

Schools and Their Multiple Ways to Impact Students: a Structural Model of Skill Accumulation and Educational Choices

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Motivation

- Identifying well-functioning and failing schools is a long standing preoccupation for policy-makers (and parents). Many countries rely on **standardized tests** to monitor school quality
→ USA (NCLB), UK (League tables), Italy (Invalsi), Catalonia/Spain (Consell d'Avaluació)
- Is school ability to raise performance a sufficient measure of school capability to improve all relevant **educational outcomes**?

Public middle schools in **Barcelona, Spain**:

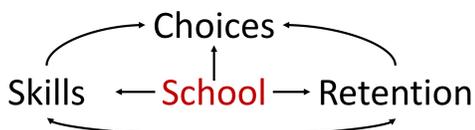
- 17% of students **drop out** before completing lower secondary education
- 35% do not enroll in academic **high school**
- Large variation across schools, after controlling for students' characteristics

This paper

Does the school attended matter for student outcomes, particularly their **educational decisions**? Are the effects **heterogeneous** across socio-economics?

Dynamic structural model of student cognitive skills accumulation and educational choices

- Students are the decision makers
- School inputs are **heterogeneous** along several dimensions:
 - value added to cognitive skills
 - grade-repetition policies
 - "motivation" to pursue further studies



Estimation approach builds on Arcidiacono et al 2016

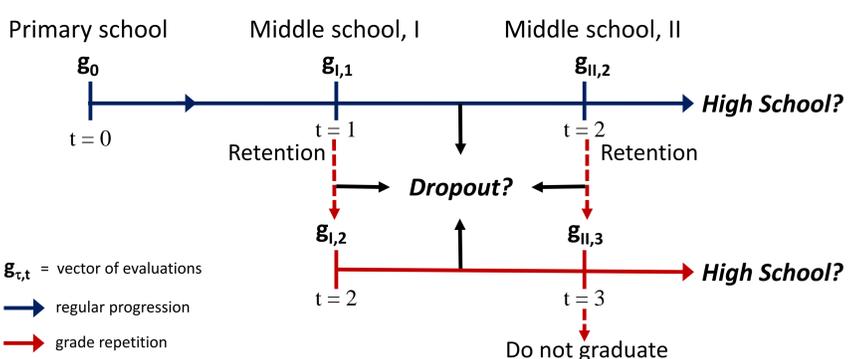
Institutional setting and data

Focus on 47 public middle schools in Barcelona

- Lower secondary education (middle school) → grades 7-10
 - Grade **repetition** very common (25% are behind at age 15)
 - Education mandatory until **age 16**
 - Students **choose** to stay or **dropout** before completion
- Academic upper secondary education (high school) → grades 11-12
 - **Choice**: free and granted access after middle school graduation
 - Completion gives direct access to college

Administrative data: enrollment from primary to high school, socio-demographics, evaluations (GPA and region-wide tests) for two cohorts of students

Model at a glance



Cognitive skills of student i attending school s in level τ at time t

$$C_{\tau,it} = \alpha_{\tau} C_{\tau-1,i} + \underbrace{\mu_{\tau} h_i + x'_{it} \beta_{\tau}}_{\text{individual characteristics}} + \underbrace{\rho'_{it} \theta_{\tau} + A_{is}}_{\text{school environment}} + \underbrace{g_{\tau,it}}_{\text{observed evaluation}}$$

unknown ability peers school value added

Grade repetition

$$\text{fail}_{\tau,it} = 1 \iff v_{\tau t} \hat{C}_{\tau,it} + x'_{it} \eta + \underbrace{\rho'_{it} \zeta + \mathcal{F}_s}_{\text{school leniency}} + e_{it} \geq 0$$

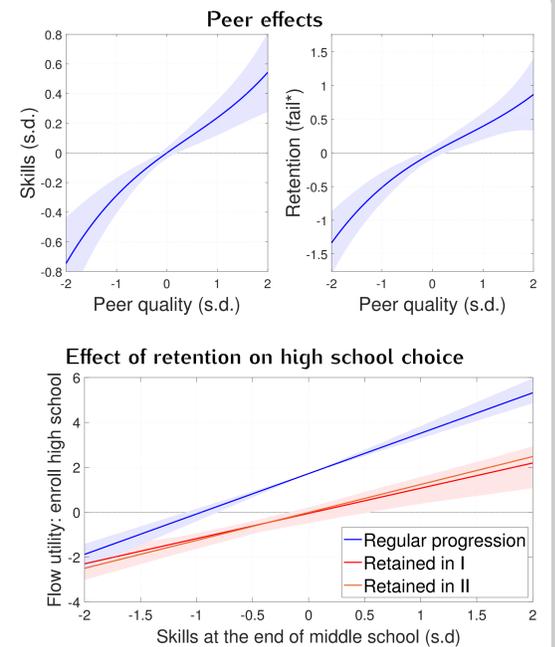
Educational choices. Students are forward looking agents with imperfect information

flow utility:

$$U_{\tau,it} = \phi_{\tau t} \hat{C}_{\tau,it} + x'_{it} \kappa_{\tau} + \underbrace{\rho'_{it} \pi_{\tau} + \mathcal{I}_s}_{\text{school motivation}} + e_{it}$$

Results

- Cognitive skills** are increasing in
 - ability h (half of total variance)
 - parental education → up to 1 s.d.
 - peer quality
 - school input \mathcal{A} → IQR=0.4 s.d
 - repeating the grade
- Retention probability** lower for
 - female and high SES
 - lower quality peers
 - IQR school input $\mathcal{F} \sim 0.4$ s.d. higher cognitive skills
- Choices**
 - Flow utility always lower for retained students
 - IQR school inputs $\mathcal{T} \sim 0.5$ s.d. higher cognitive skills



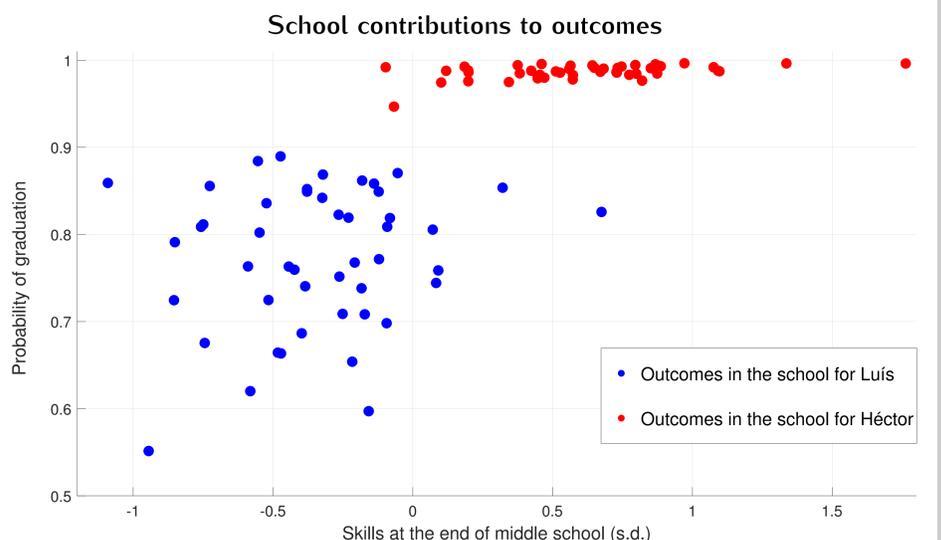
Simulations

Two (fictional) students about to start lower secondary education:

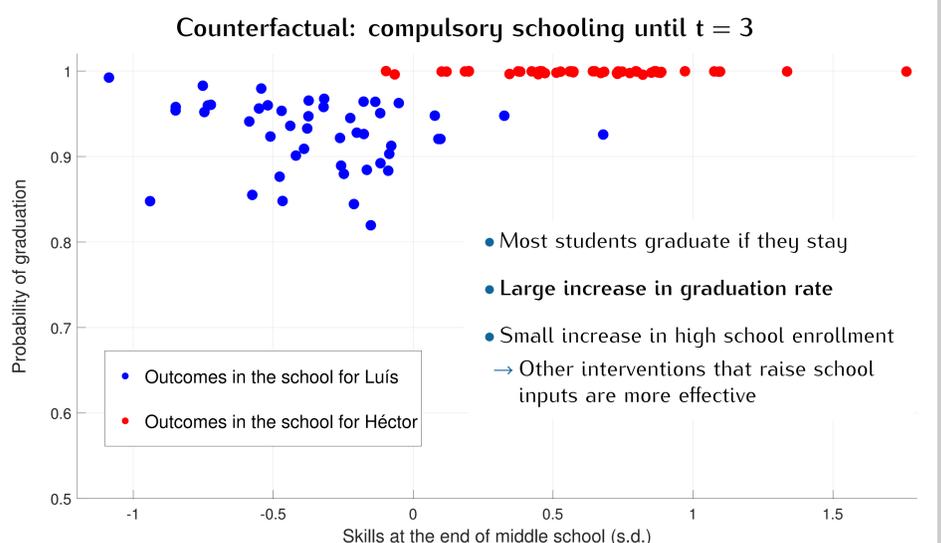
- Luís** has low educated parents. **Héctor** has highly educated parents
- Other characteristics are identical and they have average innate ability

What outcomes would they have in each middle school in Barcelona?

- I use the model to simulate their cognitive skills development, retention events, and choices



- School environment** is important for cognitive skills of both students
- It matters a lot for the **attainment** of Luís (low SES), not so much for Héctor (high SES)
- Schools that raise performance do not necessarily increase attainment**
- Measuring school quality using only the x-axis may be harmless for Héctor, but it overlooks very relevant information for Luís



- Most students graduate if they stay
- Large increase in graduation rate**
- Small increase in high school enrollment
 - Other interventions that raise school inputs are more effective