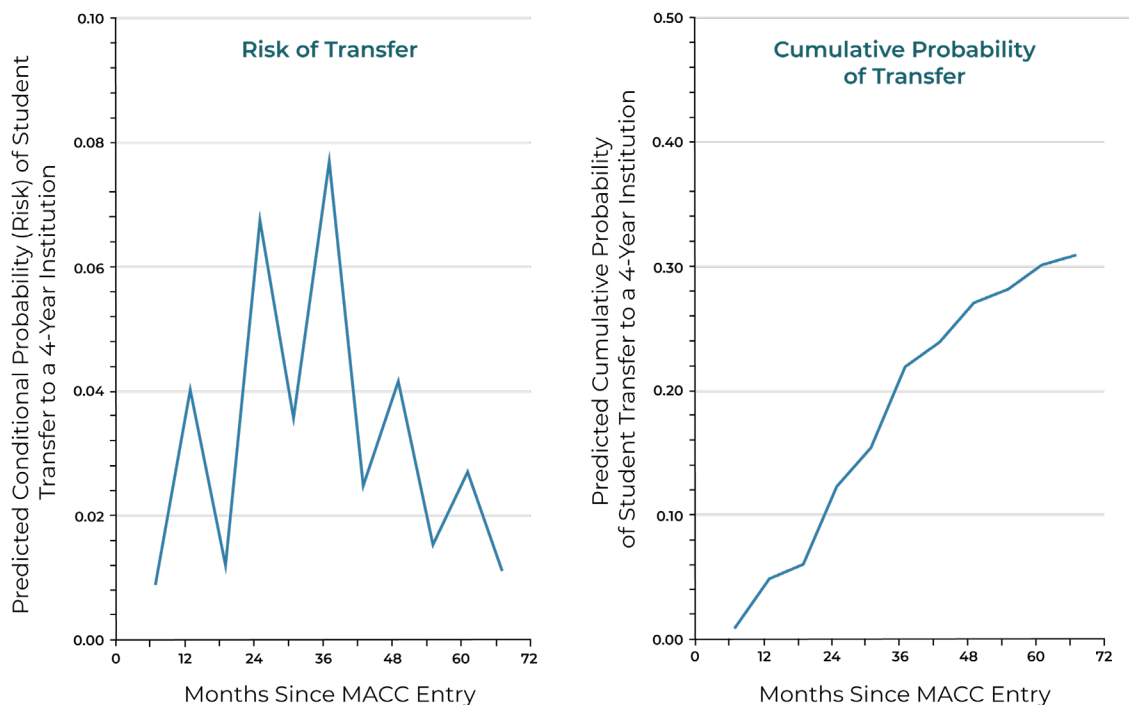


Figure 2: Predicted probabilities that students transferred from a Massachusetts community college (MACC) to a four-year institution of higher education as a function of the time (months) since the student entered the MACC, for the 2005 entry cohort. Left panel: probability of transfer at the beginning of each six-month period from entry, given that transfer had not occurred in an earlier period. Right panel: cumulative probability of transfer by the beginning of each six-month period after entry.

In the right panel of Figure 2, we display the cumulative probability of transfer for an average student in the 2005 entry cohort. This panel provides an estimate of the percentage of students in the 2005 entry cohort who transferred by the beginning of each of the designated discrete time periods. Notice that the total probability of transfer rises substantially over the first six years after initial community college enrollment, and that 31% of community college entrants in the 2005 cohort had transferred to a four-year institution within six years.²⁶

VI: FINDINGS: CROSS-COHORT TRENDS IN VERTICAL STUDENT TRANSFER

In Figure 3, we have displayed as a solid line the trend from the 2005 through the 2014 entry cohorts in the percentage of students who transferred within six years. Inspection of this line shows that the proportion of students who transferred within six years remained quite stable across cohorts. The predicted proportion was 31% for both the 2005 and 2014 entry cohorts.

ACTUAL AND “WHAT IF” CROSS-COHORT TRENDS IN THE PROBABILITY THAT STUDENTS TRANSFERRED WITHIN SIX YEARS

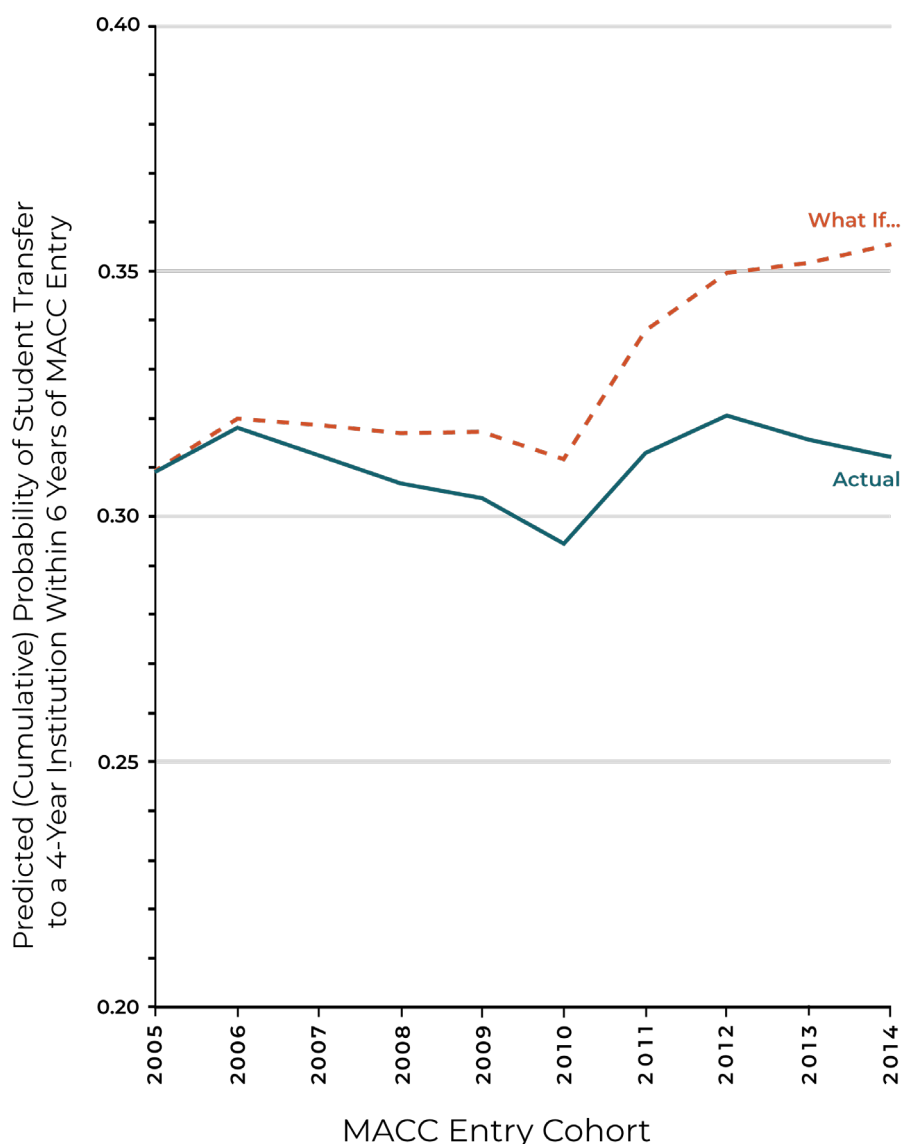


Figure 3: Trends over MACC annual entry cohorts in the predicted probability that students transferred to a four-year institution of higher education within six years after entry into an MACC, for students who were average on all demographic, socioeconomic, and academic characteristics within each entry cohort (“Actual”). For comparison, we display the analogous cross-cohort trend predicted for students under the assumption that average demographic, socioeconomic and academic characteristics remained at their values for the 2005 entry cohort (“What If”).

While we cannot isolate the impact of the MassTransfer initiatives from other factors affecting student transfer rates, we can estimate the extent to which differences across cohorts in the backgrounds of MACC entrants influenced transfer rates. As shown in Figure 1, there were important differences across the entry cohorts in the backgrounds of students who entered MACCs between 2005 and 2014. To provide insight into the role that these cross-cohort differences in the characteristics of students entering MACCs played in determining the trends in six-year transfer probabilities, we estimated what the trend would have been if the composition of the students in the sample had remained as it was in the 2005 entry cohort. We have superimposed this “What If” trend as a dashed line in Figure 3.

As illustrated by the dashed line, if the sample composition of MACC entrants had not changed over entry cohorts, the transfer rate would have been quite constant at values between 31% and 32% for the 2005 to 2010 cohorts. Then, the transfer rate would have been 2.5 percentage points higher for the 2011

cohort and another 1.2 percentage points higher for the 2012 cohort, and then remained quite stable at slightly more than 35% for the 2013 and 2014 cohorts. Thus, if the average demographic, academic, and family-financial composition of MACC entrants had remained at their 2005 values, the probabilities of transfer from community colleges to four-year institutions between the 2011 and 2014 entry cohorts would have been higher than what we observed. This is consistent with the hypothesis that the increasing availability of the MassTransfer Course and Equivalency database to counselors in the later entry cohorts aided MACC students in making course selections and transfer plans, but that the anticipated improvement was dampened by the rising proportions of disadvantaged students among those entering MACCs over the same period. The difference between the actual and “What If” trends in Figure 3 also underlines the importance of investigating cross-cohort trends in six-year transfer rates for groups of students with different demographic, academic, and family-financial characteristics, a task to which we now turn.

Trends in Transfer by Student Race/Ethnicity and Gender

In Figure 4, we display and contrast trends in predicted six-year transfer probabilities for students of different genders and races/ethnicities, with trends for female students presented in the left panel and those for male students in the right panel.

CROSS-COHORT TRENDS IN TRANSFER PROBABILITIES DIFFER BY STUDENT RACE/ETHNICITY AND GENDER

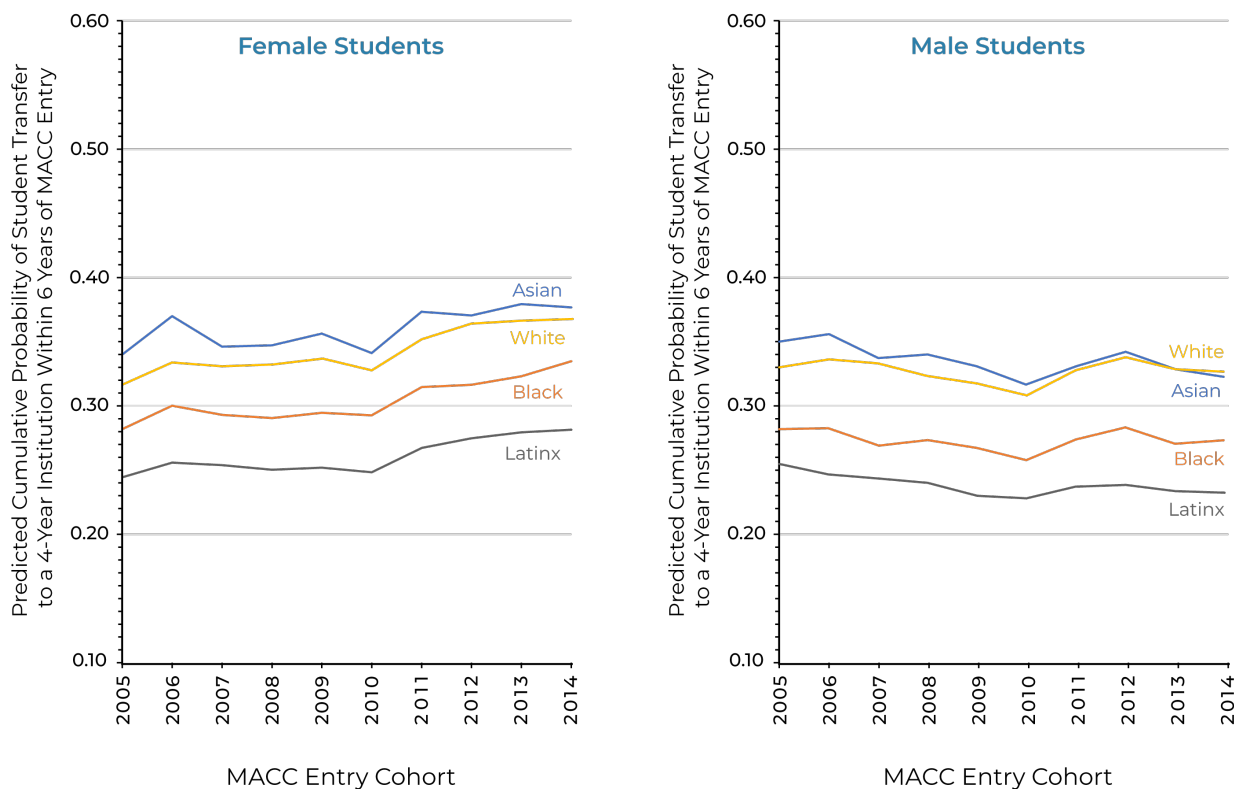


Figure 4:

Trends over MACC annual entry cohorts in the predicted probability of transfer from an MACC to a four-year institution of higher education within six years of entry into an MACC, for female (left panel) and male (right panel) students whose self-declared race/ethnicity was Asian, Black, Latinx, or White.

The first striking pattern in each of the two panels of Figure 4 concerns differences by race/ethnicity. For both male and female students, the percentages of Asian students and White students who transferred within six years are similar, and differ by less than 1 percentage point for the most recent entry cohorts. For both males and females, the proportion of Black students who transferred, however, falls about 3 to 5 percentage points below the proportions of White and Asian students who did so, and the proportion of Latinx students who transferred is 7 to 10 points lower.

A second pattern is revealed by comparing cross-cohort trends across the panels of the figure. The comparison shows that gender differences in six-year transfer probabilities consistently favor females across all entry cohorts, among students of every racial/ethnic group. Not only are transfer probabilities generally higher for female students than for male students of the same race/ethnicity over all entry cohorts, but transfer probabilities for female students of every race/ethnicity increased over the period of observation by at least 3 percentage points. In contrast, six-year transfer probabilities of male students did not increase across entry cohorts.

Trends in Transfer by Family Income

Our measure of family income is dichotomous, meaning we simply know whether or not students received free- or reduced-price lunch as 10th graders. In 2011–2012, the last school year in which students in our sample were in grade 10, the maximum family income for a child in a household of four to be eligible for a reduced-price lunch was \$41,348 (\$52,590 in May 2022 dollars). However, even this coarse measure of family income is a strong predictor of both the risk of a transfer and of bachelor’s degree receipt. In Figure 5, we display six-year transfer probabilities by student’s family income for average students of each race/ethnicity.

CROSS-COHORT TRENDS IN TRANSFER PROBABILITIES DIFFER BY STUDENT FAMILY-INCOME AND RACE

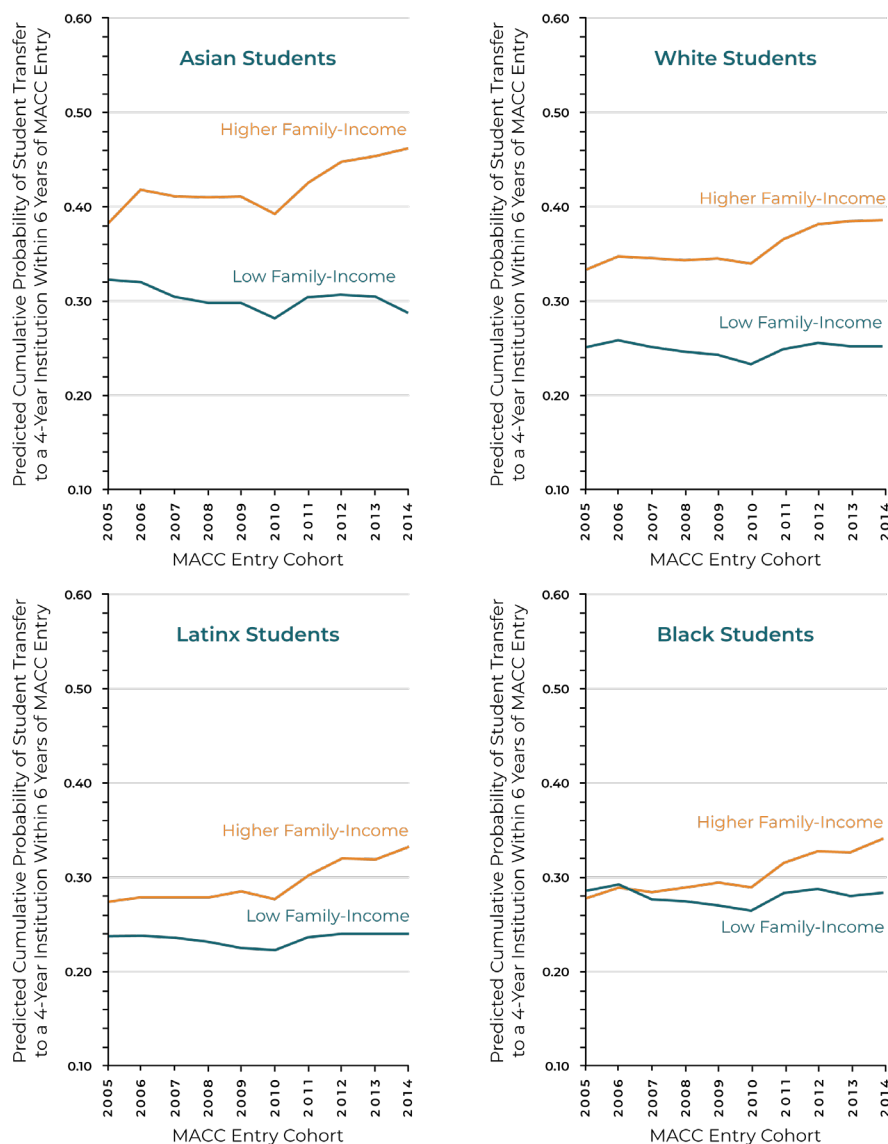


Figure 5:

Trends over MACC entry cohorts in the predicted probability of transfer from an MACC to a four-year institution of higher education within six years of entry into the MACC by students’ 10th-grade family-income (categorized as either “higher” or “low”), for students whose self-declared race/ethnicity was Asian (top left), White (top right), Latinx (bottom left), or Black (bottom right).

Inspection of the four panels of Figure 5 shows that, among students in all four racial/ethnic groups, family income matters. In each case, the percentage of students who transferred within six years is greater for students whose families were designated as higher-income than for those from low-income families. The income-based difference in transfer rates is larger for Asian and White students than for Latinx and Black students. In addition, differences in the six-year transfer probability between students from higher-income and low-income families increased from the 2005 to the 2014 entry cohorts. The differences were 14 and 17 percentage points in the 2014 entry cohort for White and Asian students, respectively, having risen from differences of about 8 and 5 percentage points for the 2005 entry cohort. In contrast, the family-income difference in six-year transfer probability was about 9 percentage points among Latinx students in the 2014 entry cohort, having risen from about 4 percentage points in the 2005 cohort. Finally, among Black students, there were no differences in the six-year transfer probability in the 2005 entry cohort between students from higher-income and low-income

families, but by the 2014 entry cohort, the family-income difference had risen to 6 percentage points.

We focus the above presentation on income differences within race/ethnic group because making comparisons by income across racial/ethnic groups is challenging. The reason is that the average incomes of families who were designated “higher income” differ across racial/ethnic groups. More concretely, “higher-income” White families have more financial resources, on average, than “higher-income” Asian, Black, and Latinx families. We know this from supplementary data on the Expected Family Contributions (EFCs) of students in the 2008 through 2014 cohorts of our sample who applied for federal financial aid to pay their college costs. Among students from “higher-income” families who applied for financial aid, the average EFC of White students (\$11,579 in 2021 dollars) was more than \$3,700 higher than that of Asian students (\$7,807) and more than \$5,200 higher than that of Black students (\$6,263) and Latinx students (\$6,349).

Trends in Transfer by Student Achievement and Family Income

In Figure 6, we display trends in six-year transfer probabilities for students whose 10th-grade math scores were at the 75th percentile of the sample score distribution (“High Math”) and for those whose scores were at the 25th percentile of this distribution (“Low Math”). We provide separate panels for students from low-income and higher-income families.²⁷

CROSS-COHORT TRENDS IN TRANSFER PROBABILITIES DIFFER BY STUDENT MATHEMATICS ACHIEVEMENT AND FAMILY-INCOME

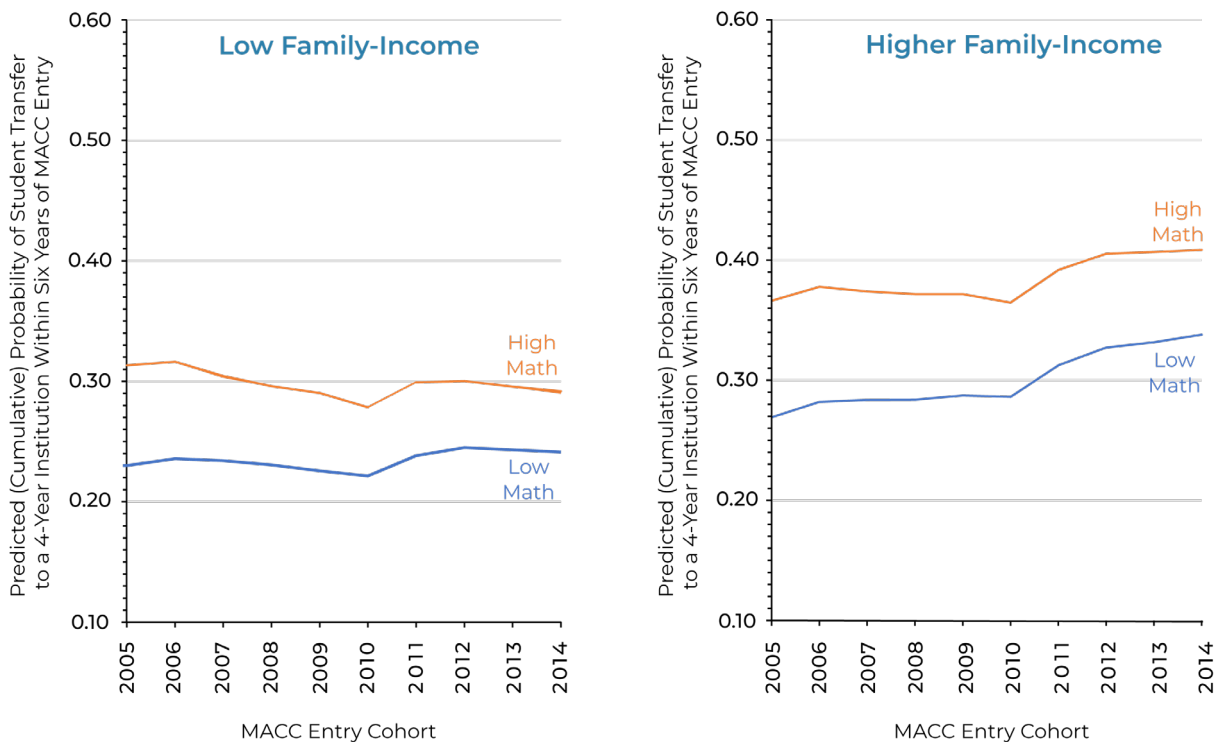


Figure 6:

Trends over MACC entry cohorts in the predicted probability of transfer from an MACC to a four-year institution of higher education within six years of entry into an MACC versus their 10th-grade MCAS mathematics score (“high” or 75th percentile versus “low” or 25th percentile), for students with low family income (left panel), and for those with higher family-income (right panel).

The most striking pattern displayed in the figure is that, among students from both low-income and higher-income families, the percentage of students with relatively high 10th-grade mathematics scores who transferred within six years is 5 to 10 percentage points higher than the proportion of students with low mathematics scores that did so. A second, more subtle pattern concerns differences in the trends. Among students from higher-income families, the six-year transfer probability rose across the 2005 to 2014 entry cohorts for both students with relatively high mathematics scores and for those with relatively low scores. For their peers from low-income families, the transfer probability declined by 2 percentage points for students with relatively high mathematics scores and held quite steady for those with lower scores.

Looking across panels reveals a third, disconcerting pattern, namely, that starting with students in the 2010 MACC entry cohort, students from low-income families who had relatively high 10th-grade mathematics scores had a lower probability of transferring within six years than students from higher-income families who had relatively low scores. For students in the 2014 entry cohort, the difference is almost 5 percentage points.

VII. FINDINGS: TRENDS IN BACHELOR'S DEGREE ATTAINMENT POST-TRANSFER

In this section, we describe the timing and occurrence of bachelor's degree attainment for students who transferred within six years after MACC entry. In the new "transferee" subsample, we again apply discrete-time survival analysis to address two research questions, mirroring those of Section VI.²⁸

Trends in the Risk of Bachelor's Degree Attainment across MACC Entry Cohorts

In the left panel of Figure 7, we display the predicted risk that an average transferring student in the 2005 MACC entry cohort earned a bachelor's degree by the end of each discrete six-month time period following transfer. Notice that the risk of degree attainment alternates annually, being higher at the end of the academic year and lower at the middle. In addition, the overall magnitude of the risk rises systematically to a maximum 23% at the end of the third academic year following transfer. Then, the risk declines in the following academic year.

RISK PROFILE AND CUMULATIVE PROBABILITY OF EARNING A BACHELOR'S DEGREE FOR 2005 COHORT

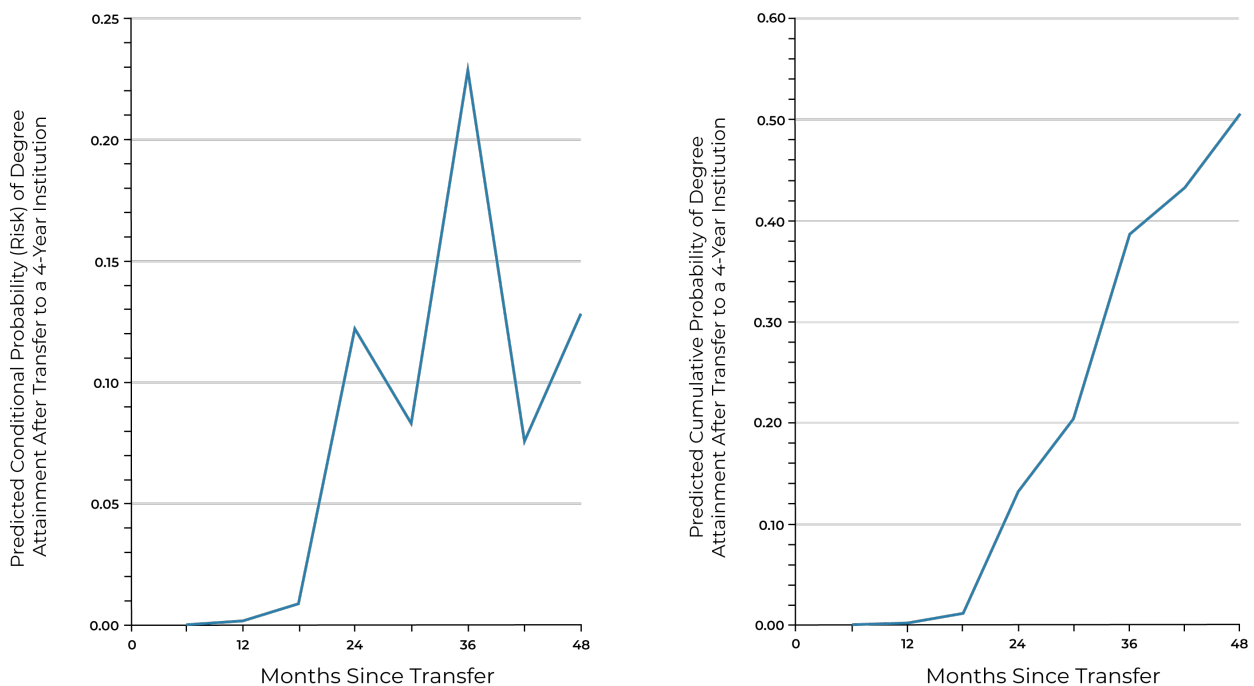


Figure 7:

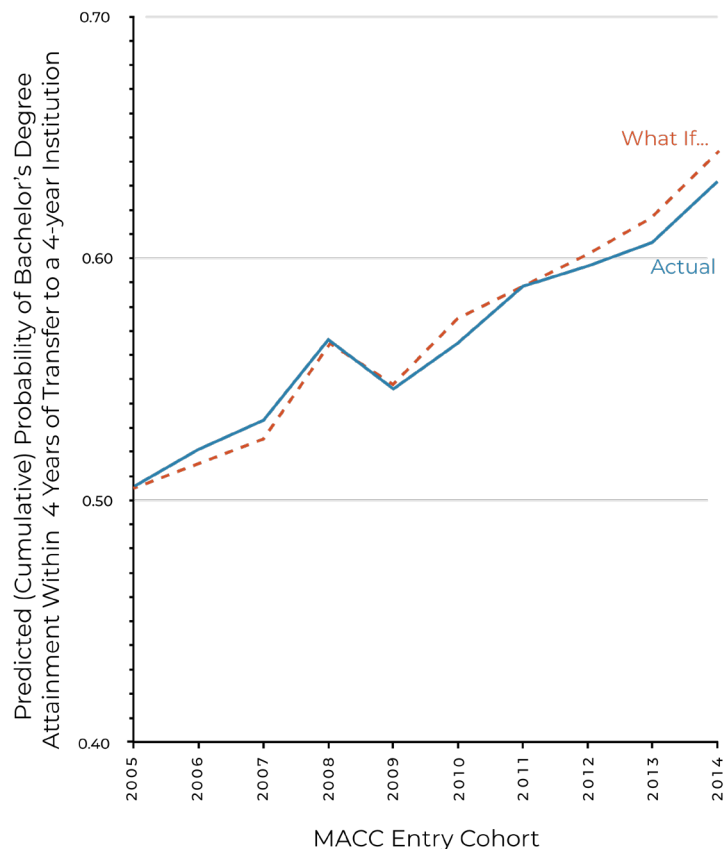
Predicted probabilities that students earned a bachelor's degree from a four-year institution of higher education after transfer from an MACC as a function of time since transfer, for the 2005 MACC entry cohort. Left panel: conditional (hazard) probability of degree attainment at the end of each discrete six-month period since entry, given that transfer had not occurred in an earlier period. Right panel: cumulative probability of degree attainment by the end of each six-month period since entry.

In the right-hand panel of Figure 7, we display the corresponding cumulative probability of degree attainment for an average transferring student in the 2005 MACC entry cohort. It provides estimates of the percentage of students who earned a bachelor's degree by the end of each of the designated discrete time periods after a transfer. Notice that more than half (51%) of transferring students from the 2005 MACC entry cohort earned a bachelor's degree within the next four years.

In Figure 8, we display as a solid line the percentage of students in each cohort who earned a bachelor's degree within four years after transferring. The line illustrates the substantial increase across entry cohorts in the bachelor's degree attainment rate for students who transferred. We do not know why the four-year degree-attainment rate increased from 51% for the 2005 to 63% for the 2014 MACC entry cohort. However, the evidence is consistent with positive impacts of the gradual implementation and dissemination of MassTransfer policies.

PREDICTED AND “WHAT IF” CROSS-COHORT BACHELOR’S DEGREE-COMPLETION PROBABILITIES DIFFER, AMONG STUDENTS WHO TRANSFERRED

Figure 8:
Trends over MACC annual entry cohorts in the predicted cumulative probability that students earned a bachelor's degree from a four-year institution of higher-education within four years after transfer from an MACC, for students averaged on all demographic, socioeconomic, and academic characteristics within each annual entry cohort (“Actual”). For comparison, we display the analogous cross-cohort trend predicted for students under the assumption that average demographic, socioeconomic, and academic characteristics remained at their values for the 2005 entry cohort (“What If”).



We know from Figure 1 that there were differences across MACC entry cohorts in the average demographic, academic, and family-financial backgrounds of students who entered MACCs between 2005 and 2014. To gain insight into the role that these background differences played in determining the trends in the proportion of transferring students who earned four-year degrees, we again estimated what the cross-cohort trend would have been if the composition of the students in the sample had remained constant at its values for the 2005 MACC entry cohort. The results indicate that the four-year transfer probability for the 2014 MACC entry cohort would have been about 1 percentage point higher if average student demographic, academic, and family-financial backgrounds had not changed across cohorts.

Trends in Bachelor's Degree Attainment by Student Race/Ethnicity & Gender

In Figure 9, we display cross-cohort trends in the percentage of students of each race/ethnicity and gender who earned bachelor's degrees within four years after transferring. One pattern that stands out is the increase across cohorts for both males and females in every racial/ethnic group. (The deviations from the upward trends stem, at least in part, from the relatively small numbers of transferring students of particular racial/ethnic groups and genders in each cohort.)

A second pattern is that, among both males and females who transferred, the percentage who earned a bachelor's degree within the next four years differs across racial/ethnic groups. The percentage who did so is lowest for Black students and second lowest for Latinx students. A third pattern is that, for the latest cohorts we studied, the proportion of Black males who earned a bachelor's degree within four years after transferring is much lower than the proportion of Black females who did so. In the 2014 cohort, the difference is 12 percentage points.

CROSS-COHORT TRENDS IN TRANSFERRING STUDENTS' PROBABILITY OF COMPLETING A BACHELOR'S DEGREE DIFFER BY RACE/ETHNICITY AND GENDER

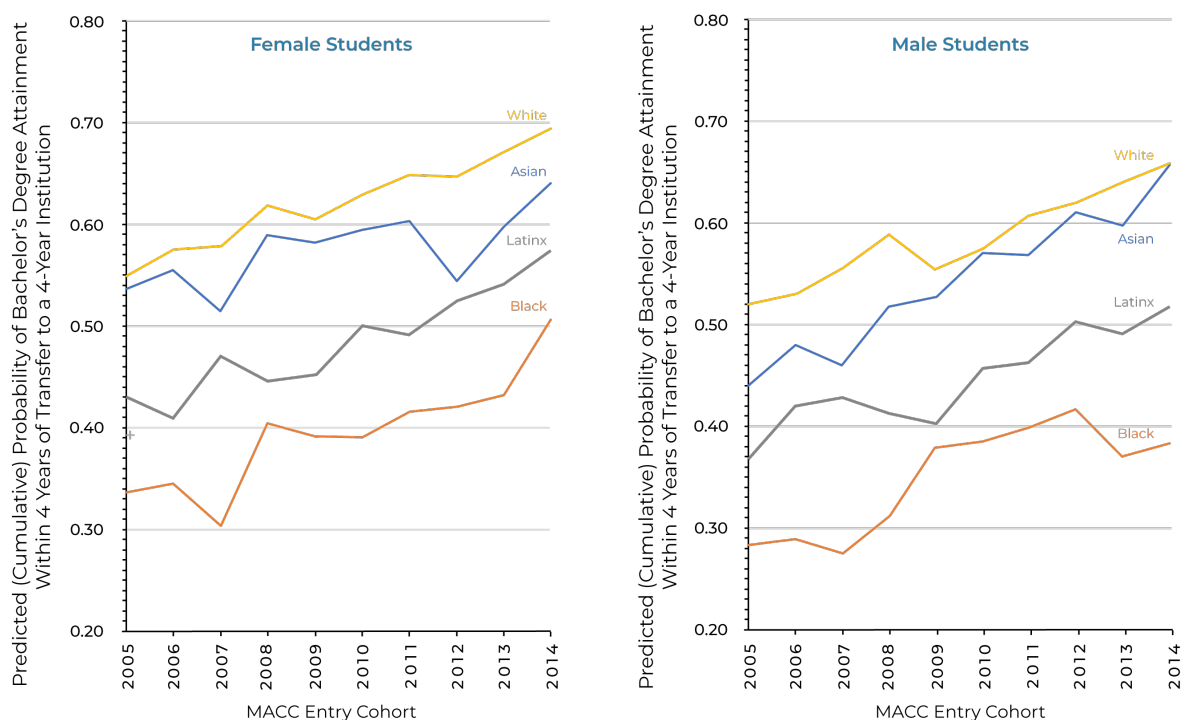


Figure 9:

Trends over MACC entry cohorts in the predicted probability that students earned a bachelor's degree from a four-year institution of higher education within four years after transfer from an MACC, for female (left panel) and male (right panel) students whose self-declared race/ethnicity was Asian, Black, Latinx, or White.

Trends in Bachelor's Degree Attainment by Student Family Income

In Figure 10, we display trends in the percentages of transferring students from low- and higher-income families who earned bachelor's degrees. Two patterns stand out. First, the percentages of students from both low- and higher-income families who earned a bachelor's degree within four years of transfer increased quite steadily, by an average of about 1.5 percentage points per entry cohort. The second is the 12-point difference between the percentage of students from higher-income families who earned a bachelor's degree within four years of transfer and the percentage of students from low-income families who did so. The size of this difference remained quite constant across entry cohorts.

CROSS-COHORT TRENDS IN TRANSFERRING STUDENTS' PROBABILITY OF COMPLETING BACHELOR'S DEGREE DIFFER BY FAMILY-INCOME

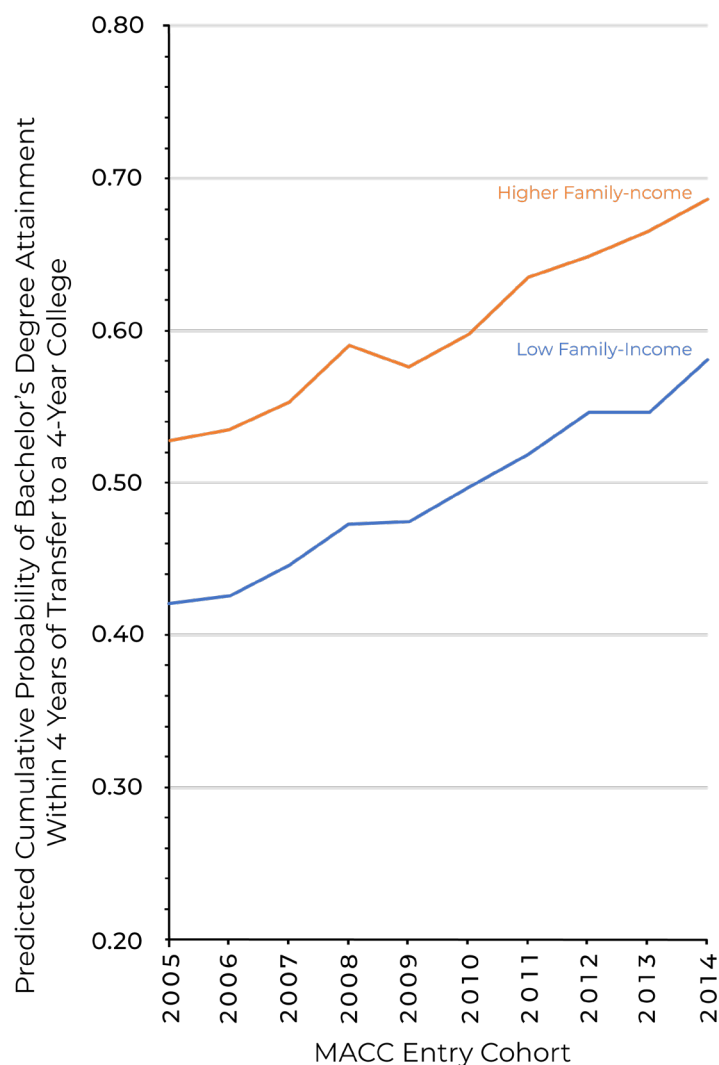


Figure 10:

Trends over MACC entry cohorts in the predicted probability that students earned a bachelor's degree from a four-year institution of higher education within four years after transfer from an MACC, for students from families whose income was "higher" versus "low" when they were in 10th grade.

Trends in Bachelor's Degree Attainment by Quality of Student Academic Preparation

As we illustrate in Figure 11, the four-year bachelor's degree completion rate among transferring students with relatively low MCAS mathematics scores is consistently lower, by about 7 percentage points, than the corresponding four-year bachelor's degree completion rate among transferring students with relatively high prior scores.

CROSS-COHORT TRENDS IN TRANSFERRING STUDENTS' PROBABILITY OF COMPLETING A BACHELOR'S DEGREE DIFFER BY THEIR HIGH-SCHOOL MATHEMATICS ACHIEVEMENT

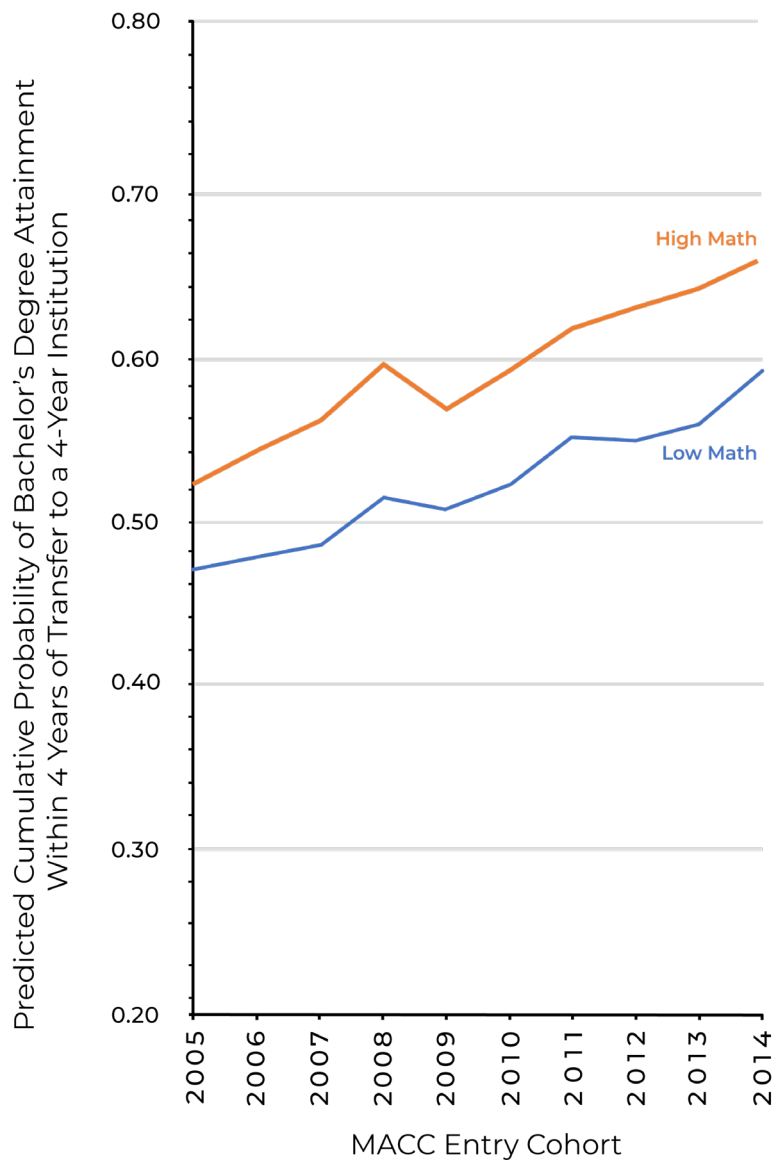


Figure 11:

Trends over MACC entry cohorts in the predicted probability that students earned a bachelor's degree from a four-year institution of higher education within four years after transfer from a MACC, for students whose 10th-grade MCAS mathematics scores were categorized as either high (75th percentile) or low (25th percentile).

Trends in Bachelor's Degree Attainment by Student Prior Credits and Credentials Earned

About 42% of students who transferred to a four-year institution did so after earning an associate degree at a community college. This percentage increased slowly over the 10 cohorts we studied, moving from 39.5% for the 2005 MACC entry cohort to 45.3% for the 2014 entry cohort. These students had earned at least 60 credits in their prior community college, with an average of 67 credits earned. Another 8 percent of the transferring students had earned at least 60 credits before transferring but had not earned an associate degree. About half of the students who transferred within six years had earned fewer than 60 credits before doing so.

In Figure 12, we display trends in bachelor's degree receipt among students who had accumulated different numbers of credits and credentials at their MACC before transferring. We do this in two panels, one for students from low-income families and one for those from higher-income families.

One striking pattern is that for both groups, the percentage of students who earned a bachelor's degree within four years after transferring is 13 to 18

percentage points higher for those who earned 60 credits and an associate's degree before transferring than it is for those who earned only 40 credits before transferring.²⁹ Of course, this is not a surprise, since bachelor's degree programs typically require completion of 120 credits. Students who transfer with relatively few credits have a longer path to travel to a bachelor's degree than those who transfer with more credits.³⁰

A second pattern is that the percentage of students who earned a bachelor's degree within four years of transferring is 3 to 7 percentage points higher among those who, in addition to earning 60 credits before transferring, also earned an associate degree than it is for students who earned 60 credits but no associate degree before transferring.

A third pattern is the increase across cohorts, both for students who had earned relatively few credits before transferring as well as those who had earned more, in the percentage who earned a bachelor's degree within four years after transferring.

CROSS-COHORT TRENDS IN TRANSFERRING STUDENTS' PROBABILITY OF COMPLETING A BACHELOR'S DEGREE DIFFER BY MACC CREDITS AND CREDENTIALS

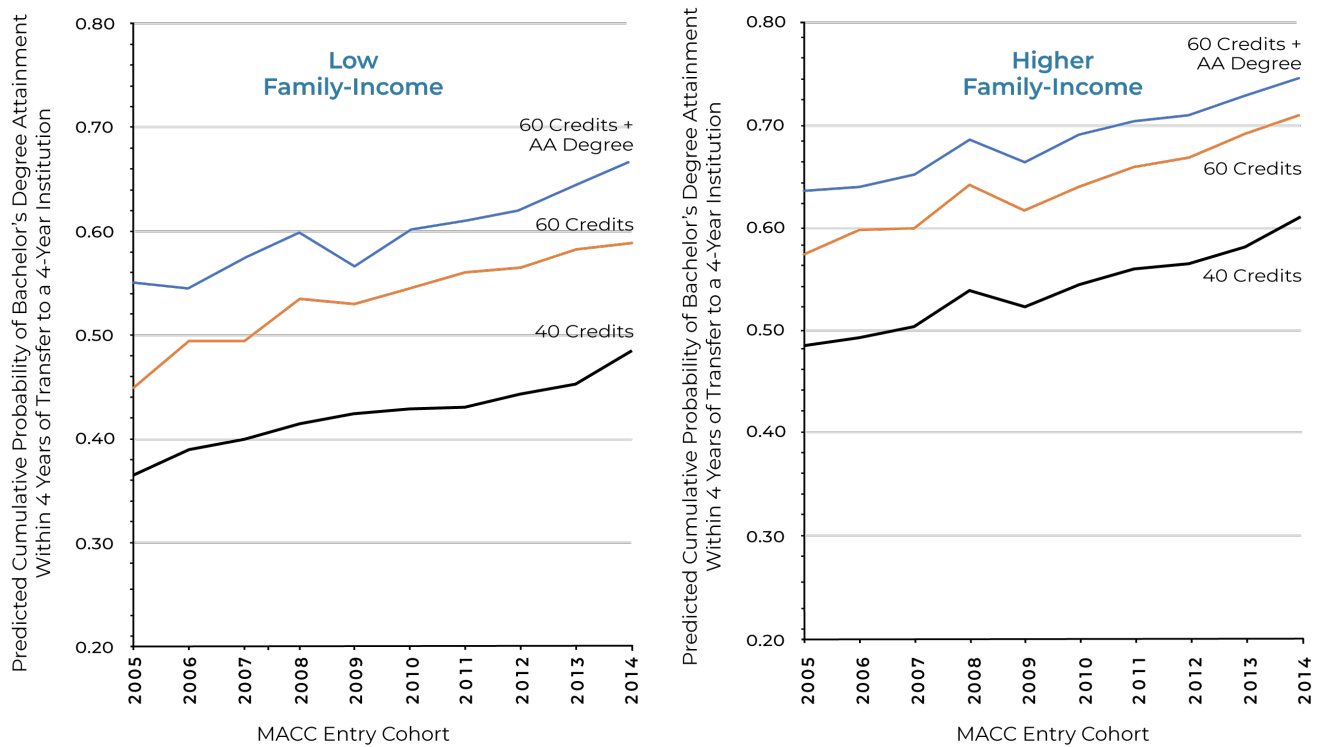


Figure 12: Trends over MACC entry cohorts in the predicted probability that students earned a bachelor's degree from a four-year institution of higher education within four years after transfer from an MACC, for average self-declared Asian, White, Latinx, and Black students with differing levels of academic accomplishment while attending the prior MACC.

One other pattern is who, among students with the same number of credits and the same credentials before transferring, the percentage who earned a bachelor's degree within four years differed across family-income groups. For example, among students in the 2010 MACC entry cohort who had earned an associate degree before transferring, 69% of those from higher-income families earned a bachelor's degree within four years after transferring, compared to 60% of those from low-income families.

VIII. DISCUSSION

This study demonstrates the value of longitudinal data, of partnerships that guide researchers to questions relevant to public policies, and of sophisticated statistical methods that support examination of differences in trends among subgroups. Simply tracking transfer rates in the aggregate would have resulted in the wrong conclusion, namely, that MassTransfer initiatives had no impacts. Rich longitudinal data, good advice from policy partners, and the use of discrete-time survival analysis allowed us to draw different, quite nuanced conclusions.

Our report provides a mixture of good news and troubling patterns. The good news includes evidence of a steady increase across cohorts in the percentage of community college entrants from higher-income families who transferred to a four-year college or university within six years. This increase is especially large for female students from higher-income families with relatively high MCAS mathematics scores. For example, 42% of Black female students with these characteristics who first enrolled in an MACC in 2014 transferred to a four-year school within six years, compared to 34% of their counterparts who first enrolled in an MACC in 2005. The proportion of male students from higher-income families who transferred within six years also increased, although the increase was more modest and began only after the 2010 entry cohort.

Another dimension of good news is the steady increase across cohorts in the proportion of transferring students who earned a bachelor's degree within four years. This aspect of the positive news pertains to students from all the backgrounds that we examined. The importance of the good news that we describe in this report should not be underestimated, since it pertains to a great many students over many recent years.

The troubling patterns have several components. First, among students in the 2005 entry cohort, the proportion of those from low-income families who transferred within six years was much lower than the proportion of those from higher-income families who did so. Second, the inequality associated with students' family income increased over subsequent

cohorts. This occurred because the proportion of students from higher-income families who transferred within six years of entry increased across cohorts, while the proportion of low-income students who did so did not increase.

A third troubling pattern concerns differences in transfer and bachelor's degree attainment rates by race/ethnicity. As illustrated in Figure 4, smaller percentages of Black students and Latinx students transferred within six years than the percentages of Asian and White students who did so. As shown in Figure 9, among students who did transfer within six years, the percentages of Black and Latinx students who earned bachelor's degrees within four years are lower than the comparable percentages for Asian and White students.

In considering potential explanations for the racial-ethnic differences in six-year transfer rates, it is informative to use our model to answer a hypothetical question: What would the trends in six-year transfer rates have been if the average MCAS mathematics score and the percentage of students from a low-income families of the students from all racial/ethnic groups who entered an MACC in any given year had been the same?

As shown by comparing the two panels of Figure 13, the transfer rates of students in each racial/ethnic group would have been different. Under this hypothetical scenario (right panel), the "adjusted" six-year transfer rates of Black students and Latinx students would have been about 4 percentage points higher than they actually were, and the transfer rate of Asian students would have been 2 percentage points higher. In contrast, the six-year transfer rate of White students in the 2014 cohort would have been more than 3 points lower than it actually was. The explanation for this pattern has two parts. First, both family income status and 10th-grade mathematics score are strong predictors of the probability that a student transfers within six years. Second, the percentages of Black, Latinx, and Asian students who came from low-income families are much higher than the percentages of White students who did so, and the av-

erage math scores of Black and Latinx students are much lower than those of White and Asian students.³¹ A close examination of the right panel shows that if the percentage of Black students and White students in the 2014 entry cohort who came from low-income families had been the same and the students had had the same average mathematics scores, the percentage of Black students in that cohort who transferred within six years (33%) would have been higher than the percentage of White students who did so (31%).

Equalizing the percentage of low-income and MCAS scores, the percentage of Latinx students transferring would also have been higher and quite close to that of White students. Under this assumption, the share of Asian students who transferred would have been two percentage points higher.

ACTUAL AND “ADJUSTED” CROSS-COHORT TRENDS IN PROBABILITY OF TRANSFER DIFFER BY STUDENT RACE/ETHNICITY

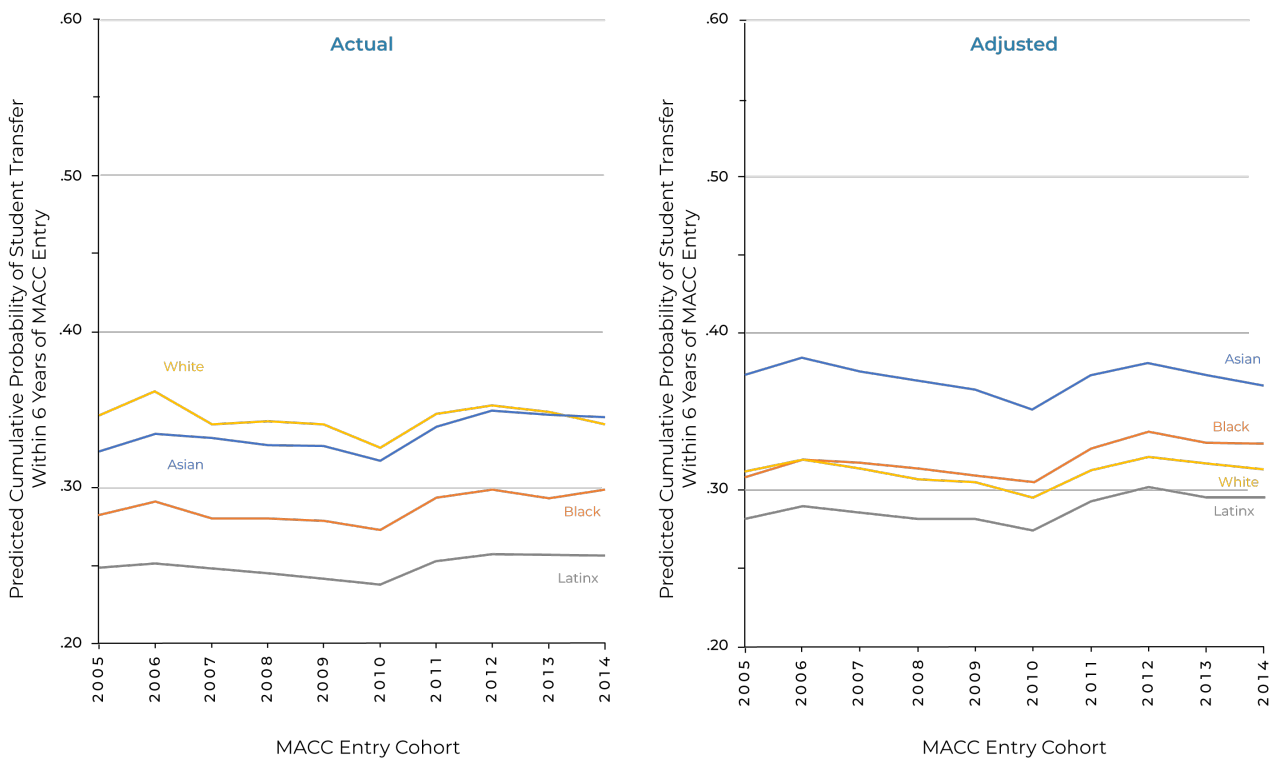


Figure 13:

Trends over MACC entry cohorts in the predicted probability of transfer from an MACC to a four-year institution of higher education within six years of entry into an MACC for students of each self-declared race/ethnicity. The left panel displays trends for students of each racial/ethnic classification who are average for their group on all other demographic, socio-economic, and academic characteristics, estimated separately for each entry cohort (“Actual”). The right panel displays trends under the assumption that the percentage of low-income students and average 10th-grade mathematics score were the same in every racial/ethnic group, estimated separately for each cohort (“Adjusted”).

One way of interpreting the results of this hypothetical comparison is that the structural inequalities in American society that result in Black and Latinx children growing up in relatively low-income families and attending relatively under-resourced elementary and secondary schools play a large role in explaining why Black and Latinx students who enroll in the state's community colleges have lower six-year transfer rates and lower bachelor's degree completion rates than do their White peers.

Our findings raise two questions. The first is: Why did the six-year transfer rate increase across cohorts for some groups? Our descriptive quantitative evidence, taken together with the comments of MACC staff members whom we interviewed, support the hypothesis that the investments made in developing the components of the MassTransfer initiative contributed to the increase in six-year transfer rates and four-year bachelor's degree completion rates that we have described. These investments included the creation of the Gen Ed Foundation Block requirements, the Course and Equivalency database, and the A2B transfer pathways. For example, several MACC staff members told us that A2B pathways have now become a much-used source of transparency about how students can fulfill degree requirements. One staff member commented that, in the past, uncertainty about which MACC courses would count toward a four-year degree posed a major deterrent to students interested in transferring. He went on to say that the A2B pathways have meant this is not the case today.

The second question is: Why did six-year transfer rates not increase across cohorts for all groups? One possible explanation comes from research that documents the variety of obstacles to academic progress that many community college students face, including family obligations, financial strains, and weak academic preparation.³² It seems plausible that these obstacles hindered the most disadvantaged community college students from taking advantage of the opportunities and knowledge resulting from the state's investments in MassTransfer.

To increase transfer rates and bachelor's degree completion rates and to reduce inequalities in these outcomes among community college students from different backgrounds, other types of investments may be needed to complement the MassTransfer initiatives. One relevant effort is the development of alternatives to traditional developmental education courses that often pose major stumbling blocks for many entering MACC students.³³ Promising alternatives that the state's community colleges have initiated are co-requisite courses that combine gateway courses in mathematics and English and that provide credit toward degrees with skill-building opportunities.³⁴ In addition, a growing number of students are matriculating to MACCs through early college programs, which help them to avoid remediation and earn a number of credits in the MassTransfer pathway prior to high school graduation.

Another relatively recent effort is Supporting Urgent Community College Equity through Student Services (SUCCESS), which is funded by the Massachusetts legislature. This initiative provides the funds to enable the state's MACCs to invest in evidence-based wraparound supports and services to improve student persistence and degree-completion outcomes.³⁵

An important question is whether these investments will enable the most disadvantaged students entering Massachusetts community colleges to benefit from the opportunities that the MassTransfer initiatives provide. The stakes are high because community colleges are currently the only viable post-secondary entry point for many of these students.³⁶

It is too early to assess the extent to which the multiple efforts by the Massachusetts legislature, the state's DHE, and the state's public colleges and universities will be successful in increasing the educational attainments of students who face a variety of obstacles to their academic success. However, the evidence provided in this report is consistent with the conclusion that the efforts already inaugurated to make transfer pathways more transparent and accessible are a part of the solution.

Notes

1. Modestino, A.S., & Forman, B. (2021). *Pathways to Economic Mobility: Identifying the Labor Market Value of Community College in Massachusetts*. The Boston Foundation.
2. Autor, D. (2014). Skills, Education, and the Rise of Earnings Inequality Among the “Other 99 Percent.” *Science*, 344(6186), 843–851.
3. Table 1A. “Community College Student Outcomes: 1994–2009.” (Washington, DC: National Center for Education Statistics, 2011). <https://nces.ed.gov/pubs2012/2012253.pdf>.
4. Figure 4. Shapiro, D., Dundar, A., Huie, F., Wakhungu, P.K., Yuan, X., Nathan, A. & Hwang, Y. (2017). *Tracking Transfer: Measures of Effectiveness in Helping Community College Students to Complete Bachelor’s Degrees* (Signature Report No. 13). Herndon, VA: National Student Clearinghouse Research Center.
5. In this report, all transfers that we describe are vertical transfers from a community college to a four-year institution.
6. Long, B.T., & Kurlaender, M. (2009). Do Community Colleges Provide a Viable Pathway to a Baccalaureate Degree? *Educational Evaluation and Policy Analysis*, 31 (1), 30–53.
7. Modestino, A.S., & Forman, B. (2021). *Pathways to Economic Mobility: Identifying the Labor Market Value of Community College in Massachusetts*. The Boston Foundation.
8. Alexander, K., Bozick, R., & Entwistle, D. (2008). Warming Up, Cooling Out, or Holding Steady? Persistence and Change in Educational Expectations After High School. *Sociology of Education* 81, 371–396; Wang, X. (2013). *Baccalaureate Expectations of Community College Students: Socio-Demographic, Motivational, and Contextual Influences*. *Teachers College Record*, 115, 1–39.
9. Baker, R. (2016). The Effects of Structured Transfer Pathways in Community Colleges. *Educational Evaluation and Policy Analysis*, 38(4), 626–646.
10. Hodara, M., Martinez-Wenzl, M., Stevens, D., & Mazzeo, C. (2017). Exploring Credit Mobility and Major-Specific Pathways: A Policy Analysis and Student Perspective on Community College to University Transfer. *Community College Review*, 45(4), 331–349.
11. Schudde, L., Bradley, D., & Absher, C. (2020). Navigating Vertical Transfer Online: Access to and Usefulness of Transfer Information on Community College Websites. *Community College Review*, 48(1), 3–30.
12. Schudde, L., Jabbar, H., & Hartman, C. (2021). How Political and Ecological Contexts Shape Community College Transfer. *Sociology of Education*, 94(1), 65–83.
13. This section draws heavily on information acquired by interviewing 13 individuals who played roles in designing, implementing, or using initiatives to facilitate student transfers from MACCs to four-year institutions. We interviewed three members of the DHE staff, one former member, three community college presidents, one vice president of a state university, and five community college staff members who were responsible for advising students about the transfer process.
14. Soliz and Mesa emphasize the importance of complementing the creation of transfer pathways with high-quality, accessible advising on community college campuses. See: Soliz, A., & Mesa, H. (2022). *Improving Community College to University Transfer*. Working paper, Peabody College of Education, Vanderbilt University.
15. Massachusetts Department of Higher Education (2020). *MassTransfer Policy and Implementation Guidelines*. Last updated Feb. 26, 2020.
16. The dataset draws on the student information systems maintained by DESE and DHE, and the National Student Clearinghouse, which provides records on the enrollment histories and credentials earned by students who enroll in colleges or universities that are not part of the Massachusetts public system. Numerous security protocols are in place to deidentify the data and protect individual privacy, in accordance with state and federal law.
17. A total of 651,005 students were first-time 10th graders in the years from 2003 through 2012. Of this number, 620,242 took the 10th-grade MCAS tests in the spring of their sophomore year (on time). Of those who did, 551,642 graduated

within three years of doing so. Of these high school graduates, 112,200 entered an MACC as their first post-secondary enrollment. Of these MACC entrants, 84,999 entered in either the fall following their high school graduation or in the next fall. One exception is that among students who took the 10th-grade MCAS tests in 2012, only those who graduated from high school within the next two years and entered an MACC in the fall term immediately following high-school graduation are included in our analytic sample. We excluded the 483 students from this MCAS cohort who enrolled in an MACC in 2015 because they had very little time to transfer and earn a bachelor's degree before our data collection ended in 2020. We also excluded from the analytic sample the 3,316 students who first enrolled in an MACC more than 15 months after their graduation from a Massachusetts public high school between 2005 and 2014. There were relatively few of these students and great heterogeneity in their age at MACC entry. In addition, exploratory analyses reveal that their academic career patterns differ considerably from those of students who enroll in an MACC soon after high school graduation.

18. We included only students who first enrolled in a fall term rather than in a spring term to keep our sample definition consistent with the practice of researchers at the Community College Research Center (CCRC) and the National Student Clearinghouse (NSC). The NSC sample definition includes students who were enrolled in two of their first three terms including the summer term at the end of the first academic year following entry. We did not enforce this option explicitly when defining our analytic sample because, in establishing a reasonable time-metric for our subsequent discrete-time survival analyses, we merged summer enrollment (which was sparse) with enrollment in the spring term that immediately preceded it.
19. The NSC sample definition does not include the requirement that a community college student be enrolled in an associate-degree program because this information is not consistently available in NSC data. Among the 70,786 students who enrolled in an associate-degree program and satisfied the other conditions for inclusion in our analytic sample, all except 1,993 enrolled in an associate-degree program immediately upon entry into an MACC. One compelling reason is that this is a condition for federal financial aid.
20. We excluded from our analytic sample the 919 students who reported to the DESE Student Information Management System (SIMS) that they were either Native Americans or multiracial, or who chose not to report their race/ethnicity. The number of students in each of these categories who met our other criteria for inclusion in our sample was too small to distinguish explicitly from other groups in our statistical models. To facilitate comparisons in Table 1, we also excluded these students in estimating descriptive statistics for the groups of all high-school graduates and for those high-school graduates who enrolled in a four-year college or university within 15 months of their high-school graduation.
21. Since we exclude from our analytic sample those 2012 MCAS test-takers who took three years to graduate from high school, we have also excluded them from the samples of students used to estimate the statistics in Table 1.
22. Clotfelter, C. T., Ladd, H. F., Muschkin, C. G., & Vigdor, J. L. (2013). Success in Community College: Do Institutions Differ? *Research in Higher Education*, 54(7), 805–824; Jenkins, D., & Fink, J. (2016). *Tracking Transfer New Measures of Institutional and State Effectiveness in Helping Community College Students Attain Bachelor's Degree*. Community College Research Center.
23. For a discussion of structural inequalities, see: Baum, S. & McPherson, M. (2022). *Can College Level the Playing Field?* Princeton, N.J.: Princeton University Press.
24. Singer, J. D., & Willett, J. B. (2003). *Applied Longitudinal Data Analysis: Modeling Change and Event Occurrence*. New York, NY: Oxford University Press.
25. One complication in creating figures to display our findings is that, even though we have separated the passage of time into six-month periods, students can only earn bachelor's degrees at the end of any discrete six-month term. For example, if a student earned the degree at the end of her second term after transfer, she would have earned it in the 12th month from transfer. In contrast, students typically transfer from an MACC to a four-year college at the beginning of a term. So, a student who transferred at the beginning of her second term after enrolling in an MACC would have transferred in the seventh month after entry. For this reason, the markers indicating the number of months in the panels of Figure 2 ("7, 13, 19, ..."), which display the predicted hazard and cumulative distribution functions for the event of transfer, differ intentionally from the numbering of months in the panels of Figure 7 ("6, 12, 18, ..."), which display the predicted hazard and cumulative distribution functions for the event of earning a bachelor's degree after transferring. For a detailed technical account of the discrete-time survival-analytic methodology and its application

and interpretation, see: Singer, J. D., & Willett, J. B. (2003). *Applied Longitudinal Data Analysis: Modeling Change and Event Occurrence*. New York, NY: Oxford University Press.

26. Some students take longer than six years to transfer from an MACC to a four-year college or university. However, the greater the number of years that we give students to transfer in our analyses, the fewer recent cohorts of students we can include in our analyses. Our data currently ends with information for the 2019–2020 academic year. By choosing six years as the length of time students have to transfer in our analyses, we can include the 2005–2014 MACC entry cohorts. Had we chosen a seven-year time period, we would not have been able to include the 2014 cohort of students in our analyses.
27. For the students in our analytic sample, the 75th percentile of the distribution of mathematics scores is +0.2403, and the 25th percentile score is -0.9118. In using our final fitted hazard model to estimate hazard and cdf profiles for the group of students with “high” versus “low” mathematics scores, we set the values of other predictors in the fitted model to their averages for students in the relevant group whose mathematics scores were in the upper versus lower half of the sample distribution. For example, in estimating fitted hazard profiles for low-income students in the 2005 MACC entry cohort with high mathematics scores (+0.2403), we set the other predictors in the model to their average values for low-income students in the 2005 cohort whose 10th-grade mathematics scores were in the upper half of the sample distribution.
28. While not a focus for our analysis, it is interesting that approximately one third of the students in our analytic sample who transferred within six years of MACC entry enrolled in a branch of the University of Massachusetts, another third enrolled in one of the other public universities or colleges in Massachusetts, and the final third transferred to an institution that is not part of the Massachusetts public higher-education system. The most striking difference in the average characteristics of students who transferred to different types of four-year institutions is that the average 10th-grade mathematics score of those who transferred to a branch of the University of Massachusetts was 0.20 standard deviations higher than the average scores of students who transferred to other types of institutions.
29. Of the students in our analytic sample who transferred to a four-year institution within six years, 37% did so after earning 40 or fewer credits in a MACC.
30. One obvious question is whether students who transferred after earning only 40 credits “caught up” over time with those who transferred with more credits. We found that this is not the case for students in the 2005–2008 MACC entry cohorts, although the gap in bachelor’s degree completion rates is smaller when students are given more time to earn this credential. For example, among students in the 2008 MACC entry cohort, the percentage of students who earned a bachelor’s degree within four years after transferring is 23 percentage points higher for those who transferred after earning 60 credits and an associate degree than it is for those who earned only 40 credits before transferring. However, the difference in bachelor’s degree completion rates between these groups six years after transferring is 15 percentage points. It is important to keep in mind two points in interpreting this pattern. First, the evidence is descriptive, not causal. The reason is that students who transfer with different numbers of credentials may differ in unobserved ways that are correlated with the probability of earning a bachelor’s degree. Second, it is not possible to address this question for recent MACC entry cohorts because not enough time has passed to provide the requisite data.
31. As a comparison of the panels in Figure 13 shows, the proportion of Asian student who transfer within six years is approximately the same as that of White students, even though a much higher percentage of the Asian-American students in our sample come from low-income families 61% than the percentage of White students who do so 18%, and the average 10th-grade mathematics score of Asian students (-0.276) is slightly lower than the average score of White students (-0.235). In interpreting this pattern, it is important to keep in mind the substantial differences in average family incomes and parental educational attainments among Asian-American adults from different countries of origin. For example, almost 90% of adults living in the Boston area whose country of origin is India have college degrees, and their average family income during the years 2014–2018 was approximately \$130,000. In contrast, fewer than 20% of adults in the Boston area whose country of origin is Cambodia have college degrees, and their average family income in these years was less than \$80,000. These differences matter because the Asian-American students enrolled in some MACCs are disproportionately from India, while those enrolled in other MACCs are disproportionately from Cambodia. See: Calef, A., & Schuster, L. (2021). *Building AAPI Power: A Profiles of AAPI Communities in Greater Boston*. The Boston Foundation.

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