

Chile has a **market-based educational system**, where people can choose among public, private voucher, or private fee-paying schools. Since the 1990s, **public school enrollment has decreased** (Bellei 2009). We analyze the **mechanisms driving the decline in public school enrollment** using an ABM. We found that a previously overlooked mechanism — **the differences in the grade levels offered by public and private voucher schools** — had the **largest influence on the declining trend**.

## I. The ABM

We implemented an ABM representing a city's **school system** in Netlogo. It depicts households and schools (see Figure 1). Each iteration represents a school year, where processes described in Figure 2 occur. The ABM **simulates the period between 2004 and 2016**.

## II. Model's calibration and validation

We used **students, school and block data from four Chilean cities to calibrate the model** (data provided by the Chilean Ministry of Education, Agencia de la Calidad de la Educación, and the Chilean National Institute of Statistics). Parameters were estimated through **statistical tools**, or calibrated using **genetic algorithms**.

We compared the real-time trends between simulated data (**baseline scenario**) and real data for each city. The model achieves **relational equivalence**.

Fig1.Osorno

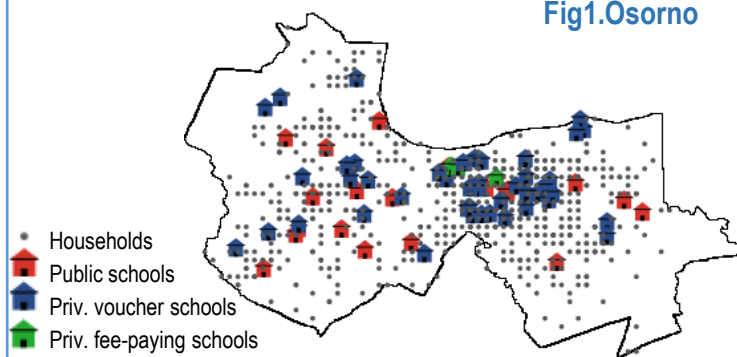
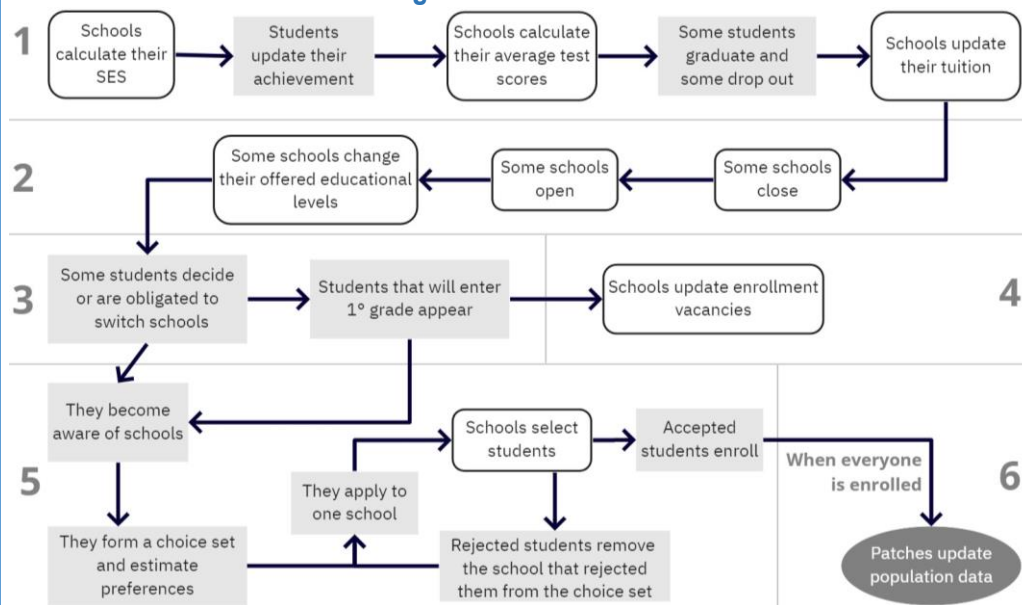


Fig2.A model's iteration



## III. Hypotheses and Experiments: Why did public enrollment decrease?

Many hypotheses have been proposed to explain the decrease:

**H1:** The **public sector has a limited capacity to open new schools** while the number of private voucher schools increased (Bellei 2009, Hsieh & Urquiola 2006) (Experiments 1 and 2).

**H2:** **Public schools have reduced their appeal** for parents (Razcynski et al.2010 & Zapata 2010) (Experiments 3 and 4).

**H3:** The **population** of age to attend **primary education** has **decreased** over time (Núñez et al. 2015) (Experiment 5).

**H4:** **The introduction of SEP program**, which implied free education for low-SES students attending public or private voucher schools participating in the SEP program (Experiment 6).

We propose two additional hypotheses:

**H5:** Most public schools offer mainly primary education, while **private voucher schools offer both primary and secondary education** (Experiments 7 and 8).

**H6:** **Population SES has increased**, raising the number of parents that can pay for private schools (Experiment 9).

We run 300 simulations for each experiment. Figure 3 shows the experiments and the public enrollment decline for the case of Osorno, one of the analyzed cities.

## IV. Results

- The **differences in the educational levels offered by schools** of different sectors (H5) seem to be the **main mechanism behind the decrease in public enrollment**.
- When the **population SES is stable** and the number of public schools increases in some cities (H6 and H1), the **public enrollment decline is less pronounced** than in the baseline case.
- Hypothesis 2, 3, and 4 have a limited effect only in some cities.

Our outcomes highlight how an **ABM can help to analyze temporal trends**, delving into the plausibility of alternative explanations.

Fig3. Mean Difference between public enrollment in 2016 and 2004. Comparison between experiments

