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A Benefit/Cost Analysis of Three Student Enrollment Behaviors at a Community College;Dropout, Transfer and Completion of an Associate's Degree/Certificate

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DEDICATION

I dedicate this dissertation to the memory of my father, Paul Stuart, whose ethic of hard work and generosity inspired me to produce this work.

I dedicate this dissertation to my wife, Nan, without whose love and support I could never have completed this dissertation.

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ABSTRACT

This dissertation seeks to increase our understanding of the factors that lead to student success at community colleges. Using data on a cohort of students enrolled at a two-year college, this dissertation presents the results of a longitudinal analysis. Citing the results of several persistence studies as well as the literature on sub-baccalaureate job markets, this dissertation constructs a hybrid model of student persistence. This model combines Tinto's theory of student dropout behavior with human capital theory to derive a benefit/cost model of student enrollment behavior.

Several hypotheses are developed regarding the relationship between various benefits and costs and students' likelihood of achieving each of three different outcomes: dropping out, transferring to a four-year institution, or completing an associate's degree. An event history analysis was conducted to find out whether these relationships actually existed. Results of this analysis are used to derive implications for theory and practice.

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CHAPTER I

INTRODUCTION

There is perhaps no institution in U.S. higher education whose impact is more uncertain than the community colleges. First established in the early 20th century, the community colleges today provide instruction to more than six million students each year – roughly 43% of all undergraduate students. As a low-cost, open access institution, these schools provide instruction to a large number of low income students with weak academic preparation. Many of these students could never have attended college, if the community colleges did not exist. Hence, by the standard of access, these institutions are wildly successful. Unfortunately, while the community colleges do enable many students to attend college who would not otherwise do so, the rate of degree completion among community college students is quite low. Data collected by the U.S. Department of Education (NCES, 2008) show that, of those students who started their college education at a community college in 1995-96, only 38.4% completed a college degree (certificate and higher) within 6 years. Similarly, a study conducted by Rosenbaum and Stephan (2005) found that only 40.8% of community college students completed a degree (associate's or above) within 8 years of graduating from high school. Completion rates

for low income students are lower than those reported averages. Hence, while the community colleges may be quite successful at increasing access, they appear to be less successful in actually enabling their students to complete a degree – either at the two-year or four-year level.

Low graduation rates among community college students have opened these institutions to a range of criticisms. Adopting the (debatable) view that the primary focus of these schools should be the successful transfer of their students to a four-year college, several writers (Clark, 1960; Brint and Karabel, 1989) have claimed that the community colleges actively work to discourage students from completing a bachelor's degree. According to this view, community colleges face a number of competing pressures from their various constituencies. On the one hand, students aspire to careers in management and the professions that require a bachelor's degree. On the other hand, the number of managerial and professional jobs that are available is limited. Community colleges respond to these pressures by "cooling out" their students (Clark, 1960), actively working to route students into careers requiring less than four-years of college. Writers differ regarding the extent to which the community colleges intentionally act to discourage students from completing a bachelor's degree. However, a literature does exist suggesting that, in their attempts to meet the conflicting needs of a number of stakeholders, these colleges have taken on a number of contradictory missions (Dougherty, 1987; Dougherty, 1994). Because the resources available to meet these missions are limited, the pursuit of one mission (vocational education) is assumed to divert resources from another mission (transfer), thereby impairing these colleges' ability to meet any of their goals very effectively.

A somewhat different view emerges from the literature on student persistence. According to this view (Tinto, 1975), student dropout behavior results mainly from an incongruity between the academic and social needs of students and the academic and social systems of the schools they attend. In the view of this theory, students enter college with a certain set of commitments, both to the school they attend and the goals they are pursuing. Once they have actually enrolled, these commitments are affected by students' experiences at the college. If students' educational needs are consistent with the values of the institution they attend, their goal commitment becomes stronger. In the language of this theory, such students become academically integrated into the school they attend. If students form positive relationships with their peers on campus, their institutional commitment becomes stronger. In the words of student persistence theory, they become socially integrated into the school they attend. Students who are well-integrated into the academic and social systems of the school they attend will likely persist at that institution. Students who are academically well integrated but socially un-integrated into the life of a college are likely to transfer. Students who are poorly integrated into both systems will probably drop out of college altogether.

One implication of Tinto's model is that persistence rates will differ among colleges, depending on the extent to which students become academic and socially integrated into them. Colleges, both two-year and four-year, differ markedly in the missions they pursue and in the students they attract. Some colleges seek to provide liberal arts education to gifted students who leave their homes and reside on-campus. Others seek to provide vocational education to poorly prepared students who live at home and commute to school. Tinto's theory suggests that persistence rates at these two types of colleges

will differ, perhaps markedly. Students at the residential, liberal arts colleges are expected to be well-integrated into both the academic and social systems of the college, since they reside on campus and are well prepared for college work. Dropout rates at such an institution are likely to be quite low. Conversely, students who attend non-residential, vocational two-year colleges are likely to be poorly integrated into both systems, since they reside off-campus and will more likely struggle with their coursework. Dropout rates at these institutions are likely to be high. Of these two types of college, community colleges most closely resemble the latter. While two-year colleges do differ in the students they serve and the programs they offer, they tend to focus on career preparation for poorly prepared students who reside off-campus. Consistent with the findings reported earlier, Tinto's model predicts that persistence rates at the community colleges will not be high.

One difference between community colleges and four-year schools that has not received much attention in the student persistence literature is the job markets they serve. According to Tinto (1975), job market conditions do play a role in the student persistence process. However, the role they play depends on the condition of the job market. In Tinto's framework, students base their initial goal commitment on some perception of the benefits and costs of preparing for a particular career. Once they have actually enrolled in school, their commitment to this goal is influenced by their on-campus social and academic experience. However, the extent of this influence depends on the stability of the job market for which they are preparing. If the market is fairly healthy, students' academic and social experiences may have a significant effect on their chances of dropping out. If the job market they are preparing for is declining, students may base

their decisions on other factors. In particular, if students feel that the job outlook in their chosen field is very much less favorable than they had originally thought, they may decide to drop out – even if they are very well-integrated into the academic and social systems of the college they attend. Extending Tinto's logic, students in some programs may find that employers place a lesser value on the credential they are seeking than they had thought when they started school. In such cases, students will have an incentive to quit their program of study (and perhaps leave higher education), even if they are well-integrated into the academic and social systems of the school they attend.

Based on this thinking, the applicability of Tinto's model may vary from one institution to another. To the extent that a college prepares its students for jobs with clearly defined training requirements and growing demand, students' on-campus experience will have a significant impact on their decision to persist. To the extent that a college prepares its students for jobs with uncertain training or credential requirements and/or declining demand, students' on-campus experience will have a smaller impact on their persistence. Unfortunately, many programs at community colleges tend to fall into this latter category. For community college students who are preparing for careers in management or the professions, job market incentives should be identical to those acting on students at the four-year colleges. However, over the past several decades, the community colleges have greatly expanded the number of programs that prepare students to enter the job market directly upon completion of an associate's degree. Job market incentives acting on students preparing for these jobs may differ significantly from those acting on students who are preparing for positions that require a bachelor's degree or higher.

According to Grubb (1996; 2002A; 2002B), the sub-baccalaureate job market follows a different dynamic than the baccalaureate market. Unlike the market for professional and managerial workers, employers place a lesser emphasis on formal education when hiring workers for jobs that require less than the bachelor's degree. While employers may require the associate's degree when filling certain positions in the health careers (for example, nurses), they often prefer specific experience when filling positions in business, engineering, and the public services. Alternatively, they may accept an industry-standard, skill-based certificate, rather than an associate's degree. Many of these positions are with smaller firms. Hence, the job ladders available to students who fill these positions may be fairly limited. Several studies (Kane and Rouse, 1995; Kane and Rouse, 1999; Grubb, 1996; Jacobson and Mokher, 2009) indicate that students who take classes at the community colleges may earn significantly more than they would if they had terminated their educations at the high school level – even if they do not complete an associate's degree or certificate. However, other studies (Grubb 1996; 2002A; 2002B) also indicate that the financial return to a sub-baccalaureate credit in one subject area may differ significantly from the return for a credit completed in another. Moreover, differences at the sub-baccalaureate level may be greater than they are at the baccalaureate level. Hence, students who enroll in programs that culminate in an associate's degree may confront a different set of incentives than do students who are pursuing a major that leads to a bachelor's degree or higher.

These findings suggest that, while Tinto's model of student persistence may provide some guidance to policy-makers who seek to reduce dropout rates among community college students, practitioners may benefit from a model that assigns a more direct role to

students' perceptions of the economic value of the credential they are seeking. Several approaches could be taken to develop such a model. However, the most direct approach is simply to reformulate Tinto's model, focusing directly on students' cost-benefit calculations and treating the concepts of academic and social integration as psychic costs incurred by students as they engage in their studies (McIntosh and Rouse, 2009). Using this approach, students treat the decision to enroll in college in the same way that they treat any other investment decision. They tally up the costs and benefits of completing an education and only enroll if the anticipated benefits of completing a degree exceed the costs. In this model, costs and benefits are of three general forms: pecuniary, psychic, and opportunity. Pecuniary costs are the actual monetary costs of completing a degree, including tuition and fees, books and supplies, and travel to and from class each day. Pecuniary benefits are the discounted lifetime earnings students expect to receive from completing a degree. Psychic costs and benefits include a range of intangible factors, such as the pleasure students receive from mastering a subject and the frustration they receive by taking classes for which they are poorly prepared. Opportunity costs refer to the income students forego by enrolling in a semester of classes. Typically, opportunity costs refer to the financial loss students incur by going to school, when they could be working for pay in the job market. However, opportunity costs may also take the form of psychic costs incurred by students who spend their time pursuing an education, when they could be spending it in other ways that they might find more appealing.

According to this model, students begin their college careers by making some rough calculation of the benefits they will receive and the costs they incur by preparing for a particular career, given some set of tastes and preferences. If the benefits exceed the

costs, they decide to enroll in college. Once in school, they re-calculate these benefits and costs on a regular basis. They continue in college just as long as the perceived benefit from enrolling for a credit of class exceeds the cost. If, at this point, students have earned enough credits to complete a degree, they graduate. Otherwise, they drop out of college. Since the return to a credit of instruction may vary from one occupation to another, students who major in different subjects may leave the community college at different points in their educational careers.

A major selling point of a community college education is the low (pecuniary) cost of a credit of instruction. However, a human capital approach to student persistence suggests that students who attend the community colleges may incur a much higher psychic cost than do their better-prepared counterparts who begin college at a four-year institution. If the dropout rates at these colleges are unacceptably high it is, therefore, for either or both of two reasons. Either the community colleges have failed to offer programs and services required to truly reduce the – largely psychic – costs incurred by students who attend them. Or they have failed to instill in their students a true understanding of the benefits they will reap upon completing a degree.

By treating student dropout behavior as an economically rational comparison of benefits and costs, a human capital approach to student persistence may provide policy makers with insights that cannot be achieved using other frameworks. Not only will models based on this theory include some variables not contained in other approaches to student persistence, but human capital models will be interpreted in somewhat different ways than results obtained from pure persistence models. They will therefore result in policy recommendations that differ somewhat from those available through other models.

Such insights may help policy makers reduce the dropout rates at community colleges. Hence, there is merit in conducting an analysis that is based on a human capital model of student enrollment. To date, such an approach has not been widely adopted in the literature on student persistence. In fact, only one study (McIntosh and Rouse, 2009) explicitly invoked human capital theory to explain persistence at the community college.

This dissertation seeks to fill this gap. Using a human capital theory framework, this dissertation will study the persistence of students at a large, multi-campus community college. With an annual headcount of more than 40,000 credits students, this institution provides instruction in more than 140 subject areas to a wide array of students. While each college is unique, this institution offers a full range of services, including a well-developed curriculum in developmental education, to students of all ages and income levels. As a result, the results of this analysis will have implications for policy makers at many institutions, even though the mix of services offered and students served at this college may differ from those at other institutions.

This analysis presented in this dissertation will focus on three competing risks discussed in three chapters, each looking at students' enrollment decisions from a different perspective. Using data on a cohort of students who started at this college in fall 1998, each chapter will study the enrollment behavior of these students over time. Each chapter will attempt to determine whether and when students experience each of three different events: dropout from higher education, transfer to a four-year college, completion of an associate's degree. Each chapter will use a human capital theory to explain the statistical results and to reframe insights gleaned from the literature on student persistence into a benefit-cost model. Event history analysis will be used to test

Box 1: Educational Products Offered at the Subject College

1. **Self-actualization/entertainment.** Due to the low cost and open access mission of the community colleges, these schools have always attracted students who wished to take a course or two to fill some personal interest. Over the past few decades, the community colleges have greatly expanded the number of non-credit courses they offer to students seeking to enrich their leisure time. The community college under study in this dissertation offers a wide range of such offerings to students who wish to take such courses on a non-credit basis. A look at the fall 2009 schedule book, reveals non-credit courses with titles such as "Holiday Gift Foods," "Pastel Drawing" and "Yoga." Senior citizens who wish to take courses on an audit basis can take credit courses at no charge via Program 60.

2. **Remediation / basic literacy**. (anti-poverty mission) Many students come to the community college in the hope of transferring to a four-year college or obtaining specific vocational training needed to get a job. However, many students lack the basic skills in reading, writing and mathematics needed to succeed in college. In order to increase students' chances of success, the community colleges offer developmental courses in English, math, and basic study skills. These courses are offered through both the credit and non-credit curricula. The college under study in this dissertation offers pre-college instruction geared to students who require various amounts of remediation. Students who have very low levels of literacy may take non-credit courses in Adult Basic Literacy and Education (ABLE) to prepare them for a GED or job-specific training program. Students who are better prepared for college work may take any of several pre-college courses in English and math available to students who are performing at the high school levels in these subjects.

3. **Training (general)**. Many students come to the community college in the hope of obtaining skills they can use to get a job. Such students do not want to complete a college degree. They want to train for a job, and they do not want to spread that training over a great length of time. To meet the needs of these students, the college under study in this dissertation has developed "fast-track job-specific training for traditionally underserved, economically disadvantaged students." This training, which typically runs for 5 – 15 weeks, provides students with training in areas such as State Tested Nurse Assistant, Precision Machining, and Basic Manufacturing Skills.

4. **Industry –standard and incumbent worker training**. In today's economy, firms face a number of challenges from a number of sources. To face these challenges, employees may need to perform tasks for which they have not been trained. Success or failure may depend on their ability to quickly obtain knowledge needed to deal with some particular challenge or opportunity. Over the past several years, community colleges have developed a number of programs designed to help firms to meet these challenges. In particular, the college under study in this dissertation has created an organizational unit designed expressly to provide customized and general training to local businesses on short notice.

5. **Industry-credentialed education.** In order to make sure that they have access to a ready pool of qualified workers, employer groups in a number of industries have established industry certificates for specific jobs. While community colleges do not necessarily offer academic credentials in these areas, they frequently offer courses that students can take to obtain the necessary skills. The community college under study in this dissertation offers a number of credit courses providing students with skills they need to sit for various licensing and certification examinations. For example, students in the two-year law enforcement program obtain the skills they need to pass their civil service exams and qualify for entry level positions as police officers. Similarly, the automotive technology program prepares students to pass the National Institute for Automotive Service Excellence (ASE) tests in automotive technology. On the non-credit side, students may prepare for certification in a number of specializations in computer programming and information technology.

6. **Associate degree credit education**. Originally established to provide the first two-years of a bachelor's degree, community colleges over the past forty years have greatly increased the number of two-year career programs they offer. As of fall 2009, the community college under study in this dissertation offers more than 90 programs that prepare students to enter the job market directly upon completing an associate's degree. These programs are broken down into five areas: health careers, business technology, engineering technology, public service technology, and automotive technology.

7. **Transfer associate's degree.** Many students who enter the community college lack the academic preparation or income necessary to enter a four-year college. These students aspire to complete a bachelor's degree. However, in the absence of some alternative route to the degree, they will not be able to complete one. The community colleges provide this avenue. Students who wish to transfer upon completion of an associate's degree may choose from a number of course in the arts and sciences. Upon completion of 60 semester credits, they are eligible for either of two degrees, the Associate of Arts or the Associate of Science.

8. **Low cost general education provision without degrees**. Many students enter the higher education market place, not wishing to obtain a college degree, but only to obtain a richer understanding of the world in which they live. Due to their low tuition costs, the community colleges provide an ideal path by which they may achieve this goal. The community college under study in this dissertation offers courses in wide range of disciplines. County residents who wish to avail themselves of these offerings may do so at a very low price.

9. **Bachelor's degree platform**. Many students seek to complete a bachelor's degree, but wish to minimize the cost, both pecuniary and psychic, of their education. These students may be college-ready in English and/or math. They may have access to financial resources needed to finance their educations. However, they may wish to take a difficult course at a community college on a trial basis, transferring the credits if they succeed in the course. They may wish to reduce the cost of their four-year degree by taking some part of their first two-years at a community college. The community college under study in this dissertation is well positioned to provide this product, offering a full curriculum of transfer courses at a very low price.

hypotheses in all chapters – though the techniques employed will vary in some ways from one chapter to another.

The community college under study in this dissertation offers a wide range of products to a diverse student population. As of fall semester 2009, this college offers as many as 9 different products to an annual total of more than 50,000 credit and non-credit students (see Box 1). These products are quite diverse. Not only does the college offer a wide range of courses in the arts and sciences that students can transfer to a four-year school

upon completing an associate's degree. It also offers a number of career programs that provide students with the skills they need to obtain a job upon completing a two-year degree. In addition to these programs, the college offers a wide range of non-credit courses that cover a dizzying range of topics – everything from cake decorating to CNC programming. Students can combine these in many different ways, thereby defining a complex assortment of product types. For example, students can take courses in the arts and sciences in the hope of completing an associate's degree, which they then transfer to a four-year institution. They can take a few courses in the arts and sciences for the purpose of reducing the cost of a four-year degree, with no intention of completing an associate's degree. Alternatively, they can take these courses to fulfill some personal interest, with no intention to transfer or to complete an associate's degree. These combinations of enrollment and intention each define a different product.

Of these nine products, this dissertation will focus on two general types: (1) two-year programs that prepare students to enter the workplace directly upon completing a two-year degree ("credit" offerings in products 5 and 6); (2) community college courses in the liberal arts and sciences that students take in an effort to reduce the cost of a bachelor's degree (products 7 and 9). These products can be further refined, based on the job markets they serve and the educational requirements of a typical job. For purposes of this analysis, credit courses offered at this institution were re-categorized to create the following, more specific products:

- Credentialing Health Careers.
- Non-credentialing health careers
- Credentialing Business Technologies

- Non-credentialing Business Technologies
- Engineering Technologies
- Automotive Technology
- Public Service Technology
- Arts and Sciences
- Other programs, including students primarily enrolled in developmental education courses

Analyses were then conducted to find out whether a relationship existed between students' selection of a major and their chances of achieving each of three outcomes, controlling for other factors deemed likely to have an impact on their persistence.

All data in these analyses came from the administrative database of a multi-campus institution in the Midwestern United States. This database contains a myriad of data on students' educational preparation, academic performance, and demographic characteristics. Of particular importance, it contains data on degree completion. These data can be combined with data obtained from external sources to provide a comprehensive picture of students' enrollment status, including transfer, in a given semester. Unfortunately, the database of this college was not designed for the purpose of testing the relationship between students' benefit/cost calculations and their likelihood of persisting in college. As a result, it was necessary to create a set of proxy variables to represent key components of the human capital theory model. In particular, students' transcript histories were used to infer majors. English and math placement scores were

used as proxies for their preparation for college work. Financial aid status provided a crude index of students' income levels. These data were combined to form a file containing 17,121 records on 3,990 students –one record for each term in which each student took a class at this institution during the period from fall semester 1998 through spring semester 2006.

An important attribute of the data in this study is the diversity of the students who comprise the cohort. Community colleges operate in a variety of locations with a wide range of needs. Because they do, no two community colleges are exactly alike. As a result, no study conducted at a single institution can possibly generalize to the entire universe of two-year institutions. If the results of the analysis are to have any value to other institutions, the underlying data must be sufficiently varied to provide a meaningful test of the theoretical model. The educational outcomes achieved by students in the fall 1998 cohort are a case in point. According to the data in Table I, roughly 59% of those in this cohort quit this college without completing a degree or transferring to a four-year college over the period from fall 1998 through spring 2006. No comparable data are available on students attending other colleges during this time period. However, data published on other institutions in other time periods suggest that the dropout rate at this institution is probably higher than rates for community colleges located in other cities. This suggests that the probability of achieving a particular outcome by a particular group of students estimated from these data may differ from those that would likely be obtained using data on students enrolled at other colleges. If the underlying causal model is valid, however, the relationships between the variables in this model should apply to other colleges, even if the actual probabilities may vary from one location to another. The

general strategy adopted in this dissertation is, thus, to conduct tests to find out whether a human capital approach to student enrollment behavior is justified. If the statistical analysis suggests that this model is justified, then the implications of overall model can then be discussed. A more detailed analysis of the extent to which the results obtained in this dissertation will apply to other colleges is presented in Box 2.

Table I: Enrollment Status of Students in Fall 1998 Cohort as of Spring 2006		
Student Outcomes as of Spring 2006	**Number**	**Percent**
Successful Outcomes		
Transferred but did not complete an associate's degree	722	18.1%
Completed an associate's degree/ certificate but did not transfer	319	8.0%
Completed an associate's degree and did transfer	189	4.7%
Still enrolled at community college or transferred to another 2-year school	346	8.7%
Non-degree Student (Over 45 year old and "majoring" in the liberal arts)	72	1.8%
Unsuccessful Outcome		
Left postsecondary education without completing a degree	2,342	58.7%
Total	3,990	100.0%

Box 2: A Note on the College under Study in this Dissertation

One question that arises in a study of this type is: to what extent can the results of this study be applied to other institutions? In an absolute sense, the results of this study probably cannot be generalized to other schools. Community colleges are complex organizations, offering a wide range of products to a diverse student population. The products offered and the students served differ significantly from one institution to another. Some colleges offer a broad array of products to a diverse mix of students. Others may offer a more limited menu of programs to a narrower array of students. Each institution is unique. As a result, if the study presented in this paper was performed at a different school, the results obtained would be somewhat different. For this reason, the analysis presented in this paper focuses on the implications of the findings to the theory of student persistence. By providing insights into the forces that influence students to persist, this dissertation hopes to provide policy makers with a set of tools that can be applied to a wide range of situations. Nevertheless, some readers may wish to know the degree to which the results obtained in this dissertation apply to a specific college or to community colleges in general. Data are presented in this box in an effort to address these questions.

The community college under study in this dissertation is a multi-campus institution located in the Midwestern United States. During fall semester 2009, this college had a total headcount of 30,325 students. These students took courses on three main campuses and several off-campus sites. The population was quite diverse, both culturally and economically. Roughly 56% of the students served were white, 43% were non-white or race unknown, and 1.0% were nonresident aliens. Sixty-two percent were females. The age distribution of students attending this college was quite wide. While 31% of the students who attend this institution were age 18-21, 35% were age of 30 or older, and 18% were over 39. Roughly 60% attended on a part-time basis. Of those students who attended the college full-time and attend in both the fall and spring semesters in a typical year, 49% receive Pell grants, indicating the large number of low income students served by this institution.

Approximately 50% of entering students place at the developmental level in English in a typical fall semester. Approximately eighty percent place at the developmental level in mathematics. As an open access institution, this college does not require students to submit results on either the SAT or the ACT. Hence, data on these tests are not available on students at this institution.

As a point of comparison, data compiled by the National Center for Education Statistics (2008) reveal that, of the students who attended a public community college in 2007, about 58% were female, 61% were white, and 39% were in the 18-21 year old age group. Sixty-one percent of these students attended part-time, and 33.5% received Pell grants.

Test score data reveal that community college students are less literate than those who attend four-year colleges. Community college students testing at the 75^{th} percentile on the SAT had a score of 516 compared to a score of 593 among students at public four-year institutions. Community colleges students at the 75^{th} percentile in math had a score of 532, compared to 594 at public four-year institutions.

Data collected by the U.S Department of education reveal that, of the students who started a community college during the 1995-1996 academic year, 38% eventually went on to complete a degree. Of these, 11% completed a certificate, 17% completed an associate's degree, and 10% completed a bachelor's degree. By contrast, over the eight year period from fall 1998 – spring 2006, 12% of the students in the cohort under study in this dissertation completed an associate's degree and 22% transferred to a four-year college. This institution granted a total of 18 certificates during this period – a rate of .4% of the students in the cohort.

Thus, while an "average" community college does not exist, the national results suggest that these colleges are similar in that they serve diverse populations of underprepared students. Graduation rates among students attending these colleges are not high. While the population at the college under study in this paper does not match the distribution of a "typical" college, leaders at this institution clearly wrestle with many of the same issues confronting policy makers at other institutions. Given these similarities and differences, an analysis of students at the college under study in this dissertation may provide useful

insights to decision makers at other schools.

Each of the three chapters of this dissertation uses a slightly different version of the human capital model described earlier to explain a different student enrollment behavior. The first chapter focuses on dropouts; those who leave the community college without completing an associate's degree and without transferring to a four-year college. Due to their low tuition costs and open-access admissions policies, community colleges attract a wide range of students pursuing a wide range of goals. Because they do, students are likely to differ from each other in significant ways. Some students have strong academic backgrounds and middle class incomes. Other students have weak academic backgrounds and lower incomes. Some students are preparing for careers with very rigid educational requirements. Others are preparing for careers in which the training requirements are quite ambiguous. As a result, different students have different incentives for completing a degree than do others. In the words of human capital theory, the benefits and costs of completing a degree differ from one student to another. The first chapter in this dissertation seeks to find out whether a relationship exists between the costs and benefits incurred by students and the likelihood that they will leave college without transferring to a four-year institution and without completing an associate's degree. Using data on a cohort of students enrolled at a single community college, this study attempts to determine the relative impacts of several different costs and benefits on students' likelihoods of dropping out. In particular, this chapter attempts to assess whether the jobs for which students are preparing have a significant impact on their

likelihood of dropping out. Using a crosswalk table prepared by the U.S. Department of Labor (National Crosswalk Service Center), this paper collects data on the amount of training typically required for entry into jobs associated with each of 45 different college majors (using data reported in the Occupational Supply Demand System). Based on this analysis, a set of hypotheses is generated regarding students' likelihood of dropping out, given that they were concentrating in any of 9 different program clusters. Logistic regression analyses were then conducted to determine the impact of each cluster on students' odds of dropping out, controlling for a set of other costs and benefits, both pecuniary and psychic. The chapter closes with a discussion of the implications of the analysis for theory and public policy.

The second chapter in this dissertation focuses on the decision to transfer. Community colleges seek not only to provide students with the vocational education needed to enter a job directly upon completion of an associate's degree; they also seek to provide them with the first two years of a bachelor's degree. The transfer function is an important mission of these colleges. Human capital theory suggests that the decision to transfer can be treated as a benefit –cost comparison, just as the decision to leave college without a degree. According to this framework, students will continue at the community college up to the point at which the cost of attending exceeds the benefit. At that point they will either transfer to a four-year college or leave the college to pursue some other goal. The likelihood that they will transfer depends upon students' expectation that they: will obtain a high-paying job upon completion of their bachelor's degree, can successfully complete their upper level courses, can "afford" the psychic costs they incur in completing a degree and the opportunity cost they incur by spending their time in

school, and not in some alternative setting. Benefit-cost ratios are, therefore, expected to depend upon students' major, academic preparation, and academic performance at the community college. An important variable in this analysis is students' age. According to human capital theory, the return to a credit of instruction is lower among older students than it is among younger ones. The amount of time required to complete a bachelor's degree is at least twice as long as the time required to complete an associate's degree. Hence, transfer rates are likely to be higher among younger students than they are among older ones. This paper will conduct a longitudinal analysis to test these hypotheses. This analysis will focus on the relationship between students' majors and the likelihood that students will transfer, the assumption being that students who prepare for jobs that require a bachelor's degree will be more likely to transfer than will those who do not. As in the first chapter, this chapter will close with a discussion of the implications of this analysis for theory and practice.

The third chapter presents lessons learned from chapters one and two in a way that is more accessible to policy makers. Unlike the first two chapters, which each focus on a single outcome, the third simultaneously assesses students' chances of leaving the college in any of three, mutually exclusive ways:

- Completing an associate's degree;
- Transferring to a four-year college without completing an associate's degree;
- Quitting the community college without completing an associate's degree and without transferring.

In order to explore the impact of job market incentives on students' enrollment behavior, this chapter examines the relationship between students' major and their chances of achieving each of these three results. In this analysis, the cumulative incidence of achieving each of these three competing events is calculated for each of eight broadly defined majors. Students' risk of achieving each event is presented graphically for each of these majors. These graphics yield a set of risk profiles. These profiles are used to examine the effects of various costs and benefits on students' educational attainment. As in the previous studies, this analysis is based on the behavior of a cohort of students enrolled at a single community college. As in studies one and two, this chapter closes with a discussion of the implications of the analysis for theory and policy.

CHAPTER II

AN ANALYSIS OF STUDENT DROPOUT BEHAVIOR OF STUDENTS ENROLLED AT A COMMUNITY COLLEGE

2.1 Introduction

One of the greatest challenges confronting the community colleges is the high rate of dropout behavior among students who attend them. As a low cost college committed to providing an education to all who apply, community colleges enroll a large percent of the nation's freshmen and sophomores. However, a relatively small number of these students go on to complete a degree, either at the two-year level or the four-year level. Numerous studies have shown that the lifetime earnings of those who complete a college degree are much higher than are the earnings of those who do not (Grubb, 1996; Kane and Rouse, 1995). As a result, the high attrition rates occurring among these students have caused a great deal of concern – both in the scholarly journals and also among policy makers. These concerns have been particularly acute due to the nature of those who attend these

colleges – many of whom are first generation college students coming from low income households, who have limited educational alternatives beyond these two-year colleges.

Over the past several decades, a theory of college student persistence has been developed. This theory has been used to guide the efforts of policy makers who wish to increase the success rates of students who attend these colleges. However, to a large extent this theory was developed with the four-year, residential campus in mind. Over time, this theory has been expanded to consider the special needs of non-traditional students. Such enhancements have increased the extent to which the model can be used to guide and develop policies at two-year colleges. However, the number of studies conducted on community college persistence has been small compared to the number conducted at four-year colleges. Lessons learned from studies conducted at universities do have implications for the community colleges. However, students who enroll in community colleges differ in significant ways from those who enroll in four-year institutions. As a result, there are significant gaps in our understanding of the factors associated with persistence among students who attend the community colleges.

The purpose of this chapter is to fill-in some of the gaps in the research on student attrition at the community colleges. Using data on a cohort of students enrolled at a large, multi-campus college, this study will attempt to clarify the role that students' "educational objective" play in their decisions on whether or not they should drop out of college. This chapter will contribute to this literature by reporting on an analysis of the role that students' majors have on the likelihood that they will quit the community college without completing a degree. In conducting this analysis, this chapter will draw heavily on human capital theory.

2.2 Theory and Literature Review

Research on student persistence has been guided by two alternative theories of student attrition: Tinto's theory of dropout and Bean's theory of student attrition. Tinto's theory of student dropout is a longitudinal model of student attrition with roots in several academic disciplines. Based mainly on Durkheim's concept of anomie, Tinto's model is also influenced by human capital theory. According to Tinto, students enter college with a set of goals, which spring from their personal characteristics and prior experiences. In Tinto's model, these goals are expressed as commitments. These commitments take two forms: (1) commitment to the institution in which a student has enrolled; (2) commitment to the educational goal itself. Once students are actually enrolled in college, they begin to interact with the social and academic systems of the school. Students take classes. They interact with other students. If students are successful in their studies, they become "academically integrated" into the college. If they meet other students whose values are similar to their own, they become "socially integrated" into the college. As students become integrated into these two systems, their goal commitments and institutional commitments become strengthened. As these commitments become stronger, students become more and more likely to complete a degree. Conversely, if students' experience with the academic and social systems of the college is not positive, these commitments become weaker, and students will tend to leave the college. How they leave it will depend on the nature of their "maladjustment." If students' academic experiences are favorable and their social experiences are not, goal commitment will

increase and institutional commitment will decline. Under these circumstances, students will transfer to another school. If students' educational and social experiences are both bad, their goal commitments and institutional commitments will decline. Under these circumstances, students will drop out of college.

An alternative theory of student persistence has been developed by Bean and Metzner (1985). Unlike Tinto's theory, which is designed to explain dropout behavior of "traditional" students, the model proposed by Bean and Metzger attempts to explain attrition among non-traditional students – commuting students, ages 25 and older. To do this, Bean and Metzger have designed a model consisting of four sets of variables: academic performance, intent to leave, background and defining variables, and environmental variables. Like Tinto's theory, Bean and Metzger's model emphasizes the impact of students' social and academic experiences on their decisions to drop out of college. However, unlike Tinto's theory, this model places a much greater emphasis on social pressures occurring off-campus in students' homes and workplaces. Non-traditional students enter college for the purpose of achieving some educational goal, which may not necessarily be to complete a degree. Once in school, they experience two types of pressure which ultimately determine whether they will meet their objectives. On the one hand they are under pressure to meet the academic requirements of the college they are attending. On the other hand, they are under some pressure to meet the needs of others in their social environments, outside of school. Of these two forces, the social pressures are the stronger. If students are unsuccessful in their school work but receive significant support from their family and friends, they will likely persist in college. Conversely, if students receive little support from family and friends, they form an intent

to leave and will likely to drop out – even if their grades are good. In contrast to Tinto's model, Bean and Metzger do not feel that students' on-campus social relationships, either with other students or faculty, play much of a role in their decision to persist in school. They simply do not have time to form them.

The formulation of these two models has, over the past few decades, spawned a great deal of research on student persistence. Much of this research has been conducted on students enrolled at 4-year institutions. However, some study has been conducted on dropouts occurring among those attending two-year colleges. These studies suggest that, while students' on-campus social experiences may play a part in their decisions to persist, other factors may play a greater role. A search of the literature on student persistence uncovered five studies of student persistence conducted on community colleges. Two of these studies (Pascarella, Smart and Ethington, 1986; Nora and Rendon, 1990) found a relationship between student integration (both academic and social) and student persistence. Three others found that student integration was either not related to student persistence (Nora, 1987; Voorhees, 1987) or had a weaker effect than other constructs assessed in the study (Bers and Smith, 1991). Contrary to predictions of the Tinto model, these studies found that events occurring outside the college had a much greater impact on student persistence than students' on-campus social and intellectual development (as distinct from academic performance). In particular, the studies by Bers and Smith (1993), Voorhees (1987) and Nora (1987) found strong relationships between educational objective/goal commitment and student persistence. Taken as a whole, these studies suggest that "students' educational objectives and intent to reenroll combined [with their] pre-college experience and employment status …provide more insights into student

persistence than either Academic or Social Integration (Bers and Smith 1991; Anderson, 1981).“

Formal models of student persistence may provide some insights into the forces that affect students’ decisions to persist in college. However, major gaps remain in our understanding of the forces that distinguish the behavior of apparently similar students who leave the community college at different points in their educational careers. For example, Bailey, Leinbach, and Jenkins (2005) conducted a study on the relationship between students’ educational objectives and their likelihood of completing a program of study. Results of this analysis revealed that the higher were students’ goals and expectations, the greater were their chances of completing a degree or transferring to a four-year institution. However, even among students who sought to complete a bachelor’s degree, the percentage of students who left the college without completing a degree or transferring was unacceptably high. Moreover, many students who left the college without achieving their educational objective reduced their educational expectations. Similarly, Pascarella, Wolniak and Pierson (2003), found that a large percentage of students who, upon entering the community college, sought to complete a bachelor’s degree had lowered their expectations by the end of their first year in school.

These analyses suggest that students form their educational objectives through a dynamic process in which initial goals are modified as a result of experiences students have while attending college. Students enter the community college with a set of goals and expectations, which are based on their personal characteristics and previous experience. Once they are enrolled in college, they modify these goals and expectations, based on their experience while enrolled. The question is: to what extent do students

devalue their objectives as a result of negative experience at the community college? To what extent do they devalue their objectives due to experiences arising off-campus in their personal and work lives?

One possibility that has not been well-researched is that students may change their goals in response to changing perceptions on the educational requirements of the jobs for which they are preparing. If it is true, as Tinto posits, that students form their goal commitments through an on-going process of cost-benefit analysis, then students will change their goals as additional information becomes available on the jobs for which they are preparing. If, for example, students find that their goal job pays less than they had expected or requires less training than they had thought, they may lower their educational goals from, say, an associate's degree to some college courses. Conversely, if students find that their goal job pays better than they had thought or requires more training than they had anticipated, they may raise their educational goals and expectations. Students who enroll at the community college seek to participate in a wide range of job markets. Not only do these colleges offer students a wide range of programs that prepare them for a wide range of jobs, but these programs exist at two different levels: baccalaureate and pre-baccalaureate. These markets may function in different ways, even for jobs that, on the surface, require similar skills. According to Grubb (1996; 2002A; 2002B), employers who fill positions that require less than a college degree place much more emphasis on specific job experience and less emphasis on formal credentials than they do when filling jobs that require a bachelor's degree or higher. However, credentialing requirements may vary significantly, depending on the job under consideration. Salaries

may vary to a greater extent for jobs requiring less than a college education than they do for jobs requiring a college degree.

Hence, the incentives confronting students who enroll at the community colleges may differ greatly, depending on the major their pursuing and the type of degree they wish to complete. On the one hand, some students may be preparing for jobs in which the pay is low and the training requirements ambiguous. Other students may be preparing for jobs in which the salaries are quite good and the training requirements are clear.

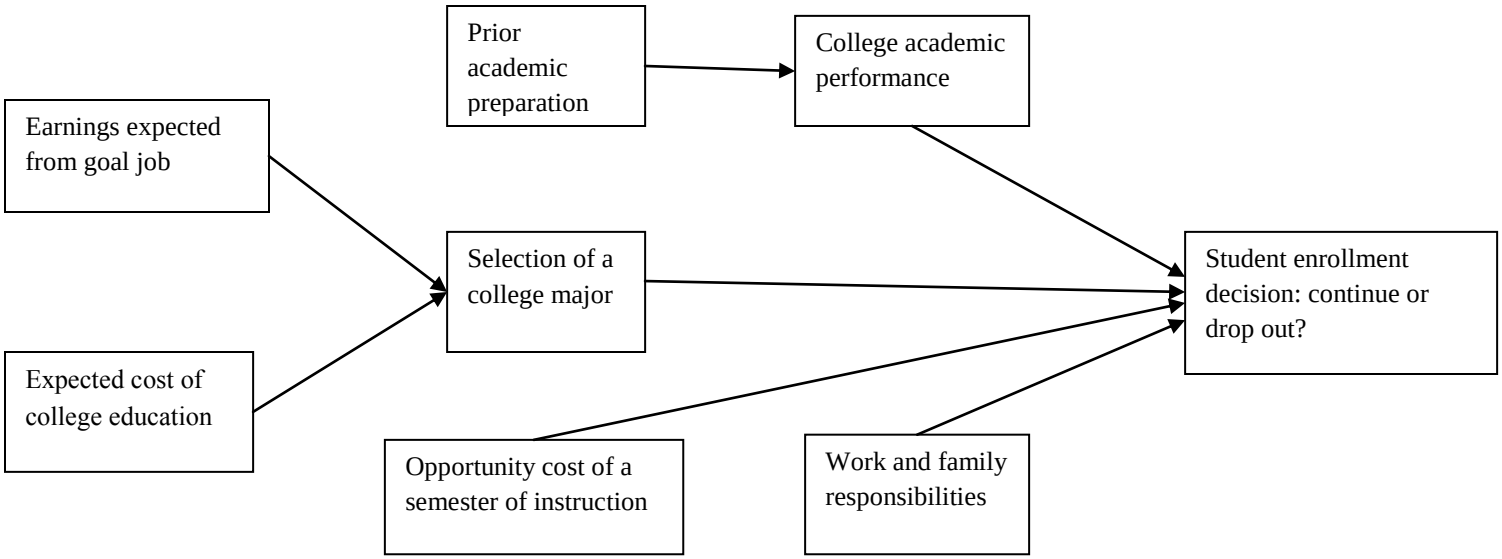
Given the theoretical importance of students' goal commitment and the results of the research that has been conducted to-date, policy makers may benefit from a better understanding of the role that job market incentives play in students' decisions to persist at college. This chapter will contribute to this knowledge by conducting an analysis of the relationship between students' majors and their chances of dropping out from a large urban community college. In this analysis, students' major will serve as a proxy for job market requirements, the idea being that different majors prepare students for different jobs, requiring different amounts of training. To the extent that training requirements differ, students majoring in one subject may have a stronger incentive to complete a degree than those majoring in another – even though a college may award associate's degrees in both subjects. If this is true, then students majoring in one subject may be less likely to complete an associate's degree than will students majoring in another. Students majoring in one subject may persist for fewer semesters than those in another.

2.3 Model to be Tested

In order to test the hypotheses outlined above, it is necessary to modify the dominant model of student persistence that has guided research in the higher education literature. Tinto's model has provided useful insights into the relationship between students' on-campus experience and persistence at the community college. However, as mentioned above, the concepts of academic and student integration may be less important than other factors in determining a student's likelihood of completing a degree. Similarly, while Bean's model pays greater attention to factors occurring off-campus, it does not assign a direct role to the market value of a college degree, treating it mainly as a psychological construct that indirectly affects persistence by way of students' "intent to leave." Given students' emphasis on career preparation, the decision to persist at a community college may be viewed as an economic decision taking place in a social and cultural environment. Human capital theory provides an ideal framework through which this may be studied.

In this modified model of student persistence, students make the decision to attend college in the same way they would any other investment decision. Subject to their individual tastes and preferences, they compare the benefits they expect to receive by attending college to the costs they will incur. In this model, costs and benefits may take any of several forms, pecuniary or psychic, direct or indirect. Tinto's concepts of academic and social integration are treated as psychic costs incurred by students as they pursue their educational goals. According to theory, students make some estimate of the extra income they can earn over the course of their lives by getting additional education.

Figure 1: A simplified model of student persistence at a community college



They then compare the expected extra earnings (converted to present value) to the cost of getting an education. If the expected present benefit of going to college exceeds the expected present cost of going to school, including psychic and opportunity costs, they decide to enroll in college. Otherwise, they do not. Once in school, they enroll in classes up to the point where the marginal cost of taking another course is just equal to the marginal anticipated benefit.

In this model, students base their educational objectives, at least in part, on signals they get from the job markets. Students scan the job market to find a career field which they can enter in order to increase their lifetime earnings. They then scan the range of available educational programs to find one that will enable them to meet the requirements of the job. In searching for a program they can pursue to achieve these goals, students have a wide range of options from which to choose. They can choose from a wide range of programs available at two-year colleges, four-year colleges, proprietary schools, or adult training programs of various types. To select the school they will enter and the program they will pursue, students compare the earnings they expect to make from preparing for a job to the cost of completing the required education. They then enter that program that yields them the greatest possible income at the lowest possible cost, subject to students' tastes and preferences.

Due to their open access missions and low tuition costs, many students will select community colleges. Once enrolled in community college, students will take classes up to the point at which the perceived cost of doing so exceeds the benefit. However, the community colleges offer a wide range of programs that prepare students for a wide range of jobs. Although all of these jobs, theoretically, require the associate's degree, many do not. Some require more than two years of training, others require less. To the extent that the

opportunity cost of a semester of instruction exceeds the benefits students expect to receive by continuing in school, they will have an incentive to quit. As a result, a student's chances of actually completing an associate's degree will vary considerably from one program to another.

To test this hypothesis, this chapter will present the results of a study conducted on a cohort of students enrolled at a large, multi-campus two-year college in the Midwestern United States (annual fall headcount ranging from 20,000 – 25,000 students). In this study, students' enrollments were tracked over eight years, from the fall semester of 1998 through the spring of 2006. Analyses were then conducted to see if a relationship existed between constructs described above and the chances that students would drop out of college, given they had enrolled for a given number of semesters. Of particular importance, analyses were conducted to see whether a relationship exists between students' majors and the odds that they would drop out of college, other things being equal. As mentioned above, community colleges offer a variety of programs that prepare students for a number of jobs. These jobs pay students a wide range of salaries and require differing amounts of training. Economic theory posits that students consider these factors when selecting a major field of study. Given differences in salaries and educational requirements that students (Grubb, 1996) are preparing for at the community colleges, students' benefit/cost comparisons may vary from one program to another. Hence, students' majors may serve as a proxy for various conditions inherent in these differing markets. The inclusion of this variable in the regression equation, therefore, provides a direct (albeit crude) test of the hypothesis that students' goal commitment results from a comparison of the various costs and benefits of attending college.

The study described in this chapter, therefore, uses students' majors as a means of testing the hypothesis that differences in the job markets for which students are preparing have a direct effect on students' goal commitment, which in turn has an effect on the odds that they will drop out of college. This analysis pays particular attention to the educational requirements of the jobs that students at this college are preparing for. Although all two-year programs offered at the community college theoretically prepare students for jobs that require an associate's degree, many do not. Many jobs in health care and engineering technology do require the services of workers who have completed an associate's degree. However, other programs prepare their students for jobs that require less than the associate's degree, while still others prepare them for jobs that require a bachelor's degree or higher. Hence, while students who seek jobs in many fields must complete an associate's or higher degree if they are to maximize their return on investment, students in many others can do so by dropping out.

For purposes of the analysis conducted in this chapter, it was assumed that a student's chances of dropping out would depend on which of several broad programs that he or she was pursuing (see Table II). As of fall 1998, the college offered more than 60 programs divided into six groups, based on similarity of content. Major groups consisted of: health careers, business technologies, engineering technologies, automotive technologies, public service technologies, and university parallel. Each of these groupings, in turn, consisted of a number of specific programs, each oriented toward a different set of markets. Educational requirements of these program-related jobs differed not only from one program to another, but also within programs, depending on a student's interest. For example, using a cross-

walk[1] prepared by the U.S. Department of Labor (DOL), the accounting program offered at this community college was linked to an occupational cluster consisting of 12 different job titles (see Appendix I). These jobs ranged from accounting clerk to auditor. Each of these jobs paid a different salary and required a different amount of education and training, from moderate-term OJT to the bachelor's degree. In contrast, the nursing program prepared students for a single job title.

Table II: A Summary of Minimal Educational Requirements of Occupations Related to Career Programs Offered at the Study College

Degree Program	Total Job Titles	# Require Associate's Degre	# Require Less Than Associate's Degree	# Require More than Associate's Degree	% Require Associates Degree	% Require Bachelor's Degree
"Credentialing" Business Technologies	74	4	31	39	5%	53%
Non-credentialing Business Technologies	20	0	19	1	0%	5%
"Credentialing" Health Careers	15	11	1	3	73%	20%
Non-credentialing Health Careers	13	0	9	4	0	31%
Engineering Technologies	10	8	2	0	80%	0%
Automotive Technologies	2	0	2	0	0%	0%
Public Service Technologies	19	2	16	1	11%	5%
Arts and Sciences	Indeterminate	--	--	--	--	--

Source: Occupational Supply Demand System, Georgia Career Information System, Georgia State University for the U.S. Department of Labor

[1] All educational programs offered colleges in the U.S. are assigned a six-digit Classification of Instructional Program (CIP) code. Occupations in this country are classified using a Standard Occupational Code (SOC). The DOL cross-walk (National Crosswalk Service Center) links CIP codes to SOCs.

Based on differences among the training requirements of these jobs, it was hypothesized that a student's odds of completing a degree would depend on the range of opportunities that were available in these program-related job clusters. Given the open access mission of the community college, students enrolled in any given class at any point in time may be pursuing a wide range of career goals, depending on their tastes, circumstances and preparation. The odds that any given set of students will complete a degree will, therefore, depend on the full range of possibilities that are available to them. Students who enroll in programs which are related to a narrow range of jobs, all of which require the associate's degree, will be likely to complete one. Conversely, those who enroll in programs which are related to a wide range of jobs, few of which require the associate's degree, will be less likely to do so. If none of the jobs in a program-related job cluster requires the completion of a degree, students' chances of completing an associate's degree will be very low. Programs in the each of the major categories listed above tend to prepare their students for similar types of jobs. For purposes of this chapter, these programs can be aggregated to form eight program clusters which yield unique benefit-cost comparisons. Academic programs associated with each cluster are listed in Appendix II.

Differences in the range of benefit-cost ratios occurring across programs should result in differences in the odds that students will drop out of college, other things being equal. These differences are hypothesized to be as follows.

- **Health careers.** Health careers programs offered at this institution can be divided into two groups: those that prepare students for jobs that require the associate's degree and those that don't. For purposes of this analysis, programs that fall into the former category are referred to as the "credentialing health careers." Those in the

latter category are referred to as the "non-credentialing health careers." As of fall 1998, the college offered 12 programs in which a student had to have an associate's degree or higher to obtain a job. It is predicted that students who enrolled in these programs will be very unlikely to drop out of college. As of fall 1998, the college offered 9 programs in the non-credentialing health careers. It is predicted that dropout rates among students in these programs will be higher.

- **Business technologies.** Like the health careers, business programs at this institution can be divided into two clusters. On the one hand, the college offers a number of programs, such as accounting and information technology, which prepare students for jobs that require a bachelor's degree. On the other hand, the college offers programs, such as court and conference reporting, that only require "some postsecondary education." These two categories are not clean. Some positions in the "credentialing" category can be filled by individuals who possess less than an associate's degree (numerical control tool programmers is an example). One position in the non-credentialing business category may require a bachelor's degree (sales engineer, which is part of the marketing program). In general, however, these clusters appear to be serving different kinds of job markets. One of these markets places great emphasis on a formal education, particularly at the baccalaureate level. The other does not. It is hypothesized that students in the credentialing business programs will be relatively unlikely to drop out of college. Those in the non-credentialing programs are hypothesized to be more likely to drop out.

- **Engineering technologies.** Programs in the engineering technologies tend to prepare students for jobs that require the associate's degree. However, it is possible for

students in these programs to obtain jobs as drafting technicians without completing the two-year credential. In addition, engineering technology positions do not have the same licensure requirements as do those in the health careers. As a result, dropout rates should be relatively high among students who enroll in these programs as compared to those in the health careers.

- **Automotive technologies.** The automotive technology program prepared students for a single job title. Typical preparation for this field is postsecondary vocational training. Hence, it is predicted that dropout rates will be relatively high among students in this field.

- **Public service technologies**. Programs in public service technology tend to prepare students for jobs which require less than the associate's degree. Some students who enroll in these programs may receive a psychic benefit from knowing they have completed a degree. Some employers may require an associate's degree or higher when filling some entry level positions. However, according to the Occupational Supply Demand System (see Bibliography), students in all of these programs will find at least some jobs that only require some postsecondary education. Given this set of possibilities, some students in these programs may find the opportunity cost of continued study to be higher than they are willing to pay. As a result, it is hypothesized that students who enroll in these programs will be more likely to drop out than are those in others.

- **University parallel program.** Many students who enroll strictly in liberal arts courses are assumed to be preparing for a bachelor's degree. Such students take their

liberal arts courses at the community college, and then take their specialized or professional courses at the four-year institution. Benefit/cost comparisons for such students are expected to be high. Such students would be expected to have strong goal commitment and low dropout rates. Contrasted to these students is a population of students who enroll in these courses in an effort to "get their 'gen ed' courses out of the way" en route to some vaguely specified goal. Because such students do not have a clear cut career goal, their benefit/cost comparisons are assumed to be low. The odds that such students will drop out of college are assumed to be fairly high. Dropout rates among students in this latter group will offset those of students in the former. As a result, the chances that students in this program will drop out of college are hypothesized to fall in between those of students in the public service programs and those in the health careers.

- **Duration of enrollment**. Because students will respond to differing signals from the job markets they seek to enter, students who enroll in different programs will seek to complete different amounts of training. As a result, the duration of enrollment will vary from one program to another. Students who enroll in the health careers programs will need to complete an associate's degree. They will drop out only as situational factors arise over the course of their studies, other things being equal. Conversely, students in the public service technologies in many cases will not need more than a course or two to enter the jobs they seek. As a result, the probability that students will drop out of college after completing a semester or two of courses is expected to be high. Enrollment patterns for students in other programs are expected to fall between these two extremes.

As stated earlier, students' educational objective/goal commitment plays an important role in the likelihood that they will drop out of college. However, prior research also shows that it is only one of several variables that affect student persistence. The literature on student persistence also suggests that students' employment status, academic performance and off-campus interpersonal relationships have an important impact on the likelihood that a student will drop out of college. Hence, these variables need to be included in any model of community college student dropout behavior. Unfortunately, the student database does not collect data on all of these aspects of students' lives. Hence, several of these dimensions must be measured indirectly, using proxies. These proxies can be used to test the following additional hypotheses.

- **Work and family responsibilities**. Students who attend the community college have many work and family responsibilities. These responsibilities affect students' ability to take classes on a full-time basis. Students who have significant work and family responsibilities are more likely to take classes on a part-time basis than are those who do not. Hence, the number of credits that students attempt each semester may be used as a proxy for work and family responsibilities. In line with studies conducted at other institutions, it is assumed that part-time students will be more likely to drop out of college than will full-time students.

- **Cumulative grade point average.** All models on student persistence include some measure of student academic performance. In Tinto's original model, grade point average served as a direct measure of academic integration. Empirical study,

however, suggests that academic performance is a separate dimension which has a direct affect on academic integration. In the current study, it is assumed to take on this latter function. Poor academic performance is assumed to result in lower academic integration, which is assumed to increase a student's odds of dropping out.

- **Students' position in the life cycle**. As students mature, they pick up on-the-job and other experience that leads them to place a higher value on their time than they did when they were younger. As the opportunity cost of their education rises, the chances that they will drop out of college rise with it. Hence, it is predicted that older students will be more likely to drop out of college than will younger students. Similarly, students who start college right out of high school are expected to have a lower dropout rate than are those who started at the college after being out of high school for more than one year.

- **Students' academic preparation.** As an open access institution, the community college in this study admits all students, regardless of their academic preparation. As a result, students who enroll at this college occupy the full spectrum of academic preparation – from 8th grade competence in English/math to college-ready in English/math. In this analysis, it is assumed that students who are less prepared for college are more likely to drop out than those who are prepared to the college level in English and mathematics.
- **Peer group influences.** Students who attend the community college may be encouraged by friends and family members, either to drop out of college or to persist to graduation. Unfortunately, the student database of this college does not collect data on the nature of these relationships. The kind of pressure students receive,

however, may be reflected by the neighborhoods in which they live. Those who reside in more affluent neighborhoods are more likely to be associated with well-educated adults than similarly motivated individuals who reside in lower income neighborhoods. Hence, the median income of the zip code in which students reside may serve as a proxy for social pressure to persist versus drop out. In this analysis, it is assumed that students who reside in lower income zip codes will be more likely to drop out than will students who reside in wealthier neighborhoods due to peer effects.

2.4 Research Method

To test this model, a discrete time event history analysis was conducted. In this analysis, students' dropout status was regressed on a set of variables which, according to theory, should have had an effect on students' persistence at the college. Using a technique described by Allison (1982), this analysis sought to find out whether students who enrolled in some programs of study were more or less likely to drop out of college than those who enrolled in others, controlling for various conditions in their academic and social lives. Of particular importance to this analysis was the variable, time. If students are basing their educational decisions on signals they receive from the job markets, then students who enroll in some programs should exit the college at different times than those who enroll in others – other things being equal. Hence, a suitable test of the model described in Figure 1 will include an analysis of the amount of time taken by students in different programs to drop out. Event history analysis was developed to address just such questions. It, therefore, provides an ideal method for this study.

In order to test the hypotheses listed earlier, this analysis employed a discrete-time methodology. Event history analysis consists of a number of techniques which have been devised to assess the relationships between the attributes of a subject and the probability of an event occurring, given the passage of time. The appropriate technique to be used in any given situation depends to a large extent on the way in which the event takes place over time. Methodologists have distinguished between two "types" of time. If the unit of time over which an event can occur is fairly large (years, quarters, terms of office), the event is said to occur in discrete time. If the unit of time over which an event can occur is quite small (days, minutes, seconds), the event is said to occur in continuous time. Different techniques are used to analyze events occurring in different types of time. In conducting the analysis presented in this chapter, it was assumed that dropping out can only occur upon the completion of a semester of college, a fairly long period of time. Hence, it was determined that the events under study occur in discrete time. Logistic regression is the technique most commonly used to assess relationships existing between causal variables and events occurring in discrete time. This technique was, therefore, used to conduct the analysis which is presented in this study.

In order to carry out this analysis, it was necessary to construct a longitudinal data set. Unlike cross-sectional analyses, which only focus on relationships occurring at a single point in time, event history analyses seek to find out whether a relationship exists between cause and effect over some lengthy period of time. To conduct such an analysis, it is necessary to collect data on those who participate in the study at multiple points in time. In the discrete time analysis, this is achieved by creating a data set containing one record for every period in which a given subject participates in the study. In the present study, such a file was created

on students in the fall 1998 cohort. In this analysis, data were collected on all terms in which students took courses during the period from fall 1998 to spring 2006. A data file was then created containing one record for each term in which each student enrolled at the college – some 17,121 records. This file contained data not only on students' dropout status and the variables deemed likely to affect it. It also contained data on the number of terms that students had enrolled as of each semester that was listed in the file. This structure made it possible to conduct analysis on the various hypothesized relationships listed earlier, controlling for the number of semesters students had attempted at the college under study.

Once this longitudinal data set had been created, it became possible to test the model described above. This was achieved by conducting an analysis in which students' term-to-term enrollment status was regressed against the other variables in the data set to yield an equation of the following form.

$$\text{Logit } h(t_j) = [a_1D_1 + a_2D_2 + \ldots a_jD_J] + [B_1X_1 + B_2X_2 + \ldots B_PX_P]$$

In this equation, the a_j's represent time. Each of these coefficients is associated with a dummy variable corresponding to the number of terms that a student was enrolled at the college. Each of the B coefficients is associated with a different substantive variable. In this equation, time variables take the place of the intercept term that is normally estimated in logistic regression. Taken together, the a_j's define the "baseline" hazard that a student will drop out of college – the probability that a student will drop out of college, given that all of the substantive variables are set to zero. A clear-cut pattern in the values of the "a-coefficients" provides an indication of the way in which the odds that a student will drop out changes over time. If the coefficients in the early terms are smaller than those in the later

terms, then a student's chances of dropping out increase with time. If the coefficients in the early terms are larger than those in the later terms, then a student's chances of dropping out get smaller with time. The "b-coefficients" in this equation reflect the effects that the substantive predictors have on the baseline rate. For example, if the coefficient is positive, then a one unit change in this variable (say from male to female) has the effect of increasing the ***log*** **odds** that a student will drop out of college by a constant amount over all time periods covered by the study. If the function in equation 1 is expressed as an antilogarithm, then a one unit change in the substantive variable increases the **odds** that a student will drop out by a constant proportion across all time periods.

An important concept in logistic regression is the notion of an odds ratio. Logistic regression is conducted to determine whether a relationship exists between a set of variables and the likelihood that an event will occur in a given period of time. The ultimate goal of this analysis may well be to estimate the probability that a particular event will occur at a particular time, given some set of characteristics or circumstances. In order to arrive at this result, however, it is first necessary to determine the relative impact of each of the component variables on the likelihood that the event will occur. In logistic regression analysis, this is most easily done by comparing the odds that an event will occur under one set of circumstances to the odds it will occur under a different set of circumstances, where the difference between these two circumstances is limited to a single change in the value of a single variable. Conceptually, this ratio requires the completion of several steps:

1. Determine the probability that an event will occur during a particular (arbitrary) time period, given a particular set of circumstances.

2. Convert the probability that an event will occur to an odds. This is done by dividing the probability that the event will occur by the probability that the event will not occur.

3. Change the value of one of the variables by one unit.

4. Compute the odds that the event will occur at some (arbitrary) period of time.

5. Divide the value in step 4 by the value in step two. This is the odds ratio.

The resulting value can range from zero to infinity. An odds ratio of 1 indicates that a one unit change in the variable has absolutely no effect on the event's likelihood of occurrence. Under this situation, the odds that the event will occur are exactly the same, no matter what value is assigned to a given variable. A ratio that greatly exceeds one indicates that a one unit change in the variable will greatly increase the likelihood that the event will occur. Conversely, a ratio that approaches zero indicates that a one unit change in the variable will greatly reduce the likelihood that the event will occur. In the standard model of logistic regression analysis, these odds ratios are assumed to be constant over time. However, a method has been developed (Singer and Willet, 2003) to determine whether the impact of a particular variable changes over time. The analysis conducted in this chapter will use this method to find out whether students who major in some subjects are more likely to drop out in some time periods than are students in others. Odds ratios and two other likelihood estimates are further described in the box on page 47.

The analysis conducted in this chapter seeks to determine the probability that a student will drop out of college in a given semester, given that he or she was still enrolled at that

college at the end of the preceding time period. In this analysis, a student may leave the college for any of three competing reasons: (1) the student may complete an associate's degree, (2) the student may transfer to a four-year institution or (3) the student may leave the college without completing an associate's degree and without transferring to a four-year institution (in the terminology of this dissertation, the student "drops out"). This analysis seeks to find out whether a relationship exists between the benefits and costs of attending college and students' probability of dropping out, given that they did not succumb to one of these three "competing risks" in an earlier semester. Conceptually, the probability that a student will drop out in a given semester is equal to the number of students who leave the college without completing a degree and without transferring to a four-year institution at the end of that semester divided by the number of students who had not succumbed to any of these three possible events in a preceding semester. The odds that a student will drop out of college are equal to the probability that he or she will drop out at the end of a given semester divided by the probability that the student will NOT drop out at the end of that term – i.e., OR = P/(1-P).

Thus, the analysis conducted in this chapter takes the form of a logistic regression that seeks to find out whether a relationship exists between the costs and benefits of pursuing a degree and students' likelihood of dropping out of college. In this analysis, costs and benefits are represented by proxy variables taken from the administrative database of the college under study. To find out whether this relationship exists, several different regression models were tested, each based on a different specification of the dropout process. These models differed both in the variables that were included in them and also in the way in which these variables interacted with each other. Of particular importance in this analysis is a test

Box 3: Some Definitions of Terms Used in Event History Analysis

Research workers who conduct discrete time event history analysis, use three different measures to describe the likelihood that an event will occur at a particular time: hazard rates, survival rates, and odds ratios. These concepts are used extensively throughout this dissertation. Hence, it may help the reader to provide a definition and example for each of these concepts.

Hazard rate. A hazard rate is simply the probability that a particular event will take place at a particular time. In this chapter, the hazard rate is the probability that a student will drop out of college, given that he or she has not dropped out, transferred, or completed an associate's degree in a previous term. Hazard rates can be computed directly from the regression model by multiplying coefficients in the equations by the relevant values, summing these up, and applying the following formula:

$H(t) = 1 /(1 + e^{-1 * \text{logit}})$

Survival Rate. The survival rate refers to the probability that a subject will last through the end of a period without experiencing an event, given that this person had not experienced it in a previous time period. This value is calculated by subtracting the hazard rate in a particular period from one and multiplying it by the survival rate in the previous term.

$S(t_n) = S(t_{n-1}) * (1 - H(t_n))$, where the subscript n refers to the current period and the subscript n-1 refers to the previous period.

Odds ratio. An odds ratio is simply a statistic comparing a person's odds of experiencing an event under two different conditions – one in which a given condition is set at some baseline value and another in which this condition is increased by one unit. This value can be computed in two steps: 1) taking the odds of observing a particular outcome under two separate conditions 2) and taking ratio of these two odds. However, it is usually much quicker to simply take the antilogarithm of the coefficient associated with a particular variable in a logistic regression analysis.

of the proportionality assumption described above (Singer and Willett, 2003). If the proportionality assumption of this method is not met, then the impact of one or more of the variables included in this model is not constant across time. As stated above, one of the major hypotheses to be tested is that students decide on how much education to complete by considering signals from the job markets. If students seeking careers in different fields require different amounts of education, then they would be expected to leave the college at different points in time. Hence, the proportionality assumption would be violated. By testing the validity of this assumption, it is therefore possible to test the truth of this hypothesis.

Results of these analyses will be presented in the remainder of this chapter. These analyses will be presented in sequential fashion, beginning with the standard model described above and then considering a model which tests the proportionality assumption. This chapter will close by discussing the implications these analyses have for theory and policy.

2.5 Data used in this Analysis

Students' major. All data used in this analysis came from the administrative database of the college under study. This data base contains a number of fields which can be used to test the hypotheses listed earlier in this chapter. Most of these data did not require any recoding to be used in this analysis. However, some of these variables did need substantial redefinition in order to be used in this analysis. Of these, the most important was students' major field of study. The student data base at this college does contain data on students' program of interest as indicated on students' application and updated on students' registration

forms. However, these particular data are not ideal for use in this study. Not only do students change their majors without making sure that these changes are noted in the college database, but they often declare majors that they do not, for one reason or another, actually pursue. As a result, many students who, according to the data base, are majoring in a particular subject area may have never taken a single course in it. A central hypothesis of this chapter is that many students who drop out of college do not quit until they have completed enough courses to meet the minimum requirements of a job. Hence, these data on students' major are of no use to this study.

To get around these difficulties, a procedure was developed which made use of transcript data to create a derived estimate of the career field which students actually sought to enter – in other words to reveal their actual, rather than stated, preferences. Using this method, transcript data were collected on every course ever attempted at the college by students who started there during fall 1998. All courses were placed into one of seven different categories: arts and sciences, business technologies, health careers, engineering, public services, developmental and other. A set of computer programs was then run to determine: (1) the subject area in which students took the greatest number of credits each term; (2) the vocational program area in which students took the greatest number of credits overall; (3) the first term in which students registered for courses in this field. Students' time at the college was then divided into two periods. Period one consisted of all semesters that occurred before students took the first course in their dominant subject area – the subject in which they attempted the greatest number of credits over their entire time at the college. During these semesters, students' majors were defined as the subject in which they attempted the greatest number of credits during a particular term. Period two consisted of all semesters occurring

on or after students took the first course in their dominant subject area. During these semesters, students' majors were defined as their dominant subject area.[2] If students did not take courses in a vocational subject or if they did not take courses in their dominant subject area during two or more semesters, this second pass was not carried out.

This method resulted in the generation of dummy variables that could be used to test the effects of students' majors on dropout status. The use of these variables had several advantages over other data that were available. Using this method, students were assigned to a major only if they had actually taken courses in a particular area. Because they were, a strong link was established between students' major and the knowledge they actually obtained at the college – or at least attempted. In so doing, this method made it possible to form inferences regarding the relationship between students' major and their dropout status that would not have been possible using students' self-declared major. Dividing students' college experience into two parts achieved two goals. First, it had the effect of recognizing knowledge obtained by students only after they had actually obtained it. Second, it had the effect of suppressing term-to-term fluctuations which occur when students take courses outside of their major in order to meet the requirements of a degree.[3] This procedure also made it possible to form some inferences regarding the relationship between students' major and their chances of dropping out that would not have been possible using other data.

This procedure was not without drawbacks. In particular, the use of this procedure may in some cases have led to incorrect major assignments, ignoring real changes in students'

[2] As an example, consider a student who attended the college for 5 semesters and took 20 hours in accounting, beginning in his third semester at the college. Such a student's major might be coded as arts and sciences during terms one and two. During semesters three through five, it would be coded as accounting

[3] An example of this situation might be an early childhood education student who took a required math course in her last semester in college.

majors. However, such errors are not likely to be frequent. In this analysis, students' majors were defined in very broad terms – for example, health careers versus engineering technology. While a student might be fairly likely to change from one engineering major to another, he or she would be less likely to change from electrical engineering to early childhood education – though admittedly this could happen. Because students' majors are being defined in such a broad way, this method will not be sensitive to very fine changes, for example from accounting to business management. Hence, while some miscoding undoubtedly did occur, the amount is not expected to be so great as to obscure the kinds of broad trends which are under study in this chapter. Given the quality of the available data and the nature of the analysis being conducted, this approach seemed to be the best way in which to define students' majors.

The net result of this procedure was that each of the 3,990 students in this cohort was assigned a major in each term in which he or she enrolled at the college. Depending on the courses that a student took, a student might have been assigned to several different majors during the time in which he or she enrolled at the college. In order to provide an unduplicated total of the number of students assigned to each major, the following table presents data only on students' majors as of the last semester in which they attended the college. In addition, the table also presents the "duplicated" total of students majors assigned to students over all semesters covered in this study.

Table III: Summary Data on Students'			
Program of Study	Students' major as assigned in all terms covered in this study	Students' major as of their last term at the college	
	#	#	%
Credentialing Health Careers	522	110	2.7%
Non-credentialing Health Careers	1,034	186	4.7%
Credentialing Business Technologies	4,028	829	20.8%
Non-credentialing Business Tech.	468	106	2.7%
Engineering Technology	263	52	1.3%
Automotive Technology	242	64	1.6%
Public Service Technology	839	210	5.3%
Arts and Sciences	6,402	1,470	36.8%
Other[4]	3,323	964	24.2%
Total	17,121	3,990	100.0%

Time. In this study, time was defined as the number of semesters students enrolled at the college. As mentioned earlier, each student in this dataset was given one record for each semester he or she enrolled at the college, beginning in the fall of 1998 and going forward for as many semesters as the student attended. These terms were numbered as if students were enrolled in consecutive semesters, even when they were not. Hence, if a student took classes in fall semester 1998 and did not return for a second term until spring of 2006, the student's first record would be coded as time 1 and his or her second semester would be coded as time 2 – even though a span of 8 years separated the student's first term from his or her second. In this analysis, time was expressed as a series of dummy variables, indicating whether a student had or had not enrolled in a particular semester. Students in this cohort attended the college for as few as one semester and as many as twenty semesters. This analysis included all semesters in which a given student enrolled, including courses taken during the summer term.

[4] Mainly students in developmental education and a few apprenticeship programs that were offered as of fall 1998.

Dropout status. In order to conduct this analysis, it was also necessary to find some way to code students' dropout status. When conducting a discrete time event history analysis, the event of interest is usually specified as a binary variable. Using this approach, those who experience a given event are assigned a value of one in the period in which the event occurs and a zero otherwise. In conducting the analysis presented in this chapter, students were considered dropouts if they met the following criteria.

- They left the college without completing an associate's degree.
- They did not transfer to another institution, either two-year or four-year.
- They were not enrolled for classes in Academic Year 2006.

All students who met these criteria were assigned a value of one in their last semester at the college. In all other semesters, they were assigned a value of zero in this field. All students who failed to meet these criteria were assigned a value of zero in all terms in which they took classes at the college – including the last semester in which they enrolled at the college. In order to focus the analysis on "voluntary" dropout behavior, students who were academically dismissed from this college were excluded from the analysis. Students who had completed a degree at another college before starting at this institution in 1998 were considered to be "recreational students." These students were also excluded from the analysis.

The coding of those students who did not drop out is important. Any time an event history analysis is conducted, some subjects will quit the study without having experienced the event of interest. To use the jargon of this methodology, such subjects are said to be "censored." The event history analysis handles such individuals by including them in the analysis up to the point in which they leave the study. After this point, they are removed

from the "risk set." During the time period before they quit the study, these subjects are included in the counts of those who are available to experience the event of interest. After they quit the study, they are not included in the population of interest. In neither time period are they counted as having experienced the event. In conducting an event history analysis, one assumes that all subjects who are in the risk set at time T are equally likely to be censored, regardless of their chances for experiencing the event. If this assumption is met, censoring is said to be "non-informative," and the resulting analysis is free from bias. If this assumption is not met, censoring is "informative" and results may be biased to some unknown extent.

In the current study, censored events are of two types. Students who were still taking classes at the community college during 2006 were censored because they had not yet experienced any event. Students who graduated or transferred to another school were censored because they experienced another, competing event. In the language of survival analysis, this latter group experienced a "competing risk." In both cases, students were included in the risk set up to the point at which they were lost to the study. Students' risk of dropping out as of a particular term was, thus, equal to the probability of dropping out, given that they have not dropped out, transferred or completed an associate's degree in a previous term.

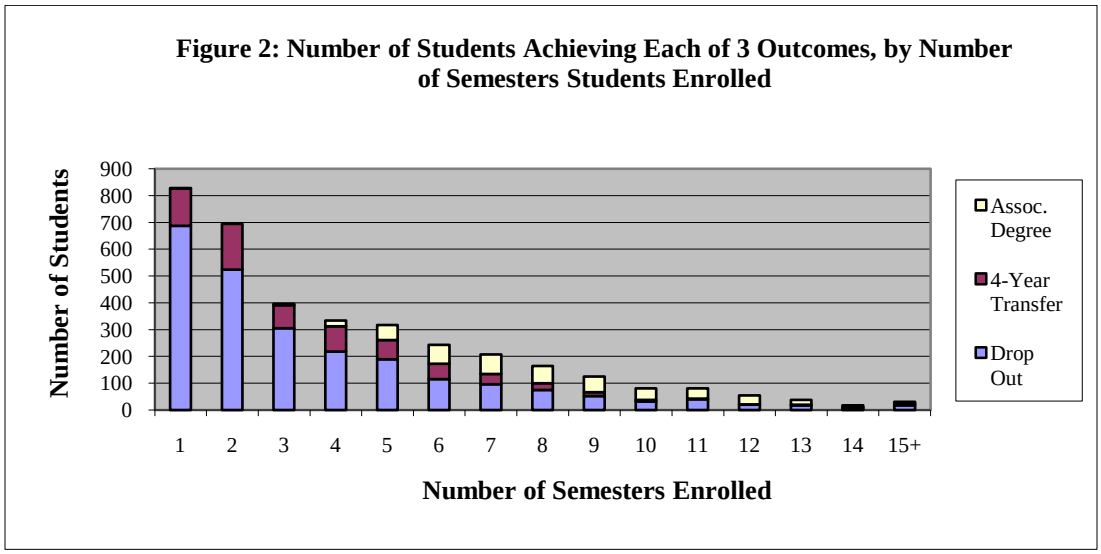
The question is, would students who left the study due to censoring have been any more likely to drop out than those who did not, had they not been "lost" to the study. In the case of students who experienced the competing risk, this is difficult to determine. The pool of students who are at risk to drop out of college at the end of, say, term 6 may be quite different from the pool of students who are at risk to drop out at the end of term 1, given that

a number of students will have dropped out, transferred or completed an associate's degree in the intervening period (and hence have been removed from the risk set). If no precautions were taken to guard against it, the removal of these students would violate the assumption that censoring was non-informative. Fortunately, it is possible to protect against this kind of bias by controlling for conditions that would be likely to distinguish among subjects who experience each of the various alternative events. In the analysis conducted in this chapter, it was assumed that students' educational goals, academic performance, and major would affect the chances that students would experience each of the alternative events. Within the limits of the data available in the college's information system, efforts were taken to control for these variables. Hence, it is assumed that this source of bias has been reduced to the lowest possible level.

In the study presented in this chapter, student dropout status was treated as a dichotomous variable in which a student either dropped out of college or moved into some other enrollment state. Of the 3,990 students in this study 2,401 were classified as dropouts. Students who did not drop out were distributed among four categories: completed a two-year degree; transferred to a four-year college; transferred to a two-year college; still enrolled for classes during academic year 2006 (see Table IV). Dropout activity occurred throughout the entire period over which this study was conducted. Unlike associate's degree completion, which did not occur until term 3, a large number of students in this cohort left the college at the end of their first semester in school. While some of these students transferred to other institutions, the vast majority dropped out of higher education altogether. The distribution of outcomes did change, once a sufficient amount of time had elapsed for students to complete their associate's degrees. Nevertheless, the number of students who decided to drop out of

higher education remained large through this study. Summary statistics on outcomes achieved by students in this cohort are presented in Table IV and Figure 2.

Table IV: Enrollment Status as Spring Semester 2006		
Enrollment Status	**# of Students**	**% of Students**
Completed Associate's Degree	509	12.8%
Transferred to 4-year College	731	18.3%
Transferred to 2-year College	196	4.9%
Still Enrolled in Academic Year 2006	153	3.8%
Dropped Out of Higher Education	2,401	60.2%
Total	3,990	100.0%



Other variables. In addition to the students' majors, this analysis also attempted to find out whether relationships existed between several other variables and student dropout behavior. These variables included students' age, academic performance, academic preparation as of the first semester in which they enrolled at the college, and the number of hours attempted each semester. These variables were of two general types: time variant and

time-invariant. Time invariant variables are constant across time periods. In this analysis, these variables included students' gender, age as of fall 1998, starting educational goal, and English and math placement scores. Time varying variables may change from one semester to another. In this analysis, these variables included students' on-going cumulative GPAs and term-to-term hours attempted. All of these data came from the student information system of the college under study. Specifications for these variables were relatively straightforward. These specifications are presented in Table V.

Table V: Variables Used in this Analysis

Variable	Definition	Specification
Dropout Status	Students' enrollment status as of the end of each term enrolled	0 = Enrolled in a subsequent term/censored 1= Drop out at the end of the term
Time	Number of semesters students had enrolled at the college as of the time in which a given record was generated	A set of dummy variables, one for each semester enrolled Specification
Cumulative GPA	Students' grade point average	Students' cumulative GPA as of the end of each term in which they attempted any classes at the community college. To aid in interpretation, this variable was re-centered at a value of 2.00 by subtracting 2.00 from all cases in the file.
Age	Students' age as of their first semester at the college	Students' age as of their first semester. As an aid in interpreting the results, this variable was re-centered at a value of 17 years by subtracting 17 from the age of each student in the file.

Table V: Variables Used in this Analysis		
Variable	**Definition**	**Specification**
Students' major	Students' major as of the semester in which a given record was generated.	A series of dummy variables, one for each of 9 majors: credentialing health careers, non-credentialing health careers, credentialing business technologies, non-credentialing business technologies, engineering technologies, automotive technology, public service technologies, arts and sciences, other (mostly developmental education). The reference variable in this analysis was public service technologies.
English placement examination score	Students' proficiency in writing as of the last time these results were entered into the college's student data base	A series of 4 dummy variables: Lower level developmental education, higher level developmental education, college level preparation, no test taken. The reference variable was lower level developmental education.
Math placement examination score	Students' proficiency in mathematics as of the last time these results were recorded in the college's database	A set of five dummy variable: (1) Pre-algebra and arithmetic, (2) beginning algebra, (3) intensified beginning algebra, (4) college math, (5) not tested. The reference variable is pre-algebra and arithmetic.
New student status	Students' highest level of education and most recent time enrolled as of their first semester at the college.	A series of 3 dummy variables: graduated from high school within 12 months of starting at the college; out of high school for more than 12 months before starting at the college; transfer in from another college. The reference variable is "graduated from high school within the past 12 months.."
Part-time status	Number of hours for which a student enrolled in a given term	This was coded as a dummy variable: coded as 1 if a student attempted fewer than 12 hours; 0 otherwise.
Financial Aid Status	Coding of this variable indicates whether a student received any financial aid in a given semester	This was coded as a dummy variable: coded as a 1 if a student received any financial aid; 0 otherwise/
Male Gender	Coding for students' gender	This was coded as a dummy variable: coded as 1 if gender was male, 0 otherwise

Table V: Variables Used in this Analysis		
Variable	**Definition**	**Specification**
Students' educational objective	Students' educational goal as stated on their application form.	This was coded as a set of two dummy variables: "Obtain an associate's degree for the purpose of transferring"; "obtain an associate's degree for the purpose of getting a job. " The reference variable was all other goals.
Median Household Income of Zip Code	The median household income of the zip code in which students' resided when they entered the college, based on 2000 census data	The median value for each zip code.

2.6 Results of the Analysis

In order to test the hypotheses listed earlier in this chapter, a logistic regression analysis was conducted. In this process, variables were entered in stepwise fashion, beginning with the variable time. In each step of this analysis, several different models were examined. Each model consisted of all the variables entered in previous steps, plus one variable that had not yet been entered into the analysis. Likelihood ratio tests were conducted on each model generated at each step, the variable associated with the highest likelihood ratio being selected for inclusion at that iteration. This process was continued until the step at which no statistically significant relationships were assessed. Results of this analysis are presented in Table VI. This table contains three different versions of this model. Models 1 and 2 include all of the variables found to have a statistically significant effect on students' chances of dropping out of college. However, Model 1 defines students' readiness for college-level study by their proficiency in math. Model 2 defines students' readiness for college-level work by their proficiency in English. Model 3 contains all of the variables in Model 1, plus

the median household income of the zip code in which students dwelled as of their first semester.

In order to determine the overall explanatory power of these three models, two sets of likelihood ratio tests were conducted. The first of these tests compared each of these models to the equation containing only the dummies for time. The second of these tests compared each of these models to a reduced model containing all but one of the variables in the full model. Results of these tests suggest that all three of these models provide a much better understanding of student dropout behavior than is available from the model containing only the time variables. Likelihood ratios for all three of these models exceeded 1774, which was significant at the .001 level of probability.

Of these three models, Model 1 appears to provide the best fit to the event history data. When this model was compared to the equation containing only the variable time, a likelihood ratio score of 1,849 was obtained. This is greater than the score of 1,749 obtained by comparing Model 2 to the time variables, suggesting that Model 1 provides a better fit to the data than does Model 2. In addition, the values for the math dummies in Model1 make more intuitive sense than the variables for English in Model 2, implying that students' are less likely to dropout as they become more proficient in math. Of the three English proficiency dummies in Model 2, only the coefficient for "test not taken" was statistically significant, implying that students who tested at the college-level in English were no less likely to dropout than those who placed into the lowest developmental level in English.

Table VI: Effects of Fixed and Time-Varying Variables on Students' Log Odds of Dropping Out of College						
	Model 1		Model 2		Model 3	
	Coef-ficient	Odds Ratio	Coef-ficient	Odds Ratio	Coef-ficient	Odds Ratio
Semester 1	-1.82*** (.13)	0.16	-1.93*** (.14)	0.14	-1.87*** (.14)	0.15
Semester 2	-1.52*** (.13)	0.22	-1.64*** (.14)	0.19	-1.57*** (.14)	0.21
Semester 3	-1.74*** (.14)	0.18	-.1.88*** (.14)	0.15	-.1.78*** (.14)	0.17
Semester 4	-1.74*** (.14)	0.18	-1.88*** (.15)	0.15	-1.78*** (.15)	0.17
Semester 5	-1.59*** (.14)	0.20	-1.74*** (.15)	0.18	-1.64*** (.15)	0.19
Semester 6	-1.83*** (.16)	0.16	-1.98*** (.16)	0.14	-1.87*** (.16)	0.15
Semester 7	-1.71*** (.16)	0.18	-1.87*** (.17)	0.15	-1.76*** (.17)	0.17
Semester 8	-1.63*** (.17)	0.20	-1.80*** (.18)	0.17	-1.67*** (.18)	0.19
Semester 9	-1.74*** (.19)	0.18	-1.90*** (.20)	0.15	-1.78*** (.20)	0.17
Semester 10	-1.87*** (.23)	0.15	-2.03*** (.23)	0.13	-1.91*** (.23)	0.15
Semester 11	-1.18*** (.22)	0.31	-1.35*** (.22)	0.26	-1.22*** (.22)	0.29
Semester 12	-1.46*** (.27)	0.23	-1.62*** (.27)	0.20	-1.50*** (.28)	0.22
Semester 13	-1.12*** (.31)	0.33	-1.29*** (.31)	0.27	-1.16*** (.31)	0.31
Semester 14	-1.54*** (.43)	0.21	-1.69*** (.43)	0.18	-1.58*** (.75)	0.21
Semester 15-20	-0.97*** (.30)	0.38	-1.12*** (.30)	0.33	-1.01*** (.46)	0.36
Cumulative GPA	-0.77*** (.03)	0.46	-.079*** (.03)	0.45	-.077*** (.03)	0.46
MATH 0950	-0.09 (.08)	0.91			-0.10 (.08)	0.90
MATH 0980	-0.22*** (.08)	0.80			-0.23*** (.08)	0.79
MATH 1060+	-0.31*** (.10)	0.73			-0.32*** (.10)	0.73
No MATH Test	0.66*** (.08)	1.93			0.65*** (.08)	1.92
Age	0.02*** (.00)	1.02	0.03*** (.00)	1.03	0.02*** (.00)	1.03
Credentialing Health	-1.62*** (.27)	0.20	-1.69*** (.27)	0.18	-1.62*** (.27)	0.20
Non-Credentialing Health	-0.57*** (.14)	0.57	-0.56*** (.14)	0.57	-0.57*** (.14)	0.57
Engineering	-0.49** (.23)	0.61	-0.59** (.23)	0.55	-0.50** (.23)	0.61
Automotive Tech.	0.02	1.02	-0.04	1.04	0.01	1.01

Table VI: Effects of Fixed and Time-Varying Variables on Students' Log Odds of Dropping Out of College						
	Model 1		**Model 2**		**Model 3**	
	Coef-ficient	**Odds Ratio**	**Coef-ficient**	**Odds Ratio**	**Coef-ficient**	**Odds Ratio**
	(.20)		(.20)		(.20)	
Credentialing Busi-ness	-0.55*** (.11)	0.57	-0.58*** (.11)	0.56	-0.56*** (.11)	0.57
Non-credentialing Business	-0.25 (.17)	0.78	-0.27 (.17)	0.77	-0.25 (.17)	0.78
Arts and Science	-0.53*** (.11)	0.59	-.058*** (.11)	0.56	-.054*** (.11)	0.58
Other	-0.01 (.11)	0.99	-0.05 (.11)	0.96	-0.01 (.11)	0.99
Developmental English (high range)			0.02 (.08)	1.02		
College English			0.00 (.08)	1.00		
No Placement Test			0.64*** (.09)	1.90		
Transfer	-0.03 (.08)	0.98	-0.16 (.06)	0.85	-0.17** (.06)	0.98
Delayed High School	0.47*** (.06)	1.61	-0.02*** (.06)	1.63	0.05*** (.06)	1.62
Part-time	0.45*** (.06)	1.57	0.50*** (.06)	1.65	0.45*** (.06)	1.56
Financial Aid	-0.21*** (.05)	0.81	-0.20*** (.05)	0.82	-0.19*** (.06)	0.82
Male	0.19*** (.05)	1.21	0.17*** (.05)	1.19	0.19*** (.05)	1.21
AA to Transfer	-0.18*** (.06)	0.84	-0.16*** (.06)	0.85	-0.17*** (.06)	0.84
AA For Job	-0.05 (.06)	0.95	-0.02 (.06)	0.98	-0.05 (.06)	0.95
Median Income Qrtl 2					0.10 (.07)	1.10
Median Income Qrtl 3					0.01 (.07)	1.01
Median Income Qrtl 4					0.08 (.07)	1.09
Zip Unknown					0.24 (.37)	1.27
Log Likelihood	-5918.4		-5955.9		-5916.9	
Likelihood Ratio Chi^2-current model compared to model which included only the time variables	1849.4***		1774.8***		1852.7***	
Likelihood Ratio Chi^2 (current model compared to model in	9.97***		9.07**		3.30	

Table VI: Effects of Fixed and Time-Varying Variables on Students' Log Odds of Dropping Out of College						
	Model 1		Model 2		Model 3	
	Coef-ficient	Odds Ratio	Coef-ficient	Odds Ratio	Coef-ficient	Odds Ratio
previous step)						
* denotes statistically significant at .05 level or better ** denotes statistically significant at .01 level or better *** denotes statistically significant at .001 level or better						

An examination of the relative merits of the model containing the median household income data (Model 3) to the model that does not (Model 1) suggests that the addition of this variable does not contribute greatly to our understanding of student dropout behavior. The likelihood ratio computed in comparing these two models was 4.30, which was significant at the .37 level of probability – not significant by conventional criteria of significance. Hence, while this variable is of theoretical importance, this specification does not suggest it has an impact on drop out behavior. Of these three equations, Model 1 is therefore the preferred model. This model serves as the basis for all subsequent discussion in this chapter.

An examination of all three of these models suggests that student enrollment decisions result from the culmination of a number of factors, including the labor market conditions associated with students' majors. Not only are the coefficients of several variables in this analysis statistically significant, but the likelihood of students' dropping out appears to change over time. A look at the results obtained in these three models suggests that a student's chances of dropping out cover a fairly narrow range during semesters 1 through 10, hitting a peak in term 2 and dropping gradually until term 10. After this point, students' probability of dropping out rises consistently from terms 11 through term 15.

What is the baseline probability that a student will drop out, given that he or she had not dropped out, transferred or completed an associate's degree in an earlier semester? Coefficients in columns 2, 4, and 6 of Table VI are expressed on a log-odds scale. Coefficients in these equations have been converted to odds ratios by exponentiating them in columns 3, 5, and 7. These values cannot be directly used to assess a student's probability of dropping out as of a particular semester. However, coefficients can be converted to probabilities using the formula below (Singer and Willett, 2003):

$$H(t) = 1/(1+ e^{-([a_1 D_1 + a_2 D_2 + \ldots a_j D_j] + [B_1 X_1 + B_2 X_2 + \ldots + B_p X_p])})$$

Applying this formula to these coefficients in model 1 suggests that, during terms 1 through 10, the baseline hazard for this cohort is a fairly shallow curve that holds steady in the range of about .13 to .18, before increasing to a range of about .19 to .28 in semesters 11 through 15. Coefficients for the time variables in these equations define the baseline hazard rate, the probability that a student will drop out when all other variables are set to zero. Given the way in which variables in this equation have been defined, this means that the probability[5] of dropping out will range from .13 to .28 for students who meet the following criteria:

- Had a cumulative GPA of 2.00
- Majored in the public service technologies
- Placed at the lowest level of developmental mathematics
- Were 17 years of age

[5] These probabilities were obtained by applying the formula $1/(1+^{e\text{-logit}})$ to model 1 for the baseline case in which all variables by time are set to zero. Thus, the probability for semester 1 in this analysis is equal to $1/(1+e^{-1*-1.82})$, which equals .14. The value -1.82 is the coefficient for semester 1. Other values were obtained in the same way.

- Attended full-time
- Were female
- Did not receive financial aid
- Completed a high school diploma within one year of starting at the college
- Had a goal other than the completion of an associate's degree.

The range of probabilities for other students will differ from these, the size of the difference depending on the nature and extent of the differences existing between these other students and the baseline student described above.

Differences in the coefficients of the time dummies suggest that dropout rates depend to some extent on the number of semesters in which a student has enrolled in college. However, results of this analysis also suggest that students' goals, experiences and personal characteristics have an impact on the likelihood that they will drop out of college. Of particular importance to this chapter, results of this analysis suggest that a student's major has an impact on the odds that he or she will drop out of college. Entering students' majors into the logistic regression (step 4 of this process) produced a likelihood ratio Chi-square of 134.8. This was significant at the .001 level of probability, indicating that students' major had an appreciable effect on students' probability of dropping out. Of the eight dummy variables entered into this equation, five were significantly different from the referent (public service technologies). Odds ratios[6] for the seven majors entered in this equation ranged from a low of .20 among students enrolled in the credentialing health careers to 1.02 and 0.99 among students enrolled in the automotive technology and "other" programs. Based on this analysis, students in the health careers are .20 times as likely to drop out of this college as are

[6] Odds ratios are obtained by finding the antilogarithms of each of the coefficients in model 1.

Table VII: Probabilities, Odds and Odds Ratios for a Baseline Student Majoring in the Credentialing Health Careers vs. Public Service Technologies in Selected Semesters					
	Probability of Dropping out		Odds of Dropping Out (Pr./[1-Pr.])		Odds Ratio
Semester	Public Service Tech.	Creden-tialing Health Careers	Public Service Tech.	Creden-tialing Health Careers	Crd. Health / Pub. Srvc
1	.14	.03	.169	.034	.20
2	.19	.04	.229	.045	.20
3	.16	.04	.184	.037	.20
10	.14	.03	.162	.032	.20

Table VIII: Probabilities, Odds and Odds Ratios for a Baseline Student Majoring in the Credentialing Business Majors vs. Public Service Technologies in Selected Semesters					
	Probability of Dropping out		Odds of Dropping Out (Pr./[1-Pr.])		Odds Ratio
Semester	Public Service Tech.	Creden-tialing Business Majors	Public Service Tech.	Creden-tialing Business Majors	Crd. Business / Pub. Service
1	.14	.09	.169	.097	.58
2	.19	.12	.229	.132	.58
3	.16	.10	.184	.106	.58
10	.14	.09	.162	.093	.58

Table IX: Probabilities, Odds and Odds Ratios for a Baseline Student Majoring in the Automotive Technology vs. Public Service Technologies in Selected Semesters					
	Probability of Dropping out		Odds of Dropping Out (Pr./[1-Pr.])		Odds Ratio
Semester	Public Service Tech.	Auto-motive Tech.	Public Service Tech.	Auto-motive Tech.	Auto. Tech / Pub. Service
1	.14	.15	.169	.173	1.02
2	.19	.19	.229	.234	1.02
3	.16	.16	.184	.188	1.02
10	.14	.14	.162	.165	1.02

students in public service technologies. Students enrolled in the non-credentialing health careers programs are about equally as likely as are those in the public service technologies to drop out of college. Odds ratios for the credentialing business technologies, arts and sciences, and engineering technologies ranged from about .57 to about .61, suggesting that students who enrolled in these programs were about .6 times as likely to drop out as were those who enrolled in the public service technologies.

In order to make these relationships a little clearer, probabilities, odds and odds ratios for a baseline set of students majoring in each of three different subjects are presented in Tables VII- IX. As can be seen from these tables, odds ratios are computed by dividing the odds of dropping out for students in a particular major by the odds of dropping out for students in the reference major – public service technology in this case. A look at the rightmost column of each of these three tables reveals that this ratio is the same, regardless of the semester for which it is computed. This proportionality assumption is an important attribute of the logistic regression approach to event history analysis.

Odds ratios for students majoring in business, arts and sciences and engineering technologies are quite similar. A question, thus, arises as to whether these variables differ from each other at all. Additional analysis confirms that the odds ratios for these three majors are not significantly different from one another. Changing the reference major from public service to arts and science increased the ratios for credentialing business and engineering technology programs to .98 and 1.04, respectively. Wald statistics computed on these coefficients were not significant at accepted levels of probability, indicating that these coefficients were not different from the referent and hence from each other. Changing the reference major to health careers altered the odds ratios for the arts and sciences,

credentialing business technologies, and engineering technologies to 3.0, 2.9, and 3.1, respectively. These differences were significant at high levels of probability. Hence, while students who enrolled in these programs were about equally likely to drop out, they were more likely to do so than were students in the health careers and less likely to do so than were students in the public service technologies. Interestingly, students in the non-credentialing business technologies were about 1.3 times as likely to drop out as were students in the arts and sciences. These students were about 3.9 times as likely to drop out as were students in the credentialing health careers. To the extent that the non-credentialing business programs prepare students for jobs requiring less than the associate's degree, this finding supports the notion that students seek to maximize the return on their educational investment by taking only those courses needed to qualify for their goal job.

The above analysis suggests that students' choice of a major does affect their chances of dropping out of college. However, a student's major is only one of several factors that influence his or her chances of dropping out of college. Results of this analysis suggest that several variables, including GPA, proficiency in math, age at first enrollment, full-time/part-time status and gender, all have an important affect on the odds that they will drop out of college. These factors affect the chances that a student will drop out in different ways and to different degrees. Coefficients for the variables GPA and transfer goal are both negative, suggesting that a one unit increase on these variables reduces a student's chances of dropping out. Conversely, coefficients for students' age, part-time enrollment status, gender, and delayed entry after high school are all positive, indicating that a one unit increase on these variables increases a student's odds of dropping out.

Of particular interest in this analysis, Wald tests conducted on math placement scores suggest that students who place at higher levels in this subject are progressively less likely to drop out than are those who place at the lowest level (pre-algebra). These results may highlight the psychic costs incurred by students who are terrified of taking math. By contrast, English placement scores were statistically significant only to the extent that students who were not tested were much more likely to drop out than were students who placed at the lowest level. All of these coefficients are significant at probabilities of .05 or better.

Given these results, the odds that a 34-year old student will drop out of college are 1.52 times as great as the odds that a 17-year old student will do the same. However, the actual probability that such a student will give up on college also depends on the student's status on the other factors considered in this model. Results of this analysis suggest that a one unit increase in students' GPAs reduces their odds of dropping out by a factor of .46, while a switch from full-time to part-time attendance would increase them by a factor of 1.57. Students who plan to transfer to a four-year college upon completion of their associate's degree are .84 times as likely to drop out as are students with other goals. Men are 1.21 times as likely to drop out as are women, and students who receive financial aid are .81 times as likely (19% less likely) to drop out as are those who do not. High school graduates who skipped a year before starting at the college are 1.61 times as likely to drop out as are those who started right after they graduated.

Given these findings, a 34-year old, female who goes full-time to college has a 2% chance of dropping out at the end of her fifth semester – assuming that she is majoring in the credentialing business technologies, has a GPA of 4.0, intends to complete a university

parallel degree, places at the college level in mathematics, and does receive financial aid. A seventeen-year old, male who goes part-time to college has a 17.4% chance of dropping out at the end of his fifth semester – assuming that he is majoring in business, has a GPA of 2.00, places at the lowest level on his math assessment tests, does not receive financial aid, and wishes to complete a technical degree.

A graphical representation of these results may help to make the meaning of this analysis a little clearer. Statisticians distinguish between two different kinds of functions when discussing event history analysis: the hazard function and the survival function. The hazard function gives the probability that a subject will experience an event at a particular point in time, given that he or she has not experienced it or any competing risk during a previous time period. The survival function gives the cumulative probability that a subject will survive through time T, and perhaps beyond, without experiencing the event of interest. Taken together, these two functions may provide some useful insights into the effect of a variable on the occurrence of an event over time. In the current study, graphs of these two functions may provide some insights into the relationships between students' majors and the probability that they will drop out of college at various points in time. In order to calculate these two functions, however, it is first necessary to define a typical student on which to base them. For purposes of this analysis, this student will be defined as follows.

- A male
- GPA of 2.0 in each semester in which he enrolled
- Seventeen years of age when he started the college in 1998
- Tested at the next to lowest developmental level in math (MATH 0950)
- Started at the college within one year of graduating from high school

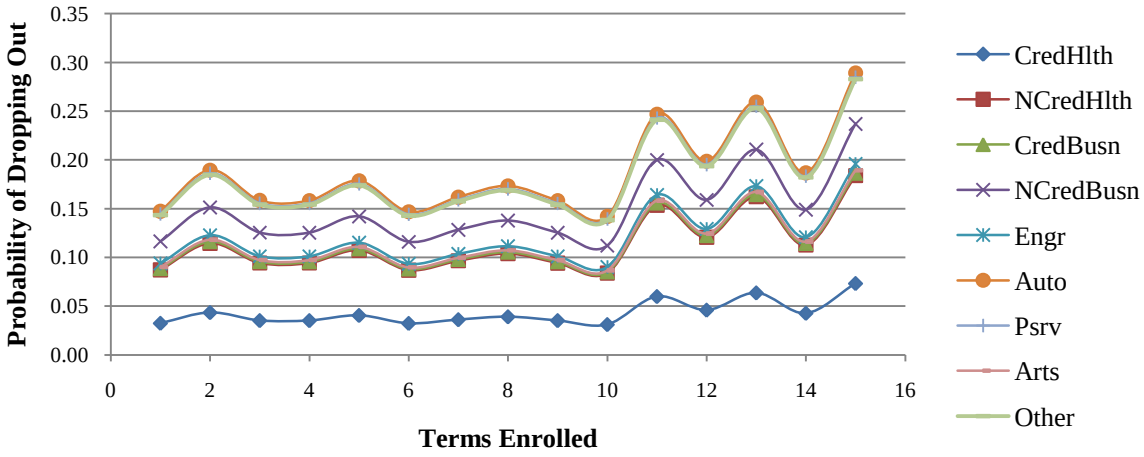
- Attended on a full-time basis in each semester in which he enrolled
- Did not receive financial aid
- Stated on his application that he wished to complete an associate's degree in a vocational subject

Once this student has been defined, it is possible to compute these rates for students pursuing different majors. In the current study, this analysis yields two sets of different, but related, curves. A plot of the hazard rates reveals a set of (roughly) parallel curves, each curve providing information on the probability that this typical student will drop out of college in a particular semester, given that he is majoring in a particular subject.[7] Each curve has an irregular u-shape, in which the hazard of dropping out reaches a peak semesters two, drops in term three, holds steady during semesters four through ten and rises from term 11 through 15 and beyond. Reflecting the coefficients in model one, the curve for the credentialing health careers is the lowest of the set, the probability of dropping out ranging from a low of about 3% to a high of about 7%. The automotive technology program, the public service technologies, and "other[8]" programs are the highest of these curves. The probability of dropping out for students in these three programs ranges from a low of about 14% to a high of 29% in semester number 15. Curves for the other programs lie between these two extremes.

[7] The odds of dropping out for a student who majors in the arts and sciences are exactly .5348 times as large as they are for a student who majors in the public services, no matter how many semesters the student enrolls. When expressed on a logit scale, the hazard that an arts and science student will drop out is in all time periods .5348 units smaller than that it is for a public service student. However, when converted to a raw probability, this proportionality holds only in rough form. Hence, while these plots are roughly parallel, they are not exactly so. Similar results are obtained for students enrolled in other programs.

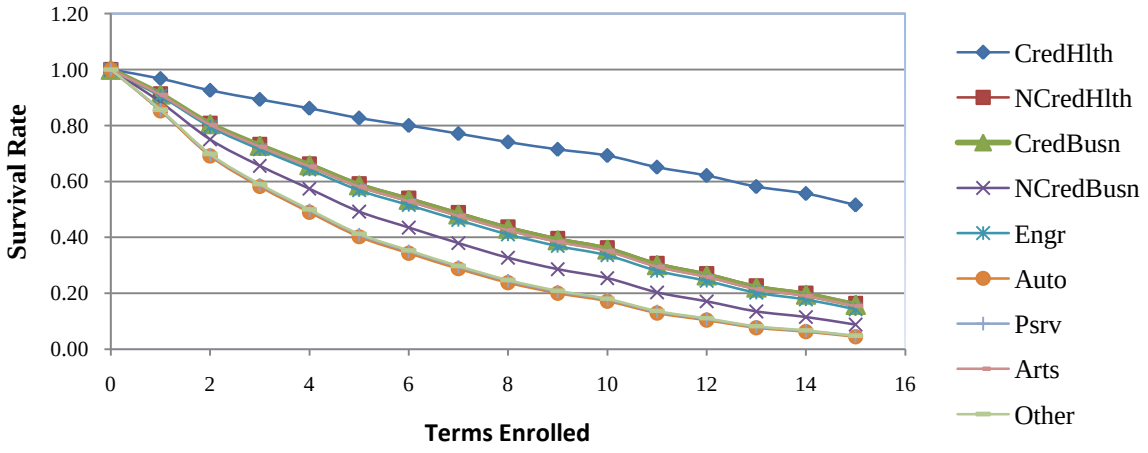
[8] The "other" program in this chapter consists primarily of students who were enrolled primarily in developmental education courses in a particular semester. Since it is not possible to earn a degree in developmental education, this category is not treated as a legitimate major in this analysis.

Figure 3: Hazard Rates for a Typical Student Enrolled in Various Majors: Odds Assumed to be Proportional Over Time



A plot of the survival functions for this typical student indicates that the cumulative probability that a student will not drop out of college varies by program. In examining these survival curves, the probability of dropping out is depicted by the vertical distance between the curve and the value of 1. As a result, this chart reverses the order of curves appearing in Figure 3. Credentialing health careers appears at the top of this graph, while the automotive technology program, public service, and "other" programs appear at the bottom. Given the relatively low hazard rates depicted in Figure 3, the probability that a typical student in the credentialing health careers will NOT drop out is very high, even after 15 semesters of enrollment at the college. Conversely, a student who enrolls in the public service technologies has only about a 59% chance of surviving after enrolling for only three semesters. Survival rates for students enrolled in other programs lie between these two extremes.

Figure 4: Survival Rates for a Typical Student Majoring in Various Subjects: Odds Assumed to be Proportional Over Time



2.7 A Test of the Proportionality Assumption

As mentioned above, logistic regression assumes that a student's odds of dropping out of college are constant across all time periods. Under this assumption, the hazard functions for students enrolled in different majors will be exactly parallel when odds are expressed on a logit scale (Singer and Willett, 2003). They will be roughly parallel when hazard is expressed as a raw probability. But what if the odds of dropping out among students who major in different programs are not proportional across time? What if students enrolled in different programs need to complete differing amounts of credit to obtain the jobs they desire? Under these circumstances, students will enroll in the college up to the semester in which they have completed enough credits to obtain some job of interest, at which time they will drop out. Because students enrolled in different programs will leave the college at different times, the odds of dropping out will not be proportional.

In order to find out whether the relationship between students' major and dropout status was proportional over time, this analysis used a method described by Singer and Willett (2003). Using this method, a model is created which includes the interaction between time and a variable of interest. In this model, the time variables are multiplied by the variable of interest to yield a measure of this interaction. These products are included in an expanded model. Likelihood ratio tests are then conducted, comparing this expanded model to the reduced model. If the likelihood ratio Chi-Square is significantly different from zero, then the slope of the variable is not constant over time. Thus, the proportionality assumption of this model is not met.

In order to apply this method to the current study, it was first necessary to find some simple means of measuring time. Models tested earlier in this chapter contained 15 time periods and 8 majors. Creating an interaction variable for each of these 120 combinations would not have been feasible. Hence, it was necessary to reduce the number of interactions to be assessed in a revised model. This was achieved by dividing students' time at the college into three different periods: 1-3 semesters, 4-6 semesters, and 7-15 semesters. A set of three dummy variables was thus created, each one corresponding to a different time period. These dummy variables were multiplied by the major codes in model one to create a set of 24 interaction terms. Tests were then conducted to find out whether a regression model which included these variables did a better job of predicting students' dropout status than the model which did not do so.

Results of this analysis suggest that students in different programs do drop out of the college at different rates per each unit of time. Comparing this expanded model to the reduced model yielded a likelihood ratio Chi-square value of 26.5. This was statistically

Table X: A Test of the Proportionality of Students' Majors on their Log-Odds of Dropping Out Over Time		
	Model 3	
Variable	Coefficient	Odds Ratio
Semester 1	-1.47***	0.23
	(.16)	
Semester 2	-1.17***	0.31
	(.16)	
Semester 3	-1.38***	0.25
	(.17)	
Semester 4	-1.94***	0.14
	(.21)	
Semester 5	-1.80***	0.17
	(.21)	
Semester 6	-2.03***	0.13
	(.22)	
Semester 7	-2.13***	0.12
	(.25)	
Semester 8	-2.05***	0.13
	(.25)	
Semester 9	-2.16***	0.12
	(.27)	
Semester 10	-2.29***	0.10
	(.29)	
Semester 11	-1.59***	0.20
	(.28)	
Semester 12	-1.87***	0.15
	(.33)	
Semester 13	-1.54***	0.21
	(.36)	
Semester 14	-1.96***	0.14
	(.47)	
Semester 15-20	-1.40***	0.25
	(.36)	
Cumulative GPA	-0.77***	0.46
	(.03)	
MATH 0950	-0.09	0.91
	(.08)	
MATH 0980	-0.23**	0.79
	(.08)	
MATH1060+	-0.32***	0.72
	(.10)	
No MATH Test	0.64***	1.89
	(.08)	
Age	0.02***	1.02
	(.00)	
Credentialing Health 1-3	-1.73**	0.18
	(.63)	
Credentialing Health 4-6	-1.10*	0.33
	(.50)	
Credentialing Health 7+	-1.38***	0.25
	(.40)	
Non-Credentialing Health 1-3	-0.86***	0.42
	(.23)	

Table X: A Test of the Proportionality of Students' Majors on their Log-Odds of Dropping Out Over Time		
	Model 3	
Variable	Coefficient	Odds Ratio
Non-Credentialing Health 4-6	-0.61*	0.54
	(.29)	
Non-Credentialing Health 7+	-0.03	0.97
	(.27)	
Credentialing Business 1-3	-1.00***	0.37
	(.16)	
Credentialing Business 4-6	-0.23	0.80
	(.21)	
Credentialing Business 7+	-0.10	0.91
	(.24)	
Non-credentialing Business 1-3	-0.53**	0.59
	(.25)	
Non-credentialing Business 4-6	-0.25	0.78
	(.32)	
Non-credentialing Business 7+	0.31	1.36
	(.34)	
Engineering Tech. 1-3	-1.37***	0.25
	(.41)	
Engineering Tech. 4-6	-0.20	0.82
	(.38)	
Engineering Tech. 7+	0.50	1.66
	(.41)	
Automotive Tech. 1-3	-0.40	0.67
	(.26)	
Automotive Tech. 4-6	0.42	1.52
	(.37)	
Automotive Tech. 7+	0.49	1.63
	(.60)	
Arts and Science 1-3	-0.85***	0.43
	(.15)	
Arts and Science 4-6	-0.41*	0.66
	(.21)	
Arts and Science 7+	-0.11	0.89
	(.26)	
Other 1-3	-0.39**	0.68
	(.15)	
Other 4-6	0.29	1.34
	(.21)	
Other 7+	0.42	1.52
	(.26)	
Delayed High School	0.47***	1.61
	(.06)	
Transfer	-0.02	0.98
	(.08)	
Part-time	0.46***	1.58
	(.06)	
Financial Aid	-0.20***	0.82
	(.05)	
Male	0.18***	1.20
	(.05)	

Table X: A Test of the Proportionality of Students' Majors on their Log-Odds of Dropping Out Over Time		
	Model 3	
Variable	Coefficient	Odds Ratio
AA to Transfer	-0.18**	0.87
	(.06)	
AA For Job	-0.05	0.93
	(.06)	
Log likelihood	-5905.3	
Likelihood Ratio Chi^2 (current model compared to model without major by time interaction terms)	26.5*	
* denotes statistically significant at .05 level or better ** denotes statistically significant at .01 level or better *** denotes statistically significant at .001 level or better		

significant at the .047 level of probability. An examination of the Wald tests for these interaction terms revealed that coefficients for several majors differed from the referent major in several time periods. In particular, Wald tests for the credentialing health programs were significantly different from those of the public service technologies in all time periods. Coefficients for the engineering and both types of business majors differed from the reference major in period one, but not in periods two and three. The coefficients for arts and sciences differ from the public service technologies in periods one and two, but not during period three. Results of this analysis are displayed in Table X.

A graphical presentation of these results may help to clarify the way in which these differences occur over time and across majors. These graphics, which appear in Figures 5-8, underscore the fact that, while hazard rates do vary from one major to another, the extent of these differences appear to vary from one time period to another. Unlike the curves appearing in Figure 3, the hazard curves in Figures 5-8 are not even roughly parallel to each other. For example, a look at the hazard curve for the public service technologies shows that a student's chances of dropping out in terms 1-3 are much larger than they are in terms 4-10.

Figure 5: Hazard Rates for Students in Credentialing Business, Non-credentialing Business and Public Service Technologies: Odds Assumed to be Non-proportional

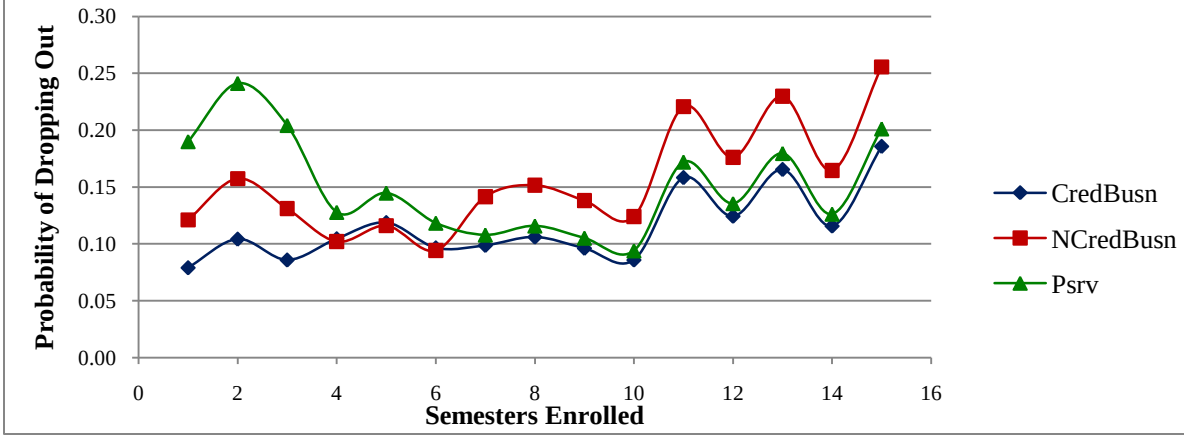


Figure 6: Hazard Rates for Students in Credentialing Business, University Parallel and Public Service Technologies: Odds Ratios Assumed to be Non-proportional

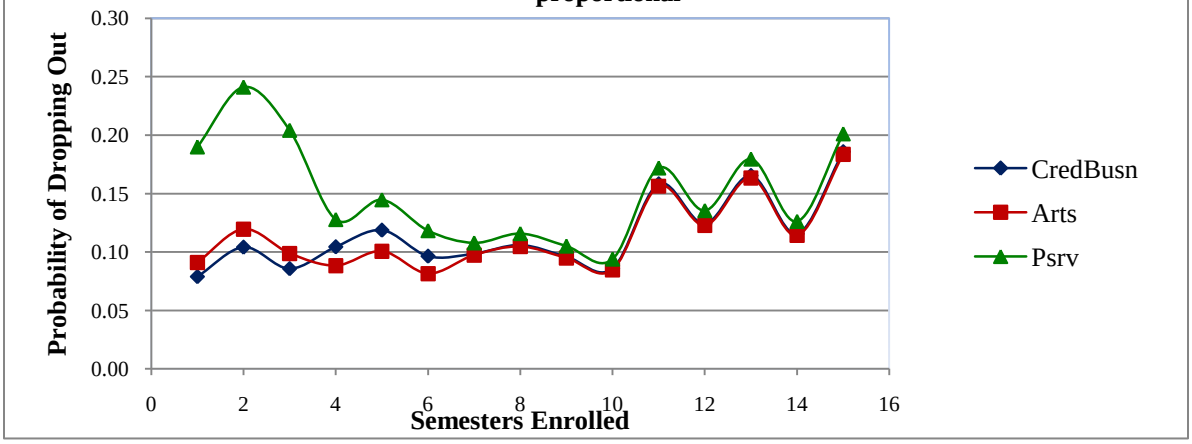


Figure 7: Hazard Rates for Students in Health Careers and Public Service Technologies: Odds Assumed to be Non-proportional

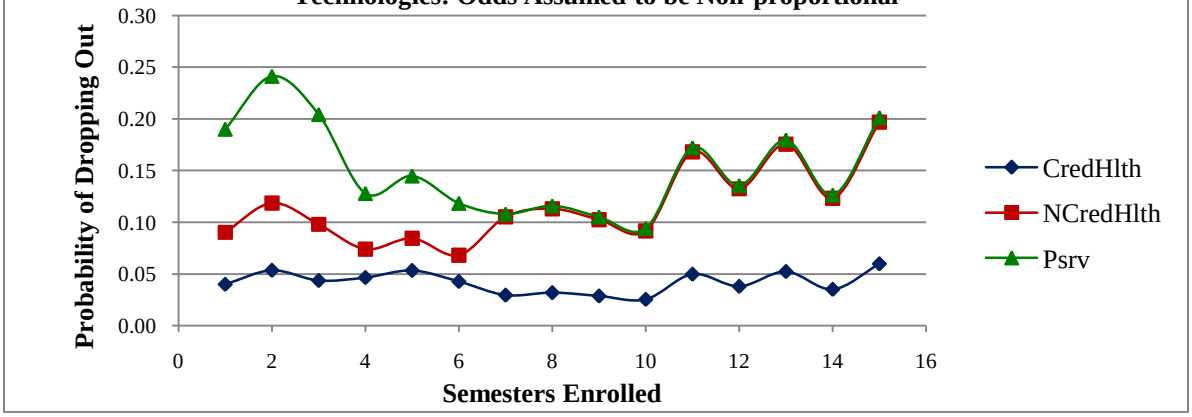
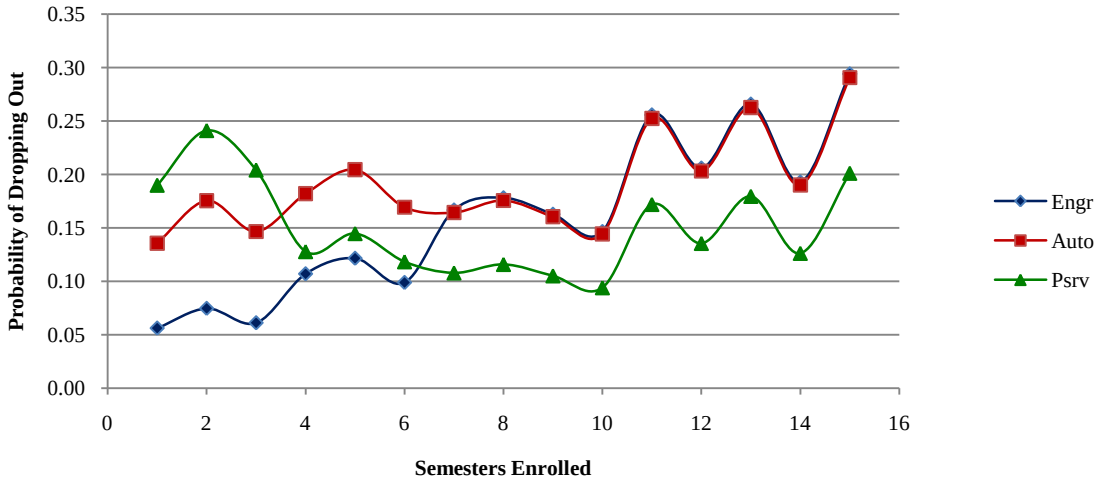


Figure 8: Hazard Rates for Students in Engineering, Automotive and Public Service Technologies: Odds Assumed to be Non-proportional



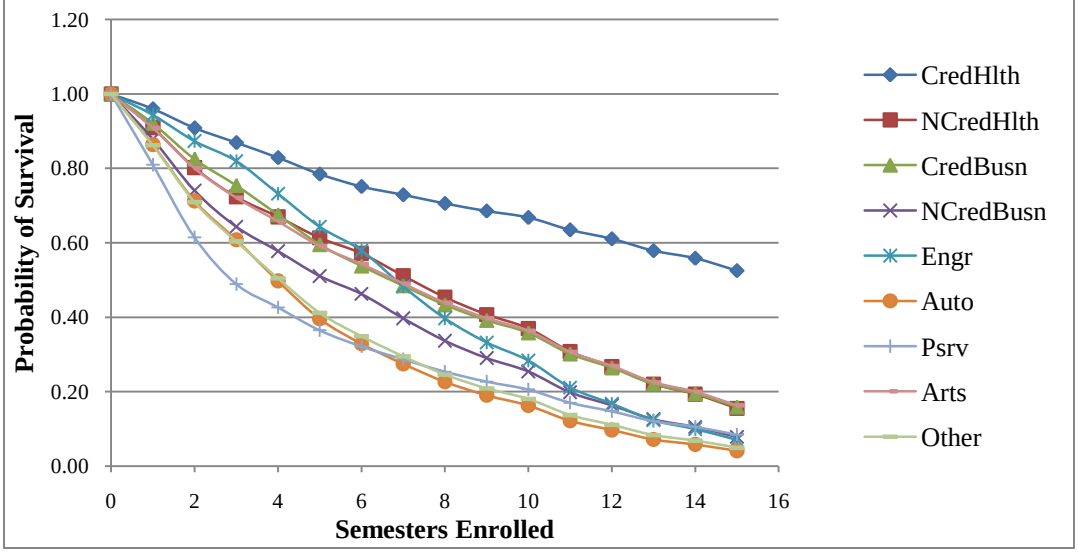
In fact, the hazard rate in term 2 is more than double the rate in term 6 (.241 versus .118). By contrast, the hazard rate for students in the credentialing business technologies who enroll in a second semester of classes is only about 1.08 times as great as it is for students who enroll in their sixth semester. The net result of these differences is that the hazard rate for students enrolling in the public service technologies is much greater than it is for the credentialing business technologies during terms 1-3. After that, the differences between these two majors become much smaller. As of students' seventh semester at the college, the hazard rates for these two majors differ by only a fraction of a percent. A similar pattern emerges for students enrolled in the arts and sciences.

Hazard rates for students majoring in each of the other subjects follow distinct patterns that differ from those described above. Hazard rates in the credentialing health careers fall below the rates of all other majors in all semesters considered in this study. By contrast, those in the engineering programs start low in terms 1 through 3 and rise steadily thereafter, eventually exceeding the rates for the public service technologies. Hazard rates for students

in the automotive technologies remain high in semesters 1 through 6, falling slightly below the levels for public service technologies in terms 1-3 and exceeding them in all terms thereafter. Rates for the non-credentialing health careers fall below those for the public service technologies in terms 1-6 and match them in all semesters thereafter. Contrastingly, rates for students in the non- credentialing business technologies fall below those of students in the public service technologies in semesters 1-6 and exceed them in all remaining terms.

Differences in the size of these hazard rates over time have small effects on the survival curves associated with students' majors. For the most part, survival rates derived from these interaction terms are quite similar to those derived from the reduced model. The likelihood that students will survive through the end of their 15^{th} semester is greatest among those in the credentialing health careers and smallest among those in the automotive technology program – just as it is when the hazard rates are assumed to be constant over time. However, survival rates for the different majors do not, in all cases, maintain the same order in one time period as they do in another. In particular, survival rates for students who enroll in the engineering programs are greater during semesters 1-8 than in all majors except the credentialing health careers. However, the increasing size of the hazard rate for these programs after the 6^{th} semester produces a large decline in the survival rate for the engineering technology programs which is unmatched by the other programs. As of the 15^{th} semester the survival rate for students in the engineering technologies is smaller than the rates for students in all but three of the nine majors considered in this study. Smaller changes in the survival curves for students in the public service technologies can also be detected in Figure 9.

Figure 9: Survival Rates for Students Majoring in Various Subjects : Odds Assumed to be Non-proportional



These results are consistent with the hypothesis that students consider the training requirements of the jobs they are preparing for when deciding how much education they wish to complete. These considerations affect the hazard that students will drop out in a given term, other things being equal. For example, students who take courses in law enforcement are likely preparing for a range of different jobs. However, a number of these students are probably preparing to be police officers. The primary training requirement at many police departments in the vicinity of this college is the successful completion of a state certifying examination. Students can prepare for this examination by taking a semester or two of classes at the community college. An associate's degree is not required. Hence, a number of these students quit the college after completing a semester or two of classes at this institution. High dropout rates among these students inflate the hazard rates and deflate the survival rates among public service technologies students during terms 1-2. By contrast, students in the health careers cannot improve their benefit/cost ratios by dropping out of college. Hence,

hazard rates among these students are low across all time periods considered in this study. Similar factors affect the hazard rates of students enrolled in other majors.

2.8 Discussion

This chapter has sought to explain the phenomenon of student dropout behavior at a community college by using a simplified model of student persistence. Drawing on the work of several theorists (Tinto, 1975; Bean and Metzger, 1985; Pascarella, Smart and Ethington, 1986), this model posits that differences in students' enrollment behaviors result from differences in students' goals. These goals are reflected in students' majors. Although all programs offered at the community colleges ostensibly prepare students for jobs that require a two-year degree, this is not strictly true. While some programs, particularly in the health sciences, do require the associate's degree, others prepare students for jobs that require more or less than the two-year degree. Students who enroll at the community colleges are motivated to maximize their return on investment. Hence, if a student feels that he or she can reduce the cost of achieving a particular career goal by dropping out of college, the student has an incentive to do so. Depending on the range of incentives (and disincentives) arising from other parts of a student's academic and personal life, a given student may or may not decide to quit school without completing a degree. All things considered, however, students who are preparing for jobs that require a degree will be less likely to drop out of college than students who are preparing for jobs that do not.

To test the accuracy of this model, a number of analyses were conducted on the enrollment status of a cohort of students enrolled at a community college. These analyses

took the form of an event history analysis, in which students' dropout status was regressed on a series of variables derived from the theory of student persistence. Results of these analyses do not provide definitive proof for the hypotheses listed earlier. However, they do suggest that students act in accordance with this general model of student persistence. Students in different programs may drop out of college for reasons having little to do with the perceived benefit of an additional credit of instruction. However, the pattern of dropout behavior uncovered in this analysis seems important. Students who were pursuing majors that would prepare them for jobs that strictly required an associate's degree were very unlikely to drop out of college. Those students who were enrolled in majors that prepared them for jobs that did not require a degree were much more likely to drop out.

Students' dropout status was also affected by other factors. Some of these factors, such as age and academic performance, had a powerful impact on student drop out. Results of this analysis suggest that these different costs and benefits may act in concert to produce enrollment behaviors that are very difficult to alter. For example, weak academic performance of a student who is preparing for a job that requires less than the associate's degree will almost assuredly result in dropout behavior. Strong academic performance of a student who prepares for a job requiring less than the associate's degree is harder to predict and may depend on the full range of benefits expected and costs incurred by the student.

Results of this analysis are consistent with a human capital theory approach to student persistence at the community college. According to human capital theory, students decide to enroll in college by comparing the costs and benefits of completing an education. Applying

this theory to student persistence, students make this comparison every semester. If the costs exceed the anticipated benefits of going to school at the end of a particular semester, students decide to quit school. If students have completed the credits needed to graduate as of this time, they complete a degree. If not, they drop out of college. Viewed from this perspective, the major theories of student persistence (Tinto, 1975; Bean and Metzger, 1985) may be viewed as highly specialized forms of cost/benefit analysis. Students who are well integrated into the academic and social systems of the college they attend receive a psychic income from going to class. Those who are not well integrated incur a psychic cost. Similarly, those who receive support from family and friends outside of school receive a psychic benefit from going to school. Those who do not receive such support incur a cost. Students compare these costs and benefits to the income they are likely to earn by completing their educational goals. If costs exceed benefits, they quit do not re-enroll.

Viewed in this light, differences in drop out behavior occurring among students in this cohort result from differences in costs they incurred and benefits they anticipated. Students in this cohort who earned low grades incurred a psychic cost, while those who earned high grades earned psychic income. Similarly, those who placed at the pre-algebra level in math incurred psychic costs not borne by students who placed into higher level courses. Students who entered this cohort after being out of high school for several years likely had work and family responsibilities that students who entered directly from high school did not possess. In addition, the delayed entry students may have had weaker high school preparation than those who came directly from high school. In either case, the older students incurred a cost that younger students, on average, did not share. A similar interpretation may be placed on other variables considered in these analyses. All of these costs and benefits are matched

against the earnings streams students expect to receive on completion of their majors. If students expect to realize significant earnings upon completion of a degree, they are likely to persist, even in the face of high costs.

An important factor in this analysis is the opportunity cost borne by students who major in different subjects. Traditionally, human capital theory has invoked the concept of opportunity costs to account for differences in the college enrollment rates of various populations (Becker, 1993). For example, human capital theory explains differences in college attendance among older versus younger students by noting that older students have acquired skills and knowledge on the job that increase their value to employers. Because such students may forego more income to attend college than younger students, they are less likely to go to school. Applying this same logic to the analysis conducted in this chapter, older students who attended the college under study were more likely to drop out than younger students, since they incurred a higher opportunity cost than their younger counterparts.

A similar logic applies to students who major in different subjects. Econometric analyses (Grubb, 1996; Kane and Rouse, 1995) suggest that students' value in the market place increases for every credit of instruction they complete at the community college – even if they don't complete a degree. If this is true, then for every credit of instruction that students complete, the opportunity cost of staying in school goes up. Although the pecuniary cost of attending the community college is quite low, students have many work and family responsibilities that students at other institutions may not share. In addition, students' previous educational experiences, in many cases, may not have been good. As a result, they incur a higher psychic cost than do students who typically attend other institutions. As

students complete more courses, increases in the opportunity cost of taking classes may reach a point where, given the other costs they incur, it is no longer rational to continue in school. At this point, students may seek to drop out. However, students enrolled in different academic programs may approach this point at different rates. Students who are preparing for jobs with strict credentialing requirements may not be able to recoup the costs of their investment until they have completed their associate's degree. Conversely, students in other programs may do so at much earlier points in their studies. Hence, the dropout rates are quite high among students who major in the public services and automotive technology. They are quite low in the credentialing health careers.

Arts and science students in this cohort likely make a different benefit-cost comparison than do students in the vocational programs. Arts and science courses at this college cover a wide range of disciplines. Occupational training data compiled by the U.S. Department of Labor suggest that students must obtain a bachelor's degree or higher to obtain jobs in most, if not all, of these fields. Hence, unlike students in some of the vocational programs, students who wish to obtain employment in these fields cannot maximize their return on investment by dropping out of college. In this respect, these students are similar to those who are majoring in the credentialing health sciences. However, it is not true that all students in the arts and sciences necessarily wish to pursue a professional career. All of the vocational degrees offered at this institution require students to complete some courses in the arts and sciences. An informal survey conducted at this school suggests that many students who "major" in these subjects are actually uncertain as to the career they wish to prepare for. Such students believe that they will benefit from completing a degree. However, because they have not formed a clear goal, they do not have a basis on which to estimate the likely

benefits they will receive by completing a degree. Conversely, these students can easily determine the cost – both pecuniary and psychic – of going to school. If these students do not formulate a career goal while they are attending college, their benefit-cost ratios may easily become negative. Such students may drop out of college after only a semester or two.

Arts and science majors in this cohort undoubtedly are a mixture of both types. Students who wish to pursue a professional career in a related field have a low probability of dropping out. Undecided students who wish to get their "gen ed requirements out of the way" have a high probability of dropping out. These two probabilities offset each other. The net result: the hazard rate among students in the arts and sciences is higher than it is among the credentialing health careers and lower than it is in the public service technologies.

2.9 Policy Implications

Assuming that this model provides a reasonably good explanation of student dropout behavior, what can be done to increase students' odds of persisting in college? If it is true, as is posited by human capital theory, that a student's enrollment decisions are based on a comparison of costs and benefits, then there is only one way to produce this effect: improve students' benefit/cost comparisons. There are two ways that a college can attempt to accomplish this. It can reduce students' perceived cost of completing a degree, or it can increase students' perceived benefit of completing a degree. Colleges have developed a wide assortment of devices to help reduce the cost of going to school. These devices can be lumped into two categories: devices that reduce the pecuniary cost of getting a degree and those that reduce the psychic cost of completing a degree. Pecuniary devices include all of

the grants, loans and work study packages which colleges make available to their students each term. Non-pecuniary devices include all of the services which have been established to build students' confidence and increase their success. Included among such services are the tutoring function, courses in college survival, and day care.

Colleges have also developed some tools to increase the perceived benefit of completing a degree. These tools involve services designed to inspire in students a wish to prepare for a higher level career than they might otherwise have considered. The primary tools available to policy makers consist of such services as career counseling, job fairs, and career exploration courses.

Based on this assessment, an effective student retention policy would involve the creation of some well-delivered package of support services. Such a package would consist of some combination of cost-reduction and benefit enhancing student services. The optimal combination of such services would depend on the institution under consideration and the students who attended it. The college under study in this chapter might benefit from a more intensive effort to intervene on the benefit side of the benefit-cost ratio. Of the eight student majors considered in this analysis, the largest consists of students who are majoring in the arts and sciences. Many of these students do complete an associate's degree or transfer to a four-year college. However, a number of these students drop out. Sometimes such students only take classes for a semester or two. Given the results of this analysis, such students could quit the college for any number of reasons. For example, their grades might be bad or they might have significant work and family experiences. However, it is also possible that many of these students simply do not have a good idea of the kind of career that an

associate's degree will bring them. In the words of several students who were interviewed as part of this dissertation research, these students are taking courses to get their "gen ed" requirements out of the way. The trouble is, if they do not have a good idea of the kind of career they can get once they have completed these "gen ed" courses, they may lack the incentive to complete more than a semester or two of classes. A career exploration course may benefit these students by providing them with a clearer career goal than they might otherwise have formed, thereby increasing the perceived benefit of a community college education and decreasing the chances they will drop out of school.

CHAPTER III

AN ANALYSIS OF THE TRANSFER BEHAVIOR OF STUDENTS ENROLLED AT A COMMUNITY COLLEGE

3.1 Introduction

Community colleges were established to provide students who were not quite ready for college with the first two years of a bachelor's degree. Earning an associate's degree and transferring seamlessly into a four-year college degree program was a central mission of the community colleges. Perhaps no area of community college activity has aroused more discussion than this transfer function. Community colleges promise to greatly increase the number of students who complete a bachelor's degree each year. However, after more than a century of operation, community colleges appear to have fallen short of achieving this goal.

The number of students who attend these colleges has grown considerably over time. However, the percentage of these students who go on to complete a bachelor's degree is relatively small. As of fall 2005, community colleges enrolled about 37% of all degree seeking undergraduates in the United States – more than 6.6 million students, nationwide (NCES, 2007). However, data from a national longitudinal study suggest that "only a little

more than 1 in 10 public 2-year college entrants" will earn a bachelor's degree within six years (Tinto, 2008). By contrast, 6 out of 10 students who enter a four-year college are likely to earn a bachelor's degree within six years. Students who complete a bachelor's degree earn considerably more on average than do those who complete an associate's degree or have only attained "some college education." Hence, the relatively low number of transfer students has caused some concern among researchers that community colleges are tracking students into lower paying careers, thereby limiting their hopes and aspirations.

Why is degree completion among students who enroll at the two-year colleges so low? What can be done to increase students' attainment? This chapter seeks to help answer these questions by studying the transfer activities of a cohort of students who first enrolled at a two-year college during the fall of 1998. Using data from an administrative database of a large, multi-campus community college, this analysis will try to identify those factors which encourage some students to transfer and others to leave the two-year colleges without doing so. In conducting this analysis, this chapter will draw on a hybrid model of student transfer which combines Tinto's theory of student persistence with human capital theory. In order to present this analysis, this chapter will first conduct a brief review of the research on student transfer at the community college. This will be followed by a discussion of the method used in this study. The chapter will then present the results of the analysis conducted on the fall 1998 student cohort. It will close with a discussion of these results and implications for policy.

Box 4: A Note on the College under Study in this Dissertation

One question that arises in a study of this type is: to what extent can the results of this study be applied to other institutions? In an absolute sense, the results of this study probably cannot be generalized to other schools. Community colleges are complex organizations, offering a wide range of products to a diverse student population. The products offered and the students served differ significantly from one institution to another. Some colleges offer a broad array of products to a diverse mix of students. Others may offer a more limited menu of programs to a narrower array of students. Each institution is unique. As a result, if the study presented in this paper was performed at a different school, the results obtained would be somewhat different. For this reason, the analysis presented in this paper focuses on the implications of the findings to the theory of student persistence. By providing insights into the forces that influence students to persist, this dissertation hopes to provide policy makers with a set of tools that can be applied to a wide range of situations. Nevertheless, some readers may wish to know the degree to which the results obtained in this dissertation apply to a specific college or to community colleges in general. Data are presented in this box in an effort to address these questions.

The community college under study in this dissertation is a multi-campus institution located in the Midwestern United States. During fall semester 2009, this college had a total headcount of 30,325 students. These students took courses on three main campuses and several off-campus sites. The population was quite diverse, both culturally and economically. Roughly 56% of the students served were white, 43% were non-white or race unknown, and 1.0% were nonresident aliens. Sixty-two percent were females. The age distribution of students attending this college is quite wide. While 31% of the students who attend this institution were age 18-21, 35% were age of 30 or older, and 18% were over 39. Roughly 60% attended on a part-time basis. Of those students who attended the college full-time and attended in both the fall and spring semesters in a typical year, 49% receive Pell grants.

Approximately 50% of entering students place at the developmental level in English in a typical fall semester. Approximately eighty percent place at the developmental level in mathematics. As an open access institution, this college does not require students to submit results on either the SAT or the ACT. Hence, data on these tests are not available on students at this institution.

As a point of comparison, data compiled by the National Center for Education Statistics (2008) reveal that, of the students who attended a public community college in 2007, about 58% were female, 61% were white, and 39% were in the 18-21 year old age group. Sixty-one percent of these students attended part-time, and 33.5% received Pell grants.

Test score data reveal that community college students are less literate than those who attend four-year colleges. Community college students testing at the 75th percentile on the SAT had a score of 516 compared to a score of 593 among students at public four-year institutions. Community colleges students at the 75th percentile in math had a score of 532, compared to 594 at public four-year institutions.

Data collected by the U.S Department of education reveal that, of the students who started a community college during the 1995-1996 academic year, 38% eventually went on to complete a degree. Of these, 11% completed a certificate, 17% completed an associate's degree, and 10% completed a bachelor's degree. By contrast, over the eight year period from fall 1998 – spring 2006, 12% of the students in the cohort under study in this dissertation completed an associate's degree and 22% transferred to a four-year college. This institution granted a total of 18 certificates during this period – a rate of .4% of the students in the cohort.

Thus, while an "average" community college does not exist, the national results suggest that these colleges are similar in that they serve diverse populations of underprepared students. Graduation rates among students attending these colleges are not high. While the population at the college under study in this paper does not match the distribution of a "typical" college, policy makers at this institution clearly wrestle with many of the same issues confronting policy makers at other institutions. Given these similarities and differences, an analysis of students at the college under study in this dissertation may provide useful insights to decision makers at other schools.

3.2 Review of the Literature

Much of the research on community college transfer has been driven by a single question: Are students who enroll in community colleges as likely to complete a bachelor's degree as are those who start their college careers at the four-year schools? The clear and consistent evidence from a number of studies is that a difference does exist. Research literature suggests that students who begin their college careers at a two-year institution are less likely to complete a bachelor's degree than are those who start at a four-year school. This relationship seems to hold true even when the research controls for factors that are likely to distinguish two-year college students from those who start their college educations at four-year schools. For example, Alba and Lavin (1981), reporting on the results of a "natural experiment arising from the open-admissions program in the City University of New York (CUNY)," found that students who started at the four-year colleges were 11.9% more likely to complete a bachelor's degree than were students who start at a two-year college. Only 41% of these students, whose stated goal was to earn a bachelor's degree, transferred to a four-year college. Similarly, Velez (1985) found that among students enrolled in an academic program, students who started at a four-year college were 19% more likely to complete a bachelor's degree than were those who started at a two-year college. According to Velez (1985, p197), "the large and positive coefficient for college type indicates that the greater finishing rates among four-year college entrants cannot be explained by selection factors." Summarizing the available research on educational attainment, Dougherty (1994) found that, controlling for academic preparation and students' backgrounds, those who

started at a four-year college were from 11% to 19% more likely to complete a bachelor's degree than are those who start at a two-year institution.

The question is: why are students who enroll in the community colleges so much less likely to complete a bachelor's degree than are students who begin at a four-year school? Several explanations have been proposed. One explanation (Clark, 1960; Brint and Karabel, 1989) holds that community colleges intentionally act to discourage students from completing this degree. According to this view, community colleges engage in a type of tracking in which students who aspire to the bachelor's degree are diverted into vocational programs offered at the two-year schools. This "cooling out" process eases the burden on four-year colleges, protecting them from the need to deal with large numbers of ill-prepared students. In the process, however, it perpetuates a highly stratified socioeconomic structure.

Another explanation is more structural in nature. According to this view (Dougherty, 1994), the lower success rates of students who enroll at community colleges do not result from any effort by these schools to cool out their students. Rather, they result from a number of effects which are incidental to the varying missions of these colleges. In responding to the needs and desires of their various publics, community colleges have established a wide range of programs and services, each responding to the needs of some particular group of students. However, these goals frequently conflict with each other. Hence, in the process of pursuing these varied goals, the community colleges create a series of "institutional obstacles" (Dougherty, 1994, p. 83) which prevent many students from achieving their goals.

Empirical study suggests that the reality may be more complex than these theories predict. For example, Grubb (1989) found that community colleges tend to simultaneously increase the number of students who complete a bachelor's degree and restrict the number of students

who did so. However, these colleges produce these effects on different populations. In particular, men who attend these colleges were more likely to complete bachelor's degrees. Women were more likely to be diverted into vocational programs. Grubb suggests that these differences may result from differences in the job markets in which men and women typically compete. Overall, Grubb found that students who resided in states with large community college enrollments were less likely to complete a bachelor's degree than were students who lived in states with smaller enrollments in these colleges. However, these effects were somewhat weaker than the effects of labor market conditions (Grubb, 1989, p 368).

In a more recent study, Rosenbaum, Deil-Amen and Person (2006) conducted qualitative research to determine the amount of effort faculty members devote to promoting the transfer mission. Results of this analysis suggested that some cooling out did occur on these campuses. However, these authors felt that faculty members spent a much greater part of their time encouraging students to go on for their bachelor's degree. Hence, while some cooling out did occur, the heating up function of these colleges more than offset it. Conversely, Pascarella (1999) found that bachelor's degree-seeking students who start their college experience at a community college are significantly more likely to lower their educational goals by the end of their second year than are similar students who start their careers at a four-year college. These findings suggest that some cooling out does occur. However, Pascarella also recognizes that many two-year college students who state that they wish to complete a bachelor's degree may in actuality be quite uncertain as to their goal. If this is the case, then community college students who do not wish to complete a degree are

not being cooled out – the community college has successfully permitted them to find their goals.

Regardless of whether they cool their students out or heat their students up, one fact remains: community colleges are complex organizations with multiple education and training products, different expectations from different stakeholders, and different objectives established by different state and federal public policies. Not only do these institutions offer a wide range of academic programs, these programs prepare students for a wide range of jobs, requiring differing amounts of training. Ultimately, all students who enroll in the community colleges are participants in a job market. Each market confronts students with a set of incentives and disincentives. Subject to students' goals and preferences, these incentives determine the amount of education that students complete. Viewed from this perspective, all efforts to increase the transfer rates at community colleges involve a change in these incentives. In order to successfully increase students' chances of transferring, policy makers must therefore have a thorough understanding of the incentives and disincentives that confront students. The purpose of this chapter is to provide some insights into the natures of these forces.

3.3 Theoretical Background

One of the most well developed theories of student behavior is Tinto's theory of student dropout. Based mainly on Durkheim's concept of anomie, Tinto's theory posits that student dropout results from a mismatch between the academic and social needs of the student and the academic and social systems of the college he or she is attending. According to Tinto,

students enter college with a set of goals that spring from their personal characteristics and prior experiences. In Tinto's model, these goals are expressed as commitments. These commitments take two forms: (1) commitment to the institution in which a student has enrolled; (2) commitment to the educational goal itself. Once students are actually enrolled in college, they begin to interact with the social and academic systems of the school. Students take classes. They interact with other students. If students are successful in their studies, they become "academically integrated" into the college. If they meet other students whose values are similar to their own, they become "socially integrated" into the college. As students become integrated into these two systems, their goal commitments and institutional commitments become strengthened. As these commitments become stronger, students become more and more likely to complete a degree. Conversely, if students' experience with the academic and social systems of the college is not positive, these commitments become weaker, and students will tend to leave the college. This theory has been applied to the phenomenon of transfer from two-year colleges (Pascarella, Smart and Ethington, 1986; Nora and Rendon, 1990). Results of these studies suggest that students who are academically and socially integrated into the community colleges they attend are more likely to complete a bachelor's degree later on and to form a "predisposition to transfer" while they are enrolled at the two-year college.

Based on Tinto's theory of student dropout, students' experience at the community college affects their decision to transfer by strengthening their commitment to complete a degree. Students enter college with various amounts of commitment, which then become stronger or weaker, depending on students' experience at the college. The relative strengths of these commitments depend, in turn, on the way in which students interact with the

academic and social systems of the college. According to Tinto, students who participate fully in both of these two systems will experience the greatest increase in commitment. A positive experience with the academic systems of the college will increase their commitment to the goal of completing a degree. A positive experience with the social systems of the college will increase their commitment to completing a degree at that institution. Hence, community college students who participate fully in both systems are expected to complete an associate's degree before transferring to a four-year college. By contrast, students who have a positive academic experience and a negative social experience are expected to experience an increase in their goal commitment and a decrease in their commitment to the institution. Such students will likely transfer to a four-year college without completing a degree at the two-year school. Students who have an unfavorable academic experience at the community college are expected to experience a decline in their goal commitment. These students are very unlikely to transfer to a four-year college.

Tinto's theory of student dropout provides a number of insights into the way in which students' on-campus experiences affect their chances of completing a degree. However, these experiences are not the only factors that shape students' enrollment decisions. In deciding on whether to enroll in college for another semester, students may consider a range of factors. These factors would likely include the benefits students expect to receive by completing a degree, the overall cost they expect to incur in attending college, and the support (or non-support) they receive from family and friends. These forces would combine to determine a person's chances of ever going to college. Once students had actually enrolled, they would interact with their on-campus experiences to determine their chances of completing a degree. Most community college students live off-campus and attend part-time.

Such students may lack the time to become fully integrated into the academic and social systems of the college. Yet many of these students do complete degrees. Given these realities, the community colleges may gain valuable insights from a theoretical model which considers the impact of students' experience both on- and off-campus.

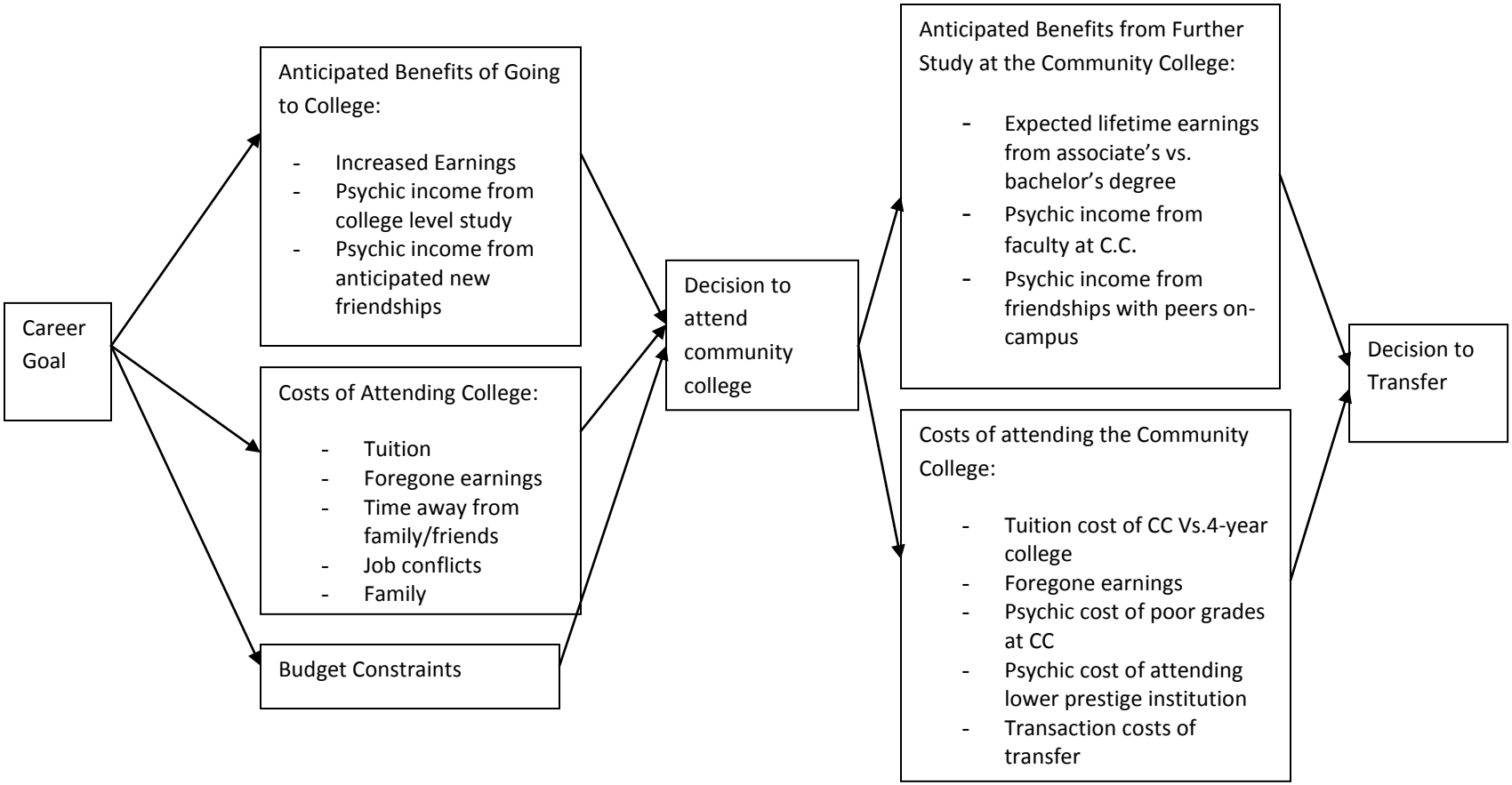
From where may the rationale for such a model be taken? One important source is human capital theory (Becker, 1993). Developed to provide an economic rationale for a person's decision to complete a training program, this model posits that students make the decision to complete a program of study by comparing the benefits they expect to receive to the costs they will incur by completing the program. According to this model, students base their decision to complete a degree on much the same logic that a firm decides to invest in a piece of physical capital. They assess the likely stream of benefits they will receive over the lifetime of their investment. They discount these benefits and compare them to the costs they will incur in completing the program. Costs and benefits in this model do not just include the direct, pecuniary sums that students will pay and receive over the course of their lifetimes. They also include the psychic costs and benefits that will result from this investment. Students decide to make an investment if the benefits of doing so exceed the cost. They would be expected to continue in the training program as long as the marginal revenue exceeds or equals the marginal cost.

The human capital model would appear to include and expand on many of the constructs provided in Tinto's model. In applying human capital theory to the phenomenon of student dropout behavior, Tinto's concepts of academic and social integration may be treated as costs and benefits of going to school. Students' goal commitment would play an important role in such a framework. As in Tinto's theory, goal commitment could be strengthened by a

students' experience at the college, since a positive experience would produce "psychic income." However, goal commitment would flow directly from the labor market. If a student expected the benefits of going to college to greatly exceed the costs, the student would have a strong commitment to completing a degree, and he or she would likely do so. If a student expected the benefits of going to college to exceed the cost by only a small margin, the student's goal commitment would be much weaker. The chances that this student would drop out of college without completing a degree would be relatively strong.

The analysis in this chapter will employ a hybrid model of student persistence to explain the transfer behavior of students enrolled at a community college. In this analysis, students' decision to transfer will be treated as an investment in human capital, similar to a worker's decision to relocate to take a new job. In this analysis, it will be assumed that students make this decision by comparing the earnings stream they will make by completing a bachelor's degree to the earnings they will receive if they only complete an associate's degree. They then compare this difference to the costs they will incur by transferring to a four-year college. This model assumes that students who transfer from one college to another incur a variety of costs, both pecuniary and psychic. In this analysis, academic and social integration are treated as psychic costs (or income) incurred by students in the pursuit of a degree. Other costs include the amount of income that students forego in pursuing the bachelor's degree. They also include the transaction costs incurred in the transfer process. In this model, it is assumed that students will transfer if the marginal benefit of a four-year college degree exceeds the cost of completing it. A graphic depiction of this model is presented in figure 10.

Figure 10: A Conceptual Model of the Decision to Transfer from a Community College



This model suggests that students who attend the college under study in this analysis will base their transfer decisions on a comparison of the benefits and costs of completing a degree. These decisions will be strongly influenced by the training requirements of the jobs students are seeking. The college under study in this chapter offers degree programs in more than 45 career clusters. These programs serve a number of job markets requiring various amounts of formal training. For the purposes of this chapter, these programs may be placed into two broad categories: university parallel programs and vocational programs. The university parallel program prepares students for study at a four-year college. Students who enroll in this program almost exclusively take courses in the traditional liberal arts and sciences. These students take the bulk of their direct, career-related courses at the four-year college. Because such students do not typically take any career courses at the two-year college, it is difficult to know from the data used in this analysis whether they are pursuing a career in, say, engineering or in business. It is assumed, however, that these students are generally preparing for a job in management or the professions. Since these positions all require a bachelor's degree or higher, it is hypothesized that transfer rates will be high among students in this group.

The vocational curriculum at this college consists of a wide range of programs that students may take to earn an associate's degree in applied science or business. These programs include offerings in such diverse fields as nursing, accounting, and electrical-electronic engineering technology. For purposes of this chapter, these programs may be combined to form four sub-groups: the health careers, business technologies, engineering technologies, and public service technologies. In theory,

these programs all prepare students for jobs that require an associate's degree. In reality, however, they prepare students for jobs requiring differing amounts of training. Only some of these jobs actually require an associate's degree. As an example, consider the accounting program. The college under study offers an associate of applied business in this field, implying that this credential is the typical mode of entry for at least some positions in accounting. But how much training do employers typically seek when filling jobs in this profession? The answer varies, depending upon the position in question. According to the U.S. Department of Labor (DOL), the accounting field does not consist of a single job. Instead, it consists of 12 different occupations, including such diverse titles as billing and posting clerks, accountants and auditors, and post-secondary business teachers. Minimum preparation for 6 of these jobs is a bachelor's degree or higher. Typical preparation for the remaining five is moderate to short-term on-the-job training (OJT). In contrast, law enforcement programs of the type offered at this college typically prepare students for seven different job titles. Minimum preparation for these positions ranges from short-term OJT to "work experience in a related job." Hence, students who major in programs such as accounting should be much more likely to transfer than should those who major in programs such as law enforcement.

Training requirements for other vocational programs fall in between these two extremes – accounting and law enforcement. According to a taxonomy prepared by the U.S. Department of Labor, the vocational programs offered at this college during the period from fall 1998 through spring 2006 prepared students for roughly 149 different occupations (see Table XI). The minimum training required for 16% of

Table XI: A Summary of Minimal Educational Requirements of Occupations Related to Career Programs Offered at the Study College						
Degree Program	**Total Job Titles**	**# Require Associ-ate's Degre**	**# Require Less Than Associate's Degree**	**# Require More than Associate's Degree**	**% Require Asssoci-ates Degree**	**% Require Bach-elor's Degree**
Business Technologies	90	3	48	39	3%	43%
"Credentialing" Health Careers	15	11	1	3	73%	20%
Non-credentialing Health Careers	13	0	9	4	0	31%
Engineering Technologies	10	8	2	0	80%	0%
Automotive Technologies	2	0	2	0	0%	0%
Public Service Technologies	19	2	16	1	11%	5%
Arts and Sciences	Indeterminate					

these was the associate's degree. The minimum requirement for 43% of these was a bachelor's degree or higher. This means that the minimum training required for 41% of these occupations is less than the associate's degree. Of the jobs that required the associate's degree, 46% were in the health careers and 33% were in the engineering technologies. Of those that required the bachelor's degree, 83% were in the business technologies, 15% were in the health careers, 2% were in the public service technologies. Based on this analysis, it is assumed that students who enroll in the business technologies will be more likely to transfer than will students who are enrolled in the other vocational programs. The strong connection between the associate's degree and employment in several health careers programs suggests that students in these programs (classed as "credentialing health careers programs" for purposes of this analysis) will be very unlikely to transfer. Programs in public

services, automotive technology, and the "non-credentialing" health career prepare students for jobs that require less than an associate's degree. Transfer rates in these programs are also expected to be low.

Not only do students who attend the community college vary greatly in the amount of income they expect to earn over their lifetimes. They also differ in other ways. These differences have implications for the costs these students will incur as they pursue a degree. For example, the median age of students in the fall 1998 cohort was 20. However, students as old as 76 years of age started at the college in fall of 1998. Many of these students had held paying jobs for a number of years, acquiring a considerable amount of human capital in the process. The amount of income which these students would forego by taking additional upper division courses at a four-year college would be quite a bit greater than the amount foregone by an 18 year old student. In addition, these students would have less time in the labor market in which to recoup their investment. Similarly, many students who enroll in community colleges enter these schools in need of remediation in English and/or mathematics. Even if these students were to correct these deficiencies, they might experience considerable anxiety at the thought of attending a four-year institution. Such students would incur a psychic cost that other students, who entered the college without such a deficiency, might not experience. Based on these differences in costs incurred and income earned, the likelihood that a student will transfer could vary considerably from person to person. In particular, it is expected that analyses conducted on the students in this cohort will produce the following results.

- **Hypothesis 1.** Students who enroll exclusively in the liberal arts and sciences will mainly be preparing for jobs in the professions. For the most part, these jobs require workers who have completed a bachelor's degree or higher. Hence, students who pursue an associate of arts or an associate of science degree will be more likely to transfer than will be students who are preparing for vocational degrees
- **Hypothesis 2**. Vocational programs offered at the subject college prepare students for career ladders of varying depth. Some programs, such as nursing, typically prepare students for jobs that require an associate's degree. Other programs, such as accounting, prepare students for jobs that require as little as some short term on-the-job training or as much as a bachelor's degree. Benefit-cost comparisons of students in these latter programs are more likely to favor the completion of a bachelor's degree than are comparisons made by students in the former. Hence, it is expected that a student's odds of transferring will be higher among those who major in the business and engineering technologies. It is expected that these probabilities will be lower in the health careers, public service technologies, and in automotive technology.
- **Hypothesis 3**. Many students who attend the community college lack the basic skills in English and mathematics needed to successfully complete college level work. To accommodate these students, this college offers an extensive curriculum in developmental English and math. It is hypothesized that students who place at the developmental level and enroll in these courses

will experience greater frustration than other students will. That is, they will incur a psychic cost that other students do not bear. These costs may be sufficient to discourage some students from transferring. It is therefore hypothesized that students who are required to take a number of courses at the developmental level will be less likely to transfer than will other students.

- **Hypothesis 4**. Older students are likely to have obtained a good deal of human capital in their years on the job, whereas younger students are less likely to have done so. Older students who go to college will, thus, incur a higher opportunity cost than will younger students. In addition, older students have fewer years over which to recoup their investment. Younger students have a greater incentive to transfer than older students. It is hypothesized that older students will be less likely to transfer than younger students.
- **Hypothesis 5**. Consistent with hypothesis 4, students who have significant work and/or family responsibilities will have less time than others to devote to their studies. As a result, they will experience frustration that other students do not share. The college under study in this chapter does not collect data on students' off-campus responsibilities. However, it seems safe to infer that, on the average, students who take courses on a part-time basis will have more responsibilities than those who enroll on a full-time basis. It is hypothesized that part-time students will, therefore, be less likely to transfer than full-time students.
- **Hypothesis 6**. Lower income students will find it harder to finance the cost of a four-year college education than will higher income students. The

community college under study in this chapter does not collect data on students' income. However, it seems reasonable to assume that students who receive financial aid will have lower incomes than students who do not. Hence, financial aid status will serve as a proxy for students' incomes. It is hypothesized that students who receive financial aid during their time at the community college will be less likely to transfer than those who do not.

3.4 Research Method

To test these hypotheses, a discrete time event history analysis was conducted. In this analysis, students' transfer status was regressed on a set of variables which, according to theory, should have had an effect on students' persistence at the college. Using a technique described by Allison (1982), this analysis sought to find out whether students who enrolled in some programs of study were more or less likely to transfer than those who enrolled in others, controlling for various conditions in their academic and social lives.

In order to test the hypotheses listed earlier, careful consideration was given to the type of analysis to be used. Event history analysis makes use of a number of techniques that has been devised to assess the relationships between the attributes of a subject and the probability of an event occurring, given the passage of time. The appropriate technique to be used in any given situation depends to a large extent on the way in which the event takes place over time. Methodologists have distinguished between two "types" of time. If the unit of time over which an event can occur is

fairly large (years, quarters, terms of office), the event is said to occur in discrete time. If the unit of time over which an event can occur is quite small (days, minutes, seconds), the event is said to occur in continuous time. Different techniques are used to analyze events occurring in different types of time. In conducting the analysis presented in this chapter, it was assumed that students can only transfer upon the completion of a semester of college, a fairly long period of time. Hence, it was determined that the events under study occur in discrete time. Logistic regression is the technique most commonly used to assess relationships existing between causal variables and events occurring in discrete time. This technique was, therefore, used to conduct the analysis which is presented in this study.

In order to carry out this analysis, it was necessary to construct a longitudinal data set. Unlike cross-sectional analyses, which only focus on relationships occurring at a single point in time, event history analyses seek to find out whether a relationship exists between cause and effect over some lengthy period of time. To conduct such an analysis, it is necessary to collect data on those who participate in the study at multiple points in time. In the discrete time analysis, this is achieved by creating a data set containing one record for every period in which a given subject participates in the study. In the present study, such a file was created on students in the fall 1998 cohort. In this analysis, data were collected on all terms in which students took courses during the period from fall 1998 to spring 2006. A data file was then created containing one record for each term in which each student enrolled at the college – some 17,121 records. This file contained data not only on students' transfer status and the variables deemed likely to affect it, but it also contained data on the number

of terms that students had enrolled as of each semester that was listed in the file. This structure made it possible to conduct analysis on the various hypothesized relationships listed earlier, controlling for the number of semesters students had attended the college under study.

Once this longitudinal data set had been created, it became possible to test the model described above. This was achieved by conducting an analysis in which students' term-to-term enrollment status was regressed against the other variables in the data set to yield an equation of the following form.

$$\text{Logit } h(t_j) = [a_1D_1 + a_2D_2 + \ldots a_jD_J] + [B_1X_1 + B_2X_2 + \ldots B_PX_P]$$

In this equation, the a_is represent time. Each of these coefficients is associated with a dummy variable corresponding to a particular term in which a student was enrolled. For example, the term a1 is associated with students' first semester at the college, a2 their second semester, and so on. Each of the b-coefficients is associated with a different substantive variable. In this equation, time variables take the place of an intercept term which is normally estimated in logistic regression. Taken together a-coefficients define the "baseline" hazard that a student will transfer to a four-year college – the probability that a student will transfer in any given term, given that all of the substantive variables are set to zero. A clear-cut pattern in the values of the "a-coefficients" provides an indication of the way in which the odds that a student will transfer changes over time. If the coefficients in the early terms are smaller than those in the later terms, then a student's chances of transferring increase with time. If the coefficients in the early terms are larger than those in the later terms, then a

student's chances of transferring get smaller with time. The concept of time is defined below (p. 116).

The "b-coefficients" in this equation reflect the effects which the substantive predictors have on the baseline rate. For example, if the coefficient is positive, then a one unit change in this variable (say from male to female) has the effect of increasing a student's ***log* odds** of transferring by a constant amount over all time periods covered by the study. If the function on the preceding page is expressed as an antilogarithm, then a one unit change in the substantive variable increases the **odds** that a student will transfer by a constant proportion across all time periods. As a result of this latter relationship, a discrete time analysis is said to be a "proportional odds" event history analysis.

3.5 Data used in this Analysis

Students' major. All data used in this analysis came from the student information system of the college under study. This data base contains a number of fields that can be used to test the hypotheses listed earlier in this chapter. Most of these data did not require any recoding to be used in this analysis. However, some of these variables did need substantial redefinition in order to be used in this analysis. Of these, the most important was students' major field of study. The student data base at this college does contain data on students' program of interest as indicated on students' application and updated on students' registration form. However, these particular data are not ideal for use in this study. Not only do students change their

majors without making sure that these changes are noted in the college database. They often declare majors that they do not, for one reason or another, actually pursue. As a result, many students who, according to the data base, are majoring in a particular subject area may have never taken a single course in it. One goal of this study is to find out whether a relationship between students' actual majors (based on the courses they took) and the chances that they will transfer to a four-year college. Hence, the recorded data on students' major are of no use to this study.

To get around these difficulties, a procedure was developed which made use of transcript data to reveal the student's true major preference. This is a derived estimate of the career field which students actually sought to enter. Using this method, transcript data were collected on every course ever attempted at the college by students who started there during fall 1998. All courses were placed into one of eight different categories: arts and sciences, business technologies, credentialing health careers, non-credentialing health careers, engineering, automotive technologies, public services, and other. A set of computer programs was then run to determine: (1) the subject area in which students took the greatest number of credits each term; (2) the vocational program area in which students took the greatest number of credits overall; (3) the first term in which students registered for courses in this field. Students' time at the college was then divided into two periods. Period one consisted of all semesters that occurred before students took the first course in their dominant subject area – the subject in which they attempted the greatest number of credits over their entire time at the college. During these semesters, students' majors were defined as the subject in which they attempted the greatest number of credits

during a particular term. Period two consisted of all semesters occurring on or after students took the first course in their dominant subject area. During these semesters, students' majors were defined as their dominant subject area.[9] If students did not take courses in a vocational subject or if they did not take courses in their dominant subject area during two or more semesters, this second pass was not carried out.

This method resulted in the generation of dummy variables that could be used to test the effects of students' majors on dropout status. The use of these variables had several advantages over other data that were available. Using this method, students were assigned to a major only if they had actually taken courses in a particular area. Because they were, a strong link was established between the students' major and the knowledge they actually obtained at the college – or at least attempted to obtain. In so doing, this method made it possible to form inferences regarding the relationship between the students' major and their transfer status that would not have been possible using the students' self-declared major. Dividing students' college experience into two parts achieved two goals. First, it had the effect of recognizing knowledge obtained by students only after they had actually obtained it. Second, it had the effect of suppressing term-to-term fluctuations which occur when students take courses outside of their major in order to meet the requirements of a degree.[10] This procedure also made it possible to form some inferences regarding the

[9] As an example, consider a student who attended the college for 5 semesters and took 20 hours in accounting, beginning in his third semester at the college. Such a student's major might be coded as arts and sciences during terms one and two. During semesters three through five, it would be coded as accounting

[10] An example of this situation might be an early childhood education student who took a required math course in her last semester in college.

relationship between the students' major and their chances of dropping out that would not have been possible using other data.

This procedure was not without drawbacks. In particular, the use of this procedure may in some cases have led to incorrect major assignments, ignoring real changes in students' majors. However, such errors are not likely to be frequent. In this analysis, students' majors were defined in very broad terms – for example, health careers versus engineering technology. While a student might be fairly likely to change from one engineering major to another, he or she would be less likely to change from electrical engineering to early childhood education – though admittedly this could happen. Because students' majors are being defined in such a broad way, this method will not be sensitive to fine changes, for example from accounting to business management. Hence, while some miscoding undoubtedly did occur, the amount is not expected to be so great as to obscure the kinds of broad trends which are under study in this chapter. Given the quality of the available data and the nature of the analysis being conducted, this approach seemed to be the best way in which to define students' majors.

The net result of this procedure was that each of the 3,990 students in this cohort was assigned a major in each term in which he or she enrolled at the college. Depending on the courses that a student took, a student might have been assigned to several different majors during the time in which he or she enrolled at the college. In order to provide an unduplicated total of the number of students assigned to each major, the following table presents data only on students' majors as of the last semester in which they attended the college. In addition, the table also presents the

"duplicated" total of students majors assigned to students over all semesters covered in this study. In the duplicated count, each student is counted several times, once for each semester in which the student was enrolled.

Table XII: Summary Data on Students' Majors			
Program of Study	**Students' major as assigned in all terms covered in this study**	**Students' major as of their last term at the college**	
	#	**#**	**%**
Credentialing Health Careers	522	109	2.7%
Non-credentialing Health Careers	1,034	186	4.7%
Business Technology:	4,496	935	23.4%
Engineering Technology	263	52	1.3%
Automotive Technology	242	64	1.6%
Public Service Technology	839	210	5.3%
Arts and Sciences	6,402	1470	36.8%
Other	3,323	964	24.2%
Total	17,121	3,990	100.0%

Note: Other analyses presented in this dissertation divide the business technologies into two categories: credentialing business technologies and non-credentialing business technologies. Using this taxonomy, credentialing business technologies consist of those majors that, generally speaking, prepare students for careers that typically require an associate's degree or higher. Non-credentialing business technologies prepare students for jobs that typically require less than the associate's degree.

I had originally intended to use this taxonomy in conducting the analyses presented in this chapter. However, results of these analyses did not suggest that

students who majored in the credentialing business technologies were any more or less likely to transfer than were students enrolled in other programs. In addition, the use of this definition increased the number of variables in these equations, using up one extra degree of freedom. As a result, some analyses that were statistically significant using a simpler definition were not significant when the more complex definition was used. As a result, I opted to combine all business programs into a single category. The interested reader can find the results of the models containing the more complex definition in Appendix III.

Time. In this study, time was defined as the number of semesters students enrolled at the college. As mentioned earlier, each student in this dataset was given one record for each semester he or she enrolled at the college, beginning in the fall of 1998 and going forward for as many semesters as the student attended. These terms were numbered as if students were enrolled in consecutive semesters, even when they were not. Hence, if a student took classes in fall semester 1998 and did not return for a second term until spring of 2006, the student's first record would be coded as time 1 and his or her second semester would be coded as time two – even though a span of 8 years separated the student's first term from his or her second. This analysis captured data on all semesters in which students took classes during this time frame: fall, spring, and summer. Students in this cohort attended the college for as few as one semester and as many as twenty semesters.

Transfer status. In order to carry out this study, it was necessary to accurately code students' transfer status. To do this, data on student transfer status were obtained from a national database on student enrollments available through the Ohio

University System. Students were then assigned a code designating their transfer status in each term they were enrolled. If a student transferred to a four-year college, the student was assigned a value of 1 as of the last semester that he or she attended the community college under study. In all other semesters, the student's transfer status was set to 0, designating that he or she was still enrolled at the two-year college. This study sought to find out whether students who complete the associate's degree are more or less likely to transfer than are students who do not. Hence, students who transferred to a four-year college were assigned a value of 1 in their last semester at the college under study in this chapter, regardless of whether they completed an associate's degree there. Students who left the college for other reasons were assigned a value of 0 in all semesters in which they were enrolled at the two-year college. In the language of event history analysis, these students were "censored," since a chance exists that some of them may have transferred to a four-year college at some time after spring semester 2006. In an effort to focus this study on those who were serious in their efforts, students who were academically dismissed from the college were excluded from this analysis.

Of the 3,990 students in this cohort 911 (23%) eventually transferred to a four-year college. Of these students, 189 completed an associate's degree at the college before going on to a four year school. Data on other outcomes are presented in table XIII.

Table XIII: Enrollment Status of Students in Fall 1998 Cohort as of Spring 2006		
Student Outcomes as of Spring 2006	**Number**	**Percent**
Transferred but did not complete an associate's degree	722	18.1%
Completed an associate's degree/ certificate but did not transfer	319	8.0%
Completed an associate's degree and did transfer	189	4.7%
Still enrolled at community college or transferred to another 2-year school	346	8.7%
Non-degree Student (Over 45 year old and "majoring" in the liberal arts)	72	1.8%
Left postsecondary education without completing a degree	2,342	58.7%
Total	3,990	100.0%

Other variables. In addition to the students' majors, this analysis also attempted to find out whether relationships existed between several other variables and student transfer. These variables included students' age, academic performance, academic preparation as of the first semester in which they enrolled at the college, and the number of hours attempted each semester. These variables were of two general types: time variant and time-invariant. Time invariant variables are constant across time periods. In this analysis, these variables included students' gender, age as of fall 1998, starting educational goal, English and math placement scores. Time varying variables may change from one semester to another. In this analysis, these variables included cumulative GPA as of the end of each semester in which students were enrolled. They also included students' term-to-term hours attempted. All of these data came from the student information system of the college under study.

Specifications for these variables were relatively straightforward. These specifications are presented in table XIV.

Table XIV: Variables Used in this Analysis		
Variable	**Definition**	**Specification**
Transfer Status	Students' enrollment status as of the end of each term enrolled.	0 = Enrolled in a given term/censored 1= Transferred to a four-year college – assigned only in students' last semester at the community college
Time	Number of semesters students had enrolled at the college as of the time in which a given record was generated	A set of dummy variables, one for each semester enrolled.
Cumulative GPA	Students' cumulative grade point average as of the end of each term covered in this analysis.	Students' GPA for all work completed at the college through the end of the term in which a given record was generated. This variable was re-centered at a value of 2.00 by subtracting a value of 2.00 from each GPA in each term.
Age	Students' age as of their first semester at the college	Students' age as of their first semester – re-centered at a value of 17 years by subtracting a value of 17 from each student's age.
Students' major	Students' major as of the semester in which a given record was generated.	A series of dummy variables, one for each of 8 majors: credentialing health careers, non-credentialing health careers, business technologies, engineering technologies, automotive technology, public service technologies, arts and sciences, other. The reference variable in this analysis was public service technologies.

Table XIV: Variables Used in this Analysis		
Variable	**Definition**	**Specification**
English placement examination score	Students' proficiency in writing as of the last time these results were entered into the college's student data base	A series of 4 dummy variables: Lower level developmental education (ENG 0980), higher level developmental education (ENG 0990), college level preparation (ENG 1010), no test taken. The reference variable was the lower level developmental education.
Mathematics placement examination score	Students' proficiency in math as of the last time these results were entered into the college's student database	A series of 5 dummy variables: basic arithmetic (MATH 0910), beginning algebra (MATH 0950), accelerated algebra (MATH0980), college level math (MATH 1060 and higher), no test taken. The reference variable in this analysis was MATH 0910.
New student status	Students' highest level of education and most recent time enrolled as of their first semester at the college.	A series of 3 dummy variables: graduated from high school within 12 months of starting at the college; out of high school for more than 12 months before starting at the college; previously attended another college. The reference variable is "graduated from high school within the last 12 months"
Part-time status	Number of hours for which a student enrolled in a given term	This was coded as a dummy variable: coded as 1 if a student attempted fewer than 12 hours; 0 otherwise
Financial Aid Status	Coding of this variable indicates whether a student received any financial aid in a given semester	This was coded as a dummy variable: coded as a 1 if a student received any financial aid; 0 otherwise/
Male Gender	Coding for students' gender	This was coded as a dummy variable: coded as 1 if gender was male, 0 otherwise

Table XIV: Variables Used in this Analysis		
Variable	**Definition**	**Specification**
Students' educational objective	Students' educational goal as stated on their application form.	This was coded as a set of two dummy variables: "Obtain an associate's degree for the purpose of transferring"; "obtain an associate's degree for the purpose of getting a job. " The reference variable was all other goals.
Median Household Income of Zip Code	The median household income of the zip code in which students' resided when they entered the college, based on 2000 census data	The median value for each zip code.

3.6 Results of the Analysis

In order to test the hypotheses listed earlier in this chapter, a pair of statistical models was generated. These models each took the form of a logistic regression analysis, each one looking at the issue of transfer from a somewhat different point of view. These models were generated in a stepwise manner. Beginning with the variable time, variables were entered into the model one at a time. At each step, a number of possible regression equations were generated, each one adding a variable that was not included in the preceding step. At each step, the model producing the largest likelihood ratio score was selected. This continued until no variable entered into the model produced a statistically significant likelihood ratio.

Results of this analysis are presented in Table XV. This table consists of two models. Model 1 contains a set of variables, each of which entered the equation at the .05 level of significance or better. Model two includes all the variables entered in model one. In addition, however, Model 2 also tests to see whether the effects of

students' major on transfer are moderated by their age. In this model, interactions appear as a set of cross-product terms in which students' age is multiplied by the dummy variable associated with their major. As with the variables in model one, a likelihood ratio test was conducted to determine whether a relationship existed between these interaction variables and students' chances of transferring. Two sets of likelihood ratio tests are presented in this table. One set compares the results of the two models to the equation containing only time effects. A second test compares the results of a given model to the one with all variables but those added in the most recent step of the analysis.

3.7 Time Effects

A look at the coefficients for time in these two models suggests that students' probability of transferring to a four-year college increases with time, ranging from a low of -4.32 during students' first semester at the college to a high of -2.94 in the eighth semester. Coefficients in these models are expressed on a log odds scale. However, they can be converted to probabilities using the following formula.

$$H(t) = 1/(1+ e^{-([a_1 D_1 + a_2 D_2 + \ldots a_j D_j] + [B_1 X_1 + B_2 X_2 + \ldots + B_p X_p])})$$

Applying this formula to Model 1 suggests that, in the baseline case in which all variables but time are set to zero, a student's probability of transferring to a four-year

college rises from 1.3% in semester 1 to 5.0% in semester 8, before dropping back to around 3.6% in semesters 10-20. A similar pattern was obtained using Model 2. Comparing these two models to the one containing only the variable time, the likelihood ratios for both equal or exceed 614. This is statistically significant at the .001 level of probability. Likelihood ratios are used to compare the explanatory of a statistical model to a reduced model containing some subset of the variables in the fuller model. The larger the likelihood ratio, the greater is the explanatory power of the full model, compared to the reduced model. Hence, the addition of the variables in these two equations provides a significant improvement over the predictive power of the model in which time is included as the only variable.

3.8 The Effects of Students' Major on their Chances of Transferring

A look at the substantive variables in this model suggests that students' decisions to transfer are affected by several factors. According to the analysis presented in Table XV, the chances that a student enrolled at this college would transfer depended on the students' major, age, proficiency in English, proficiency in mathematics, income, and educational goals. Coefficients for most of these variables were in the expected directions. However, there were some surprises. Looking at the coefficients for the seven majors examined in Model 1, students majoring in the arts and sciences were 2.26 times as likely as those in the public service technologies to

Table XV: Effects of Fixed and Time-Varying Variables on Students' Log Odds of Transferring to a Four-Year College				
	Model 1		Model 2	
	Coef-ficient[1]	Odds Ratio	Coef-ficient	Odds Ratio
Semester 1	-4.32** (.27)	0.01	-4.52*** (.31)	0.01
Semester 2	-3.77*** (.26)	0.02	-3.96*** (.30)	0.02
Semester 3	-4.15*** (.27)	0.02	-4.34*** (.31)	0.01
Semester 4	-3.56*** (.27)	0.03	-3.74*** (.31)	0.02
Semester 5	-3.44*** (.27)	0.03	-3.62*** (.31)	0.03
Semester 6	-3.18*** (.27)	0.04	-3.36*** (.31)	0.03
Semester 7	-3.10*** (.28)	0.05	-3.28*** (.32)	0.04
Semester 8	-2.94*** (.28)	0.05	-3.12*** (.32)	0.04
Semester 9	-3.03*** (.31)	0.05	-3.21*** (.34)	0.04
Semester 10-20	-3.29*** (.28)	0.04	-3.48*** (.32)	0.03
Credentialing Health	-1.62*** (.46)	0.20	-1.24** (.60)	0.29
Non-Credentialing Health	-1.15*** (.33)	0.32	-1.51*** (.46)	0.22
Business	-0.01 (.20)	0.99	0.30 (.26)	1.35
Engineering	-0.14 (.36)	0.87	0.15 (.48)	1.16
Automotive Tech.	-.59 (.49)	0.55	-0.57 (.62)	0.56
Arts and Science	0.82*** (.19)	2.26	1.01*** (.24)	2.75
Other	0.48** (.21)	1.62	0.58** (.26)	1.79
Place in ENG 0990 (Language Fundamentals II)	0.24 (.17)	1.27	0.24 (.17)	1.27
Place in ENG 1010 (Freshman English)	0.46*** (.17)	1.58	0.45*** (.17)	1.57
No Placement Test	.63*** (.20)	1.87	0.62*** (.20)	1.86
Place in MATH 0950 (Beginning Algebra)	0.18 (.15)	1.20	0.19 (.15)	1.21
Place in MATH 0980 (accelerated beginning algebra)	0.39*** (.14)	1.48	0.40*** (.14)	1.48
Place in MATH1060 (college-level Math)	0.72*** (.15)	2.05	0.71*** (.14)	2.04
No math test	0.61***	1.83	0.63***	1.88

Table XV: Effects of Fixed and Time-Varying Variables on Students' Log Odds of Transferring to a Four-Year College				
	Model 1		**Model 2**	
	Coef-ficient[1]	**Odds Ratio**	**Coef-ficient**	**Odds Ratio**
	(.17)		(.17)	
Age	-0.06***	0.94	-0.02	0.98
	(.01)		(.03)	
AA to Transfer	-0.31***	0.73	-0.31***	0.73
	(.08)		(.08)	
AA For Job	-0.67***	0.51	-0.67***	0.51
	(.12)		(.12)	
Delayed High School	-0.07	0.93	-0.07	0.93
	(.10)		(.10)	
Transfer-in	0.53***	1.70	0.53***	1.70
	(.11)		(.11)	
Financial Aid	-0.33***	0.73	-0.33***	0.72
	(.08)		(.08)	
Cumulative GPA	0.10**	1.11	0.11**	1.11
	(.04)		(.04)	
Age by Credentialing Health Careers			-0.08	0.92
			(.09)	
Age by Non-Credentialing Health Careers			0.05	1.05
			(.04)	
Age by Business			-0.06**	0.94
			(.03)	
Age by Engineering			-0.07	0.94
			(.09)	
Age by Automotive Tech.			0.00	1.00
			(0.07)	
Age by Arts and Science			-0.04	0.96
			(.03)	
Age by Other			-0.02	0.98
			(.03)	
Log Likelihood	-3243.4		-3237.1	
Likelihood Ratio Chi^2 (current model compared to model in previous step)	5.6***		12.6*	
Likelihood Ratio Chi^2 (current model compared to model containing times as only variable)	614.4***		626.9***	
*Denotes statistically significant at .10 or better probability ** Denotes statistically significant at .05 or better probability ***Denotes statistically significant at .01 or better probability				

transfer to a four-year college. Students in the "other" category were 1.62 times as likely to transfer as were those in the public service technologies, reflecting the importance of the community college to developmental education students seeking to complete a bachelor's degree[11]. Conversely, students majoring in the credentialing health careers were .20 times as likely to transfer as those in the referent major. Students majoring in other subjects fell between these two extremes. Of those majoring in a vocational subject, students in the public service technologies were the most likely to transfer, followed by those in the business and engineering technology programs. This was surprising. Given the large number of managerial jobs that require the bachelor's degree, it had been hypothesized that business students would be quite likely to transfer. The opposite had been hypothesized for students majoring in public service technology. These results, therefore, call for further analysis.

One possible explanation for this finding may be that students of different ages use these academic programs in different ways. If credentialing requirements differ significantly from one occupation to another, students who seek to enter or advance in some occupations may find it easier to combine formal training with on-the-job experience than students who seek to advance in others. Human capital theory posits that older students typically have more on-the-job experience than younger students. Hence, age and major may interact to determine students' odds of transferring. The coefficients for students' major in Model 1 may mask this effect.

[11] The "other" category is a catch-all category in which students were placed if they did not fit into one of the other 7 majors used in this analysis. However, the vast majority of these students were taking developmental English and math courses.

To test this hypothesis, a model was constructed which sought to find out whether an interaction existed between students' age and major as these related to students' likelihood of transferring. In this model, cross-product variables were created in which students' majors were multiplied by their ages. A likelihood ratio test was then conducted, comparing this model to Model 1. This test was significant at the .08 level of probability, suggesting that age and major do interact to determine students' likelihood of transferring to a four-year college.

As can be seen from Model 2, the coefficients for all seven majors change when they are permitted to interact with age. In particular, the coefficient for the business technologies changes substantially, rising from -0.01 in Model 1 to 0.30 in Model 2. The coefficient for arts and sciences also increases, changing from .82 to 1.01. In the analysis of interaction effects, the coefficients for students' majors reflect the effect that these variables have on transfer when the age variable is set to zero. In this model, age has been re-centered to 17 years by subtracting 17 from the age of all students in the analysis. Taking the antilogarithm of the coefficients for students' majors produces an odds ratio of 1.35 for the business major and 2.75 for the arts and sciences. Hence, a 17 year-old student who majors in either of these two subjects is 1.4 to 2.8 times as likely to transfer as is one who majors in public service. Of these two variables, only arts and sciences is significantly different from public service technologies.

A look at the age by major interaction terms in this model suggests that age has a greater impact on the odds that a business major will transfer than it does on the odds that a public service major will do so. In particular, the coefficient for the interaction

of AGE BY BUSINESS in this model is -.06. Taking the antilogarithm of this coefficient yields a value of .94. Thus, a one-year increase in students' age decreases their chance of transferring by a factor of .94. Combining this information with the results obtained for the 17 year-old student, a 32-year old student would be .51 times ($1.35 \text{ X } .94^{15}$) as likely to transfer as would a student in the public service technologies. These results suggest that younger students use the business major in different ways than do older students. To a large extent, younger students who major in business do so in order to obtain a bachelor's degree. Older students, on the other hand enroll in these courses primarily in the hope of obtaining some skills that they can apply directly to a job they already have. By contrast, students in the public service technologies do not differ in this way. While older students in these fields were less likely to transfer than younger ones, the difference was smaller than it was among business students..

Figures 11 and 12 are survival graphs, showing the probability that two students[12] majoring in various subjects will not have transferred through the end of a particular term. In these graphs, the probability of transferring is the distance between the line at each point and the number one on the y-axis. As can be seen from these graphs, younger students are much more likely to transfer than are older students. In addition, students' chances of transfer decline at faster rates in some programs than they do in others. In particular, the survival curve for the 17 year old business student lies below that of the public service technology major, indicating a higher transfer rate for the business student. For the 32-year old student, the survival curve for

[12] Values in these figures assume a student, aged 17 or 32, who placed at the highest developmental level in English and math, attended full-time, did not receive financial aid, and intended to transfer.

business lies above the curve for public service technology, indicating a lower transfer rate for the business student.

As mentioned earlier, models were also tested in which the business programs were broken into two categories: credentialing and non-credentialing. A test for AGE By MAJOR interactions was only significant at the .12 level of probability. Results of this analysis are presented in Appendix III at the end of this dissertation.

Figure 11: The cumulative probability that a 17-year old student in a given major will survive a semester without transferring

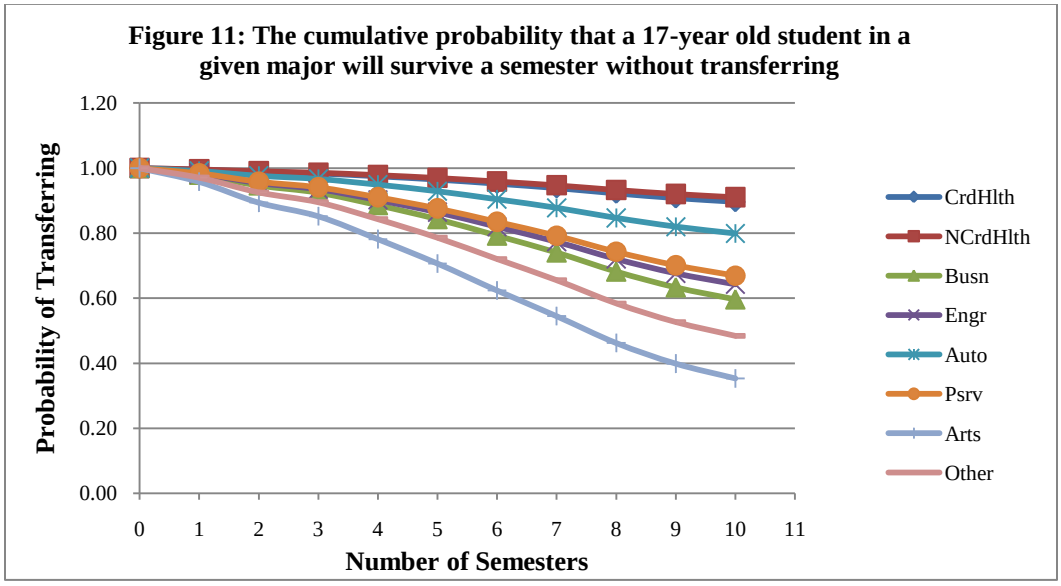


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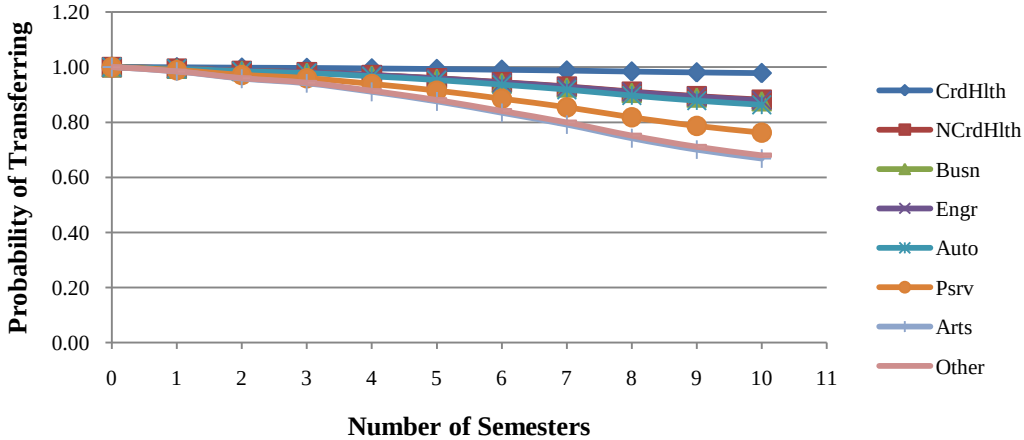
Figure 12: The cumulative probability that a 32-year old student in a given major will survive a semester without transferring



3.9 The Effects of other Variables on Students' Chances of Transferring

Academic variables. Regardless of their major, students who were well-prepared for college were more likely to transfer than those who were not well-prepared. In particular, students who were ready to take the standard courses in freshman English and mathematics as of their first semester at the college were significantly more likely to transfer than were those who placed at the developmental level in these subjects. Converting the coefficient for college-level English in Model 1 into an odds ratio reveals that students placing at the college level in English were more than 1.58 times as likely to transfer as were those who placed at the lowest level of developmental English. Similarly, students who placed at the college level in mathematics were 2.05 times as likely to transfer as were students who placed at the lowest level of mathematics – Basic Arithmetic.

However, the impacts of smaller increases in students' literacy were less certain. For example, the coefficient for the developmental English variable in Model 1 was .24, implying that students who placed at the highest level of developmental English offered at this college (ENG 099) were 1.27 times as likely to transfer as were students who placed at the lowest level (ENG 098). However, this relationship was not significant at accepted levels of probability. Similarly, students who placed into MATH 0950 were only 1.20 times as likely to transfer as those who placed into Basic Arithmetic. This was not a statistically significant change in odds.

What are the implications of these results? Theoretically, an increase in students' academic preparation in English and math should reduce the difficulty they have in

successfully completing their courses. This, in turn, should reduce the psychic cost they incur, thereby increasing their chances of transferring. The results obtained in Model 1 suggest that an increase in students' overall literacy does reduce the (psychic) costs incurred by students who place at the developmental level (hence, the positive coefficients). However, students who place at higher levels in developmental English or math still lack English and math skills needed to ensure their success. Developmental English and math courses are quite intensive, providing students with several years of material in a single semester or two. Not all students have the will or the ability to cope with this instruction. If students do not obtain the skills needed to master their course material with a reasonable amount of effort, their chances of academic failure remain high. If such students do have trouble, the psychic cost of completing a bachelor's degree may outweigh the perceived benefit. Such students may opt to continue at the community college or to drop out of higher education altogether. They are only slightly more likely to transfer than those with weaker preparation. Thus, the standard errors for these coefficients are large and the odds ratios are small. Conversely, students who enter the community college with college-level preparation in English and math will experience considerably less frustration than those with less preparation. Such students are more likely to experience a favorable benefit-cost comparison than those with weaker skills. Other things being equal, they are more likely to transfer.

Consistent with the results on placement in English and math, students' cumulative GPA had a significant effect on transfer. The coefficient for cumulative GPA in Model 1 is .10. The antilogarithm of this value is 1.11. Hence, a one-unit

increase in students' GPA (say from 2.00 to 3.00) increases their likelihood of transferring by a factor of 1.11. This finding is, potentially, quite important. If students' transfer rates respond positively to an increase in GPA, then programs designed to help them become more academically successful should increase the number of students who go on to get bachelors' degrees. Such programs would be particularly helpful to students who place at the developmental level in English and/or math, since their likelihood of graduating is otherwise quite low. To what extent might such programs increase the transfer rates of such students? To answer this question requires an analysis of the interaction between students' GPAs and their proficiency in English and math.

Interaction effects. To answer this question, the regression in Model 1 was expanded to include a series of GPA BY PLACEMENT LEVEL interaction variables. In this analysis, two models were examined. In one of these models, tests were conducted to find out whether proficiency in English interacted with GPA to determine students' probability of transferring. In the other, tests were conducted to find out whether students' proficiency in mathematics interacted with GPA to determine their probability of transferring. Results of these analyses appear as Models 3 and 4 in Table XVI.

Results of this analysis suggest that students' cumulative GPAs interact with their math and English placements to determine their likelihood of transferring. According to the results presented in Model 3, an increase in the GPAs of students who were well-prepared in mathematics had a much bigger effect on their transfer behavior than

Table XVI: A Test of the Interaction Between Students' Proficiency in Math/English and their Academic Performance as these Relate to Transfer Behavior				
	Model 3		Model 4	
	Coef-ficient[1]	Odds Ratio	Coef-Ficient	Odds Ratio
Semester 1	-4.27*** (.27)	0.01	-4.32*** (.28)	0.01
Semester 2	-3.70*** (.27)	0.02	-3.76*** (.27)	0.02
Semester 3	-4.08*** (.28)	0.02	-4.15*** (.28)	0.02
Semester 4	-3.48*** (.27)	0.03	-3.56*** (.28)	0.03
Semester 5	-3.36*** (.27)	0.03	-3.43*** (.28)	0.03
Semester 6	-3.09*** (.27)	0.05	-3.17*** (.28)	0.04
Semester 7	-3.00*** (.28)	0.05	-3.08*** (.28)	0.05
Semester 8	-2.83*** (.29)	0.06	-2.92*** (.29)	0.05
Semester 9	-2.92*** (.31)	0.05	-3.01*** (.31)	0.05
Semester 10-20	-3.20*** (.29)	0.04	-3.27*** (.29)	0.04
Credentialing Health	-1.61*** (.46)	0.20	-1.64*** (.46)	0.19
Non-Credentialing Health	-1.14* (.33)	0.32	-1.16*** (.33)	0.31
Business	-0.02* (.20)	0.98	-0.02 (.20)	0.98
Engineering	-0.13 (.36)	0.88	-0.15 (.36)	0.86
Automotive Tech.	-.59 (.49)	0.55	-0.58 (.49)	0.56
Arts and Science	0.81*** (.19)	2.24	0.81*** (.19)	2.24
Other	0.45*** (.21)	1.56	0.46** (.21)	1.58
Placement in ENG 0990 (Language Fundamentals II)	0.26 (.17)	1.30	0.35* (.19)	1.42
Placement in ENG 1010 (Freshman English)	0.50** (.17)	1.64	0.34* (.19)	1.40
No Placement Test	0.67** (.20)	1.94	0.67*** (.22)	1.95
Placement in MATH 0950 (Beginning Algebra)	0.12 (.17)	1.12	0.20 (.15)	1.22
Placement in MATH 0980 (Accelerated Algebra)	0.45 (.15)	1.58	0.41*** (.14)	1.51
Placement in MATH 1060 or higher (College Math-	0.27 (.18)	1.30	0.72*** (.15)	2.06

Table XVI: A Test of the Interaction Between Students' Proficiency in Math/English and their Academic Performance as these Relate to Transfer Behavior				
	Model 3		Model 4	
	Coef-ficient[1]	Odds Ratio	Coef-Ficient	Odds Ratio
ematics)				
No math test	0.46 (.19)	1.58	0.61*** (.17)	1.84
Age	-0.06*** (.01)	0.94	-0.06*** (.01)	0.94
AA to Transfer	-0.31*** (.08)	0.73	-0.31*** (.08)	0.73
AA For Job	-0.69*** (.12)	0.50	-0.67*** (.12)	0.51
Delayed High School	-0.06 (.10)	0.94	-0.09 (.10)	0.92
Transfer-in	0.54*** (.11)	1.72	0.51*** (.12)	1.67
Financial Aid	-0.33*** (.08)	0.72	-0.33*** (.08)	0.72
Cumulative GPA	-0.11 (.13)	0.89	0.12 (.19)	1.12
Placed into ENG 0990 X GPA			-0.24 (.21)	0.79
Placed into ENG 1010 X GPA			0.12 (.20)	1.13
No English Test X GPA			-0.04 (.20)	0.96
Placed into MATH 0950 X GPA	0.15 (.18)	1.16		
Placed into MATH 0980 X GPA	-0.05 (.15)	0.95		
Placed into MATH 1060 X GPA	0.55*** (.16)	1.73		
No Math Test X GPA	0.26 (.15)	1.29		
Log Likelihood	-3230.6		-3238.5	
Likelihood Ratio Chi[2] (current model compared to model in previous step)	25.6***		9.71**	
Likelihood Ratio Chi[2] (current model compared to model containing times as only variable)	614.4***		614.4***	

*Denotes statistically significant at .10 or better probability
** Denotes statistically significant at .05 or better probability
***Denotes statistically significant at .01 or better probability

did an identical change among students who were not so well-prepared. To understand the way in which these variables interact, it is necessary to look at three sets of coefficients: individual math placement results, cumulative GPA, and the GPA BY PLACEMENT LEVEL interaction terms.

In Model 3, the coefficients for the individual math placement levels provide information on students' likelihood of transferring, given that they placed at a particular level in math and that they were assigned a value of zero on the variable, GPA. In this equation, GPA has been re-centered to 2.00 by subtracting a value of 2 from each student's GPA. Hence, the math placement coefficients in this equation provide information on students' chance of transferring, given that they have a cumulative GPA of 2.00. The coefficients for MATH 0950 and MATH 1060 are .12 and .27, respectively. These convert to odds ratios of 1.12 and 1.30. Hence, a student who places into college-level math and has a cumulative GPA of 2.00 is 1.30 times as likely to transfer as is a person who places into basic arithmetic and has a GPA of 2.00. A student who places into MATH 0950 and has a GPA of 2.00 is 1.12 times as likely to transfer as is a comparable student who places into basic arithmetic, given that both students have GPAs of 2.00.

Coefficients for the math placement variables in Model 3 suggest that students who place at higher levels in math are more likely to transfer than are those who place into MATH 0910 – given that students in each group have GPAs of 2.00. If cumulative GPAs interact with proficiency in math, however, this relationship will not necessarily hold true at higher (or lower) levels of performance. In Model 3, the coefficient for cumulative GPA provides information on the relationship between

students' GPA and their chances of transferring, given that they placed into MATH 0910. The odds ratio for this variable was 0.89, suggesting that that a one-unit increase in the cumulative GPAs of students who place into basic arithmetic actually reduces their chances of transferring. Coefficients in Model 3 do not provide direct information on the relationship between GPA and the transfer behavior of students who placed into other math courses. To obtain information on these relationships, it was necessary to manipulate the data in some way. The simplest way to do this is to systematically change the reference variable from MATH 0910 to one of the other levels specified in the model. The coefficient for cumulative GPA will then provide information on the effects of a one-unit change in GPA, given that students placed at a particular level in math.

Table XVII presents the results of this exercise for students in this cohort. Data presented in this table suggest that the relationship between students' GPA and their chance of transferring does vary with students' initial math placement. An increase in GPA did not have a clear effect on the transfer behavior of students placing at the developmental level in mathematics. However, students' academic performance apparently does have a positive effect on the transfer behavior of those placing into college-level math. The coefficient for this variable was .44, producing an odds ratio of 1.55. Hence, a one-unit increase in GPA increases students' odds of transferring by a factor of 1.55 for students placing into MATH 1060. Comparing the odds ratio for MATH 1060 to the ratio for MATH 0910 yields a comparison value (a ratio of the ratios) of 1.73. According to this model, an increase in GPA among students placing

into MATH 1060 had a much greater effect on student's transfer behavior than a comparable increase among students placing into MATH 0910.

By contrast, the effects of GPA on transfer behavior were considerably weaker among students who placed at the developmental level in math. Of the three courses into which students can place, the odds ratio was positive only for MATH 0950. However, this ratio was small and non-significant. Coefficients for the other two levels were negative, implying that a one-unit increase in GPAs of students placing at these levels reduced their chances of transferring. Taken together, these results suggest that academic performance does not have a strong effect on the transfer behavior of students placing at the developmental level in math. Cumulative GPA does interact with students' initial math placement to affect their chance of transferring. However, these effects are concentrated mostly on students who place at the college level in mathematics. Academic performance of these students may provide them with some psychic income. However, they are as likely to drop out or complete an associate's degree as they are to transfer.

Table XVII: Impact of a 1-Unit Increase in GPA on Likelihood of Transferring of Students with Varying Amounts of Math Proficiency

Math Placement Level	Coefficient	Odds Ratio	Statistical Significance	Odds Ratio/Odds Ratio for MATH 0910
MATH 0910	-0.11	0.89	0.38	--
MATH 0950	0.04	1.04	0.78	1.16
MATH 0980	-0.16	0.85	0.06	0.95
MATH 1060	0.44	1.55	0.00	1.73
No Math Test Taken	0.14	1.15	0.08	1.29

Results from a similar analysis into the interaction between English placement and GPA (see Model 4) suggested that the transfer behavior of students placing at the lowest developmental level in English do respond to an increase in GPA. However, the magnitude of this increase (odds ratio = 1.12) was not large compared to the asymptotic standard error. The result was, therefore, not statistically significant. This implies that, while grade point average may have a positive effect of students placing at the developmental levels in math and English, many students respond to academic success in some way other than transferring – completing a vocational associate's degree or leaving higher education without completing a degree. As a result, it is not certain that an increase in GPA would have the same overall effect on another group of students drawn at random from the population of possible students. By contrast, academic performance had a strong effect on the transfer behavior of students who placed at the college level in English, increasing their odds of transferring by a factor of 1.26.

Table XVIII: Impact of a 1-Unit Increase in GPA on Likelihood of Transferring of Students with Varying Amounts of English Proficiency

Math Placement Level	Coefficient	Odds Ratio	Statistical Significance	Odds Ratio/Odds Ratio for ENG 0980
ENG 0980	0.12	1.12	0.54	--
ENG 0990	-0.12	0.88	0.20	0.79
ENG 1010	0.24	1.26	0.00	1.13
No English Test Taken	0.07	1.07	0.34	0.96

Based on this evidence, it must therefore be concluded that, while students' academic performance at the community college does have an impact on their transfer behavior, it is only one of several factors they consider. Developmental education students may receive great satisfaction in academic successes achieved at the community college. Many of these students do transfer, as indicated by the statistically significant, positive coefficient among students in the "other" program. However, academic successes among these students do not necessarily result in transfer behavior. The community colleges offer a wide range of educational products, only one of which is the university parallel program. Students have a wide range of needs. Those who enter at the developmental level – at least in math – are more likely to take advantage of some of the other products offered by the college than are students placing into college level courses. Results of this analysis suggest that the community colleges may best serve their students by providing strong programs that are oriented to careers at both the baccalaureate and sub-baccalaureate levels.

Other Factors. The effects of students' preparation and academic performance play an important role in students' transfer decisions. However, they are not the only costs that students consider when deciding on whether to complete a bachelor's degree. In addition to these costs, students also consider the monetary cost of completing a degree and the amount of earnings they must forego while going to school. In this analysis, these costs were modeled by two proxies: financial aid status and students' age as of their first semester at the community college.

In conducting this analysis, it was hypothesized that lower income students would find it harder to afford the cost of a four-year degree than students from more affluent backgrounds. Income data were not available on all students in the data base of the college under study. As a result, it was necessary to find a proxy for students' financial situation. Financial aid status served as such a proxy, the assumption being that students who received financial aid came from lower income homes than students who did not.

Results of this analysis, not surprisingly, indicate that low income students are less likely to transfer to a four-year college than are their more affluent peers. The coefficient for the financial aid variable in Model 1 was -.33, which converts to an odds ratio of .72. Hence, students who received financial aid in a given semester were .72 times as likely to transfer to a four-year college at the end of that term as were students who did not receive aid. Controlling for other costs, these students are more likely than their more affluent peers to pursue some goal other than a bachelor's degree. However, students' chances of transferring depend on the full range of benefits they receive and costs they incur by going to school.

Another factor that students consider when deciding on whether to transfer is the amount of income they are likely to forego by continuing their educations. According to human capital theory, the cost of an education does not simply consist of the money students spend on tuition, books and school-related living expenses. It also includes the amount of income that students are giving up by spending time in school that they could be using to earn money. According to theory, opportunity costs vary with students' age.

Human capital theory posits that as students grow older, they obtain more work experience. This experience increases their value to employers, which in turn increases the opportunity cost of going to college. As students' opportunity costs increase, their odds of completing a four-year degree are expected to decline. Hence, it was hypothesized that older students who attend the college under study in this chapter would be less likely to transfer than younger ones. To test this hypothesis, students' age was included as a variable in the analysis.

Results of the analysis conducted in this chapter support this conclusion. The coefficient for this variable in Model 1 was -.06, suggesting that each additional year of age reduced students' odds of transferring by a factor of .94. Wald statistics for this variable were significant at the .001 level of probability. Hence, a one-year increase in students' age decreases their odds of transferring by a factor of .94.

In addition to students' age, it was hypothesized that part-time enrollment status would serve as a proxy for students' work and family responsibilities, the idea being that students who attend part-time were more likely to have significant off-campus responsibilities than those who attended full-time. It was further hypothesized that students who attended part-time would be less likely to transfer than those who attended full-time. The analysis presented in this paper did not find a statistically significant relationship between part-time status and students' likelihood of transferring to a four-year college.

3.10 Discussion

In an effort to help colleges increase the success of students who seek to complete a bachelor's degree, this chapter has tested a hybrid model of student transfer behavior. This model combines concepts from Tinto's theory of student dropout with concepts from human capital theory to derive a framework that focuses on the benefit-cost comparisons made by students as they progress through college. According to this model, students treat the decision to complete a college degree in the same way they treat any other investment decision. They compare the expected benefits of completing the degree to the costs they can expect to incur by going to school. If the benefits exceed the costs, they make the investment. Otherwise, they do not. Students who decide to complete a degree may achieve their goal through a number of means. They may go directly to one of the many four-year institutions that are available to them, or they may start off at a two-year college and transfer at a later time. Students who take this latter route may transfer at any time – upon the completion of single semester, upon the completion of an associate's degree, or at any time in between. Exactly when they transfer depends on their benefit/cost comparisons. At the close of each semester, students assess the benefits and costs of attending the community college for another semester. If the benefits of continuing at the community college exceed the costs, students will leave it. If their career goals require them to complete a degree, they transfer to a four-year college. Otherwise, they drop out of college. In making these comparisons, students consider both the pecuniary and psychic costs and benefits of going to college.

Analyses conducted in this chapter provide some insights into the factors that students weigh when they make these decisions. Using data on a cohort of students who first attended a community college in fall semester 1998, this analysis sought to determine the impact of four specific costs and benefits on students' transfer behavior:

- Students' career goals, as indicated by their major
- Students' readiness for college level work as of the time at which they started at the college
- Students academic performance at the college
- Students' financial situation

Because the college under study does not collect specific data required to address these issues, the analysis was forced to rely on proxy measures to estimate their effects. In spite of these limitations, the analysis does provide some insights into the ways in which these costs and benefits combine to determine students' chances of transferring.

One of the more important findings to emerge from this study is that, while students' career goals do play an important role in their decision to transfer, these goals are shaped by a number of factors that lie outside of the economic arena. One hypothesis to be tested in this chapter was the idea that students' transfer decisions would be strongly influenced by the educational requirements of the jobs for which they were preparing. Information made available through the U.S. Department of Labor suggested that jobs available to students majoring in different subjects differed widely in the amount of formal education they required. At one extreme, virtually all

the jobs in the public service technologies are available to students with less than the associate's degree. At the other extreme, many jobs in business and the professions require the completion of a bachelor's degree or higher. The most efficient way for a community college student to prepare for these careers is to concentrate in the liberal arts. Hence, it was hypothesized that transfer rates would vary significantly from one program to another.

Results of this analysis supported this hypothesis. In general, students who – based on the courses they took – were preparing for jobs that required the bachelor's degree tended to transfer. Students who were preparing for jobs that required less than the bachelor's degree tended not to transfer. One exception to this finding was the business programs. Due to the large number of business jobs that require a bachelor's degree, it was hypothesized that business majors would be significantly more likely to transfer than would students in the reference major, public service technology. However, in the initial analysis, there was no significant difference between business majors' odds of transferring and public service majors' chances of transferring. Only when an analysis was conducted to find out whether students' majors interact with their ages did a relationship became clear. Younger students were significantly (but only at the .08 level of probability) more likely to transfer than public service students. Older students majoring in both subjects were less likely to transfer than were younger students. However, the decline in transfer rates was much greater in the business technologies than it was in public service technology. Hence, older students majoring in business were less likely to transfer than were comparable public service technology students. Perhaps reflecting differences in the educational

requirements of relevant jobs, transfer probabilities declined at different rates in different majors.

One possible explanation for the low overall transfer results among students majoring in the business technologies may lie in the diversity of the job titles associated with these programs. For example, one of the majors comprising this group was the college's Real Estate program. The CIP code for this program is 52.1501. According to the Occupational Supply Demand System, this program potentially prepares students for any of four occupations:

- Property, Real Estate and Community Association Managers
- Appraisers and Assessors of Real Estate
- Real Estate Brokers
- Real Estate Sales Agents

Of these occupations, the first two – Real Estate Managers and Real Estate Appraisers - require at least a bachelor's degree. The other two require work experience in a related occupation or a postsecondary vocational award. Because two of these occupations require a bachelor's degree, this program was classified as a "credentialing business" program. However, many of the students who take real estate classes at this community college probably do so in the hope of becoming real estate sales agents or brokers. While some students do aspire to careers requiring the bachelor's degree, the number of such students may be small compared to the number who are preparing for jobs as sales agents or brokers. Hence, while the transfer rates of students in this program are greater than zero, they are not much higher than they

are in other majors that prepare their students for jobs requiring an associate's degree or less.

Another finding to emerge from this study concerns the way in which students' academic performance interacts with their proficiency in math and English. Analyses conducted in this chapter suggest that students' academic performance at the community college does play a role in their decision to transfer. However, the nature of that role depends on students' in proficiency in math and English. According to this analysis, a one-unit increase in the grade point averages of students placing into college-level math produced a significant increase in students' odds of transferring. By contrast, an increase of this size apparently had no such effects among students placing into the developmental courses. Results of a similar analysis focusing on English placement found similar results. The coefficient for the lowest level of developmental English was positive, suggesting that a one-unit increase in GPA increased students' probability of transferring by a factor of 1.12. However, this result was not statistically significant. Hence, these results suggest that while high performing students who place at this level do transfer, they also respond to increasing GPA in other ways – completing an associate's degree or credential, or leaving higher education without a degree. Only for students who placed at the college level did a strong relationship emerge.

Results of this analysis thus suggest the outlines of a benefit/cost approach to the transfer behavior of students enrolled at a community college. In this model, students enter the community college with an educational goal, which is based on at least a vague comparison of the benefits and costs of investing in a range of educational

products. These products range from the completion of a single course to the completion of a graduate or professional degree. In making this comparison, students consider a full range of costs and benefits, both pecuniary and psychic. Once they are enrolled in college, they continue to do so up to the semester in which the marginal cost of continued study exceeds the marginal benefit. If students' goals require the completion of a bachelor's degree, they will transfer at this point. If not they will leave higher education altogether, either with or without an associate's degree, depending on the amount of training they have completed at the two-year institution.

Students who transfer from the community college may earn a wide range of benefits by doing so, both psychic and pecuniary. Psychic benefits include the confidence they obtain by mastering a subject area. Pecuniary benefits consist mainly of the discounted lifetime earnings increase students are likely to receive by completing the degree. The community college under study in this dissertation offers a number of different academic programs, preparing students for a wide range of careers. These careers differ significantly in the amounts of training they actually require and in the benefits they offer – both pecuniary and psychic. Results obtained in this analysis suggest that students will gravitate towards those majors that are most consistent with their abilities, tastes, and position in the life cycle. Students who attend this college may seek to earn a baccalaureate degree in any number of fields. However, courses offered in students' specialization at the two-year college will not necessarily meet the requirements of the major at their intended four-year institution. Hence, students who wish to transfer will concentrate mainly in courses offered in the arts and sciences – the traditional general education curriculum.

Two costs are of particular importance to students who make the decision to transfer: 1) the opportunity costs incurred in pursuing a bachelor's degree; 2) the psychic cost of continued study. The opportunity cost of a semester at college is of importance to all students, no matter what their circumstance. However, it is of particular importance to students in older age groups. At least some of these students have already obtained a good deal of productivity-enhancing training through work experience and formal education. Because they have, their annual incomes are higher than those of younger students with comparable amounts of formal education. They therefore incur a higher cost by taking a college course than do their younger peers. As a result, they are somewhat less likely than younger students to take courses in the traditional university parallel program. Regardless of their major, they are considerably less likely to transfer than are their younger counterparts.

The psychic costs of continued study appear also to play an important role in determining students' transfer behavior. In contrast to four-year colleges, two-year institutions admit all students who apply, regardless of their proficiency in English and mathematics. As a result, students who attend these colleges differ significantly in their readiness for college-level study. On the one hand, many students who attend these colleges are fully prepared for college level work in both English and mathematics. On the other hand, a number of students can barely function at ninth grade levels in either of these two subjects. Students in this latter group incur a number of psychic costs that greatly reduce their probability of transferring. Not only does their poor preparation make it difficult for these students to succeed in their college-level courses (which they may take concurrently with their developmental

courses), it also discourages them from continuing on – even when they have earned high grades in the courses they complete. This appears to be particularly true among students who place in the developmental math sequence.

Students compare these varied costs of transferring to a four-year college against the expected benefits. The net result of this process is a dynamic environment in which students enter with multiple goals and leave at multiple points in time, the point of transfer depending on the psychic cost of remaining in the community college and students' ability to finance continued study.

3.11 Policy Implications

Results of this analysis provide insights for policy makers who wish to increase their students' odds of transferring to a four-year college. Findings presented in this chapter suggest that, in making the decision to transfer, students consider a wide range of costs and benefits. These include students' academic preparation, the increased earnings they will likely realize by completing a degree, their academic performance at the two-year college, and the educational requirements of various goal jobs. Human capital theory posits that students base their decision to transfer on a comparison of the benefits and costs of completing a bachelor's degree. This implies that community colleges that want to increase their transfer rates can adopt either or both of two general strategies: 1) they can reduce the cost of completing a college

degree or 2) they can increase students' perceived benefits of going on to complete a bachelor's degree.

A wide range of possible strategies exist by which colleges can improve students' benefit/cost ratios. On the cost side of the equation, for example, they can adopt various efficiency enhancements in an effort to reduce the monetary cost of a two-year education. Alternatively, they can offer services such as counseling and tutoring to reduce the psychic cost of going to college. On the benefit side of the equation, they can implement policies to increase the perceived value of a four-year degree. For example, they might involve employers more directly in the educational process, partnering with 4-year institutions to develop cooperative education programs that expose students to the kinds of jobs that would be available to them upon completion of a bachelor's degree.

Evidence from the community college under study in this paper suggests that much – if not most – of the effort designed to increase transfer rates involve the reduction of costs. In particular, community colleges spend a good deal of effort working with four-year colleges to design transfer guides aimed at reducing the number of courses students take that do not transfer. These techniques reduce the number of unnecessary courses students ultimately must complete to earn their bachelors degree, thereby reducing the pecuniary cost of a college degree. These efforts undoubtedly have a positive impact on students' transfer behavior. However, the evidence from this dissertation suggests that, for many students, the highest costs are psychic costs resulting from poor academic preparation and low self-esteem. If these students are to overcome these costs and complete a bachelor's degree, they

need some insurance that they will reap an offsetting benefit by completing a bachelor's degree. Hence, community colleges that wish to increase their transfer rates may wish to supplement these efforts at cost reduction with more aggressive programs aimed at convincing students that they, too, can reap the benefits of a four-year degree, if they will only persevere. For example, these institutions may wish to collaborate more intensively with four-year colleges in particular academic majors than they currently do. They may also wish to involve employers more aggressively in the educational process, working closely with businesses to identify opportunities for students who complete a bachelor's degree.

Even with these efforts, however, the cost of a four-year degree will still be too high for many students – particularly those placing at the developmental levels in English and math. A viable policy on four-year transfer program must, therefore, be coupled with a range of carefully designed programs preparing students for jobs that require less than a bachelor's degree – at the associate's degree level and possibly lower.

CHAPTER IV

A GRAPHICAL ANALYSIS OF STUDENTS' LIKELIHOOD OF EXPERIENCING EACH OF THREE COMPETING EVENTS

4.1 Introduction

Community college leaders are under a good deal of pressure to increase their rates of student success. As an open access higher education institution committed to providing their students with a wide range of low-cost educational opportunities, community colleges make it possible for a number of students to attend college who would otherwise not do so. In so doing, they increase the number of students who go on to higher education each year, accounting for nearly half of all first-time freshmen in 2005 (National Center for Education Statistics, 2008). At the same time that they increase access to higher education, these institutions also have a hard time retaining their students. Not only do a fairly small percentage of these students complete an associate's degree each year, but research indicates that the number of these students who go on to complete a bachelor's degree is also relatively small – smaller than one would expect based on the graduation rates of similar students who start their college

careers at four-year schools (for example, see Pascarella, 1999). As a result, community college leaders have been under great pressure to increase the number of students who complete a degree – either two-year or four-year.

In order to increase the number of students who complete a credential, these colleges need a good understanding of the forces that influence the enrollment decisions of their student populations. Unfortunately, most models of student persistence and success were designed with bachelor's degree students in mind. Such models can provide useful insights into the forces that affect students' success at the community colleges. However, community college students differ from those who attend the four-year colleges in important ways. As a result, while the use of these models has undoubtedly led to the development of some innovations which have helped students, their impacts have been limited and they are also limited in the insights they provide about the motivation of community college students.

The purpose of this chapter is to study some of the factors that contribute to the success of students who attend a two-year college. To achieve this goal, this chapter will conduct a critical analysis of the main theories of student persistence at a two-year college. Having completed this analysis, this chapter will describe an alternative model that yields some insights not available through other approaches. Using data on a cohort of students who started at a community college in the fall of 1998, this chapter will then conduct an analysis to find out whether the main features of this model seem true. In particular, this analysis will focus on the relationship between students' major and their likelihood of achieving each of three outcomes: dropping

out, completion of an associate's degree, and transfer to a four-year college. This essay will close with a discussion of the policy implications of this model.

4.2 Theories of Student Persistence in Higher Education

The dominant theory of student persistence in higher education is Tinto's (1975) theory of student dropout. Based on Durkheim's concept of anomie, Tinto likens students' decisions to drop out of college to a person's decision to commit suicide. According to this view, a healthy society is one in which two conditions are prevalent. First, citizens feel that the values of the larger society are consistent with their own. Second, they find it easy to interact with other "members of the collectivity." If a person is not well-integrated into these two systems, social and moral, the likelihood that he or she will commit suicide goes up.

In Tinto's view, a similar process takes place with respect to a student's decision to drop out of college. According to Tinto, students enter college with a set of goals that spring from their personal characteristics and prior experiences. In Tinto's model, these goals are expressed as commitments. These commitments take two forms: (1) commitment to the institution in which a student has enrolled; and (2) commitment to the educational goal itself. Once students are actually enrolled in college, they begin to interact with the social and academic systems of the school. Students take classes. They interact with other students. If students are successful in their studies, they become "academically integrated" into the college. If they meet other students whose values are similar to their own, they become "socially

integrated" into the college. As students become integrated into these two systems, their goal commitments and institutional commitments become strengthened. As these commitments become stronger, students become more and more likely to complete a degree. Conversely, if students' experience with the academic and social systems of the college is not positive, these commitments become weaker, and students will tend to leave the college.

Since the publication of Tinto's (1975) seminal article, a number of studies have been conducted in an effort to find out whether the concepts of academic and social integration provide meaningful insights into a student's likelihood of persisting in college. These studies have mainly focused on students enrolled at four-year colleges. However, some of these studies have addressed two-year schools. Studies on community colleges have generally been of two types: (1) studies on the year-to-year or term-to-term persistence of students enrolled at the community college; and (2) studies on the longer term persistence of community college students who may have gone on to transfer to a four-year college. Year-to-year studies have produced mixed results. On the one hand, several authors (Pascarella, Smart and Ethington, 1986; Nora and Rendon, 1990) have found that a relationship does exist between student integration (both academic and social) and student persistence. Conversely, other writers (Nora, 1987; Voorhees, 1987) have found that student integration was either not related to student persistence or had a weaker effect than other constructs assessed in the study (Bers and Smith, 1991). Contrary to predictions of the Tinto model, these studies found that events occurring outside the college had a much greater impact on student persistence than students' on-campus social and intellectual

development (as distinct from academic performance). In particular, studies by Bers and Smith (1993), Voorhees (1987) and Nora (1987) found strong relationships between a student's educational objective or goal commitment and student persistence. Taken as a whole, these studies suggest that "students' educational objectives and intent to reenroll combined [with their] pre-college experience and employment status …provide more insights into student persistence than either Academic or Social Integration (Bers and Smith 1991; Anderson, 1981). "

Few studies have been conducted on the relationship between student integration and the decision to transfer. However, these studies (Pascarella, Smart and Ethington, 1986; Nora and Rendon, 1990) suggest that students who are academically and socially integrated into the community college they attend are more likely to complete a bachelor's degree later on and to form a "predisposition to transfer" while they are enrolled at the two-year college than are other students. In spite of these findings, studies conducted by a number of scholars suggest that students who start their college careers at community colleges are much *less* likely to complete a bachelor's degree than are students who begin them at four-year institutions. Assuming that Tinto's theory describes the full range of forces that determine persistence, these results suggest that students who attend the community college are not well-integrated into schools they attend. If Tinto's theory is incomplete, these results suggest that other factors may play a role in determining students' decisions to transfer. All things considered, this theory of persistence may require some elaboration if it is to be meaningfully applied to the two-year colleges.

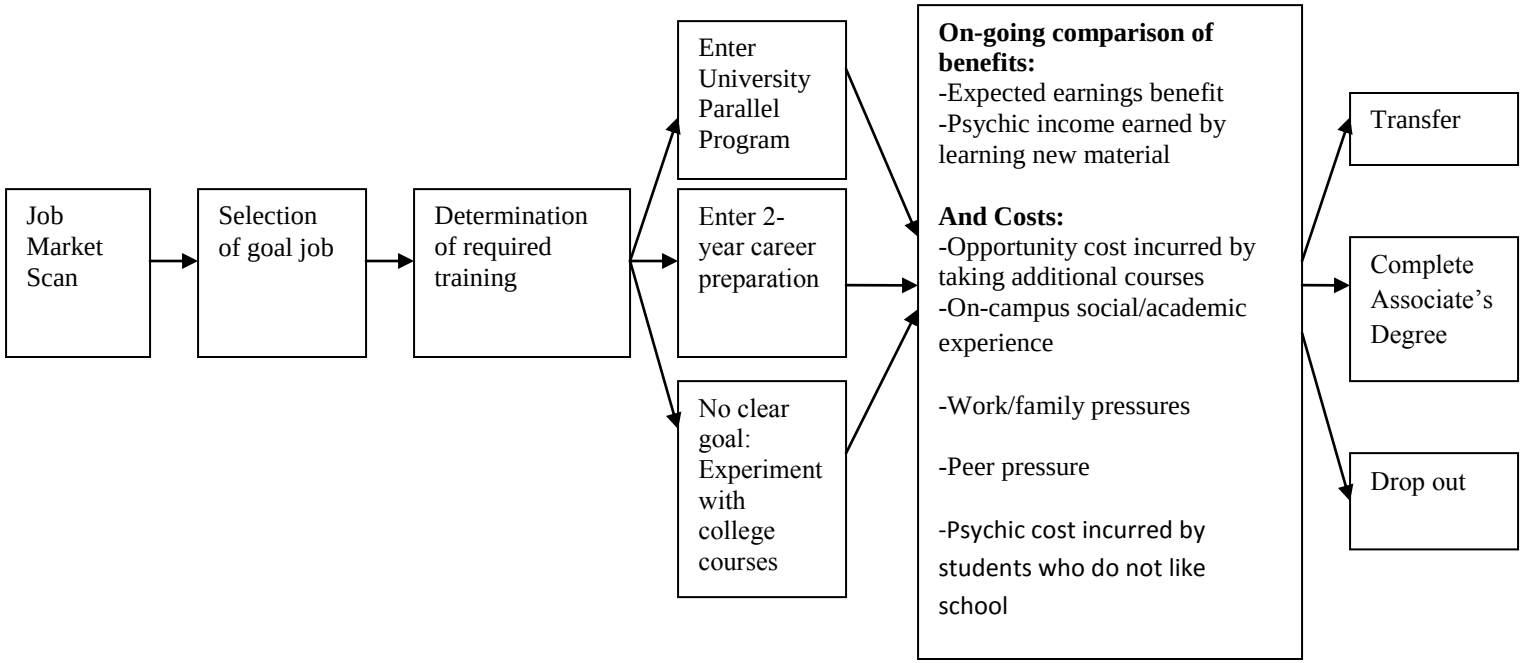
A major weakness of Tinto's theory may be in the way that it defines students' goals. In Tinto's model, the concept of goal commitment plays a big role in determining students' likelihood of persisting. As mentioned above, this model posits that students enter college with some commitment to completing a degree, which is strengthened or weakened by their on-campus experience. However, this conception may be inadequate for community college students. Like students who begin their college careers at the four-year schools, community college students enter college with the hope of improving their lives in some way, typically by preparing for a new career or advancing in a career they have already started. However, unlike students who start their college careers at a 4-year school, this goal does not necessarily require them to complete a degree – either a two-year or a four-year degree. The extent to which their goals will require a degree depends on the job markets in which students ultimately wish to compete. Community colleges offer students a much wider range of program choices than is available at many 4-year colleges. Not only must students who enroll in these colleges select from a wide range of majors. They must also decide on which of two major job markets they wish to compete in, upon completing their course work: baccalaureate or sub-baccalaureate.

Students who wish to enter the sub-baccalaureate job markets will respond to a different set of incentives than will those who opt to prepare for jobs requiring a bachelor's degree or higher. According to Grubb (1996), employers use a different set of standards when filling jobs that require less than a bachelor's degree than they do when filling jobs that require higher levels of training. When filling jobs that require a high level of training, employers in most cases demand the services of

workers who have completed a college degree. By contrast, employers are much more flexible in the kinds of preparation they are willing to consider when filling jobs that require less than a bachelor's degree. Grubb's research suggests that, given the choice between an inexperienced worker who possesses a two-year degree and an experienced worker who has less education, most employers would prefer the more experienced worker. As a result, students who opt for two-year vocational programs may see little reason to complete a degree, once they have completed a certain number of credits. Such students may quit college without completing a degree, even if they are doing well in their school work and have made a number of friends on-campus.

Based on these observations, a good model of student persistence at the community college must explicitly address the educational requirements of the jobs for which students are preparing. While students' on-campus experiences undoubtedly do have an effect on the odds that they will complete an associate's degree, the strength of these effects may depend on the rewards that students can expect in the job market. Hence, a viable model of student persistence will blend the best components of Tinto's model with some conception of the demand for trained workers in the job markets – both baccalaureate and sub-baccalaureate. The question is: what is the best way to achieve this goal?

Figure 13: A Model of Student Educational Attainment at the Community College



Perhaps the most straight-forward way to build such a model is to treat students' decision to persist in college as an investment in human capital. Using this framework, student persistence would be treated just like any other investment in human capital – as a comparison of the benefits and costs of going to college. In such a model, students would first estimate the stream of benefits they would likely receive by completing a credit of instruction. They would compare these to the cost of taking an additional credit of instruction. If the benefit exceeded the cost by a sufficient amount, students would continue in school. Otherwise, they would quit. In this model, costs and benefits would be both pecuniary and psychic. Pecuniary benefits would include the actual incomes students would receive by taking a job in their chosen career. Pecuniary costs would include the tuition and fees that students pay to take classes. Psychic costs may include a wide range of factors. Among these are the fear of failure experienced by students with weak academic backgrounds, self-doubts engendered by family members who do not want students to complete a degree, and so on. In this model, Tinto's concepts of social and academic integration would be treated as psychic benefits and costs. Each semester students would tally up these various costs and benefits, both psychic and pecuniary. They would persist in college up to the point at which the marginal cost of a credit of instruction exceeded the marginal benefit.

This model is depicted in Figure 13. In this model, the college experience starts with the decision to prepare for some career. In setting this goal, students consider their own tastes and preferences and the job market as they know it. In setting their goal, students will not only consider the type of training they will need to complete, but also the credential they wish to acquire – bachelor's degree, associate's degree or certificate. Based on this

information, which will vary in quality from one student to another, the student will then search for a school at which he or she can prepare for this career. During this part of the decision process, students will select a major. Once enrolled in school, the student will experience a number of incentives and disincentives. In this model, the student will perceive these as benefits and costs. The most important benefit considered by students is the stream of increased earnings they will likely receive over the course of their lives. Significant costs include not only the tuition charged by the school, but also the opportunity cost of taking classes, and a range of psychic costs that vary from one student to another. Included among these costs and benefits are Tinto's concepts of academic and social integration. In this model, the student will continue to take classes up to the point at which the marginal cost of a credit of instruction exceeds the marginal benefit.

4.3 The Importance of Students' Major in Determining their Persistence

Of all the factors that determine students' persistence at the community college, student' major must rank near the top. In selecting a major, students make at least an initial commitment to a particular career goal, and they also begin to obtain skills and knowledge that they can exchange for income in the job market. To the extent that different jobs require different amounts of training and offer students different amounts of income, the incentive to actually complete a credential may differ significantly from one major to another. As mentioned earlier in this chapter, the sub-baccalaureate labor market differs from the baccalaureate market in that employers in the former are more willing to substitute experience for education than are employers in the latter. In addition, educational

qualifications may vary significantly from one job to another within the sub-baccalaureate market. To the extent they do, persistence rates should vary significantly from one major to another.

To test this hypothesis, I will conduct an analysis on a cohort of students who enrolled at a large, urban community college during the period from fall 1998 through spring 2006. In conducting this analysis, I will attempt to find out whether a relationship exists between students' major and their chances of experiencing each of three different events: dropping out of college, completion of an associate's degree, and transferring to a four-year college. To achieve this goal, I will divide the academic programs offered at this college into 8 different categories. An analysis of the job markets served by each of these eight groupings is then conducted. Based on this analysis, these programs are then ranked according to the likelihood that students will experience each of these three outcomes, or events. Analyses will then be conducted to find out whether students actual enrollment behavior is consistent with these hypotheses. Human capital theory suggests that students' majors are only one of several factors that affect student persistence. Hence, all analyses attempt to control for other variables that seem likely to affect students' enrollment behavior.

4.4 Hypotheses to be tested in this Chapter

As of fall 1998, the college under study offered more than 65 academic programs leading to four different degrees: the associate of arts, the associate of science, the associate of applied science, and the associate of business. Academic programs offered at this college could, in turn, be divided into 8 broad collections of majors:

- Health careers – “credentialing” (Associate of Applied Science)
- Health careers – “non-credentialing” (Associate of Applied Science)
- Business technologies – “credentialing“ (Associate of Applied Business)
- Business technologies – “non credentialing” (Associate of Applied Business)
- Engineering technologies (Associate of Applied Science)
- Automotive Technology (Associate of Applied Science)
- Public service technologies (Associate of Applied Science)
- Liberal arts and sciences (Associate of Arts, Associate of Science)

In theory, these programs all prepare students for jobs that require either an associate’s degree or a bachelor’s degree. However, reality is more complex than suggested by the degrees offered in these subjects. Using a cross-walk developed for the U.S. Department of Labor (DOL) by the National Crosswalk Service Center, an analysis was conducted to determine the amount of training required to fill jobs related to each of the academic programs offered at this college. This analysis suggested that the 65 programs offered at this college in 1998 prepared students for 154 different occupations. These occupations differed greatly in the amounts of education they required. Of these occupations, 25 typically required the associate’s degree, 80 required less than the associate’s degree, and 48 required a bachelor’s degree or higher. As indicated in Table IX, programs that prepare students for jobs requiring the associate’s degree are concentrated in the health careers and the engineering technologies. Those requiring the bachelor’s degree are concentrated in the business technologies. Programs in public service technologies and automotive technology

prepared students for jobs that almost exclusively required some form of on-the-job training. Based on these differences, students who aspire to positions in the baccalaureate job market are likely to gravitate to different academic programs than students who aspire to positions in the sub-baccalaureate market. Students who aspire to jobs that require less than the associate's degree are likely to gravitate to different vocational programs than are students who seek to complete a two-year degree.

If students who seek jobs requiring different amounts of training are attracted to different programs, then students' odds of completing (or not completing) a given degree should vary from one program to another. The university parallel program is specifically designed to prepare students for upper level courses required for entry into many jobs in the baccalaureate job market. The business programs also provide training that is linked to a number of positions in the baccalaureate job market. As a result, students who enter these programs are expected to transfer. Conversely, courses in public service and automotive technologies prepare students for jobs that often require less than an associate's degree. Hence, the odds are good that students who major in these subjects will drop out of college

Table XIX: A Summary of Minimal Educational Requirements of Occupations Related to Career Programs Offered at the Study College[13]						
Degree Program	**Total Job Titles**	**# Require Associ-ate's Degree**	**# Require Less Than Associate's Degree**	**# Require More than Associate's Degree**	**% Require Asssoci-ates Degree**	**% Require Bach-elor's Degree**
Credentialing Business Technologies	74	4	31	39	5%	53%
Non-credentialing Business Technologies	20	0	19	1	0%	5%
"Credentialing" Health Careers	15	11	1	3	73%	20%
Non-credentialing Health Careers	13	0	9	4	0	31%
Engineering Technologies	10	8	2	0	80%	0%
Automotive Technologies	2	0	2	0	0%	0%
Public Service Technologies	19	2	16	1	11%	5%
Arts and Sciences	Indeterminate					

without completing any degree. Since many positions in the health careers require workers who have obtained an associate's degree, students majoring in the health careers are expected to drop out of college or transfer to a four-year college at lower rates than are those who major in other subjects. Based on this logic, it should be possible to create a profile of the distribution of outcomes among the eight different majors listed in Table IX. Programs that prepare students for jobs requiring a bachelor's degree or higher should have high transfer rates and low dropout rates. Programs preparing students for jobs that require less than an associate's degree are likely to have high dropout rates. Programs that prepare students for a

[13] Data on job qualifications suggested that programs in the health careers could be fruitfully divided into two categories: credentialing and non-credentialing health careers. Similar logic suggested that the engineering technologies could be divided into engineering technologies and automotive technologies.

number of jobs requiring differing amounts of training may be moderately high on two dimensions (say transfer and dropout) and low on a third.

Based on the educational requirements of jobs for which students are likely preparing, outcomes profiles for each program may vary in the following ways.

- **Liberal arts and sciences**. Students who take courses in the arts and sciences have likely enrolled to achieve one of three general goals. They seek to complete a bachelor's degree and enter a career in management or the professions, they seek to complete a vocational associate's degree and take courses in the liberal arts as part of their degree requirements, or they are undecided as to a career or other goal and are taking courses on an "experimental" basis. Given the high return that students can receive upon completion of a bachelor's degree, students who major in the liberal arts and sciences have a strong incentive to transfer to a four-year college. Many of these students – particularly those who come from low income households – may view the associate's degree as an important milestone along the way to a bachelor's degree. Hence, it is expected that a student's likelihood of completing an associate's degree is also likely to be fairly high. In direct contrast to these students, students who enter the college on an experimental basis may in many cases decide that they do not wish to complete a college education. Hence, the dropout rate among students who "major" in the arts and sciences may also be somewhat high. Overall, it is anticipated

that among students who major in the arts and sciences, transfer rates will be high, while graduation and transfer rates will be somewhat lower.

- **Credentialing health careers**. As defined in this chapter, the credentialing health careers consist of programs, such as nursing and radiologic technology, that prepare students for jobs that require the job seeker to have completed an associate's degree or higher. Students who complete these jobs stand an excellent chance of landing a good paying job in their field of interest. As a result, students who major in these subjects have a strong incentive to complete an associate's degree, a weak incentive to drop out, and a weak incentive to transfer to a four-year institution.
- **Non-credentialing health careers**. As defined in this chapter, the non-credentialing health careers consist of programs, such as emergency medical technology and medical assisting, that prepare students for jobs that require less than the associate's degree, although they may frequently require the job seeker to take a licensing examination of some sort. During the period covered by this study, the college under study in this dissertation did award 1-year certificates in fields such as practical nursing and medical assisting. However, other programs in the non-credentialing health careers awarded only the associate's degree. Given the relatively weak emphasis on degree completion in these programs, dropout rates from these programs are expected to be relatively high. Transfer rates and associate's degree completion rates are expected to be low. Certificates were not completed by students in any programs outside of the non-credentialing health careers during this time frame. Hence, it is not possible to compare the completion of this credential by students in this major to completion of the credential by students in any other programs.

- **Business technologies**. As of fall 1998, the college under study in this dissertation offered than 11 different programs and 18 different concentrations[14] in the business technologies. In theory, these programs all prepare students for jobs that require the associate's degree. However, an examination of typical training required for program-related jobs in the business technologies suggests that these majors prepare students for jobs that require varying amounts of preparation. On the one hand, jobs in accounting and information technology tend to prepare students for jobs that require a bachelor's degree. On the other hand, jobs in court and conference reporting and hospitality management typically require less than the associate's degree. Given the range of jobs available to students with different amounts of training, an economically rational student preparing for a career in one business program would have an incentive to enter the job market at a different point than an economically rational student preparing for a career in another business program. Hence, transfer, degree completion, and dropout rates are likely to vary significantly among students majoring in these different subjects.

  To test this hypothesis, the business technologies were divided into two categories: credentialing business technologies and non-credentialing business technologies. The credentialing business technologies were all those majors that appear to prepare students for jobs requiring an associate's degree or higher credential. The non-credentialing business technologies consisted of majors that require an associate's

[14] For example, the college offered three concentrations within the hospitality management program: culinary art, hotel-motel management, and restaurant/food service management. The computer studies program had a mainframe and a microcomputer specialization.

degree or lower. Majors in the credentialing business category included such disciplines as accounting, information technology, interior design, and paralegal studies. Majors in the non-credentialing business category included such subjects as court and conference reporting, hospitality management, marketing and office administration (this program has since been folded into the information technology area). Based on data available through the Occupational Supply Demand system, it is hypothesized that students in the credentialing business programs will be more likely to transfer and less likely to drop out than will students in other majors. Conversely, it is hypothesized that students in the non-credentialing business technologies will be less likely to transfer and more likely to drop out than will students in other majors.

- **Engineering technologies**. Engineering technologies prepare students for jobs such as electrical/electronic engineering technician, mechanical engineering technician, and cost estimator. According to the DOL, these jobs typically require the associate's degree. At the same time, a student can take a few courses in one of these engineering programs and get a job as a drafter or CAD operator without completing a degree. Other students who enter the college with the intention of obtaining a job as a technician may change their minds, opting instead to complete a four-year program in engineering. Given the large percentage of these jobs that require an associate's degree, it is expected that students who major in these programs will be quite likely to complete an associate's degree. The existence of these other possibilities suggests that dropout and transfer rates may also be somewhat high.
- **Public service technologies**. The public service technologies at this college include programs in law enforcement, fire technology and early childhood education. These

programs typically prepare students for jobs that require less than the associate's degree. Students may earn a great deal of psychic income by completing a two-year degree – whether or not they actually need it to gain employment. Others, who seek employment in a federal agency, or desire a supervisory position, or expect to climb a credentialed career ladder may decide to complete a bachelor's degree. In general, however, it is expected that dropout rates will be relatively high among students who major in these subject areas. Associate degree completion and transfer rates are expected to be fairly low.

- **Automotive technologies**. This program prepares students to work as automobile mechanics and technicians. According to the DOL, these positions typically require less than the associate's degree. Therefore, it is expected that dropout rates will be high compared to other programs. Graduation rates are expected to be low. Transfer rates are expected to be very low.

Analyses to be conducted in this chapter will test to see whether students who major in these subjects behave in ways that are consistent with these profiles. In order to make these hypotheses clearer to the reader, these profiles are summarized in the table below.

Table XX: Hypothesized Relationships Between Students' Major and their Chances of Experiencing Each of Three Different Outcomes			
Students' Major	**Likelihood of Dropping Out**	**Likelihood of Completing an Associate's Degree**	**Likelihood of Transferring**
Liberal Arts and Sciences	++	++	++
Credentialing Health Careers	+	+++	+
Non-credentialing Health Careers	++	+	++
Credentialing Business Technologies	++	++	++
Non-Credentialing Business Technologies	++	+	+
Engineering Technologies	++	++	++
Automotive Technology	+++	+	+
Public Service Technologies	+++	++	+
Probability of Occurring: + Very Unlikely; ++ Somewhat Likely; +++Very Likely;			

4.5 Research Method

In order to test these hypotheses, this chapter will conduct a longitudinal analysis of students enrolled in each major. This analysis will use a graphical technique to find out whether a relationship exists between students' majors and their chances of dropping out, transferring or completing a degree. In this analysis, these three outcomes will be treated as "competing risks." Statistics will then be generated to determine the way in which the risk of experiencing each of these events varies over time, given that students are majoring in one of these subjects. Research suggests that students' age, academic performance, and proficiency

in English and mathematics have big impacts on the likelihood that they will achieve each of these three outcomes. Hence, steps will be taken to control for these important variables.

In this analysis, students' chances of experiencing each of these three outcomes will be summarized through the use of cumulative incidence curves (CIC). Developed mainly by researchers in the health sciences, this method can be used to assess a person's chances of experiencing an event, given that he or she has not already succumbed to one of several competing events. Unlike other methods, which assume that a person's chance of experiencing one event (death from heart disease) is independent of his or her chance of experiencing another (death from cancer), this method makes no assumptions about the independence of one event from another. As a result it is ideal for use in longitudinal studies of competing risks. In the study presented in this chapter, a dropout is defined as a student who completed at least one semester at the College and then terminated his or her studies without earning an associate's degree and without transferring to another college – either 2-year or 4-year. A graduate is defined as a student who enrolls for a number of semesters and quits the college upon completing an associate's degree or a certificate. A transfer is defined as a student who enrolls at the college for one or more semesters and leaves it to attend a four-year college, without first completing an associate's degree. These categories are defined in such a way that a student cannot simultaneously be in two categories. They are competing risks. A cumulative incidence analysis is appropriate for this kind of data.

An example from the health care industry may help to further clarify the concept of a competing risk. In large scale drug trials, pharmaceutical companies frequently need to know whether a particular drug is effective in reducing a patient's risk of death from a particular disease – say heart attack. To determine the effectiveness of this drug, researchers might

randomly select a group of patients who does not receive this drug and compare their survival rates to a group of patients who does receive it. Researchers will then collect longitudinal data to determine the risk of survival in each group, given the passage of time. To measure the effectiveness of this drug, however, researchers need to distinguish deaths due to heart attack from deaths due to other causes. Patients who participate in such trials may suffer from several different diseases. However, their deaths will only be caused by a single event. For example, a patient may have diabetes and heart disease. If the person dies from heart attack, the drug failed. If the person dies from a cause that is directly related to his diabetes, then the drug did not fail. These different causes of death may be categorized as "competing risks."

In the study presented in this chapter, three different educational outcomes are treated as competing risks. A student can leave the college due to any of three, mutually exclusive causes. The student can leave higher education without completing any credential. The student can leave the community college by completing an associate's degree (or in a small number of cases, a certificate). The student can transfer to a four-year college without completing an associate's degree.

In conducting this analysis, the "marginal probability" of each event will be computed for each treatment. That is, it is the proportion of all students in the cohort who experienced a given outcome, regardless of whether they experience one of the other competing events. In this analysis, the treatment is students' major. The marginal probability is the proportion of all students who experienced an event, given that they did not experience any of the other two events in a previous semester. To compute this probability, the proportion of students who experience a given event at a given time will be compared to the number of students

who are enrolled at the outset of that time. Ordinarily, a study of this type would focus on a single event (dropout for example) and present the cumulative incidence of this one event for each of the treatments under consideration. In this study, all three events are of interest. Hence, this chapter will present the cumulative incidence of all three events in a series of eight stacked area graphs, one for each major. This will permit a descriptive analysis in which the risk profile for one set of programs is compared to that of another visually. Computation of cumulative incidence involves several steps. These are detailed in the box on page 175.

As mentioned earlier, the purpose of this chapter is to study the effects of students' major on their chances of experiencing each of three different outcomes: dropping out of higher education, completion of a two-year degree, or transfer to a four-year college. However, while students' choice of a major likely does have an important impact on their chances of experiencing these events, other factors also play a role. In particular, theory and research suggest that a student's age, proficiency in English and math, and academic performance at the two-year college will have a significant impact on that student's odds of experiencing each event. Hence, it is necessary to control for these variables in some way. To accomplish this goal, the analysis presented in this chapter will be conducted in three parts. The first two parts will focus on the relationship between students' major and each of the three outcomes described above, controlling for age and GPA. In particular, the first part will focus on outcomes attained by students aged 19 and younger as of their first term at the college. The second part will focus on outcomes attained by students aged 20 and up. The third part will ignore students' major and focus on the relationship between students' proficiency in

Box 5: Summary of a Method Used to Calculate the Cumulative Incidence of an Event

Several steps are required to compute the cumulative incidence that an event will take place. In step one, the number of students who are at risk for experiencing an event at a given time is determined. This is equal to the total number of students who have not experienced the event as of the start of the present time period. At the outset of the study (fall 1998), the risk set consists of all students in the cohort. During any subsequent semester, it consists of all students who have not transferred, dropped out or completed an associate's degree during any of the previous time periods.

Once the risk set has been calculated, it is necessary to calculate the hazard rate for the particular event under consideration. This is done by dividing the number of individuals who experienced a particular event (say dropping out of college) in a particular time period by the number of individuals in the risk set.

Once the event-specific hazard rate has been computed, it is necessary to compute the probability that an individual will have survived all of the competing events in all prior time periods. This is accomplished in two steps. First the number of individuals who experienced each of the competing events under study is calculated. This number is divided by the number of subjects who are at risk for experiencing the event in the time period under consideration. This percentage is subtracted from one and multiplied by the overall survival rate as calculated in the previous time period.

The event-specific hazard rate is then multiplied by the overall survival rate to yield the incidence of the event in a particular semester. The incidence of the event in a given semester is then added to the incidence in all prior terms to yield the cumulative incidence.
As an example, consider the following.

Time	At Risk	Drop out	2-Year Dgr.	Transf-er	Hazard Drop	Survive All	Inci-dence	Cum. Inc.
0	1000	0	0	0	0	1		
1	1000	50	0	20	50/1000	(1-(70/1000))*1=.93	.047	.047
2	930	55	0	25	55/930	(1-(80/930))*.93=.85	.050	.097

In this example, we wish to calculate the cumulative incidence of dropping out. To do this, we first calculate the specific hazard of dropping out in each time period. In time period 1 this is equal to the number dropping out divided by the total number at risk: 50/1000. To calculate the overall survival rate, we sum up the number who transferred, dropped out or completed an associate's degree during the time period under consideration, subtract this from one and multiply it by the survival rate in the previous time period. In time 1 this is equal to (1 – (50 + 0 + 20)/1000 * 1): .093. The incidence is equal to the specific hazard times the overall survival rate. In time 1, this is equal to .05 * .97 or .0465. The cumulative incidence is equal to the incidence in the present term plus the incidence in all prior terms. In term 1, this equals .0465 + 0.

English and their chances of obtaining each of the three outcomes described earlier. To control for academic performance at the two-year college, analyses in each of these three parts will focus exclusively on students who have GPAs exceeding 2.00 as of their final semester at the college.

Population under analysis. During fall semester 1998, the college under study in this chapter enrolled 4,454 first-time students. These students ranged in age from 15 to 76 years of age. Students in this cohort enrolled at the college for varying lengths of time,

ranging from a single semester to (1,054 students) to fifteen or more semesters (43 students). As determined by the number of credits attempted as of their last semester at the college, these students were pursuing a wide range of career goals. Of those students who had clearly signaled a vocational interest, the vast majority were preparing for jobs in business or the health careers. However, a large number of students – nearly 2,500 – had not taken a single course in the vocational curriculum as of their final semester at the college. Of the students in this cohort, 2,723 had earned a GPA exceeding a 2.00 as of their final semester at the college. These students left the college at various points in their educational experience. Overall 50% of these students left the postsecondary education system without completing a degree, 19% completed an associate's degree, and 22% transferred to a four-year college without first completing an associate's degree. An additional 4% had transferred to a two-year college upon completing their last semester at the college under study. The analysis conducted in this chapter will treat these latter students in the same way it will treat those who were still enrolled at the college as of Fall/Spring 2006, dropping them from the analysis

(censoring them) as of their last semester at the college. Summary statistics on students in this cohort are presented in the following table.

Table XXI: Percentage of Students Experiencing Each of Three Outcomes, By Students' Major as of their Last Semester at the College Under Study

Major	# Students	% Drop Out	% Complete Associate's Degree/ Certificate	% Transfer without Associate's Degree	% Transferred to 2-Year College/ at study School in AY 2006
Credentialing Business Tech.	623	52%	23%	14%	10%
Non-credentialing Business Tech.	112	60%	24%	6%	10%
Credentialing Health Careers	107	16%	77%	1%	7%
Non-Credentialing Health Careers	153	50%	26%	8%	17%
Engineering	43	51%	21%	16%	12%
Automotive Technology	54	70%	24%	2%	4%
Public Service Tech.	165	65%	18%	12%	6%
Arts and Science	1036	41%	14%	38%	7%
Other	444	67%	5.2%	15%	13%
Total	2,723	50%	19%	22%	9%

4.6 Results of the Analysis

Younger Students (aged 20 and below as of their first semester in college) Results of this analysis suggest that students do consider the job market when deciding on whether to persist for an additional semester in college. Students who are preparing for jobs that place a

strong emphasis on a particular credential tend to complete that credential. Students who are preparing for jobs that can be reached by a number of paths tend to prepare for their careers in a number of different ways. Of the eight majors considered in this analysis, training requirements are the most stringent in the credentialing health careers. To obtain employment in these occupations, students must complete an associate's degree and pass a licensing or certification examination. It was, therefore, hypothesized that students who majored in these subjects would be quite likely to complete an associate's degree and quite unlikely to dropout or transfer. Results of this analysis support this hypothesis. The cumulative risk of completing an associate's degree in the health careers after 16 semesters of enrollment was 76% among students aged 19 and younger. The risk of dropping out over this period was 21%, and the incidence of transfer was 0%.

In contrast to the credentialing health careers, some programs offered at the community college tend to prepare students for jobs that require less than an associate's degree. According to the department of labor, for example, many jobs in the public service technologies require only some on-the-job training. Jobs in the "non-credentialing" health careers, such as emergency medical technicians, may require only a "postsecondary vocational award." Consistent with these observations, students who majored in these subjects are more likely to drop out of college than are those who are preparing for jobs in which the entry requirements are more stringent. The cumulative risk of dropping out among public service technologies students is 53% after 15 semesters. The risk among automotive

Figure 14: Cumulative Risk of 3 Outcomes Occurring Among "Credentialing" Health Careers Students Ages 15-19

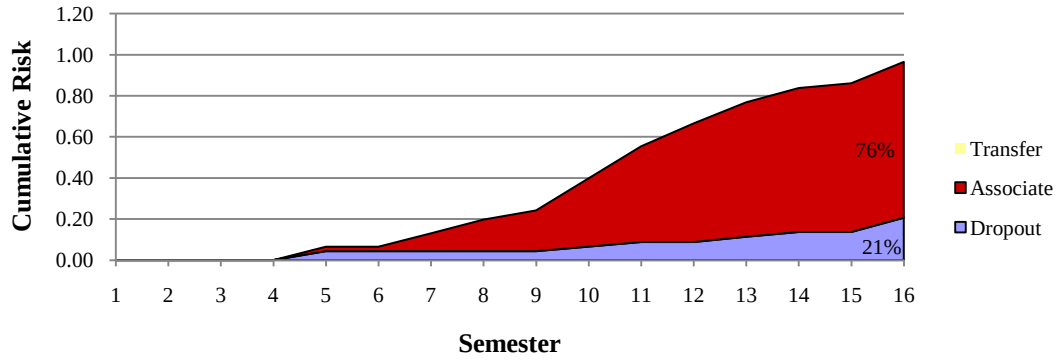


Figure 15: Cumulative Risk of 4 Outcomes Occurring Among "Non-credentialing" Health Careers Students Ages 15-19

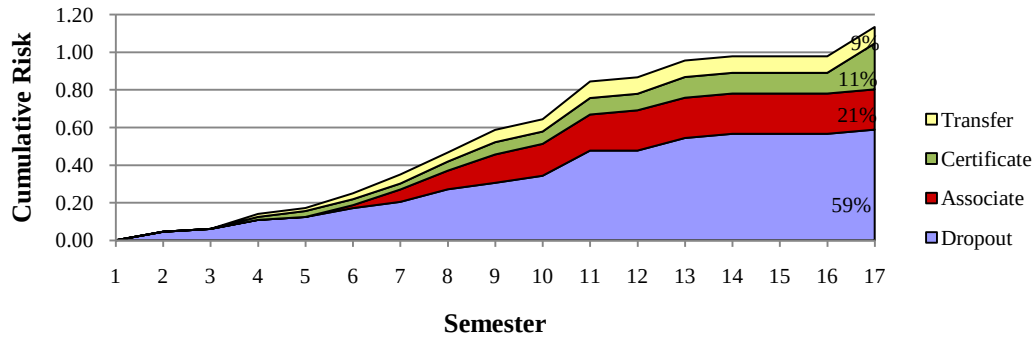


Figure 16: Cumulative Risk of 3 Outcomes Occurring Among Arts and Science Students Ages 15-19

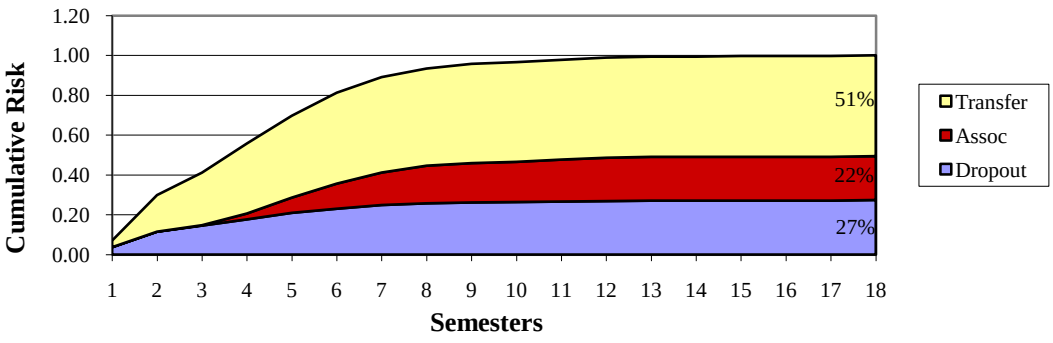


Figure 17: Cumulative Risk of Three Outcomes Occurring Among Credentialing Business Students Ages 15-19

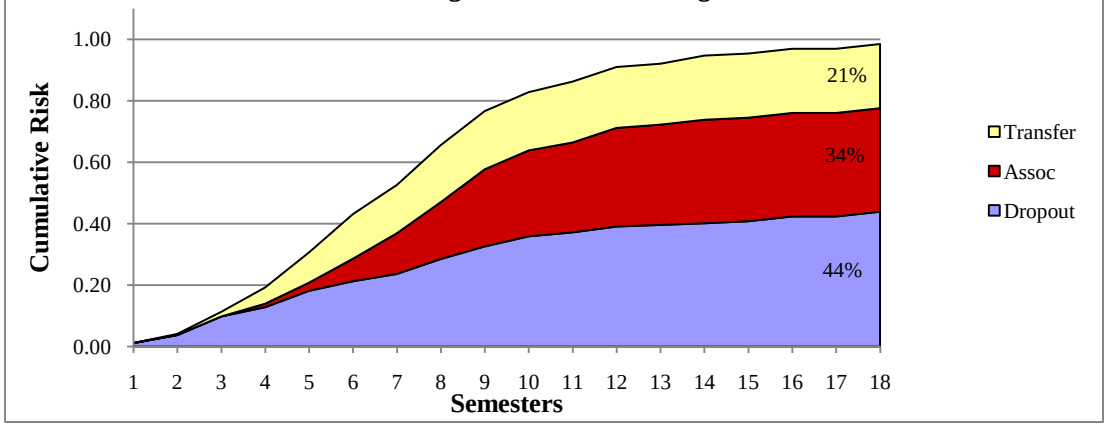


Figure 18: Cumulative Risk of Three Outcomes Occurring Among Non-credentialing Business Students Ages 15-19

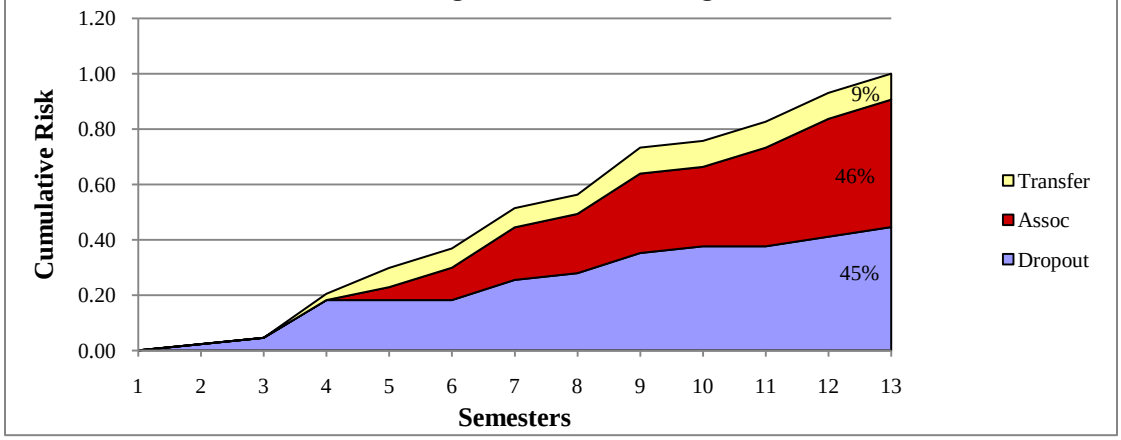


Figure 19: Cumulative Risk of 3 Outcomes Occurring Among Engineering Tech. Students Ages 15-19

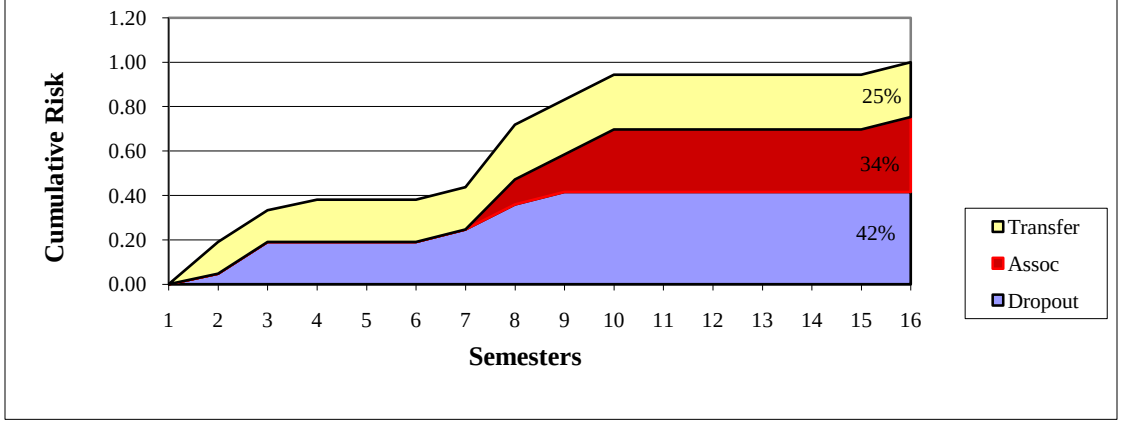


Figure 20: Cumulative Risk of 3 Outcomes Occurring Among Public Service Tech. Students Ages 15-19

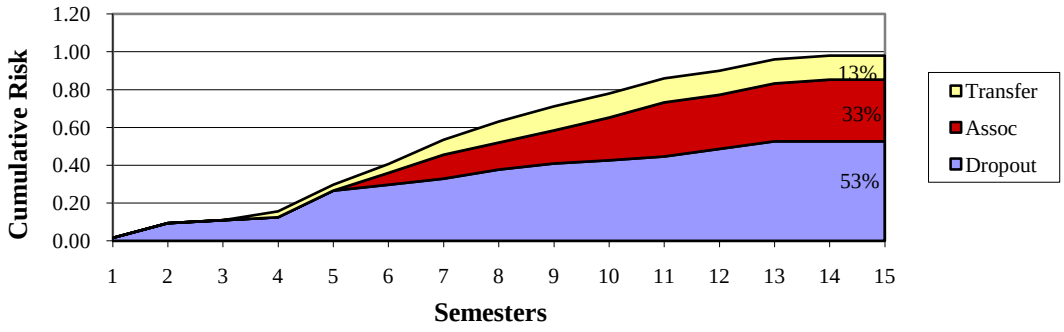
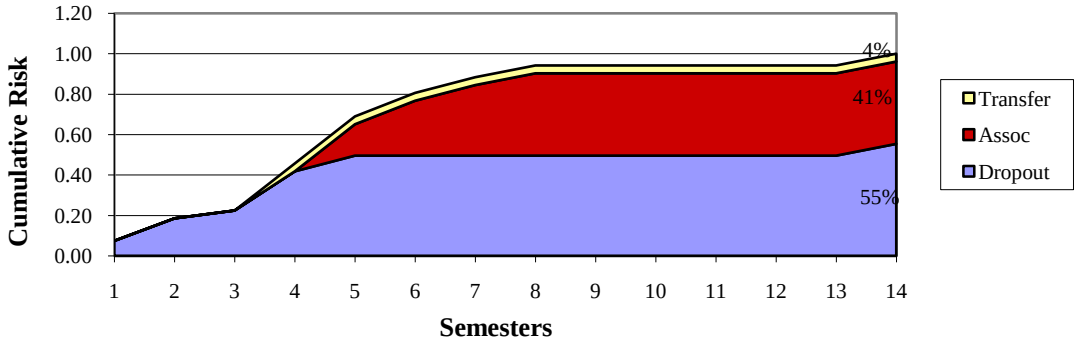


Figure 21: Cumulative Risk of 3 Outcomes Occurring Among Automotive Tech. Students Ages 15-19



technology students is 55% after 14 semesters[15], and the risk among students in the non-credentialing health careers is 59% after 17 semesters.

Dropout rates in some other subjects fell between those in the credentialing health careers and the automotive technologies. Due to the large number of managerial jobs that require a bachelor's degree or higher, it had been expected that transfer rates in the credentialing business technologies would be high and that dropout rates would be low. Results of this analysis partially support this hypothesis. Reflecting the large number of managerial jobs

[15] Please note that in counting the number of semesters in which students were enrolled, I included summer terms.

that require the bachelor's degree, the cumulative risk of transferring to a four-year college after 19 semesters of enrollment was 21%. This was more than double the rate (9%) achieved by students in the non-credentialing business technologies. However, it was well below the rate (51%) achieved by arts and sciences students. Conversely, the dropout rate among students in the credentialing business technologies was considerably higher than had been expected. The cumulative risk of dropping out for students who majored in this subject was 44% after 19 semesters at the college. By contrast, the cumulative risk of dropping out for students in the non-credentialing business technologies was 45% after 13 semesters. Among students in the arts and sciences, the risk was 27% after 18 terms at the college.

Results in credentialing business technology may partially reflect the mix of jobs for which students in these majors can, potentially, prepare. In dividing the business programs into credentialing and non-credentialing majors, I sought to distinguish majors that primarily prepare students for jobs that require a bachelor's degree from jobs that do not. In creating these categories, I attempted to divide the business programs into two fairly homogeneous groups, each containing a number of different occupations requiring similar amounts of training. Majors listed in the credentialing business technologies were similar in that they were more likely to prepare students for jobs that required a bachelor's degree or higher. Majors listed in the non-credentialing business technologies were similar in that they were more likely to prepare students for jobs that require less than an associate's degree. Unlike the programs in the health careers, however, the educational requirements of jobs that pertained to these majors varied considerably – even within these two categories of credentialing and non-credentialing programs. As a result, my expectations regarding the transfer behavior of credentialing business students may have been unrealistically high.

As an example, the Real Estate program offered at the community college under study in this chapter was defined as a "credentialing" business program. According to the Department of Labor (Occupational Supply Demand System), students who major in this subject can potentially qualify for four positions. Two of these, property managers and real estate appraisers, require the bachelor's degree. The other two occupations, real estate sales agents and real estate brokers, require less than the associate's degree. Because this major does prepare students for jobs that require the bachelor's degree, it was classified as a credentialing business technology. However, many, if not most, of the students who major in real estate at the community college under study in this dissertation are probably preparing for careers as real estate agents or brokers. To the extent that these jobs do not necessarily require a college degree, students who wish to have careers in these areas have an incentive to leave college without completing a degree. Some students in this major may seek careers as property managers or appraisers. However, these students comprise only a fraction of those who major in this subject. The presence of students preparing for these jobs in the baccalaureate job market increases the risk of transferring. However, it is offset by "dropout" behavior of those pursuing other goals.

Similarly, while the college's program in business management does prepare students for a number of jobs that require the bachelor's degree, it was expanded during the period of this study to include courses formerly listed under the office administration program. Hence, students enrolled in this program are not only preparing for position that will ultimately require them to complete a bachelor's degree, but also for clerical positions requiring an associate's degree or less. Given these realities, the results of this analysis suggest that while

students in the credentialing business programs show a general tendency to prepare for positions in the baccalaureate market, they are not focused exclusively on this market.

Results in the engineering technologies were very similar to those among business students. However, it is likely that students in the engineering technologies responded to a somewhat different set of incentives than did those in the business program. In contrast to the business program, employers place a strong emphasis on the associate's degree when hiring engineering technicians[16]. As mentioned earlier, an analysis of training requirements of program-related jobs in the engineering technologies suggests that 80% of the jobs for which students at this college were likely preparing required the associate's degree. As a result, the rate of degree completion among engineering students was expected to be relatively high. Despite these expectations, the cumulative risk of completing an associate's degree in engineering was only about 34% after 16 semesters of enrollment. This compares to a rate of about 76% in the credentialing health careers. Why the difference? One reason may be the existence of substitute jobs requiring both more and less than the two-year degree. On the lower side of the skills continuum, employers in a number of industries require the services of qualified drafters. These positions include architectural drafters, electrical/electronic drafters and mechanical drafters. According to the U.S. Department of Labor, a worker in one of these positions in the state of Ohio could have expected an annual salary in the range of $39,000 to $42,000 in 2007. The typical training requirement for these positions is a "postsecondary vocational award." An examination of courses completed at this community college by engineering dropouts reveals drafting and computer assisted

[16] This college offered four programs in engineering technology during the period in which this study was conducted: architecture and construction technology, electrical-electronic engineering technology, mechanical engineering technology, and manufacturing/industrial technology. According to the Occupational Supply Demand System, these programs prepared students for positions as Engineering Technicians. According to the OSDS, to qualify for these positions, the applicant must typically possess an associate's degree.

drafting (CAD) courses were among the engineering courses most frequently completed by such students. These results suggest that a number of these students enrolled at the college with the intention of taking jobs in the engineering field and left to take jobs in the drafting of CAD fields. On the higher side of the skills continuum, bachelor's degree engineers can earn substantial incomes. Hence, students who did well in their community college engineering courses would have a strong incentive to transfer to a four-year college. The net result is that cumulative risk of dropping out of an engineering program after 16 semesters was 42%. The risk of transferring was 25%.

Results in the arts and sciences offer a stark contrast to outcomes experienced in the other majors. Unlike the other programs offered at this college, the associate of arts program was not designed for the purpose of enabling students to enter a specific career upon the completion of their degree. Rather, it was designed to provide students with the first two years of a bachelor's degree. Students who complete this degree do not, for the most part, take courses in a vocational area, taking the majority of their courses in the traditional liberal arts. Once they have transferred, students may specialize in a particular subject area in which they intend to find a job. Given the lack of a specific vocational orientation in their community college courses, it is difficult to identify the actual training requirements of the jobs students hope to attain. Regardless of their intended career goal, students in this cohort do not seem to feel that this curriculum will lead to a high paying job in the sub-baccalaureate job market. The cumulative risk of transferring to a four-year college after 18 semesters at the college was 51%. The risk of completing an associate's degree was 22%, while the risk of dropping out was only 27%. Given these results, it is likely that a connection does exist between students' major and their chances of experiencing these three

events. However, given the range of jobs for which students could be preparing, this connection is not as strong as one might like.

Older Students (Ages 20 and up as of their first semester at the college) Human capital theory suggests that dropout rates should be higher among older students than they are among those aged nineteen and under. Older students are likely to have obtained a good deal of productivity-enhancing on-the-job training, which is unavailable to the very young. As a result, the opportunity cost of completing an additional semester of class is likely to be higher than it is among younger students. In addition, older students have fewer years over which to recoup their investment than do younger students. Hence, older students have a strong incentive to spend as little time in college as possible. It was, thus, expected that older students would be more likely to dropout and less likely to transfer or complete an associate's degree than their younger counterparts.

Results of this analysis tend to support this hypothesis. Event profiles for students aged 20 and up differ significantly from profiles for students ages 19 and younger. In general, dropout rates were higher, graduation and transfer rates lower for these students than they were for younger ones. The one exception appears to be the health careers. The cumulative risk of dropping out for older students in the credentialing health careers programs remained low across all terms. Older students' risk of dropping out was higher than the risk for younger students during semesters 1-10. However, it was actually lower in semesters 14-16 than it was for younger students. In particular, the cumulative risk of dropping out for older students was 12% as of term 17. This compares to a rate of 21% among students aged 19 and younger during the last term in which one of these students was enrolled for classes. Conversely, the graduation rate for students in the older age groups was higher than it was

Figure 22: Cumulative Risk of 3 Outcomes Occurring Among "Credentialing" Health Careers Students Ages 20+

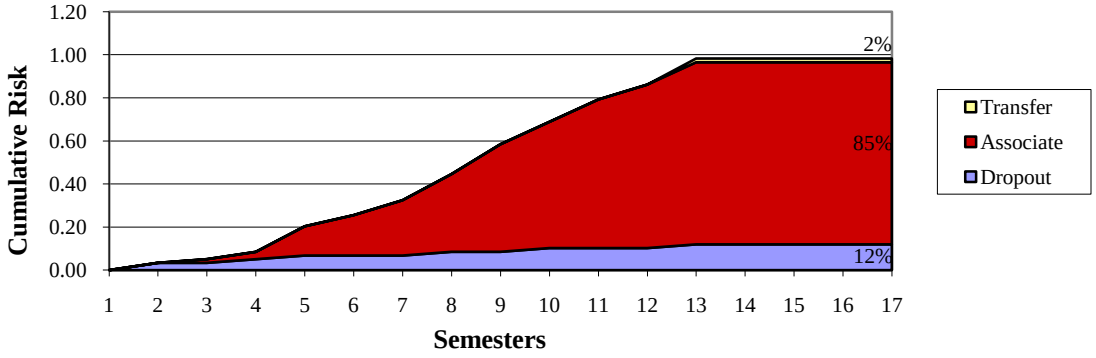


Figure 23: Cumulative Risk of 4 Outcomes Occurring Among "Non-credentialing" Health Careers Students Ages 20+

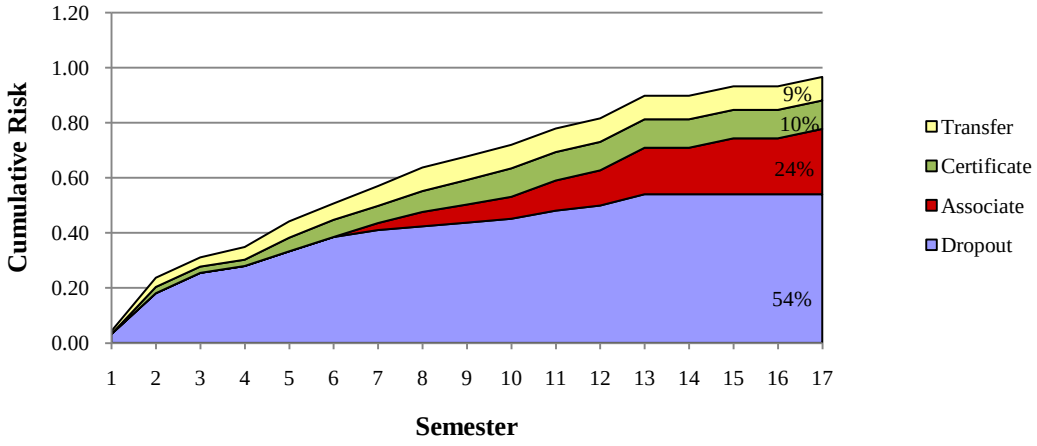


Figure 24: Cumulative Risk of 3 Outcomes Occurring Among Arts and Science Students Ages 20+

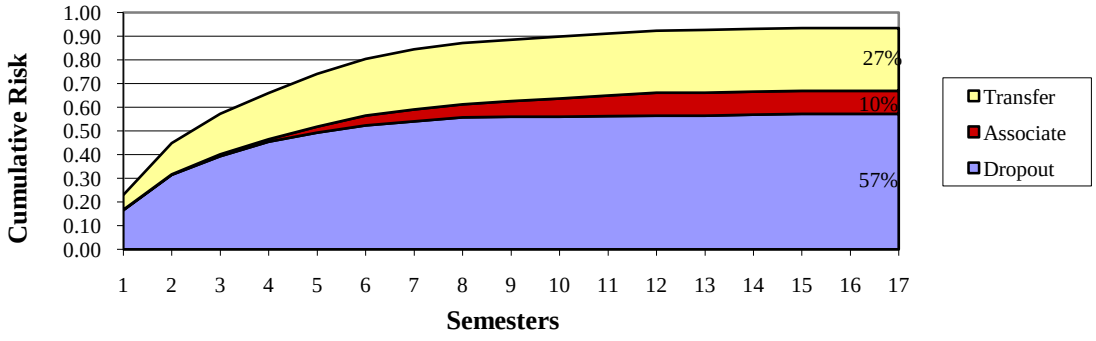


Figure 25: Cumulative Risk of 3 Outcomes Occurring Among Credentialing Business Students Ages 20+

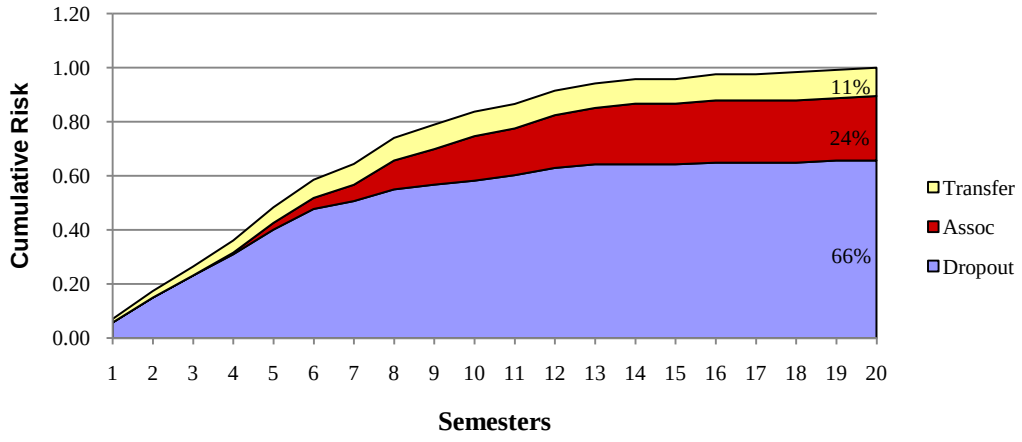


Figure 26: Cumulative Risk of 3 Outcomes Occurring Among Non-Credentialing Business Students Ages 20+

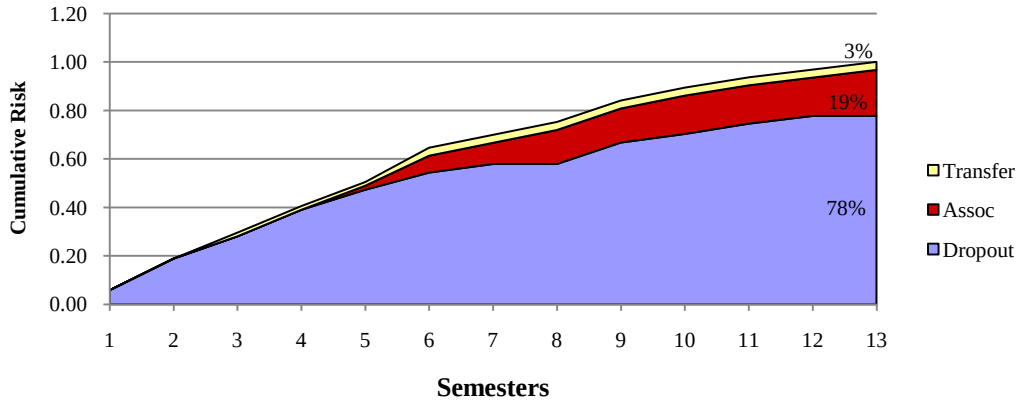


Figure 27: Cumulative Risk of 3 Outcomes Occurring Among Engineering Tech. Students Ages 20+

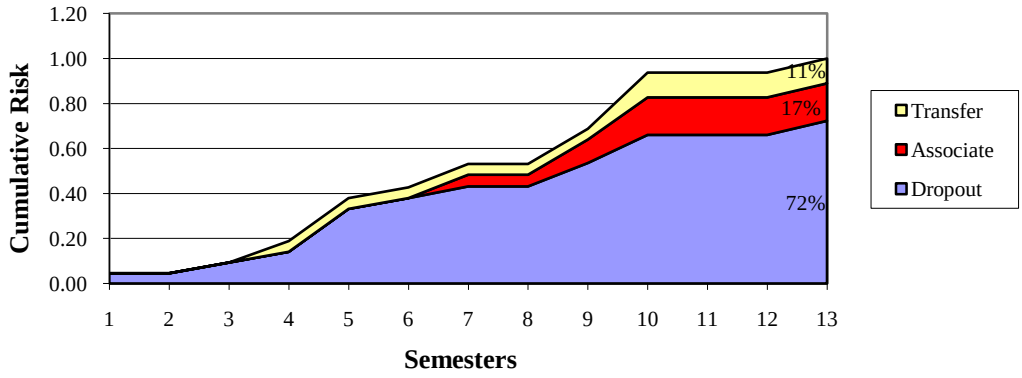


Figure 28: Cumulative Risk of 3 Outcomes Occurring Among Public Service Tech. Students Ages 20+

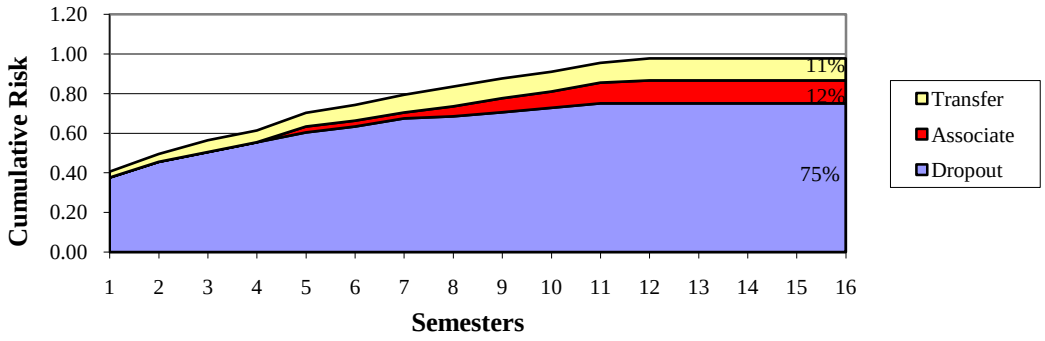
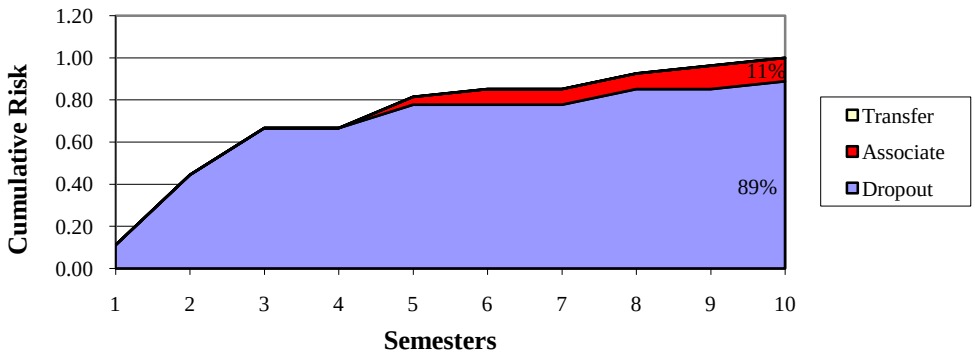


Figure 29: Cumulative Risk of 3 Outcomes Occurring Among Auto Tech. Students Ages 20+



for younger students who majored in this subject. As of semester 17, the cumulative risk of completing an associate's degree was 85% for the older students, compared to a risk of 76% for the younger students. Similarly, in the non-credentialing health careers program, the cumulative risk of dropping out was slightly lower (54% after 17 semesters) among older students than it was among younger ones (59% after 17 semesters).

On the whole, however, older students were much less likely to complete an academic credential than were younger students. Whereas credentialing business majors in the younger age group had a cumulative risk of completing an associate's degree of 34%, the risk

of graduation among older students was only 24%. The risk of transferring among these students dropped from 21% to 11%. Similarly, the risk of transferring among students in the non-credentialing business technologies dropped from 9% to 3%, while the risk of completing an associate's degree dropped from 46% to 19%. Among students in the engineering technologies, the risk of graduation dropped by 17% (from 34% to 17%) and the risk of transferring dropped by 14% (from 25% to 11%). Among students who majored in the public service technologies, the risk of transferring dropped only slightly, from 13% to 11%. However, the risk of completing an associate's degree dropped by 21%, falling from 33% to 12%. Among students in the arts and sciences, the marginal probability of transferring dropped from 51% among younger students to 27% among those aged 20 and up. Incidence curves for students for students aged 20 and up appear in Figures 22-29.

Differences in these rates likely stem from differences in the number of ways by which a person can obtain the human capital needed to perform a job in which he or she is interested. Due to strict licensing and certification requirements, students who seek careers in the credentialing health career must complete a two-year program in order to gain entry into the occupation. Regardless of students' age, those who seek entry into these career fields must complete a degree. As a result, the odds that a group of students will drop out of such a program are very low, no matter how old the students may be. By contrast, employers are much more willing to consider other sources of human capital when filling jobs in other occupations. In particular, employers may be quite willing to hire a person in many positions if they have obtained relevant experience on a similar job.

However, students differ in their access to various alternative sources of training. Younger students are less likely to have obtained any significant on-the-job training than are

older ones. The postsecondary education system is the most easily available source of training for these younger students. In addition, these students have fewer work and family responsibilities than older students. Hence, they are more likely to complete an associate's degree or to transfer to a four-year college than are older students. Conversely, older students may have been working for a number of years. In the course of their careers, they have likely obtained a good deal of human capital. These students attend the community college mainly to obtain some specific knowledge which they can combine with skills and knowledge they have already obtained. Such students may also have significant work and family responsibilities. Competing pressures from other responsibilities act as an additional disincentive, discouraging them from completing a degree.

Developmental education. The developmental education curriculum can be thought of as a special case of the arts and sciences. Although the college does not offer a degree in "developmental education," many students enter the college with serious deficiencies in English and math. Such students may need to take several courses in either or both of these two subjects before completing a degree. The developmental education curriculum includes courses oriented for students at various levels of deficiency. Students who place at the lowest developmental English or math differ a great deal from students who place at the college level in these subjects. As a result, students who start their college education at the lowest levels of these subjects would appear to be much more likely to drop out of college and much less likely to complete a degree or transfer to a four-year college than would students who start their careers at higher levels.

Figure 30: Cumulative Risk of 3 Outcomes Occurring Among Students who took English 0980 as their first English Course

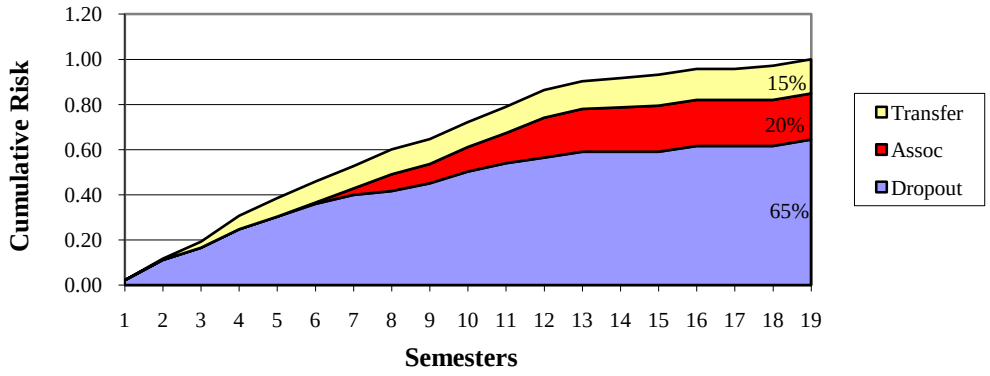


Figure 31: Cumulative Risk of 3 Outcomes Occurring Among Students who took English 0990 as their first English Course

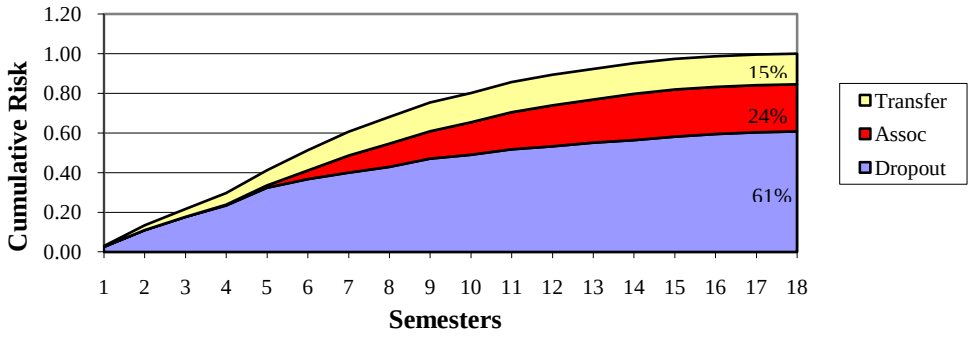
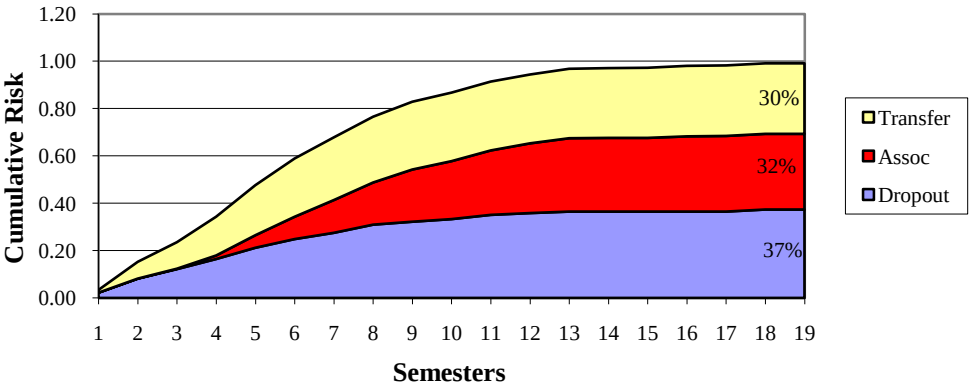


Figure 32: Cumulative Risk of 3 Events Occurring Among Students who took English 1010 as their first English Course



The graphics presented in Figures 30-32 support these hypotheses. These graphics summarize students' risk of achieving each outcome, given that they started their education by taking a particular English course. In particular, Figure 30 presents data on students whose first English course was at the lowest developmental level. Figure 31 presents data on students who first English course was at the highest level, and Figure 32 presents data on students who started off in the traditional freshman English course. Looking only at students who had a cumulative GPA of 2.00 or higher as of their last semester at the college, these figures reveal that the outcomes profile for students in the developmental curriculum differs a good deal from the profile for students who enter at the freshman level. Not only are dropout rates considerably higher for students who start at the developmental level than they are for those who start in freshman English, but the pattern of these rates differs for students placing at these three levels of English proficiency.

Dropout rates for students who start their educations in freshman English tend to level off after 9 or 10 semesters, whereas the dropout rates for developmental students rise steadily through terms 18 and 19. In addition, success rates for students who start at the highest developmental level of English are much closer to rates among students who start in the lowest level of English than they are to students who start at the freshman level. As mentioned earlier, the college's developmental English/math offerings can be considered to be part of the arts and science curricula. However, all students who wish to complete a college degree –two-year or four-year – must complete some courses in these subjects. Students with weak skills in English and mathematics may gravitate towards programs that prepare their students for jobs that require less than the associate's degree. To the extent they

do, students will have at least two incentives to quit the college without completing a degree – one from the job market and one from their own discomfort with academic work.

4.7 Discussion

This chapter contains a descriptive analysis of the relationship between students' major and their likelihood of achieving each of three different outcomes: dropping out, completing an associate's degree, and transferring to a four-year college without completing an associate's degree. In an effort to improve upon existing models of student persistence at the two-year college, this analysis has sought to assess the role of students' job and career goals in determining their chances of completing a degree. Results of this analysis suggest that student persistence among community colleges may depend to a large extent on the educational requirements of the jobs that students are preparing for. Although all associate's degree programs offered at the community college, in theory, prepare students for jobs that require two years of formal training, training requirements vary significantly from one program to another. Certain jobs in the health sciences place a very strong emphasis on the completion of an associate's degree. Jobs in the public service technologies, for the most part, require less than an associate's degree. Other program clusters prepare students for jobs with varying educational requirements. It was hypothesized that student persistence would vary with the training requirements of the jobs for which students were actually preparing.

Results of this analysis suggest that the theory of student persistence can profitably be expanded to incorporate concepts from human capital theory. Not only did student persistence reflect the educational requirements of the jobs for which they were preparing,

but persistence patterns differed greatly across age groups. Students who majored in subjects that prepared them for jobs requiring an associate's degree or higher tended to complete degrees or transfer to 4-year colleges. Students who majored in subjects that prepared them for jobs requiring less than the associate's degree tended to drop out of higher education after completing only a few semesters. With the exception of those who majored in the credentialing and non-credentialing health careers, older students were much more likely to drop out of college than were younger students. Taken together, these findings suggest that students do consider the educational requirements of the jobs for which they are preparing when they make the decision on whether or not to continue in college. However, students' chances of achieving a given outcome also depend on the amount of human capital they have already obtained as of the time they start their educations and by the number of ways in which they can obtain skills and knowledge needed to achieve their career goals. Students who have little work experience are likely to complete a degree, even if they are preparing for jobs that do not necessarily require one. Conversely, students seeking jobs requiring less than the associate's degree are less likely to complete one if they have already obtained relevant skills and knowledge through prior work experience. These students use their college courses mainly to augment human capital they have already obtained. Students who are preparing for jobs which require the job seeker to complete a degree are very likely to complete one – no matter how much related experience they may have obtained. No matter what the students' goal job or what their human capital endowment, their chance of completing a degree is also constrained by their personal experiences. In particular, frustrations experienced by students who enter the college with poor preparation in English or math may prevent many students from completing a degree.

If community colleges are to increase the number of students who complete the degrees they offer, they must develop policies that reflect the full range of costs and benefits that confront their students. In doing so, they must consider both the pecuniary and psychic costs incurred and benefits expected by their students. These costs include the opportunity cost of a semester of courses, the psychic cost incurred by students who have been unsuccessful in previous coursework, and the psychic cost of balancing a hectic work and family schedule. Beyond the cost of their education, results of this study suggest that colleges may need to do a better job of increasing students' expectations of the likely benefits of completing a degree. In order to achieve this goal, community colleges must come to a clearer understanding of the requirements of the two major markets for which their students are preparing: the sub-baccalaureate and the baccalaureate job markets. Of particular importance, results of this study suggest that community colleges need to come to a better understanding of the needs of the sub-baccalaureate labor market. If employers who hire students for positions that require less than the bachelor's degree do not have a strong preference for the associate's degree, students do not have a strong incentive to get one. Such students are more likely to drop out than they would be if these employers placed a strong emphasis on the two-year degree. With the exception of certain jobs in the health careers, most of the jobs for which vocational students are preparing require less than an associate's degree. Yet students who have completed a carefully structured body of coursework have intellectual tools to draw upon that are unavailable to those who have only completed a course or two. What can be done to increase the value students assign to the courses they complete at the community college? Results of the current study suggest the following.

- **Provide students with better information regarding the range of careers that are available to them upon completion of a degree**. Many students who enter the community college have only a vague idea of the range of jobs that are available to those who complete a given program. Such students believe that a college education will enable them to increase their incomes over time. However, they do not associate a college education with a specific career. Because they do not, they are unable to make a realistic estimate of the earnings increase they will likely receive upon completing a degree. Benefit/cost comparisons of these students are likely to be low. Hence, they are more likely to drop out than are students with more definite goals.

  The community college can increase the odds that these students will complete a program by providing them with information needed to form more concrete goals. In particular, students might benefit from information regarding the kinds of activities performed by workers in various jobs, the skills required to perform these jobs, and the income typically earned by those who hold them. Combined with information on the educational programs needed to prepare for a career, this information would give students a stronger incentive to complete a given program than they might otherwise have. In so doing, this information would reduce the number of students who quit the college without completing a coherent body of study.

- **Give employers a stronger role in the development of the curriculum**. One reason why many employers do not seek workers who have completed the associate's

degree is that many such programs do not provide their students with the skills that employers seek when filling positions in the sub-baccalaureate market. Research (Rosenbaum, Deil-Amen, and Person, 2006) suggests that while the community colleges do seek the views of employers when building their curricula, they do not explicitly use these contacts to enhance the employability of their students. According to this research, community college faculty do meet with employers to identify industry trends that affect their curricula. However, these advisory committees do not necessarily meet on a regular basis. Employers on these committees may not hire community college graduates. Community college faculty do not necessarily use these committees to obtain information about the kinds of skills that employers seek when filling jobs at the sub-baccalaureate level. The net result: employers do not seek individuals who have completed an associate's degree when filling jobs that might require it.

In order to counteract this trend, community colleges may need to involve employers more directly in the educational process than they currently do. By interacting more intensively with employers, the community colleges will obtain better information on the kinds of skills employers require when hiring workers. This will permit them to tailor their programs to more directly meet the needs of employers. In addition, a relationship may be established between the program and the employer that students can draw upon when they complete their program. The availability of such a linkage could provide an additional incentive to students, thereby increasing their chances of graduating (Person and Rosenbaum, 2006).

- **Consider the effects of age on persistence when creating services aimed at increasing persistence**. Results of this analysis indicate that students' odds of completing a degree depend to a large extent on their age. Older students are less likely to complete an associate's degree than are younger students. They are much less likely to transfer than are younger students. These differences in student behavior result from differences in the incentives that confront students at different points in the life cycle. Given the strength of these incentives, community colleges may need to tailor the programs they design to the needs of students in various age groups. Persistence programs targeted toward younger students may place a greater emphasis on transfer programs and integrating students into campus life than those oriented toward older students. Programs oriented toward older students may place a greater emphasis on short-term programs designed to provide the student with skills needed for a particular job.

CHAPTER V

CONCLUSION

This dissertation has sought to present an alternative model of student persistence at the community college. Over the past few decades, the community colleges have come under close scrutiny, due in part to the continuing low graduation rates –both two-year and four-year – of their students. Analysts have invoked a number of theories to account for the low graduation rates among community college students. These models have provided policy makers with a set of tools that can be used to reduce the percentage of students who leave these institutions without completing a credential – associate's degree, bachelor's degree or certificate. In particular, Tinto's model of student persistence suggests that the high rate of dropout among students who attend the community colleges results from an incongruity between students' needs and the academic and social systems of the schools they attend. In order to reduce these incongruities – and hence dropout rates – community colleges are encouraged to develop policies which increase students' engagement in the academic and

social systems of the college they attend (Community College Survey of Student Engagement). Such recommendations have considerable merit.

However, a careful consideration of Tinto's model of student dropout reveals several shortcomings as this theory applies to the community colleges. Tinto's concepts of academic and social integration may provide useful information about the relationship between students' on-campus experiences and their likelihood of dropping out of college. However, community college students do not typically reside on-campus. As a result, students' off-campus experiences with the family, neighborhood, and workplace may have a greater impact on their enrollment decisions than do their on-campus experience. Perhaps more important, Tinto's model assumes that the job outlook in students' chosen career fields are stable over time. This assumption may not hold true for a number of job markets typically served by the community colleges. In particular, it may not hold for many of the vocational programs which prepare students for jobs requiring less than bachelor's degree.

According to Grubb (1996; 2002A; 2002B) programs offered at the community colleges prepare students for two general kinds of jobs: (1) jobs that require a bachelor's degree; (2) jobs that require less than the bachelor's degree. In Grubb's view, these markets function in different ways. Employers who fill jobs requiring a bachelor's degree tend to place a strong emphasis on the completion of a degree when hiring new employees. Conversely, employers who fill jobs requiring less than the bachelor's degree place much less emphasis on the completion of a degree. While employers who fill these positions are not averse to considering an inexperienced worker who possesses an associate's degree, they place a greater emphasis on industry-specific (or even firm-specific) experience than they do on formal education when filling these jobs. Students who enter the community college with the

intention of completing an associate's degree may find out once they are enrolled that employers do not require the credential they are pursuing. To the extent they do, their expectations may change, and with them their goals. In this sense, these job markets are unstable and Tinto's concepts of academic and student integration do not hold. Hence, while Tinto's model may provide some useful policy guidance, community college leadership may benefit from a model that more directly assesses the impact on job market conditions on students' enrollment behavior. Human capital theory provides a ready vehicle for including these conditions.

This dissertation has sought to assess the impact of job market incentives on students' decisions to persist in college. Using data on a cohort of students who first enrolled at a community college in fall 1998, this study has sought to find out whether a relationship exists between students' major and the likelihood that they would achieve each of three outcomes, controlling for a number of other costs and benefits that are likely to have an impact on student persistence. In constructing these models, this dissertation has used human capital theory to explain the phenomenon of student persistence at a community college. According to this framework, student persistence at the community college results from a comparison of the costs and benefits of going to school. According to this model, students treat the decision to attend college as an investment in human capital. In making this decision, students conduct some initial analysis of the range of careers that are available to them, factoring in the earnings potential of a given career and the cost they will incur by preparing for it, subject to their individual tastes and preferences. If the benefits exceed the costs, students decide to invest. Otherwise, they do not. Once in school, students continue to evaluate the costs and benefits of taking classes. As long as the benefits equal or exceed the costs,

students have an incentive to enroll in class. Once the costs of attending college exceed the benefits, students will leave school. If at that point students have completed enough credits to earn a degree, they are considered a success. If they have not completed sufficient credits to earn a degree they are considered dropouts. Students may transfer from a community college without completing a degree if the psychic cost of continuing at the two-year college exceeds the benefit.

This dissertation has presented the results of three separate analyses, each exploring the effects of various benefits and costs on students' chances of experiencing each of three different outcomes. The first chapter of this dissertation focused on the impact of these benefits and costs on students' likelihood of dropping out of college. In this analysis, dropouts were defined as students who left the college without completing an associate's degree and without transferring to a four-year college. Costs considered in this analysis included the psychic costs incurred by students who were not proficient in English and/or math and the frustration experienced by students who earn low grades in their community college courses. Benefits consisted mainly of the increased earning students expect to realize by completing a degree. A key hypothesis of this analysis was that opportunity costs incurred by students in this cohort would differ significantly from one major to another. In theory, all two-year degree programs offered at the community colleges prepare students for jobs requiring an associate's degree. However, a review of job market analyses conducted by the U.S. Department of Labor suggests that this is not always the case. On the one hand, employers will not consider candidates who have less than the associate's when hiring nurses and other positions in the "credentialing" health sciences. On the other hand, employers may be quite willing to hire a non-degree person when filling jobs such as food service manager

or court reporter – especially if this person has a little industry-specific experience. Given these possibilities, it was hypothesized that dropout rates would vary significantly from one program to another, other things being equal.

Results of an event history analysis tend to support these hypotheses. Not only did dropout rates of students in this cohort vary from one major to another, but these relationships were significant at high levels of probability, increasing the chances that these differences actually do exist. More important, differences in dropout probabilities were in expected directions. Students who were preparing for jobs with strong credentialing requirements (as evidenced by their choice of a major) tended not to drop out. Students who were preparing for jobs with weak credentialing requirements tended to dropout at high rates. Dropout rates of students who prepared for jobs with ambiguous training requirements – business and engineering technology, for example – tended to fall between these two extremes. In addition, dropout behaviors of students in different majors occurred at different points in time, suggesting that at least some students left higher education to take jobs requiring skills they had obtained at the community college. As expected, students with high GPAs were much less likely to drop out than were students with low GPAs. Students with high proficiency in math and English were less likely to drop out than were students with low proficiency in these subjects. Students from low incomes households (as evidenced by receipt of financial aid) were more likely to drop out than were other students.

The second chapter of this dissertation focused on transfer behavior. As in Chapter 1, the analysis in Chapter 2 was conducted to find out whether a relationship exists between students' benefit/cost comparisons and their likelihood of transferring. As in Chapter 1, the analysis in the second chapter was particularly interested in the relationship between

students' major and their likelihood of transferring. However, unlike the analysis on student dropout behavior, the relationship between students' career goals and their odds of transferring could not be inferred directly from their major. While students who wish to transfer to a four-year college will receive credit for a wide range of courses offered at the community college, courses taken in students' intended major will not necessarily be counted toward the requirements of the major. Hence, students who wish to transfer to a four-year college tend to take general education courses in the arts and sciences. An examination of data presented in the Occupational Supply Demand System suggests that students who concentrate in the arts and sciences need to complete at least a bachelor's degree to receive a significant return on their investment. Hence, it was hypothesized that students who concentrate in these subjects were intending to transfer, probably in preparation for a career in the arts, the professions or in management.

Students who take courses in the vocational curriculum at the community college may find that a number of these courses do not meet the requirements of their intended major when they transfer to a four-year college. As a result, students who wish to transfer may have a disincentive to take many such courses. This does not mean, however, that students who major in these subjects at the community college will not transfer to a four-year college. Students who enter the community college for the purpose of completing a vocational associate's degree may change their minds if they feel that they can increase their lifetime earnings significantly by completing a bachelor's degree. However, it was hypothesized that transfer behavior might differ significantly from one vocational major to another. Data presented in the Occupational Supply Demand system suggest that majors offered at the community college under study in this dissertation prepare students for jobs that require

differing amounts of training. On the one hand, business courses of the type offered at the community college prepare students for a number of jobs that require a bachelor's degree or higher. On the other hand, public service technology courses offered at this institution prepare students for few jobs requiring bachelor's level training. Hence, it was hypothesized that students who major in the business programs would be more likely to transfer than students in the public service technologies – bearing in mind that students who intend to transfer may lose transfer credits by taking too many courses in these subjects and hence would tend to avoid them while enrolled at the community college. As in Chapter 1, it was assumed that students' academic preparation, financial circumstances, and academic performance at the college would have a significant effect on the outcome under study – student transfer.

Results of a survival analysis tended to support these hypotheses. According to this analysis, students who were preparing for careers that required a bachelor's degree were quite likely to transfer. Students who were preparing for careers that placed a strong emphasis on the associate's degree tended not to transfer. In particular, students who majored in the arts and sciences were significantly more likely to transfer than were students who majored in the reference major, public service technologies. Students who majored in the credentialing health careers were less likely to transfer than those in the reference major. Somewhat surprisingly, students who majored in the business technologies were not more likely to transfer than were students in the reference major. On closer inspection, however, this may be explained by a difference in the way that students of different ages use the business curriculum. In particular, results of this analysis suggested that younger business students are much more likely than older business students to transfer. Age is negatively

related to transfer behavior among students in the reference major, as well as in most others. However, increasing age has a much greater effect on business students than it does on students in the reference major. This suggests that older students who take courses in the business curriculum may use those courses mainly to supplement human capital they have already obtained, either through on-the-job training or formal education. The more gradual decline among students in the public service technologies suggests that older students who major in these subjects are doing so for the same reason as younger students: to prepare for a new career.

As in Chapter 1, a relationship did exist between students' prior academic preparation and their likelihood of transferring. However, in this case the relationship was positive. Students who placed at the college level in English and math were significantly more likely to transfer than were students who placed at the developmental level in these two subjects. A similar relationship also existed between students' academic performance at the community college and their transfer behavior. However, the strength of this latter relationship may depend upon students' proficiency in math and, to a lesser extent, English. Results of this analysis suggest that a one unit increase in the GPAs of students placing at the college level in mathematics had a significant, positive effect on students' chances of transferring. A one-unit increase in the GPA of students who placed at the developmental level in math had no such effect. A one-unit increase in the GPAs of students who placed at the college level in English seemed to have a greater impact on their transfer behavior than did a comparable increase among students at the lowest developmental level in this subject area.

The final chapter of this dissertation was a graphic analysis of students' risk of experiencing each of three outcomes: dropping out, completing an associate's degree or

certificate at the community college, transferring to a four-year college without completing a degree. As has been stated repeatedly throughout this dissertation, academic programs offered at this community college prepare students for different sets of jobs requiring different amounts of training. Some programs, such as those in the "credentialing" health careers, prepare students for jobs in which the applicant must possess an associate's degree or higher. Others, such as those in law enforcement or court and conference reporting, prepare students for jobs in which the applicant may possess less than the associate's degree and still obtain employment. Still others, such as those in accounting or real estate, prepare students for a range of jobs requiring varying amounts of education – from less than the associate's degree (for bookkeepers or real estate sales agents) through the bachelor's degree and higher (for certified public accountants or property managers). Each program at the community college prepares students for a different mix of jobs requiring different amounts of training. To the extent they do, the incentives for students to achieve any given educational outcome will differ from one program to another. In the words of human capital theory, benefit/cost comparisons of students will vary, depending on the field in which they are majoring. To the extent that students' benefit/cost comparisons differ, the risk of achieving any particular outcome will vary from one program to another.

To test these hypotheses, the final chapter in this dissertation presented the results of a competing risks analysis of these three outcomes. To conduct this analysis, a risk profile was hypothesized for each of 8 different majors. The cumulative risk of achieving each of these three outcomes was computed for students in each of these 8 majors – excluding all students with GPAs of 2.00 and less. Results of this analysis were presented in two sets of area graphs, one set for students ages 15-19, one set for students ages 20 and up. A comparative

analysis of these profiles was then conducted in which the implications for theory and policy were discussed. To provide some additional insights into the role of students' English and math proficiency on the achievement of these outcomes, this analysis was supplemented with an examination of the relationship between English placements and the incidence of these three outcomes.

Results of this analysis tended to support the hypotheses listed above. However, there were some surprises. In general, outcomes profiles for the eight majors considered in chapter three were consistent with expectations. Regardless of their age, students who majored in the credentialing health careers had a higher risk of completing an associate's degree than did students in any other major. Regardless of their age, students in the arts and sciences had far and away the highest chances of transferring to a four-year college. Dropout rates for older students tended to be higher than those for younger ones, regardless of their major. Among younger students, the risk of dropping out was particularly high for students in the non-credentialing health careers, followed closely by students in automotive technology and public service technology. These results were as expected, based on the training requirements of program-related jobs presented in the Occupational Supply Demand system.

Other results were harder to interpret. For example, while the automotive technology program had the second highest dropout rate of the 8 majors considered in this chapter, it also had the second highest rate of associate's degree completion – second only to the credentialing health careers. This was surprising since, according to the OSDS, these jobs typically require less than the associate's degree. Transfer rates in the credentialing business technologies were more than double the rate in the non-credentialing business technologies. However, the transfer rates among students in this program were slightly lower than those in

engineering technology. Given the large number of managerial jobs that require a bachelor's degree and the apparent strong emphasis on the associate's degree for jobs in the engineering technologies, these findings ran counter to expectations.

On closer examination, however, these results are not so surprising. While it is true, for example, that the minimum educational requirement for automotive service technicians is a postsecondary vocational award, it is also true that students who participate in the automotive technology program at this community college can prepare for the National Institute for Automotive Service Excellence certification. To the extent that students who complete the associate's degree perform better on this test than do students who do not, they have an incentive to complete the degree – even though the entry level job apparently requires less than the associate's degree. While the risk of transferring was somewhat lower for credentialing business students than had been expected, it was still high when compared to other majors. In addition, training requirements were not homogeneous among the business majors, as they were for the credentialing health careers programs. In some cases – real estate, for example – students in these majors could prepare for jobs requiring various amounts of training, from less than the associate's degree through the bachelor's degree. Given this diversity, students in this major still demonstrated a tendency to transfer.

Regardless of their major, results of this final chapter indicated that these outcomes were much more favorable among students who placed at the college level in English than they were for other students. Students who placed at the college level in English were much more likely to complete an associate's degree or to transfer than were students who placed at the developmental level. Students who placed at the lowest developmental level were slightly less likely to drop out than were students who placed at the highest developmental

level in English. However, the risk profile for students in the highest developmental level in English (English 0990) looked more likely the profile for the lower developmental level (English 0980) than it did for college-level English (English 1010).

Taken together, the results from this dissertation suggest that students who enroll at the community colleges respond in rational ways to the benefits and costs of a college education. The data available for these analyses do not make it possible to arrive at any definitive conclusions. However, the results of these various analyses do suggest that a human capital approach to student persistence has considerable merit. All three of the analyses reported in this dissertation uncovered a strong relationship between students' major and their probability of achieving each of the three outcomes examined. This relationship was clearer for some majors than it was for others. Students in the credentialing health careers showed a strong tendency to complete the associate's degree. Students in the arts and sciences showed a strong tendency to transfer. Even among majors in which the trends were more ambiguous, results were still in expected directions. While associate's degree completion rates were lower and transfer rates were somewhat higher than expected among engineering students, dropout rates for these students were consistent with expectations. Similarly, while transfer rates among business students were, on average, lower than expected, a stronger relationship did emerge when students' age was admitted as a factor in the analysis.

These findings suggest that community college students respond to signals from the job markets when deciding on how much education to complete. The community college under study in this dissertation offers a number of programs that are designed to prepare students to obtain employment directly upon completion of an associate's degree. However, the jobs toward which these programs are oriented do not necessarily require this credential. To the

extent that they do, students have an incentive to complete the associate's degree. To the extent they do not, students have an incentive to achieve other goals, opting for more or less education, depending on the job market. Enrollment behaviors of students in this cohort appeared to be in at least rough accord with the mix of signals likely to emanate from the markets in which they participated.

The students who receive these signals, however, are complex individuals who differ from each other in a number of ways. These students enter the community college with a variety of different characteristics and prior experiences. Results of this analysis suggest that students' enrollment behavior is determined by the way in which the characteristics and experiences of students interact with these job market signals. Analyses conducted in this dissertation suggest that five variables are particularly important in determining student's enrollment behavior: students' age, their proficiency in English, their proficiency in mathematics, and their academic performance at the community college, and financial aid status. Students who had poor proficiency in English and math, performed poorly at the community college and came from low income households were more likely to drop out and less likely to transfer than were other students – regardless of their major. Conversely, students who were proficient in English and math, had strong academic performance at the community college and come from high income households are much more likely to transfer than other students.

These results suggest that students' characteristics and experience may interact with job market characteristics to determine type and amount of human capital students ultimately obtain from the postsecondary education system. Under this scenario, students enter the community college with a goal job and a set of proficiencies, tastes and preferences. Once

they have entered the community college, they interact with the academic systems of the college. This interaction determines the range of courses they are able to complete, and hence the human capital they ultimately obtain. Low income students who enter community college at the lowest developmental levels in English and math may transcend their initial disadvantages and complete an associate's degree in, for example, the credentialing health careers. However, given the extent of their academic disadvantage, they are much more likely to major in another subject – public service technology or a non-credentialing business technology, for example. Once they have successfully made the transition from their developmental courses to those in their field of interest, they will continue up to the point at which the costs exceed the expected benefits of enrolling for a course. If the job they are preparing for requires the associate's degree, this point will likely come at the point at which they have completed the degree. If the job requires less than associate's degree, this point will likely come prior to the completion of the degree. The opportunity cost of remaining in school simply are too high for such students to complete the degree – given the other costs, both pecuniary and psychic, they incur by taking an additional semester of courses.

Students who place at the college level in English and math are much more likely to complete a college degree – either two-year or four-year – than those who place at the developmental level in these subjects. These students do not incur the psychic costs borne by students who place at the developmental level in these subjects. Because these better prepared students receive substantial psychic income from college-level study, they are – other things being equal – likely to prepare for jobs that require an associate's degree and perhaps a bachelor's degree.

This is not to say, however, that these students will necessarily complete a degree. Community colleges attract students from across the income and age spectra. Results of this study suggest that students' age and income are positively correlated with their odds of dropping out. Students' age has a particularly powerful effect on students' chances of completing a degree. Empirical findings presented in this paper are well-supported by economic theory. Human capital theory posits that older students have more human capital and fewer years over which to recoup their investment in higher education than do younger students. Hence, the opportunity cost of a semester in college is much greater for these students than it is for younger students of comparable ability. Human capital theory thus suggests that older students will be much more likely to leave postsecondary education without completing a degree than will younger students. This implies that, other things being equal, students' choice of a major may depend not only on their academic preparation and work ethic, but also on their place in the life cycle.

A similar logic suggests that students from low income households are likely to select a major that requires the completion of fewer credits than they are to choose one that requires the completion of a bachelor's degree. Results presented in this dissertation tend to support these hypotheses. College-ready-students from older age groups and low income households are less likely to transfer and more likely to drop out than are younger students from high income households.

5.1 Policy Implications

Results of the analyses presented in this dissertation suggest that community college students behave in ways that are consistent with a human capital approach to student persistence. According to this framework, students treat their community college education as an investment decision. Based on some set of tastes and preferences, they formulate a career goal. They then scan the environment to find an academic program through which they can prepare for this career. They may consider programs available at a range of postsecondary institutions – from proprietary schools to community colleges to four-year colleges. Once they have identified a program of interest, they compare the benefits of a given educational credential to the expected costs. If the expected benefits exceed the costs of attending a given school, students go to college. Once they are enrolled in college, they continue to compare the benefits and costs of going to school. They will continue to enroll up to the point at which benefits no longer exceed costs.

If this framework is correct, then community colleges that want to increase their students' odds of graduating must develop policies aimed at reducing the cost and/or increasing the perceived benefit of completing a degree. In order to succeed in these efforts, policy makers must consider the full range of benefits received and costs incurred by their students. Community colleges work hard to keep their tuition charges as low as possible. As a result, financial obligations of community college students tend to be quite low. However, human capital teaches us that the pecuniary cost of a college education is only one of many charges incurred by students. In addition to the actual monetary cost of a semester in college, students also incur a set of opportunity costs and psychic costs. Depending on students'

educational background, financial situation, and their position in the life cycle, the cost of a semester at the community college may be extremely high. If students enter the college with only a vague idea of the benefits they will receive upon completion of a degree, their benefit/cost ratios may not be favorable. Such students may drop out of college after only a semester, or two.

Community colleges have developed a number of programs and service aimed at reducing the cost of a college education. To reduce the monetary cost of a college degree, they implement policies aimed at increasing the efficiency with which they deliver services, thereby keeping their tuition and other fees as low as possible. To make it easier for students to pay these low tuition costs, they offer their students a full range of financial aid packages. In addition to these efforts, community colleges offer a range of programs designed to reduce the psychic costs of going to college. To reduce the anxiety experienced by students with weak preparation in English and mathematics, these colleges offer a full range of tutoring services. To make it easier for adult students to care for their younger children while they are in school, they provide on-campus day care services. To reduce the cost of taking courses that do not transfer to a four-year college or apply to an associate's degree, they provide counseling services to their students.

Community colleges have also taken steps to increase students' perceived benefit of completing a degree, both two-year and four-year. They have developed career exploration courses. They offer cooperative work experiences for students who wish to combine their academic work with actual on-the-job experience. They sponsor career day events, in which students can talk to employers about job opportunities in their career field of interest. They

offer job placement services for students who do complete an associate's degree or certificate.

In spite of all these efforts, graduation rates remain quite low among students who attend the community colleges. If human capital theory is correct, this would imply that these institutions have not done enough either to reduce the cost of a college education or to increase the benefits students expect to receive by completing a degree. Results of the analyses conducted in this dissertation suggest that graduation rates would probably respond to enhancements made on both the cost and benefit sided of this equation. However, the most productive changes may come from enhancements made on the benefit side. If Grubb's analysis of the sub-baccalaureate job market is correct, employers are ambivalent regarding the value of a two-year degree when hiring workers to fill many jobs requiring less than a bachelor's degree. On the one hand, they may feel that a worker with an associate's degree will bring knowledge to the workplace that a person with less education does not possess. On the other hand, the employers may feel that in many positions, formal training is much less important than on-the-job experience. If employers are willing to hire an experienced worker with less than an associate's degree to fill many jobs, students who enrolled in two-year degree programs do not have an incentive to complete one. If students do not have strong preparation in English or math, they incur a high psychic cost simply by going to class. When students compare the uncertain return they will receive by completing an associate's degree to the high cost they will incur to complete it, the benefit/cost comparison tells them to quit school and take a job based on the training they have completed.

If the community colleges are to increase students' probability of completing a credential, they thus need to obtain a better understanding of the sub-baccalaureate job market. Several

policy recommendations have been made throughout the course of this dissertation. A few of these are reiterated below.

- Many students enter the community colleges with only the vaguest idea as to the kind of career they can get with an associate's degree. These students believe that a community college education is a good thing, but they do not have a specific career goal in mind. Such students may drift from one course to another without any clear sense of purpose. Community colleges may reduce the likelihood that such students will drop out by providing them with better career information than they are currently making available. Colleges could provide such information in any of several ways, including career counseling, career exploration courses, and job fairs.

- Community colleges can expand the number of cooperative education programs and internships they make available to students. If Grubb's analysis is correct, employers who fill positions in the sub-baccalaureate prefer experience over formal education. Expanding the number of cooperative work experience options available to students could increase degree completion rates. The development of these programs would require the community colleges to interact with employers more intensively than they currently do. This would likely provide the community colleges with a better understanding of employer training needs than they currently have. This improved understanding would result in the modification or creation of curricula which focused more directly on employer requirements. If the fit between program requirements and employer training requirements were to improve, students' perception of the

benefits of training would also improve. To the extent it did, graduation rates would also increase.

- The community colleges can increase the number of job-specific certificate programs they create. As mentioned at several points in this dissertation, many jobs in the sub-baccalaureate job market require only some postsecondary vocational education or on-the-job training. Students who want to enter jobs that typically require such training will not have a strong incentive to complete an associate's degree. The community colleges can aid both students and employers by increasing the number of shorter training programs that focus specifically on the requirements of these positions.

- Many students who enter the community colleges want to complete a bachelor's degree. However, many of these students are not proficient in English and mathematics. Such students incur a high psychic cost in attending the community college. These students may doubt their ability to succeed at the four-year colleges – even if their grades are good at the two-year institutions. In order to help these students overcome their fears, the community colleges may wish to form closer partnerships with four-year colleges than they currently do – perhaps encouraging students to take courses on the four-year campuses or inviting faculty from the four-year campus to teach some courses at the community college.

- The community colleges may want to give employers a stronger role in the development of curriculum than they currently do. Although community colleges do give employers a role in designing vocational curricula, research (Rosenbaum, Deil-

> Amen and Person, 2006) suggests that when the community colleges do seek the view points of employers, they do not explicitly use these contacts to enhance the employability of their students. Advisory committees may meet infrequently. Employers on these committees may not hire community college graduates. Community college faculty members do not necessarily use these committees to obtain information about the kinds of skills employers seek when filling jobs at the sub-baccalaureate level. Community colleges may address this situation by involving employers more directly and intensively in the educational process than they currently do. In particular, program faculty may use advisory committees to obtain information on job openings which might be available to students.

Ultimately, the research presented in this dissertation suggests that there is a range of jobs requiring more than a high school diploma and less than the associate's degree that have historically been overlooked by the community colleges. This research suggests that students and employers both might be better served if the community colleges would focus their attention on these markets. T o meet the needs of these jobs, the community colleges might need to create some new curricula. However, most of these unmet needs might be addressed simply by repackaging some existing products. The community college under study in this dissertation has, over the past decade or so, devoted considerable effort to making sure that its two-year degree programs meet the needs of employers. In this process, faculty and administrators from this institution have met with employers and other stakeholders for the purpose of identifying skills needed to perform jobs associated with two-year programs. As a result of this process, administrators and faculty have obtained a good understanding of the skills and knowledge employers require. However, like all other community colleges in this

state, this institution's efforts are focused to a large extent on the associate's degree. Skills and knowledge needed to enter these jobs are thus packaged in units consisting of 60 credits of instruction.

However, research conducted in this dissertation suggests that, in the final analysis, employers do not place a strong demand on this particular package. Many students who enroll at the community college incur psychic and monetary costs that make it difficult for them to complete more than a few semesters. Given these realities, the market for the associate's degree is in many cases limited. The community colleges might provide a great service to employers and students alike if they would simply repackage some of their existing products, breaking some of their associate's degree programs into smaller pieces that more clearly met the needs of students and employers. If properly structured, these certificates would provide students with the incentive they need to earn a marketable credential. In addition, they would provide students with the basis for future efforts on a higher level credential – either an associate's degree or a bachelor's degree.

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APPENDICES

Appendix I
Training Requirements of Jobs[17] Associated With Six Career Education Programs Offered at a Community College

Accounting Program

CIP Code 52.0301 – Accounting

Occupation	Minimum Education Level
Financial Managers	Bachelor's or higher, plus work experience
Accountants and Auditors	Bachelor's degree
Budget Analysts	Bachelor's degree
Credit Analysts	Bachelor's degree
Financial Analysts	Bachelor's degree
Personal Financial Advisors	Bachelor's degree
Loan Counselors	Bachelor's degree
Loan Officers	Bachelor's degree
Financial Specialists, All Other	Bachelor's degree

CIP Code 52.0302 – Accounting Technology/Technician and Bookkeeping

Occupation	Minimum Education Level
Tax Preparers	Moderate-term on-the-job training
Billing and Posting Clerks and Machine Operators	Moderate-term on-the-job training
Bookkeeping, Accounting and Auditing Clerks	Moderate-term on-the-job training
Payroll and Timekeeping Clerks	Moderate-term on-the-job training
Brokerage Clerks	Moderate-term on-the-job training
Statistical Assistants	Moderate-term on-the-job training

[17] Source: Occupational Supply Demand System

Information Technology Program

CIP Code 11.0201 – Computer Programming/Programmer, General

Occupation	Minimum Education Level
Computer and Information Scientists, Research	Doctoral degree
Computer Programmer	Bachelor's degree
Computer Support Specialists	Associate's degree
Computer Systems Analysts	Bachelor's degree
Data Administrators	Bachelor's degree
Network and Computer Systems and Data Communications Analysts	Bachelor's degree
Computers Specialists, All Other	Associate's degree
Computer Operators	Moderate-term on-the-job training
Numerical Control and Process Control Programmers	Work experience in a related occupation

Hospitality Management Program

CIP Code 52.0901 – Hotel/Motel and Restaurant Management

Occupation	Minimum Education Level
Food Service Managers	Work experience in a related occupation
Lodging Managers	Work experience in a related occupation

Mechanical Engineering Technology Program

CIP Code 15.0805 – Mechanical Engineering/ Mechanical Technology/Technician

Occupation	Minimum Education Level
Mechanical Engineering Technicians	Associate's degree

CIP Code 15.1306 - Drafting

Occupation	Minimum Education Level
Architectural and Civil Drafters	Postsecondary vocational award
Electrical and Electronics Drafters	Postsecondary vocational award
Mechanical Drafters	Postsecondary vocational award
Drafters, All Others	Postsecondary vocational award

Nursing Program

CIP Code 51.1601 – Nursing – Registered Nurse Training (RN, ASN, BSN, MSN)

Occupation	Minimum Education Level
Registered Nurse	Associate's Degree

Radiography Program

CIP Code 51.0907 – Medical Radiologic Technology/Science – Radiation Therapist

Occupation	Minimum Education Level
Radiation Therapists	Associate's Degree
Radiologic Technologists and Technicians	Associate's Degree

Appendix II

Typology of Academic Programs Used in this Dissertation

Credentialing Health Careers
Dental Hygiene
Diagnostic Medical Sonography
Electroneurodiagnostic Technology
Health Information Management
Medical Laboratory Technology
Nuclear Medicine
Nursing
Occupational Therapy Assistant Technology
Physical Therapist Assisting Technology
Radiography
Respiratory Care
Veterinary Technology

Non-credentialing Health Careers
Dental Assisting
Dietetic Technology
Emergency Medical Technology
Human Services
Medical Assisting
Optical Technology
Pharmacy Technology
Practical Nursing
Surgical Technology

Credentialing Business Technologies

Accounting
Business Management
Information Technology
Interior Design
Paralegal Studies
Real Estate
Visual Communication and Design

Non-credentialing Business Technologies
Court and Conference Reporting
Hospitality Management
Information Technology – Applications Specialist
Marketing
Office Administration (Offered in fall 1998, discontinued later)

Engineering Technologies
Construction Technology (Formerly Architecture and Construction Technology)
Electrical/Electronic Engineering Technologies
Manufacturing Industrial Engineering Technology
Mechanical Engineering Technology
Recording Arts and Technology

Automotive Technology
Automotive Technology

Public Service Technology

Early Childhood Education
Fire Technology
Law Enforcement

Arts and Sciences
The traditional general education core curriculum including (but not limited to) courses in the following disciplines:

Anthropology
Art
Dance
Economics
English
Geography
History
Mathematics
Music
Physical Education
Philosophy
Political Science
Psychology
Religion
Sociology
Speech
Theater
Urban Studies

Other Programs
This category is a catch-all containing students predominantly enrolled in developmental education courses. It also contains students enrolled in some apprenticeship courses.

Appendix III: Alternative Versions of Transfer Models 1 and 2 Based on a Specification of the Business Programs into Credentialing and Non-Credentialing Business Technologies

Effects of Fixed and Time-Varying Variables on Students' Log Odds of Transferring to a Four-Year College				
	Model 1		Model 2	
	Coef-ficient[1]	Odds Ratio	Coef-ficient	Odds Ratio
Semester 1	-4.25**	0.01	-4.45***	0.01
	(.26)		(.30)	
Semester 2	-3.77***	0.02	-3.96***	0.02
	(.26)		(.30)	
Semester 3	-4.15***	0.02	-4.33***	0.01
	(.27)		(.30)	
Semester 4	-3.55***	0.03	-3.73***	0.02
	(.26)		(.30)	
Semester 5	-3.39***	0.03	-3.57***	0.03
	(.26)		(.30)	
Semester 6	-3.16***	0.04	-3.34***	0.04
	(.27)		(.30)	
Semester 7	-3.07***	0.05	-3.25***	0.04
	(.27)		(.31)	
Semester 8	-2.87***	0.06	-3.05***	0.05
	(.28)		(.31)	
Semester 9	-2.98***	0.05	-3.16***	0.04
	(.30)		(.33)	
Semester 10-20	-3.20***	0.04	-3.38***	0.03
	(.28)		(.31)	
Credentialing Health	-1.69***	0.18	-1.31**	0.27
	(.45)		(.60)	
Non-Credentialing Health	-1.13*	0.32	-1.47***	0.23
	(.32)		(.44)	
Credentialing Business	-0.03	0.97	0.28	1.32
	(.20)		(.25)	
Non-credentialing Business	-0.35	0.71	-.02	0.98
	(.35)		(.46)	
Engineering	-0.16	0.85	0.10	1.10
	(.36)		(.48)	
Automotive Tech.	-.61	0.54	-0.59	0.55
	(.49)		(.62)	
Arts and Science	0.79***	2.21	0.98***	2.68
	(.19)		(.24)	
Other	0.51***	1.66	0.61**	1.84
	(.21)		(.26)	
Place in ENG 0990 (Language Fundamentals II)	0.23	1.25	0.23	1.26
	(.16)		(.16)	
Place in ENG 1010 (Freshman English)	0.43**	1.54	0.43***	1.53
	(.16)		(.16)	
No Placement Test	.57**	1.76	0.57***	1.76
	(.19)		(.19)	
Place in MATH 0950 (Beginning	0.19	1.21	0.20	1.22

Effects of Fixed and Time-Varying Variables on Students' Log Odds of Transferring to a Four-Year College				
	Model 1		Model 2	
	Coef-ficient[1]	Odds Ratio	Coef-ficient	Odds Ratio
Algebra)	(.15)		(.15)	
Place in MATH 0980 (accelerated beginning algebra)	0.42 (.14)	1.53	0.42*** (.14)	1.52
Place in MATH1060 (college-level Math)	0.73 (.14)	2.09	0.72*** (.14)	2.06
No math test	0.65 (.16)	1.93	0.68*** (.16)	1.97
Age	-0.06*** (.01)	0.94	-0.03 (.03)	0.97
AA to Transfer	-0.31*** (.08)	0.73	-0.32*** (.08)	0.73
AA For Job	-0.63*** (.11)	0.53	-0.62*** (.11)	0.54
Delayed High School	-0.04 (.09)	0.96	-0.04 (.09)	0.96
Transfer-in	0.57*** (.11)	1.76	0.56*** (.11)	1.75
Financial Aid	-0.32*** (.08)	0.73	-0.32*** (.08)	0.73
Cumulative GPA	0.11 (.04)	1.12	0.11 (.04)	1.12
Age by Credentialing Health Careers			-0.08 (.09)	0.92
Age by Non-Credentialing Health Careers			0.05 (.04)	1.05
Age by Credentialing Business Tech.			-0.07** (.03)	0.94
Age by Non-credentialing Business Tech.			-.07 (.07)	0.93
Age by Engineering			-0.06 (.09)	0.94
Age by Automotive Tech.			0.00 (0.07)	1.00
Age by Arts and Science			-0.04 (.03)	0.96
Age by Other			-0.02 (.03)	0.98
Log Likelihood	-3336.9		-3330.5	
Likelihood Ratio Chi[2] (current model compared to model in previous step)	5.3**		12.7	
Likelihood Ratio Chi[2] (current model compared to model containing times as only variable)	627.8***		641.6***	

Effects of Fixed and Time-Varying Variables on Students' Log Odds of Transferring to a Four-Year College				
	Model 1		Model 2	
	Coef-ficient[1]	Odds Ratio	Coef-ficient	Odds Ratio

*Denotes statistically significant at .10 or better probability
** Denotes statistically significant at .05 or better probability
***Denotes statistically significant at .01 or better probability