

# Identifying Factors Related to Student Success: Utilizing Multinomial Logit Regression to Study Graduation in Higher Education

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**UNIVERSITY OF MINNESOTA**

# Project Background:

## Known factors related to U of M graduation

- Academic preparation/early success
- Geography
- Pell Eligibility
- Social Factors
  - Social Interaction
    - Social Integration
    - Academic Success



# Expand the Scope of “Success”

- Expand the role of the dependent variable
  - Earning a baccalaureate degree:
    - University of Minnesota “U of M”
    - Other four-year institution “Elsewhere”



# Research Question

Do previously identified predictive relationships change when “success” is expanded to include degree attainment either at the University of Minnesota or at other four-year institutions?

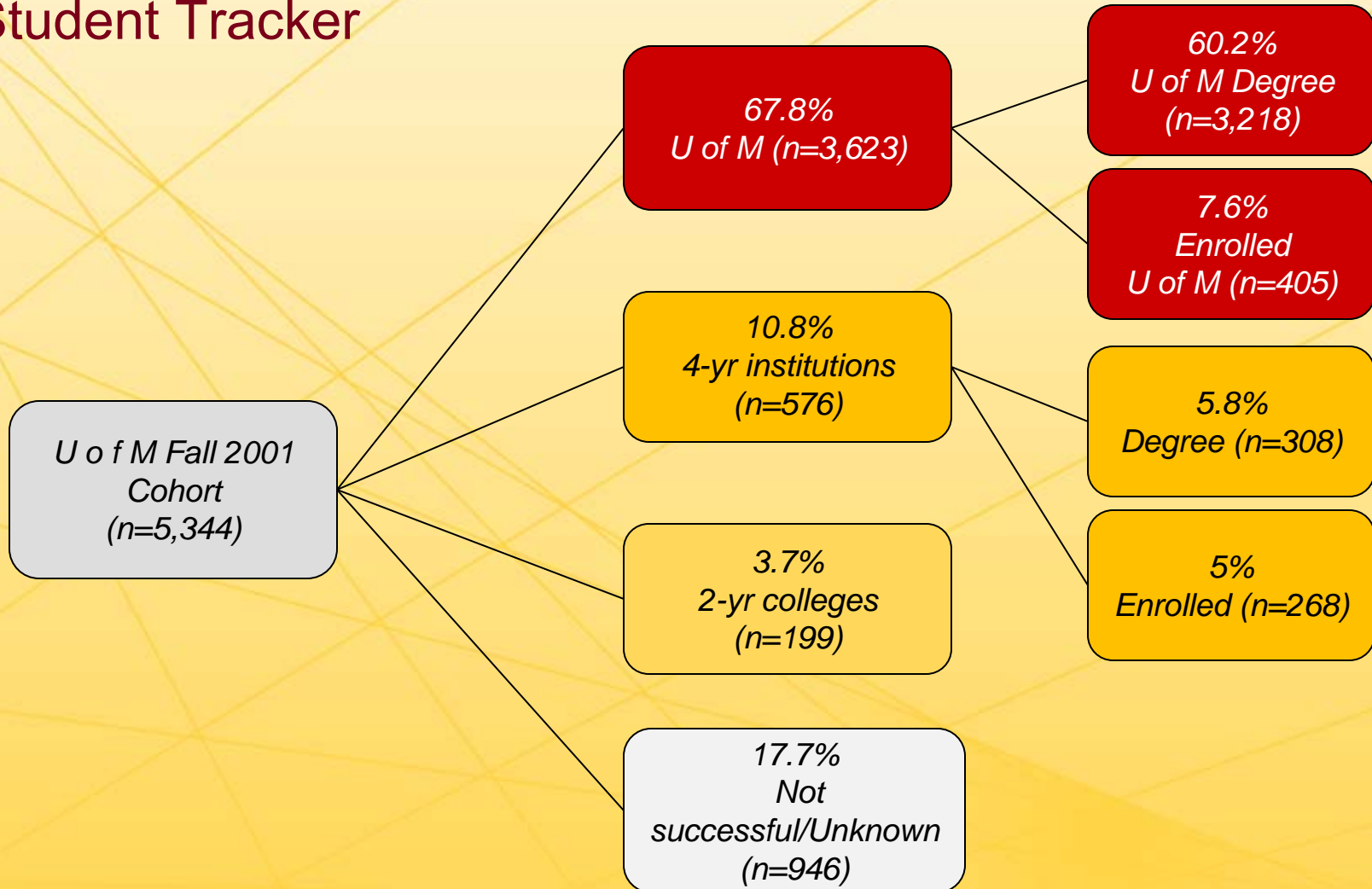


# Significance of Our Study:

- Utilize data from **National Student Clearinghouse**.
  - Ability to track student enrollment and degree attainment at a truly national level
  - “Did they earn a degree elsewhere”
- Up to now NSC studies have been primarily descriptive, few predictive models utilizing this data exists



# How do you spell “Success”? National Student Clearinghouse: Student Tracker



- Enrollment checked: August 2006 – April 2007
- Degrees: up through Fall 2006



# Variables in the Model

- Independent variables
  - First-term academic performance
  - Academic preparedness
  - Demographics
  - Geographic/tuition residency
  - Financial need
  - Social integration



# Dependent Variable

- Earned baccalaureate
  - Earned degree from U of M
  - Earned degree elsewhere
  - Reference group: did not earn degree
- Coding
  - 0=no degree
  - 1=elsewhere
  - 2=U of M



# Descriptive Statistics of the Sample (N=5,150)

Category	Variables	Values	Mean	Std. Dev.	Variable Description (type of variable)
Academic Performance	Earned Degree	0-2			Earned a baccalaureate degree (response variable)
	Ratio	0-1	0.95	0.16	Ratio of first term credits earned to attempted
	First-term GPA	0-4	3.02	0.75	First-term Grade Point Average (GPA)
	W Count	0-4	0.12	0.36	Number of W (course withdrawals) first semester
	Retained first-year	0-1	0.85	0.35	First year retention (dummy variable)
Academic Background	ACT/SAT Score	11-35	24.60	4.13	ACT composite score/SAT converted
	General College	0-1	0.16	0.37	If admitted to General College (dummy)
	Not admitted to 1 <sup>st</sup> choice college	0-1	0.26	0.44	Not admitted to first-choice college (dummy)
Demographics	Athlete	0-1	0.04	0.19	If student athlete (dummy)
	Male	0-1	0.49	0.50	If Male (dummy)
	Asian	0-1	0.10	0.30	If Asian (dummy)
	Underrepresented Minority	0-1	0.07	0.25	If American Indian/Black/Hispanic (dummy)
Geography	Reciprocity	0-1	0.27	0.44	If tuition reciprocity state (dummy)
	Non-reciprocity	0-1	0.05	0.21	If non-tuition reciprocity state (dummy)
Financial	Pell Grant	0-1	0.17	0.38	If Pell grant eligible (dummy)
Social	On-campus Housing	0-1	0.59	0.49	If living in residence hall first-term (dummy)
	Living & Learning Community (LLC)	0-1	0.11	0.32	If in living & learning community "house" (dummy)
	Honors – LLC	0-1	0.05	0.21	If in living & learning community honors "house" (dummy)
	Campus Recreational Facilities Usage Count				Total number of visits to a Campus Recreation Facilities (CRF) first semester
			0-154	10.02	15.42



# Methods

- Multivariate approach
- Graduation outcomes are represented by an unordered multi-categorical dependent variable
- Neither OLS nor standard Logit models are appropriate
- The solution: Multinomial Logit model



# Multinomial Logit Probability Model

- Equations represent the likelihood of each possible alternative outcome relative to the base outcome, examined in pairs
- Statistically significant coefficients indicate the associated variable helps distinguish the alternative outcome from the base outcome
- Each pair of outcomes must be compared separately



# MNL Model : Graduation

U of M | no degree

Elsewhere| no degree

Area	Predictor	Coefficient	Sig.	Coefficient	Sig.
Academic Performance	Completion Ratio	2.402		2.144	
	First-term GPA	1.044		0.628	
	W Count	-0.389		-0.737	
	Retained first-year	3.359		-1.451	
Academic Background	ACT/SAT Score	-0.007		-0.021	
	General College	-1.336		-1.002	
	Denied 1 <sup>st</sup> College Preference	-0.111		0.410	
Demographics	Athlete	0.208		0.265	
	Male	-0.078		-0.384	
	Asian	-0.359		-0.943	
	Underrepresented Minority	-0.391		-1.253	
Geography	Reciprocity	-0.098		0.856	
	Non-Reciprocity	-0.063		0.991	
Financial	Pell	-0.391		-0.403	
Social	On-Campus Housing	0.223		0.062	
	Living Learning Community	0.227		0.157	
	Honors LL Community	1.110		-0.489	
	Recreational Sports Usage Count	0.007		0.009	

$P = < .05$

# Understanding the “Odds” and Ends of MNL

- Logit allows us interpret the coefficients in terms of changes in the odds.
- Recall that the odds of an event are expressed:

$$\Omega = \frac{\Pr( y = 1 )}{\Pr( y = 0 )}$$

- For an average non-minority student, the odds of obtaining a degree from U of M versus not obtaining a degree are:

$$\frac{\Pr( y = \textit{grad} )}{\Pr( y = \textit{nograd} )} = \frac{0.60}{0.36} = 1.67$$

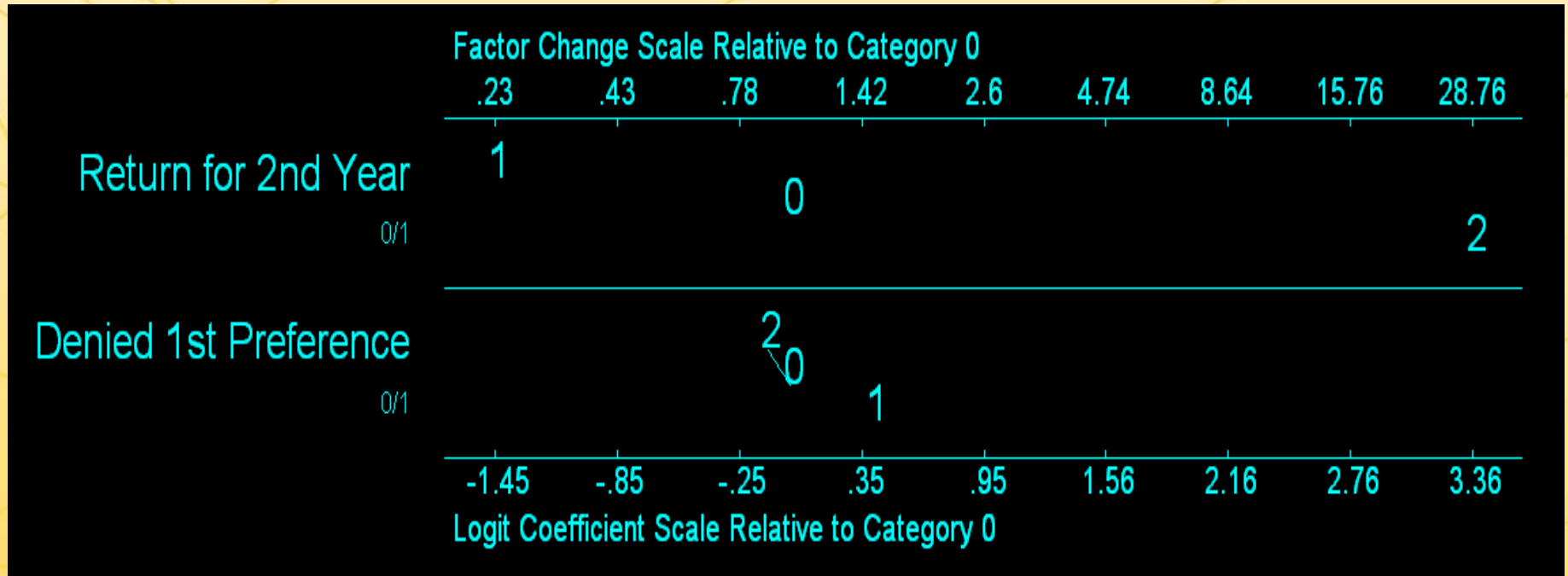


# Factor Changes in the Odds

- Exponentiation of the logit coefficient produces the factor change in the odds.
- We can interpret this such that:
  - For a unit change in  $x_k$ , the odds are expected to change by a factor of  $\exp(\beta_k)$ , holding all other variables constant.
  - For example, a change in the underrepresented minority (URM) status is expected to change the odds of success by a factor of 0.676 (which is  $\exp(-0.391)$ ), ceteris paribus.

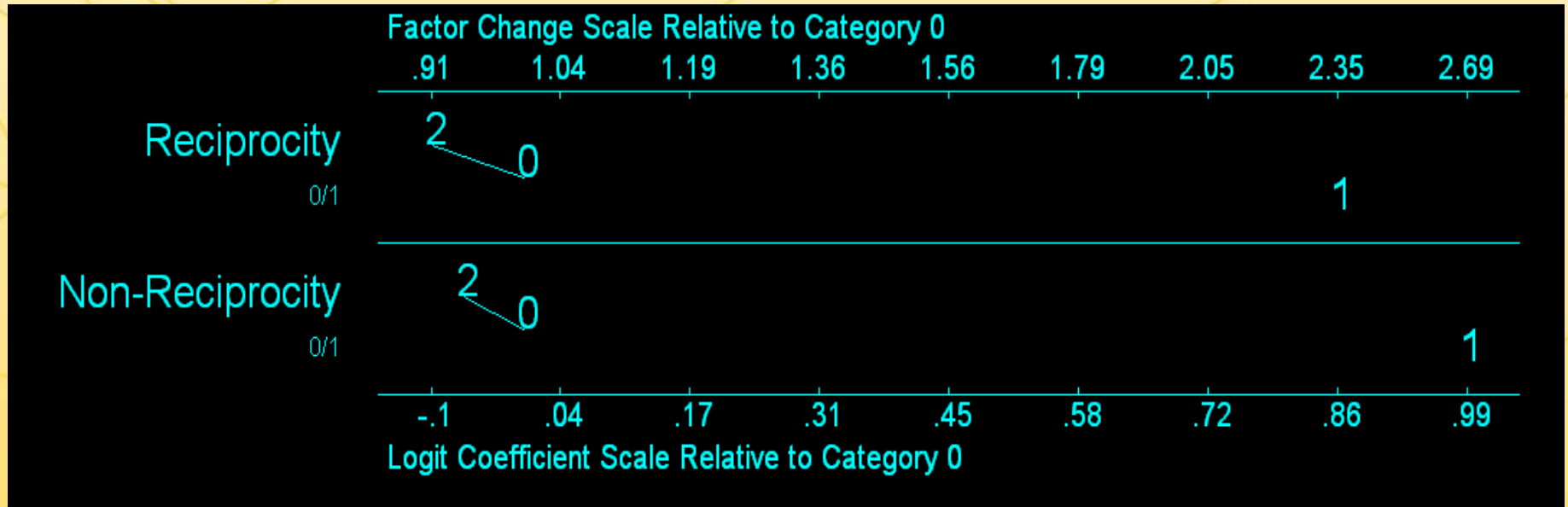


# Academic Background & Performance



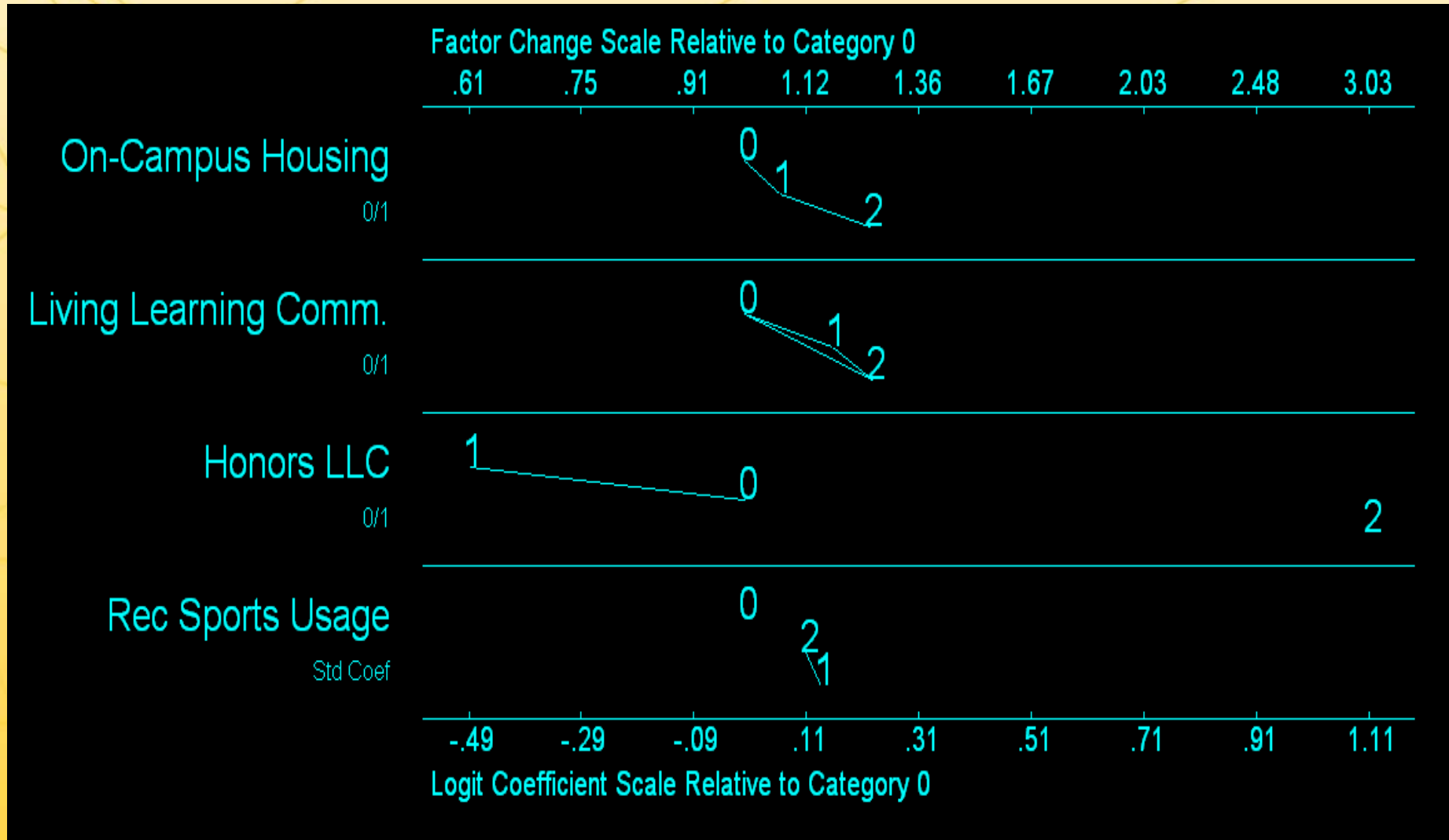
2=U of M, 1=Elsewhere, 0=no degree

# Geography



2=U of M, 1=Elsewhere, 0=no degree

# The Effects of Social Integration



2=U of M, 1=Elsewhere, 0=no degree



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# Policy Implications

- Academic performance in the first term is critical for future success both at U of M and elsewhere
- Geographic location, Reciprocity/non-reciprocity successful--just not here
- Pell eligibility lowers probability of success not only at U of M but elsewhere



# Implications cont.

- Integration into the broader university community is important for success at U of M
  - On-campus housing/living learning communities
  - Other engagement activities
  - Campus Recreational facility usage appears to be important



# Questions?



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