Constrained School Choice and the Demand for Effective Schools

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General Issue

- Choosing a school is an important decision parents make regarding their children's human capital
  - An increasing number of school systems have adopted centralized mechanisms that allow for some parental choice
  - Depending on the mechanism's incentive properties, observed applications may or may not reflect parental preferences (e.g., Boston, DA with length constraint)
- Understanding parental preferences is critical for evaluating policy reforms
  - For example, consider a setting where seats are allocated through a one-shot exam and there is an application length constraint, but policymakers wish to transition to a system of unrestricted choice and lotteries
- The effects of such a policy depend on:
  - Whether parents value school effectiveness in short (i.e., test scores) and long-term outcomes (i.e., wages), or they just care about prestige (i.e., peer quality)

This Paper

Secondary school admission in Barbados:

- Rank-Ordered Lists (ROLs) have a length constraint
- Priority index relies on a one-shot exam
- Matching algorithm is the serial dictatorship

Questions:

- Does the length constraint affect ROLs and assignments?
- Do parents value school effectiveness in test scores and wages after controlling for peer quality?

Intuition

- Consider an economics job market candidate applying to academic jobs
- Suppose there is a constraint such that the applicant can at most apply to three academic jobs
- Assume that universities A, B, and C are the most selective and also have the highest quality
- Would the applicant include these schools in her application list?
- Imagine we observe data on applications and conclude that applicants do not value university quality
- Is this informative for a market where the applicant is free to choose?

Preview

1. Policy change: tighten length constraint
   - Parents react by ‘skipping the impossible’
   - Pay-off irrelevant: no effect on assignments

2. Preferences for effectiveness
   - Assuming truth-telling:
     - Hastings et al., 2009; Burgess et al., 2015; Abdulkadiroglu et al., 2020; Ainsworth et al., 2023; Campos and Kearns, 2024
     - Parents do not value effectiveness when controlling for peer quality
   - Taking into account ‘skipping the impossible’ truncation:
     - Fack et al., 2019; Artemov et al., 2020
     - Parents value effectiveness even when controlling for peer quality

Education market in Barbados

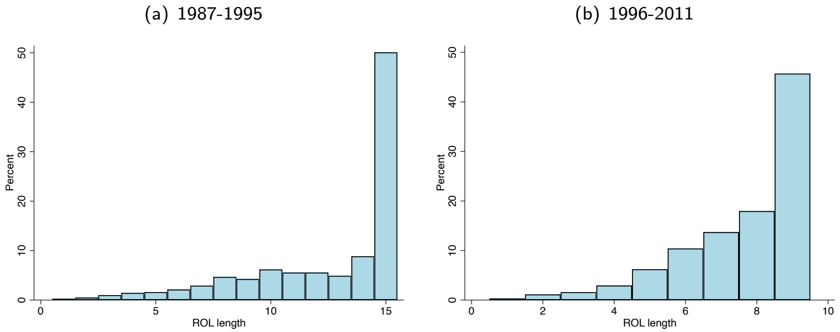
- At the end of primary school, parents submit ROLs for secondary school admissions
- Students take a one-shot standardized admission exam
- Serial dictatorship: order applicants by admission exam score, proceeding in order, assign each applicant to her most preferred school among the schools with available seats
- Gender quota: half the seats for boys and half for girls
- Policy change:
  - Before 1996 parents could list up to 15 schools in their ROLs, after 1996 they could could only list 9 schools
  - Schools ranked third to ninth were restricted to those within the geographical zone where the student resided

Data

- Applications
  - All applicants to secondary schools 1987-2011
  - 4,000 applicants per year, 120 primary schools, 22 secondary schools
  - Application lists, one-shot exam score, school assignment, admission cut-offs
- Outcomes
  - CSEC: end of secondary school exams that determine if a student qualifies for tertiary education Stats
  - 2016 Barbados Survey of Living Conditions: 2% survey of the population, information on wages (25-40 years old) Stats

Policy change

Figure: ROL length

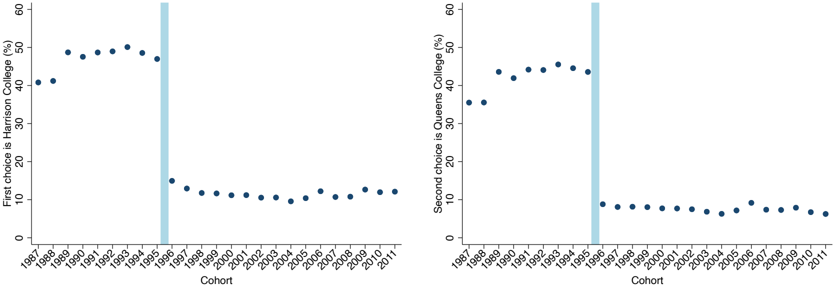


- Policy change in 1996 further constrained application lists length to nine
- Constraint is binding before and after the change

Applications: first and second choices

Figure: Most popular first and second choices

(a) Harrison College (b) Queens College

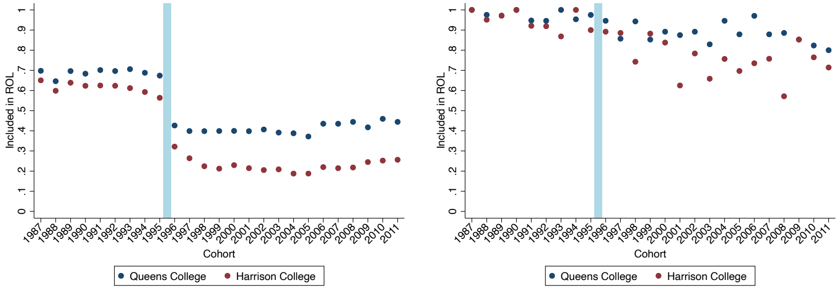


- Harrison College and Queens College are the two most demanded schools
- Proportion of parents listing them as first and second choices decreased (35pp)

Applications: included in list

Figure: Share of applicants to the most selective schools

(a) All applicants (b) Top scorers

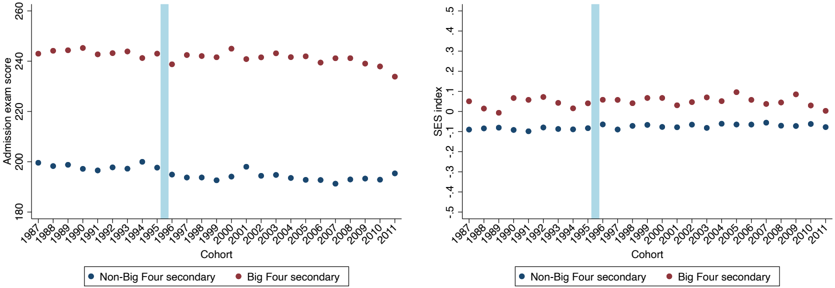


- Decrease in the share of parents that *include* HC and QC in their applications (30pp)
- DID: top scorers vs the rest (20pp)

Assignments: composition

Figure: Composition changes

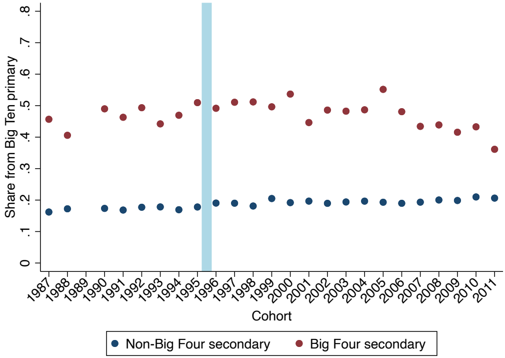
(a) Admission exam score (b) SES index



- Big Four: historically the four most prestigious and selective schools
- No change in skill or SES composition

Assignments: primary schools

Figure: Application list length 1996-2011



- 10/120 primary schools take half the selective seats
- Pay-off irrelevant: selective schools are out of reach for many

Preferences: model

Let U_{ij} be the indirect utility of parent i for school j:

$$U_{ij} = \underbrace{X_j'\rho + \xi_j + \lambda d_{ij}}_{V_{ij}} + \epsilon_{ij} = \delta_j + \lambda d_{ij} + \epsilon_{ij}$$

- $\delta_j = X_j'\rho + \xi_j$ measures average tastes for school j
- X_j is a vector of school characteristics (e.g., school effectiveness, peer quality)
- ξ_j is an unobservable school characteristic
- d_{ij} measures distance from student i to school j
- ϵ_{ij} is type I extreme value

Preferences: estimation

- Truth-telling: uses observed applications L

$$P(R_i = L) = \prod_{j \in L} \frac{\exp(\delta_j + \lambda d_{ij})}{\sum_{j' \nsucc_L j} \exp(\delta_{j'} + \lambda d_{ij'})},$$

- Stability: uses assignments, exam scores s_i, and admission cut-offs κ_j

$$\arg\max_{j \in \Omega_i} \quad U_{ij} \qquad\qquad \Omega_i = \{j : s_i \geq \kappa_j\}$$

$$Pr(S_i = j) = \frac{\exp\left(\delta_j + \lambda d_{ij}\right)}{\sum_{k \in \Omega_i} \exp\left(\delta_k + \lambda d_{ik}\right)}$$

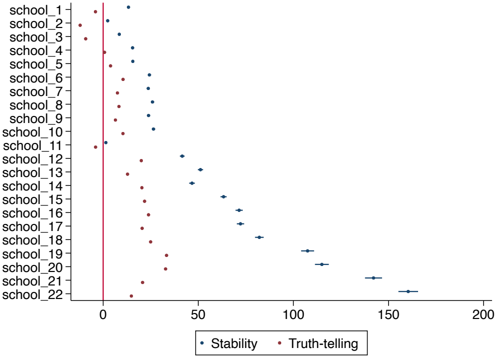
Example

Consider a market with five schools where parents can rank at most three. Assume schools A and B are the most selective and effective

- Preferences: $A \succ B \succ C \succ D \succ E$
- ROL=[C,D,E]; Match=[C]
- Truth-telling: $C \succ \{D, E, A, B\}$; $D \succ \{E, A, B\}$; $E \succ \{A, B\}$
- Stability: $C \succ \{D, E\}$

Estimates $\hat{\delta}_j$: 1987-1995 After

Figure: Average tastes in willingness-to-travel ($\frac{\delta_j}{\lambda}$)



- Truth-telling: not high average taste for selective schools
- Stability: highest average taste for the most selective schools

Effectiveness and peer quality

- We define potential outcomes:

$$Y_{ij} = \alpha_j + X_i'\beta + \eta_{ij}$$

- α_j measures effectiveness and we define peer quality Q_j as:

$$A_i = (1/J)\sum_j Y_{ij} \qquad Q_j = E[A_i \mid D_i = j]$$

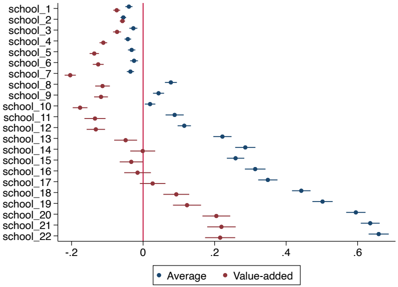
- Under selection-on-observables we obtain estimates from value-added specification:

$$Y_i = \sum_{j=1}^{J} \alpha_j S_{ij} + X_i'\beta + \epsilon_i$$

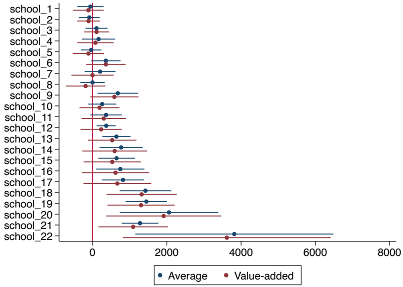
Estimates $\hat{\alpha}_j$ Correlations

Figure: Effectiveness estimates 1987-1995

(a) Qualified for tertiary



(b) Monthly wages



- Outcome averages overestimate school effectiveness
- The most selective are the most effective

Robustness $\hat{\alpha}_j$

- Control function CF
  - Allow for selection on unobservables using choice probabilities from choice model
- RD validation RD
  - Exploit admission discontinuities generated by serial dictatorship to assess bias
- Multivariate empirical bayes MEB
  - Combine estimates of school effectiveness on test scores and wages for shrinkage

Preferences, peer quality, and school effectiveness

$$\hat{\delta}_{jt} = \rho_{0t} + \rho_1 \hat{Q}_{jt} + \rho_2 \hat{\alpha}_{jt} + \xi_{jt},$$

Table: Preferences determinants: 1987-1995

	Qualified for tertiary		Qualified for tertiary (yearly)		Monthly wages	
	Truth-telling	Stability	Truth-telling	Stability	Truth-telling	Stability
$\hat{Q}_j$	0.944***	0.474***	0.978***	0.779***	0.793***	0.475***
	(0.141)	(0.070)	(0.060)	(0.049)	(0.220)	(0.120)
$\hat{\alpha}_j$	-0.117	0.555***	-0.084	0.345***	0.017	0.562***
	(0.196)	(0.101)	(0.055)	(0.054)	(0.267)	(0.093)
Observations	22	22	194	194	22	22

- Assuming truth-telling, parents do not value school effectiveness after controlling for peer quality
- Under stability, parents value *both* school effectiveness and peer quality

Conclusion

- Schools matter for short and long-term outcomes
- Under a constraint in the length of ROLs, parents trade-off schools effectiveness for admission probabilities
- In this context, may ROLs show a lack of preferences for school effectiveness on test scores and wages even though parents do value school effectiveness
- In some centralized markets parents' effective choice sets are narrowly constrained in practice, and they recognize these limits
    - They do not need information, they need choice

Administrative data

◂ Back

Table: Summary Statistics

BSSEE cohorts:	1987-1995	1996-2011
	(1)	(2)
Panel A: Administrative Data		
Female	0.50	0.50
	(0.50)	(0.50)
Admitted cohort size	160.57	154.74
	(49.54)	(46.53)
Took CSEC	0.56	0.75
	(0.50)	(0.43)
Qualified for tertiary	0.21	0.30
	(0.41)	(0.46)
Observations	37,074	58,317

Survey data ◂ Back

Table: Summary Statistics

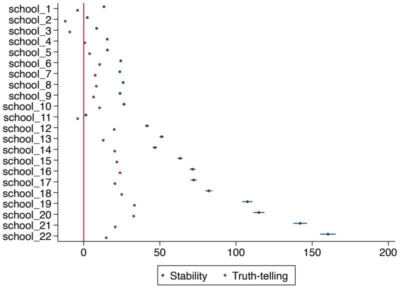
BSSEE cohorts:	1987-1995	1996-2011
	(1)	(2)
Panel B: Matched Survey Data		
Years of education	10.76	11.81
	(4.52)	(4.22)
Completed secondary school	0.75	0.83
	(0.43)	(0.37)
University degree	0.16	0.20
	(0.37)	(0.40)
Employed	0.76	0.76
	(0.43)	(0.43)
Monthly wage (2016 US$)	1,423.82	1,121.37
	(1074.91)	(806.02)
Observations	516	424

Estimates $\hat{\delta}_j$: before and after policy change

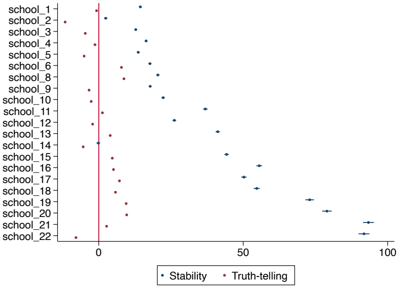
◂ Back

Figure: Average tastes in willingness-to-travel ($\frac{\delta_j}{\lambda}$)

(a) 1987-1995



(b) 1997-2011



- Truth-telling: after the policy change, negative taste for the most selective school
- Stability: parents prefer the most selective schools

Estimates $(\hat{\alpha}_j, \hat{Q}_j)$ Back

Table: Effectiveness, peer quality, and selectivity

	$\hat{\alpha}_j^{test}$	$\hat{\alpha}_j^{wage}$	$\hat{Q}_j^{test}$	$\hat{Q}_j^{wage}$	κ_j
$\hat{\alpha}_j^{test}$	1.00				
$\hat{\alpha}_j^{wage}$	0.81	1.00			
$\hat{Q}_j^{test}$	0.76	0.73	1.00		
$\hat{Q}_j^{wage}$	0.65	0.61	0.94	1.00	
κ_j	0.78	0.74	0.99	0.89	1.00

- School effectiveness is positively correlated with selectivity
- Effectiveness in test scores is positively correlated with effectiveness in wages

Robustness: control function

Back

$$E[Y_i \mid X_i, D_i, S_i = j] = \alpha_j + X_i'\beta + \sum_{k=1}^{J} \psi_k \lambda_k(X_i, D_i, \Omega_i) + \varphi\lambda_j(X_i, D_i, \Omega_i)$$

- For j chosen:

$$\lambda_j = -ln(P_j)$$

- For j' not chosen:

$$\lambda_{j'} = \frac{P_{j'} ln(P_{j'})}{1 - P_{j'}}$$

Robustness: multivariate empirical Bayes

Back

- We estimate the two outcome equations as a system (SUR)
- We use the covariances across effectiveness estimates for shrinkage

$$Y_{ik} = \sum_j \alpha_{jk} S_{ij} + X_i' \beta_k + \epsilon_{ik}, \quad k \in \{test, wage\}$$

$$\alpha_j^* = (V_j^{-1} + \Sigma_\alpha^{-1})^{-1} (V_j^{-1} \hat{\alpha}_j + \Sigma_\alpha^{-1} \mu_\alpha)$$

- α_j^* borrows strength across multiple outcomes as well as across the ensemble of schools when predicting any one of the outcome-specific effectiveness parameters

Validation: admission discontinuities ◂ Back

- We take advantage of the system discontinuities and derive p_{ij} as a matrix that only takes 3 values: 0, 0.5, 1
- Individuals with $p_{ij} = 0.5$ have ROLs and admission scores such that within a bandwidth they are effectively randomized into schools

$$
\begin{aligned}
Y_i =& \kappa_0 + \phi \hat{Y}_i + \sum_p \sum_j \kappa_{jp} \mathbb{1}[p_{ij} = p] + e_i \\
\hat{Y}_i =& \pi_0 + \sum_j \pi_j S_{ij} + \sum_p \sum_j \omega_{jp} \mathbb{1}[p_{ij} = p] + v_i
\end{aligned}
$$

	Uncontrolled	Value-added
$\hat{\phi}$	0.827	0.961
	(0.024)	(0.027)
Forecast (p-val)	0.000	0.144
Overid. (p-val)	0.000	0.030