Competing risks or different pathways? An event history analysis of the relationship between financial aid and educational outcomes for Latinos

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Using a competing risks event history model this study explores the effects of differentiated forms of financial aid on the postsecondary enrollment patterns of Latino college students in Indiana. Much of the prior research on financial aid has employed cross-sectional methods, which assume that the effects of aid do not vary across time. This assumption does not match current practices and those required more nuanced techniques to consider the influence eof financial aid. Knowing more about the relationships between timing of aid and academic success among Latinos has practical implications for enrollment managers and campus financial aid practitioners who can use these findings to more effectively distribute scarce resources to students.

At a time when Latinos make up an growing proportion of the U.S. school age population and increasingly seek entrance to postsecondary education the role of financial aid in postsecondary access remains in flux and uncertain. Though federal, state, and institutional grants have historically helped the lowest income students pay for their educational costs, grants have generally not kept pace with increasing costs (Advisory Committee on Student Financial Assistance, 2001; Ficklen & Stone, 2002). Understanding what factors can promote the educational attainment of Latino students is an area of significant need for further research in the field of higher education. Demographic trends, shifts in the financing of postsecondary education, and continuing inequity in academic success among racial/ethnic groups in are increasing the likelihood that more and more of the U.S. population will be kept outside the doors of postsecondary education, or without a degree in hand.

It is in this context then that this study responds to calls for more research on the effects of financial aid on underrepresented students. This study asks "To what extent do loans, grants, institutional aid, and work-study affect the enrollment patterns of Latinos and how do these effects change over time?" In addition, this study seeks to extend existing approaches to studying financial aid use among underrepresented students by employing event history analysis. The goal is to not only understand more about *how* aid (or the lack thereof) promotes or perturbs access for Latinos, but as importantly *when* those effects occur and how they may vary over time. Understanding more about how the *timing* of aid affects enrollment can assist financial aid professional and enrollment managers with determining targeted aid more effectively to promote the attainment of Latinos.

Data Sources and Sample

Data for this study come from the Indiana Commission for Higher Education (ICHE) statewide student information system (SIS) unit record database and the National Center for Education Statistics Integrated Postsecondary Education Data System (IPEDS). SIS data are collected from all public universities, colleges, and community colleges in Indiana for enrollment-related transactions—such as , courses taken, grades received, race, ethnicity, and all other information necessary for institutional business. Institutional price data from IPEDS along with receipt of aid data from SIS are used to calculate the net price of attending college (total cost of attendance less total aid) for each student. Total 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.

First-time, first-year baccalaureate degree-seeking Latinos, African Americans, and Whites who began in Indiana's public four-year institutions in 1999 (n=28,576) constitute the sample of interest. Among all students who began in Indiana public postsecondary institutions in 1999 (n=43,846), those who started in baccalaureate degree programs represented just over 65 percent, with the remainder enrolling in a community college. Baccalaureate-degree students were followed annually through the end of the 2006-2007 academic year (eight years in all). This includes those students who may have transferred to a community college at some point during the study period. Because White students are included in this study only as a point of comparison for Latinos and because of data constraints associated with analysis of person-period datasets, a representative random sample of White students was drawn for inferential modeling. The sample includes all Latinos and African Americans who began studies in 1999. The effective sample size, therefore, is 4,369 first-time, first-year entrants (783 Latinos, 1,865 African Americans, and 1,721 Whites) representing 34,952 person-periods (4,369 students per year times eight years).

Models and Methods

Competing risks are conceptualized as related but mutually exclusive events in which experiencing one event removes someone from risk of experiencing another event at the same point in time (Allison, 1984). Exit from postsecondary education is the general event of interest in this study. Conceptually, there are a variety of ways students can exit postsecondary education at any point in time, such as stopping out, departing for an extended period, transferring to another institution, or earning a postsecondary credential, to list a few. Therefore, for the purposes of this analysis stopping-out (i.e., not attempting to earn credit during an entire academic year) and graduation (earning a baccalaureate degree) are the specific forms of exit considered.

The definition of stopout used here is distinct from traditional definitions in that it does not focus on a single institution, but rather departure from an entire state's system of public postsecondary education. This is consistent with research on educational mobility and social stratification (e.g., Spady, 1970) and in recognition of increasingly complex patterns of student enrollment (Adelman, 1999, 2006). Because students may stop in and out of postsecondary education while working toward a degree, stopout is considered a repeated event, with students remaining in the sample (or risk pool) until graduation. Once a student graduated, she was no longer considered at-risk for exit of any form.

A discrete-time model was used to estimate the effects of financial aid on timing to first departure with time (*t)* measured in academic years. As suggested by Allison (1984), in instances where time is measured in discrete units 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 at a discrete point in time (*j*), *D* represents the baseline hazard intercept parameter at time periods 1 through 8, and β_1 through β_5 represent the slope coefficients for the predictor variables.

Equation 1. General Form of Discrete-time Survival Model

$$\text{logit } h(t_j) = \begin{array}{l}[\alpha_1 D_1 + \alpha_2 D_2 + ... + \alpha_8 D_8] + \\ [\beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5]\end{array}$$

The models control for factors posited by theory and previous research to affect academic success in vectors of variables (*x*) for (a) student background (x_1), (b) academic preparation (x_2), (c) campus characteristics (x_3), (d) college enrollment characteristics (x_4), and (e) financial aid (x_5). Table 3 lists the variables included in the event history models.

Table 3. Variables Included in the Discrete-Time Event History Models

Student Background	Academic Preparation	Campus Characteristics	College Enrollment Characteristics[a]	Financial Aid[a]
Age[a]	% Free lunch HS	% Faculty of Color[a]	Housing	Cost of attendance
Gender	High school rank	% Students of Color[a]	Credits attempted	Cumulative loan debt
Race/ethnicity	SAT score		Dev. ed. credits	Applied for aid
Income[a]			Cumulative credits	Received aid
			Institutional type	Need-based aid receipt
			Declared major	
			GPA	

a denotes time-varying variables

A series of seven event history models were estimated (See Table 4). First, a baseline model including Latinos, African Americans, and Whites was estimated to ascertain to what extent differences in likelihood of stopout and graduation exist by race/ethnicity and to establish hazard profiles for each event. Next, models were estimated separately for each racial/ethnic group to examine the relationships between financial aid, campus characteristics, and the events of interest.

Table 4. Event History Models

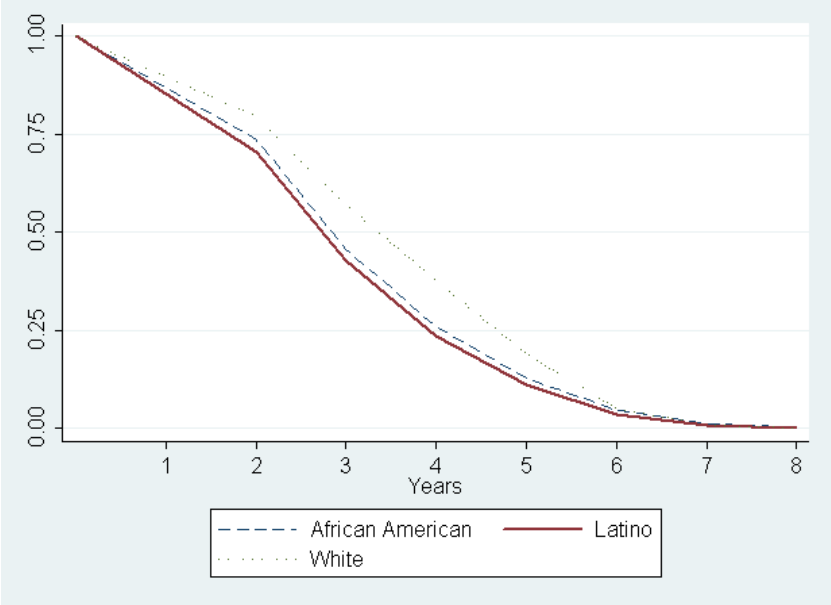
Model	Groups	Events	IVs	Method
1	All	Stopout, Grad.	All	Multinomial
2	Latinos	Stopout, Grad.	All	Multinomial
3	African Americans	Stopout, Grad.	All	Multinomial
4	Whites	Stopout, Grad.	All	Multinomial
5	Latinos	Stopout	Time-varying	Fixed-effects
6	African Americans	Stopout	Time-varying	Fixed-effects
7	Whites	Stopout	Time-varying	Fixed-effects

Findings

Descriptive analysis shows that stopping-out was most common in the third and fourth years of enrollment among all students. However, differences emerge with respect to stopout by race and ethnicity. Represented graphically, we find that the surivor function is steeper in the

initial years of enrollment for Latinos and African Americans than Whites, indicating that Latinos and African Americans were more likely to stopout in the initial years of enrollment (See Figure 1).

Figure 1. Kaplan-Meier Survival Estimates for Stopout by Race/Ethnicity



A Log-Rank test for equality of stopout survivor functions by race and ethnicity confirms the conclusion that there is a significant difference with respect to timing to stopout among Latinos, African Americans, and Whites, χ^2 =29.28, p-value < 0.00.

The largest proportion of students who completed a baccalaureate degree did so in the fourth (n=643) and fifth (n=671) years (See Table 5). By the end of the study period nearly 60 percent of students had not yet completed a degree. Differences by race and ethnicity were evident.

Table 5. Kaplan-Meier Survival Estimates for Graduation

Time	Beg. Total	Fail	Survivor Func.	Std. Error	95% Conf. Int.	
2	4369	4	0.9991	0.0005	0.9976	0.9997
3	4365	17	0.9952	0.001	0.9926	0.9969
4	4348	643	0.848	0.0054	0.837	0.8583
5	3705	671	0.6944	0.007	0.6805	0.7079
6	3034	255	0.6361	0.0073	0.6216	0.6501
7	2779	113	0.6102	0.0074	0.5956	0.6245
8	2666	65	0.5953	0.0074	0.5806	0.6097

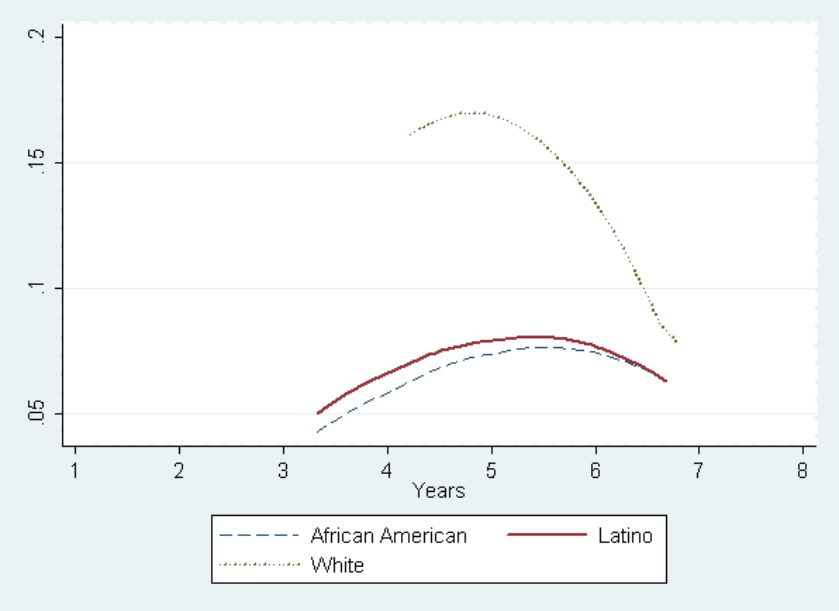
Whites had the highest rate of completion (54%), followed by Latinos (33%) and African Americans (31%) (See Table 6).

Table 6. Degree Completion by Race/Ethnicity

	Count	Proportion
Latinos	258	33%
African Americans	578	31%
Whites	932	54%
Total	1768	40%

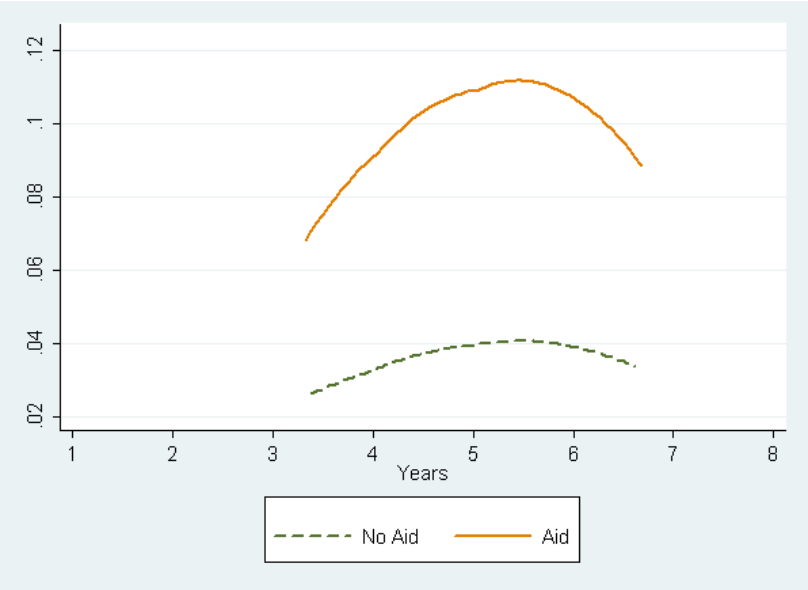
Latinos and African Americans were most likely to complete a degree in five years, whereas most Whites who earned a degree did so in four years. Overall, the incidence of degree completion in any period for Latinos and African Americans was much lower than that of their White peers, as is represented graphically in Figure 2. A Log-Rank test for equality survivor functions confirms the conclusion that there is a significant difference with respect to timing to graduation among Latinos, African Americans, and Whites, $\chi^2 = 289.54$, p-value < 0.00.

Figure 2. Smoothed Hazard Estimates for Degree Completion by Race/Ethnicity



Descriptive analysis of the effects of financial aid on timing to degree completion among Latinos suggests that receipt of financial aid has a significant and positive effect on degree completion. As represented in Figure 3, Latinos who received aid had a significantly higher incidence of graduation than their Latino peers who did not receive aid. A Log-Rank test for quality of the survivor function confirms a statistically significant difference in timing to degree completion between Latino who received aid and those who did not, χ^2 =97.93, p-value < 0.00.

Figure 3. Smoothed Hazard Estimates for Degree Completion Among Latino by Aid Receipt



Inferential Findings

Financial Aid

Results from the inferential models allow for control for factors hypothesized to affect stopout and graduation. The findings suggest that financial aid has a modest effect on likelihood of graduation, primarily through reducing the likelihood of stopout and possibly through reducing cost of attendance.

Cost of attendance. Among all groups, the cost of attendance was associated with greater propensity to stopout, though it was statistically significant for Latinos and Whites only. Perhaps somewhat surprisingly, cost of attendance appeared to be positively related to degree completion (See Table 7). For Latinos, A $1,000 increase in cost of attendance increased the likelihood of stopping out the following year by just over three percent. For Whites a $1,000 increase in cost was associated with a nearly seven percent increase in the likelihood of stopout and roughly a

three percent increase in likelihood of graduating. No statistically significant relationship was found between cost of attendance and stopout or graduation for African Americans.

Loan debt.

Generally, findings from the models suggest that increased debt is negatively related to graduation for all groups, but that differences emerge in regard to its effects on stopout. With respect to stopout, a $1,000 increase in loan debt was associated with about a six percent decrease in likelihood for Whites. Though not statistically significant, the coefficient for the effects of loans on stopout for Latinos and African Americans was positive, suggesting loans make a student of color more likely to stopout. With respect to graduation, a $1,000 increase in cumulative loan debt made it about one percent less likely a White student would graduate compared to about 1.4 percent for African Americans. No statistically significant relationship between loan debt and graduation was found for Latinos.

Applying for and receiving aid. African Americans applied for aid in the greatest proportion (87%) compared to Latinos (76%) and Whites (69%). For all groups, applying for financial aid appeared to have no statistically significant relationship with stopout or graduation, with the exception of African Americans, for whom it was associated with a decreased likelihood (by about 17%). Receiving financial aid significantly reduced the likelihood of stopout for African Americans and White (by about 31% and 1% respectively), but had no similar effect for Latinos. Interestingly, receipt of any form of aid reduced the likelihood of graduation by about half for Whites, controlling for all else. No significant relationship was found among receiving need-based aid, stopout, or graduation, controlling for all else.

Table 7. Selected Results from Competing Events Regression Models

	Latinos		African Americans		Whites	
	Model Two		Model Three		Model Four	
	Stopout	Graduation	Stopout	Graduation	Stopout	Graduation
Cost of attendance ($1,000s)	0.031 (0.02) *	0.033 (0.02)	0.005 (0.01)	0.022 (0.02)	0.068 (0.01) *	0.034 (0.011) *
Cumulative loans ($1,000s)	0.00 (0.01)	-0.011 (0.01)	0.00 (0.00)	-0.014 (0.0) *	-0.006 (0.003) *	-0.01 (0.003) *
Received aid	-0.236 (0.17)	0.201 (0.29)	-0.274 (0.12) *	0.094 (0.26)	-0.006 (0.107)	-0.405 (0.138) *
Need-based aid receipt	-0.027 (0.16)	-0.195 (0.22)	-0.108 (0.1)	-0.081 (0.16)	-0.142 (0.118)	0.173 (0.15)
Applied for aid	-0.099 (0.15)	-0.152 (0.36)	-0.179 (0.09) *	-0.165 (0.32)	-0.106 (0.106)	-0.088 (0.169)
Age	0.075 (0.01) *	0.028 (0.04)	0.041 (0.01) *	0.019 (0.02)	0.07 (0.011) *	-0.055 (0.033)
Income ($1,000s)	0.004 (0.0) *	0.007 (0.0) *	0.004 (0.0) *	0.005 (0.0) *	0.005 (0.001) *	0.008 (0.001) *
% Free lunch HS	0.01 (0.0) *	-0.007 (0.01)	0.009 (0.0) *	-0.006 (0.0)	0.001 (0.004)	0 (0.006)
% Faculty of Color	-1.275 (0.62) *	0.292 (1.38)	-1.064 (0.32) *	-0.635 (0.93)	-2.425 (0.704) *	1.847 (0.882) *
% Students of Color	0.013 (0.79)	-0.418 (1.69)	-0.202 (0.49)	-0.666 (1.14)	-0.435 (1.534)	-0.304 (1.712)
Credits attempted	-0.112 (0.01) *	0.054 (0.01) *	-0.092 (0.01) *	0.062 (0.01) *	-0.122 (0.007) *	0.06 (0.009) *
Cumulative credits	0.053 (0.0) *	0.017 (0.01) *	0.048 (0.0) *	0.005 (0.0)	0.052 (0.003) *	-0.006 (0.003)
Dev. ed. credits	0.023 (0.09)	-0.405 (0.19) *	0.01 (0.03)	-0.651 (0.29) *	0.024 (0.09)	-5.003 (0.647) *
Years Stopped-out	3.584 (0.17) *	-1.983 (0.48) *	3.242 (0.1) *	-2.23 (0.23) *	4.675 (0.172) *	-2.237 (0.274) *
AIC		3843.647		9757.158		7058.737
BIC		4275.172		10244.227		7540.663
-2 Log L		9629.158		6930.737		20839.272

Standard error in parentheses

* significant at the 0.05 level

The results from the fixed-effects models for the effects of financial aid on stopout largely confirm the preceding findings (See Table 8). For all groups, an increase in cost of attendance was associated with an increase in the likelihood of stopping-out (about 6% for Latinos, 4% for African Americans, and 10% for Whites). As loan debt increased for Latinos, the likelihood of stopping-out decreased, controlling for all else. A $1,000 increase in cumulative loan debt decreased the likelihood of Latinos stopping out by about three percent compared to about two percent for Whites. Applying for aid and receiving need-based aid were associated with a decreased likelihood of stopout for African Americans, but was not statistically significant for Latinos or Whites.

Table 8. Selected Results from Fixed-Effects Stopout Models

	Model Five	Model Six	Model Seven
	Latinos	African Americans	Whites
Cost of attendance ($1,000s)	0.056 (0.026) *	0.038 (0.014) *	0.099 (0.014) *
Received aid	-0.023 (0.287)	0.006 (0.185)	-0.087 (0.227)
Need-based aid receipt	-0.418 (0.281)	-0.4 (0.165) *	-0.209 (0.217)
Cumulative loans ($1,000s)	-0.035 (0.014) *	-0.001 (0.009)	-0.021 (0.009) *
Applied for aid	-0.197 (0.168)	-0.54 (0.099) *	-0.262 (0.148)
Time	-1.797 (0.152) *	-1.665 (0.091) *	-1.993 (0.136) *
Income ($1,000s)	0.004 (0.002) *	0.004 (0.001) *	0.005 (0.001) *
Compared to On-Campus			
Off-campus	0.118 (0.28)	0.803 (0.145) *	0.824 (0.204) *
With Parents	0.534 (0.629)	0.518 (0.267)	1.784 (0.476) *
% Faculty of Color	-0.841 (0.423) *	-0.933 (0.239) *	-1.708 (0.41) *
% Students of Color	-0.513 (1.954)	0.478 (1.062)	2.551 (2.36)
Credits attempted	-0.106 (0.011) *	-0.088 (0.006) *	-0.123 (0.009) *
Cumulative credits	0.091 (0.008) *	0.076 (0.004) *	0.09 (0.006) *
Dev. ed. credits	0.055 (0.075)	-0.056 (0.027) *	-0.08 (0.081)
GPA	-0.197 (0.099) *	-0.204 (0.054) *	-0.245 (0.086) *
Declared major	0.581 (0.303)	0.471 (0.148) *	0.57 (0.237) *
Compared to Research Universities			
Regional	0.276 (0.432)	0.1 (0.269)	-0.414 (0.391)
Branch	-0.272 (0.749)	0.208 (0.311)	-0.711 (0.46)
Urban	-0.331 (0.504)	-0.015 (0.268)	-0.408 (0.4)
Community College	-0.657 (0.47)	-0.174 (0.284)	-1.39 (0.381) *
Years Stopped-out	3.751 (0.198) *	3.366 (0.115) *	4.558 (0.185) *
AIC	1413.56	3863.52	1785.25
BIC	1554.26	4022.51	1941.89
-2 Log L	1371.56	3821.52	1743.25

Standard error in parentheses

* significant at the 0.05 level

Other factors influencing stopout and graduation

For all groups, not surprisingly, having stopped-out was the strongest predictor of future stopout or graduation. Moreover, as the amount of time spent stopped-out increased so too did the likelihood of remaining stopped-out or not graduating. For example, a one year increase in the number of years stopped-out decreased the likelihood of graduating 600 percent for Latinos, compared to over 800 percent for African Americans and Whites.

Campus characteristics as well as student enrollment characteristics also exerted strong influences on the outcomes of interest in this study as well. For example, the proportion faculty of color at the institution attended by the student reduced the likelihood of stopping out the following year by about 250 percent for Latinos and 11 percent for African Americans. The strongest effect was observed for Whites, for whom a one point increase in the proportion faculty of color was associated with being more than 1,000 percent less likely to stopout the following year. No similar relationship was observed among the proportion of students of color, stopout, and graduation, however.

Credit taking patterns were also significantly related to stopout and graduation. For all groups, taking more rather than fewer credits each academic year reduced the likelihood of stopping-out the following academic year. Taking one credit more reduced the likelihood of a Latino student stopping-out the next year by about 11 percent. An increase in credits was associated with a nine percent decrease in likelihood of stopping out for African Americans and a 13 percent decrease for Whites. Attempting more credits increased the likelihood of graduation for Latinos by about 5 percent compared to 6 percent for African Americans and Whites. Though somewhat counterintuitive, an increase in cumulative credits attempted was associated with an

increased likelihood of stopout as well as graduation for Latinos. Taking one additional credit increased the likelihood of stopout about five percent but also increased the likelihood of graduating just under two percent. For both African Americans and Whites, an increase in cumulative credits increased the likelihood of stopout (about five percent for both). Although relatively few students attempted developmental education credits, doing so was negatively related to graduation for all groups. A one credit increase in developmental education decreased the likelihood of graduating by about 50 percent for Latinos and 91 percent for African Americans. The effect was greater for Whites. An increase in developmental education credits decreased the likelihood of graduating about five times.

Discussion

The findings in this study illustrate the need to further explore the price sensitivity of all students, but particularly Latino and White students. While institutions may see an increase of $1000 to be minor, this study indicates that this increase can be associated with a greater likelihood of stopping-out. When considering loan debt, the findings on this study seem odd. One possible explanation could be that if the increase in loan debt is associated with students working less hours for pay, this finding may indicate the need to educate Latino students about the consequences of working too many hours and the positive influence of some level of loan debt.

Finally the finding that increase in faculty of color present at the institution decreases the likelihood of stop-out is consistent with other studies that considered cultural affinity (the presences of the Latino culture within the college environment) as one of the variables that influence Latino students' intent to persist. Torres (2006) found that the largest total effect on intent to persist occurred from cultural affinity through encouragement and institutional

commitment. The presence of faculty of color may increase the likelihood that students of color will find mentors and advisors that will understand their circumstances and assist them in maneuvering the educational system.

For enrollment and financial aid professionals the findings in this study would indicate that careful consideration should be given to the consequences of raising tuition without comparable financial aid to cover the cost. This balancing of cost and aid is a constant struggle for professionals and this study indicates that the struggle is justified. In addition, practitioners should consider the level of involvement for faculty of color in recruitment and retention. While having these faculties participate in every event is unrealistic, making sure they have accurate information about cost and aid should be considered as essential to the success of students of color. Though all faculty should be given this information, because many students of color are also first generation in college they may create their own theories about how financial aid works, which may not be accurate (Ziskin, Torres, Pellicciotti, Fischer, & Player-Sanders, 2009). Careful attention should be given to how accurate information can be disseminated widely on the college campus.

In conclusion, this study provides a more nuances view of the factors that influence college student stop-out, with particular attention to Latino students. This nuanced view provides context for some of the tensions professionals in enrollment and financial aid have wrestled with for many years as well as providing some data on what could make a difference. Reducing the likely of stopping-out is one of the ways that institutions can increase their retention and graduation rates. This study contributes to the understanding of stop-out process by using longitudinal data to consider multiple events in history and their influence on student success indicators.

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