Educational Leadership Faculty Publications   Department of Educational Leadership

Winter 2015

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eCommons Citation

Institutional Merit-Based Aid and Student Departure: A Longitudinal Analysis

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A good deal of research attention has been paid to the effects of financial aid on postsecondary student enrollment behaviors including access, postsecondary destinations, measures of student success such as GPA or credits earned, and student persistence and graduation. However, the past decade has also seen a growing interest in the effects of financial aid on student persistence and graduation as evidenced by the College Completion Agenda (College Board, 2011; Ochoa, 2011).

State and federal policymakers are demonstrating a growing interest in student persistence and are advocating its use along with graduation rates as indicators of institutional quality. In recent years, as the accountability movement in postsecondary education has gained momentum, measures of student success such as retention and graduation rates have increased in

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importance. For example, the Higher Education Opportunity Act of 2008 requires institutions to report graduation rates. Both the Spellings Commission and statements from the Obama Administration have identified persistence and graduation rates as indices for assessing institutional quality (Gold & Albert, 2006; SHEEO, 2005). Indeed, several states—including Arkansas, Florida, Illinois, Indiana, Kansas, Louisiana, New Mexico, and Ohio—have enacted state funding formulas that use student persistence or graduation rates to help determine levels of state funding.

In this context, this study explores the relationship between institutional merit-based aid and whether a student departs from the statewide system of higher education. The central research question is: "To what extent does institutional merit-based aid affect student departure?" We begin by contextualizing the contemporary policy debate about the use of merit criteria in awarding aid. Then we review empirical findings on the relationship between merit aid and persistence.

THE DEBATE OVER MERIT AID

In its simplest form, this debate focuses on the trade-offs between need-based and non-need-based aid. The use of need-based criteria in awarding aid has been a hallmark of federal aid policies since the first passage of the Higher Education Act in 1965. However, in more recent times, the use of merit criteria in awarding aid has grown considerably and, some argue, is supplanting need as the central factor in awarding aid. For example, between 1992–1993 and 2003–2004, the awarding of need-based institutional aid declined at public four-year colleges from 37% to 35% (College Board, 2006).

At the heart of the debate lies the question of the equity of awarding aid based on merit rather than need. State and institutional merit aid alike tends to flow to higher-income students and may negatively affect access and attainment for low-income and students of color (Heller, 2006, 2008; Heller & Marin, 2002). Focusing such concerns are the relatively recent advent of state merit scholarship programs such as Georgia's Helping Outstanding Pupils Educationally (HOPE) scholarship program and others similar to it that award aid to large numbers of students who meet relatively broad criteria. The allocation of aid based on criteria other than need has become particularly troubling because of some evidence (Dynarski, 2002; Heller & Marin, 2002) that these programs disproportionately benefit student groups with historically high rates of college attendance (i.e., White and higher-income students).

Although the supplanting of need-based aid by merit aid may be the most visible feature of the debate, other issues include the use of non-need-based aid to promote racial diversity as well as efficiency in the use of limited fiscal

resources. Brown (2007) notes that awarding merit aid on the basis of race/ ethnicity has been an especially visible component of the debate since the *Hopwood v. State of Texas* case in 1996.

Awarding aid on the basis of merit is certainly not a new phenomenon in postsecondary education, nor has the practice been confined to that sphere. Civic organizations, local governments, churches, states, and even private individuals have had policies whereby meritorious achievement is defined and rewarded (Allan, 1988; Dynarski, 2002). The National Defense Act of 1958 awarded aid based on the interests of the national defense and encouraged high academic achievers to attend postsecondary institutions (Baum & Schwartz, 1988).

As the primary locus of support for postsecondary institutions, states have long been in the business of awarding merit aid. Dynarski (2002) argues that states, in one sense, award merit aid to students by subsidizing the tuition of in-state residents. According to this logic, institutions define and award merit on the basis of admission; and once admitted, students are granted equal opportunity to pursue an education.

Contemporary uses of merit criteria constitute a distinct societal shift toward the concept of meritocracy. Studies of the effects of merit aid, in addition to having a pragmatic rationale, also have the potential of shedding light on the meritocratic approach and its consequences. Michael F. Young coined the term "meritocracy" in 1958 in his fictional dissertation about the future, *The Rise of the Meritocracy*, which predicts a grim scenario for a society stratified by ability. The history and reception of the concept of meritocracy has been marked in the United States by its positive and rarely examined interpretation as a new expression of democratic ideals. Yet the concept has critics, many of whom have focused on the impossibility of achieving a true and fair meritocracy (Persell, 1977). Their argument finds support in research on the effects of unconscious aversive racism on employment and educational decisions (Dovidio, 2001; Dovidio & Gaertner, 2000). Further, some critics note that the pervasive assumption that meritocracy is a goal of democratic education in itself distracts us from challenging the inequities built into the goal (Gutmann, 1987; Howe, 1997; Persell, 1977).

On the other hand, as Persell (1977) has noted, efforts to implement meritocracy more completely—rather than to replace it as a central goal—have had the positive effect of fostering political mobilization and protest. The many dimensions of this history show the broad reach and complexity of the concept of meritocracy—its uses for the legitimation of social inequality as well as its mobilizing potential for civil rights.

PRIOR STUDIES OF INSTITUTIONAL MERIT AID

As Hossler, Ziskin, Gross, Kim, and Cekic (2009) note, a challenge in drawing conclusions about the effects of merit-aid on persistence is the difficulty in disentangling need and merit criteria in awarding institutional aid. Moreover, given the proliferation over the past 20 years of state merit-aid programs with relatively broad eligibility criteria (Doyle, 2006), much of the recent merit-aid research (e.g., Domina, 2014; Hu, Trengrove, & Zhang, 2012; Zhang & Ness, 2010) has focused on state-level programs, while relatively fewer studies (e.g., Baum & Schwartz, 1998; DesJardins, Ahlburg, & McCall, 2002; Singell, 2004) have focused on the relationship between institutional merit aid and persistence.

Most studies that have examined the impact of merit aid on persistence have found positive effects (Battaglini, 2004; DesJardins, Ahlburg, & McCall, 2002; Singell, 2004; Singell & Stater, 2006; Somers, 1995a, 1995b; Turner & Wiedmann, 2001). Nevertheless the findings are complex and not entirely consistent. For example, Avery and Hoxby (2004), report that named scholarships have an impact over and above the actual dollar value of a merit scholarship. Hossler (1984) has called this outcome the "courtship effect" of campus-based aid.

Somers (1995a) reported intriguing findings associated with institutional merit aid. She found that receiving merit aid at an urban commuter institution was negatively associated with persistence. Even though her findings were limited in generalizability, Somers speculated that the negative relationship may be the result of offering merit aid to top students who ultimately elect to transfer because there are insufficient numbers of similar "high-ability" students enrolled at this urban institution. Somers concludes that the use of merit aid by individual institutions can attract top students (as measured by standardized exams) but may not keep them.

The effects of merit aid (state or institutional) on persistence may be limited to initial enrollment and the first few years of college. Singell and Stater's (2006) work indicates that the most important contribution to improving persistence may be to attract students who are more likely to persist. Other researchers (DesJardins, Ahlburg, & McCall, 2002; Herzog, 2005) found that the initially positive effects of aid on persistence tend to diminish and even disappear within two years of initial enrollment. In sum, the majority of studies find a positive relationship between merit aid and persistence but also suggest that this positive relationship may be short-lived.

Until recently, one of the weaknesses of many of the studies on the relationship between student financial aid, enrollment, and persistence has been the failure of researchers to address problems of endogeneity (Hossler et al., 2009). Since students can reject or accept financial aid, they have discretion regarding which types of aid or what amounts and which institutions they

will seek and accept. Do students who receive merit aid persist at higher rates because they have attributes that make them more likely to persist or do they persist because of the unique effects of merit aid? Herzog (2005) and DesJardins, Ahlburg, and McCall (2002) have used techniques to control for self-selection to examine the impact of state-based merit aid programs. Singell and Stater (2006) have used advanced analytic techniques to study the effects of institutional merit aid on student persistence. They conclude that campus-based merit aid does not exert unique effects on the odds of recipients persisting. Higher persistence rates, they conclude, are the result of attracting students with personal attributes that make them more likely to persist.

Except for the notable study by Singell and Stater (2006), this dearth of research is surprising because the incentives are strong for institutional and public policymakers to better understand the effects of institutional aid on student persistence. The amount of institutional aid alone—more than $34 billion nationwide in 2012–2013 (College Board, 2013)—might predictably prompt broader interest in developing a better understanding of the effects of institutional aid on persistence and student success.

In this article, we employ a statewide student unit record (SUR) database to investigate the relationship between institutional merit-based aid and student persistence. Our purpose is to add to the work of Singell and Stater (2006) by examining the effects of merit-based aid at two large public universities. While we lack the ability to specify merit- and need-based aid with the precision of Singell and Stater, because both institutions are in the same state, it is easier for us to control for state context in terms of high school preparation, aid policies, and more. We draw our persistence measures from records of student enrollment in consecutive academic years, and our models rely on prior conceptual and empirical work in academic success and student persistence. We turn next to the conceptual framework that guided our empirical modeling.

Conceptual Framework

We guide our empirical analysis with the conceptual framework of the student adjustment model (SAM) (Cabrera, Castañeda, Nora, & Hengstler, 1992; Cabrera, Stampen, & Hansen, 1990). This model hypothesizes that students' experiences at postsecondary institutions occur in social and academic domains. The social domain is comprised of interactions with students, staff, and faculty that are informal in nature. Academic interactions are similar to those in the social domain but are characterized by a greater degree of formality, such as structured co-curricular activities led by student affairs staff or academic courses taught by faculty. Experiences in both domains propel

the affective and intellectual development of the student, in turn affecting the commitment to earning a degree.

We treat student experiences in the social and academic domains as mutually reinforcing. Student background characteristics (e.g., gender, race/ethnicity); precollege ability; external factors (such as ability to pay or parental encouragement); academic and intellectual development; and academic and social integration are all components of the student adjustment model (Nora & Cabrera, 1996). In considering integration along with external factors, the student adjustment model synthesizes key concepts from student integration (Tinto, 1975) and student attrition models (Bean, 1980, 1982, 1985; Bean & Metzner, 1985).

A particularly relevant component of SAM for the purposes of this study is the role of finances—in this case, financial aid. Financial aid may equalize educational opportunity and enable students' academic and social integration into an institution (Cabrera, Nora, Castañeda, 1992). Adequate financing may affect students' overall satisfaction and goal commitment, while also allowing them to devote more time and energy to their academic and social pursuits in college.

Finally, an addition to our operationalization of the student adjustment model is the inclusion of the temporal dimension. As Chen and DesJardins (2007) note, researchers are incorporating time and time-varying variables in studies of attainment (e.g., Bahr, 2012; Calcagno, Crosta, Bailey, & Jenkins, 2007; Chen & DesJardins, 2007; DesJardins, Ahlburg, & McCall, 1994, 2002; DesJardins, Kim, & Rzonca, 2003; DesJardins, McCall, Ahlburg, & Moye, 2002; Doyle, 2006; Ishitani, 2003; Ishitani & DesJardins, 2002; Ishitani & Snider, 2004; McLendon, Heller, & Young, 2005; Singer & Willett, 1993; Willett & Singer, 1991, 1995). Event history analysis (EHA) is the longitudinal analysis of individuals' or organizations' experiences of events of interest over time (Allison, 1984). EHA incorporates time in estimating coefficients and the overall fit of the model, while allowing for variation from time-period to time-period in explanatory variables. For a detailed discussion of the use of event history techniques in studying educational attainment. see DesJardins (2003).

METHODS

Data

Data for this study came from the Indiana Commission for Higher Education's (ICHE) statewide longitudinal data system (SLDS). These data are derived from the student information systems (SIS) of all public universities, colleges, and community colleges in Indiana. SIS data, which are usually collected for enrollment-related transactions, include information on standard-

ized testing, family income, and any financial aid from institutional, state, and federal sources. SIS data represent the universe of students enrolled in Indiana's public postsecondary institutions. Institutional price data used to calculate cost of attendance came from the National Center for Education Statistics Integrated Postsecondary Education Data System (IPEDS).

Sample

First-time, first-year baccalaureate degree-seeking students who began at Indiana's two public doctorate-granting institutions in 2001 constitute the population of interest. First-time entrants are defined as students who have not previously attended any college. Students who attended summer courses just prior to fall enrollment or who may have advanced standing, for example through Advanced Placement credit, are defined as first-time entrants. First-year (or freshman) students are those enrolled in baccalaureate degree programs that have completed less than 25% of their degree program. To arrive at our effective sample, we began by identifying students using these criteria (i.e., first-time, first-year).

Next, we limited our sample to only those students who met the selection criteria in 2001 for an effective sample of 12,301 students. Using coarsened exact matching as described below, we derived a matched sample consisting of 4,254 students. We followed these students for five years through the end of the 2006–2007 academic year.

OPERATIONALIZING THE STUDENT ADJUSTMENT MODEL

Our empirical models include blocks of variables pertaining to the constructs in the Student Adjustment Model: precollege ability (or academic preparation); student background characteristics; collegiate academic domain; collegiate social domain; and finances. We next describe each block. Table 1 provides more details about the coding of the variables.

Academic preparation is operationalized using the combined (i.e., math and verbal) Scholastic Aptitude Test (SAT) score, students' high school rank, and a high school-level variable indicating the percent of students who received free and reduced federal lunch. Gender, race/ethnicity, age, and adjusted gross income serve as measures of student background. The academic domain includes formal aspects of enrollment. Our models incorporate credits attempted, whether a student had a declared major, the number of developmental credits taken, the cumulative number of credits earned, and the cumulative college GPA, consistent with prior work (e.g., Nora & Cabrera, 1996).

We operationalized the social domain primarily through measures of structural diversity, specifically the proportion of students of color enrolled and where a student lived (e.g., on- or off-campus). The representation of

TABLE 1

VARIABLES IN THE DEPARTURE MODEL

Variable	Definition
Dependent Variable	
State system departure	Student was not reported as enrolled or attempting to earn credits by any postsecondary public institution for an academic year.
Academic preparation	
Combined SAT score	Sum of verbal and mathematics score for the Scholastic Achievement Test, if taken.
High school rank	Rank based on the student's high school grade point average relative to the rest of his or her graduating classmates.
Percent free lunch at high school	The number of students reported by the Indiana Department of Education as receiving free or reduced federal lunch as a proportion of total high school enrollment.
Student background	
Gender	Gender reported by institution (1=male, 0=female).
White	Any person having origins in any of the original peoples of Europe, the Middle East, or North Africa as white (1=yes, 0=no). Whites serve as the reference category.
Latino	Any person of Cuban, Mexican, Puerto Rican, Cuban, South or Central American, or other Spanish culture or origin, regardless of race (1=yes, 0=no).
African American/Black	Any person having origins in any of the Black racial groups of Africa as African American or Black (1=yes, 0=no).
Indigenous	Any person having origins in any of the original people of North, South, or Central America (1=yes, 0=no).
Asian American, Indigenous	Any person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian sub
Hawaiian, or Pacific Islander	continent including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, Vietnam, Hawaii, Guam, Samoa, or other Pacific Islands (1=yes, 0=no).
Race/ethnicity missing	Any student for whom race or ethnicity is missing or not reported (1=yes, 0=no).
Age*	Calculated as the number of years between date of birth and September of the academic year.
Adjusted gross income*	The combined taxable (AGI) and non-taxable income received by the student or parents, consistent with student Congressional methodology definitions.
Academic Domain*	
Credits attempted	Sum of semester credit hours attempted in fall and spring as reported by the institution.
Major status	Whether a student had a declared academic major (1=yes, 0=no).

Variable	Definition
Developmental credits	Sum of developmental math and language credits as reported by the institution.
Cumulative credits	Cumulative sum of credits earned as reported by the institution.
Cumulative GPA	The student's cumulative grade point average (GPA) from enrollment to last term attended based on a four-point grading scale. Entered as a scale variable.
*Social Domain**	
On-campus housing	Indicates whether a student lived on-campus while enrolled (1=yes, 0=no). On-campus is the reference group.
Off-campus housing	Indicates whether a student lived off-campus while enrolled (1=yes, 0=no).
Lived with parents or elsewhere	Indicates whether a student lived with parents or elsewhere (e.g., in own apartment or house while enrolled (1=yes, 0=no).
Students of color	Number of Asian American, Native American, African American/Black, and Hispanic full-time equivalent undergraduate students enrolled as a proportion of total full-time equivalent undergraduate students enrolled.
*Finances**	
Received aid	Indicates whether a student received any form of financial aid, institutional, state, federal, or private (1=yes, 0=no).
Received need-based aid	Indicates whether a student received any form of need-based aid, including Pell Grant, Supplemental Equal Opportunity Grant, federally subsidized loan, state or federal work-study, and Perkins loan (1=yes, 0=no).
Cumulative loans	Annual cumulative sum of Perkins, Stafford, parent loan for undergraduate students, unsubsidized Stafford, supplemental loan to student, and other loans (e.g., health professions loans, nursing loans) received during the fiscal year, in $1,000s.
Applied for aid	Indicates whether a student filed a Free Application for Federal Student Aid (1=yes, 0=no).
Net price	Cost-of-attendance less sum of all financial aid, excepting institutional aid. Cost-of-attendance is calculated based on students' residency status, i.e., resident or nonresident of the state, and whether the student lived on- or off-campus, including with family if a dependent. Total college costs included tuition, room, board, fees, books, supplies, and other expenses as reported by the institutions to IPEDS, in $1,000s.
Ratio of loans to total aid	Calculated as the ratio of loans (as defined above) to total aid in each academic year, in $1,000s.
Institutional grant aid	Sum of institutional aid received by the student in any form (grants, fee remissions, etc.) at any time during the fiscal year, including athletic grants, in $1,000s. Student did not meet criteria for merit aid.
Institutional merit aid	Sum of institutional aid received by the student in any form (grants, fee remissions, etc.) at any time during the fiscal year, including athletic grants, in $1,000s. Student did meet criteria for merit aid.

*A time-varying variable. Time-varying variables have values that can vary with each observation period.

diverse students at an institution constitutes structural diversity and may play a role in creating a welcoming climate for students of color (Hurtado, 2002). In addition, we include an indicator of living on- or off-campus.

Finally, consistent with prior research (Chen & DesJardins, 2010; St. John, Paulsen, & Carter, 2005) this study differentiates financial aid by type (e.g., federal grants, loans) and the amount of aid received. We include dichotomous indicators of whether a student applied for aid, received aid, or received need-based aid. In addition, we include net price and the ratio of loans to total aid. Our focal independent variable is institutional merit-based aid. We used institutional price data along with aid data for each student to calculate the net price as detailed in Table 1. Next, we describe how we determined whether institutional aid was merit- or need-based.

ICHE instructs institutions to report aid from institutional sources as *gift*. Such gift aid includes:

> student aid in any form (grants, fee remissions, etc.) received by the student at any time during the fiscal year, including athletic grants: institutional need-based aid; institutional non-need-based [aid]; fee remissions provided as employee benefits to employees, spouses, and children of employees; [and] state entitlement programs, including CDV [Children of Disabled Veterans], [and] police [Public Safety Officer Supplement Grant, including spouses and children of deceased officers]. (ICHE, 2000, p. 21)

The preceding definition does not include aid awards funded through institutional foundations and endowments or Title IV funds, such as federal work-study, Supplemental Educational Opportunity Grants (SEOG), or Pell Grants.

Unfortunately for our study, the two institutions we studied made no distinction between scholarships awarded based on need versus those awarded on merit. To determine whether students were merit-eligible in their first year of enrollment we contacted the admissions and financial aid offices at each institution. We gathered data about selection criteria for all scholarships—departmental, college, and institution—awarded in 2001. The two institutions offered nearly a dozen different merit scholarships. Criteria included high school rank, SAT score, intended major, and whether a student came from an underrepresented group (e.g., low-income, African American/ Black). We considered students who received institutional aid but did not meet the merit eligibility criteria as need-based aid recipients. Students who met merit eligibility criteria and received institutional aid were considered merit-based aid recipients.

EMPIRICAL MODEL

We used a discrete-time event history model to estimate time to departure, using academic years as a unit of time measurement. As defined in Table 1,

a student was classified as having departed after not enrolling for credit in any public postsecondary institution in Indiana during an entire academic year. As stated by Allison (1984) and Singer and Willett (2003), in instances where time is measured in discrete units and when a large number of ties are possible (i.e., events happening at the same point in time), it is appropriate to employ discrete-time methods. Equation 1 denotes the general form of the model where $h(t_j)$ represents the hazard rate of departing at a discrete point in time, D represents the baseline hazard intercept parameter in Years 1–6, and β_1 through β_5 represent the slope coefficients for the blocks of variables corresponding to each of the five constructs in the model (i.e., academic preparation, student background, academic domain, social domain, and finances.

Equation 1. General Form of Discrete-Time Survival Model
$$\text{logit } h(tj)=[\alpha_1 D_1+ \alpha_2 D_2+\dots+ \alpha_6 D_6] + [\,\beta_1 x_1+ \beta_2 x_2+ \beta_3 x_3+ \beta_4 x_4+ \beta_5 x_5]$$

Based on our conceptual framework, merit-based aid should reduce the likelihood of departure by enabling students to engage more completely in the academic and social domains of their institution. We next address our modeling approaches, paying particular attention to the issue of sample selection bias.

Modeling Approaches

Considerable attention has been paid to the need for evidence-based research in education and education policy making (Schneider, Carnoy, Kilpatrick, Schmidt, & Shavelson, 2007). As Schneider et al. (2007) note, "This concern is fundamentally about having better evidence for making decisions about what programs and practices do or do not work" (p. 1). Financial aid researchers have wrestled with this question as well (DesJardins, Ahlburg, & McCall, 1999; Dowd, 2006; Titus, 2007). As Cellini (2008) observes, endogeneity—caused by reverse causality or self-selection bias within models—impacts our ability to make inferences about the effects of a cause.

Selection bias can be particularly problematic in the study of merit aid because students may self-select at key points along their educational trajectory. For example, prior to entering college, institutional offers of aid may affect which institution a student attends, initial commitment to that institution, and subsequent decisions to re-enroll (Singell, 2004). Moreover, some scholarships are awarded only to students whose propensity to apply for aid may result from underlying (and unmeasured) characteristics. For example, applying for aid may be related to factors such as motivation, parental encouragement, and access to information about college, all of which can affect whether a student stays in or departs from higher education. For

a more detailed discussion on selection bias and financial aid research, see Alon (2005), Deming and Dynarski (2009), Dowd (2006), or Titus (2007). Concerns about selection-bias inform our modeling approaches, as described next.

We conceptualize merit-based institutional aid as the intervention (or cause) in this study. We seek to determine its relationship to educational attainment, specifically students' timing of departure. In making inferences about the relationship between merit-based aid and departure, we include in our models observed differences in students (e.g., academic preparation, student background, engagement with the social domain) as guided by our conceptual model. However, given the observational nature of the data, we are limited in our ability to control for self-selection and unobserved heterogeneity. Characteristics such as motivation remain unobserved, yet are likely related to both our variable of interest (merit-based aid) and also to the likelihood of departure. This entanglement may result in attributing an observed effect (in this case, departure) to the wrong cause (in this case, receipt of merit-based aid) or to overestimating the magnitude of the effect. We attempt to address this problem in four ways.

First, we employ coarsened exact matching (CEM), a matching method within the category of quasi-experimental techniques, which—at a conceptual level—seeks to create two groups who are comparable with respect to observed characteristic, but which differ in their receipt of the intervention or treatment. Conceptually, CEM is similar to propensity score matching (PSM) in which estimates of an individual's propensity to receive treatment are derived for the purposes of matching treated individuals with those who received no treatment. Propensity score matching has been used (Doyle, 2009; Titus, 2007) as an alternative to other quasi-experimental techniques, such as regression discontinuity. In this study, we matched the students on a number of observed characteristics including: combined SAT score, high school rank, income, gender, race/ethnicity, and the proportion receiving federally subsidized lunch at the high school. The matching criteria include those used by both institutions in this study to award merit-based aid. Our inclusion of free and reduced lunch information in the matching model serves as a contextual indicator of the socioeconomic status of students in each high school (Heck, 2000). SES arguably has strong effects on students' learning and on their subsequent eligibility for and perceptions of merit-based aid (Ness & Tucker, 2008).

We then sorted students, matching them by strata. We retained strata with control and treated cases, discarding strata with control cases only (Iacus, King, & Porro, 2009a). We used the original values of the coarsened variables in our subsequent analysis of the phenomena of interest. (Additional details about the matching procedure are available upon request.)

We took three steps in addition to CEM to address the issue of endogeneity. Key variables were lagged to reduce the effects of reverse causality. For example, we used loan amounts from the first year to predict the likelihood of departure during the second year. This approach helped eliminate the question of whether enrollment led to taking out loans or whether taking out loans led to enrollment. Conceptually, using lagged variables also makes sense. What a student does and experiences one year affects what happens the following year.

Next, all models included a dichotomous indictor of whether a student had applied for aid. The inclusion of a dichotomous indicator of aid application served as a proxy variable to help control for omitted variables (Cellini, 2008). Finally, we estimated a shared frailty model (gamma distribution) to control for unobserved but shared factors in the sample population. Frailty models in event history analysis are similar to random effects models, which assume that unmeasured covariates introduce heterogeneity (Wienke, Arbeev, Locatelli, & Yashin, 2003). Frailty is the notion that individuals have varying (and frequently unobserved) susceptibility to "accidents" (Greenwood & Yule, 1920) that increase the hazard of such occurrences (Vaupel, Manton, & Stallard, 1979). In our study, frailty corresponds to the notion that certain students or groups of students are more or less prone to departure but that this proneness is not fixed and may vary over time. If this proneness is unobserved, the hazard of the sample may appear to decrease over time conditional on the observed variables. In fact, what is happening is the attrition of high-risk individuals early in the observation period due to unobserved characteristics. Just as omitted variables may bias estimates, so too can unmeasured heterogeneity bias hazard profiles.

Shared frailty implies a common proneness among clusters (e.g., campuses) (Andersen, Klein, & Zhang, 1999) or repeated observations of individuals (Gutierrez, 2002). We assert two possible forms of shared frailty in this study. First, we hypothesize that unobserved characteristics exist for students who were offered and accepted merit-based aid. Thus, we assume a shared frailty among merit-based aid recipients compared to nonrecipients to account for the multiple forms of self-selection likely at play. Second, consistent with the student adjustment model, we hypothesize that characteristics of the campus environment affect departure. We estimate a shared frailty by institution of origin (i.e., the institution at which the student first began) to account for contextual factors that likely affect degree attainment.

The event of interest in all models was departure, defined as not attempting to earn credit over the course of an academic year (fall to spring). We ran a total of four models. First, we ran a proportional hazards model on the full sample prior to matching to provide a baseline comparison for subsequent models run on matched samples. The remaining three models used the

matched sample. Models 3 and 4 incorporated shared frailties. All models were estimated using robust standard errors. Finally, given correlations among our regressors (e.g., SAT and high school rank), we were sensitive to the degree of multicollinearity in our models. As recommended by Gujarati (2002) we examined a number of indicators, including pairwise correlations (all below 0.40 in our case), condition index (below 30), and variance inflation factors (below 10). We concluded that the extent of multicollinearity was within an acceptable range. (Full details are available upon request.)

LIMITATIONS

A number of limitations warrant mention. First, as mentioned above, although our matching approach yielded some improvement in the comparability of the merit/nonmerit groups, substantial differences remained. Their presence suggests that our efforts to create comparable groups were only somewhat successful and only with respect to observed variables. Unobserved heterogeneity likely remains a concern, making it inappropriate to draw causal conclusions from this study. However, as noted by Cook and Shaddish (1994), it is possible that some effects may be observed often enough through on-going study that conclusions can be drawn about the causal nature of variables of interest. This study contributes to that body of evidence.

Second, although we employ the student adjustment model as our conceptual framework, the use of secondary data limits our ability to include what might be important measures of the social domain, such as campus climate, engagement, and social interactions. Hossler et al. (2009) note in their review of the literature on financial aid and persistence that few studies of this nature include rich measures of social integration. Ours is no different.

Third, because institutional aid data were not reported as merit- or need-based by institutions in Indiana until 2010, we rely on institutionally reported criteria to code aid data as merit- or need-based. This limitation has at least two implications for our study. The first is that we can estimate the effects of merit-based aid awarded in the first year of enrollment only, rather than including it as a time-varying variable year after year. It is possible that merit-based aid has a different effect in the second or third year of enrollment than it does in the first. This possibility warrants additional research with merit-based aid data once several years are available for these institutions. The second implication is that our definition of "merit-based" does not discern the extent to which financial need figured into the awarding of institutional aid. As Baum and Schwartz (1988) note, institutions may have two methods for awarding merit-based aid: one independent of considerations of financial need and another that rations institutional aid to needy students based on merit. We intentionally use "merit-based" to acknowledge

that merit may not have been the only criteria that the institutions in this study used in awarding institutional aid.

We acknowledge one final limitation of this study: We did not use a two-stage model that would attempt to control for the effects of merit-based aid on the enrollment decision. Singell (2004) employed this approach and concluded that the primary effect of merit aid was that it attracted students who were more likely to persist once enrolled. The scope of our study is more narrowly defined, looking only at the relationship between merit-based aid and departure. Therefore, we are likely not capturing other (e.g., enrollment decisions) important aspects of institutional merit-based aid.

Results

Descriptive Findings

An important context against which to read the results is that our data include the universe of students enrolled in Indiana public postsecondary institutions and are not derived from a probability sample. Our intent is not to make inferences to all students enrolled in Indiana institutions (e.g., private institutions). Therefore, we rely on simple frequency distributions in describing the sample. This approach is consistent with prior work using Indiana data (e.g., Hu & St. John, 2001; St. John, Hu, & Weber, 2001; St. John, Musoba, & Simmons, 2003).

Student characteristics were similar across both institutions with respect to academic preparation, college experiences, and receipt of financial aid. In the aggregate, the student population generally reflected the characteristics of Indiana's population. Most of the students were also from Indiana. Two differences between the two populations were that Hispanic or Latino/a students represented 2.0% of the sample but constituted about 3.5% of the state population in 2000. African American/Black students represented about 4% of the sample, yet constituted about 9% of the state population in 2000. As expected, given the selection criteria, about 94% of the sample was 21 or younger, 84% had declared a major during their first year, and 85% lived on campus. About 52% of the sample was male.

Overall, 52% of the students in the full sample met the criteria for receiving institutional merit-based aid. (See Table 2.) However, just 2,522 students (about 20%) received institutional aid. Students who met the merit criteria received institutional aid at a higher rate than students who were not merit-eligible (20% compared to 15%). Women were overrepresented among recipients as were Whites. African Americans/Blacks and Hispanic students were underrepresented among recipients. Although high-income (>= $79,000) students represented 32% of the overall sample, they represented nearly 55% of merit-based aid recipients, whereas the lowest income

TABLE 2

CHARACTERISTICS OF MERIT-BASED AID RECIPIENTS COMPARED TO NONRECIPIENTS

| | | Merit Aid Receipt | | | |
| | | No | | Yes | |
		Count	Column N %	Count	Column N %
Gender	Female	4,799	47.7%	1,164	51.7%
	Male	5,252	52.3%	1,086	48.3%
Race/rthnicity	Native American, Other	43	0.4%	6	0.3%
	Asian American, Pacific Islander	473	4.7%	108	4.8%
	African American	405	4.0%	102	4.5%
	Hispanic	208	2.1%	38	1.7%
	Race missing	233	2.3%	155	6.9%
	White	8,689	86.4%	1,841	81.8%
Adjusted gross income	Below $19,000	4,262	42.4%	161	7.2%
	$19,000 to $41,999	948	9.4%	296	13.2%
	$42,000 to $78,999	2,008	20.0%	569	25.3%
	$79,000 and more	2,833	28.2%	1,224	54.4%
Combined SAT score	Low SAT (<=910)	1,479	14.7%	79	3.5%
	Mid SAT (920-1020)	2,124	21.1%	176	7.8%
	High SAT (>=1030)	6,448	64.2%	1995	88.7%
High school rank	Lowest quartile	150	1.5%	4	0.2%
	Third quartile	1,140	11.3%	56	2.5%
	Second quartile	4,087	40.7%	619	27.5%
	Top quartile	4,674	46.5%	1,571	69.8%

(<$19,000) students constituted about 35% of the sample yet made up only 7% of merit-based aid recipients.

As expected, given the award criteria, students with the highest SAT scores and who were in the top quartile of their high school classes comprised the majority of merit-based aid recipients. This distribution of merit-based aid by income and race/ethnicity is consistent with prior work (e.g. Heller, 2008), which found that merit criteria tend to favor wealthier (and therefore often White) students.

INFERENTIAL FINDINGS

Merit-Based Aid

Bivariate comparison of the equality of survivor functions for merit-based aid recipients compared to nonrecipients in the full sample indicates a statistically significant difference between the two groups with respect to timing to departure (not shown). Without controlling for other variables hypothesized to affect departure, merit-based aid recipients were less likely to depart than nonrecipients. Even after we controlled for other factors thought to affect departure (e.g., academic preparation, social domains), merit-based aid recipients remained less likely to depart. (See Table 3.) A $1,000 increase in merit-based aid from the institution in Year 1 reduced the odds of departure by about 6.5%, controlling for all other factors. By comparison, a $1,000 increase in need-based aid from the institution reduced likelihood of departure by about 6%, all other factors held constant. However, when we assess the effects of merit-based aid using the matched sample only, it is no longer statistically significant. A $1,000 increase in merit-based aid had no significant relationship with departure. By comparison, need-based aid remained significant, with a $1,000 increase associated with about a 5% decrease in the odds of departure.

Models 3 and 4 used the matched samples. We included the assumption of a shared frailty (e.g., unobserved proneness to departure) among merit-based aid recipients (Model 3) and among initial institution of enrollment (Model 4). (See Table 4.) Eligibility for merit-based aid is likely to be associated with factors that influence educational attainment independently of any aid awarded and that may be unobserved (Deming & Dynarski, 2009). We suspect that a number of factors such as aspirations, motivation, and familial encouragement are shared among students who were eligible for merit-based aid, but these factors were unmeasured in our data. We found that in Model 3, which assumed a shared frailty among merit-based aid recipients, a $1,000 increase in aid had no significant relationship with departure. Need-based aid from the institution, however, was related to a 5.3% reduction in the odds of departure, controlling for all other factors.

TABLE 3
REGRESSION RESULTS, FULL AND MATCHED SAMPLES

Variable	Full Sample			Matched Sample		
	Coefficient	Standard Error	Significance	Coefficient	Standard Error	Significance
Men compared to women	-0.015	0.016		0.016	0.037	
Age	-0.009	0.002	***	-0.043	0.020	
Compared to Whites						
Hispanic	0.056	0.046		-0.005	0.177	
African American/Black	0.188	0.042	***	0.269	0.092	**
Asian, Asian American	0.095	0.030	**	0.067	0.074	
Native American, Other	0.049	0.093		0.212	0.239	
Race missing	0.441	0.037	***	0.770	0.096	***
High school rank	0.000	0.001		-0.001	0.002	
Combined SAT	0.000	0.000	*	0.000	0.000	
Income ($1,000s)	0.001	0.000		0.001	0.000	
Percent free/reduced lunch	-0.001	0.001		-0.002	0.002	
Compared to living on campus[a]						
Off campus	0.414	0.029	***	0.449	0.059	***
With parents/guardians	0.531	0.061	***	0.532	0.120	***
% students of color at PSI[a]	0.505	0.336		0.622	0.638	
Total credits attempted[a]	0.001	0.002		0.005	0.003	
Total developmental credits[a]	-0.007	0.012		-0.029	0.034	
College GPA[a]	-0.120	0.009	***	-0.113	0.021	***
Cumulative credits[a]	-0.027	0.001	***	-0.029	0.001	***
Declared major[a]	0.254	0.029	***	0.144	0.068	
Received aid[a]	0.179	0.032	***	0.047	0.075	
Received need-based aid[a]	0.191	0.028	***	0.222	0.064	*
Cumulative loans[a]	0.012	0.001	***	0.008	0.002	**
Applied for aid[a]	-0.100	0.029	**	-0.233	0.093	*
Net price[a]	0.028	0.002	***	0.026	0.004	***
Ratio of loans to total aid[a]	-0.745	0.044	***	-0.490	0.084	***
Institutional merit aid in YR1[a]	-0.063	0.020	**	0.019	0.020	
Institutional need aid[a]	-0.058	0.011	***	-0.050	0.020	*

Note: Italicized variables indicate time-varying; [a] indicates lagged variables
Significance: *** < 0.001; ** < 0.01; * < 0.05

TABLE 4
TIME-TO-DEPARTURE, SHARED FRAILTY MODELS

Variable	Merit Eligible Frailty			Campus Frailty		
	Coefficient	Standard Error	Significance	Coefficient	Standard Error	Significance
Men compared to women	0.002	0.041		0.043	0.055	
Age	-0.039	0.017		-0.039	0.043	
Compared to Whites						
Hispanic	0.011	0.203		0.017	0.203	
African American/Black	0.247	0.099	*	0.247	0.089	**
Asian, Asian American	0.058	0.093		0.075	0.084	
Native American, Other	0.217	0.271		-0.037	0.225	
Race missing	0.744	0.082	***	0.623	0.069	***
High school rank	-0.001	0.002		-0.005	0.002	*
Combined SAT	0.000	0.000		0.000	0.023	
Income ($1,000s)	0.001	0.001		0.001	0.048	
% free/reduced lunch	-0.003	0.002		-0.001	0.298	
Compared to living on campus[a]						
Off campus	0.451	0.058	***	0.429	0.052	***
With parents/guardians	0.529	0.133	**	0.534	0.122	***
% students of color at PSI[a]	0.931	0.730		-2.026	0.791	*
Total credits attempted[a]	0.005	0.003		0.003	0.003	
Total developmental credits[a]	-0.034	0.036		-0.029	0.041	
College GPA[a]	-0.118	0.022	***	-0.078	0.038	*
Cumulative credits[a]	-0.029	0.001	***	-0.022	0.022	
Declared major[a]	0.140	0.067		0.090	0.056	
Received aid[a]	-0.027	0.091	*	0.241	0.087	*
Received need-based aid[a]	0.240	0.072	**	0.204	0.066	*
Cumulative loans[a]	0.009	0.003		0.007	0.042	
Applied for aid[a]	-0.209	0.102		-0.421	0.088	**
Net price[a]	0.025	0.004	***	0.028	0.007	***

Table 4, cont.

Variable	Merit Eligible Frailty			Campus Frailty		
	Coefficient	Standard Error	Significance	Coefficient	Standard Error	Significance
Ratio of loans to total aid[a]	-0.461	0.099	***	-0.589	0.085	***
Institutional merit aid in YR1	0.007	0.022		0.076	0.014	***
Institutional grant aid[a]	-0.052	0.020	*	-0.015	0.012	
Theta	0.007			9.910		
Likelihood ratio test of $\Theta=0$						
Chibar2(01)	12.840			1584.610		
Prob ≥Chibar2	0.000			0.000		

Note: Italicized variables indicate time-varying; [a] indicates lagged variables
Significance: *** < 0.001; ** <0.01; * <0.05

By contrast, our findings for Model 4, which assumed a shared frailty by initial institution of enrollment, suggest that merit-based aid reduces the likelihood of departure. Specifically, a $1,000 increase in merit-based aid reduced the odds of departure by about 1.4%, holding all else constant. Some research suggests that campus climate, structural diversity, and student retention are interrelated in complex ways with diversity, improving persistence by providing students with opportunities to break down environments (Hernandez, 2000; Hurtado, 2002; Kuh & Love, 2000), develop cognitive maps for navigating institutions by forming connections with peers or faculty/staff (Attinasi, 1989; Torres, 2006), and affording students opportunities to find welcoming communities (Attinasi, 1989; Hernandez, 2000; Titus, 2006; Torres, 2006).

In summary, in response to our research question about the extent to which merit-based aid affects departure, we found that, once we began to account for self-selection to the extent possible, there was no significant relationship. By contrast, need-based aid was consistently related to decreased odds of departure. An important caveat, however, is that the relationship between merit-based aid and departure may be moderated by institutional contexts and students' interactions with those contexts.

Other Forms of Aid

A number of other financial aid variables were also significantly related to departure. A consistent finding was that, as net price increased, so, too, did the likelihood of departure, holding other factors constant. A $1,000 increase in net price was associated with a 2.5% to 2.8% increase in odds of departure in the various models. Receiving need-based aid (e.g., Stafford loans, Pell grants) was related to increased odds of departure across all models as well, ranging from about a 20% increase in odds in the full sample to 24% increase in odds in the shared merit frailty model. Applying for aid was associated with reduced odds of departure, with aid applicants having about 26% (Model 2) to 52% (Model 4) lower odds of departure. Together, these findings point toward the importance of applying for aid and that financial aid (by reducing the net price) can help decrease departure among students. However, the finding regarding need-based aid receipt suggests that aid may be inadequate to meet the needs of students (St. John, Paulsen, & Carter, 2005).

We found that an increase in loans as a proportion of the total aid package was associated with decreased odds of departure. This finding is consistent with prior research (DesJardins et al., 2002) that examined traditional students who began their studies at a flagship public research institution. We do not differentiate whether loans as a proportion of total aid is moderated by race, ethnicity, or income as has been suggested by St. John, Paulsen, and Carter (2005). Moreover, we do not distinguish between subsidized and unsubsidized loans.

Social Domain

Our models incorporated measures of the social domain by including a variable for whether a student lived on-campus or elsewhere, along with a variable representing the proportions of students of color at the postsecondary institution. In all models, students who lived on-campus compared to off-campus or with a parent had lower odds of departure, holding all other factors constant. The proportion of students of color at an institution was not related to decreased odds of departure, except in the campus shared-frailty model. Although only significant at the 0.05 level of probability, as the proportion of students of color increased by 1%, the odds of departing decreased by over 600%. This intriguing finding merits additional study with respect to the effects of campus context. However, it should be interpreted with caution given the inconsistency of the finding across the various models.

Academic Domain

With respect to the variables included as a measure of the academic domain, college GPA was the most consistently related to odds of departure across the models. A 0.1 increase in GPA was associated with decreased odds of departure of around 13% in all the models. Total credits attempted each year as well as developmental credits taken were not significantly related to likelihood of departure in the models. Cumulative credits were associated with about a 3% reduction in the odds of departure in Models 2 and 3. In other words, as a student moved closer toward degree completion as measured by credits accumulated, he or she was less likely to leave higher education.

Student Background

The only consistent finding with respect to the effects of student background on likelihood of departure was that African American/Black students had greater odds of departing, ranging from 18% to about 27%, than their White peers. This finding, coupled with those on the relationship between need-based institutional aid, points to the need to explore the extent to which race/ethnicity moderates the effects of aid on departure as St. John, Paulsen, and Carter (2005) conclude.

DISCUSSION

These results raise a set of intriguing findings. Descriptively we see that high-income students were overrepresented among merit-aid recipients. Although they constituted just about one-third of the sample, they were 55% of aid recipients. The lowest-income students, who also represented about one-third of the sample, were underrepresented among merit-based aid recipients, with just 7% receiving aid.

As might be expected, since some of the scholarships included a preference for African American recipients, they were somewhat overrepresented among merit-based aid recipients while Hispanic students were underrepresented. This descriptive finding is indicative of the sometimes competing aims of merit-based scholarships. On the one hand, such scholarships can be used as instruments to achieve important institutional goals, such as diversity. On the other hand, the institutional dollars are flowing disproportionately to high-income students, those whose families may have the greatest ability to pay. Yet given the criteria for many of the scholarships (e.g., SAT scores), it is not surprising that high-income students were disproportionately represented among recipients.

The results related to need-based aid are quite consistent with previous research. Although need-based aid can decrease the net price paid by low-income students, thus decreasing their net price (which should have a salutary impact on student persistence), students who receive need-based aid are more likely to have lower grades and test scores. Recipients are also more likely to be students of color and/or first-generation students. All of these are factors associated with the increased likelihood of departing prior to graduation.

Results from the full and matched survival models suggest that an increase in the amount of need-based aid has positive effects on not departing, net of unobserved heterogeneity issues that might be at play—at least to the extent that our matching method reduced the effects of unobserved heterogeneity. The same was not true of merit-based aid. This finding indicates that a $1,000 increase in merit-based aid had no discernible effect on retaining students, a finding similar to that of Singell and Stater (2006). The implication is that institutions are spending money on students who were likely to persist anyway. This finding sheds light on the role of merit aid in social stratification based on the ideals of meritocracy and supports the argument that inequalities are increased by merit-based aid.

The fact that merit-based aid was associated with a proneness to depart in the campus frailty model merits careful consideration. Recall that our findings suggest an unobserved proneness for merit-based aid recipients to depart at the institutional level. The results may echo Somer's (1995a) results using the following logic chain. As the amount of merit-based aid offered to a student rises at these two institutions, the award reflects the underlying structure of the student market niches these two institutions occupy. As the ability level of student applicants increases, the institutions must offer increasingly larger amounts of merit aid to induce these high-ability students to enroll. The increased amount of merit-based aid reflects the fact that fewer students with higher levels of academic performance are likely to enroll. Thus, the results would be consistent with Somer's findings that some high-ability students are more likely to withdraw because fewer students like them are enrolled at these two public institutions.

However, Pascarella and Terenzini (2005) note that decisions to persist or withdraw are strongly influenced by the attributes of the individual campuses at which students enroll. Thus, high-ability students who have received a large merit-based aid award may persist or withdraw—based not only on the amount of their scholarship package but also on the extent to which they become integrated into the academic and social fabric of the campus. The fact that higher enrollments of students of color increased the odds of dropping out may provide empirical clues about some of the institutional attributes that exert an indirect effect on student departure. Given the increasingly large investment of institutional revenue in merit-based aid programs, more research is needed on the effects of merit aid on college choice, academic momentum, and student departure and graduation. Although large national databases such as that of the National Postsecondary Student Aid Study (NPSAS) in the United States can shed light on the effects of aid, student departure is strongly influenced by the unique experiences of students on individual campuses. Thus, more research should be conducted to enable scholars to focus on the effects of aid on individual campuses. To carry out these studies, researchers need access to databases such as those used in this study and in the Singell and Stater (2006) work.

In addition, our findings contribute to the important debate about social stratification and educational attainment. In the context of declining public support for higher education in the United States and abroad (Immerwahr & Johnson, 2010), the use of institutional resources for merit-based aid may be inefficient from the perspective of encouraging educational attainment. Results suggest that need-based aid has a positive effect. Institutions might consider conducting an equity analysis, looking closely at who is receiving institutional need- and merit-based aid, what their outcomes are, and how money might be best used to help more students persist and graduate. This goal is especially important in the context of the United States, which faces projected shortfalls in educated workers (Carnevale, Rose, & Hanson, 2012).

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