# DETERMINANTS OF BACCALAUREATE DEGREE COMPLETION AND TIME-TO-DEGREE FOR HIGH SCHOOL GRADUATES IN 1992

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# ABSTRACT

U.S. colleges and universities are failing to graduate a greater number of students than in previous decades, although there has been more than a 25 percent increase in the number of students enrolling in colleges after high school graduation for the last three decades. Nevertheless, the 6-year graduation rate has been lingering around 66 percent for the same period (National Center for Education Statistics). This means more students are accessing higher education, however, they are leaving without a degree. Moreover, students are taking a longer time to complete their degree.

Perceiving that economic and social benefits are increasingly based on postsecondary education, the public is now accepting degree completion rate and completion in a timely manner as critical measures of accountability for colleges and universities. Consequently, legislatures and citizens criticize colleges for students' failure to complete a degree or failure to complete it in a timely manner. In response to these public requests, states are developing policies to boost their colleges and universities' 6-year degree completion rates.

Higher education policies such as linking funding to performance and penalizing students who take more credits than required must be based on reliable research. However, there are conflicting findings on factors affecting 6-year degree completion, and research on time-to-degree completion (time-to-degree, hereafter) has only recently become more prevalent. The contradictory findings are a 'Unit of Analysis' Problem. Most studies on degree completion and time-to-degree were conducted based on single-institution. Therefore, the results have been conflicting and not generalizable.

The goals of this research were: 1) to advance and test the validity of the Degree Commitment Model (DCM), 2) to provide the higher education community with reliable research findings on factors affecting undergraduates' degree completion and time-to-degree (TTD) based on a nationally representative data set (PETS: 2000), and 3) to introduce a method, the Zero-Inflated Negative Binomial Model (ZINB), that models two different dependent variables simultaneously and addresses the problem of overdispersion in the observed numeric dependent variable.

Following the disciplines of DCM, this research specified four hypotheses concerning degree completion that were examined based on the results of the study: 1) The determinants that contributed to previously formed commitment propensity will further affect the level of later commitment in degree-seeking process, 2) The higher the satisfaction level, the higher the commitment level will be: Variables assumed to have positive relationship to students' satisfaction would increase the probability of degree completion, 3) The higher the quality of alternatives to obtaining a degree, the lower the commitment level, which would reduce the probability of graduation, and 4) Increased investment size would enhance the commitment level and degree completion.

The findings of this study regarding degree completion confirmed what other studies have identified. One of the unique findings of this study concerns students who have the obligation of taking care of dependents: The binary variable of dependent suggests that students who came to have dependents to take care of are more than two times less likely to graduate (234%). Students' background variables, such as race/ethnicity and gender, did not have a relationship to the probability of degree completion.

The findings of this study on academic preparedness emphasize "what" courses students took while they were in high school, rather than "how well" they did in those classes. High school rank and GPA quintile and high school senior test scores were not related to degree completion. The intensity of the high school curriculum, however, revealed its strong relationship to the odds of degree completion.

The variables pertaining to enrollment patterns indicated their relationship with degree completion. Students who started their postsecondary academic career at a selective institution had higher chances of degree completion than their counterparts. One encouraging finding on enrollment patterns was that students transferring from a 2-year institution to a 4-year institution appeared to have a positive relationship to degree completion.

Not surprisingly, many of the predictors concerning enrollment patterns were found to be associated with enrolled TTD. Starting at a selective institution and not in a home state decreased the expected length of enrolled TTD. The total number of credits earned for the first calendar year and the GPA was shown to reduce the enrolled TTD. Students who took a remedial reading course were found to take more time than those who did not in the process of degree completion. Students' background variables and academic preparedness from high school did not show any statistically significant relationship with enrolled TTD.

Based on research findings of the study, policy implications were presented followed by limitations of the study and future directions of research regarding the topic of degree completion and time-to-degree.

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# CHAPTER I: BACKGROUND AND RATIONALE OF THE STUDY

## INTRODUCTION

American higher education has seen considerable growth in access. For the last three decades, the percentage of high school graduates entering college immediately after high school has increased more than 25 percent, from 45.9 percent in 1974 to 71.5 percent in 2004 (National Center for Educational Statistics [NCES]: Digest of Education Statistics). Overall enrollment growth is taking place primarily at public postsecondary education institutions. This trend of increasing access is expected to continue well into the 21st century: college enrollment is projected to grow by 17.2 percent by 2014 (NCES: Digest of Education Statistics).

In contrast, the baccalaureate graduation rate has changed little since the early 1970s. According to the national grade-cohort longitudinal studies conducted by the National Center for Education Statistics (NCES), the 6-year graduation rate remains at 66-67 percent for 1972, 1982, and 1992 high school graduates who enrolled at a 4-year college (Adelman, 2004, 2006; Horn, 2006). The figure decreases to 52 percent when considering an average 6-year institutional graduation rate in which only a student who attains a degree from the same institution as he/she initially enrolled is counted as a graduate (DesJardins, Ahlburg, & McCall, 2002 ; Horn, 2006). Internationally, for its world-leading higher education participation rate, the United States ranked in the

bottom half in the proportion of students who complete their college degree: 16th among 27 countries compared (Callan, 2006).

Access to higher education is a necessary condition for securing benefits of higher education, but access alone is not sufficient. What gives young adults a substantial benefit of college is the degree awarded by an institution. Adelman (1999) argued that degree attainment is the true goal for college administrators, state legislators, parents, and most importantly, students. Although students experience cognitive, attitudinal, value, and psychosocial changes during the college years (Pascarella & Terenzini, 2005), the labor market rewards a college degree far more than college attendance alone (Adelman, 2004; Cabrera, Burkum, & Nasa, 2005; DesJardins et al., 2002 ; Kim, 2007; Lotkowski, Robbins, & Noeth, 2004).

College graduates have greater economic and social benefits than both high school graduates and college dropouts. For example, the unemployment rate of bachelor's or higher degree holders was 2.7 percent, while high school completers without any college experience and those with some college education showed unemployment rates of 5.0 percent and 4.5 percent, respectively (Snyder, Tan, & Hoffman, 2006).

The income difference between college completers and high school graduates contrasts strikingly with the comparison between high school graduates and college dropouts. Considering the median annual income in 2004, a year-round, full-time male worker with a bachelor's degree who is more than 24 years old earned $57,220, while college dropouts earned $41, 895, and high school graduates, $35,725, respectively (Snyder et al., 2006). The $21,495 income difference between a college graduate and a

high school graduate is far wider than the $6,170 difference between college dropouts and high school graduates. On top of this income difference, college graduates appear to live healthier lives, their spouses are more educated, and their children do better in school (DesJardins, Kim, & Rzonca, 2002-2003; Pascarella & Terenzini, 2005).

Perceiving that economic and social benefits are increasingly based on postsecondary education, the public is now accepting degree completion rate and completion in a timely manner as critical accountability measures for colleges and universities. Consequently, the public, including state legislatures, criticizes higher education institutions for students' failure to complete a degree or failure to complete a degree in a timely manner (Adelman, 1999; DesJardins et al., 2002 ). As an illustration, some states, such as Texas and Virginia, adopted graduation rates as criteria for evaluating institutional performance (DesJardins et al., 2002-2003). Other states have considered various plans, such as restricting financial aid beyond the fourth year (e.g., New York) and increasing tuition for students who take more than an allotted duration or who take more than the required number of credits needed to graduate (e.g., Utah).

In response to this accountability pressure, postsecondary institutions are struggling to increase graduation rate by encouraging students to complete their baccalaureate degree in a timely manner (Adelman, 2004; Berger & Lyon, 2005; Horn, Berger, & Caroll, 2004). For example, the University of Minnesota instituted a tuition policy which applies to students who register for more than 15 credits per semester; All credits above 13 per semester are tuition-free (Dickey, 1999).

Given the high benefits of an attained college degree, the increasing number of students failing to attain a degree, and widespread use of graduation rate as an

accountability measure of higher education, understanding the factors that are associated with degree completion and completion in a timely manner is crucial for the success of both individuals and higher education institutions.

## BACKGROUND OF THE STUDY

Following student retention theories, much of the literature on undergraduate degree completion and the length of time taken by a student to complete a degree (time-to-degree, hereafter) analyzed the completion probability for individual students and the factors facilitating degree completion process for students who attained a degree. Even though the existing studies have made important contributions to our understanding of the factors that influence degree completion and time-to-degree, the body of research is not sufficient to form a reliable set of conclusions. Research findings can be grouped into four broader explanatory categories: pre-college characteristics, college academic performance, college experiences, and institutional factors, including financial aid.

Pre-college characteristics are of great interest to policy makers; however, the findings are inconsistent. Some studies found that female and Asian students are doing better in attaining a bachelor's degree than their male, black, and Hispanic counterparts (Adelman, 2004; DesJardins et al., 2002-2003; Horn, 2006; Titus, 2006a, 2006b), whereas other studies identified that minority status had no effect on degree completion (Adelman, 2004, 2006).

Another conflicting finding concerns the relative importance of students' academic preparedness for undergraduate study. Introducing the concept of academic resources consisting of high school curriculum, test scores, high school class rank, and

high school GPA, Adelman (2006) argued that the intensity and quality of high school curricula are the most powerful predictors of degree completion. However, DesJardins and his colleagues (2002) concluded that actual academic performance is more crucial to degree completion than academic resources. These studies do agree on the positive association between SES and degree completion (Adelman, 1999, 2006; Cabrera et al., 2005; Kim, 2007; Noxel & Katunich, 1998; Titus, 2006a, 2006b).

Academic performance at college was found to be a strong determinant of degree completion and time-to-degree (Adelman, 2004, 2006; Lee, Huesman, Brown, Kellog, & Radcliffe, 2007; Titus, 2006a, 2006b). Most factors related to college experience are also associated with the rate of degree completion across all students. Findings on remedial course attendance have yielded conflicting results (Adelman, 1999, 2006; DesJardins et al., 2002 ; Huesman, Brown, Lee, Kellogg, & Radcliffe, 2007). Adelman (2006) concluded that remediation did not make a significant difference in degree completion, whereas Huesman et al. (2007) identified its negative association with degree completion.

In terms of college experiences, enrollment patterns appear to have significant impacts on degree completion. Among those patterns, continuous enrollment is the most powerful variable in explaining degree completion and elapsed time-to-degree (Adelman, 2006; Cabrera et al., 2005; Pascarella, 1985). Findings on transfer from a community college to a four-year college are also mixed (Doyle, 2008; Adelman, 2006; Cabrera et al., 2005), but transfer from one four-year college to another appeared to have negative impacts on degree attainment (Adelman, 2006; Pascarella, 1985). Attending multiple institutions resulted in taking a longer time to complete a

baccalaureate degree (National Center for Education Statistics: Fast Facts). One of the most hazardous characteristics that have negative impacts on degree completion is withdrawing from a class without any penalty and repeating it (Adelman, 2006; Cabrera et al., 2005; DesJardins et al., 2002; Lee et al., 2007).

Some researchers expanded the existing research and integrated institutional level variables into their models (Astin, 2005-2006; Kim, 2007; Pascarella, 1985; Scott, Bailey, & Kienzl, 2006; Titus, 2006b). Among those institutional level variables, financial aid is one of the most important variables in higher education research. The chance of completing a college degree is negatively associated with unmet financial need and more than 10 hours per week of work (DesJardins et al., 2002; Titus, 2006a, 2006b). Findings on financial aid indicate that loans and grants are positively related to graduation (Kim, 2007; Titus, 2006a, 2006b), and their effect declines as time passes (Cabrera et al., 2005; DesJardins et al., 2002).

Compared to the extensive research on degree completion, research on time-to-degree is fairly new (DesJardins et al., 2002 ; DesJardins et al., 2002-2003; DesJardins, McCall, Ahlburg, & Moye, 2002). The research findings indicate that students who enter the institution with prior college credits are more likely to graduate in four years (DesJardins, Kim, & Rzonca, 2002-2003). While at college, students who were from outside of the state took more credits and performed better were shown to have increased the odds of timely graduation (DesJardins et al., 2002-2003).

The National Educational Study of 1988 (NELS:88/2000) revealed that the average time-to-degree was 4.14 calendar years for those students with no withdraws (Ws) and no-credit-repeats (Rs) among bachelor's degree recipients. The figure

increased to 4.45 and 5.97 calendar years for the same group with one or two grades of Ws and Rs and with seven or more, respectively (Adelman, 2004). Academic major is also an important variable that makes a difference in time-to-degree: Students from the college of liberal arts took less time compared to others (DesJardins et al., 2002).

There are four reasons for conflicting findings in the extant studies: a unit of analysis problem, variations in allowed time-to-degree, differences in the underlying theories of each study, and associated research methods. Research findings on degree completion and time-to-degree (TTD) often disagree because of the difference in the unit of analysis at the institutional, state, system, or national level. A national study disclosed that only 43 percent of all college students remained at the institution from which they initially began their undergraduate studies, and around 60 percent of undergraduates in the 1990s have attended more than two institutions (Adelman, 2006). With this complexity of students' enrollment patterns, most studies were conducted at a single institutional level (DesJardins, Ahlburg, & McCall, 1998; Knight & Arnold, 2000; Lee, Huesman, Brown, Kellog, & Radcliffe, 2007). Furthermore, these single institutional-level studies often limited their sample to a subset of admitted students who are first-time, full-time, degree-seeking, fall-semester enrollees.

Secondly, there exists a difference in the allowed time period for degree completion. The typical length of time allowed for degree completion was 6 years; however, some allowed 5 years, 8.5 years, or even 9 years (Adelman, 2006; Lee et al., 2007; Pascarella, 1985). Again, this research practice is related to sampling in the target study group. For example, the sample size for NELS: 88/2000 increases 5.2

percentage points, from 64.2 to 69.4 percent, when the time period for degree completion is increased from 6 to 8.5 years, respectively.

The third factor that leads to conflicting findings is the varied theories adopted to guide the study. The overall body of research has not been led by a coherent theoretical framework. Most research on degree completion and time-to-degree is based on the student retention theories such as Tinto's internationalist theory and Bean's student attrition model (DesJardins et al., 2002-2003; Pascarella, 1985). However, some studies extended their perspective and included environmental variables (Astin, 2005-2006; Scott et al., 2006), which would definitely affect the research findings.

In addition, inappropriate application of statistical methods contributed to the mixed findings. Some studies used just the simple multiple regression method to model a dichotomous dependent variable, degree completion (Astin, 2005-2006; Pascarella, 1985). This can be potentially problematic, because expected values based on the regression coefficients can fall outside of the possible range of the dependent variable, ranging from 0 to 1, and therefore violates the assumptions for regression analysis. This study addressed these gaps in the existing body of literature.

Adopting a more appropriate analytic strategy, the Zero-Inflated Negative Binomial (ZINB) regression model, this study addresses dual research questions of degree completion and time-to-degree. Its analysis of inclusive data collected from a national sample is expected to fill the gap of conflicting findings from limited data and to expand the extent of the definition of degree completion from a single institution to higher education institutions in general. Regarding transferred students as a failure, the

majority of studies on degree completion and time-to-degree revealed a variety of weakness in study design. As Bean (1980) pointed out in his study, dropping out of a particular higher education institution is not necessarily negative. In the following section, the research questions are addressed.

## RESEARCH QUESTIONS

Reviewing the body of literature on degree completion and time-to-degree disclosed that the gaps mainly resulted from limited data on which studies have been based. At a single institutional level, institutions typically do not have any information about students who dropped out, stopped out, or transferred out. Concerning these various enrollment behaviors, researchers argue that leaving one institution does not necessarily mean failure, which is regarded as failure in the institutional-level research. Thus, the existing research on the factors affecting graduation rate and time-to-degree is incomplete.

Trying to address these shortcomings, another stream of research attempted to utilize data generated by a national longitudinal study such as National Education Longitudinal Study of 1988 (NELS: 88/2000), Graduation Rates Survey (GRS), Beginning Postsecondary Students (BPS), and Cooperative Institutional Research Program (CIRP). They have rich and relatively exact information from surveys, interviews, and/or official transcripts. However, only a handful of studies applied an appropriate theoretical framework and analytic method. Studies modeling time-to-degree are far more limited (Adelman, 2006; DesJardins et al., 2002).

Two notable studies tried to address the limits in data and analytic methods: Adelman (2006) and DesJardins et al. (2002). Applying the logistic regression method, Adelman clearly explained the determinants of degree completion. However, his use of a simple linear regression method when he analyzed the factors related to time-to-degree could be potentially problematic since the distribution of elapsed time to degree violates the normal distribution assumption of the regression model (see Appendix A). Using an event history model approach, DesJardins et al. (2002) overcame both limits in data and analytic method, but that study used data collected from the high school class of 1982. Given that NELS:88 students are the ones who attended high school after the waves of reforms in the 1980s (Adelman, 2006), it is worth examining whether the determinants shown to be related to degree completion for high school graduates of 1982 hold up for the high school graduates ten year later.

This study adds a unique contribution to the existing body of literature by analyzing updated data based on both an appropriate analytic method, ZINB, and a new theoretical framework: ZINB does not require the normal distribution assumption for the continuous response variable. Drawing on PETS: 2000 data originated from NELS: 88/2000, this study answers the following research questions.

***Research Question 1: What variables are associated with baccalaureate degree completion in 8.5 years after high school graduation for the high school class of 1992?***

Utilizing the Zero Inflated Negative Binomial (ZINB) model (inflation equation), this study identifies discriminating factors that classify a student into the degree

completion group or failure group. This study allows 8.5 years for students to complete a degree: NELS:88 and other national longitudinal studies found that 8.5 years was a long enough time for students who actually obtained a baccalaureate degree to graduate. After elaborating on the Degree Commitment Model, this study also answers the question of what constructs and/or measures of the model affect undergraduate degree completion.

***Research Question 2: What are some determinants that are related to the amount of time that college students take until they complete a degree?***

Among the measures included in the Degree Commitment Model, what are the factors that influence time-to-degree? The findings of this research reaffirm or adjust the existing findings.

***Research Question 3: Does the data from PETS: 2000 support the Degree Commitment Model advanced in this study?***

After reviewing the existing research on degree completion and time-to-degree, this study advances the Degree Commitment Model with four hypotheses. The research findings of this study will confirm whether the theoretical constructs and measures chosen from PETS: 2000 have any relationships with degree completion.

## ORGANIZATION OF THIS DISSERTATION

Chapter I addressed the importance of the study on degree completion and time-to-degree and concluded with three research questions. Next, Chapter II reviews theories applied in addressing those topics and closes with research findings from extant studies. Chapter III starts by elaborating on the Degree Commitment Model as a guiding theory of this study. Chapter III continues by explaining the NELS: 88/2000 study from which PETS: 2000 was derived. Then, variables modeled in this study are described in detail, followed by a description of the analytic strategy, ZINB. Chapter III ends with four hypotheses established for this study. In Chapter IV, model specification statistics and research findings on degree completion and time-to-degree are presented in the order of the theoretical constructs of the Degree Commitment Model. Chapter V discusses important implications from this study, followed by the contributions and limitations of this study.

# CHAPTER II: REVIEW OF LITERATURE

In the following sections, existing research on baccalaureate degree completion and time-to-degree (TTD, hereafter) is extensively reviewed. Before reviewing theoretical frameworks underlying the existing studies and research findings, the terms that can cause confusion in studying degree completion and TTD are discussed, such as "persistence," "graduation," and "graduation rate." Then, the national trend of graduation rates is described. The main purpose of this chapter is to review various theoretical frameworks that other researchers have adopted in their studies of degree obtainment and TTD. This chapter ends with a brief overview of research findings on degree completion and TTD.

## THE DEFINITION OF GRADUATION RATE

The method of defining graduation rate is very important, since the subjects to be included for the analysis are decided by that definition. The measure of graduation rate seems to be clear-cut; however, two facts make the calculation of it very complex. The one is variability in student enrollment patterns, and the other is disagreement on the proper length of time allowed for degree completion.

Before any further discussion, it is worth clarifying the term "persister." Hagedorn (2005) defined a persister as "a student who enrolls in a college and remains enrolled until degree completion" (p. 89). The problem lies in that persisters can claim only one institution as their graduation institution, regardless of their prior enrollment at other colleges and universities during their academic career. Other institutions, except

the last institution, will regard the student as a dropout (failure), which would negatively affect their graduation rate.

With this complexity of enrollment patterns, most studies relying on a single institution limited their analysis to a subset of admitted students: first-time, full-time, degree-seeking, fall semester enrollees. On average, institutions reported that 71 percent of admitted freshmen were included in their 1998 graduation rate cohorts (Horn, 2006), which means that the other 29 percent are excluded from the graduation cohort group.

Arguing that dropping out does not necessarily mean failure, researchers suggested that the whole higher education system-wide graduation rate should be used. Still others argued that in spite of this defect, institutional graduation rate is a good indicator of higher education performance. For example, Adelman (1999) and Cabrera et al. (2005) insisted that policies stressing year-to-year persistence within one institution should be revised to emphasize persistence to degree completion across the entire higher education system. Given that only 43 percent of all college students remained at the first institution where they commenced their higher education and around 60 percent of undergraduates have attended more than two institutions in the 1990s (Adelman, 2004), this argument is convincing.

With respect to the proper length of time to degree completion, existing studies drawing on institutional level data have focused on 4-year, 5-year, or longer graduation rates according to the availability of data. However, the Student Right-to-Know and Campus Security Act (Public Law 101-542) and national longitudinal studies from a

governmental research agency (Graduation Rate Survey conducted by NCES) is regulating it as 150% of normal time of completion, 6 years.

According to the Student Right-to-Know and Campus Security Act of 1992, institutions that participate in any student financial assistance program under Title IV of the Higher Education Act of 1965 are to disclose information about graduation rate to current and future students (Broyles, 1997). To help institutions comply with requirements of Student Right-to-Know, the Integrated Postsecondary Education Data System (IPEDS) developed the Graduation Rate Survey (GRS). In the survey, the graduation rate is defined as the percentage of full-time, first-time, degree-seeking enrolled students who graduate after 150 percent of the normal time (4 years for 4-year college and 2 years for 2-year college) for completion (Broyles, 1997; Hagedorn, 2005). For 4-year institutions, as an illustration, the allowed time for graduation in GRS is six years, and for 2-year institutions, three years.

## NATIONAL TREND OF GRADUATION RATE

Historical research based on data collected by the U.S. Department of Education and the U.S. Census Bureau has shown that college completion rates have changed little since 1972 with the completion rates of 66-67 percent for the last four decades (Adelman, 2004; Horn et al., 2004). Adelman (2006) analyzed transcript files of three overlapping grade-cohort longitudinal studies conducted by NCES (National Longitudinal Study of the High School Class of 1972-NLS: 72, High School & Beyond/Sophomore Cohort-HS&B/So: 1980, and National Longitudinal Study of 1988-NELS:88) and concluded that the graduation rate has been stable since 1972.

Horn et al. (2004) also reported little change in 5-year bachelor's degree completion rate between 1989 and 1995, but that the percentage of students who are still enrolled (persisters) had increased from 13.3 to 17.2 percent, respectively. These results indicated an increase in the percentage of students who are taking longer than 5 years to complete a degree. When the allowed time-to-degree is set to 8.5 years from high school graduation, the average amount of time is increased from 4.34 to 4.56 calendar years (Adelman, 2004).

Contrasted to this stable degree completion rate for the past couple of decades, the percent of students who were from second language backgrounds has increased from 5.3 percent for the 1982 grade cohort to 10.2 for the 1992 grade cohort. Specifically, the number of Latino participants is increasing dramatically: from 44.3 to 56 percent (Adelman, 2004). It is also clear that a larger percentage (from 33.1 in 1972 to 46.4 in 1992) of students are acquiring their degree from an institution other than their first institution of attendance (Adelman, 2004).

The last notable trend in degree attainment is the difference between genders. Among students who had ever attended any 4-year college, the percentage of students who attained at least a bachelor's degree declined for men, while the percentage for women increased: the percentage change for men was from 66.6 for the high school class of 1972 to 61.5 percent for the high school class of 1992, and from 65.3 to 71.0 percent, respectively, for women (Adelman, 2004).

## THEORETICAL BACKGROUND

Most of the extant studies on the factors associated with degree attainment are not as rigorous as desired in their selection of theoretical foundations (Adelman, 1999, 2006; DesJardins et al., 2002; DesJardins et al., 2002; Horn, 2006; Horn et al., 2004; Huesman, Brown, Lee, Kellogg, & Radcliffe, 2007; Kim, 2007; Lee et al., 2007; Nora, Barlow, & Crisp, 2005). An appropriate theoretical framework supports the research by reducing an extensive list of variables to a parsimonious and thoughtful set (Bean, 1980; Noxel & Katunich, 1998). However, with lack of data fitting a desired theoretical framework, most of the studies selected variables that are readily available and limited their study sample to students in a narrower subgroup. This reality often resulted in conflicting findings (Adelman, 2006; DesJardins et al., 2002; Kim, 2007; Lee et al., 2007; Titus, 2006a).

Emphasizing the importance of applying organizational theory as an analytic framework to better understand how colleges and universities affect the educational experiences and outcomes of undergraduate students, Berger (2000) pointed out that researchers need to integrate different theories or models into a coherent whole rather than viewing each theoretical perspective as either "right" or "wrong." In other words, each of the existing theories can be thought of as a specific dimension that contributes to the overall understanding of behavior in an organization (Berger, 2000).

For analyzing the factors associated with degree completion and TTD, this research reviews four different theories to extract essential dimensions in designing a model of degree completion process: Interactionalist Theory, Geometric Model, Student Attrition Model, and Investment Model. Retention literature is used as a

guiding tool for selecting student-level variables that are related to college completion (Berger & Milem, 2000; Titus, 2006a). In this research, Tinto's Interactionalist Theory (1975) and Swail's Geometric Model (2003) are reviewed to identify which student and institutional level variables are influential on degree completion. The former is focused on the interaction between institution and students, while the latter stresses the importance of students as active subjects.

Integrating external influences outside of higher education institutions into the scope of degree completion process, as well as inter-institutional factors and individual characteristics, this research posits that higher education institutions are open systems. Colleges and universities function as part of the larger social system in which they are embedded (Berger & Milem, 2000). To understand the impacts of variables external to an institution (Titus, 2006a), Bean's (1980) student attrition model is reviewed. As the final step, the Investment Model is introduced, which extends the scope of Bean's model by adding the influence of invested resources to the existing model.

### *Interactionalist Theory*

A number of theories and models have been developed to explain student attrition in higher education based on the empirical research on retention. Among those, Tinto's Interactionalist theory of college student departure has enjoyed paradigmatic stature (Braxton & Hirschy, 2005). Tinto (1975) views student departure as a longitudinal process through which the individual student ascribes meaning to his or her interactions with the formal and informal dimensions of a given college or university (Braxton, Hirschy, & McClendon, 2004).

Students enter with a variety of background characteristics, skills and abilities, levels of prior education, value orientations, intentions, goals, and commitments (DesJardins, 1996). These individual characteristics directly influence students' departure decisions, as well as their initial commitment to the institution and to the goal of college graduation.

As shown in Figure 1, the initial commitment affects the level of a student's integration into the academic and social systems of the college or university, which influences a student's subsequent commitments to the institution and to the goal of college graduation (Braxton et al., 2004; DesJardins, 1996; Tinto, 1975; Yorke & Longden, 2004). Academic integration has structural and normative dimensions (Tinto, 1975). Structural integration entails the meeting of explicit standards of the college or university, whereas normative integration pertains to an individual's identification with the normative structure of the academic system. Social integration refers to the extent of congruency between the individual student and the social system of a college or university (Yorke & Longden, 2004).

### *Geometric Model*

Emphasizing the practical utility of theories on the practice of student departure, Swail (2003) advanced the Geometric Model. The model distinguishes itself from others by placing students at the center rather than regarding them as a passive element in a flow chart or structural equation model. Focusing on the cognitive and social attributes that a student brings to college and the institutional role in the student experience, the Geometric Model asks what an institution can do to help each student get through the college.

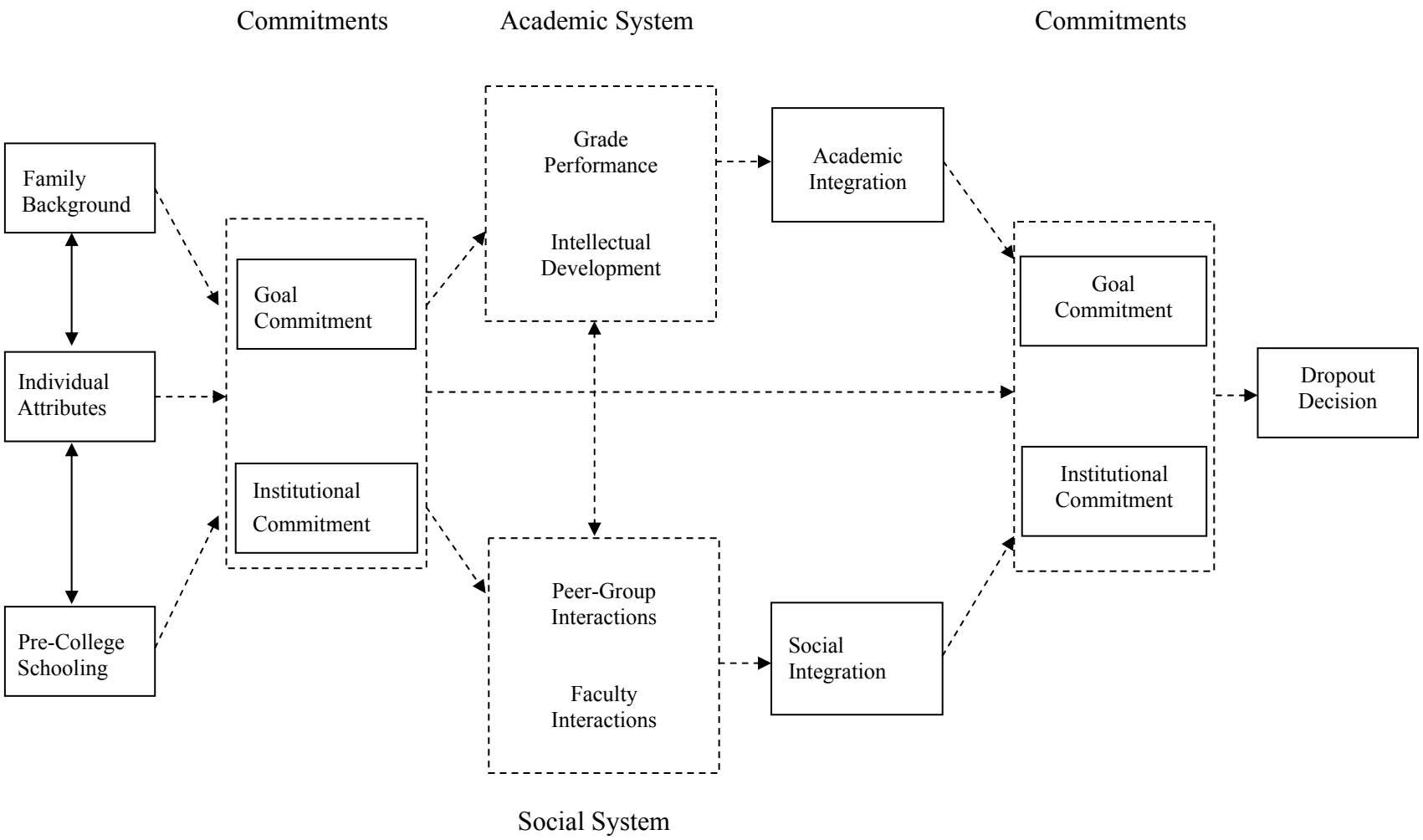


**Figure1: Conceptual Schema for Dropout from College: Tinto, 1975; p. 95**

Unlike theories that originated from organizational behavior study, the model simultaneously describes persistence and achievement because of the inextricable relationship between the two components.

In Figure 2, the area external to the triangle represents all the factors related to students' development and decision making, whereas the triangle symbolizes the complex set of internal processes within each student that foster the student's ability to persist and achieve (Swail, 2003). The main concept of this model is equilibrium, which indicates the status when the cognitive, social, and institutional forces combine in a manner that supports persistence and achievement.

Cognitive factors pertain to the intelligence, knowledge, and academic ability students bring to their college environment, which is related to students' ability to meet the academic requirements for degree completion. The second element related to student persistence and performance is a set of social factors such as parental and peer support, the development or existence of career goals, educational legacy, and the ability to cope with social situations. The third element in the geometric model is institutional factors, which pertain to the ability of an institution to provide appropriate support to students, both academically and socially (Swail, 2003).

The model postulates that each component in each facet of the model has its peculiar impact on the student and that certain variables can alter the effect of other components. This reciprocity concept is applied not only to the variables in each factor, but to the three elements as a whole.

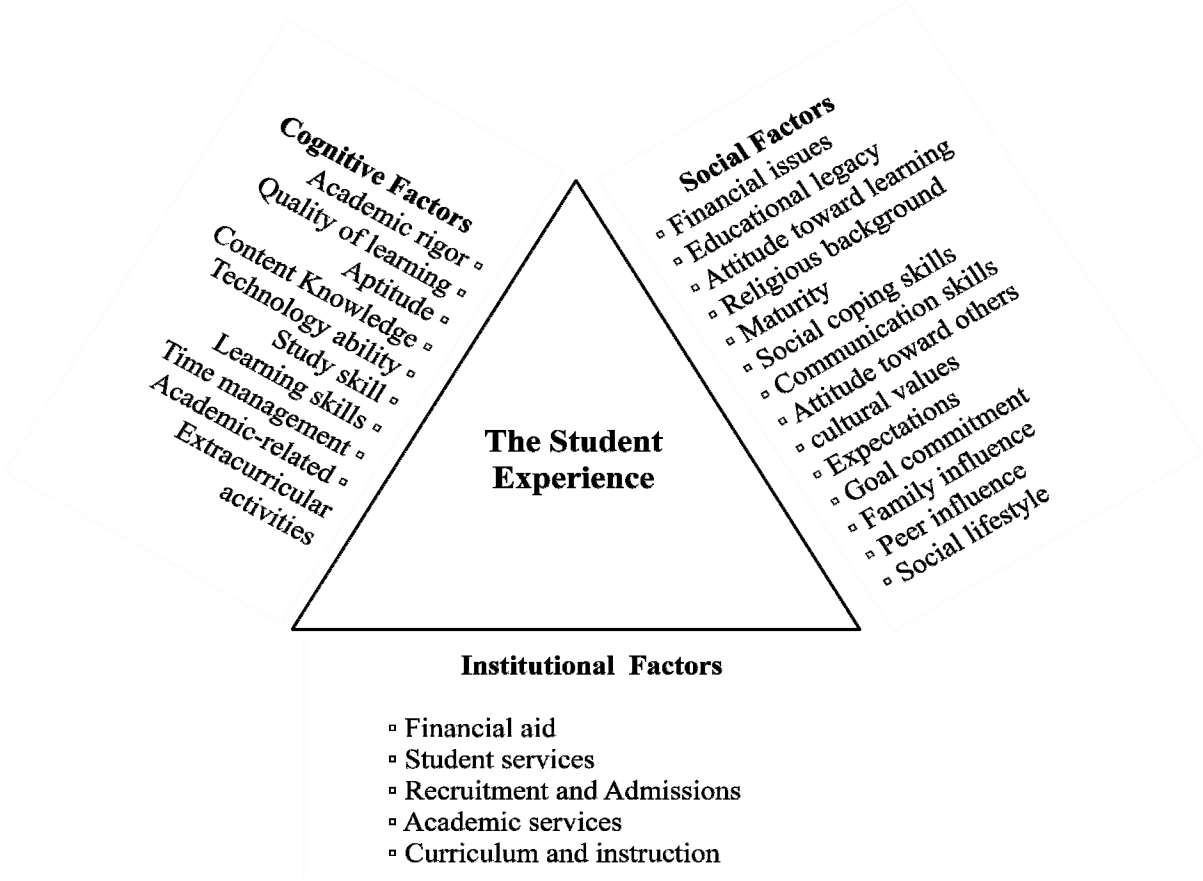


**Figure 2: Geometric Model of Student Persistence and Achievement: Swail, 2003; p. 77.**

When equilibrium is lost, students experience the risk of dropping out. This happens when one component of the model is forced to overcompensate for too many negative factors attributed to the other two sides of the triangle. For example, a student with low cognitive and social resources is likely to drop out, regardless of the support services the institution provides.

### *Model of Student Attrition*

While organizational research in higher education largely deemphasizes students, research focusing on the impact of college on students generally ignores organizational behavior as a source of influence (Berger, 2000; Berger & Milem, 2000; Gansemer-Topf & Schuh, 2005). Adapting the employer turnover model in the field of organizational behavior, Bean (1980) advanced the Model of Student Attrition with the assumption that students drop out of higher education for the reasons similar to employee turnover.

Four distinct parts comprise the model: the background variables (e.g., past academic achievement, socioeconomic status, distance to home), the organizational determinants (e.g., institutional quality, goal commitment, interaction with advisor, major, alternative opportunity), intervening variables (satisfaction and institutional commitment), and the dependent variable of dropout (Bean, 1980). In the model, organizational determinants are assumed to influence satisfaction, which is expected to increase the level of institutional commitment. Finally, institutional commitment leads to degree completion.

In his study, Bean (1980) established two models by gender since an interaction effect was found between gender and satisfaction. The model suggests that satisfaction does not act as an intervening variable between the organizational determinants and institutional commitment for men (Bean, 1980), which suggests that satisfaction and institutional commitment are two separate determinants. Institutional commitment was found to be the most important of all the variables in explaining dropout (Bean, 1980). One of the contributions of the student attrition model, which applies the employee

turnover model, is that the opportunity variables were included as an important factor in determining institutional commitment.

Notable characteristics of the Student Attrition Model include the construct of "pay" in higher education institutions by using four proxies: grade point average (GPA), development, institutional quality, and practical value (Bean, 1980, 1983). As an extrinsic reward, GPA can be used as a tangible resource in the negotiation for improved opportunity for further education and a successful career (Bean, 1980; DesJardins, 1996; Noxel & Katunich, 1998; Tinto, 1975).

The other three variables are measures of students' perception of their education and the institution. Development indicates the degree to which students believe that they are developing as a result of attending the colleges. Institutional quality evaluates the degree to which students believe that the institution is providing a good quality of education (Bean, 1980). Practical value means the degree to which students perceive that their education will lead to employment. Figure 3 summarizes the causal relationships among these variables.

### *Investment Model*

Social scientists have striven to understand why some relationships persist over time, whereas others wither and die (Rusbult, Martz, & Agnew, 1998). One conventional approach to this topic has been to identify determinants and consequences of positive affect, such as attraction and satisfaction. This approach, however, fails to explain why some unhappy relationships persist, why some satisfying relationships end,

and how some relationships persist in spite of fluctuations in satisfaction (Rusbult et al., 1998).

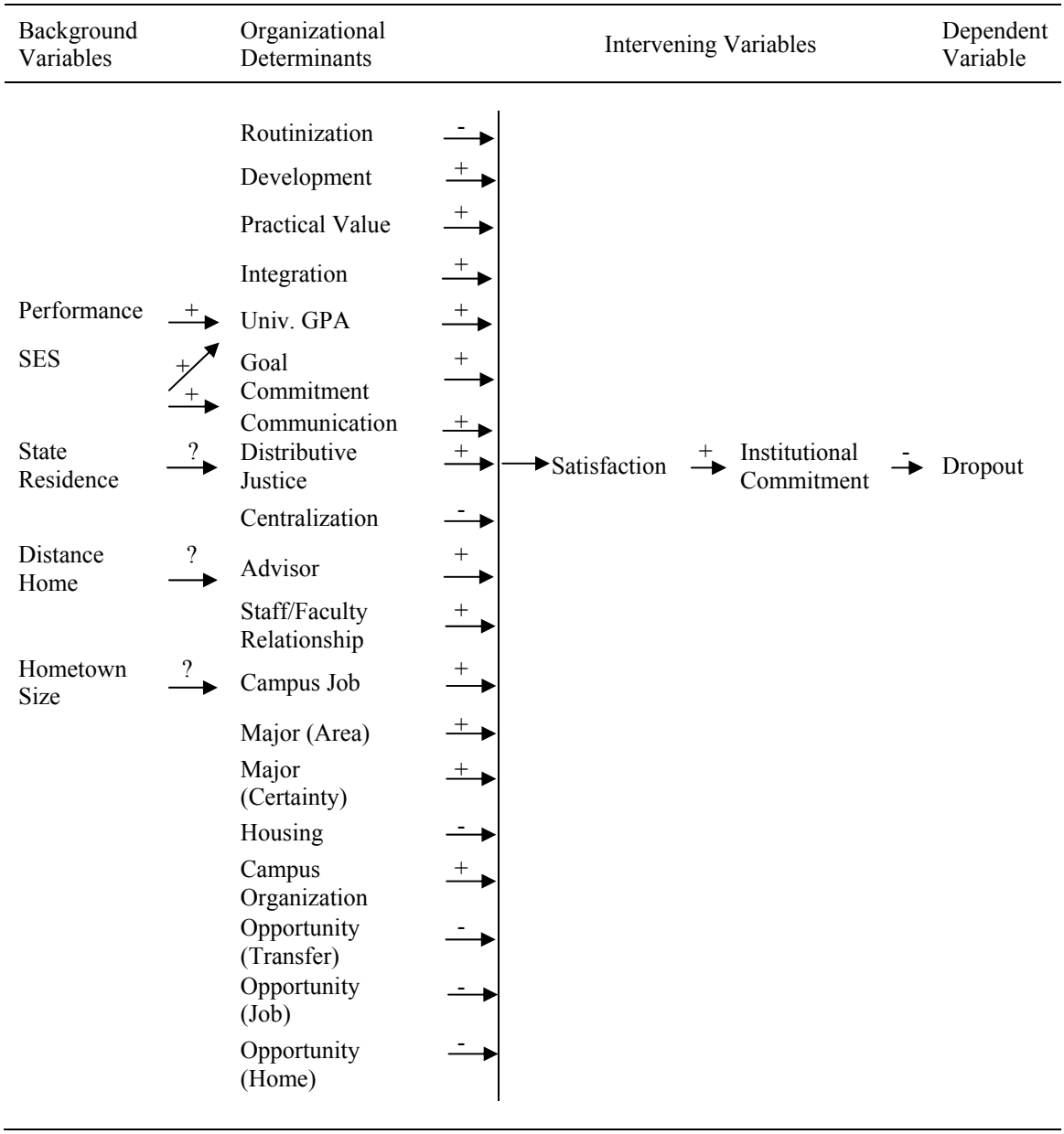


**Figure 3: Model of Student Attrition: Bean, 1980; p.158**

Understanding that satisfaction and persistence are two distinct constructs, researchers found the answer to the complex configuration of persistence in the concept of commitment, on which the Investment Model is based (Rusbult et al., 1998). In the Investment Model, job commitment is a function of satisfaction, investments, and alternatives, whereas job satisfaction is a simple function of cost and reward (Farrell & Rusbult, 1981; Noxel & Katunich, 1998; Rusbult et al., 1998). The Investment Model is in the general tradition of Exchange Theory and represents an expansion and formalization of selected aspects of Interdependence Theory (Farrell & Rusbult, 1981 ).

Interdependence Theory differs from other relationship theories in that it relies on an analysis of the interdependence structure characterizing a given relationship, not on the personal dispositions of people involved (Rusbult et al., 1998). The central feature of the Interdependence Theory is "dependence," which predicts the likelihood of persistence. Consistent with the tenet of Interdependence Theory, the level of dependency of a student with a higher education institution refers to the extent to which a student needs the current relationship, or relies uniquely on a relationship to obtain a degree at a currently enrolled institution.

The level of dependency intensifies through two main processes: satisfaction level and quality of alternatives (Harvey & Wenzel, 2001; Rusbult et al., 1998). First, individuals become increasingly dependent on a relationship to the extent that they achieve high satisfaction. In a similar vein to traditional approaches, the satisfaction level can vary by the positive or negative affect. The other factor influencing the extent of dependency is the quality of available alternatives (Harvey & Wenzel, 2001).

Quality of alternatives refers to the perceived desirability of the best available alternatives to a relationship (Harvey & Wenzel, 2001). Dependency becomes greater as satisfaction increases or the quality of alternatives decreases.

The Investment Model extends Interdependence Theory by adding the construct of investment size and commitment level (Harvey & Wenzel, 2001). To explain the enduring relationship in the face of tempting alternatives and fluctuating satisfaction, the Investment Model brings investment size, which means the magnitude and importance of the resources that are attached to current relationship (Harvey & Wenzel, 2001; Rusbult & Farrell, 1983; Rusbult et al., 1998). If the relationship disapears, the value of the resources would decline.

As a psychological construct that directly influences everyday behavior, commitment is defined as the intent to persist in a relationship. The level of commitment directly influences the decision to persist as well as everyday performance (Farrell & Rusbult, 1981; Rusbult & Farrell, 1983; Rusbult et al., 1998). Figure 4 describes the relationships among constructs of the Investment Model.

The Investment Model, with its foundation in sociology, overcomes the limits of other theories such as Tinto's Interactionalist theory (1975) and Bean's student attrition model (1980); the former is criticized for viewing a higher education institution as a closed system, while the latter is criticized for its incorrect assumption that satisfaction is directly related to persistence. The Investment Model is used to guide this study and will be elaborated further in Chapter III.

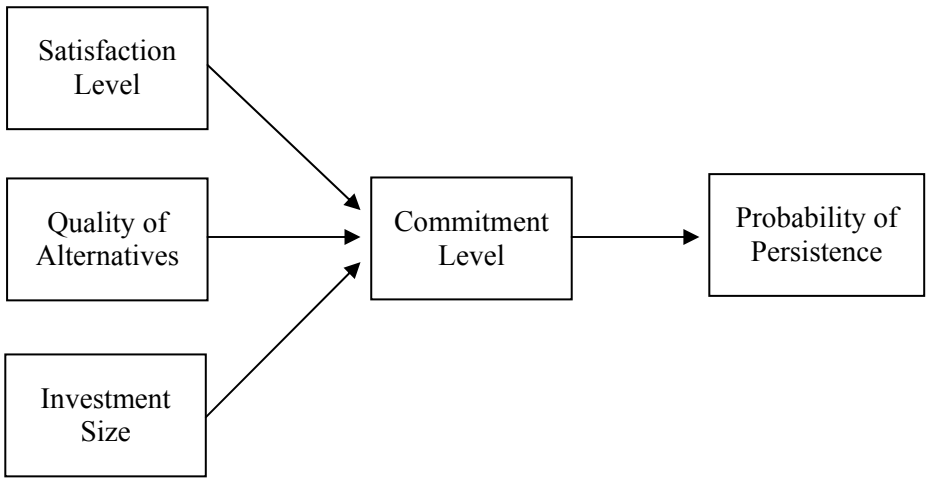


**Figure 4: The Investment Model - Commitment Processes: Rusbult et al., 1998; p. 360.**

### *Summary of Theoretical Frameworks*

This section discusses the important characteristics of theories and models adopted for retention studies. Table 1 summarizes the strength and weakness of each model/theory. The major contribution of the Interactionalist Model lies in its emphasis on a longitudinal specification of student departures from college. Attempting to include as many variables as possible, Tinto (1975) imposed a heavy burden on two commitment concepts: goal commitment and institutional commitment. For Tinto, goal commitment means educational expectations, while institutional commitment represents a student's disposition that causes him/her to prefer one institution over another.

The two commitments are formed from past experiences and background characteristics, and are modified through a longitudinal process of interactions between the individual and the academic and social systems of colleges.

**Table 1: The Strengths and Weaknesses of Each Model/Theory**

| Author | Model | Roots | Key Constructs | Strengths | Weaknesses |
|---|---|---|---|---|---|
| Tinto | Interactionalist Theory | Durkheim's Theory of Suicide | -Background variables<br>-Goal commitment<br>-Institutional commitment<br>-Social system<br>-Academic system<br>-Integration | -Longitudinal Process<br>-Focus on the interaction between institutions and students<br>-Sub-dividing different type of dropout behaviors | -Closed System approach<br>-Absence of students' financial factor<br>-Ignore external factors<br>-Heavy reliance on students' rational decision making ability |
| Swail | Geometric Model | Tinto's Interactionalist Theory<br><br>Anderson's Force Field Analysis | -Student experiences<br>-Cognitive factors<br>-Social factors<br>-Institutional factors<br>-Reciprocity of variables<br>-Equilibrium | -Focus on the interaction between institutions and students<br>-The reciprocity of variables<br>-Stress the importance to understand students' needs | -Closed System approach<br>-Ignore external factors |
| Bean | Student Attrition Model | Job Turnover Model | -Background variables<br>-Organizational determinants<br>-Satisfaction<br>-Institutional commitment | -Integrating background variables into organizational theory<br>-Considering majors<br>-Considering external variables such as opportunity<br>-Explaining causal relationship among variables | -Single institution<br>-Traditional age students<br>-Caucasian<br>-first-time first-semester freshmen not transferred from other institution<br>-Sample is biased toward higher ability students<br>-Improper assumption on the relationship between satisfaction and commitment |
| Noxel | Investment Model | Interdependence Theory | -Satisfaction level<br>-Quality of alternatives<br>-Investment size<br>-Commitment level<br>-Commitment propensity | -Consideration of investment size<br>-Clear separation of the concept of commitment from satisfaction<br>-Integration of commitment propensity<br>-Introduction of degree commitment variable | -No information on causal relationship among variables |

The level of both commitments keeps changing by the individual's evaluation of external impacts and cost-benefit analyses (Tinto, 1975). In Tinto's model, what determines persistence is the interplay between the individual's commitment to the goal of college completion and his/her commitment to the institution. By focusing on an individual institution, Tinto distinguished his model from a system model and intended to provide practitioners in the higher education field with knowledge on the obstacles to degree completion within an institution.

However, Tinto's model is often criticized for its narrow scope of seeing a higher education institution as a closed system: it emphasizes the interaction between students' various characteristics (skills, abilities, commitments, and value orientation) and the academic and social systems of an institution. It does not take the impact of the external environment into consideration (Tinto, 1982). Research on student persistence has suggested that the external environment, such as financial aid, plays an important role in students' decisions about persistence (Nora et al., 2005). Another weakness of the model is that it is vague about the causal ordering of student departure.

The strength of the Geometric Model is that it provides administrators with the information about the relationship between institutional practices and the academic and social needs of students. This enables an institution to work proactively to help students persist and achieve higher academic success. The model also clearly posited that the individual impact of variables can alter the effect of other variables by introducing the concept of "reciprocity."

The notable strength of this model lies in its emphasis on the role of the institution in meeting the needs of students. This model helps institutions to understand students and implement possible interventions to address any identified deficiencies in students. However, this model is deficient in addressing the possible impact of factors external to a particular institution, such as the quality of alternatives, and it is also based on an improper assumption that students' achievement and persistence are inextricably linked. The Investment Model clearly showed that satisfaction and commitment are separable constructs.

Bean (1980) advanced the Student Attrition Model based on organizational theory, which provides a powerful framework for learning more about ways in which colleges and universities affect the educational experiences and outcomes of undergraduate students (Berger, 2000). It is noticeable that Bean included determinants external to an institution in his model. For example, opportunity, defined as various alternatives, such as transferring to another institution or finding employment, is used to predict students' satisfaction. Bean also integrated student background variables into the original employee turnover model to understand their interaction within the environment of the institution of higher education. Further, the model attempted to identify causal relationships between independent and dependent variables.

However, the Student Attrition Model did not correctly theorize the relationship between satisfaction and institutional commitment to explain student departure, which originated from adopting the employee turnover model as its root. In Bean's Model, satisfaction with being a student is posited to directly influence the intent to leave an

institution. However, the Investment Model suggested that satisfaction is a different construct from commitment (Farrell & Rusbult, 1981; Rusbult & Farrell, 1983; Rusbult et al., 1998).

The Investment Model moved one step forward by integrating the construct of "commitment propensity," similar to the student background construct that Bean added to the Job Turnover Model. Different from other theories, the Investment Model introduced the concept of investment size, which refers to the magnitude and importance of the resources that are attached to a relationship, and differentiated the commitment concept from satisfaction. Investment size is a useful concept to explore whether invested resources in higher education can explain the variations in degree completion. In this model, commitment level directly influences decisions to persist.

## RESEARCH FINDINGS

Following is a brief summary of research findings on degree completion and time-to-degree. The determinants included in studies so far are divided into three major categories: pre-college characteristics, college performance, and environmental factors. Pre-college characteristics include race/ethnicity, gender, SES, and other variables representing academic experience in students' high schools. The independent variables related to academic performance, social integration, and enrollment pattern comprises the category of college performance. Environmental factors encompass determinants related to external conditions in which higher education institutions are operating, including financial aid.

### *Pre-College Characteristics*

The difference in educational achievement by gender and race/ethnicity has been of considerable interest to education policy makers. Concerning gender differences, research has found that female students are doing a better job in attaining a bachelor's degree than men are: The average 2004 six year graduation rate for women was 60 percent, which was higher than the rate for men by 6 percentage points (Horn, 2006; Lee et al., 2007).

There has been a consistent gap in degree completion rates by race, and unfortunately the gap is getting wider (Adelman, 2004): White and Asian students tend to graduate at higher rates than African American and Hispanic students. In 2004, the average gap in graduation rates between white and African American students was 18 percentage point, whereas the gap between white and Hispanic students was 12 percentage points (Horn, 2006). Multilevel analysis also identified that being an African American or Hispanic student is inversely related to degree completion (Titus, 2006a, 2006b). DesJardins (2002) confirmed that minority status reduces the probability of degree completion. However, Adelman's analysis of national longitudinal survey (NELS:88/2000) conflicts with the finding: Minority status has no effect on degree completion once collegiate performance is considered (Adelman, 2006).

Studies agree on the positive association between socioeconomic status (SES) and degree completion (Adelman, 1999, 2006; Cabrera et al., 2005; Titus, 2006a, 2006b). According to Adelman (2006), the only demographic variable that remains significant is SES. Specifically, the highest-SES quartile students are 44 percent more

likely to earn a college degree than the lowest-SES students (Cabrera et al., 2005; Kim, 2007; Titus, 2006a, 2006b). However, irrespective of SES, students who received encouragement from parents and friends while in high school to pursue a college degree were more likely to complete a degree (Cabrera et al., 2005).

For first-generation students, reasonably assumed to be less exposed to encouragement than their non-first-generation counterparts, the probability of attaining a bachelor's degree is reduced by 21 percent (Adelman, 2006). As a similar psychological concept to encouragement, college degree aspiration, which is positively related to student success measured by degree completion, increases as the SES level increases (Cabrera et al., 2005). Noxel and Katunich (1998) also found that personal motivation and goal setting are the most important factors that facilitate students' degree progress.

As a composite measure of the high school curriculum, test scores, class rank and GPA, academic resources variable was shown to be a critical factor in degree completion. Adelman (2006) found that the intensity and quality of high school curricula shows the most powerful impact on bachelor's degree completion for students who attended a 4-year college at any time during the study period of NELS: 88/2000. In his previous study examining the 1980 high school sophomore cohort, Adelman (2005) had the same conclusion. Cabrera et al. (2005) also found a substantial effect of academic resources on degree completion.

However, the impact of the academic resource variable decreased by 36 percent once the actual academic performance variable (GPA) is added (DesJardins et al., 2002),

which conflicts with Adelman's finding. Based on his research, DesJardins and his colleagues argued that what students do with academic resources while they are enrolled in higher education institutions is more important than the academic resources that students bring with them into college.

### *College Performance*

Decades of research identified and confirmed the association between collegiate experiences and first-, second-, and third-year retention (Aitken, 1982; Astin, 1997; Bean, 1980; Pascarella, 1985; Swail, 2003; Tinto, 1975, 1982, 1988, 1998). Given the connection between persistence and collegiate experience on the one hand, and persistence and degree completion on the other, the connection between these collegiate experiences and degree completion seems appropriate. However, the role of those factors in degree completion is largely unknown (Cabrera et al., 2005).

While some collegiate experiences increase the rate of degree completion across all students, academic performance in college, measured by college GPA, is the single most significant determinant of degree attainment (Cabrera et al., 2005; DesJardins et al., 2002 ; Huesman et al., 2007; Kim, 2007; Lee et al., 2007; Titus, 2006a, 2006b).

Another academic behavior that is related to degree completion is curricular choice (Cabrera et al., 2005): Students who take at least one college math course are 27 percent more likely to complete their degree compared to students who take no college math course. However, it is not clear whether this is due to math course-taking or to a difference in majors (i.e., students in liberal arts fields do not need to take a math course). Findings on remedial course-taking conflict among studies (Adelman, 1999,

2006; DesJardins et al., 2002 ; Huesman et al., 2007). Adelman (2006) concluded that remediation did not make a strategic difference in degree completion, whereas Huesman et al. (2007) identified its negative association with degree completion.

According to Tinto (1975), social integration is as important to degree completion as is academic integration. Out-of-classroom experiences, quality of instruction, counseling, institutional prestige, and working on campus have small but significant effects on degree completion (Cabrera et al., 2005). Positive out-of-classroom activities were found to increase degree completion rate by 8 percent, while exposure to good classroom instruction also increases the degree completion rate by 8 percent (Cabrera et al., 2005).

In addition to these findings, living on campus and involvement in extra-curricular activities during the freshman year are positively related to degree completion (Huesman et al., 2007; Lee et al., 2007; Titus, 2006a). Students with the experience of working on campus are less likely to drop out or repeat courses (Noxel & Katunich, 1998).

Students' college enrollment patterns have a significant impact on degree completion. Among those patterns, continuous enrollment is the most powerful variable in explaining degree completion: Continuous enrollment increases the probability of degree completion by 43 percent (Adelman, 2006; Cabrera et al., 2005; Pascarella, 1985). Students who do not maintain continuous college enrollment are 23 percent less likely to earn a bachelor's degree (Cabrera et al., 2005).

In terms of intensity of college enrollment, part-time attendance is negatively related to degree obtainment (Adelman, 2006). If students attend college full-time, they are more likely to succeed in completing a degree by 20.3 percent than their part-time counterparts (Kim, 2007). One of the most hazardous characteristics that have a negative impact on degree completion is withdrawing from a class without any penalty and repeating it (Adelman, 2006; Cabrera et al., 2005; DesJardins et al., 2002; Lee et al., 2007). For example, dropping, withdrawing from, or failing to complete more than 20 percent of the course work reduces a student's chances to complete a degree by 27 percent (Cabrera et al., 2005).

Transfer behavior is also associated with degree completion. Transferring from a community college to a 4-year college is shown to have no relationship to degree completion; however, moving back and forth between four and two year institutions is negatively associated with degree completion (Adelman, 2006). Simply, the number of colleges attended has a significant negative regression coefficient with degree completion (Pascarella, 1985). The type of first postsecondary institution attended is also an important factor in degree completion: Low-income students are more likely to enroll in two-year institutions than are their economically better-off counterparts and their bachelor's degree completion rate is low (Cabrera et al., 2005). This institutional attendance pattern seems to support the claim of inequity of educational opportunities based on one's socioeconomic background (Cabrera et al., 2005).

### *Environmental Factors*

Working as a discount factor when viewed from an economic perspective, financial aid is one of the most important variables in higher education research. The chance of completing a college degree is negatively associated with unmet financial need, and working more than 10 hours per week has a similar effect (DesJardins et al., 2002; Titus, 2006a, 2006b). Findings on financial aid indicate that loans and grants are positively related to graduation (Kim, 2007; Titus, 2006a, 2006b): These effects decline as time passes (DesJardins et al., 2002). For all students, receiving grants-in-aid and loans increases the probability of completing a 4-year degree (Cabrera et al., 2005).

Some of the research deviated from focusing on students' characteristics and, instead, considered organizational characteristics and behavior (Gansemer-Topf & Schuh, 2005; Noxel & Katunich, 1998; Titus, 2006a). For example, Titus (2006) found that the percentage of revenue derived from tuition is positively related to degree completion, and the level of educational and general expenditures are positively associated with degree completion (Titus, 2006a). Kim (2007) confirmed these findings: tuition, selectivity, and institutional control (i.e., public/private) had a significant relationship to the probability of degree attainment. Concerning expenditures of an institution, institutional grants were found to have a significant positive influence on graduation rate (Gansemer-Topf & Schuh, 2005).

Few studies explored the association between state-level higher education policies and degree completion after taking student and institutional variables into account. Titus (2006) attempted to answer these state-level policy questions by utilizing multilevel analysis. From the research, he found that college completion is

positively associated with the percentage of total state grants as a percentage of appropriations of state tax funds for the operating expenses of higher education. State need-based grant dollars per individual in the traditional college age population also appeared to have positive impact (Titus, 2006a). At the institution level, the average SES of the freshman class and being enrolled at a highly selective institution are positively related to the chance of degree completion (Horn, 2006; Titus, 2006a).

# CHAPTER III: METHODOLOGY

Chapter III begins with a description of the Degree Commitment Model elaborated by adopting and revising the Investment Model. In the following section, this study introduces the procedures by which NELS: 88/2000 collected data and what information was added to PETS: 2000. Specific variables included in the analytic model of this study are described in detail, followed by a description of the applied analytic strategy, the Zero-Inflated Negative Binomial model. This chapter closes with an explanation regarding the subjects selected for the analysis and hypotheses of this study.

## DEGREE COMMITMENT MODEL

This study advances the Degree Commitment Model by integrating the Investment Model into the extant theoretical literature on degree completion. Drawing on data from a single institution and adopting the Investment Model, Noxel et al. (1998) first attempted to provide a theoretical basis that could direct studies on the degree completion process. Their study, however, did not include an essential theoretical component of the Investment Model, because it was limited by data collected from a single institution.

A more critical shortcoming of their study is that the researchers confused enrollment intensity with degree commitment. The authors argued that "applying the concept of job commitment to an educational institution implies that … a student is

committed to earning a degree, and with a greater commitment would come faster progress" (Noxel et al., 1998; p. 7). Further, they operationally defined degree commitment as the "credit hours earned per elapsed quarter" from admission to graduation. Originated from relationship theory, however, the Investment Model explains why certain relationships persist whereas others do not. It does not pertain to the intensity or quality of a relationship, but is appropriate to interpret degree commitment as students' persistence until they obtain a degree.

Introducing surrogate measures appropriate for the study of students rather than employees, this study identifies four constructs of the Investment Model (satisfaction, quality of alternatives, investment size, and commitment level) and the construct of commitment propensity (Lee, 1992) in order to develop the Degree Commitment Model (DCM). DCM extends the concept of persistence from persisting "with an institution" to persisting "with a college degree" utilizing longitudinal data that tracked participating students. By doing this, the study overcomes the limitations of the majority of existing studies that relied on the data from a single institution and/or incomplete theoretical frameworks.

The basic construct comprising the Investment Model is satisfaction. Satisfaction level refers to the positive versus negative affect experienced in a relationship (Rusbult et al., 1998). Originated within Interdependence Theory explaining romantic relationships, satisfaction level is defined as the extent to which a partner gratifies the individual's most important needs. In organizational studies, job

satisfaction is primarily a simple function of the rewards and costs associated with the job (Farrell & Rusbult, 1981).

Specifically, reward means a positive reinforcement such as pay, task identity, and opportunity for promotion (Emerson, 1976; Farrell & Rusbult, 1981). As another critical factor used to determine the level of satisfaction, cost has two basic meanings: cost in the form of aversive stimuli (e.g., painful or boring work performed) and rewards forgone (Emerson, 1976). Noxel and Katunich (1998) interpreted cost as the absence of rewards.

The third concept related to measuring satisfaction is comparison level. The amount of utility obtained per transaction over time with a given environmental source becomes a neutral point on the scale of value for utility (Emerson, 1976). Emerson (1976) explained this construct using the following example (1976, p.348).

> A child's weekly allowance from his parents for specified duties or general good behavior might be X dollars. The child, after value adaptation to that level, will act as though departures from X carry greater value, positive or negative, than X itself.

Using the three constructs of reward, costs, and comparison level, Farrell et al. (1981) formalized the satisfaction level as following:

$$SAT_x = ( R_x - C_x ) – CL$$

In the equation, $SAT_x$, $R_x$, $C_x$, and CL means satisfaction level, rewards, costs, and comparison level, respectively.

This study uses college GPA as a surrogate measure of satisfaction with being a student. Studies adopting commitment theories used GPA as the appropriate replacement for reward under the assumption that it is a tangible resource to be utilized for future success (Bean, 1980, 1983; Noxel & Katunich, 1998). Combined with reward, four indicators of cost were used in this study to determine the level of satisfaction: having dependents, failing in attempted courses, taking remedial courses, and attending colleges not in his/her home state.

The comparison level stands for the average quality of outcomes that the individual has come to expect from associations (Farrell & Rusbult, 1981) to which the value of the current association is compared. In this study, however, the specific measure indicating comparison level was not used because there was no information available in PETS: 2000 data about students' judgment on the superiority of the value of their current associations over expected associations in the data chosen for the analysis.

The second construct of DCM is the quality of alternatives. It refers to the perceived desirability of the best available alternative to the current relationship (Rusbult et al., 1998). The quality of alternatives is determined by the extent to which an individual's most important needs could be effectively fulfilled outside of the current relationship (Rusbult et al., 1998). Applying this construct to the higher education setting, this study assumes that students' most important need is to obtain a degree, and that they will terminate their relationship with their current college and transfer to another institution once they regard it as a more effective way to obtain a degree.

Three measures were used in this study to represent the quality of alternatives: institutional selectivity of the first institution, classic transfer from a 2-year to a 4-year college, and multiple school attendance. The interdependency between institution and student deepens as the quality of alternatives decreases.

Investment size is an important construct explaining why certain relationships endure even with low satisfaction and/or attractive alternatives. Investment size refers to the magnitude and importance of the resources that are attached to a relationship (Farrell & Rusbult, 1981; Harvey & Wenzel, 2001; Rusbult et al., 1998). Once a relationship ends, the value of the invested resources would decline or be lost. The form of invested resources may be either material or psychological, and either intrinsic or extrinsic (Farrell & Rusbult, 1981). Farrell et al. (1981) listed length of services, acquisition of non-portable skills, and retirement programs as common examples of job investments (Farrell & Rusbult, 1981). The increased size of investment is hypothesized to be positively related to commitment by increasing the costs of terminating the current relationship (Harvey & Wenzel, 2001).

Considering that students form a relationship with higher education through experiences within higher education institutions, the amount of invested resources in an institution can be directly interpreted as that of investment in higher education. The measures used in this study represent the amount of invested resources used to obtain a college degree. The number of earned credit hours is a good measure indicating investment size. If a degree-seeking student had to end his/her relationship with the current institution, the student would confront the risk of depreciation of the invested

resources: Certain credits earned in an institution might not be transferred to another institution and the value of earned credits that are not transferred toward a degree significantly drops. This study includes credits earned for the first calendar year as a measure of investment size.

As a similar way of ending the current relationship with an institution, changing major is also used as a surrogate measure of investment size. Students are expected to face the risk of depreciation of the values in their current investment by moving from one discipline to another. Contrary to this depreciating factor, accelerating credits from high school work as a positive factor in obtaining a degree. Taking cooperative or internship classes is also a good indicator of investment size, since that means students are well integrated into the academic fabric of the system of an institution.

Assuming that individuals enter an organization with a set of personal characteristics and prior experiences that can affect their subsequent adaptation to the work environment, DCM integrates the construct of "commitment propensity." The importance of the personal characteristics in understanding the degree completion process is well documented in both organizational behavior and student performance research. Lee et al. (1992) found that personal characteristics influence initial job commitment, which, in turn, influences subsequent commitment. Similar to this finding, Bean's (1980) path model of student attrition confirmed that students' background variables interact with organizational determinant variables to influence satisfaction and institutional commitment.

Three components comprise the concept of commitment propensity (Lee, Ashford, Walsh, & Mowday, 1992; Mowday, Porter, & Steers, 1982; Noxel & Katunich, 1998): personal characteristics, expectations, and organizational choice. Newcomers with a high level of self-efficacy and self-confidence (personal characteristics) should be more likely to respond positively to the challenges of an environment. Also, expectations that newcomers bring to the organization should serve as a frame of reference in evaluating their new experiences. Newcomers with more positive expectations should interpret their subsequent experiences as consistent with their prior beliefs (Lee et al., 1992). The decision to enter one organization over another also influences newcomers' subsequent attitudes (Lee et al., 1992).

The commitment propensity is differentiated from organizational commitment in that it is developed prior to organizational entry and yields a greater likelihood that actual commitment develops after entry (Lee et al., 1992). It can be compared to the concept of initial commitment in the Interactionalist Theory, which is directly influenced by students' entry characteristics. In this way, DCM complements the weakness of the Investment Model overemphasizing variables reflecting differences among relationships rather than differences among individuals.

In this study, the following student background and expectation variables are included: race/ethnicity, gender, SES quintile, cognitive test scores in reading and math, anticipation of degree attainment, parents' education, and parenthood.

Like Bean's student attrition model, DCM postulates that degree obtainment is the final product of degree commitment. Working as a direct cause of degree

completion, commitment level is defined as the intent to persist in a relationship, as well as feelings of psychological attachment regardless of satisfaction (Farrell & Rusbult, 1981; Rusbult & Farrell, 1983). Therefore, commitment is the most direct and powerful predictor of degree obtainment.

Four constructs addressed above-commitment propensity, satisfaction level, investment size, and alternative quality-determine the commitment level and each of these variables contributes unique variance to predicting it. The commitment can now be expressed as:

$$COM_x = COMProp_x + SAT_x + I_X - A_Y$$

In the equation, $COMProp_{x,}$ $SAT_{x,}$ $I_{X,}$ $A_Y$ means commitment propensity, satisfaction level, investment size, and quality of alternatives, respectively.

Following the model, this study assumes that degree commitment is the likelihood that an individual will remain with a degree and feel psychologically attached to it, whether it is satisfying or not. Figure 5 illustrates the constructs and specific variables comprising the Degree Commitment Model as well as the assumed causal relationships.

## NELS: 88/2000 AND PETS: 2000

The principal data for this study were drawn from the National Education Longitudinal Survey of 1988 (NELS: 88/2000). NELS: 88/2000 is a nationally representative study that sampled 8$^{th}$ graders in 1988 and tracked them for 12 years with the goal of providing longitudinal data about critical transitions experienced by the high

school class of 1992. The sampled subjects of the study (N=12,114) were contacted four times since their base year survey and tests: the first follow-up was in 1990 when they were 10th graders, the second follow-up was in 1992 when they were 12th graders, the third follow-up was 2 years after their scheduled high school graduation, and the fourth follow-up was in 2000, 8.5 years after their scheduled high school graduation.

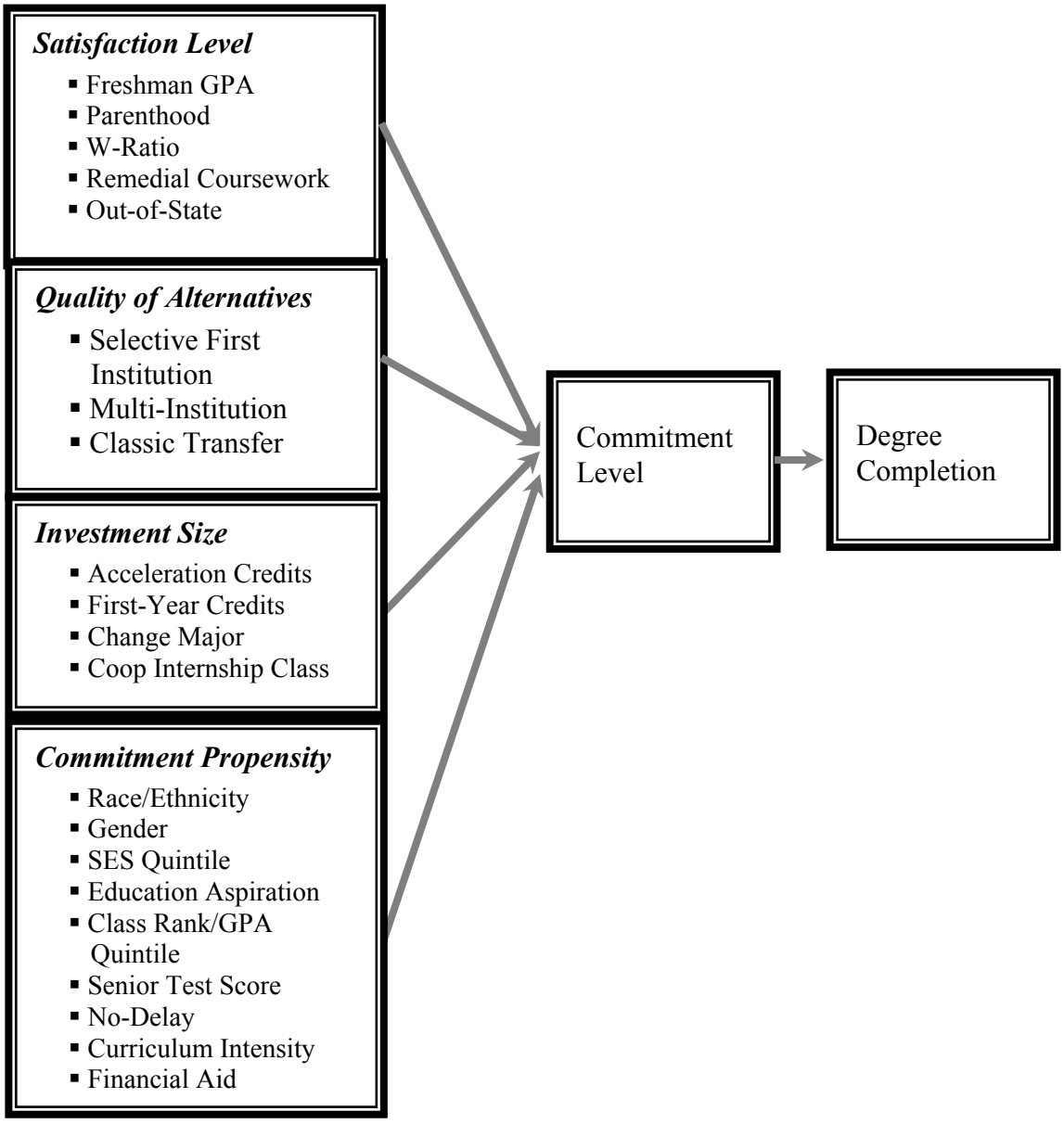


**Figure 5: Degree Commitment Model**

Additionally, data were also collected from parents, schools, teachers, and extant high school and postsecondary transcripts depending on the year (Curtin, Ingels, Wu, & Heuer, 2002). NELS: 88/2000 represents an integrated system of data that tracked students from middle school through secondary and postsecondary education, labor market experiences, and family formation (Curtin et al., 2002).

The main source of data for this study was the Postsecondary Education Transcript Study (PETS: 2000), which was derived from NELS: 88/2000 and collected college transcripts. Some of the variables were taken directly from NELS: 88/2000 and merged with PETS: 2000 as needed. PETS: 2000 data was chosen for this study for two reasons: minimization of errors and allowance of enough time for students to obtain a degree.

The requests for postsecondary transcripts of 9,602 students who had attended college by 2000 were submitted to the relevant institutions, and 15,562 transcripts were received for 8,889 students (Goldrick-Rab & Pfeffer, 2007). By including high school and college transcripts, which allows precise documentation of pre-college and college academic performance, the data set minimized measurement errors.

Another reason to use this data set is its allowance for a long time period for undergraduate degree completion. From the majority of subjects with expected high school graduation in 1992, NELS: 88/2000 allows students 8.5 years to complete a bachelor's degree. When the length of time-to-degree is extended from 4 to 6 years among the NELS: 88/2000 subjects who began in four-year colleges, degree completion rate increases by 30.3 percent, from 33.9 to 64.2 percent. However, the increase was

only 5.1 percent when 8.5 years were used as the bar to degree completion rather than 6 years (Adelman, 2006), which indicates 8.5 years is a long enough time for baccalaureate degree completion for students who actually acquired a degree.

### *Sample Design of NELS: 88*

In the NELS: 88/2000 base year, a two-stage stratified sample design was used to select a nationally representative sample of 8th grade students in the spring of 1988 (Curtin et al., 2002). The primary sampling unit was schools, and students were the second stage sampling unit. Within each stratum (50 states), schools were selected with probabilities proportional to their estimated 8th grade enrollment. A total of 1,052 schools were selected from the first stage (815 public and 237 private), and the second stage produced a random sample of 26,435 students, of which 24,599 participated (Curtin et al., 2002).

The first follow-up of NELS: 88/2000 collected basically the same data as the base-year study; however, an additional 1,034 students who were not contained in the base-year sampling frame were selected through a process called "freshening" (Curtin et al., 2002). This is a statistical process to make the sampled subjects for NELS:88/2000 representative of students enrolled in the 10th grade in the 1989-90 school year (Curtin et al., 2002). The second follow-up again added 364 new subjects through a sample freshening process to achieve a representative sample of students enrolled as 12th graders during the spring term of the 1991-92. This process resulted in the total sample size of 20,923; the sample size decreased by 3,676 after the second follow-up survey.

To select the third follow-up subjects, the sample for the second follow-up study was divided into 18 groups based on their response history, dropout status, eligibility status, school sector types, race, test score, socioeconomic status, and freshened status (Curtin et al., 2002). Each sampling group, then, was assigned an overall selection probability and the final sample size was 15,875 (Curtin et al., 2002). The fourth follow-up sub-sampled 15,237 individuals from the sample for the third follow-up study (Curtin et al., 2002). This process removed 1,033 participants who did not respond to the third or fourth follow-ups.

### *Instruments*

The data collection instrument for NELS: 88/2000 was enhanced with each new wave of the data collection activities, and new instruments were added. Instruments for the base year included a student questionnaire, a parent questionnaire, and teacher and school administrator questionnaires (Curtin et al., 2002). In addition to these instruments, student cognitive tests covering four subject areas (reading, mathematics, science, and social studies) was developed and administered to assess students' cognitive growth during high school (Curtin et al., 2002). The combined tests consisted of 116 items to be completed in 85 minutes. In the first and second follow-ups, interviewers re-administered these instruments, except for the parent questionnaire.

Before the start of the NELS: 88/2000 study, the research team field-tested data collection procedures and instruments: Results were used to inform planning for the study and to improve the measurement properties of test and questionnaire items (Curtin et al., 2002). The student questionnaire administered through the second follow-up

study included information on student background, home environment, perception of self, aspirations for higher education, and school experiences and activities (Curtin et al., 2002). For the same study period, cognitive tests were administered.

As the sampled students began their diverse pathways in their transition from high school to postsecondary education or to work, the research team developed a student interview questionnaire to collect information on students. Focused on postsecondary access and employment, the survey asked for information about academic achievement, impression about the current postsecondary institution, and family environment. The survey questionnaire was refined through field-testing and advice from the technical review panel (Curtin et al., 2002). Then, the refined interview was conducted by telephone, or a paper questionnaire was administered for those cases where respondents were unavailable for an interview over the phone. Specific contents of the interview questions covered the areas of family information, high school and postsecondary academic achievement, employment experience, and location.

The basic process for developing the student interview questions was the same for the third follow-up study. The fourth follow-up instrument was comprised of 10 sections: current activities, employment, job-related training, high school completion, postsecondary education, adult education, family formation, income and expenses, other outcomes, and race/ethnicity.

To collect information about factors that influence educational attainment and participation, NELS: 88/2000 developed a parent questionnaire for the base-year and second follow-up studies. The questions are about family background, socioeconomic

characteristics, and the character of home educational support system. In addition to questions about family, it also collected household income, postsecondary educational costs and financial aid decisions, and religious affiliation.

As the final stage of data collection activities, the study submitted requests for transcripts from high schools and postsecondary institutions. Researchers were able to validate the collected information and assess the influence of course-taking behaviors on postsecondary achievement using the collected transcripts.

This study restricted the analysis sample to students who claimed that they attended a 4-year institution at any time during the study period and whose college transcript was received; 170 students with incomplete transcript data were excluded. This reduced the total number of eligible students for this analysis to 6,260.

### *Variables*

The variables included in the Degree Commitment Model (DCM) were selected for each of the theoretical constructs in the model. Related to satisfaction level are first year GPA, having dependents, failed course(s), remedial course(s), and attending an institution not in a student's home state. Institutional selectivity of first attending institution, classic transfer, and attending multiple institutions are used to measure the quality of alternatives. The third construct, investment size, is indicated by accelerating credits, earned credits for the first academic year, and change of major. Commitment propensity includes variables related to pre-college academic performance, demographic information, and financial aid. More detailed explanation on each variable follows a description of the criterion variables used in this study.

### *Criterion Variables*

Two dependent variables were chosen: a binary variable of degree completion and a continuous variable indicating the number of enrolled weeks to baccalaureate degree completion. The variable of degree completion is coded as 1, if a bachelor's degree was earned on at least one received transcript, and 0, if a bachelor's degree was not attained.

The second dependent variable measures the length of time that students took until their degree completion. This variable was derived based on four variables: the number of terms enrolled, term type, the date of true enrollment in higher education, and the date of first bachelor's degree obtainment. Now that different institutions are adopting different academic calendar systems, this study calculated the total number of weeks in which students enrolled as the measure of enrolled time. For example, in the case of a student who enrolled 10 semesters (including summer terms) until degree completion, 15 weeks is multiplied and the total number of enrolled time to degree becomes 150 weeks. For students who transferred, the total number of transferred courses was divided by four to estimate semester equivalent academic load, then multiplied by 15. Summing up the total enrolled and transferred weeks, this study could get the enrolled TTD variable (see Appendix B). Terms that students enrolled before the start of college study as a real college student and after receiving a first bachelor's degree were not added to TTD.

***Satisfaction***

***Freshman GPA:*** Grade Point Average in the first full calendar year of postsecondary attendance. Freshman year GPA was calculated for the first full calendar year of postsecondary attendance (e.g., for students who started from the fall semester of 1992, one full calendar year includes the fall semester of 1992, spring of 1993, and summer of 1993). The GPAs in other scales were transferred to a 0 to 4.0 scale.

***Dependents:*** This variable was constructed from two variables: marital status in 1994 and the number of children born to respondents by 1994. Based on this information, a dichotomous variable was derived: coded as '1' if respondents have any dependent and '0' if students are single and have no children.

***Remedial Course Work***: A dichotomous variable indicating whether students took any remedial courses during the first calendar year of attendance. Two separate binary variables, remedial reading and remedial math, are included in this study: coded as '1' if students took a remedial course, '0' otherwise.

***W-Ratio***: The ratio of non-penalty withdrawal and no-credit repeat grades to all grades received over the entire postsecondary career. The number of courses from which the student withdrew without penalty plus those that the student repeated was the numerator, and the total number of courses in which the student enrolled was the denominator. Then, the values were rescaled as a percentile value. W-Ratio is expected to have negative relationship with academic productivity.

***Out-of-State***: This variable represents whether the state of the student's high school is different from that of the first postsecondary institution in which the student

enrolled. Twenty-four percent of students in the study sample crossed the border and they were coded as '1,' otherwise '0.'

***Quality of Alternatives***

***Selective Institution:*** A dichotomous variable indicating that the first institution attended by the student was either highly selective or selective (Adelman, 2006). This variable was derived from the selectivity of the 1st true institution attended: Highly selective and selective institutions were merged together to form selective first year institution category, non-selective otherwise. This study decided to recalibrate the scale of this institutional selectivity variable as a binary with the concern that the difference between highly selective and selective institutions might not be the same as that between non-selective and open institutions. The measure of selective institution is identified as the mean SAT composite score of entering freshman based on the Cooperative Institutional Research Project (1992): The average SAT composite sore of entering freshman students for selective institutions is 1,050. Subjects with missing values and indeterminable institutional selectivity (111 subjects) were deleted list-wise from the analysis: coded as '1' if selective institutions, otherwise '0.'

***Multi-Institution:*** This is another dichotomous variable marking that a student attended more than one 4-year institution. Students who transferred from a 2-year institution to a 4-year were not included in the "multi-institution" group, but in "classic-transfer" group. Students who attended more than one 4-year institution were coded as '1,' otherwise '0.'

***Classic Transfer:*** This variable was derived from a basic combination of institution type attended (INSTCOMB from PET: 2000). Institutions attended prior to high school graduation were not included. Students with the value of "3," which means first attended a 2-year college and then transferred to a 4-year college, were selected as classic transfer. Classic transfer students were coded as '1,' otherwise '0.'

***Investment Size***

***Acceleration Credits:*** Total credits earned prior to high school graduation and by examination. It included Advanced Placement, College Level Examination Program (CLEP), and institutional challenge exams (the majority of these are in foreign languages). Most of these credits were earned either prior to matriculation or during the first term of enrollment (Adelman, 2006) and the values range from 0 to 60.

***First-Year Credit (TCREDG):*** The total number of undergraduate credits earned during the first calendar year. Credit hours from the real first institution were included. This variable is of particular interest in tracking the momentum of beginning successful students.

***Change Major:*** The last NELS follow up survey in 2000 asked students whether they had changed majors at any time during the study period. A dichotomous change major variable was developed and modeled in this study. Multiple sources of information were combined to judge whether a student changed majors: students who answered that they changed majors, community college transfer students who moved from general studies to a specific major, and cases where the student presented two

transcripts with different majors. Coding scheme was '1' for students who ever changed majors, '0' otherwise.

***Co-op and Internship:*** This continuous variable represents the total number of cooperative or internship courses in which students enrolled. The cooperative course does not refer to cooperative learning.

***Commitment Propensity***

***Race/Ethnicity****:* The race/ethnicity variable was extracted from the base year student survey and the values for race were: 1= Asian or Pacific Islander, 2= Hispanic, regardless of race, 3= Black, not of Hispanic origin, 4= White, not of Hispanic origin, 5= American Indian or Alaskan Native, 8= Missing. Each race category was coded as a dichotomous variable and put into the equations with White category as the base group.

***Male:*** Male variable was constructed from the base year student questionnaire, with men coded as '1,' women as '0.'

***SES Quintile:*** This variable was constructed using father's education level, mother's education level, father's occupation, mother's occupation, and family income data. For cases where all parent data components were missing (8.1 percent of the participants), students' response were used to compute the variable. The value for this variable ranged from 1, lowest quintile, to 5, highest quintile.

***Education Anticipation (In 1992):*** The question used to measure students' educational expectation was, "As things stand now, how far in school do you think you will get?" The values of the variable are as follows: 1= High school graduate or less, 2 = Trade school, 3 = Some college, 4 = Finish college, 5 = Graduate degree, and -1 =

Missing or indeterminable. In his Tool-Box study, Adelman (2006) collapsed this category to calculate a dichotomous variable. However, this study did not do so since the true difference among response options could be attenuated by merging multiple categories.

***Class Rank/GPA Quintile:*** This variable is a composite of high school class rank and GPA quintile. To create this variable, class rank was chosen for the base reference because it overrides variability in local grading practices. For missing cases, the value was calculated using an equipercentile concordance method. Basing a percentage scale first on high school rank percentile, weighting the combined scale, and cutting it by quintiles solves some of the bias and validity problems that would result from relying on GPA alone (Adelman, 2006). The highest quintile value is coded as '1,' and the lowest, '5.'

***Senior Test Scores:*** This variable is derived from student cognitive test results. Students in the $12^{th}$ grade completed a series of achievement tests for each wave of the study at their in-school or off-campus survey sessions, and composite scores on an enhanced mini-SAT were reorganized as a quintile measure. Value 1 means the highest quintile and 5, lowest.

***No-Delay:*** To calculate this variable, the month and year of high school graduation was subtracted from those of the first attendance in a postsecondary institution following high school graduation. Then the decision rule of 7 months was applied to judge whether students were regarded as direct entry or not. Results were coded as '1' if delayed, and '0' if not delayed.

***Curriculum Intensity:*** This variable was created through multiple processes. First, 31 levels of academic curriculum intensity and quality were constructed from the standardized empirical distribution of Carnegie units earned in core academic fields by NELS:88/2000 students. Then, the variable was rescaled as a quintile version. Value labels are as follows: 1- highest quintile, 2- second quintile, 3-third quintile, 4- fourth quintile, and 5- lowest quintile.

***Financial Aid:*** Unfortunately, the total dollars of financial aid students received was not available in PETS: 2000 data. As an alternative measure, this study included a binary variable indicating whether a student received any financial aid or not: '1' for Yes, '0' for No.

## ANALYTIC STRATEGY

The research questions addressed in this study concern determinants affecting undergraduate degree completion and TTD. The existing research on the topic has applied various statistical methods, such as basic correlation analysis, logistic regression, structural equation modeling, hierarchical linear modeling, and event history model (Adelman, 1999, 2006; DesJardins et al., 2002; Kim, 2007; Knight & Arnold, 2000; Titus, 2006a, 2006b).

A well-designed landmark study on factors affecting degree completion was conducted by Clifford Adelman (2006): *The Toolbox Revisited*. To answer his research question about determinants related to degree completion, Adelman adopted a logistic regression model and used the same data that this study chose, PETS: 2000. Adelman's

study received considerable attention in higher education circles (Hebel, 2000); however, it dealt with the question of TTD by adopting only a simple linear regression method.

Another notable study was done by DesJardins and his colleagues; "Adding a timing light to the tool box" (DesJardins et al., 2002). DesJardins et al. (2002) tried to add the temporal dimension of predictors focusing on the longitudinal nature of the postsecondary transcript file of the High School and Beyond/Sophomore Cohort longitudinal study (NCES CD #98-135), which Adelman used for his old version of toolbox study: "Answers in The Toolbox" (Adelman, 1999). Replicating DesJardins' research using an updated version of data and new analytic techniques would offer useful information to policy makers and higher education institutions, which is one of the goals of this study.

One of the two dependent variables modeled in this study is a binary variable indicating whether a student succeeded in obtaining a 4-year degree. The other dependent variable is TTD represented by the number of weeks enrolled, which is a count variable. In order for students to have a value for the number of weeks to degree, they must actually complete their degree program. There are therefore two processes at work, one which determines whether a student completes a degree, and a second which determines how long it took until degree completion. While some factors may indeed influence both processes, there are no a priori reasons to expect both processes to be driven by identical sets of forces (Lee et al., 2007).

Looking at the distribution of enrolled TTD in the form of weeks, it becomes clear that applying simple linear regression method is not appropriate: violation of the assumption of normal distribution. Figure 6 shows the distribution of enrolled TTD in weeks for the 6,152 students in this study (mean: 110.15, standard deviation: 91.65).

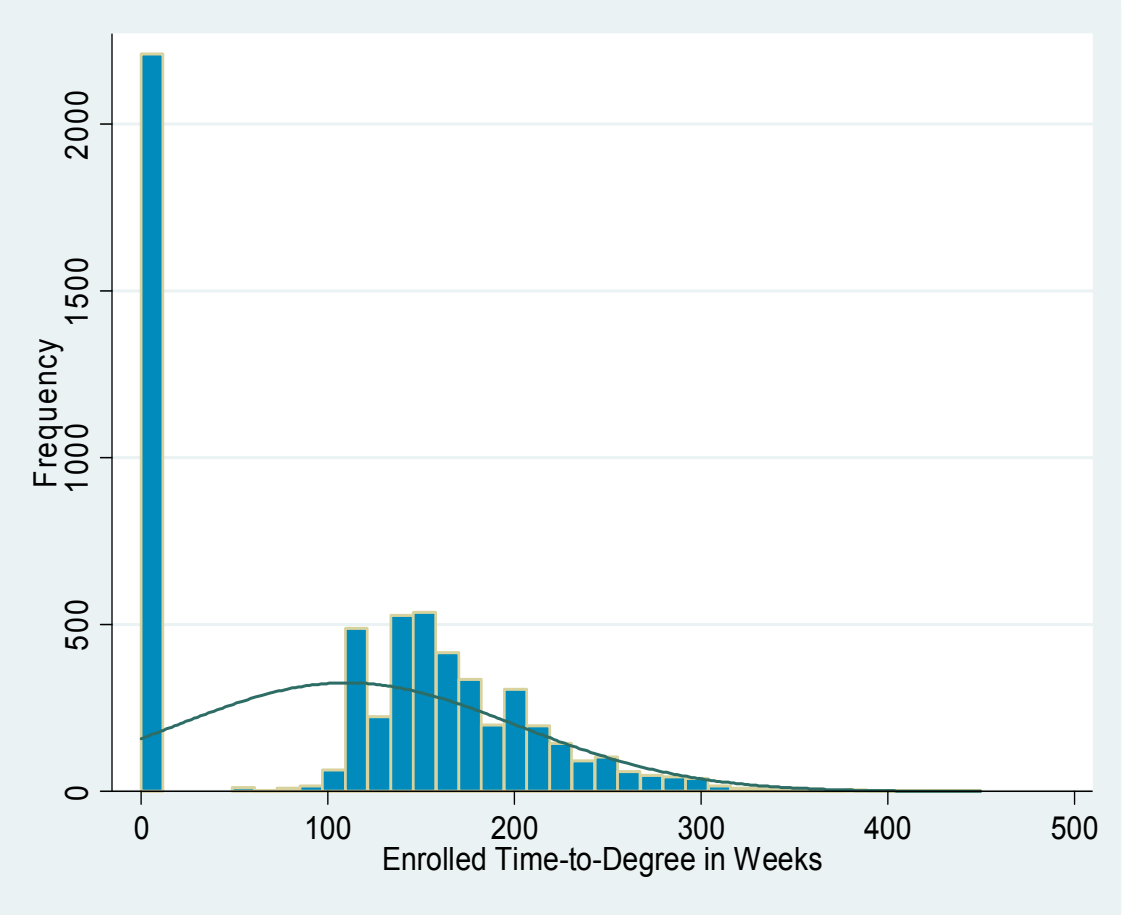


**Figure 6: Distribution of Enrolled Time-to-Degree in Number of Weeks**

The distribution of enrolled TTD indicates that an analytic strategy other than multiple-regression needs to be adopted because it significantly violates the assumption of a normal distribution. The Poisson regression model might be an appropriate alternative

to model the count variable (enrolled TTD) if there are not excess zero observations in the dependent variable of enrolled TTD, which is not the case here. In practice, the standard errors in the Poisson regression model tends to be biased downward, resulting in spuriously higher Z-values and spuriously smaller p-values, which often leads to type II errors (Long & Freese, 2006).

Applying the Zero-Inflated Negative Binomial regression model (Greene, 2003; Long & Freese, 2006), this study solves the problem of non-normal distribution and overdispersion. Overdispersion is the presence of greater variability in a data set than would be expected, which causes downward estimation of standard errors. This fairly new statistical model is a continuation of previous study at a single institution level (Lee et al., 2007), which found that some predictors positively related to degree completion are negatively related to TTD.

The Zero Inflated Negative Binomial (ZINB) model estimates two equations. The first is a logistic regression equation predicting whether a student falls into the "zero" category, meaning that he/she did not complete a degree. The second equation is an advanced Poisson regression equation of the number of weeks enrolled for those students who did complete a degree. The study uses two same sets of independent variables in each equation, binary and count equation, and the binary equation explains the relationship between predictors and degree completion, whereas the count equation explains the relationship between predictors and TTD (Long & Freese, 2006).

ZINB is a variation of Poisson regression model which is the most basic model for count outcomes and has the defining characteristic that the conditional mean of the outcome is equal to the conditional variance (Long & Freese, 2006; p. 349):

$$\Pr(y|\mu) = \frac{\exp(-\mu)\mu^{y}}{y!} \text{ for } y = 0, 1, 2, \ldots.$$

In the equation above, 'μ' is the expected number of times that an event has occurred per unit of time, and 'y' is the observed count. This study limits the length of time for degree completion to 8.5 years since it is the maximum length that PETS: 2000 allows.

The assumption of equality of the mean and the variance is known as equidispersion. In practice, count variables often have a variance that is greater than the mean, which is called overdispersion. This overdispersion causes the under estimation of the standard error and wrongly rejects $H_0$. This overdispersion is highly likely to exist in time-to-degree research since most of students graduate in 4-6 years after their entry to higher education and with a high frequency of '0' counts, which means no student can graduate before the end of the first semester in college. This over-dispersion is corrected by ZINB model (Long, 1997; p. 245):

$$\Pr(y_i=0|X_i, Z_i) = F(Z_i\gamma) + [1-F(Z_i\gamma)]\exp(-\exp[X_i\beta])$$

$$\Pr(y_i|X_i, Z_i) = [1- F(Z_i\gamma)]\frac{\exp(-\exp[X_i\beta])\exp(X_i\beta)^{yi}}{y_i!} \text{ for } y_i>0$$

When F is either the normal or the logistic cumulative distributive function, and means the vector of predictors and coefficients. As the equation shows, the ZINB model

assumes that the population consists of two groups: group one with the probability of $y_i$=0, which means students who commenced higher education but failed to complete, and y$i$ indicates the observed number of weeks that students took before they graduated: one equation estimates the factors affecting degree completion, and the other, TTD.

This study used the STATA version-11 statistics package. The package requires two separate sets of predictors for the ZINB model (STATA command "Zinb"): one set of variables that predict the membership in the zero group (binary equation) and the other one that affect TTD (count equation). This study constructed two identical sets of predictors to explain the impact of each determinant on both undergraduate degree completion and TTD.

Researchers should be careful when analyzing the data from a longitudinal study like PETS: 2000 to apply the proper weight to come up with a nationally representative sample. Weights should be applied to PETS: 2000 data to compensate for unequal probabilities of selection and to adjust for the effects of non-response (Curtin et al., 2002). This study applied the "F4F2P3WT" panel weight which generalizes to NELS: 88/2000 postsecondary education participants for whom data were collected in 1992, 1994, and 2000 and complete transcript information was gathered. Using this weight enables the findings of this study to be generalized to the national population of students who ever attended any 4-year college represented by NELS: 88/2000 subjects.

STATA, through its "svy" command, handles complex survey data so that the variance and standard errors can be corrected by taking complex survey design into consideration. This study declared the PETS: 2000 to be from complex survey design

using “svyset” command. The svyset requires four components: strata, primary sampling unit (clusters), sampling weights, and finite population correction (StataCorp, 2009).

Specifically, the strata component specifies the name of a variable that contains stratum identifiers, and the “STRATFU4” variable was used from PETS: 2000 file. The primary sampling unit (PSU) is the variable that identifies the clusters from which students are randomly sampled (PSUFU4, in this study). As explained earlier, the “F4F2P3WT” variable was used to represent students with 4-year institution entry experience and corrects the difference in probabilities of being selected and possible bias of non-response.

The option “fpc” requests a finite population correction for the variance estimates. An fpc accounts for the reduction in variance that occurs when sampling without replacement from a finite population occurs compared to sampling with replacement from the sample population (StataCorp, 2009). Specifying an fpc variable in stage ‘i’ indicates that the sampling units in that stage were sampled without replacement. Typically, the fpc variable contains the number of sampling units per stratum in the population. If the value of fpc is less than or equal to 1, it is interpreted as a stratum sampling rate $f_h = nh/Nh$, where nh = number of units sampled from stratum h and Nh = total number of units in the population belonging to stratum h.

In this study, the fpc option was ignored because the total number of schools (38,866) is relatively larger than the number of selected schools (1,734): about 4 percent of the population. If this is the case, the reduction in the variance can be ignored.

## THE SAMPLE

The basic population of analysis in this study was limited to students who ever attended a four-year postsecondary institution by 2000. Therefore, the students who failed to graduate from high school or did not enroll in a 4-year institution in the process of their postsecondary education career were excluded from the analysis. Subjects whose postsecondary education transcripts were not received were also excluded from the analysis. Based on students' response on their higher education history, transcripts were requested for 9,602 students and 15,562 transcripts were received for 8,889 students. Among those, 6,430 students attended a 4-year institution before the year 2000. From the sample, 170 students were excluded with incomplete transcript data, which left 6,260 students (see Appendix D). Table 2 provides the descriptive analysis of the unweighted study sample.

Among 6,260 eligible subjects of this study, 47 percent were male students and 28 percent were minority students. Twenty-four percent of the students attended their first college located in a different state from their high school states, and about 7 percent of them had dependents. The percentage of students who received any financial aid was 65. Considerable missing values (1,143 students) were generated in the quintile version of high school rank and GPA composite. However, it is one of the crucial variables measuring commitment propensity, which made it appropriate to retain in the analysis.

**Table 2: Unweighted Descriptive Statistics**

| Variable | N | Mean | SD | Min | Max |
|---|---|---|---|---|---|
| Degree Completion | 6,260 | 64.73 | 0.48 | 0.00 | 1.00 |
| Enrolled TTD | 6,152 | 110.15 | 91.64 | 0.00 | 450.00 |
| Anticipation | 5,897 | 4.37 | 0.74 | 1.00 | 5.00 |
| HS Sr. Test Quintile | 5,695 | 3.86 | 1.18 | 1.00 | 5.00 |
| HS Rank/GPA Quintile | 5,117 | 2.39 | 1.31 | 1.00 | 5.00 |
| SES | 6,233 | 3.69 | 1.30 | 1.00 | 5.00 |
| Male | 6,260 | 0.47 | 0.50 | 0.00 | 1.00 |
| Asian | 6,260 | 0.10 | 0.30 | 0.00 | 1.00 |
| Hispanic | 6,260 | 0.09 | 0.29 | 0.00 | 1.00 |
| Black | 6,260 | 0.08 | 0.27 | 0.00 | 1.00 |
| American Indian | 6,260 | 0.01 | 0.08 | 0.00 | 1.00 |
| Dependent | 6,260 | 0.07 | 0.25 | 0.00 | 1.00 |
| No-Delay | 6,260 | 0.89 | 0.31 | 0.00 | 1.00 |
| Financial Aid | 5,919 | 0.65 | 0.48 | 0.00 | 1.00 |
| HS Curri. Intensity | 5,465 | 2.22 | 1.21 | 1.00 | 5.00 |
| First Year GPA | 5,912 | 2.68 | 0.75 | 0.07 | 4.00 |
| W-Ratio | 6,260 | 7.28 | 11.00 | 0.00 | 100.00 |
| Remedial Read | 6,260 | 0.07 | 0.25 | 0.00 | 1.00 |
| Remedial Math | 6,260 | 0.19 | 0.39 | 0.00 | 1.00 |
| Out-of-State | 6,260 | 0.24 | 0.42 | 0.00 | 1.00 |
| Inst. Selectivity | 6,260 | 0.23 | 0.42 | 0.00 | 1.00 |
| Multi School | 6,260 | 0.62 | 0.49 | 0.00 | 1.00 |
| Classic Transfer | 6,260 | 0.15 | 0.36 | 0.00 | 1.00 |
| Accelerating Credits | 6,260 | 2.32 | 5.89 | 0.00 | 60.00 |
| First-Year Credits | 6,260 | 24.92 | 10.10 | 0.00 | 62.00 |
| Change Major | 6,189 | 0.39 | 0.49 | 0.00 | 1.00 |
| Co-op or Internship | 6,260 | 0.18 | 0.65 | 0.00 | 12.00 |

Twenty-three percent of students started their undergraduate career at a selective institution, and 15 percent of all students had the experience of transferring from a 2-year college to a 4-year institution. Most of the students (89 %) continued to postsecondary education without a significant delay from high school graduation and about two-thirds of the students (62 %) in the study sample attended multiple 4-year institutions (i.e., the ones who moved from one 4-year institution to another). Compared to remedial reading course, a higher percentage of high school graduates took remedial math, 7 percent versus 19 percent, respectively.

A large portion of the sample (76%) did not earn any college credits before they graduated high school. Among those who earned any college credit, the average credit hours was 2.32, and an analysis found that students who brought in college credits are more likely to complete a degree than their not-transferring counterparts (see Appendix C).

Considering that the 'Degree Completion' is a binary variable (coded "1" if graduated, otherwise "0"), the mean value of it could be interpreted as the degree completion rate. The degree completion rate of students who had ever entered a 4-year college is 65 percent (N=4,052) when allowed 8.5 years from high school graduation. Of those who acquired a baccalaureate degree, the average TTD was 171 weeks, which can be converted into a semester value by dividing the total weeks by 15 (11.4 semesters).

## HYPOTHESES OF THE STUDY

This section describes an expected relationship between each measure and dependent variables based on the Degree Commitment Model introduced in Chapter III. It is assumed that four theoretical constructs interact to determine the level of commitment, which, in turn, affects undergraduate degree obtainment. At a lower level, each measure interacts to determine the magnitude of the four constructs. Focusing on this lower level interaction, this study specifies four hypotheses that elucidate the relationship between each individual measure selected from PETS: 2000 file and the dependent variable of degree completion. As an illustration, a positive relationship is postulated between the first calendar-year GPA and degree completion. It is reasonable to posit in that way, given that higher GPA indicates higher satisfaction, which has a positive relationship to degree commitment: Degree completion is directly influenced by the level of degree commitment.

This study, however, does not set an a priori relationship between each construct and TTD, since DCM is not a theory explaining the intensity of a relationship, but a theory pertains to the persistence of a relationship. Still, examining the influence of the independent variables on TTD drawing on the actual data is beneficial in that it provides important policy implications to higher education administrators and legislatures who strive to demonstrate the institutional accountability.

However, it is beyond the scope of this study to develop a unified scale measuring each theoretical construct of DCM and to explicate causal relationships among those constructs and the dependent variable of degree completion. One of the

obstacles to this is that no surrogate measures could be chosen from PETS: 2000 to quantify the black box of "Commitment Level."

***Hypothesis One: The determinants associated with previously formed commitment propensity will further show their statistically significant relationship to the level of later commitment in degree- seeking process.***

The extant research findings on the relationship between pre-college characteristics and baccalaureate degree completion are well documented as shown in Chapter II. The construct of commitment propensity is sub-divided into familial background (SES), demographic characteristics (race and gender), personal characteristics (educational anticipation), financial aid, academic preparedness (senior test score, curriculum intensity, class rank/GPA), and enrollment behavior (No-delay). Among them, SES, educational aspiration, financial aid, no-delay, and higher academic performance from high school are expected to have a positive relationship with commitment level, whereas minority status is predicted to be negative.

***Hypothesis Two: The higher the satisfaction level, the higher the commitment level will be: Variables assumed to have positive relationship to students' satisfaction will increase the probability of degree completion.***

According to DCM, the satisfaction level is determined by the combination of costs, rewards, and comparison level. At the predictor level, it is assumed that first-year academic performance, measured by first-calendar-year GPA, will have a positive

relationship with degree completion, whereas W-ratio, remedial reading and math, having dependent, and cross-border variables representing cost, will have a negative relationship with degree completion.

***Hypothesis Three: The higher the quality of alternatives to obtaining a degree, the lower the commitment level, which will reduce the probability of graduation.***

If students commenced their undergraduate study from a selective institution, they might have lower quality of alternatives compared to their counterparts who started from non-selective institutions. Contrary to this upper tier group, students who are swirling around different 4-year institutions might suggest that they have better quality alternatives. This enrollment pattern is assumed to lower the chance of degree completion. However, students transferring from a 2-year college to a 4-year institution might have lower quality of alternatives given that they might end up in the transferred institution after considering every possible option available to them. Therefore, classic transfer is assumed to have positive relationship to degree completion.

***Hypothesis Four: Increased investment size will enhance the commitment level and degree completion.***

This study hypothesizes that greater investments in students' efforts to degree completion will result in greater commitment, which will positively affect degree completion. It is expected that earned credits before high school graduation and earned

credits during the first calendar year at college have a positive relationship to commitment level, which will increase degree completion. However, changing major might mean the depreciation of invested resources in completing the current major, which will lower the chances of degree completion.

# CHAPTER IV: DETERMINANTS OF BACCALAUREATE DEGREE COMPLETION AND TIME-TO-DEGREE COMPLETION

This chapter presents the findings of this study. First, overall model checking information is provided, followed by the explanations of the strategy used to interpret the statistically significant coefficients from both inflated (pertaining to determinants of degree completion) and count models (pertaining to determinants of TTD). Next, the predictors related to degree completion are explained. This chapter closes with the account of factors affecting TTD.

## OVERALL MODEL SPECIFICATION

The overall model fit indices were examined to determine the validity of the research model. The total number of unweighted observations was 4,432 students from 894 primary sampling units (schools) within 28 strata (states) and the represented population size by the students was 984,052 after applying the "F4F2P3WT" panel weight. The statistical model is composed of two dependent variables, degree completion and enrolled TTD in weeks, and independent variables as described in Table 2. The study model, as a whole, was significant at the $p < 0.001$ level.

The reason this study adopted one of the negative binomial models is because of the concern for overdispersion in the count variable, number of weeks to degree completion. If there exists an overdispersion, estimates from the Poisson regression model are inaccurate with standard errors that are biased downward, even if the model

includes the appropriate variables. Accordingly, it is important to examine whether the overdispersion exists or not. The Zero-Inflated Negative Binomial model provides an estimate of the natural log of the overdispersion coefficient, "lnalpha," along with an untransformed value. The result showed that the alpha value was significantly different from zero, which suggests that the data is overdispersed and a negative binomial model is more appropriate than a simple Poisson regression model: the log α value was -3.22 and t-value was -57.38: significant at the $p < 0.001$ level.

In the following section, the way of interpreting changes in the expected value of the count (μ) for one unit change in the independent variables is discussed. This study chose to use percent change in expected dependent variables as a way to interpret the relationship between the independent and dependent variables. The percentage change in the expected count for a δ unit change in $\chi_K$, holding other variables constant, can be computed as follows:

$$100 \times \frac{E(y|X,\ Xk+\delta) - E(y|X,\ Xk)}{E(y|X,\ Xk)} = 100 \times \{\exp(\beta k \times \delta) - 1\} \qquad \text{(Long, 2006; p. 360)}$$

The STATA command, "listcoef," allows us to estimate percent change in dependent variables for each one-unit change in an independent variable, as well as percent change in the dependent variables for one standard deviation change in predictors. Understanding the variability in an independent variable from the value of its standard deviation helps interpret the practical importance of each predictor on degree completion and TTD.

## DETERMINANTS AFFECTING DEGREE COMPLETION

In the following section, the relationship between the independent variables and degree completion is described in the order of the four hypotheses established for this study. When interpreting zero-inflated models, it is easy to be confused by the direction of the coefficients. In the binary equation, which explains the relationship between a predictor and the dependent variable of degree completion, a positive coefficient value means that the odds of falling within the zero group (students who attended any 4-year institution, but did not obtain a degree) increases as the predictor value increases. That is, the predictor has a negative relationship to degree completion.

The overall findings of this study on degree completion confirmed many findings from other studies, but with some exceptions. One of the unique findings of this study concerns students who have the obligation of taking care of dependents. A detailed explanation of each variable is presented after a brief summary of the results of this study. Among predictors at an individual level, the educational anticipation of students has a positive relationship to degree completion. The level of socioeconomic status was also found to be statistically significant in predicting the probability of degree completion. Students' background variables, such as race/ethnicity and gender, did not have a relationship to the probability of degree completion.

The findings of this study on academic preparedness emphasize "what" courses students took while they were in high school, rather than "how well" they did in those classes. High school rank and GPA quintile and high school senior test scores were not

related to degree completion. The intensity of the high school curriculum, however, revealed its strong relationship to the odds of degree completion.

The momentum of academic performance at a college during the first-calendar year was found to be important in completing a degree: total first-year credits earned and GPA showed a positive relationship to degree completion, whereas the W-ratio showed a negative relationship. Remedial course taking behaviors were shown to have no relationship to degree completion.

The variables pertaining to enrollment patterns indicated their relationship with degree completion. Students who started their postsecondary academic career at a selective institution had higher chances of degree completion than their counterparts. In contrast, moving from one 4-year college to another lowered the odds of degree completion. One encouraging finding on enrollment patterns was that students transferring from a 2-year to a 4-year institution showed a positive relationship to degree completion: Students who started at a 2-year institution and continued to a 4 year institution are 59.4% more likely to complete a degree and its effects is comparable to the SES predictor.

Table 3 summarizes the relationships among predictors and degree completion. In the following section, four hypotheses were examined with a detailed explanation of the pertinent findings.

***Hypothesis One: The determinants that contributed to previously formed commitment propensity will further affect the level of later commitment in degree-seeking process.***

**Table 3: Determinants Associated with Degree Completion**

| | | | Degree Completion | | |
|---|---|---|---|---|---|
| | Sig. | | % | %-SD | SD |
| Anticipation | 0.006 | ** | -27.4 | -20 | 0.70 |
| HS Sr. Test Quintile [a] | 0.269 | | 8.8 | 10.1 | 1.13 |
| HS Rank/GPA Quintile [a] | 0.281 | | 6.7 | 8.4 | 1.24 |
| SES | 0.000 | *** | -26.4 | -31.0 | 1.21 |
| Male | 0.370 | | 12.9 | 6.2 | 0.50 |
| Asian | 0.259 | | -38.2 | -9.9 | 0.22 |
| Hispanic | 0.131 | | 39.8 | 8.1 | 0.23 |
| Black | 0.407 | | 25.8 | 6.3 | 0.27 |
| American Indian | 0.459 | | 70.8 | 2.9 | 0.05 |
| Dependent | 0.000 | *** | 234.2 | 30.7 | 0.22 |
| No-Delay | 0.012 | ** | -49.5 | -14.7 | 0.23 |
| Financial Aid | 0.540 | | 9.4 | 4.3 | 0.47 |
| HS Curri. Intensity | 0.000 | *** | 27.5 | 32.7 | 1.16 |
| First Year GPA | 0.000 | *** | -58.2 | -48.2 | 0.75 |
| W-Ratio | 0.000 | *** | 11.8 | 173.4 | 0.09 |
| Remedial Read | 0.543 | | 18.3 | 3.9 | 0.23 |
| Remedial Math | 0.552 | | 10.1 | 3.8 | 0.39 |
| Out-of-State | 0.336 | | 17.2 | 6.8 | 0.41 |
| Inst. Selectivity | 0.007 | ** | -41.7 | -20.0 | 0.41 |
| Multi School | 0.003 | ** | 49.6 | 21.5 | 0.48 |
| Classic Transfer | 0.000 | *** | -59.4 | -27.1 | 0.35 |
| Accel Credits | 0.381 | | -1.2 | -6.6 | 5.47 |
| First-Year Credits | 0.000 | *** | -4.8 | -33.9 | 8.46 |
| Change Major | 0.395 | | 11.5 | 5.4 | 0.49 |
| Co-op/Internship | 0.000 | *** | -54.7 | -42.2 | 0.69 |

[a.] Value labels: Highest = 1; 2nd quintile = 2; 3rd quintile = 3; 4th quintile = 4; lowest quintile: 5.

* $p < .05$; ** $p < .01$; *** $p < .001$

The findings on commitment propensity are described in the order of familial background (SES), demographic characteristics (race and gender), personal

characteristics (educational anticipation), financial aid, academic preparedness (senior test score, curriculum intensity, class rank/GPA), and enrollment behavior (No-delay).

Socioeconomic status (SES) was assumed to have a positive relationship with the commitment level after entering a college, which would increase the probability of degree completion. The result of this study confirmed the assumption: The t-value was -5.95, statistically significant at $p < 0.001$. The value of -26.4 percent under the '%' column in Table 3 can be interpreted to mean a one unit increase in the SES quintile is related to a 26.4 percent increase in the probability of degree completion. The column next to the percent change means the percentile change in the odds of degree completion given a one standard deviation change in the predictor variable of SES. Thus, a one standard deviation change in SES is related to a 31 percent decrease in the probability of falling within the zero group, students who did not complete a degree after 8.5 years of high school graduation.

Concerning the difference in the chance of degree completion by demographic variables, this study identified neither gender differences nor differences by race/ethnic categories. Based on existing literature on degree completion, it was expected that students of color would show a lower probability of degree completion compared to their white colleagues, which was not true.

Educational anticipation was found to play a significant role in predicting the probability of degree completion. The value of -27.4 in the percent change column means that a one-unit increase in the educational anticipation variable is related to a 27.4 percent increase in the odds of degree completion. Regarding the percent change

value for the standard deviation change, a one standard deviation change in this variable was found to be related to a 20 percent increase in the chances of degree completion. By comparing this value with percent change for a one standard deviation change in SES, we estimate which predictor has a greater effect on the dependent variable as we interpret a standard coefficient value from a simple regression model. Between the two, SES (31 percent) has a greater effect on degree completion than educational anticipation (20 percent).

The financial aid variable did not reach the threshold of statistical significance. Again, the interpretation related to this financial aid variable is done with caution given that the data from PETS: 2000 was not rigorous.

Academic preparedness, measured by senior test score and high school GPA and rank quintile, did not have a statistically significant effect in the odds of degree completion. However, the measure indicating the rigorousness of the high school curriculum had a positive relationship to degree completion. A one-quintile value increase in the variable increased the chance of degree completion by 27.5 percent. Its effect on the dependent variable of degree completion is slightly greater than that of SES, 32.7 percent versus 31.1 percent, respectively.

The last variable, no-delay, was statistically significantly related to the probability of degree obtainment. Students who continued undergraduate study right after high school graduation were 49.5 percent more likely to complete their degrees compared to those who delayed.

***Hypothesis Two: The higher the satisfaction level, the higher the commitment level will be. Variables assumed to contribute to students' satisfaction will increase the probability of degree completion.***

Five variables were selected from the PETS: 2000 file as specific measures for the construct of satisfaction level: first-year GPA, W-ratio, having a dependent, taking remedial courses, and crossing a state border in the first institution attended. First-year GPA as the surrogate measure of satisfaction had a positive relationship to degree completion. A one unit increase in the first-year GPA (i.e., from 2.5 to 3.5) would result in a 58 percent increase in the probability of degree completion. The standard deviation of this variable was 0.75, and a one standard deviation change in first-year GPA would result in a 48.2 percent increase in the odds of degree completion. The effect of this variable is greater than the effects of SES and educational anticipation predictors.

The other variables are related to costs, which combine to determine the level of satisfaction. Therefore, positive coefficient values in the binary equation were expected for these variables. Remedial course taking activities and attending a college not located in the students' home state were not statistically significant. Table 2 indicated that 6.6 percent of the study group students took remedial reading, whereas 19.1 percent took remedial math. Twenty-four percent of the 6,260 students (1,476) started their postsecondary academic career in a state different from their home states.

One of the most highly significant variables influencing degree completion is the ratio of withdrawn courses to total courses attempted. A one-unit increase in the

percentile value of the ratio of non-penalty withdrawal and no-credit repeat grades to all grades received is associated with a 11.8 percent decrease in the odds of degree completion. The value of a one-standard deviation change in the W-ratio predictor was 9 percent, so if a student's W-ratio increases from zero to 9 percent, they are 173 percent less likely to graduate. This is the single most powerful predictor that has a negative relationship to degree completion among the 24 predictors in this study model. The binary variable of dependent suggests that students who have dependents are more than two times less likely to graduate (234%).

***Hypothesis Three: The higher the quality of alternatives to obtaining a degree, the lower the commitment level, which would decrease the probability of graduation.***

The quality of alternatives in this study was defined as the perceived desirability of the best available alternatives to a student's relationship with the current institution in the process of degree seeking. Three variables were selected to measure this construct: selectivity of the first institution, moving from one 4-year institution to another, and transferring from a 2-year college to a 4-year institution, classic transfer.

All three variables showed a statistically significant association with the dependent variable of degree completion. Specifically, students who started at a selective institution are 41.7 percent more likely to obtain a baccalaureate degree than students who commenced their study at a non-selective institution. Selective institutions were identified based on the average SAT composite score of the entering

freshman class (the criterion composite score is 1,050). This finding could be interpreted as meaning that students who entered a selective institution have lower quality of alternatives and stay there until they obtain an undergraduate degree.

The predictors related to student mobility among different institutions are expected to be highly correlated, which was not true: the highest correlation value was 0.32 between classic transfer and multi-school. Examining specific types of mobility, students who moved from one 4-year institution to another had a negative association with degree obtainment: they are 50 percent less likely to graduate. Classic transfer, however, appeared to have a positive relationship with the odds of degree completion: Students who started at a 2-year institution and continued to a 4-year institution are 59 percent less likely to be in zero-group, which means they are more likely to complete a degree.

The findings suggest that the degree completion process is influenced by the quality of alternatives. A detrimental attendance pattern to degree completion is moving among different 4-year institutions, which Adelman (2006) referred to as 'swirling' students.

***Hypothesis Four: Increased investment size would enhance the commitment level and degree completion.***

Working as a restraining factor in dropout, investment size was assumed to have a positive relationship with degree commitment. Four variables were included to

measure this construct: accelerating credits, credits earned from the first calendar year at college, changing majors, and cooperative or internship courses.

Accelerated credits earned before the commencement of undergraduate study were expected to have a positive impact on degree completion. However, the results of this study indicated no impact. The number of credits earned during the first year at college was found to have a positive relationship with degree completion. A one-unit increase (i.e., one credit of a three-credit course) in earned first-year credits is related to a 4.8 percent increase in degree completion. In other words, if a student takes one more three-credit course during the first academic year, he/she would see a 14.4 percent increase in the probability of degree completion. The effect of this variable is greater than that of SES. A one-standard deviation change in the credits earned during the first calendar year for the study sample students was 8.5 (roughly three 3-credit bearing classes), and the average credit hours earned for the first calendar year was 24.9. Therefore, other things being equal, if a student earns 33.4 credits for the first calendar year, his/her chance of degree completion will increase by 33.9 percent compared to those students who complete an average number of credits.

Changing majors was also posited to have a negative impact on completing a degree, in that the value of earned credits could be depreciated as a result of different course requirements. However, this variable did not make any difference in the chances of obtaining a degree.

One of the notable findings of this study concerns cooperative and internship courses. The variable is a continuous variable, counting the number of cooperative or

internship courses in which students enrolled. The result shows that a one-unit increase in this predictor is expected to increase degree completion by 54.7 percent. Again, the effect of this variable on degree completion is greater than the effect of SES or credits earned for the first calendar year. However, this finding on cooperative and internship courses needs to be interpreted with caution, considering that students take these courses later in their degree process and that there are many types of courses included in these two categories.

## DETERMINANTS AFFECTING TIME-TO-DEGREE

Research findings on determinants affecting the length of time to degree completion have received attention by higher education interest groups as well as by administrators in an institution. Currently, higher education institutions that participate in any student financial aid program under Title IV of the Higher Education Act of 1965 are required to report their 4, 5, and 6-year degree completion rates to the federal government. The TTD statistics are shared with various private parties involved in college ranking business such as *U.S. News & World Report*. Given that the figures portray the image of institutional accountability, it is understandable why higher education institutions struggle to increase the rates. From a different angle, increasing the portion of students who complete a degree in a timely manner is seen as a way to increase access to higher education (Adelman, 2006) by keeping space for incoming high school graduates.

This study did not assume any relationship between a predictor and the dependent variable of TTD because the Degree Commitment Model does not pertain to enrollment intensity, but persistence. Instead, this study describes the relationship between a predictor and TTD based on the results of this study. Thus, the same set of determinants was modeled in the count equation of ZINB regression to examine their relationship with TTD.

Not surprisingly, many of the predictors related to enrollment pattern were found to be associated with TTD. Starting at a selective institution and not in a home state decreased the expected length of enrolled TTD. Moving from one 4-year institution to another and from one academic program to another extended the enrolled TTD. The predictor of W-ratio, again, showed its positive relationship with enrolled TTD: As the ratio of withdrawal/repeat courses increases, the enrolled TTD increases.

The first-year academic momentum was found to be statistically significant in predicting enrolled TTD. The total number of credits earned for the first calendar year and the GPA was shown to reduce the enrolled TTD. Students who took a remedial reading course were found to take more time than those who did not in the process of degree completion.

Students' background variables and academic preparedness from high school did not show any statistically significant relationship with enrolled TTD, except being an American Indian student and receiving financial aid. American Indian students took less time in their degree process than their counterparts, and students who received any type of financial aid graduated from college in a shorter time than their colleagues who

did not receive financial aid. In the following section, the relationship between the predictor and the dependent variable of enrolled TTD is addressed in detail. Table 4 specifies the results for the TTD dependent variable.

**Table 4: Determinants Associated with TTD**

| | | | Time-to-Degree | | |
|---|---|---|---|---|---|
| | Sig. | | % | %-SD | SD |
| Anticipation | 0.377 | | -0.8 | -0.6 | 0.70 |
| HS Sr. Test Quintile [a] | 0.424 | | -0.7 | -0.8 | 1.13 |
| HS Rank/GPA Quintile [a] | 0.614 | | -0.4 | -0.5 | 1.24 |
| SES | 0.539 | | -0.3 | -0.4 | 1.21 |
| Male | 0.684 | | 0.6 | 0.3 | 0.50 |
| Asian | 0.611 | | -1 | -0.2 | 0.22 |
| Hispanic | 0.112 | | 3.4 | 0.8 | 0.23 |
| Black | 0.219 | | -2.5 | -0.7 | 0.27 |
| American Indian | 0.004 | ** | -13.2 | -0.8 | 0.05 |
| Dependent | 0.621 | | 1.7 | 0.4 | 0.22 |
| No-Delay | 0.423 | | 2.3 | 0.5 | 0.23 |
| Financial Aid | 0.002 | ** | -4.8 | -2.3 | 0.47 |
| HS Curri. Intens. | 0.988 | | 0 | 0 | 1.16 |
| First Year GPA | 0.005 | ** | -3.2 | -2.5 | 0.75 |
| W-Ratio | 0.000 | *** | 1.5 | 14 | 0.09 |
| Remedial Reading | 0.019 | * | 6.5 | 1.4 | 0.23 |
| Remedial Math | 0.213 | | 3.5 | 1.4 | 0.39 |
| Out-of-State | 0.000 | *** | -5.2 | -2.2 | 0.41 |
| Inst. Selectivity | 0.001 | *** | -5.6 | -2.4 | 0.41 |
| Multi School | 0.000 | *** | 19.3 | 8.9 | 0.48 |
| Classic Transfer | 0.083 | | 3.8 | 1.3 | 0.35 |
| Accel Credits | 0.033 | * | -0.2 | -1.3 | 5.47 |
| First-Year Credits | 0.195 | | -0.1 | -1.2 | 8.46 |
| Change Major | 0.000 | *** | 5.7 | 2.7 | 0.49 |
| Co-op or Internship | 0.120 | | 0.9 | 0.6 | 0.69 |

[a]. Value labels: Highest = 1; 2nd quintile = 2; 3rd quintile = 3; 4th quintile = 4; lowest quintile: 5.

* $p < .05$; ** $p < .01$; *** $p < .001$

### *Commitment Propensity and TTD*

Results in Table 4 show that variables shown to be related to degree completion do not necessarily have a similar relationship with TTD. Most of the predictors related to the commitment propensity construct of DCM did not have a statistically significant relationship with the dependent variable of enrolled TTD. SES was found not to be associated with enrolled TTD. Another strong predictor of degree completion, educational anticipation, did not show any statistically significant relationship with TTD.

The two variables that passed the threshold of statistical significance were being American Indian and receiving financial aid. Being American Indian reduced the expected enrolled TTD by 13.2 percent. This percent change can be expressed in weeks by multiplying expected enrolled TTD: $0.13 \times 172 = 22.4$ weeks. Divided by 15, it can be rescaled as a semester value: American Indian student completed their undergraduate degree in a shorter length of enrolled time than their counterpart by 1.5 semesters. Receiving any type of financial aid reduced the length of time to degree by 8.2 weeks ($0.048 \times 172$).

### *Satisfaction and TTD*

Results from the count equation indicated that satisfaction-related variables are statistically significant in predicting the enrolled TTD. Among them, W-ratio has a significantly positive relationship to enrolled TTD, which means an increase in the enrolled TTD. A one standard deviation change in W-ratio predictor (9 percent) would

result in a 14 percent increase in TTD (0.14×172 = 24.1 weeks). This is the largest effect among all predictors. The top second predictor of TTD is the multi-school variable, and its percent change in the expected TTD for a one standard deviation change was 8.8.

The first-year GPA showed a significant negative relationship to TTD: A one-unit increase in first-year GPA is related to a 3.2 percent decrease in expected number of enrolled weeks to degree completion. Remedial course-taking appeared to have a negative relationship with TTD. Students who took a remedial reading course took 11.2 weeks longer than their counterparts who did not take remedial reading. Attending a college not in their home states shortened the expected enrolled TTD by 5.3 percent.

### *Quality of Alternatives and TTD*

The quality of alternatives was also statistically significant in explaining TTD. Commencing undergraduate study at a selective institution reduced TTD by almost 10 weeks, a quarter. As one of the detrimental factors to degree completion, moving around among 4-year institutions, showed its significantly positive relationship with TTD. Students who had the experience of transferring from one 4-year institution to another took 33 more weeks (i.e., longer than two semesters) than students who stayed at one 4-year institution or transferred from a 2-year college to 4-year. Classic transfer was not statistically significant.

### *Investment Size and TTD*

The predictors related to investment size have a statistically significant relationship with TTD; however, the percentile change in the expected time-to-degree for a one-unit change in each predictor was smaller compared to other significant variables. The percentage change of 1 unit increase in accelerating credit variable was -0.2 percent. As an illustration, students who took a 3-credit college course before high school graduation would see a one-week decrease in enrolled TTD. Changing major also extended the length of TTD by 5.7 percent (9.8 weeks).

# CHAPTER V: DISCUSSION AND CONCLUSIONS

Postsecondary education institutions are serious about degree completion rate and strive to increase it as it is widely used as a measure of institutional accountability by both public and private sectors. In addition to the pressure of graduating a greater portion of their incoming students, institutions are being mandated to graduate them in a limited time, normally 6 years for baccalaureate degree granting institutions.

The study examined an extensive set of variables to identify factors affecting both degree completion and enrolled time-to-degree completion. Only a few studies have analyzed a national data set (e.g., NELS:88/2000, ELS: 2002) that includes measures of the variables with the least error and enables us to generalize the findings to a broader set of higher education institutions so that higher education leadership can establish policy interventions with a high level of confidence. Rather, most of the extant studies relied either on data from a single institution or narrowed the study population too much (e.g., first-time, full-time, fall semester enrollees), which often distorts the true indicators of baccalaureate degree completion as well as generated conflicting findings.

Recognizing that, this study addressed the gaps existing in the current research. First, this study used the most recent national longitudinal study (PETS: 2000) that allows enough time for the high school class of 1992 to complete their undergraduate studies. By integrating transcript data, the study minimized the possible errors in the data collected from subjects and school administrators. This study also integrated

existing theories and advanced the Degree Commitment Model. Adopting the Investment Model allowed this study to add new constructs, such as "Quality of Alternatives."

Additionally, this study introduced a relatively new research method, ZINB, that simultaneously models both dichotomous and numerical outcomes. This method assumes an overdispersion in the continuous dependent variable, which means that the mean distribution is greater than the variance, and does not require the normal distribution assumption for the outcome variable. The ZINB is composed of two equations, a binary equation that explains the relationship between the predictor and the binary dependent variable of degree completion, and a count equation that explains the relationship between the predictors and the count outcome (TTD).

Existing research results indicate that a statistically significant predictor of one outcome (e.g., degree completion) does not necessarily have the same relationship with another outcome (e.g., TTD). In the following section, this study briefly summarizes and compares the research findings from the two different equations using the ZINB model. Table 5 contrasts the results for degree completion to those for TTD.

Some predictors showed a statistically significant relationship to degree completion, but not to TTD: educational anticipation, SES, high school curriculum intensity, having dependents, no-delay of college entry, classic transfer, and credits earned during the first calendar year. Contrary to this group of variables, some other predictors showed their association with only TTD: American Indian, financial aid, remedial reading, out-of-state, accelerating credit, and changing major. One set of

variables had a statistically significant relationship to both dependent variables: Predictors that affect both degree completion and TTD are first-year GPA, W-ratio, institutional selectivity, and multi school.

**Table 5: Contrast of the Results for Degree Completion to TTD**

| | Binary Model (Completion) | | | Count Model (TTD) | | |
|---|---|---|---|---|---|---|
| | Sig. | | % Change | Sig. | | % Change |
| Anticipation | 0.006 | ** | -27.4 | 0.377 | | -0.8 |
| HS Sr. Test Quintile | 0.269 | | 8.8 | 0.424 | | -0.7 |
| HS Rank/GPA Quintile | 0.281 | | 6.7 | 0.614 | | -0.4 |
| SES [a] | 0.000 | *** | -26.4 | 0.539 | | -0.3 |
| Male | 0.370 | | 12.9 | 0.684 | | 0.6 |
| Asian | 0.259 | | -38.2 | 0.611 | | -1 |
| Hispanic | 0.131 | | 39.8 | 0.112 | | 3.4 |
| Black | 0.407 | | 25.8 | 0.219 | | -2.5 |
| American Indian | 0.459 | | 70.8 | 0.004 | ** | -13.2 |
| Dependent | 0.000 | *** | 234.2 | 0.621 | | 1.7 |
| No-Delay | 0.012 | ** | -49.5 | 0.423 | | 2.3 |
| Financial Aid | 0.540 | | 9.4 | 0.002 | ** | -4.8 |
| HS Curri. Intensity | 0.000 | *** | 27.5 | 0.988 | | 0 |
| First Year GPA | 0.000 | *** | -58.2 | 0.005 | ** | -3.2 |
| W-Ratio | 0.000 | *** | 11.8 | 0.000 | *** | 1.5 |
| Remedial Reading | 0.543 | | 18.3 | 0.019 | * | 6.5 |
| Remedial Math | 0.552 | | 10.1 | 0.213 | | 3.5 |
| Out-of-State | 0.336 | | 17.2 | 0.000 | *** | -5.2 |
| Inst. Selectivity | 0.007 | ** | -41.7 | 0.001 | *** | -5.6 |
| Multi School | 0.003 | ** | 49.6 | 0.000 | *** | 19.3 |
| Classic Transfer | 0.000 | *** | -59.4 | 0.083 | | 3.8 |
| Accel Credits | 0.381 | | -1.2 | 0.033 | * | -0.2 |
| First-Year Credits | 0.000 | *** | -4.8 | 0.195 | | -0.1 |
| Change Major | 0.395 | | 11.5 | 0.000 | *** | 5.7 |
| Co-op Internship | 0.000 | *** | -54.7 | 0.120 | | 0.9 |

[a]. Value labels: Lowest = 1; 4th quintile = 2; 3rd quintile = 3; 2nd quintile = 2; Highest = 5.

* $p < .05$; ** $p < .01$; *** $p < .001$

Comparing these two groups of variables, it is evident that most variables in the former group are related to students' transition from one academic status to another. From this finding, degree completion rate is expected to increase by getting students well-prepared for postsecondary education through a rigorous high school curriculum, encouraging them to have higher expectations for their educational goal, helping them retain high academic momentum, and guiding students who plan to transfer from a 2-year to a 4-year institution. Regarding TTD, it is essential to help students meet the financial and academic needs and select a major of real interest to reduce the length of TTD. These variables are related to academic performance in higher education and enrollment behavior.

## DISCUSSION

In this section, the research findings of the study are discussed in relationship to findings by other researchers. The findings on SES and educational anticipation agree with what other studies have identified (Aldeman, 1999, 2006; Cabrera et al., 2005; Titus, 2006a, 2006b): A one-level increase in SES quintile is related to a 26.4 percent increase in the odds of degree completion. Students from well-off families tend to have high expectations for postsecondary education, and both socioeconomic status and education anticipation are positively related to degree completion.

The descriptive analysis in the national study of "Principal Indicators of Student Academic Histories in Postsecondary Education in 1972-2000" shows the significant difference in graduation rate by SES: Students in the top quintile have a 71.6 percent

chance of graduation, whereas this percentage drops sharply to 43.6 percent for the second highest quintile. Students from lowest SES quintile showed only a 15.7 percent chance of degree completion. This study also showed a comparable difference in the degree completion rate by SES, in spite of an upward bias caused by limiting the sample to students who had ever attended any 4-year institutions. When a panel weight was applied, the total sample size was about 1.5 million, and 79 percent of the top SES quintile students obtained a degree during the study period, whereas 35 percent of students in lowest SES quintile succeeded in completing a degree.

One of the commitment propensity variables, anticipation, showed its close relationship with SES. Figure 7 describes this relationship.

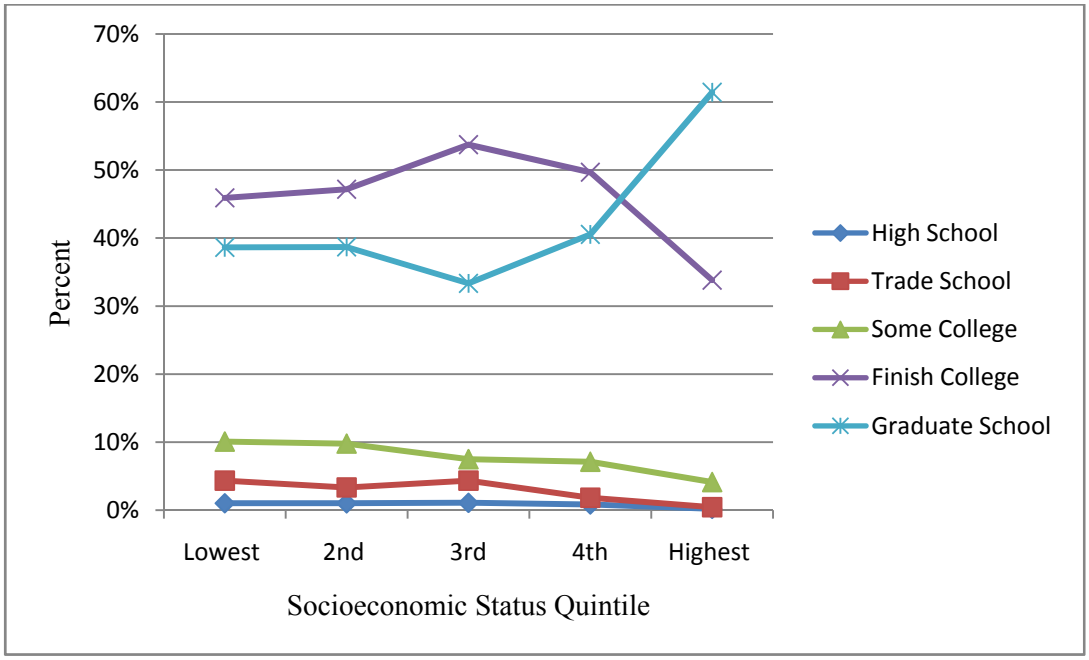


**Figure 7: Education Expectation by SES Quintile**

For the two lowest quintile groups, students' anticipation for their education career looks fairly similar. However, a clear difference appears for the highest SES group: More than 60 percent of them expected that they would complete a graduate-level degree. Of these in the highest SES group, 73 percent actually obtained a baccalaureate degree, which is significantly higher than those who anticipated trade school level education, 15 percent. This finding confirms the finding by Noxel and Katunich (1998) who found that the greatest percentage of 4-year graduates responded that their personal motivation and goal setting was the most important factor that helped their degree progress. However, Cabrera et al. (2005) found that students who received encouragement from parents and friends while in high school to pursue a college degree were more likely to complete a degree, irrespective of SES.

Demographic variables such as gender and race/ethnicity variable did not show any relationship with degree completion in this study. These findings conflict with the results from other studies: Some studies found that female students are doing better than their male counterparts (Horn, 2006; Lee et al., 2007), and others found that Black and Hispanic students showed lower degree completion probability than their Asian and white counterparts (Horn, 2006; Titus, 2006a; DesJardins, 2002).

Even though this model did not show any statistically significant difference in the odds of degree completion by race, it is clear that there exists a degree obtainment gap by race. Descriptive analysis after applying panel weight indicates that white and Asian students are performing better than students in the other racial groups. For example, Asian students' completion rate (67.8 percent) is higher than that of any other

race category. Other groups' degree completion rates stayed around the mid 40s. Among them, only 43 percent of Hispanic students were successful in obtaining a degree when allowed 8.5 years after graduation.

Then why did the effect of race disappear? This could be interpreted as most of the race effect operates through one's GPA. Applying the Event History Model, Desjardins et al. (2002) also identified that when GPA is controlled, the negative relationship between degree completion and minority status decreased. Adelman (2006) also found that the impact of race disappears when the GPA variable is added to the model. The results provide evidence of the importance of controlling for actual college performance if we want to make statements about the independent effects of race on degree completion (DesJarins et al., 2002). An interesting finding related to race category is that being American Indian is expected to reduce enrolled TTD. This means that American Indian students who completed a degree took less time to complete their degree: almost 23 weeks less than all others who graduated.

This study confirmed the positive relationship between high school curriculum and the probability of degree completion. Students who went through a rigorous high school curriculum tend to readily continue to higher education, and a higher portion of them obtained a degree compared to those who experienced less intensive high school curriculum. Thirty-one percent of high school graduates from high schools in the lowest quintile of high school curriculum intensity delayed the commencement of undergraduate study, whereas only 3 percent did so in the highest quintile, and students who did not delay are 50 percent more likely to graduate than their counterparts.

Financial aid was related to a reduced length of time-to-degree completion, but it did not contribute to the probability of graduation. Under unprecedented economic constraints starting in 2007, higher education institutions are experiencing a severe crisis in securing resources. Given these limits, using tight resources in a savvy way is critical to keep an institution effective in terms of student success: degree completion and completion in a timely manner. Other studies have reported a positive impact of financial aid on degree completion (Braunstein, McGrath, & Pescatrice, 2000-2001 ; Kim, 2007; Long, 2004). However, this study did not identify any significant effect of financial aid on degree completion.

As mentioned in other chapters, the result of this study on financial aid needs to be interpreted with caution because of the weakness of the information on financial aid variable from NELS: 88/2000 data. From the data set, the best available way to model financial aid was to dichotomize the student body by whether a student received any financial aid or not. In spite of it not being significant, Figure 8 shows a continuously higher degree completion rate for students who received any financial aid. Thus, the finding from this study needs to be interpreted with caution. However, the impact of financial aid on TTD confirmed findings from other studies. For example, using a Time-Varying Coefficient model, DesJardins et al. (2002) identified a positive relationship between loans and TTD.

One of the cleanest findings of this study concerns students' course taking behavior: The number of courses from which students withdrew without any penalty and/or repeated significantly increases both the risk of dropout and required TTD.

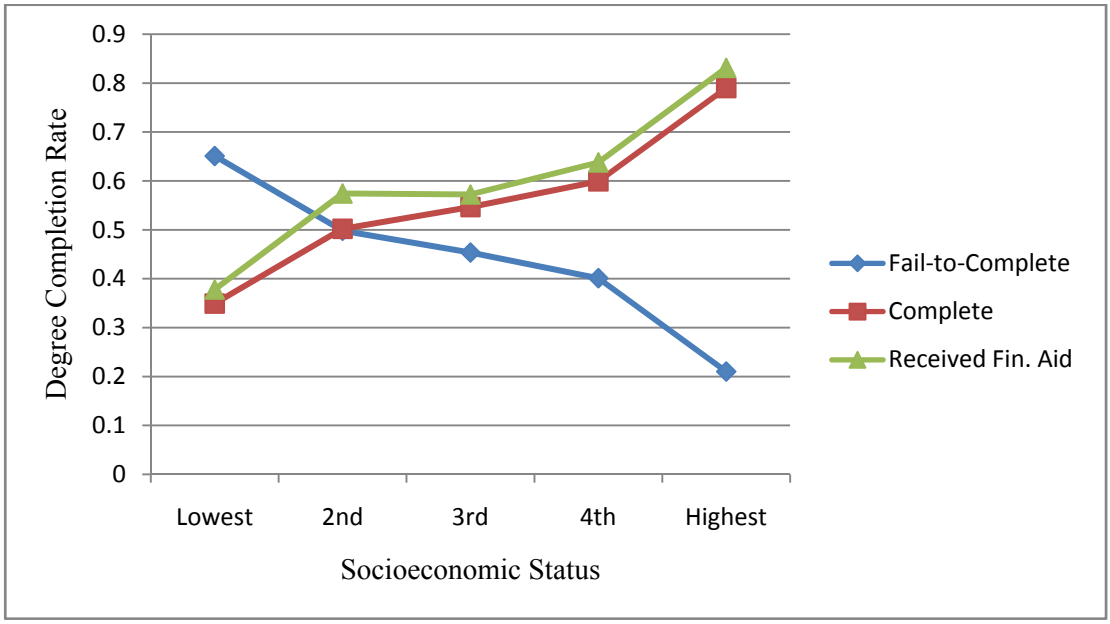


**Figure 8: Degree Completion Rate by Socioeconomic Status**

*Note*. This figure represents 1,463,457 high school class of 1992 who ever attended any 4-year college.

Adelman (2006) suggested that enrolling in a class and withdrawing from it after the customary period and repeating courses was akin to a "Kiss on the Death." Both an analysis of data from a single institution (Lee et al., 2007) and the results in the present study confirmed his finding. The negative impact of this enrollment behavior, no matter when the withdrawal happens, is considerable: A one-standard deviation change would change the probability of degree completion by 173 percent, and would increase TTD by 24 weeks (i.e., about a semester and a half).

Classic transfer has a positive impact on degree completion. Students who started their academic career at a 2-year college and then transferred to a 4-year college are more likely to obtain a degree. This finding contradicts the previous findings on its negative impact on degree completion (Doyle, 2008). The finding needs to be

replicated considering that the current study limited the analysis sample to students who attended a 4-year college during the study period.

## POLICY IMPLICATIONS AND FUTURE RESEARCH

The results of this study indicate that academic momentum during the freshman year has a significant relationship with both degree completion and TTD. The academic momentum has two layers: number of credits earned and grade point average. As stated previously, taking one more course during the freshmen year would increase the probability of degree completion by 14.4 percent, and a one grade increase in first-year GPA is related to a 58.2 percent increase in the odds of degree completion.

Existing studies have suggested the same conclusion on the relationship between first-year academic performance and degree completion as well. As an illustration, Adelman (2006) found in his tool box study that students who earned 20 credits or more in their first year have higher odds of degree completion than those who fell below the 20-credit threshold. Braunstein and his colleagues (2000-2001) also found that first-year academic performance is overwhelmingly the most significant factor affecting a freshman's decision to persist. Individuals devoting their time and energy to improve the quality of their first-year academic performance will see the rewards for it (Passaro, Lapovsky, Feroe, & Metzger, 2003) and institutions need to encourage students to invest their time and efforts and ensure that institutional practices facilitate academic success. What really matters relative to students' success is not what they bring in from high school, but what they do with it while they are at college (DesJardins et al., 2002).

Institutional, statewide, or even federal-level intervention for students with dependents would increase the chances of degree completion for those with other competing obligations. This study identified that students with dependents are much less likely (234 percent) to graduate. Drawing on the data from the high school class of 1982, DesJardins et al. (2002) also found that students who are parents were less likely to graduate than their single counterparts. To help students with dependents, colleges may want to discuss increasing the availability of onsite childcare centers on their campuses, and states and the federal government might consider additional financial or childcare benefits for students who have other competing obligations than just seeking a degree.

Current way of calculating degree completion rate as a measure of institutional accountability needs to be modified by reflecting the differences in the characteristics of the incoming freshmen. One of the significant contributions of this study is that it added the quality of alternatives construct in the Degree Commitment Model. All three indicators of this construct were found to have a significant relationship with degree completion, and two of them affected TTD. Among those, what we need to carefully consider is the institutional selectivity variable. Students starting at a selective institution are 42 percent more likely to obtain a degree. This can be interpreted that students with a high academic profile expressed by high GPA and standardized test scores (ACT, SAT) start at a selective institution, which leads to higher rate of degree completion. From this finding, research questions arise regarding graduation rates: How much is attributable to the efforts of institution? Or should credit be given to the

characteristics of incoming students? If the graduation rate is to be used as a measure of institutional accountability, it is necessary that it be corrected so that the quality of input could be reflected. Astin (1997) asserted that 'raw' outcome measures such as first-year retention rate are seriously flawed because those measures do not consider the powerful effect of student input/characteristics. Later, he extended this logic to degree completion rate (Astin, 2005-2006).

Using a regression technique could be an alternative: By modeling characteristics of incoming students, an expected graduation rate is calculated, which com be compared to actual graduation rate of an institution (Astin, 1997). For example, institutions that are focusing on helping enrolled students to obtain a degree would be expected to have a degree completion rate that is higher than expected, whereas those with a weak academic support system would see a lower rate than expected. Specifically, Astin concluded that more than two-thirds of the variation in degree completion rate is explained by the characteristics of the entering student body (Astin, 2005-2006). Let me add one more thing by citing what Astin (2005-2006) argued:

> Efforts at the state level to make institutions more accountable by comparing their raw retention rates are misguided. The danger of such state policies is that they discourage institutions from enrolling relatively poorly prepared students in order to maximize their raw retention rate. All states have a vested interest in raising the educational level of their under-prepared students to the maximum,

> since such students pose the greatest risk of eventually becoming dependent on the state. (p. 15)

Institutions need to find external resources (e.g., private companies, public organizations, or professionals in a field) and strive to provide students with cooperative and/or internship courses. One of interesting findings of this study pertains to taking cooperative and internship courses. In his tool box study, Adelman (2006) did not find a significant relationship between taking cooperative and internship courses and degree completion. He suggested that special attention be given to this finding, since other researchers observed the significant benefits from taking those classes (Knight, 2004). It is worth repeating what Knight (2004) argued:

> Timely degree completion is not all that matters in terms of college student outcomes. Both analytical and student self-report evidence supports the fact that enrollment in cooperative education classes, involvement in internships, etc., while extending time-to degree, significantly improves student learning and skill development, affective outcomes, career prospects, and the like. Significantly reducing time-to-degree could perhaps demand a trade-off against other long-term (and maybe more important) outcomes. (p. 14)

This study confirmed the positive impact of cooperative and internship courses on degree completion. However, the result of the study did not indicate a statistically significant relationship between those classes and TTD.

The finding supports the beliefs regarding collaborative learning and learning through getting involved in internships. How? Promote student awareness of and access to appropriate cooperative and internship courses and provide professional development opportunity from which faculty members could learn how to organize classes in such a way that encourage collaborative work with other colleagues (Braxton & Mundy, 2001-2002).

## LIMITATIONS OF THE STUDY

Although this study integrated essential concepts of the Investment Model to introduce and test the Degree Commitment Model, the variables measuring the concept of comparison level, which is needed to determine satisfaction level, could not be modeled. One of the possible ways to include this concept is to merge PETS: 2000 data with state-level data. Specifically, the economic condition of each state might be used as a measure of comparison level. If students in a state feel like they can get a good job even with a high school diploma by virtue of economic prosperity, then they would be tempted to pursue an employment opportunity after they enroll over continuing in academic career, which is unlikely under the condition of economic downturn.

NELS: 88/2000 does not have a reliable source of information on the financial aid variable. One possible alternative to solve this problem is to integrate institutional data from Integrated Postsecondary Education Data System (IPEDS) by using the institutional identification number. Fortunately, PETS: 2000 includes the unique IDs of institutions in which students enrolled, which can be used as an identifier when a researcher intends to merge IPEDS data with PETS: 2000 data. This alternative would make it possible to utilize rich institutional-level finance data.

Another limitation of this study is that it did not take the temporal dimension of predictors into consideration. DesJardins and his colleagues (2002) concluded that adding a temporal dimension improves the model fit index, however, the ZINB model is weak in modeling temporal variables.

Like other theoretical frameworks, quantifying the construct of commitment level is very important to establishing a reliable degree completion model. However, the limit in the available data did not allow this study to measure the construct, which made it difficult to test the relationship among satisfaction, commitment, and degree completion. Other variables, such as major field, were found to be related to degree completion, but PETS: 2000 does not have that much detailed information.

## CONTRIBUTIONS OF THE STUDY

This study added its unique contributions in the following aspects. First, the research findings based on a national sample provided significant policy implications.

The research findings on factors affecting degree completion pointed out a potential problem of using raw degree completion rate as a measure of institutional accountability. The answers to the second research question, factors affecting time-to-degree, provided higher education community with policy suggestions on such a plan to penalize students who take more credits than required for degree completion. Advancing and testing the validity of the Degree Commitment Model is expected to inform researchers of the critical determinants that should be included in further studies. Methodologically, this research demonstrated how higher education researchers can model two different types of dependent variables at the same time.

## FUTURE RESEARCH

The study found that students from the lowest SES quintile delayed their entrance to higher education, which is negatively related to degree completion. However, this study did not provide a more detailed story about why those students from the lowest quintile delayed their study at college. Further study at the state level might be designed to explain more on the relationship between the level of SES and baccalaureate degree obtainment and develop policy interventions. For example, a qualitative researcher might compare two different high schools with different curriculum intensity to answer the question of delayed enrollment in postsecondary education.

With the weakness of PETS: 2000 data on financial aid, the study provided less evidence about the relationship between financial aid and degree completion. My

suggestion on this issue is to have institutional researchers do their own analysis for their own institutions rather than trying to find one generalized answer to that question. It sounds reasonable to assume that the impact of financial aid could vary depending on the characteristics of the student body of each institution. For example, students at a large selective private research university might have less concern for financial capacity. For that institution, financial aid might not make a significant difference in improving degree completion. However, for an institution whose students rely heavily on financial aid, changing the financial aid would affect degree completion rate.

The study suggested the withdrawing/repeating behavior is a critical hindrance to degree completion itself and completion in a timely manner. Still remaining to be answered is "why?" Why do students decide to withdraw from a class? Did they not like the voice of the instructor? Did they decide to drop the course after failing a mid-term exam? Or, are they repeating a course to improve the graduation GPA to raise the possibility of being admitted to a selective major or admission to graduate or professional school? One thing that is to be recognized is that repeating a course is not always a bad decision. However, each institution needs to understand the reasons to better manage their enrollments so that they secure a seamless transition to upper level courses and develop possible policies to address this issue. This is where a microscopic study needs to be designed for detailed explanations about this behavior.

Given that the federal government requires postsecondary institutions to report the portion of the entering new high school students who graduated within 150% of normal time of degree completion (six and three years for baccalaureate and associate

degree granting institutions, respectively) and that it is widely accepted as a performance measure of colleges and universities, examining the relationship between each of the independent variable selected in this study and collapsed time to degree completion would provide higher education community with practical implications.

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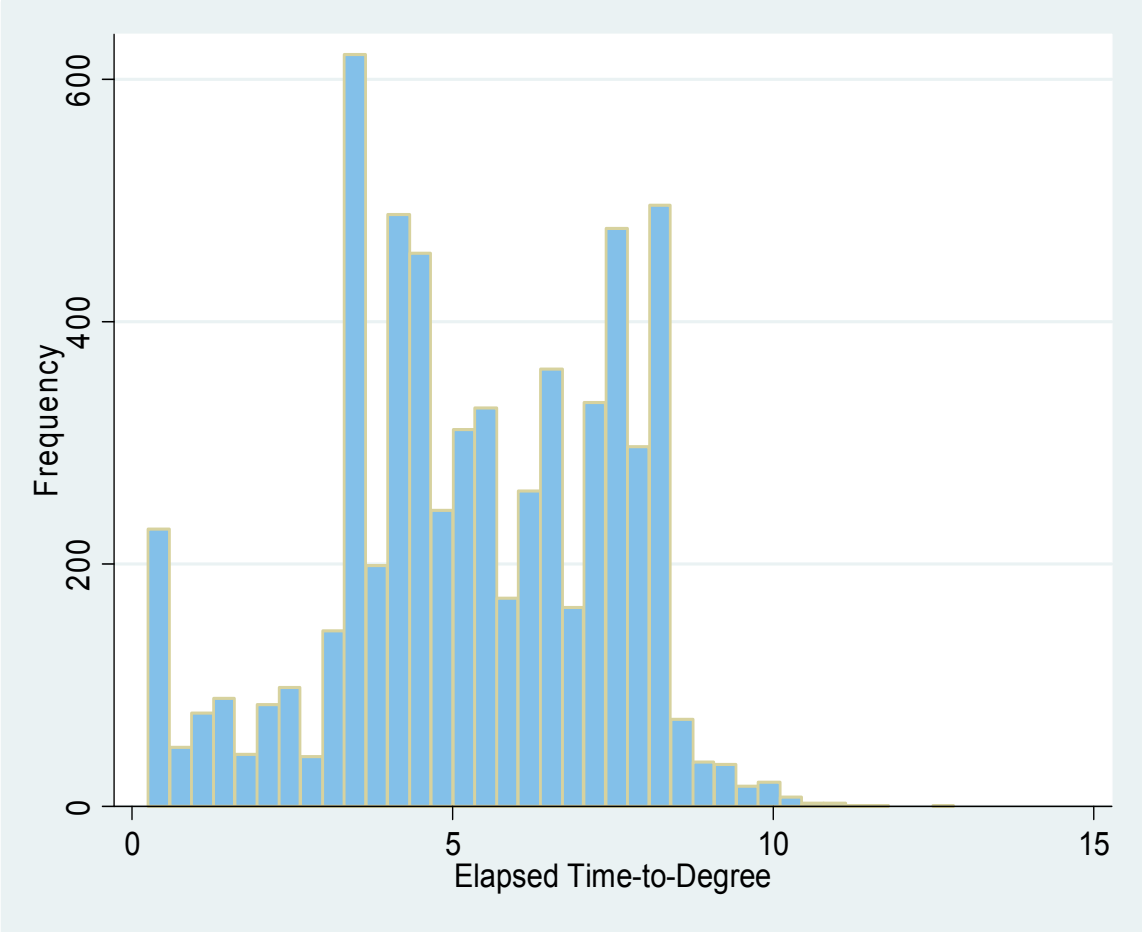
# APPENDICES

## APPENDIX A: DISTRIBUTION OF ELAPSED TIME-TO-DEGREE IN CALENDAR YEAR FOR HIGH SCHOOL GRADUATE OF 1992



## APPENDIX B: STATA COMMAND TO CREATE ENROLLED TIME TO DEGREE

```
replace TERMTYPE_1  = 0 if TERMDATE_1 < REFDATE
replace TERMTYPE_2  = 0 if TERMDATE_2 < REFDATE
replace TERMTYPE_3  = 0 if TERMDATE_3 < REFDATE
replace TERMTYPE_4  = 0 if TERMDATE_4 < REFDATE
replace TERMTYPE_5  = 0 if TERMDATE_5 < REFDATE
replace TERMTYPE_6  = 0 if TERMDATE_6 < REFDATE
replace TERMTYPE_7  = 0 if TERMDATE_7 < REFDATE
replace TERMTYPE_8  = 0 if TERMDATE_8 < REFDATE
replace TERMTYPE_9  = 0 if TERMDATE_9 < REFDATE
replace TERMTYPE_10 = 0 if TERMDATE_10 < REFDATE
replace TERMTYPE_11 = 0 if TERMDATE_11 < REFDATE
replace TERMTYPE_12 = 0 if TERMDATE_12 < REFDATE
replace TERMTYPE_13 = 0 if TERMDATE_13 < REFDATE
replace TERMTYPE_14 = 0 if TERMDATE_14 < REFDATE
replace TERMTYPE_15 = 0 if TERMDATE_15 < REFDATE
replace TERMTYPE_16 = 0 if TERMDATE_16 < REFDATE
replace TERMTYPE_17 = 0 if TERMDATE_17 < REFDATE
replace TERMTYPE_18 = 0 if TERMDATE_18 < REFDATE
replace TERMTYPE_19 = 0 if TERMDATE_19 < REFDATE
replace TERMTYPE_20 = 0 if TERMDATE_20 < REFDATE
replace TERMTYPE_21 = 0 if TERMDATE_21 < REFDATE
replace TERMTYPE_22 = 0 if TERMDATE_22 < REFDATE
replace TERMTYPE_23 = 0 if TERMDATE_23 < REFDATE
replace TERMTYPE_24 = 0 if TERMDATE_24 < REFDATE
replace TERMTYPE_25 = 0 if TERMDATE_25 < REFDATE
replace TERMTYPE_26 = 0 if TERMDATE_26 < REFDATE
replace TERMTYPE_27 = 0 if TERMDATE_27 < REFDATE
replace TERMTYPE_28 = 0 if TERMDATE_28 < REFDATE
replace TERMTYPE_29 = 0 if TERMDATE_29 < REFDATE
replace TERMTYPE_30 = 0 if TERMDATE_30 < REFDATE
replace TERMTYPE_31 = 0 if TERMDATE_31 < REFDATE
replace TERMTYPE_32 = 0 if TERMDATE_32 < REFDATE
replace TERMTYPE_33 = 0 if TERMDATE_33 < REFDATE
replace TERMTYPE_34 = 0 if TERMDATE_34 < REFDATE
replace TERMTYPE_35 = 0 if TERMDATE_35 < REFDATE
replace TERMTYPE_36 = 0 if TERMDATE_36 < REFDATE

gen time_1 = 0
gen time_2 = 0
gen time_3 = 0
gen time_4 = 0
```

```
gen time_5 = 0
gen time_6 = 0
gen time_7 = 0
gen time_8 = 0
gen time_9 = 0
gen time_10 = 0
gen time_11 = 0
gen time_12 = 0
gen time_13 = 0
gen time_14 = 0
gen time_15 = 0
gen time_16 = 0
gen time_17 = 0
gen time_18 = 0
gen time_19 = 0
gen time_20 = 0
gen time_21 = 0
gen time_22 = 0
gen time_23 = 0
gen time_24 = 0
gen time_25 = 0
gen time_26 = 0
gen time_27 = 0
gen time_28 = 0
gen time_29 = 0
gen time_30 = 0
gen time_31 = 0
gen time_32 = 0
gen time_33 = 0
gen time_34 = 0
gen time_35 = 0
gen time_36 = 0

replace time_1 = 15  if TERMTYPE_1 == 1 &  TERMDATE_1 < DEGDAT4
replace time_1 = 10  if TERMTYPE_1 == 2 &  TERMDATE_1 < DEGDAT4
replace time_1 = 15  if TERMTYPE_1 == 3 &  TERMDATE_1 < DEGDAT4
replace time_1 = .   if TERMTYPE_1 == 4 &  TERMDATE_1 < DEGDAT4
replace time_1 = 0   if TERMTYPE_1 == 5 &  TERMDATE_1 < DEGDAT4
replace time_1 = .   if TERMTYPE_1 == 6 &  TERMDATE_1 < DEGDAT4
replace time_1 = 0   if TERMTYPE_1 == 7 &  TERMDATE_1 < DEGDAT4
replace time_1 = 15  if TERMTYPE_1 == 8 &  TERMDATE_1 < DEGDAT4
replace time_1 = 15  if TERMTYPE_1 == 9 &  TERMDATE_1 < DEGDAT4

replace time_2 = 15  if TERMTYPE_2 == 1 &  TERMDATE_2 < DEGDAT4
```

```
replace time_2 = 10  if TERMTYPE_2 == 2 &  TERMDATE_2 < DEGDAT4
replace time_2 = 15  if TERMTYPE_2 == 3 &  TERMDATE_2 < DEGDAT4
replace time_2 = .   if TERMTYPE_2 == 4 &  TERMDATE_2 < DEGDAT4
replace time_2 = 0   if TERMTYPE_2 == 5 &  TERMDATE_2 < DEGDAT4
replace time_2 = .   if TERMTYPE_2 == 6 &  TERMDATE_2 < DEGDAT4
replace time_2 = 0   if TERMTYPE_2 == 7 &  TERMDATE_2 < DEGDAT4
replace time_2 = 15  if TERMTYPE_2 == 8 &  TERMDATE_2 < DEGDAT4
replace time_2 = 15  if TERMTYPE_2 == 9 &  TERMDATE_2 < DEGDAT4

replace time_3 = 15  if TERMTYPE_3 == 1 &  TERMDATE_3 < DEGDAT4
replace time_3 = 10  if TERMTYPE_3 == 2 &  TERMDATE_3 < DEGDAT4
replace time_3 = 15  if TERMTYPE_3 == 3 &  TERMDATE_3 < DEGDAT4
replace time_3 = .   if TERMTYPE_3 == 4 &  TERMDATE_3 < DEGDAT4
replace time_3 = 0   if TERMTYPE_3 == 5 &  TERMDATE_3 < DEGDAT4
replace time_3 = .   if TERMTYPE_3 == 6 &  TERMDATE_3 < DEGDAT4
replace time_3 = 0   if TERMTYPE_3 == 7 &  TERMDATE_3 < DEGDAT4
replace time_3 = 15  if TERMTYPE_3 == 8 &  TERMDATE_3 < DEGDAT4
replace time_3 = 15  if TERMTYPE_3 == 9 &  TERMDATE_3 < DEGDAT4

replace time_4 = 15  if TERMTYPE_4 == 1 &  TERMDATE_4 < DEGDAT4
replace time_4 = 10  if TERMTYPE_4 == 2 &  TERMDATE_4 < DEGDAT4
replace time_4 = 15  if TERMTYPE_4 == 3 &  TERMDATE_4 < DEGDAT4
replace time_4 = .   if TERMTYPE_4 == 4 &  TERMDATE_4 < DEGDAT4
replace time_4 = 0   if TERMTYPE_4 == 5 &  TERMDATE_4 < DEGDAT4
replace time_4 = .   if TERMTYPE_4 == 6 &  TERMDATE_4 < DEGDAT4
replace time_4 = 0   if TERMTYPE_4 == 7 &  TERMDATE_4 < DEGDAT4
replace time_4 = 15  if TERMTYPE_4 == 8 &  TERMDATE_4 < DEGDAT4
replace time_4 = 15  if TERMTYPE_4 == 9 &  TERMDATE_4 < DEGDAT4

replace time_5 = 15  if TERMTYPE_5 == 1 &  TERMDATE_5 < DEGDAT4
replace time_5 = 10  if TERMTYPE_5 == 2 &  TERMDATE_5 < DEGDAT4
replace time_5 = 15  if TERMTYPE_5 == 3 &  TERMDATE_5 < DEGDAT4
replace time_5 = .   if TERMTYPE_5 == 4 &  TERMDATE_5 < DEGDAT4
replace time_5 = 0   if TERMTYPE_5 == 5 &  TERMDATE_5 < DEGDAT4
replace time_5 = .   if TERMTYPE_5 == 6 &  TERMDATE_5 < DEGDAT4
replace time_5 = 0   if TERMTYPE_5 == 7 &  TERMDATE_5 < DEGDAT4
replace time_5 = 15  if TERMTYPE_5 == 8 &  TERMDATE_5 < DEGDAT4
replace time_5 = 15  if TERMTYPE_5 == 9 &  TERMDATE_5 < DEGDAT4

replace time_6 = 15  if TERMTYPE_6 == 1 &  TERMDATE_6 < DEGDAT4
replace time_6 = 10  if TERMTYPE_6 == 2 &  TERMDATE_6 < DEGDAT4
replace time_6 = 15  if TERMTYPE_6 == 3 &  TERMDATE_6 < DEGDAT4
replace time_6 = .   if TERMTYPE_6 == 4 &  TERMDATE_6 < DEGDAT4
replace time_6 = 0   if TERMTYPE_6 == 5 &  TERMDATE_6 < DEGDAT4
```

```
replace time_6 = .    if TERMTYPE_6 == 6 &  TERMDATE_6 < DEGDAT4
replace time_6 = 0    if TERMTYPE_6 == 7 &  TERMDATE_6 < DEGDAT4
replace time_6 = 15   if TERMTYPE_6 == 8 &  TERMDATE_6 < DEGDAT4
replace time_6 = 15   if TERMTYPE_6 == 9 &  TERMDATE_6 < DEGDAT4

replace time_7 = 15   if TERMTYPE_7 == 1 &  TERMDATE_7 < DEGDAT4
replace time_7 = 10   if TERMTYPE_7 == 2 &  TERMDATE_7 < DEGDAT4
replace time_7 = 15   if TERMTYPE_7 == 3 &  TERMDATE_7 < DEGDAT4
replace time_7 = .    if TERMTYPE_7 == 4 &  TERMDATE_7 < DEGDAT4
replace time_7 = 0    if TERMTYPE_7 == 5 &  TERMDATE_7 < DEGDAT4
replace time_7 = .    if TERMTYPE_7 == 6 &  TERMDATE_7 < DEGDAT4
replace time_7 = 0    if TERMTYPE_7 == 7 &  TERMDATE_7 < DEGDAT4
replace time_7 = 15   if TERMTYPE_7 == 8 &  TERMDATE_7 < DEGDAT4
replace time_7 = 15   if TERMTYPE_7 == 9 &  TERMDATE_7 < DEGDAT4

replace time_8 = 15   if TERMTYPE_8 == 1 &  TERMDATE_8 < DEGDAT4
replace time_8 = 10   if TERMTYPE_8 == 2 &  TERMDATE_8 < DEGDAT4
replace time_8 = 15   if TERMTYPE_8 == 3 &  TERMDATE_8 < DEGDAT4
replace time_8 = .    if TERMTYPE_8 == 4 &  TERMDATE_8 < DEGDAT4
replace time_8 = 0    if TERMTYPE_8 == 5 &  TERMDATE_8 < DEGDAT4
replace time_8 = .    if TERMTYPE_8 == 6 &  TERMDATE_8 < DEGDAT4
replace time_8 = 0    if TERMTYPE_8 == 7 &  TERMDATE_8 < DEGDAT4
replace time_8 = 15   if TERMTYPE_8 == 8 &  TERMDATE_8 < DEGDAT4
replace time_8 = 15   if TERMTYPE_8 == 9 &  TERMDATE_8 < DEGDAT4

replace time_9 = 15   if TERMTYPE_9 == 1 &  TERMDATE_9 < DEGDAT4
replace time_9 = 10   if TERMTYPE_9 == 2 &  TERMDATE_9 < DEGDAT4
replace time_9 = 15   if TERMTYPE_9 == 3 &  TERMDATE_9 < DEGDAT4
replace time_9 = .    if TERMTYPE_9 == 4 &  TERMDATE_9 < DEGDAT4
replace time_9 = 0    if TERMTYPE_9 == 5 &  TERMDATE_9 < DEGDAT4
replace time_9 = .    if TERMTYPE_9 == 6 &  TERMDATE_9 < DEGDAT4
replace time_9 = 0    if TERMTYPE_9 == 7 &  TERMDATE_9 < DEGDAT4
replace time_9 = 15   if TERMTYPE_9 == 8 &  TERMDATE_9 < DEGDAT4
replace time_9 = 15   if TERMTYPE_9 == 9 &  TERMDATE_9 < DEGDAT4

replace time_10 = 15  if TERMTYPE_10 == 1  &  TERMDATE_10 < DEGDAT4
replace time_10 = 10  if TERMTYPE_10 == 2  &  TERMDATE_10 < DEGDAT4
replace time_10 = 15  if TERMTYPE_10 == 3  &  TERMDATE_10 < DEGDAT4
replace time_10 = .   if TERMTYPE_10 == 4  &  TERMDATE_10 < DEGDAT4
replace time_10 = 0   if TERMTYPE_10 == 5  &  TERMDATE_10 < DEGDAT4
replace time_10 = .   if TERMTYPE_10 == 6  &  TERMDATE_10 < DEGDAT4
replace time_10 = 0   if TERMTYPE_10 == 7  &  TERMDATE_10 < DEGDAT4
replace time_10 = 15  if TERMTYPE_10 == 8  &  TERMDATE_10 < DEGDAT4
replace time_10 = 15  if TERMTYPE_10 == 9  &  TERMDATE_10 < DEGDAT4
```

```
replace time_11 = 15  if TERMTYPE_11 == 1  &  TERMDATE_11 < DEGDAT4
replace time_11 = 10  if TERMTYPE_11 == 2  &  TERMDATE_11 < DEGDAT4
replace time_11 = 15  if TERMTYPE_11 == 3  &  TERMDATE_11 < DEGDAT4
replace time_11 = .   if TERMTYPE_11 == 4  &  TERMDATE_11 < DEGDAT4
replace time_11 = 0   if TERMTYPE_11 == 5  &  TERMDATE_11 < DEGDAT4
replace time_11 = .   if TERMTYPE_11 == 6  &  TERMDATE_11 < DEGDAT4
replace time_11 = 0   if TERMTYPE_11 == 7  &  TERMDATE_11 < DEGDAT4
replace time_11 = 15  if TERMTYPE_11 == 8  &  TERMDATE_11 < DEGDAT4
replace time_11 = 15  if TERMTYPE_11 == 9  &  TERMDATE_11 < DEGDAT4

replace time_12 = 15  if TERMTYPE_12 == 1  &  TERMDATE_12 < DEGDAT4
replace time_12 = 10  if TERMTYPE_12 == 2  &  TERMDATE_12 < DEGDAT4
replace time_12 = 15  if TERMTYPE_12 == 3  &  TERMDATE_12 < DEGDAT4
replace time_12 = .   if TERMTYPE_12 == 4  &  TERMDATE_12 < DEGDAT4
replace time_12 = 0   if TERMTYPE_12 == 5  &  TERMDATE_12 < DEGDAT4
replace time_12 = .   if TERMTYPE_12 == 6  &  TERMDATE_12 < DEGDAT4
replace time_12 = 0   if TERMTYPE_12 == 7  &  TERMDATE_12 < DEGDAT4
replace time_12 = 15  if TERMTYPE_12 == 8  &  TERMDATE_12 < DEGDAT4
replace time_12 = 15  if TERMTYPE_12 == 9  &  TERMDATE_12 < DEGDAT4

replace time_13 = 15  if TERMTYPE_13 == 1  &  TERMDATE_13 < DEGDAT4
replace time_13 = 10  if TERMTYPE_13 == 2  &  TERMDATE_13 < DEGDAT4
replace time_13 = 15  if TERMTYPE_13 == 3  &  TERMDATE_13 < DEGDAT4
replace time_13 = .   if TERMTYPE_13 == 4  &  TERMDATE_13 < DEGDAT4
replace time_13 = 0   if TERMTYPE_13 == 5  &  TERMDATE_13 < DEGDAT4
replace time_13 = .   if TERMTYPE_13 == 6  &  TERMDATE_13 < DEGDAT4
replace time_13 = 0   if TERMTYPE_13 == 7  &  TERMDATE_13 < DEGDAT4
replace time_13 = 15  if TERMTYPE_13 == 8  &  TERMDATE_13 < DEGDAT4
replace time_13 = 15  if TERMTYPE_13 == 9  &  TERMDATE_13 < DEGDAT4

replace time_14 = 15  if TERMTYPE_14 == 1  &  TERMDATE_14 < DEGDAT4
replace time_14 = 10  if TERMTYPE_14 == 2  &  TERMDATE_14 < DEGDAT4
replace time_14 = 15  if TERMTYPE_14 == 3  &  TERMDATE_14 < DEGDAT4
replace time_14 = .   if TERMTYPE_14 == 4  &  TERMDATE_14 < DEGDAT4
replace time_14 = 0   if TERMTYPE_14 == 5  &  TERMDATE_14 < DEGDAT4
replace time_14 = .   if TERMTYPE_14 == 6  &  TERMDATE_14 < DEGDAT4
replace time_14 = 0   if TERMTYPE_14 == 7  &  TERMDATE_14 < DEGDAT4
replace time_14 = 15  if TERMTYPE_14 == 8  &  TERMDATE_14 < DEGDAT4
replace time_14 = 15  if TERMTYPE_14 == 9  &  TERMDATE_14 < DEGDAT4

replace time_15 = 15  if TERMTYPE_15 == 1  &  TERMDATE_15 < DEGDAT4
replace time_15 = 10  if TERMTYPE_15 == 2  &  TERMDATE_15 < DEGDAT4
```

```
replace time_15 = 15  if TERMTYPE_15 == 3  &  TERMDATE_15 < DEGDAT4
replace time_15 = .   if TERMTYPE_15 == 4  &  TERMDATE_15 < DEGDAT4
replace time_15 = 0   if TERMTYPE_15 == 5  &  TERMDATE_15 < DEGDAT4
replace time_15 = .   if TERMTYPE_15 == 6  &  TERMDATE_15 < DEGDAT4
replace time_15 = 0   if TERMTYPE_15 == 7  &  TERMDATE_15 < DEGDAT4
replace time_15 = 15  if TERMTYPE_15 == 8  &  TERMDATE_15 < DEGDAT4
replace time_15 = 15  if TERMTYPE_15 == 9  &  TERMDATE_15 < DEGDAT4

replace time_16 = 15  if TERMTYPE_16 == 1  &  TERMDATE_16 < DEGDAT4
replace time_16 = 10  if TERMTYPE_16 == 2  &  TERMDATE_16 < DEGDAT4
replace time_16 = 15  if TERMTYPE_16 == 3  &  TERMDATE_16 < DEGDAT4
replace time_16 = .   if TERMTYPE_16 == 4  &  TERMDATE_16 < DEGDAT4
replace time_16 = 0   if TERMTYPE_16 == 5  &  TERMDATE_16 < DEGDAT4
replace time_16 = .   if TERMTYPE_16 == 6  &  TERMDATE_16 < DEGDAT4
replace time_16 = 0   if TERMTYPE_16 == 7  &  TERMDATE_16 < DEGDAT4
replace time_16 = 15  if TERMTYPE_16 == 8  &  TERMDATE_16 < DEGDAT4
replace time_16 = 15  if TERMTYPE_16 == 9  &  TERMDATE_16 < DEGDAT4

replace time_17 = 15  if TERMTYPE_17 == 1  &  TERMDATE_17 < DEGDAT4
replace time_17 = 10  if TERMTYPE_17 == 2  &  TERMDATE_17 < DEGDAT4
replace time_17 = 15  if TERMTYPE_17 == 3  &  TERMDATE_17 < DEGDAT4
replace time_17 = .   if TERMTYPE_17 == 4  &  TERMDATE_17 < DEGDAT4
replace time_17 = 0   if TERMTYPE_17 == 5  &  TERMDATE_17 < DEGDAT4
replace time_17 = .   if TERMTYPE_17 == 6  &  TERMDATE_17 < DEGDAT4
replace time_17 = 0   if TERMTYPE_17 == 7  &  TERMDATE_17 < DEGDAT4
replace time_17 = 15  if TERMTYPE_17 == 8  &  TERMDATE_17 < DEGDAT4
replace time_17 = 15  if TERMTYPE_17 == 9  &  TERMDATE_17 < DEGDAT4

replace time_18 = 15  if TERMTYPE_18 == 1  &  TERMDATE_18 < DEGDAT4
replace time_18 = 10  if TERMTYPE_18 == 2  &  TERMDATE_18 < DEGDAT4
replace time_18 = 15  if TERMTYPE_18 == 3  &  TERMDATE_18 < DEGDAT4
replace time_18 = .   if TERMTYPE_18 == 4  &  TERMDATE_18 < DEGDAT4
replace time_18 = 0   if TERMTYPE_18 == 5  &  TERMDATE_18 < DEGDAT4
replace time_18 = .   if TERMTYPE_18 == 6  &  TERMDATE_18 < DEGDAT4
replace time_18 = 0   if TERMTYPE_18 == 7  &  TERMDATE_18 < DEGDAT4
replace time_18 = 15  if TERMTYPE_18 == 8  &  TERMDATE_18 < DEGDAT4
replace time_18 = 15  if TERMTYPE_18 == 9  &  TERMDATE_18 < DEGDAT4

replace time_19 = 15  if TERMTYPE_19 == 1  &  TERMDATE_19 < DEGDAT4
replace time_19 = 10  if TERMTYPE_19 == 2  &  TERMDATE_19 < DEGDAT4
replace time_19 = 15  if TERMTYPE_19 == 3  &  TERMDATE_19 < DEGDAT4
replace time_19 = .   if TERMTYPE_19 == 4  &  TERMDATE_19 < DEGDAT4
replace time_19 = 0   if TERMTYPE_19 == 5  &  TERMDATE_19 < DEGDAT4
replace time_19 = .   if TERMTYPE_19 == 6  &  TERMDATE_19 < DEGDAT4
```

```
replace time_19 = 0    if TERMTYPE_19 == 7  &  TERMDATE_19 < DEGDAT4
replace time_19 = 15  if TERMTYPE_19 == 8  &  TERMDATE_19 < DEGDAT4
replace time_19 = 15  if TERMTYPE_19 == 9  &  TERMDATE_19 < DEGDAT4

replace time_20 = 15  if TERMTYPE_20 == 1  &  TERMDATE_20 < DEGDAT4
replace time_20 = 10  if TERMTYPE_20 == 2  &  TERMDATE_20 < DEGDAT4
replace time_20 = 15  if TERMTYPE_20 == 3  &  TERMDATE_20 < DEGDAT4
replace time_20 = .    if TERMTYPE_20 == 4  &  TERMDATE_20 < DEGDAT4
replace time_20 = 0    if TERMTYPE_20 == 5  &  TERMDATE_20 < DEGDAT4
replace time_20 = .    if TERMTYPE_20 == 6  &  TERMDATE_20 < DEGDAT4
replace time_20 = 0    if TERMTYPE_20 == 7  &  TERMDATE_20 < DEGDAT4
replace time_20 = 15  if TERMTYPE_20 == 8  &  TERMDATE_20 < DEGDAT4
replace time_20 = 15  if TERMTYPE_20 == 9  &  TERMDATE_20 < DEGDAT4

replace time_21 = 15  if TERMTYPE_21 == 1  &  TERMDATE_21 < DEGDAT4
replace time_21 = 10  if TERMTYPE_21 == 2  &  TERMDATE_21 < DEGDAT4
replace time_21 = 15  if TERMTYPE_21 == 3  &  TERMDATE_21 < DEGDAT4
replace time_21 = .    if TERMTYPE_21 == 4  &  TERMDATE_21 < DEGDAT4
replace time_21 = 0    if TERMTYPE_21 == 5  &  TERMDATE_21 < DEGDAT4
replace time_21 = .    if TERMTYPE_21 == 6  &  TERMDATE_21 < DEGDAT4
replace time_21 = 0    if TERMTYPE_21 == 7  &  TERMDATE_21 < DEGDAT4
replace time_21 = 15  if TERMTYPE_21 == 8  &  TERMDATE_21 < DEGDAT4
replace time_21 = 15  if TERMTYPE_21 == 9  &  TERMDATE_21 < DEGDAT4

replace time_22 = 15  if TERMTYPE_22 == 1  &  TERMDATE_22 < DEGDAT4
replace time_22 = 10  if TERMTYPE_22 == 2  &  TERMDATE_22 < DEGDAT4
replace time_22 = 15  if TERMTYPE_22 == 3  &  TERMDATE_22 < DEGDAT4
replace time_22 = .    if TERMTYPE_22 == 4  &  TERMDATE_22 < DEGDAT4
replace time_22 = 0    if TERMTYPE_22 == 5  &  TERMDATE_22 < DEGDAT4
replace time_22 = .    if TERMTYPE_22 == 6  &  TERMDATE_22 < DEGDAT4
replace time_22 = 0    if TERMTYPE_22 == 7  &  TERMDATE_22 < DEGDAT4
replace time_22 = 15  if TERMTYPE_22 == 8  &  TERMDATE_22 < DEGDAT4
replace time_22 = 15  if TERMTYPE_22 == 9  &  TERMDATE_22 < DEGDAT4

replace time_23 = 15  if TERMTYPE_23 == 1  &  TERMDATE_23 < DEGDAT4
replace time_23 = 10  if TERMTYPE_23 == 2  &  TERMDATE_23 < DEGDAT4
replace time_23 = 15  if TERMTYPE_23 == 3  &  TERMDATE_23 < DEGDAT4
replace time_23 = .    if TERMTYPE_23 == 4  &  TERMDATE_23 < DEGDAT4
replace time_23 = 0    if TERMTYPE_23 == 5  &  TERMDATE_23 < DEGDAT4
replace time_23 = .    if TERMTYPE_23 == 6  &  TERMDATE_23 < DEGDAT4
replace time_23 = 0    if TERMTYPE_23 == 7  &  TERMDATE_23 < DEGDAT4
replace time_23 = 15  if TERMTYPE_23 == 8  &  TERMDATE_23 < DEGDAT4
replace time_23 = 15  if TERMTYPE_23 == 9  &  TERMDATE_23 < DEGDAT4
```

```
replace time_24 = 15  if TERMTYPE_24 == 1  &  TERMDATE_24 < DEGDAT4
replace time_24 = 10  if TERMTYPE_24 == 2  &  TERMDATE_24 < DEGDAT4
replace time_24 = 15  if TERMTYPE_24 == 3  &  TERMDATE_24 < DEGDAT4
replace time_24 = .   if TERMTYPE_24 == 4  &  TERMDATE_24 < DEGDAT4
replace time_24 = 0   if TERMTYPE_24 == 5  &  TERMDATE_24 < DEGDAT4
replace time_24 = .   if TERMTYPE_24 == 6  &  TERMDATE_24 < DEGDAT4
replace time_24 = 0   if TERMTYPE_24 == 7  &  TERMDATE_24 < DEGDAT4
replace time_24 = 15  if TERMTYPE_24 == 8  &  TERMDATE_24 < DEGDAT4
replace time_24 = 15  if TERMTYPE_24 == 9  &  TERMDATE_24 < DEGDAT4

replace time_25 = 15  if TERMTYPE_25 == 1  &  TERMDATE_25 < DEGDAT4
replace time_25 = 10  if TERMTYPE_25 == 2  &  TERMDATE_25 < DEGDAT4
replace time_25 = 15  if TERMTYPE_25 == 3  &  TERMDATE_25 < DEGDAT4
replace time_25 = .   if TERMTYPE_25 == 4  &  TERMDATE_25 < DEGDAT4
replace time_25 = 0   if TERMTYPE_25 == 5  &  TERMDATE_25 < DEGDAT4
replace time_25 = .   if TERMTYPE_25 == 6  &  TERMDATE_25 < DEGDAT4
replace time_25 = 0   if TERMTYPE_25 == 7  &  TERMDATE_25 < DEGDAT4
replace time_25 = 15  if TERMTYPE_25 == 8  &  TERMDATE_25 < DEGDAT4
replace time_25 = 15  if TERMTYPE_25 == 9  &  TERMDATE_25 < DEGDAT4

replace time_26 = 15  if TERMTYPE_26 == 1  &  TERMDATE_26 < DEGDAT4
replace time_26 = 10  if TERMTYPE_26 == 2  &  TERMDATE_26 < DEGDAT4
replace time_26 = 15  if TERMTYPE_26 == 3  &  TERMDATE_26 < DEGDAT4
replace time_26 = .   if TERMTYPE_26 == 4  &  TERMDATE_26 < DEGDAT4
replace time_26 = 0   if TERMTYPE_26 == 5  &  TERMDATE_26 < DEGDAT4
replace time_26 = .   if TERMTYPE_26 == 6  &  TERMDATE_26 < DEGDAT4
replace time_26 = 0   if TERMTYPE_26 == 7  &  TERMDATE_26 < DEGDAT4
replace time_26 = 15  if TERMTYPE_26 == 8  &  TERMDATE_26 < DEGDAT4
replace time_26 = 15  if TERMTYPE_26 == 9  &  TERMDATE_26 < DEGDAT4

replace time_27 = 15  if TERMTYPE_27 == 1  &  TERMDATE_27 < DEGDAT4
replace time_27 = 10  if TERMTYPE_27 == 2  &  TERMDATE_27 < DEGDAT4
replace time_27 = 15  if TERMTYPE_27 == 3  &  TERMDATE_27 < DEGDAT4
replace time_27 = .   if TERMTYPE_27 == 4  &  TERMDATE_27 < DEGDAT4
replace time_27 = 0   if TERMTYPE_27 == 5  &  TERMDATE_27 < DEGDAT4
replace time_27 = .   if TERMTYPE_27 == 6  &  TERMDATE_27 < DEGDAT4
replace time_27 = 0   if TERMTYPE_27 == 7  &  TERMDATE_27 < DEGDAT4
replace time_27 = 15  if TERMTYPE_27 == 8  &  TERMDATE_27 < DEGDAT4
replace time_27 = 15  if TERMTYPE_27 == 9  &  TERMDATE_27 < DEGDAT4

replace time_28 = 15  if TERMTYPE_28 == 1  &  TERMDATE_28 < DEGDAT4
replace time_28 = 10  if TERMTYPE_28 == 2  &  TERMDATE_28 < DEGDAT4
replace time_28 = 15  if TERMTYPE_28 == 3  &  TERMDATE_28 < DEGDAT4
```

```
replace time_28 = .    if TERMTYPE_28 == 4  &  TERMDATE_28 < DEGDAT4
replace time_28 = 0    if TERMTYPE_28 == 5  &  TERMDATE_28 < DEGDAT4
replace time_28 = .    if TERMTYPE_28 == 6  &  TERMDATE_28 < DEGDAT4
replace time_28 = 0    if TERMTYPE_28 == 7  &  TERMDATE_28 < DEGDAT4
replace time_28 = 15   if TERMTYPE_28 == 8  &  TERMDATE_28 < DEGDAT4
replace time_28 = 15   if TERMTYPE_28 == 9  &  TERMDATE_28 < DEGDAT4

replace time_29 = 15   if TERMTYPE_29 == 1  &  TERMDATE_29 < DEGDAT4
replace time_29 = 10   if TERMTYPE_29 == 2  &  TERMDATE_29 < DEGDAT4
replace time_29 = 15   if TERMTYPE_29 == 3  &  TERMDATE_29 < DEGDAT4
replace time_29 = .    if TERMTYPE_29 == 4  &  TERMDATE_29 < DEGDAT4
replace time_29 = 0    if TERMTYPE_29 == 5  &  TERMDATE_29 < DEGDAT4
replace time_29 = .    if TERMTYPE_29 == 6  &  TERMDATE_29 < DEGDAT4
replace time_29 = 0    if TERMTYPE_29 == 7  &  TERMDATE_29 < DEGDAT4
replace time_29 = 15   if TERMTYPE_29 == 8  &  TERMDATE_29 < DEGDAT4
replace time_29 = 15   if TERMTYPE_29 == 9  &  TERMDATE_29 < DEGDAT4

replace time_30 = 15   if TERMTYPE_30 == 1  &  TERMDATE_30 < DEGDAT4
replace time_30 = 10   if TERMTYPE_30 == 2  &  TERMDATE_30 < DEGDAT4
replace time_30 = 15   if TERMTYPE_30 == 3  &  TERMDATE_30 < DEGDAT4
replace time_30 = .    if TERMTYPE_30 == 4  &  TERMDATE_30 < DEGDAT4
replace time_30 = 0    if TERMTYPE_30 == 5  &  TERMDATE_30 < DEGDAT4
replace time_30 = .    if TERMTYPE_30 == 6  &  TERMDATE_30 < DEGDAT4
replace time_30 = 0    if TERMTYPE_30 == 7  &  TERMDATE_30 < DEGDAT4
replace time_30 = 15   if TERMTYPE_30 == 8  &  TERMDATE_30 < DEGDAT4
replace time_30 = 15   if TERMTYPE_30 == 9  &  TERMDATE_30 < DEGDAT4

replace time_31 = 15   if TERMTYPE_31 == 1  &  TERMDATE_31 < DEGDAT4
replace time_31 = 10   if TERMTYPE_31 == 2  &  TERMDATE_31 < DEGDAT4
replace time_31 = 15   if TERMTYPE_31 == 3  &  TERMDATE_31 < DEGDAT4
replace time_31 = .    if TERMTYPE_31 == 4  &  TERMDATE_31 < DEGDAT4
replace time_31 = 0    if TERMTYPE_31 == 5  &  TERMDATE_31 < DEGDAT4
replace time_31 = .    if TERMTYPE_31 == 6  &  TERMDATE_31 < DEGDAT4
replace time_31 = 0    if TERMTYPE_31 == 7  &  TERMDATE_31 < DEGDAT4
replace time_31 = 15   if TERMTYPE_31 == 8  &  TERMDATE_31 < DEGDAT4
replace time_31 = 15   if TERMTYPE_31 == 9  &  TERMDATE_31 < DEGDAT4

replace time_32 = 15   if TERMTYPE_32 == 1  &  TERMDATE_32 < DEGDAT4
replace time_32 = 10   if TERMTYPE_32 == 2  &  TERMDATE_32 < DEGDAT4
replace time_32 = 15   if TERMTYPE_32 == 3  &  TERMDATE_32 < DEGDAT4
replace time_32 = .    if TERMTYPE_32 == 4  &  TERMDATE_32 < DEGDAT4
replace time_32 = 0    if TERMTYPE_32 == 5  &  TERMDATE_32 < DEGDAT4
replace time_32 = .    if TERMTYPE_32 == 6  &  TERMDATE_32 < DEGDAT4
replace time_32 = 0    if TERMTYPE_32 == 7  &  TERMDATE_32 < DEGDAT4
```

```
replace time_32 = 15  if TERMTYPE_32 == 8  &  TERMDATE_32 < DEGDAT4
replace time_32 = 15  if TERMTYPE_32 == 9  &  TERMDATE_32 < DEGDAT4

replace time_33 = 15  if TERMTYPE_33 == 1  &  TERMDATE_33 < DEGDAT4
replace time_33 = 10  if TERMTYPE_33 == 2  &  TERMDATE_33 < DEGDAT4
replace time_33 = 15  if TERMTYPE_33 == 3  &  TERMDATE_33 < DEGDAT4
replace time_33 = .   if TERMTYPE_33 == 4  &  TERMDATE_33 < DEGDAT4
replace time_33 = 0   if TERMTYPE_33 == 5  &  TERMDATE_33 < DEGDAT4
replace time_33 = .   if TERMTYPE_33 == 6  &  TERMDATE_33 < DEGDAT4
replace time_33 = 0   if TERMTYPE_33 == 7  &  TERMDATE_33 < DEGDAT4
replace time_33 = 15  if TERMTYPE_33 == 8  &  TERMDATE_33 < DEGDAT4
replace time_33 = 15  if TERMTYPE_33 == 9  &  TERMDATE_33 < DEGDAT4

replace time_34 = 15  if TERMTYPE_34 == 1  &  TERMDATE_34 < DEGDAT4
replace time_34 = 10  if TERMTYPE_34 == 2  &  TERMDATE_34 < DEGDAT4
replace time_34 = 15  if TERMTYPE_34 == 3  &  TERMDATE_34 < DEGDAT4
replace time_34 = .   if TERMTYPE_34 == 4  &  TERMDATE_34 < DEGDAT4
replace time_34 = 0   if TERMTYPE_34 == 5  &  TERMDATE_34 < DEGDAT4
replace time_34 = .   if TERMTYPE_34 == 6  &  TERMDATE_34 < DEGDAT4
replace time_34 = 0   if TERMTYPE_34 == 7  &  TERMDATE_34 < DEGDAT4
replace time_34 = 15  if TERMTYPE_34 == 8  &  TERMDATE_34 < DEGDAT4
replace time_34 = 15  if TERMTYPE_34 == 9  &  TERMDATE_34 < DEGDAT4

replace time_35 = 15  if TERMTYPE_35 == 1  &  TERMDATE_35 < DEGDAT4
replace time_35 = 10  if TERMTYPE_35 == 2  &  TERMDATE_35 < DEGDAT4
replace time_35 = 15  if TERMTYPE_35 == 3  &  TERMDATE_35 < DEGDAT4
replace time_35 = .   if TERMTYPE_35 == 4  &  TERMDATE_35 < DEGDAT4
replace time_35 = 0   if TERMTYPE_35 == 5  &  TERMDATE_35 < DEGDAT4
replace time_35 = .   if TERMTYPE_35 == 6  &  TERMDATE_35 < DEGDAT4
replace time_35 = 0   if TERMTYPE_35 == 7  &  TERMDATE_35 < DEGDAT4
replace time_35 = 15  if TERMTYPE_35 == 8  &  TERMDATE_35 < DEGDAT4
replace time_35 = 15  if TERMTYPE_35 == 9  &  TERMDATE_35 < DEGDAT4

replace time_36 = 15  if TERMTYPE_36 == 1  &  TERMDATE_36 < DEGDAT4
replace time_36 = 10  if TERMTYPE_36 == 2  &  TERMDATE_36 < DEGDAT4
replace time_36 = 15  if TERMTYPE_36 == 3  &  TERMDATE_36 < DEGDAT4
replace time_36 = .   if TERMTYPE_36 == 4  &  TERMDATE_36 < DEGDAT4
replace time_36 = 0   if TERMTYPE_36 == 5  &  TERMDATE_36 < DEGDAT4
replace time_36 = .   if TERMTYPE_36 == 6  &  TERMDATE_36 < DEGDAT4
replace time_36 = 0   if TERMTYPE_36 == 7  &  TERMDATE_36 < DEGDAT4
replace time_36 = 15  if TERMTYPE_36 == 8  &  TERMDATE_36 < DEGDAT4
replace time_36 = 15  if TERMTYPE_36 == 9  &  TERMDATE_36 < DEGDAT4
```

```
gen enroll_ttd = 0
replace enroll_ttd_v2 = time_1 + time_2 + time_3 + time_4   + time_5 + time_6 +
time_7 + time_8 + time_9 + time_10 + time_11 + time_12 + time_13 + time_14 +
time_15 + time_16 + time_17 + time_18 + time_19 + time_20 + time_21 +
time_22 + time_23 + time_24 + time_25 + time_26 + time_27 + time_28 +
time_29 + time_30 + time_31 + time_32 + time_33 + time_34 + time_35 +
time_36
```

## APPENDIX C: TOTAL NUMBER OF ACCELERATING CREDITS AND DEGREE COMPLETION

| Accelerated credits | Not-Graduate | Graduate | Total |
|---|---|---|---|
| 0.0 | 1,936 | 2,846 | 4,782 |
| 1.0 | 5 | 18 | 23 |
| 2.0 | 9 | 18 | 27 |
| 3.0 | 57 | 200 | 257 |
| 4.0 | 15 | 100 | 115 |
| 5.0 | 11 | 37 | 48 |
| 6.0 | 46 | 161 | 207 |
| 7.0 | 4 | 29 | 33 |
| 8.0 | 18 | 88 | 106 |
| 9.0 | 19 | 42 | 61 |
| 10.0 | 4 | 31 | 35 |
| 11.0 | 3 | 25 | 28 |
| 12.0 | 5 | 71 | 76 |
| 13.0 | 5 | 20 | 25 |
| 14.0 | 1 | 18 | 19 |
| 15.0 | 3 | 15 | 18 |
| 16.0 | 6 | 43 | 49 |
| 17.0 | 0 | 8 | 8 |
| 18.0 | 4 | 21 | 25 |
| 19.0 | 4 | 8 | 12 |
| 20.0 | 2 | 16 | 18 |
| 21.0 | 0 | 6 | 6 |
| 22.0 | 0 | 8 | 8 |
| 24.0 | 3 | 26 | 29 |
| 25.0 | 2 | 9 | 11 |
| 26.0 | 1 | 7 | 8 |
| 27.0 | 0 | 6 | 6 |
| 28.0 | 1 | 15 | 16 |
| 30.0 | 1 | 7 | 8 |
| 32.0 | 1 | 8 | 9 |
| 33.0 | 0 | 5 | 5 |
| 35.0 | 0 | 6 | 6 |
| 36.0 | 0 | 4 | 4 |
| 37.0 | 1 | 5 | 6 |
| 40.0 | 0 | 4 | 4 |
| 44.0 | 0 | 2 | 2 |
| 60.0 | 0 | 1 | 1 |
| Total | 2,208 | 4,052 | 6,260 |

** Not all values in ACCELCRD are included in this table.

APPENDIX D: NUMBER OF STUDENTS IN EACH STEP OF SELECTING SUBJECTS WITH COMPLETE INFORMATION

| | Number of Students | Remaining Students for the Analysis |
|---|---|---|
| Number of students for whom transcripts were requested | 9,602 | 9,602 |
| Number of students whose transcript(s) was received | 8,889 | 8,889 |
| Number of students who had 4-year college experience | 6,430 | 6,430 |
| Number of students with incomplete transcript record (excluded) | 170 | 6,260 |
| Number of students with missing TTD (excluded) | 108 | 6,152 |

## APPENDIX E: ZERO-ORDER CORRELATION AMONG TTD AND INDEPENDENT VARIABLES

| | TTD | Anticipate | HS-Test | HS-Rank | SES | Male |
|---|---|---|---|---|---|---|
| TTD | 1.000 | | | | | |
| Anticipate | 0.132 | 1.000 | | | | |
| HS-Test | 0.140 | 0.286 | 1.000 | | | |
| HS-Rank | -0.191 | -0.252 | -0.439 | 1.000 | | |
| SES | 0.189 | 0.209 | 0.278 | -0.064 | 1.000 | |
| Male | -0.052 | -0.054 | 0.010 | 0.178 | 0.081 | 1.000 |
| Asian | 0.065 | 0.077 | 0.073 | -0.079 | 0.027 | -0.010 |
| Hispan | -0.080 | -0.009 | -0.123 | 0.022 | -0.188 | 0.008 |
| Black | -0.088 | 0.000 | -0.212 | 0.089 | -0.140 | -0.036 |
| Ameri-In | -0.050 | 0.003 | -0.038 | 0.044 | 0.006 | -0.009 |
| Dependent | -0.152 | -0.040 | -0.095 | 0.031 | -0.123 | -0.094 |
| No-Delay | 0.136 | 0.142 | 0.103 | -0.130 | 0.106 | -0.062 |
| Fin-aid | -0.049 | 0.003 | 0.025 | -0.169 | -0.215 | -0.063 |
| HS-Curri | -0.197 | -0.277 | -0.432 | 0.411 | -0.205 | 0.014 |
| GPA-1st | 0.304 | 0.130 | 0.326 | -0.435 | 0.159 | -0.115 |
| W-PCT | -0.328 | -0.094 | -0.240 | 0.288 | -0.148 | 0.084 |
| Rem-Read | -0.078 | -0.092 | -0.322 | 0.181 | -0.150 | -0.014 |
| Rem-Math | -0.151 | -0.197 | -0.432 | 0.317 | -0.187 | -0.007 |
| Out-State | 0.016 | 0.135 | 0.168 | -0.035 | 0.221 | 0.043 |
| Inst-Selct | 0.079 | 0.245 | 0.312 | -0.263 | 0.240 | 0.032 |
| Multi-Sch | 0.030 | -0.040 | -0.121 | 0.115 | -0.025 | -0.028 |
| Classic-Trs | 0.091 | -0.172 | -0.183 | 0.144 | -0.105 | -0.001 |
| Accel-CRD | 0.074 | 0.165 | 0.222 | -0.212 | 0.149 | -0.018 |
| CRD-1st | 0.330 | 0.190 | 0.350 | -0.384 | 0.223 | -0.076 |
| Chng-Maj | -0.031 | 0.025 | -0.039 | 0.044 | -0.014 | 0.009 |
| Coop-Intern | 0.115 | 0.036 | 0.028 | -0.030 | 0.023 | -0.018 |

| | Asian | Hispan | Black | Ameri-In | Dependent | No-Delay |
|---|---|---|---|---|---|---|
| Asian | 1.000 | | | | | |
| Hispan | -0.099 | 1.000 | | | | |
| Black | -0.094 | -0.084 | 1.000 | | | |
| Ameri-In | -0.022 | -0.020 | -0.019 | 1.000 | | |
| Dependent | -0.033 | 0.062 | 0.043 | -0.015 | 1.000 | |
| No-Delay | -0.007 | -0.031 | -0.059 | 0.000 | -0.088 | 1.000 |
| Fin-aid | -0.016 | 0.050 | 0.123 | 0.014 | 0.046 | 0.017 |
| HS-Curri | -0.140 | 0.050 | 0.070 | 0.037 | 0.101 | -0.133 |
| GPA-1st | 0.062 | -0.067 | -0.112 | -0.061 | -0.091 | 0.029 |

| | | | | | | |
|---|---|---|---|---|---|---|
| W-PCT | -0.022 | 0.145 | 0.091 | 0.051 | 0.102 | -0.084 |
| Rem-Read | -0.016 | 0.081 | 0.138 | 0.015 | 0.068 | -0.011 |
| Rem-Math | -0.057 | 0.102 | 0.139 | 0.020 | 0.086 | -0.086 |
| Out-State | -0.009 | -0.069 | 0.002 | 0.043 | -0.040 | 0.005 |
| Inst-Selct | 0.184 | -0.049 | -0.037 | -0.010 | -0.088 | 0.074 |
| Multi-Sch | 0.031 | 0.047 | -0.033 | 0.001 | 0.020 | -0.051 |
| Classic-Trs | -0.021 | 0.047 | -0.053 | -0.015 | 0.044 | -0.085 |
| Accel-CRD | 0.170 | -0.014 | -0.071 | -0.014 | -0.030 | 0.052 |
| CRD-1st | 0.052 | -0.147 | -0.101 | -0.023 | -0.177 | 0.184 |
| Chng-Maj | -0.007 | 0.005 | 0.018 | -0.001 | -0.001 | -0.003 |
| Coop-Intern | -0.003 | -0.024 | -0.033 | 0.008 | -0.027 | 0.020 |

| | Fin-aid | HS-Curri | GPA-1st | W-PCT | Rem-Read | Rem-Math |
|---|---|---|---|---|---|---|
| Fin-aid | 1.000 | | | | | |
| HS-Curri | -0.025 | 1.000 | | | | |
| GPA-1st | 0.098 | -0.235 | 1.000 | | | |
| W-PCT | -0.030 | 0.210 | -0.369 | 1.000 | | |
| Rem-Read | 0.012 | 0.159 | -0.151 | 0.112 | 1.000 | |
| Rem-Math | -0.046 | 0.345 | -0.220 | 0.215 | 0.255 | 1.000 |
| Out-State | 0.010 | -0.104 | 0.088 | -0.113 | -0.047 | -0.072 |
| Inst-Selct | -0.036 | -0.284 | 0.122 | -0.175 | -0.112 | -0.197 |
| Multi-Sch | -0.070 | 0.113 | -0.118 | 0.163 | 0.044 | 0.131 |
| Classic-Trs | -0.130 | 0.209 | 0.030 | 0.068 | 0.064 | 0.176 |
| Accel-CRD | 0.039 | -0.187 | 0.229 | -0.121 | -0.074 | -0.120 |
| CRD-1st | 0.096 | -0.315 | 0.571 | -0.466 | -0.237 | -0.358 |
| Chng-Maj | 0.002 | 0.032 | -0.141 | 0.149 | 0.016 | 0.058 |
| Coop-Intern | 0.017 | -0.034 | 0.078 | -0.072 | -0.021 | -0.026 |

| | Out-State | Inst-Selct | Multi-Sch | Classic-Trs | Accel-CRD | CRD-1st |
|---|---|---|---|---|---|---|
| Out-State | 1.000 | | | | | |
| Inst-Selct | 0.200 | 1.000 | | | | |
| Multi-Sch | -0.052 | -0.131 | 1.000 | | | |
| Classic-Trs | -0.141 | -0.217 | 0.318 | 1.000 | | |
| Accel-CRD | 0.089 | 0.317 | -0.014 | -0.070 | 1.000 | |
| CRD-1st | 0.164 | 0.200 | -0.124 | -0.125 | 0.166 | 1.000 |
| Chng-Maj | -0.048 | -0.033 | 0.132 | -0.010 | -0.033 | -0.101 |
| Coop-Intern | 0.005 | -0.016 | 0.002 | -0.014 | 0.008 | 0.079 |

| | Chng-Maj | Coop-Intern |
|---|---|---|
| Chng_Maj | 1.000 | |
| Coop_Intern | -0.044 | 1.000 |

## APPENDIX F: ZERO-ORDER CORRELATION AMONG DEGREE COMPLETION AND INDEPENDENT VARIABLES

| | Completion | Anticipate | HS-Test | HS-Rank | SES | Male |
|---|---|---|---|---|---|---|
| Completion | 1.000 | | | | | |
| Anticipate | 0.203 | 1.000 | | | | |
| HS-Test | 0.269 | 0.285 | 1.000 | | | |
| HS-Rank | -0.303 | -0.253 | -0.442 | 1.000 | | |
| SES | 0.264 | 0.207 | 0.279 | -0.067 | 1.000 | |
| Male | -0.064 | -0.053 | 0.011 | 0.179 | 0.078 | 1.000 |
| Asian | 0.074 | 0.076 | 0.075 | -0.081 | 0.026 | -0.011 |
| Hispan | -0.125 | -0.009 | -0.126 | 0.022 | -0.187 | 0.007 |
| Black | -0.104 | 0.000 | -0.214 | 0.088 | -0.139 | -0.036 |
| Ameri-In | -0.052 | 0.003 | -0.038 | 0.044 | 0.006 | -0.009 |
| Dependent | -0.186 | -0.041 | -0.095 | 0.031 | -0.123 | -0.093 |
| No-Delay | 0.170 | 0.141 | 0.102 | -0.129 | 0.106 | -0.061 |
| Fin-aid | -0.007 | 0.000 | 0.025 | -0.169 | -0.212 | -0.062 |
| HS-Curri | -0.299 | -0.277 | -0.430 | 0.411 | -0.205 | 0.015 |
| GPA-1st | 0.437 | 0.128 | 0.326 | -0.434 | 0.161 | -0.117 |
| W-PCT | -0.470 | -0.093 | -0.240 | 0.286 | -0.149 | 0.084 |
| Rem-Read | -0.144 | -0.091 | -0.322 | 0.182 | -0.151 | -0.014 |
| Rem-Math | -0.244 | -0.196 | -0.432 | 0.318 | -0.183 | -0.008 |
| Out-State | 0.097 | 0.134 | 0.168 | -0.035 | 0.220 | 0.041 |
| Inst-Selct | 0.207 | 0.245 | 0.313 | -0.265 | 0.237 | 0.033 |
| Multi-Sch | -0.136 | -0.040 | -0.126 | 0.119 | -0.026 | -0.028 |
| Classic-Trs | -0.022 | -0.171 | -0.184 | 0.145 | -0.105 | -0.003 |
| Accel-CRD | 0.154 | 0.164 | 0.218 | -0.211 | 0.147 | -0.021 |
| CRD-1st | 0.473 | 0.188 | 0.347 | -0.382 | 0.222 | -0.074 |
| Chng-Maj | -0.120 | 0.024 | -0.038 | 0.044 | -0.015 | 0.009 |
| Coop-Intern | 0.118 | 0.034 | 0.028 | -0.027 | 0.020 | -0.018 |

| | Asian | Hispan | Black | Ameri-In | Dependent | No-Delay |
|---|---|---|---|---|---|---|
| Asian | 1.000 | | | | | |
| Hispan | -0.099 | 1.000 | | | | |
| Black | -0.094 | -0.083 | 1.000 | | | |
| Ameri-In | -0.022 | -0.019 | -0.018 | 1.000 | | |
| Dependent | -0.033 | 0.061 | 0.043 | -0.015 | 1.000 | |
| No-Delay | -0.007 | -0.032 | -0.060 | -0.001 | -0.088 | 1.000 |
| Fin-aid | -0.014 | 0.051 | 0.121 | 0.014 | 0.045 | 0.017 |
| HS-Curri | -0.141 | 0.050 | 0.069 | 0.037 | 0.100 | -0.132 |
| GPA-1st | 0.062 | -0.068 | -0.113 | -0.061 | -0.089 | 0.030 |

| | | | | | | |
|---|---|---|---|---|---|---|
| W-PCT | -0.022 | 0.147 | 0.092 | 0.051 | 0.102 | -0.085 |
| Rem-Read | -0.016 | 0.084 | 0.137 | 0.015 | 0.067 | -0.012 |
| Rem-Math | -0.059 | 0.102 | 0.139 | 0.020 | 0.084 | -0.085 |
| Out-State | -0.009 | -0.069 | 0.001 | 0.043 | -0.038 | 0.004 |
| Inst-Selct | 0.185 | -0.050 | -0.036 | -0.011 | -0.088 | 0.074 |
| Multi-Sch | 0.032 | 0.049 | -0.031 | 0.001 | 0.020 | -0.051 |
| Classic-Trs | -0.021 | 0.048 | -0.054 | -0.015 | 0.045 | -0.084 |
| Accel-CRD | 0.170 | -0.014 | -0.070 | -0.014 | -0.029 | 0.052 |
| CRD-1st | 0.055 | -0.147 | -0.099 | -0.023 | -0.177 | 0.184 |
| Chng-Maj | -0.005 | 0.004 | 0.019 | -0.001 | 0.000 | -0.003 |
| Coop-Intern | -0.004 | -0.025 | -0.033 | 0.008 | -0.026 | 0.020 |

| | Fin-aid | HS-Curri | GPA-1st | W-PCT | Rem-Read | Rem-Math |
|---|---|---|---|---|---|---|
| Fin-aid | 1.000 | | | | | |
| HS-Curri | -0.026 | 1.000 | | | | |
| GPA-1st | 0.100 | -0.234 | 1.000 | | | |
| W-PCT | -0.030 | 0.210 | -0.369 | 1.000 | | |
| Rem-Read | 0.011 | 0.160 | -0.151 | 0.115 | 1.000 | |
| Rem-Math | -0.046 | 0.343 | -0.219 | 0.212 | 0.254 | 1.000 |
| Out-State | 0.010 | -0.104 | 0.089 | -0.113 | -0.047 | -0.073 |
| Inst-Selct | -0.036 | -0.283 | 0.120 | -0.174 | -0.112 | -0.198 |
| Multi-Sch | -0.071 | 0.115 | -0.121 | 0.162 | 0.043 | 0.133 |
| Classic-Trs | -0.130 | 0.209 | 0.029 | 0.066 | 0.062 | 0.182 |
| Accel-CRD | 0.039 | -0.183 | 0.225 | -0.120 | -0.074 | -0.118 |
| CRD-1st | 0.099 | -0.313 | 0.569 | -0.466 | -0.236 | -0.353 |
| Chng-Maj | 0.005 | 0.032 | -0.141 | 0.148 | 0.015 | 0.057 |
| Coop-Intern | 0.015 | -0.033 | 0.076 | -0.071 | -0.019 | -0.027 |

| | Out-State | Inst-Selct | Mlti-Sch | Clasic-Trs | Accel-CRD | CRD-1st |
|---|---|---|---|---|---|---|
| Out-State | 1.000 | | | | | |
| Inst-Selct | 0.198 | 1.000 | | | | |
| Multi-Sch | -0.054 | -0.132 | 1.000 | | | |
| Classic-Trs | -0.141 | -0.218 | 0.319 | 1.000 | | |
| Accel-CRD | 0.088 | 0.312 | -0.010 | -0.062 | 1.000 | |
| CRD-1st | 0.164 | 0.201 | -0.126 | -0.124 | 0.165 | 1.000 |
| Chng-Maj | -0.050 | -0.032 | 0.131 | -0.012 | -0.032 | -0.102 |
| Coop-Intern | 0.003 | -0.017 | 0.001 | -0.014 | 0.007 | 0.076 |

| | Chng-Maj | Coop-Intern |
|---|---|---|
| Chng_Maj | 1.000 | |
| Coop_Intern | -0.043 | 1.000 |