

Do parents *choose* the school for their children under the Boston Mechanism?: Evidence from Barcelona*

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VERY PRELIMINARY

Abstract

The Boston mechanism is a widely used mechanism in actual cities around the world to allocate children to schools. The mechanism provides strong incentives for families to exclude their most desired schools if they are overdemanding since not being accepted in your first choice reduces your chances of being admitted in any other school. The safest option is to apply to the neighborhood school, for which families are given priority. We exploit a policy change occurring in 2007 in Barcelona changing the definition of neighborhood schools, and show that families exclude any preferred option and apply to their safest option, that is their neighborhood school. This implies that parents' preferences have little to say in determining where their children will go to school.

Keywords: School Choice, Boston Mechanism, Neighborhood priorities

JEL Classification: C72, C78, D78, I20,

1 Introduction

In Barcelona, as in large number of cities around the world, families have to choose the school where their children will attend primary and elementary school and sometimes even secondary school and high school. In principle choice is warranted to children's families given the importance of this decision and its relevance to guarantee the equality of opportunity of the system. In education, as in other circumstances, there are different approaches

*We are very grateful to Jordi Baró, Isabel Darder, Francesc Iñiguez and Joan-Miquel Ragué for providing us with the children microdata. We are also grateful to Javier Asensio, Isaac Aparicio, Albert Esteve, Sabine Flamand and Diego Puga for helping us with the streetmap data from Barcelona. Anna Muñoz has provided outstanding research assistance. We also thank Antonio Ciccone and seminar participants at the Matching in Practice workshop in Brussels and the University of Edinburgh.

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that can be taken, both on parents and on schools' side, and the agreement between the two is crucial for the successful education of children. Choosing and being chosen is a productive symbiosis in itself. The psychologist Sheena Iyengar, from Columbia Business School, states in her book \The Art of Choosing\, describes how the performance in a task improves significantly when the task has been chosen by the individual. On the other hand, Antonio Cabrales and Brindusa Anghel, from Universidad Carlos III, in a chapter of the FEDEA monograph \Talent, effort and social mobility\, study the determinants of the success of primary schools in Spain and note that the participation of parents through the APMA (asociacion de madres y padres) is important determinant of the performance of a school. Victor Lavy, from the Hebrew University, shows, in study carried out in Israel, that allowing parents to choose the school for their children improves the performance of these children, compared to that of children from comparable neighborhoods where choice was not allowed. And last, but not least, eliciting preferences, families are implicitly evaluating the schools and forcing a regenerating process in the educational system.

In principle in Spain families can choose the school for their children. The problem is that often the number of families that wish to have a spot in a certain school exceeds the number of seats available in that school. Therefore a set of rules need to be determined to decide who should access the school and who should opt for a different alternative. The implementation of such choice procedure usually takes the following format: families submit a list with a ranking of schools for which they would like to opt following their preferences between february and march. Once the preferences are collected the allocations are determined following the set of norms and according to the submitted preferences. This set of norms generates a complicated strategic game for families are forced to play to determine the school for their children. The main problem that the current set of norms presents is that the optimal strategy for families is rarely stating true ranking of schools. Stating a modification of the true ranking can result in a being allocated to a better school than stating the true ranking. More importantly, the optimal strategy depends on information that families have. Therefore the optimality of their behavior and of their final allocation depends on the amount of information and the sophistication of families to process and understand that information.

Briefly the mechanism can be described as follows. Once lists with families' preferences have been submitted, all applicants are allocated to their first choice. If the number of applicants is larger than the number of seats for a certain school applicants are given points, following a scale that depends mainly on the existence of siblings in the school and distance to the school, and those applicants with higher number of points are accepted and the rest rejected. Ties in number of points are broken through a random lottery. Applicants rejected from their first choice opt for a seat in the next school in their submitted ranking *that has a free seat* after the previous round. If there are more applicants than free seats, spots are allocated randomly within the applicants. The process continues until all children have an assigned seat in some school.

The options of getting a seat in most of the schools is greatly reduced if rejected from your first choice. This forces families to exclude schools that they like but they think chances of being admitted are small. The risk of asking for an overdemanded school and

to be left with few spots in the remaining schools is too large for families to take. The problem can be illustrated through a simple example. Consider a family that lives in the district of school B , but its preferences are such that A is preferred to B , which in turn is preferred to C . Hence, $A > B > C$. If it submits the true ranking and school A is overdemanding, because it lacks the points of living in the neighborhood, it will most likely be rejected. If school B was filled up in the first round it will have to go to school C , and in any case, chances of getting in school B will be greatly reduced if the school has been demanded as a first choice. If instead, it submits a list with $B > C$ then it will be accepted in B given the priority it gets because of living in the neighborhood. Therefore, submitting a modified list the child gets a seat in a better school than submitting the true ranking. The importance of this problem needs an exhaustive analysis both at the theoretical and empirical level, which are at the center of this document.

This problem has been mostly investigated theoretically and experimentally, studying the strategic properties of these norms and of alternative sets of norms. The theory and experiments then suggest that individuals may best respond by excluding highly demanded schools and apply for a school for which they have a good chance of being admitted. If families are given priority for the schools in their neighborhood, those schools become easier to get accepted to. But families could potentially apply for other schools if they are not overdemanding by families in the neighborhood. If families tend to play it safe and ask for their neighborhood school, entering any other school will become harder since it is already demanded by families in their neighborhood. The extent to which this last equilibrium will occur or whether there will still be room for choice over and above the neighborhood school is yet to be determined and is the objective of this paper.

In 2007 there was a change in the district school design in Barcelona. Before 2007 the city was divided into 10 disjunct school districts that coincided with other administrative districts. All families living within a district had highest priority for all schools in that district (an average of 30 school per district). This design had two different problems: the first was that depending on the density of schools in a district the number of schools with highest points changed substantially for people living in different districts. On the other hand, one of the purposes of giving priority to families living in the area was to integrate families to the neighborhood and schools and minimize commuting, but with the district system families living on the border of two districts had higher priorities for further away schools and not for close by schools in many instances.

This led to the implementation of priority zones, where instead of there being some fixed districts, the set of schools changed for families depending on the specific address where families lived. An area around every address was established to include, at least, the six closest schools (3 public and 3 semi-public or *concertadas*). These priority zones change depending on the location of the family. What is crucial for our analysis is that the set of schools for which families have maximal priority changed with this policy change. Therefore the set of schools for which families can expect to be admitted and therefore should apply for when responding to the incentives provided by the mechanism have changed. First, the set of schools has been reduced for all families, changing from our 30 to around 6 schools.

So a large amount of schools that were of highest priority before are not of highest priority after 2007. For families living in the borders of the old districts not only some schools have been excluded from the set of highest priority schools, but also new schools that were not in the set before are in the set now. The change was implemented responding to a common rationale and can be thought of as an exogenous source of variation.

A first analysis of the submitted lists allows us to verify that the change has affected all families, in the sense that all families have at least seen their set of schools reduced. The degree of change varies from the set simply being reduced to more than sixty percent of the schools having changed with the policy change. The policy change then has affected all families in the city of Barcelona.

To identify the changes in behavior as a result of changes in incentives we assume that preferences that families have for the different schools have not changed in a systematic manner that coincides with the direction in which the incentives provided have changed. The set of schools for a given family change before and after 2007 but families choosing school are not the same. In fact families who appear for a second time over the years are excluded from our analysis, since having siblings in a given school gives a higher number of points than living in the neighborhood, and therefore changes incentives and preferences in a very special way. We therefore are left with a set of families that changes every year. Therefore, when we compare the behavior of families over time we assume that the distribution of preferences should be the same over time. We focus on certain aspects of families behavior to be able to aggregate it, derive some hypothesis that derive from the theory and from our knowledge of the specifics of Barcelona, and then we test them looking at the actual data.

Our preliminary results show that families restrict their choices to schools for which they have highest priority. That is, when the policy change is implemented, the proportion of families that apply for a school for which they had highest priority before the policy change but not after is reduced by more than 50%

2 The literature on *school choice* and the Boston Mechanism

The problem of assigning children to schools is a particular case of a more general, so called *two sided matching* problem, where indivisible elements of two sets (one in each side of the market) need to be matched. Examples of this kind of problems include situations like the marriage market, the assignment of students to college, of medical residents to hospitals, or of kidneys donors to recipients. The assignment can be done in a decentralized manner, where both "sides" look independently for their best match, or through a centralized process, where preferences are submitted by both sides and an algorithm determined by a set of norms decides the final matching, like in the case of school choice.

The process briefly described above and that will be at the center of this document is a centralized market. Gale and Shapley (1962) were the first to formalize a similar problem known as the *college admissions* problem. We have two sets of individuals, in that case seats in universities and students, that need to be paired. Individuals of both sides of the market

have preferences over the elements in the set in the other side of the market with which they need to be paired. In this type of markets there do not exist prices and therefore there need to be alternative rules to determine the final allocation. Alvin Roth (1984) studied the problem of assigning medical residents to hospital and started a long and influential literature in the field of market design for these types of markets.

In general the literature assumes that both sides of the market are strategic, in the sense that agents in both sides can submit a list of preferences that will determine the final allocation. Therefore, both sides are strategic because they have to decide the list to submit and can thereby affect the final allocation. The case of *school choice* is different because schools are not strategic, since they do not have a say in the final allocation of students. Schools' preferences are substituted by *priorities*, which determines for each school an order of the students depending mainly on whether they have siblings in the given school and whether they live in the school district. Therefore families are the only strategic agents in this two sided matching market to which school seats need to be allocated. Abdulkadiroglu y Sonmez (AER 2003) adapt the college admissions problem to the specifics of school choice. In particular, they analyze the properties of the Boston mechanism, which is extremely similar to the mechanism used in Barcelona and in many cities in Spain. They show that the mechanism is not *strategy proof*, meaning that it is not the best strategy for each individual to submit the true preferences, and that the optimal strategy depends on what other individuals are doing. Excluding some schools or changing the order may lead to a better allocation than being truthful.

2.1 Positive aspects of the Boston mechanism

The school choice mechanisms and the centralized matching procedures in general, only consider ordinal preferences. The intensities with which individuals value the different schools is ignored. When the literature analyzes the efficiency of the mechanisms, it only emphasizes Pareto efficiency. But recently Abdulkadiroglu, Che and Yasuda (AER2011) and Miralles (2009) show that the Boston mechanism captures cardinal preferences in a way that strategyproof mechanisms cannot. They show that in the case that all individuals have the same ordinal preferences but different cardinal preferences, and when there are no priorities, then only those who value the best school relatively more will be risking to include it as first choice in the submitted list, while the rest will manipulate the list by excluding their most desired school. Similarly, from the individuals left, only those that value the second best school more will include it as a first choice. In summary, only those valuing the school relatively more will apply for it as a first choice. With GS or TTC all individuals would have submitted the exact same list and therefore the allocation would have been random, ignoring individuals' cardinal preferences. Both papers ignore the presence of private schools, which would change the results in an undesirable manner, since it would lead to those families with a better outside option taking the risk and therefore applying for the best schools.

This aspect is important and provides a potential rationale to explain why this mechanism is used so widely, but this positive aspect only applies to a very special case and it is

not clear it compensates the problems described above.

3 Evidence from the natural experiment in Barcelona

The problem created in the Boston mechanism as a result of the large weight given to the first choice has been analyzed theoretically and experimentally, but the empirical relevance of this phenomena is still to be determined.

The main problem in empirically verifying whether families report their true preferences is that true preferences are not observable. 90% of the families get in their submitted first choice. This fact, published in the newspapers every year, is it a result of the school system adapting families preferences nicely, as the news seem to suggest, or of families understanding the incentives provided by the mechanism and responding optimally to it by carefully including as a first choice a school that they believe they can access?

To verify the veracity of the proposed hypothesis it is necessary to understand to what extent the submitted preferences correspond to the true families' preferences or if they are an optimal response to the incentives provided by the mechanism. A policy change occurring in Barcelona serves a natural experiment that allows us to provide a first answer to this issue.

3.1 The natural experiment in Barcelona

From the observed behavior we focus on whether the school they apply for as a first choice. In particular we track whether the school they apply for was of highest priority before and after 2007. For each individual, given the address of residence, we classify the schools as YY is they were of in their district school before 2007 and in their priority zone after

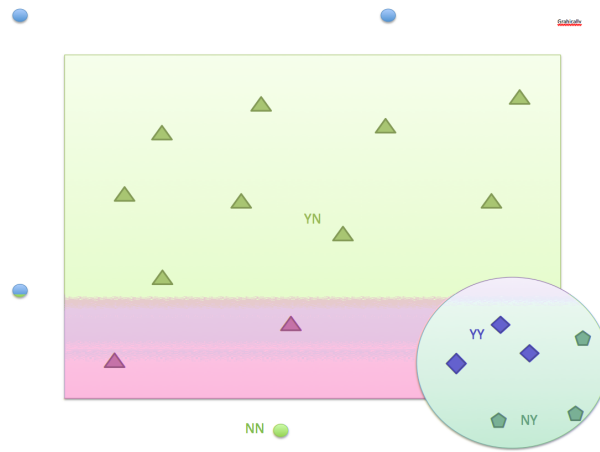


Figure 1: Classification of schools for a generic address

We therefore want to verify the following hypothesis:

Hypothesis 1: The proportion of families asking for the different types of schools should not change between the years 2005 and 2006, and neither between 2007, 2008, 2009 and 2010. The only change should happen between the year 2006 and 2007, when priority zones were implemented.

Hypothesis 2: The proportion of families that ask for schools of type YN should not increase between 2006 and 2007, given that those schools become less safe after the policy change.

Hypothesis 3: The proportion of families asking schools of type NY should not decrease between 2006 and 2007, given that those schools become safer to apply for after the policy change.

The following table shows the percentage of families applying for each type of school each year.

	2005	2006	2007	2008	2009	2010
NN	10.54	10.86	6.41	7.98	8.33	7.67
YY	63.26	61.07	71.28	72.68	72.06	71.93
YN	19.40	20.29	11.53	8.42	8.58	9.34
NY	6.8	7.78	10.78	10.9	11.03	11.06

Table 1: Percentage of families applying to each type of school every year

Table 1 shows that the three hypotheses are true. In particular, the proportion of families applying to YN school is reduced from 20% to 8-9% and the proportion applying for NY increase from 7% to 11%. These changes are significant. On the other hand, before and after 2007 the proportions for each type of school do not change, except for year 2007 where the proportion of schools of type NN seem smaller and for YN larger. But given

that 2007 is the first year with the new policy change it is acceptable for there to be some readjustments taking place.

The extent to which the policy affected families depends on how their district school intersected with their priority zone. We now present the analysis for the most extreme cases. The first case is the one in which the policy change has only reduced the set of schools with highest priority, which corresponds to families living at the center of the old district schools as represented in figure 2. In case 2, the new priority zone includes a high proportion of schools that were not in the district, that is, the case of families living on the frontier of the old district schools, as illustrated in figure 3.

Case 1: The set of schools with highest priority is reduced: families in the center of old district schools

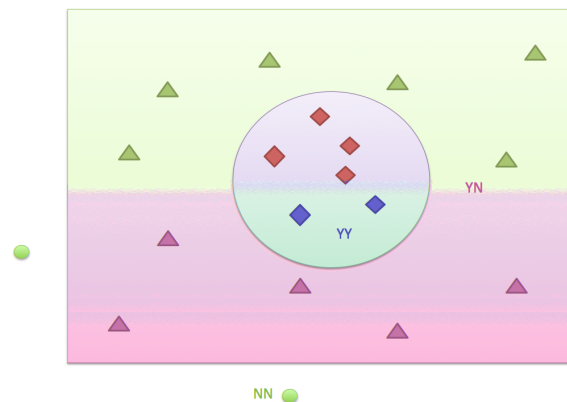


Figure 2: Policy effect for a family living in the center of the district school

Table 2 presents the results for families living in the center of the old district schools. These families do not have NY schools because the priority zone is a subset of the old district school. As the table shows the demand for schools YY is increased and the demand for YN is decreased from 18-19% to 7%.

	2005	2006	2007	2008	2009	2010
NN	8.01	8.99	5.36	6.68	6.44	5.78
YY	74.75	71.80	86.78	88.23	86.48	86.81
YN	17.24	19.21	7.81	5.09	7.08	7.36
NY	-	-	-	-	-	-

Table 2: Percentage in each type of school for families in the center of old district

Case 2: The set of schools changes: families living on the frontier of old district schools

Table 3 shows that these families tend to demand schools that are not of highest priority slightly more often: NN+NY before 2007 is relatively high, showing that the old system

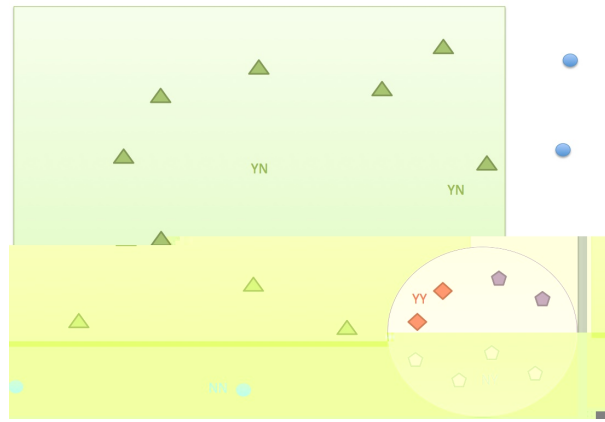


Figure 3: Policy effect for a family living on the frontier of old district

was not adequate for those families since close by schools were not of highest priority. But still, when the policy changes, their behavior changes significantly, reducing their demand for YN schools and increasing that of NY schools.

	2005	2006	2007	2008	2009	2010
NN	12.68	14.23	7.24	9.21	8.21	11.9
YY	34.15	26.92	29.61	30.96	37.14	35.71
YN	19.72	26.69	16.78	12.13	9.29	12.3
NY	33.45	36.15	46.38	47.7	45.36	40.08

Table 3: Percentage demands for families on the frontier of old districts

The change in policy in Barcelona allows of to conclude that families respond highly to the incentives offered by the mechanism. Although it does not show that families do not respond to their preferences it does suggest that the priority design greatly affects their behavior.

4 Conclusions

From the analysis so far we can derive that the Boston mechanism does not only lead parents to exclude highly demanded school, but that it leads them to apply for the schools they are given highest priority for. There is therefore little choice for parents through this mechanism when priority for residence exists.