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1. Introduction

In Spain public education starts at age 3, when children start preschool. At this point families have to choose the school that their children will attend, preschool, 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 that can be taken, both on the parents and on the schools' side, and the agreement between the two is crucial for the successful education of children.

In a study carried out in Israel, Victor Lavy (2010) shows 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. On the other hand, Brindusa Anghel and Antonio Cabrales, 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 (*Asociación de Madres y Padres de Alumnos* or Parents' Association) is an important determinant of the performance of a school. And last, but not least, expressing preferences, families are implicitly evaluating the schools and forcing a regenerating process in the educational system.

Although families in Spain can, in principle, choose the school for their children, in practice many families are unable to get their children into the school that they prefer most. This is because demand for some schools exceeds the number of places available. Therefore, a set of rules needs to be determined to decide who should access the school and who should opt for an alternative.

The implementation of this selection process usually takes the following format. Families submit a list with a ranking of schools 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 that families are forced to play to determine the school for their children. The main issue raised by the current set of norms is that the optimal strategy for families is rarely to state the true ranking of schools. This is because stating a modification of the true ranking can result in being allocated to a better school than by stating the true ranking.

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 places 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. Those applicants with the highest number of points are accepted and the rest rejected. Ties in the number of points are broken through a lottery. Applicants rejected from their first choice opt for a place in

the next school with free places in their submitted ranking. If there are more applicants than free places, allocation is made randomly within the applicants. The process continues until all children have an assigned place in some school.

This system implies that once a family has been rejected for its first choice, options of getting a place in lower-ranked schools are greatly reduced if rejected from your first choice. This forces families to exclude schools that they like but where chances of being admitted are small. The risk of asking for a highly requested school and being 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 school *A* is preferred to school *B*, which in turn is preferred to school *C*. Hence, $A>B>C$. If this family submits its true ranking and school *A* is overrequested by families that live in the neighborhood, the family will be rejected from school *A*. Moreover, if school *B* is filled up in the first round, the family will end up having to go to school *C*. As a result, the family might be ultimately better off by submitting a ranking where school *B* is ranked higher than school *A* (instead of the family's true preferences). This way the family has a chance of being accepted in school *B* given the priority it gets because of living in the neighborhood. Submitting a list that does not reflect the family's preferences therefore may increase the family's chances to get into a school they like better.

The importance of this problem requires an exhaustive analysis both at the theoretical and empirical level. This is the goal of the present *opuscle*. The first part revises our knowledge about the literature and in particular of the mechanism used in Spain, its problems and its potential solutions. The second part exploits a natural experiment occurred in Barcelona to shed some light on the empirical relevance of the strategic problem generated by the mechanism.

The main conclusion to be drawn is that the risk of not getting the first choice leads families to apply for the safest option, that is, their neighborhood school.

2. The literature on school choice: lessons from theory and experimental evidence

The problem of assigning children to schools is a particular case of a more general problem referred to as a *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 problem include situations like the marriage market, the assignment of students to college, of medical interns 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 obeying a set of norms decides the final matching, as in the case of school choice.

The process briefly described above, which 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 places in universities and students, that need to be paired. Individuals of each side of the market have preferences over the elements in the other side of the market with which they need to be paired. In this type of market there do not exist prices and therefore alternative rules are needed to determine the final allocation. Alvin Roth (1984) studied the problem of assigning medical interns to hospitals and started a long and influential literature in the field of market design for these type of market.

In general the literature assumes that both sides of the market are strategic, in the sense that agents on both sides 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 determine for each school an order of the students depending mainly on whether they have siblings in the given school, whether they live in the school district and other socioeconomic circumstances. Therefore families are the only strategic agents in this two-sided matching market to which school places need to be allocated.

Abdulkadiroglu and Sönmez (2003) adapt the college admissions problem to the specifics of school choice. In particular, they analyze the properties of the Boston mechanism, which is very similar to the mechanism used in Spain.[1]

They show that the mechanism is not *strategy proof*, meaning that is not the best strategy for each individual to submit their 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. Their work offers two alternative mechanisms, which are again modifications of well known ones. The first is the Deferred Acceptance algorithm by Gale and Shapley (GS) and the second the Top Trading Cycles (TTC). These two alternatives are strategy proof, so that being truthful is optimal independently of what others are doing.

Briefly GS works similarly to the Boston mechanism with the crucial difference that in each round of the algorithm applications are only pre-accepted. Then, when an application is rejected it is considered for its next best school in the submitted ranking together with the pre-accepted applicants and the new applicants.

This means that being rejected from a school does not put an applicant in a worse position to being accepted in any other school than if the school it got rejected from was taken out of the list.

On the other hand TTC can be summarized by saying that students are assigned randomly to the schools in their neighborhood and that cycles of mutually beneficial exchanges are allowed for, where these cycles are created through the submitted lists of preferences.

We now proceed to formally describing the above mentioned processes. Each family submits a list with preferences and schools rank students according to a set of points conditional on the existence of siblings in the school and residence in the school district. Ties are broken randomly. The three main mechanisms have the following in common:

In each round k, $k>1$: if an application has not been assigned in the previous round, it applies for the next school in the list.

The three mechanisms can be characterized as follows:

• **Boston (BOS)}:** In each round k, $k>1$, each school accepts the students that apply to it following the order determined by priorities (according to the point system and a lottery). If the school capacity is reached all remaining and future applications are rejected.

The algorithm finishes when all students are allocated a seat in a school.

• **Gale and Shapley (GS):** In each round k, $k>1$, each school pre-accepts the applications following its priority order considering the new applicants and the previously pre-accepted applications together. If school capacity is reached the remaining applications are rejected.

The algorithm finishes when no school rejects an application. The pre-assignment then becomes final.

• **Top Trading Cycles (TTC):** Each student is initially assigned to a school for which it has highest priority. Then the algorithm creates cycles of mutually beneficial trades. The algorithm starts by a random student in a random school, say school *A*. This student is tentatively assigned to the student's preferred school, say school *B*. A student at school *B* is then tentatively reassigned to this students' preferred school, say school *C*, and so on. A so-called cycle is completed when the last student that is tentatively reassigned has school *A* as the highest preferences. Once the cycle is completed, all tentative reassigments are made effective. The assignment is final when there are no more cycles that can be completed.

The criteria according to which the different mechanisms have been evaluated in the literature are the following:

- *Strategy proofness:* revealing true preferences is a dominant strategy, that is, it is the optimal response independently of what other applicants do.

- *Efficiency:* the assignments are such that there does not exist an alternative assignment that makes an individual better off without making another individual worse off (Pareto efficiency).

- *Stability:* the assignments are such that there is no participant who likes another school better than the one he or she has been assigned to that has accepted an application with lower priority than him or her.

The Boston mechanism is neither strategy proof nor stable.[2] Both the GS and the TTC mechanisms are strategy proof, but GS is stable and not efficient, and TTC is efficient but not stable. In fact, there is no mechanism that satisfies the three properties simultaneously.

Table 1 shows the results from the experiment in Chen and Sönmez (2006), replicated in Calsamiglia, Haeringer and Klijn (2010). In the experiment 36 subjects need to be assigned 36 places in 7 schools. Each participant is said to be from the district of one of the schools. Subjects have highest priority, that is, highest number of points, for the school in their district. All other priorities are resolved randomly. Payoffs assigned to a specific school were generated according to some common "quality" of the school, distance to the individual and a random component. The table shows the results on truth-telling, efficiency and stability. Truth-telling is measured by the proportion of subjects who state their true preferences in the list. Efficiency is measured by the mean payoff obtained, and stability by the number of pairs that could potentially block the assignment.[3]

As we can see in Table 1, the proportion of subjects who tell the truth is significantly larger in GS and TTC. Efficiency is larger in TTC and the number of blocking pairs is smaller in GS. These differences are all significant.[4] Therefore the experimental evidence confirms the theoretical results.

In 2005 the cities of Boston and New York advised by researchers such as Attila Abdulkadiroglu, Tayfun Sönmez and Alvin Roth changed the mechanism and adopted the GS, which has the desired strategic properties and stability. TTC, to my knowledge, has not been implemented anywhere. In Spain the mechanism is identical to the mechanism in Boston, except that priorities after the first round are irrelevant, meaning that the remaining places are assigned randomly among the new applicants, independently of their residence or the other criteria that determine priorities in the first round. This implies that after the first round, chances of getting in any of the remaining schools are identical for all applicants. The difference between the Boston mechanism and the mechanism used in Spain should be very minor in practice, since most applicants are allocated their first choice anyway in both cases.

Table 1. Strategy proofness, efficiency and stability of the mechanims

Mechanism	Stretegyproofness Proportion truthtelling	Efficiency Mean payments	Stability #blocking pairs
BOS	18.1	11.3	11.4
GS	58.3	11.5	4.7
TTC	62.5	11.9	15.5

3. Constraints in the list of schools submitted: an avoidable mistake

When implementing the alternative GS mechanism, a crucial aspect for the success of these procedures was ignored: the list that parents submit with their preferences should not be constrained, that is, should include as many positions as schools available. In a large number of applications of these mechanisms around the world, the procedure asks families to rank a small number of schools. For example, in New York the list cannot include more than 12 schools and in Barcelona 6, when the total number of schools is larger than 300. This apparently innocuous and simplifying modification creates important problems for the performance of these mechanisms. In particular, families may exclude schools from the submitted list, fearing being rejected by all of the schools in the list and being left aside until the end of the process, where they will be allocated the remaining places.

Haeringer and Klijn (2009) analyse the problem theoretically and conclude that the set of Nash equilibria is the same. But there is a crucial aspect: the Nash equilibrium in dominant strategies disappears in the case of GS and TTC. Revealing true preferences is not possible anymore and there is no other dominant strategy. The optimal strategy depends on what other players are doing. The dreadful consequences of including this constraint can be evidenced in Calsamiglia, *et al.* (2010), which provides a variation of the previous experiment. They add a treatment with a constraint to each one of the previous treatments and compare the behavior of subjects with and without the constraint. In particular, out of the seven schools, in the constrained treatment individuals can only express their preferences over three schools.

Results can be summarized as follows:

Less truth-telling. The proportion of subjects who reveal their true preferences with respect to the first three schools in GS and TTC is significantly reduced when the constraint is included. On the other hand the amount of truth-telling is similar between the three mechanisms when the constraint is included.

In Table 2 we find the percentage of subjects who revealed their preferences for the first three schools truthfully. In general we see that including

Table 2. Truncated truth-telling in the constrained and unconstrained case

Mechanism	Full sample		Low district		High district	
	Constr	Unconstr	Constr	Unconstr	Constr	Unconstr
BOS	8.1	18.1	16.7	19.0	20.0	16.7
GS	25.0	58.3	2.4	45.2	56.7	76.7
TTC	22.2	62.5	0	64.3	53.3	60.0

the constraint reduces the percentage very significantly for GS and TTC. For Boston the incentives to be truthful are already very small and the constraint does not change truth-telling significantly.

In the table we distinguish between the subjects who live in a district with a school that has a high payoff (top three), and those who have their district school fourth or lower in their true ranking. Their incentives are different since those in the high-district sample can safely include their true preferences up until their district school, which is a guaranteed option both in GS and TTC only if it is included in the list. As expected, subjects in a district with a relatively bad school reveal less their true preferences. The modifications in their reported preferences consist in excluding schools where they have low chances of being admitted to, and substituting them by schools that they are likely to accept them.

Improving the ranking of their neighborhood school and excluding hard-to-get schools. As we can see in Table 3, in GS and TTC, the proportion of subjects that include the district school in the list when they otherwise would not do if respecting their true preferences is larger in the constrained case. On the other hand, in Table 4 the number of participants that exclude small schools is significantly larger in the constrained case compared to the case where subjects submit their true most preferred schools.

Table 3. Proportion of subjects that include their district school in the list

Mechanism	Low district		High district	
	Constr	Unconstr	Constr	Unconstr
BOS	81.0	57.1	76.7	83.3
GS	90.5	11.9	40.0	20.0
TTC	85.7	14.3	43.3	33.3

Table 4. Proportion of subjects that exclude small schools from the submitted list

Mechanism	Low district		High district	
	Constr	Unconstr	Constr	Unconstr
BOS	76.2	66.7	80.0	76.7
GS	71.4	50.0	40.0	23.3
TTC	73.8	33.3	43.3	36.7

Less efficiency. The final allocation with the constraint leads to a significantly worse average payoff, as seen in Table 5.

Less stability. Analyzing Table 6 we find that in general stability is low, since there always exist blocking pairs (stability requires that no blocking pairs exist). But with the constraint the number of blocking pairs is higher, meaning that stability is smaller.

More segregation. One of the potentially important problems of including the constraint and of families applying for their "safe" schools is that they more often ask for their neighborhood school even when they do not have a strong preference for it. Consequently, a larger number of subjects

Table 5. Average payoff obtained by subjects

Mechanism	Constrained	Unconstrained
BOS	10.4	11.3
GS	10.9	11.5
TTC	11.2	11.9

Table 6. Average number of blocking pairs

Mechanism	Constrained	Unconstrained
BOS	10.6	11.4
GS	7.6	4.7
TTC	10.4	15.5

Table 7. Proportion of subject that are assigned their neighborhood school

Mechanism	Constrained	Unconstrained
BOS	67.9	58.1
GS	65.5	54.2
TTC	59.2	46.1

will be allocated to their neighborhood school as we can see in Table 7.[5]

The lesson to learn from this study is simple: the constraint on the number of schools that families can submit does nothing but harm the properties of any of the mechanisms considered in the literature. Most importantly it affects strategy proofness, and therefore all other properties, since both efficiency and stability rely on revealed preferences being truthful. The solution is easy: families need to be able to express their preferences over as many schools as they wish. For instance, in New York, where GS was implemented but a constraint was included, the success of the mechanism is still limited and would improve if they eliminated the constraint.

In Spain, since the mechanism is effectively the Boston mechanism, strategy proofness is already violated and in particular the most relevant aspect of the chosen strategy is the first choice, which is always available independently of the size of the constraint. But it is important to note that if the mechanism were changed in Spain to improve upon the existing mechanism, eliminating the constraint would be crucial.

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, that is, cardinality of preferences, are ignored. When the literature analyses the efficiency of the mechanisms, it only emphasizes Pareto efficiency. But recently Abdulkadiroglu, Che and Yasuda (2011) and Miralles (2009) show that the Boston mechanism captures cardinal preferences (intensity of preferences) in a way that strategy proof 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. This implies that Boston would be better than GS in terms of efficiency, where efficiency is defined by the sum of utilities.

Both papers mentioned above ignore the presence of private schools, which would change the results in an undesirable manner. Rich families with a better outside option, the private school, would be the ones taking the risk and therefore applying and accessing the best schools. Most importantly they also ignore the presence of priorities, which clearly distort families' behavior by offering safe options for families and removing the nice properties of the Boston mechanisms that these papers present.

This aspect is important and provides a potential rational 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 that it compensates for the problems described above.

4. Do families in Barcelona choose the school for their kids? Evidence from a natural experiment

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. We know that the mechanism provides incentives for families to apply as a first choice to a school where they have large chances of being admitted. This involves applying for a school for which they have high priorities and excluding schools for which demand is high. If families simply exclude schools that they would not have accessed anyway, the problem may not be too large. But if fear of being rejected forces them to apply for the school where they have highest priority independently of their preferences, then the problem is more significant, since the final allocation may be completely independent of families' preferences.

The main problem in empirically evaluating the relevance of the problem is that verifying whether families report their true preferences is difficult since true preferences are not observable. Every year around 90% of the families get their submitted first choice. Is this fact, published in the newspapers every year, a result of the school system adapting families' preferences nicely, as the news seems to suggest, or of families understanding the incentives provided by the mechanism and including as a first choice a school that they believe they can access, independently of their preferences?

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 mainly shaped by the priorities given to families for schools. A policy change occurring in Barcelona serves as a natural experiment that allows us to provide a first answer to this issue.

The natural experiment in Barcelona

In 2007 there was a change in the district school design in Barcelona. Before 2007 the city was divided into 10 school districts that coincided with existing administrative districts. All families living within a district had highest priority for all schools in that district (an average of 30 schools 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 families 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 distant schools and not for nearby 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 (three public and three semi-public). 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 for which families have highest priority has been reduced for all families, changing from 30 to 6 schools, approximately. So many schools that had been of highest priority before were not of highest priority after 2007. For families living in the borders of the old districts not only were some schools excluded from the set of highest priority schools, but also new schools that had not been in the set before were added . 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 set of schools for a given family changes before and after 2007 but families choosing school are not the same. In fact, families that 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 consider a different set of families every year. Consequently, when we compare the behavior of families over time we assume that the distribution of preferences is the same over time, or that the change in preferences does not systematically coincide with the direction in which the incentives provided have changed.[6]

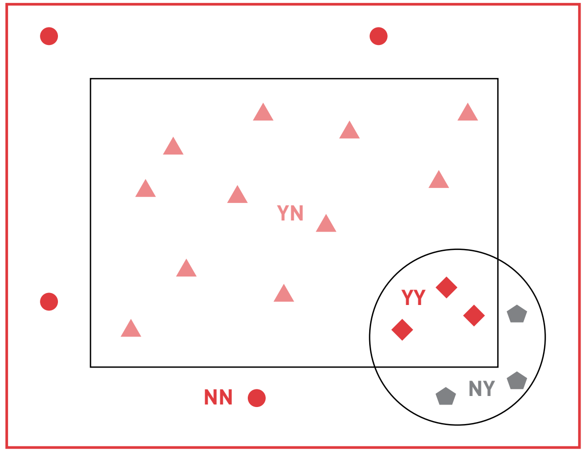
We focus on certain aspects of families' behavior that we can aggregate, state hypotheses implied by the theory and from our knowledge of the specifics of Barcelona, and then we test them looking at the actual data.

From the observed behavior we focus on the school they applied for as a first choice. In particular, we track whether the school applied for was of highest priority before and after 2007. For each individual, given the address of residence, we classify the schools as YY if they were in their district school before 2007 and in their priority zone after 2007, that is, schools in the set of highest priority schools both before and after the policy change. Similarly, for a family living in a particular address, schools of type YN are schools that were in the district school but are not in the priority zone for a given family, that is, schools that were of highest priority for the family before 2007 but not after 2007. Also, schools of type NY are schools that were not in the district before, but became of highest priority afterwards Finally, schools of type NN are schools that were never in the families set of highest priority.

Figure 1 illustrates how this classification would apply for an address for which the priority zone is not fully included in the district zone. Objects in this graph are schools. The big rectangle represents the old district school zone that was used before 2007, and the circle represents the priority zone starting 2007.

In each year we expect a high proportion of families applying for the schools for which they have highest priority (YY and YN schools before 2007 and YY and NY schools starting 2007). On the other hand, and key to our analysis to be informative about the response to incentives by families, we expect that the proportion of families demanding YN schools is reduced significantly

Figure 1. Classification of schools for a generic address



starting 2007, since they were safe schools before but not after the policy change. Similarly, the proportion of families asking for NY schools should not decrease starting 2007, since they become safe schools with the policy change. Our treated families are those that were applying for YN schools, since for them the type of school they were applying for was not of highest priority after the policy change. So those families are the ones affected by the policy. The increase in NY will reflect that, when allowed, families apply for this type of schools more often, but whether they increase YY or NY depend on their relative preferences among those particular schools. By the same token we do not expect YY to be reduced either. The theory has no implications on what should happen to the relative demand of NN type of schools.

We therefore want to verify the following hypotheses:

Hypothesis 1: The proportion of families asking for the different types of schools does 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 for schools of type NY should not decrease between 2006 and 2007, given that those schools become safer to apply for after the policy change.

Hypothesis 4: The proportion of families asking for schools of YY type should not decrease between 2006 and 2007, given that there is a smaller set of schools with highest priority after 2006.

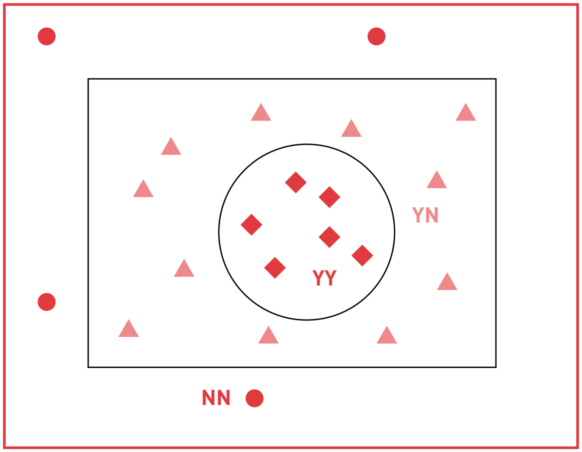
Table 8 shows the percentage of families applying for each type of school each year.

Table 8. Percentage of families applying to each type of school every year

Tipus/ Year	2005	2006	2007	2008	2009	2010
NN	10.5	10.9	6.4	8	8.3	7.7
YY	63.3	61.1	71.3	72.7	72.1	71.9
YN	19.4	20.3	11.5	8.4	8.6	9.3
NY	6.8	7.8	10.8	10.9	11	11

Table 8 shows that the four hypotheses are true. In particular, the proportion of families applying to YN schools is reduced from 20 to 8-9%, meaning that 60% of the families that were going to apply to YN schools did not. Also the proportion applying for NY increases from 7 to 11%, meaning that the demand increased by around 54%. These changes are large and significant. On the other hand, before and after 2007 the proportions

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



for each type of school do not change, except for year 2007 where the proportion of schools of type NN are significantly smaller and for YN larger. But given that 2007 is the first year with the new policy change some readjustments were 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 only reduced the set of schools with highest priority, corresponding to families living at the center of the old district schools, as represented in Figure 2. In the second case, the new priority zone includes a high proportion of schools that were not in the district, that is, corresponding to families living on the frontier of the old district schools, as illustrated in Figure 1.

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

Table 9 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 schools. As the table shows, the demand for schools YY is increased and the demand for YN is decreased from 18-19% to 7%, a decrease of more than 60%.

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

Table 10 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 was not adequate for those families since nearby 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 for NY schools.

The change in policy in Barcelona allows us to conclude that families not only respond highly to the incentives offered by the mechanism, but they respond by playing the safest strategy which is to apply for the school with highest priority.

True preferences and incentives for schools

Given the design in Spain schools have an ensured number of applicants from the neighborhood. Usually choice reveals families' preferences, but in this case this inference is not valid. Families choose a school because they fear the alternative of going to a worse school (either in terms of quality or of similar quality but worse location). Schools do not receive this valuable feedback from parents. Also, policy makers lose this valuable

Table 9. Percentage in each type of school for families in the center of the old district

Tipus/ Year	2005	2006	2007	2008	2009	2010
NN	8.0	9	5.4	6.7	6.5	5.8
YY	74.8	71.8	86.8	88.2	86.5	86.9
YN	17.2	19.2	7.8	5.1	7.1	7.3
NY	-	-	-	-	-	-

Table 10. Percentage demands for families on the frontier of old districts

Tipus/ Year	2005	2006	2007	2008	2009	2010
NN	12.7	14.2	7.3	9.2	8.7	12.0
YY	34.2	26.9	29.2	31.0	36.7	33.6
YN	19.7	22.7	16.6	12.1	10.1	12.0
NY	33.5	36.2	46.8	47.7	44.4	42.3

and objective information, which they could use to condition their financial decision. Bad school teams could be diluted and substituted by better ones, responding to families preferences. By eliminating the link between choice and preferences we are losing valuable information that could be used to improve the performance of the system.

5. Conclusions

This *opuscle* presents theoretical and empirical evidence on how the norms used to allocate children to schools affect the preferences submitted by parents and therefore the final allocation of children to schools. In particular, we provide evidence that the mechanism used in many cities around the world, and in Spain in particular, creates very strong incentives for parents to submit a list that does not reflect their true preferences.

The rules almost force families to apply for the school that they think they will be accepted to, independently of their preferences. The main reason is that not getting in your first choice leaves you with a reduced set of options, that is, it leaves you with the places in schools that have not been demanded as a first choice. The fear of being left with such a reduced set forces families to choose a school that ensures them that they will not be left with a small and worse set of options.

A first part of the document shows the theoretical and experimental properties of the mechanism used in Spain and of alternative mechanisms suggested by the literature. It also shows how limiting the number of schools that families can include in their list can harm, and never improve, the properties of the mechanisms. The mechanism should allow parents to include as many schools as they wish. In the case of the mechanism used in Spain relaxing this constraint is not expected to improve things substantially, since the mechanism's properties are already poor. But it would still be convenient to remove it, since having it does not improve the mechanism's performance either.

A second part of the document exploits a natural experiment occurring in Barcelona to evaluate empirically the relevance of one of the problems of the mechanism in Spain. The mechanism provides incentives for families to exclude schools that are highly demanded because of the importance of getting in your first choice. The empirical evidence shows that parents do in fact eliminate highly-demanded schools and that they tend to put as their first choice the schools that the mechanisms gives them priority for, that is, their neighborhood school. Their own preferences play a secondary role in determining the list they submit. Families only choose from the set of schools that they are given maximal points for. This implies that the point system determining the priorities defines the set of schools from which families choose from. This suggests that priority zones should be increased if we want to allow families to be able to choose from a larger set of schools.

Finally, we need to continue understanding the properties of alternative mechanisms in the concrete domain of school choice, since most of the literature is still based on the more abstract and general case of two-sided matching markets. In particular, the role that priorities play in GS and TTC is still not addressed in the literature.

Priorities, we believe, are a key ingredient in this process and they therefore deserve further analysis in order to provide additional advice. Priorities, which initially seemed to serve only as a tie-breaking rule, seem to be playing an important role worth clarifying with further research.

Notes

(1) The name of the mechanism derives from the fact that this was the mechanism implemented in Boston up until 2005. After Abdulkadiroglu and Sönmez (2003) a debate started that led to a change in the mechanism.

(2) In terms of efficiency, it is not efficient if defined as we just did but, as described later in the text, if preferences are cardinal and efficiency is defined as the sum of cardinal utilities being maximized, then the Boston may be better than GS or TTC.

(3) These numbers are calculated using recombinant estimators introduced by Mullin and Reiley (2006), to get improved statistics on outcomes of a game in the case of two identical sessions where subjects can be hypothetically recombined and expect their behavior to remain unchanged. More specifically we use our two sessions to create more than 100000 simulated sessions and their outcomes to compute the mean payoff and number of blocking pairs.

(4) Significant results refer to significant at 5% confidence level throughout this document.

(5) These effects should be even large when we take into account that families, knowing of the problematic incentives that the mechanism provides, choose their residence influenced by the quality of the schools.

(6) Unfortunately, no information on quality of these schools is available and so we cannot prove that this was the case. Catalonia is particularly conservative about making such information available. The only measure available to us is demand for schools, but in this case it is very distorted as a measure of quality, precisely because of the incentives that the mechanism provides. It is reasonable to assume, however, that the ranking of schools would not have changed dramatically from one year to the other.

References

Abdulkadiroglu, A., and T. Sönmez (2003) “School choice: a mechanism design approach”, *American Economic Review*, 93 3, 729-747.

Abdulkadirouglu, A., Y-K. Che and Y. Yosuda (2011) “Resolving conflicting preferences in school choice: the ’Boston ’mechanism reconsidered”, *American Economic Review*, 101 1, 399-410.

Anghel, B. and A. Cabrales, (2011).“Los determinantes del éxito en la educación primaria en España”, *Talento, esfuerzo y movilidad social*. FEDEA, monograph coordinated by Antonio Cabrales and Marco Celentani.

Calsamiglia, C., G. Haeringer and F. Klijn, (2010). “Constrained school choice: an experimental study”, *American Economic Review*, 100 4, 1860-1874.

Chen, Y. and T. Sönmez (2006) “School choice: an experimental study”, *Journal of Economic Theory*, 127, 202-231.

Gale, D. and L.S. Shapley (2006) “College admissions and stability of marriage”, *American Mathematical Monthly*, 69 1, 9-15.

Lavy, V., 2010. “Effects of free choice among public schools”, *Review of Economic Studies*, 77 3, 1164-1191.

Miralles, A., mimeo (2010) “School choice: the case for the Boston mechanism”

Mullin, C.H. and D.A. Reiley (2006) “Recombinant estimation for normal-form games with applications to auctions and bargaining,” *Games and Economic Behavior*, 54, 159-182.

Roth, A. (1984) “The evolution of the labor market for medical interns and residents: a case study in game theory,” *Journal of Political Economy*, 92 6, 991-1116.

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