

# Tuition discounting for revenue management

Nick Hillman  
Assistant Professor  
Educational Leadership & Policy  
University of Utah

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# Summary

## Known:

- 1) College tuition is rising
- 2) Publics are reliant on **tuition revenue**
- 3) Non-repayable **grant aid** reduces sticker prices
- 4) Grants impact enrollment outcomes
- 5) **Institutions** provide much of this aid (33%)

## Unknown:

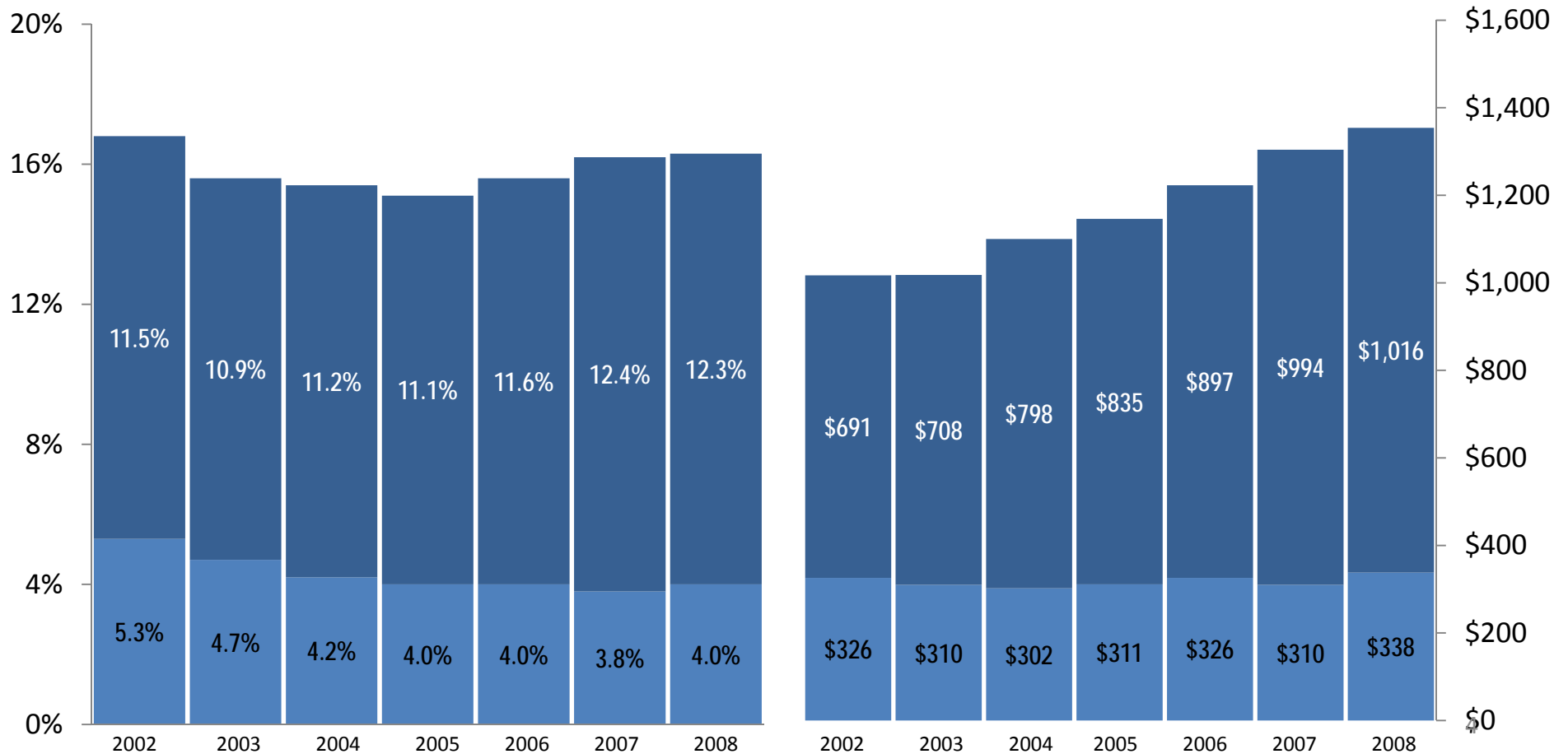
- 1) Does aid also impact revenue outcomes? **YES**
- 2) If so, how and to what extent? **Let's take a look**

# Definitions

- Institutional aid
  - **Funded:** endowed funds
  - **Unfunded:** operating budget
- “Tuition discount”
  - Total institutional aid expenditures divided by gross tuition revenue
  - Need and non-need
  - Athletic inclusive
- Public four-year only

# Public 4-year discounting trends (2002-2008)

Average discount rate
UNFUNDED
FUNDED
Average award size

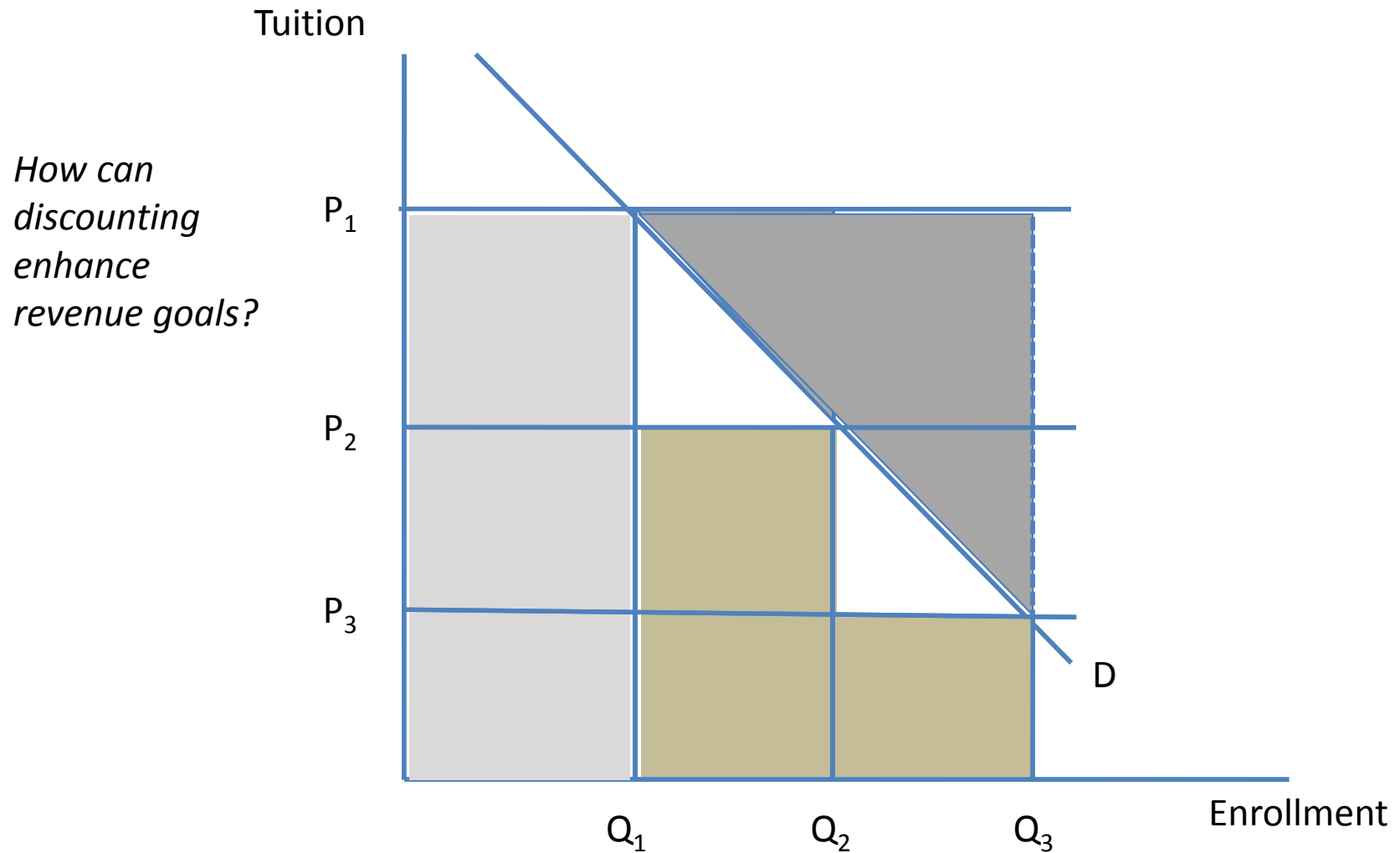


# Variables & data

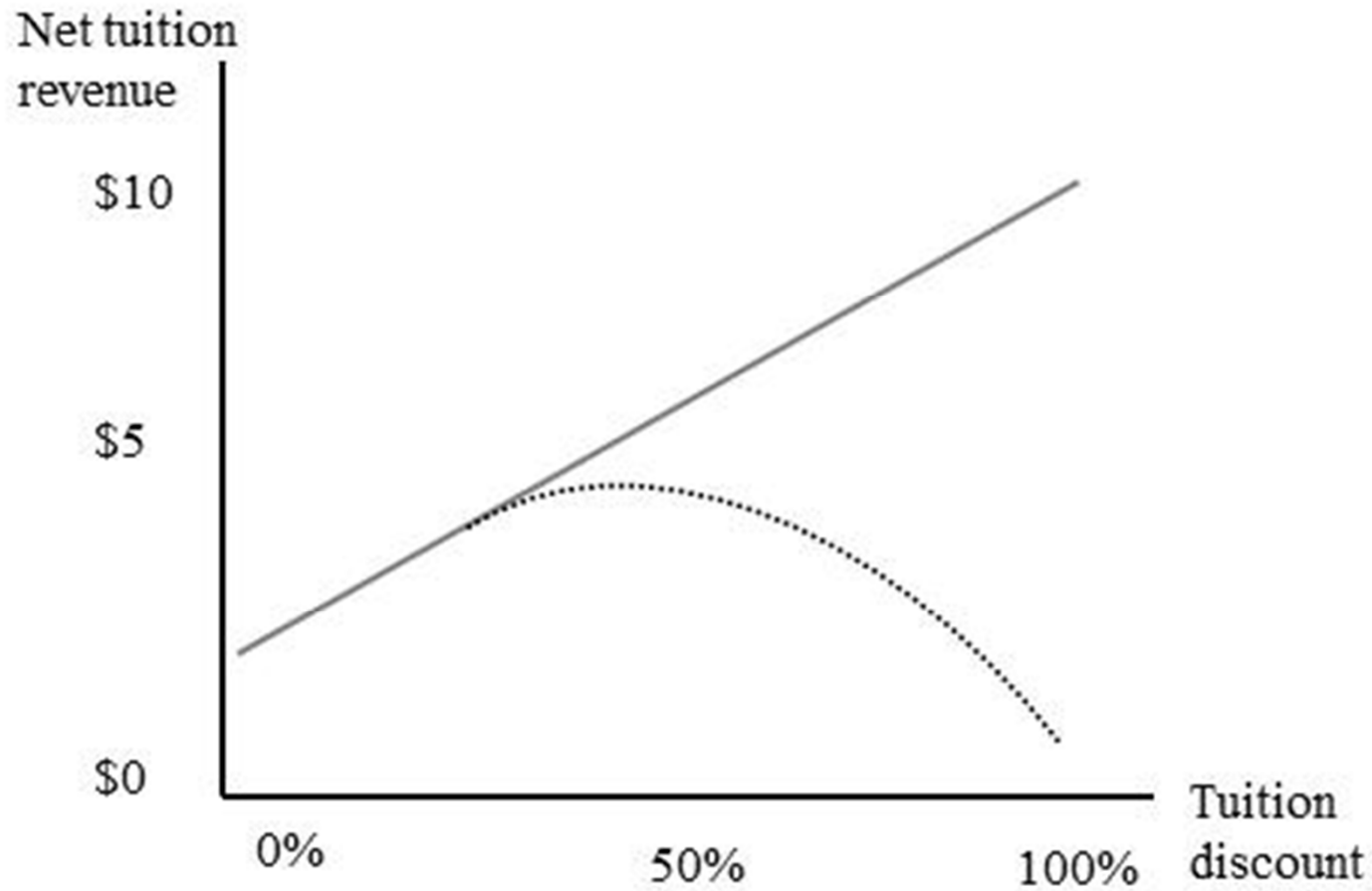
- Delta Cost Project (IPEDS plus)
- 2002-2008
- Sample of 174 public four-year institutions

Economic	Enrollment & revenue management
Demand elasticity (in and out)	Percent minority
Tuition price (in and out)	Percent poor
Total enrollment (in and out)	Percent non-resident
Funded discount rate	Median SAT
Unfunded discount rate	Selectivity
	State appropriations

# Conceptual framework



# Conceptual framework



# Analytical technique

- Two Models:
  - Economic only
  - Economic plus enrollment management
- Endogeneity problems
  - Decreases model efficiency (s.e.)
  - Example: aid impacts NTR, but NTR impacts aid
  - Instrumental variable technique is required
- Autocorrelation problems
  - Increases biased parameter estimates
  - Last year's NTR is best predictor for this year's NTR



# Analytical technique

- Generalized method of moments (GMM)
  - Arellano-Bond (xtabond2 in STATA)
- “Fixes” autocorrelation and “cures” endogeneity
- Testing the instruments
- Formal model:

$$y_{it} = \alpha_{it} + \beta_1 y_{it-1} + \gamma_2 (W_{it} - W_{it-1}) + \gamma_3 (Z_{it} - Z_{it-1}) + (e_{it} - e_{it})$$

Outcome variables:

- Net tuition revenue (per FTE)

Endogenous variables:

- Enrollment
- SAT
- Selectivity
- Percent minority
- Percent low-income
- Discount rate

Exogenous variables:

- State appropriations
- Tuition
- Demand elasticity

# Key findings

- Economic model is “well behaved”
  - Empirical evidence to support the theory
- Unfunded discounts are + associated with NTR
  - Aid may be leveraged to enhance revenues
- Unfunded aid faces the law of diminishing returns
  - This tipping point occurs around 13% discounts

# Conclusions & further research

- **Unfunded discounts have opportunity costs**
  - A dollar spent on unfunded disc is \$1 that could have been spent on teaching, research, or service
  - Is aid reducing “mission critical” resources?
- **Enrollment and revenue management goals are not mutually exclusive**
  - But only if cautiously designed and well targeted
  - How might results differ if need/no-need aid is included?
- **Institutions may want to discount more, but they can't**
- **Unfunded discounts threaten the financial wellbeing of institutions**
  - Pursuit of prestige will only exacerbate this trend
  - What are common characteristics of “inefficient” discounters?

# Thank you!

For a copy of this paper or presentation, please contact:

Nick Hillman

[Nick.Hillman@utah.edu](mailto:Nick.Hillman@utah.edu)

Assistant Professor

Educational Leadership & Policy

University of Utah

Salt Lake City, UT

# Additional material

Table 3: Descriptive statistics		
Variable	Mean	Std. Dev.
Net tuition revenue per FTE	\$5,952	2,428.99
Percent minority	0.267	0.1869
Median SAT	1,062	108.038
Selectivity (% admitted)	0.733	0.157
Percent poor	0.100	0.0498
State revenue per FTE	\$7,478	3599.16
Elastic (in)	0.499	38.72
Elastic (out)	-3.960	335.14
Enrollment (in)	9,847	7,735.70
Enrollment (out)	2,329	3,247.12
Tuition (in)	\$5,352	1,810.07
Tuition (out)	\$13,999	4,780.11
Funded discount rate	4.28%	4.87
Unfunded discount rate	11.57%	9.08

Table 4: F-statistics for first-stage 2SLS fixed effect estimate of instrument strength	
	F-statistic
Percent minority	406.45***
Selectivity (% admitted)	9.52***
Median SAT	99.28***
Enrollment (in)	97.07***
Enrollment (out)	27.98***
Percent poor	12.67***
Funded discount rate	16.59***
Unfunded discount rate	19.20***
Note: * p<.01, ** p<.005, *** p<.001	

**Table 5: Regression models explaining net tuition revenue per FTE, 2002-2008**

	Model 1	Model 2
Lagged net tuition revenue	0.811154 *** (.019)	0.7960124 *** (.021)
Elasticity (in)	-0.34737 (.464)	-0.142111 (.2672)
Elasticity (out)	0.528312 (.455)	0.0046026 (.0428)
Enrollment (in)	0.015507 *** (.004)	0.0115511 *** (.0033)
Enrollment (out)	0.05553 *** (.01)	0.0608698 *** (.0064)
Tuition (in)	0.187269 *** (.019)	0.1536294 *** (.0154)
Tuition (out)	0.000607 (.005)	0.0094432 (.0061)
Funded discount rate	83.42265 *** (13.569)	58.79905 (9.2134)
Funded discount rate (sq.)	-2.15761 *** (.313)	-2.232381 *** (.317)
Unfunded discount rate	13.20955 * (8.041)	14.39962 *** (7.1122)
Unfunded discount rate (sq.)	-0.69509 *** (.186)	-0.565899 *** (.1438)

**Table 5: Regression models explaining net tuition revenue per FTE, 2002-2008**

	Model 1		Model 2	
Selectivity (% admitted)	-		-230.4595	
			(180.7787)	
Percent minority	-		-246.942	***
			(159.2685)	
Median SAT	-		1.075266	***
			(.3953)	
Percent poor (AGI<\$30,000)	-		1579.868	**
			(431.971)	
State appropriations	-		-0.043463	***
			(.007)	
Constant	-210.515	***	-703.8609	
	(74.021)		(444.9405)	
Num. of groups	174		143	
Num. of instruments	73		99	
Post-hoc tests				
Arellano-Bond test for AR(1)	0.000	***	0.000	***
Arellano-Bond test for AR(2)	0.829		0.376	
Hansen J test statistic	0.002	*	0.426	
Difference-in Hansen	0.236		0.397	

Note: Small sample standard errors (Windmeijer, 2004) presented in parenthesis

Note: \* p<.01, \*\* p<.005, \*\*\* p<.001