Freshmen Teachers and College Major Choice: Evidence from a Random Assignment in Chile

Mohit Karnani (mkarnani@fen.uchile.cl), School of Economics and Business, University of Chile

Introduction

There is an important challenge for economists to quantify the effects of teachers on their students' outcomes, as usually students choose their teachers according to unobserved characteristics and therefore endogenously determine these "external" teacher-shocks that affect them and their decisions.

We exploit the exogenous characteristic of random freshmen course assignment in a large Chilean university to identify the causal effect of teachers and their qualitative characteristics over students' major choice. Using administrative records, we establish what makes students from the "Commercial Engineering" career chose an "Economics" over a "Business" major.

The Model

Consider that student i may choose between majoring in Business or in Economics. Denote the observed outcome Y_i as 1 if she chooses Economics and 0 if not. Suppose that there is a tacit net utility of choosing Economics over Business for student i and denote it as U_i. Thus, we have that

$$Y_i = \begin{cases} 1 \text{ iff } U_i > 0 \\ 0 \text{ iff } U_i \leq 0 \end{cases}, \tag{1}$$

i.e. student i is fully rational and will choose a major if and only if it yields a higher net utility than the other.

Now we impose some structure on U_i, letting it be

$$U_i = \beta_0 + \sum \beta_j T_{ij} + \mathbf{XB} + \varepsilon_i, \tag{2}$$

where T_{ij} is 1 if student i was assigned to teacher j in set J and 0 if not, $\mathbf{X}$ is a set of observed characteristics and ε_i is an unobserved error component. In this case, β_j may be interpreted as the effect of a non-specific shock received by a student from teacher j, just as we commented before.

Suppose now that $\varepsilon_i \sim N(0, \sigma_t^2)$, where t indexes years/cohorts. Then, substituting (2) in (1) we get

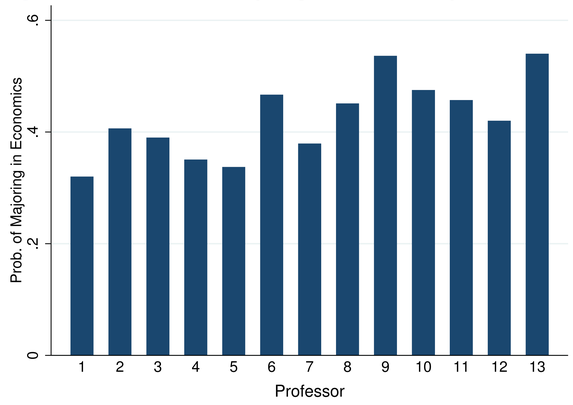
$$Y_i = \begin{cases} 1 \text{ iff } \beta_0 + \sum_{j\in J} \beta_j T_{ij} + \mathbf{XB} + \varepsilon_i > 0 \\ 0 \text{ iff } \beta_0 + \sum_{j\in J} \beta_j T_{ij} + \mathbf{XB} + \varepsilon_i \leq 0 \end{cases}.$$

But $\beta_0 + \sum_{j\in J} \beta_j T_{ij} + \mathbf{XB} + \varepsilon_i > 0$ is equivalent to stating that $\varepsilon_i > -\left(\beta_0 + \sum_{j\in J} \beta_j T_{ij} + \mathbf{XB}\right)$ and the odds of this event are equal to

$$\mathbb{P}\left(Y_i = 1 | \{T_{ij}\}_{j\in J}, \mathbf{X}\right) = \Phi\left[\left(\beta_0 + \sum_{j\in J} \beta_j T_{ij} + \mathbf{XB}\right)/\sigma_t\right],$$

where Φ is a cumulative standardized Gaussian distribution. Therefore, we finally obtain a reduced-form Probit model.

Figure 1: % of Students Majoring in Economics by Professor

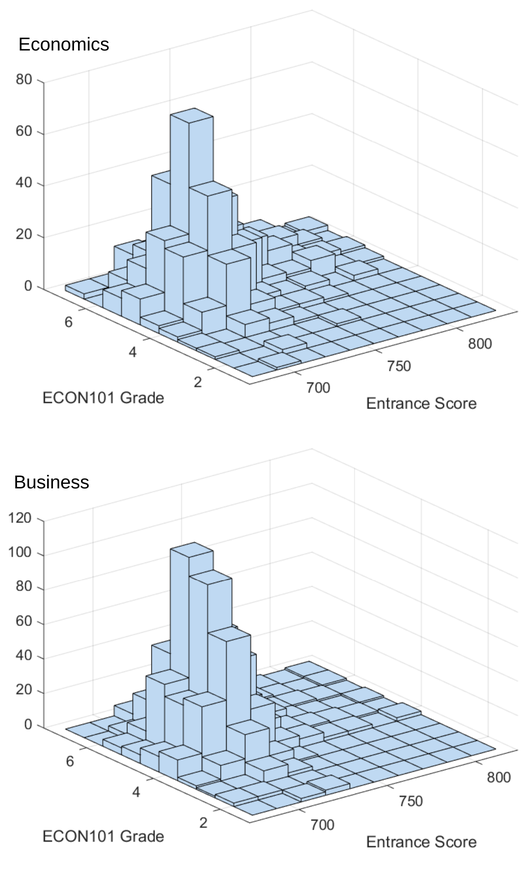


The Data

Table 1: Summary Statistics

Variable	Mean	S. D.	Variable	Mean	S. D.
Econ. Major	0.41	0.49	Prof. 2	0.04	0.20
ECON101 Grade	4.79	0.92	Prof. 3	0.07	0.26
Entrance Score	723.91	23.40	Prof. 4	0.14	0.35
Preference	1.49	0.66	Prof. 5	0.11	0.31
School GPA	6.41	0.26	Prof. 6	0.05	0.21
Week Days	1.30	0.46	Prof. 7	0.14	0.35
Failed ECON101	0.12	0.33	Prof. 8	0.07	0.25
Year 2006	0.10	0.30	Prof. 9	0.04	0.20
Year 2007	0.10	0.30	Prof. 10	0.13	0.34
Year 2008	0.11	0.31	Prof. 11	0.12	0.32
Year 2009	0.10	0.30	Prof. 12	0.03	0.18
Year 2010	0.13	0.34	Prof. 13	0.03	0.17
Year 2011	0.10	0.30	Block. 2	0.21	0.41
Year 2012	0.04	0.21	Block. 3	0.16	0.37
Year 2013	0.11	0.31	Block. 4	0.09	0.29
Year 2014	0.14	0.35	Block. 5	0.04	0.20
Observations	1829		Block. 6	0.05	0.22

Figure 2: ECON101 Grade and Entrance Score Bi-Histogram



Identification Strategy

Course assignment is random, conditional on program. As our sample consists uniquely in students of the Commercial Engineering career, our assignment is completely random. We estimate the following pooled Probit model:

$$Y_i = \beta_0 + \sum_{j\in J} \beta_j T_{ij} + \mathbf{XB} + \varepsilon_i, \tag{3}$$

where Y_{ij} is 1 if student i chooses economics as her major and 0 otherwise; T_{ij} is 1 if she is assigned to professor j in set J and 0 otherwise; $\mathbf{X}$ is a set of student and course covariates and ε_i is a well-behaved unobserved component.

We also use the responses to the Teacher Evaluation Survey proxying twelve characteristics of teachers. One may estimate their effects on major choice with the model described by

$$Y_i = \beta_0 + \sum_{j\in J} T_{ij} \cdot \left(\sum_{k\in K} \beta_k Q_{tjk}\right) + \mathbf{XB} + \varepsilon_i, \tag{4}$$

where Q_{tjk} is the average score (ranging from 1 to 7) for teacher j on characteristic $k \in K$ in cohort t (without student i).

Main Result

First semester ECON101 teachers may account for 15-22% of the probability of choosing Economics as a major. We also identify four relevant characteristics of these teachers that make Commercial Engineering students more prone to choosing this major.

Figure 3: ECON101 Grade and Entrance Score Densities

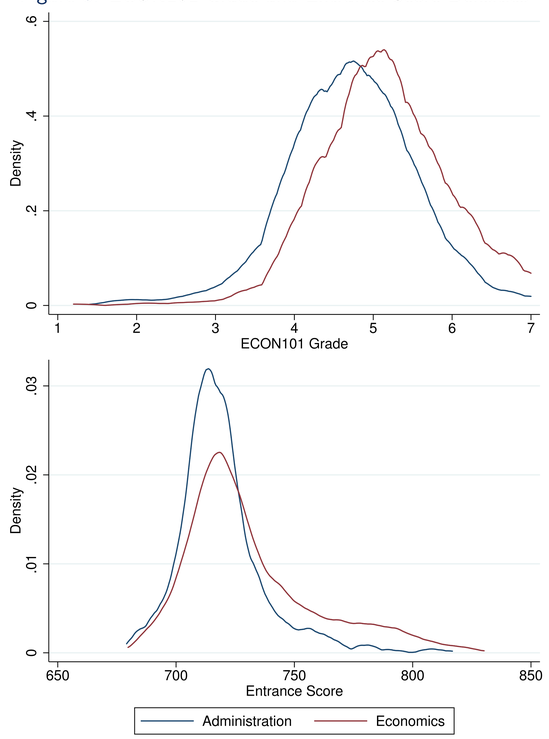


Table 2: Probit Estimates (Marginal Effects) of Model (3)

Econ. Major	(1)	(2)	(3)	(4)
Professor 2 (d)	0.0912	0.0252	0.0188	0.0191
	(0.0897)	(0.0815)	(0.0751)	(0.0749)
Professor 3 (d)	0.0742	0.0634	0.0581	0.0583
	(0.120)	(0.154)	(0.149)	(0.148)
Professor 4 (d)	0.0328	0.0565	0.0836	0.0841
	(0.0860)	(0.105)	(0.0999)	(0.1000)
Professor 5 (d)	0.0186	0.0351	0.0619	0.0623
	(0.0813)	(0.101)	(0.0959)	(0.0955)
Professor 6 (d)	0.152	0.129	0.132	0.132
	(0.136)	(0.148)	(0.140)	(0.140)
Professor 7 (d)	0.0629	0.0519	0.0853	0.0856
	(0.0925)	(0.101)	(0.0931)	(0.0926)
Professor 8 (d)	0.136	0.123	0.124	0.123
	(0.0874)	(0.112)	(0.107)	(0.105)
Professor 9 (d)	0.220**	0.214**	0.214**	0.215**
	(0.0994)	(0.107)	(0.101)	(0.101)
Professor 10 (d)	0.160*	0.153*	0.154*	0.154*
	(0.0887)	(0.0931)	(0.0879)	(0.0884)
Professor 11 (d)	0.142**	0.161*	0.168**	0.168**
	(0.0716)	(0.0875)	(0.0819)	(0.0824)
Professor 12 (d)	0.105	0.132	0.120	0.120
	(0.0863)	(0.113)	(0.109)	(0.108)
Professor 13 (d)	0.223*	0.228*	0.215	0.215
	(0.123)	(0.126)	(0.131)	(0.131)
Failed ECON101 (d)			-0.236***	-0.236***
			(0.0433)	(0.0439)
School GPA				0.00258
				(0.0374)
Block Controls	NO	YES	YES	YES
Observations	1561	1561	1561	1559

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Probit Estimates (Marginal Effects) of Model (4)

Econ. Major	(1)	(2)	(3)	(4)
Shows Confidence	-0.0366	-0.0189	-0.00832	-0.00224
	(0.128)	(0.127)	(0.125)	(0.127)
Prepares Classes	0.0202	0.00787	0.0353	0.0228
	(0.0736)	(0.0829)	(0.0845)	(0.0876)
Exposes Clearly	-0.0327	-0.0355	-0.0468	-0.0479
	(0.140)	(0.158)	(0.160)	(0.160)
Solves Doubts	-0.0963	-0.0802	-0.0926	-0.0925
	(0.185)	(0.195)	(0.194)	(0.194)
Promotes Discussion	-0.122	-0.110	-0.0867	-0.0890
	(0.112)	(0.107)	(0.106)	(0.107)
Allows Sharing Ideas	0.305**	0.264*	0.276**	0.276**
	(0.146)	(0.136)	(0.133)	(0.136)
Stimulates Interest	0.199***	0.213**	0.210**	0.211**
	(0.0769)	(0.0972)	(0.0966)	(0.0966)
Evaluates Fairly	0.142***	0.149**	0.125**	0.132**
	(0.0551)	(0.0704)	(0.0593)	(0.0593)
Shows-up Punctually	-0.0434	-0.0312	-0.0315	-0.0256
	(0.0629)	(0.0685)	(0.0695)	(0.0694)
Meets Deadlines	0.00697	-0.00686	-0.0103	-0.0123
	(0.0333)	(0.0446)	(0.0483)	(0.0476)
Treats Respectfully	-0.280***	-0.293***	-0.307***	-0.308***
	(0.104)	(0.113)	(0.107)	(0.105)
Is Available	-0.00122	0.00390	-0.00170	-0.00310
	(0.0635)	(0.0711)	(0.0713)	(0.0717)
Failed ECON101 (d)			-0.235***	-0.235***
			(0.0373)	(0.0376)
School GPA				-0.00538
				(0.0430)
Block Controls	NO	YES	YES	YES
Observations	1540	1540	1540	1539

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$