Siblings in Centralized School Choice: Preferences over Joint Allocations, Information, and Design

Tomas Larroucau coauthors

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Outline

- Motivation from Market Design and IO (preferences over bundles)
- Chilean SAE rules for siblings & information policy
- Stylized facts (admin + surveys)
- Model: Family utility over joint allocations with complementarities
- Strategic incentives: static and dynamic (explicit)
- Identification & estimation (RP+SP integrated; survey-aided)
- Counterfactuals and policy design

Motivation

- Market design: school choice mechanisms typically elicit preferences over *individual* matches; families with multiple children value *bundles of assignments*.
- IO: identification of preferences over bundles is hard with revealed-preference data alone; surveys can discipline primitives and beliefs.
- Our setting: Chile's SAE allows a *family application* option that couples two lists $\Rightarrow$ quasi-bundles with a well-defined mechanism.[1]
- We combine administrative data, a large-scale information intervention, and targeted surveys to identify complementarities across children and belief formation.

[1] See official rule descriptions and diagnostics in our MINEDUC reports.

Related literature

Market design & school choice: Abdulkadiroğlu and Sönmez (2003); Hatfield and Milgrom (2005); Agarwal and Somaini (2018); Azevedo and Leshno (2016).

Preferences over bundles in IO: multi-product/bundling identification, e.g., Crawford and Yurukoglu (2012).

Eliciting structural primitives with surveys: stated beliefs/choices to discipline models Wiswall and Zafar (2015).

This paper: preferences over *joint child allocations*, belief formation and policy using admin + surveys in a centralized mechanism with a family-application option.

SAE sibling rules (concise)

- **Sibling priorities:** (i) static (enrolled sibling), (ii) dynamic (older assigned this year $\Rightarrow$ younger priority next year).
- **Family application:** if selected and there is a common school, when the older child is assigned to s the younger child's list is modified to place s at the top (does not guarantee joint assignment).
- **Same-level siblings:** same lottery number in common schools.
- **Information policy (2023):** personalized "cartilla" showing event-level and aggregated probabilities under $\{$family, individual$\}$ options; low take-up for the dynamic module.

Stylized facts (admin + surveys)

- Large incidence: ∼25–30% of applicants have a sibling applying simultaneously.
- Understanding is limited; misperceptions about family application and guaranteed-seat interaction.
- Many families display strong complementarities: a sizable share prefer being together in a lower-ranked school over being separated in higher-ranked schools.
- Information nudges shift the choice between family vs individual application and modestly de-bias beliefs.

Model: family utility over joint allocations

Let the joint allocation be $y = (s_1, \ldots, s_K)$. Utility:

$$U(y;\theta) \;=\; \sum_{k=1}^{K} \left[\alpha^\top X_{s_k,k} - \lambda \cdot \mathrm{dist}(s_k) + \eta_k(s_k)\right] \;+\; \gamma \cdot \mathbf{1}\{s_1 = \cdots = s_K\} \;-\; \delta \cdot \mathrm{coord\_cost}(y)$$

- γ captures complementarities (togetherness); δ collects disamenities from cross-campus logistics.
- $\eta_k(\cdot)$ are child-specific unobserved taste shocks.
- Mechanism maps submitted lists into a distribution over y.

Strategic incentives (static)

Claim. Under family non-separable preferences ($\gamma \neq 0$), DA is not SP for families.

Example (2 children, 2 schools A, B, cap.=1 each).

- Child 1: $A \succ B$. Child 2: $B \succ A$. Family: (A, A) or $(B, B) \succ$ separation.
- Truthful lists yield (A, B). By profitable misreport (swap), (A, A) or (B, B) occurs with positive probability and strictly higher family welfare.

Implication: truthful reporting at the individual level need not implement truthful family preferences.

Strategic incentives (dynamic; explicit)

Channels.

- *Priority stock creation:* placing the older child in s today raises the younger's priority at s next year.
- *Option value of a guaranteed seat:* accept/reject today interacts with the younger's guaranteed seat and next year's choice set.
- *Belief spillovers:* current lists/acceptance convey information for next year's joint options under DA.

Even if DA is static-SP, families face dynamic incentives to manipulate current reports and acceptance to improve the future sibling priority and joint-hit probability.

Dynamic environment: state and timing

State at t: $x_t = (\mathcal{S}_t, \text{grades/ages}, \Pi_t, \pi_t^{\text{bel}}, c_t)$ where

- $\mathcal{S}_t$: feasible common schools and capacities; Π_t: sibling-priority stock per school from past allocations;
- π_t^{bel}: beliefs about event probabilities under $\{$family, individual$\}$;
- c_t: outside options (guaranteed seat), logistics.

Within t: submit lists (family vs individual), mechanism $\Rightarrow$ allocation y_t, accept/reject.

Law of motion: $\Pi_{t+1}(s) = \mathbf{1}\{\text{older assigned to } s \text{ in } t\}$; beliefs update with feedback (cartilla, outcomes).

Identification & estimation (integrated RP + SP)

Likelihood. Families choose lists and acceptance to maximize expected $U(y;\theta)$ under perceived allocation probabilities $\pi(y \mid \sigma)$.

$$\mathcal{L}(\theta,\phi) \;=\; \prod_i p_{\mathrm{DA}}(y_i^{\mathrm{obs}} \mid X_i;\theta,\phi) \;\times\; \prod_i L^{\mathrm{EL}}(r_i \mid X_i;\theta) \;\times\; \prod_i g\left(\hat{\pi}_i - \pi_i^{\mathrm{perc}}(\cdot \mid \sigma_i;\phi)\right).$$

- p_{DA}: revealed-preference component from realized joint allocations (admin).
- L^{EL}: *Exploded Logit* on survey rankings of joint outcomes (Beggs et al., 1981).
- $g(\cdot)$: belief moments mapping elicited probabilities $\hat{\pi}$ to perceived probabilities via a misperception map $\pi^{\mathrm{perc}} = h_\phi(\pi^{\mathrm{true}})$ a la Wiswall and Zafar (2015).

Alternative (survey-heavy) identification

- Treat survey rankings of joint allocations as truth-telling for the relevant local menus; estimate θ from L^{EL} alone.
- Add belief equations using elicited probabilities on $\{$together, separated, at least one unmatched$\}$ under $\{$family, individual$\}$.
- Use admin data only to (i) map menus and mechanism probabilities, (ii) anchor logistics/guaranteed-seat parameters and dynamic transition moments.

Pros: transparent, fast, robust to strategic behavior in admin data. **Cons:** external validity beyond surveyed menus; requires careful treatment of focality and framing.

Counterfactuals (sketch)

- Mechanism variants: disable/enable family application; alter priority weights; togetherness tie-breaking.
- Information design: *cartilla* scope and timing; dynamic-module targeting.
- Medium-run dynamics: creation of sibling-priority stock via acceptance policies.

References I

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State, decisions, and transitions (formal)

Let t index admission cycles. For a two-child family ($k \in \{1, 2\}$) define:

- State $x_t = (A_t, \Pi_t, c_t, \pi_t^{\text{bel}})$: admissible menus A_t; sibling-priority stock Π_t; outside options/coordination costs c_t; beliefs π_t^{bel}.
- Decision $\sigma_t \in \{\text{family}, \text{individual}\} \times$ lists; acceptance/re-enroll rules after assignment.
- Transition: $\Pi_{t+1}(s) = \mathbf{1}\{\text{older assigned at } s\}$; A_{t+1} via observed cutoffs/capacities and guaranteed-seat rules.

Per-period payoff is $U(y_t; \theta)$ from the main deck; families are forward-looking with discount β.

Dynamic problem

Value function:

$$V(x_t) \;=\; \max_{\sigma_t}\; \mathbb{E}\big[\, U(y_t;\theta) \;+\; \beta V(x_{t+1}) \,\big|\, x_t, \sigma_t \big].$$

Beliefs used to forecast y_t are $\pi^{\text{perc}}(\cdot \mid x_t, \sigma_t; \phi)$, linked to objective probabilities via a misperception map. Acceptance choice affects both immediate payoff and the evolution of Π_{t+1} and A_{t+1} (guaranteed seats).

RP–SP integrated estimation

Observed data:

- Admin: lists, assignments y, accept/reject, guaranteed-seat status, sibling relations.
- Surveys: (i) rankings of joint outcomes; (ii) stated probabilities under {family, individual}; (iii) strategic adjustments if single-child.

Components:

1. *Exploded Logit* on joint-outcome rankings to pin down θ (including γ, δ).
2. Belief moments $g(\hat{\pi} - h_\phi(\pi^{\text{true}}))$ to identify ϕ (bias/attenuation, noise).
3. RP block $p_{\text{DA}}(y^{\text{obs}} \mid x; \theta, \phi)$ using the known mechanism to link (θ, ϕ) to frequencies of events.

Estimation by MLE/GMM or a pseudo-likelihood that stacks (1)–(3) with analytic gradients.

Measurement & moments (examples)

Belief moments. For each family i and option $o \in \{\text{fam}, \text{ind}\}$ we observe $\hat{\pi}_{io}^{(\text{together})}$, $\hat{\pi}_{io}^{(\text{sep})}$, $\hat{\pi}_{io}^{(\text{unm})}$ with $\sum \hat{\pi} = 1$. Map:

$$\pi_{io}^{\text{perc}} \;=\; h_\phi(\pi_{io}^{\text{true}}) \;=\; \text{softmax}\big(\phi_0 + \phi_1 \log \pi_{io}^{\text{true}}\big)$$

and match means/variances across cells; include cartilla-exposure shifters (information treatment) in ϕ.

RP moments. Frequencies of (i) together at new school, (ii) together at guaranteed seat, (iii) separated, by menus and priority bins.

Computation (sketch)

- Mechanism simulator: from submitted lists and priorities, compute event probabilities under $\{$family, individual$\}$, with guaranteed-seat logic.
- DP simplification: small T and limited changes in menus allow finite-horizon or 2-period approximation (current cycle $+$ one look-ahead via Π_{t+1}).
- Gradient-based estimation with automatic differentiation for EL and belief blocks; RP block via simulation.