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Comparative advantage and preferences in college admissions in Turkey

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Abstract

Each year, approximately 2 million students compete for 200 thousand seats in Turkish colleges. The central authority takes students’ preferences and test scores into account and place students to the limited seats of majors in the colleges. Balinski and Sönmez (1999) note that the algorithm used in this process is college optimal and propose a student optimal algorithm to overcome some deficiencies. We use 2005 data-set and show that both algorithms generate almost the same results. This reveals the simple truth in student preferences: the students want to be in majors where their comparative advantages lay.

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1. Introduction

The central college admissions authority (ÖSYM) conducts a college admissions examination (ÖSS) in June of every year in Turkey. After the test scores are revealed, the students fill out preference lists in which they rank majors in the colleges. For instance, a student may rank economics in college X as his first choice, engineering in college Y as his second choice, etc. To be concise, we refer to the majors in the colleges as “programs”.

ÖSS test has five components: Math, Turkish, Science, Social Science and Foreign Languages. All students can take all these components. Four different types of test scores are computed by giving different weights to these components. Different majors take different types of test scores into account. The test score types and examples to programs which respect to these test score types are as follows:

1) A quantitative score (QS) is computed by giving a higher weight to math and science (e.g., engineering).
2) An equally weighted score (EW) is computed by giving a higher weight to math and Turkish (e.g., economics).
3) A verbal score (VS) is computed by giving a higher weight to Social Sciences and Turkish (e.g., history).
4) A foreign language score (FL) is computed by giving a higher weight to Foreign Languages and Turkish (e.g., British Literature).

All colleges use the same type of test score for the same major. For instance, economics majors in all colleges use the EW score. Each program has a limited capacity. ÖSYM uses the information about the students’ test scores, preferences and places students to the programs subject to their capacities.

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Balinski and Sönmez (1999) note that ÖSYM uses a college optimal algorithm (COA) and propose a student optimal algorithm (SOA)\(^2\) to overcome some deficiencies such as inefficiency, vulnerability to manipulation, and the potential of penalizing students for improved test scores. They note that SOA is characterized as “best” in this context. Let’s take the following example to show how these algorithms produce different placements. Let there be only two students, A and B, and only two programs with capacities one for each. First program is “science” which accepts students respecting QS and the second program is “economics” which accepts students respecting EW. Say, student A prefers to be an economist but has the highest score in QS, and student B prefers to be a scientist but has the highest score in the EW. Scoring higher in the QS shows a comparative advantage in becoming a scientist whereas scoring higher in the EW shows a comparative advantage in becoming an economist. The COA is more concerned about these comparative advantages than the preferences of the students. In this example, both student A and student B will be placed to their second choices by COA whereas they will be placed to their first choices by SOA.

In this paper, we use the Turkish student placement system data–set of year 2005 to compare the placements under these algorithms and show that these algorithms differ for just six students. This is just a tiny number given that almost 200 thousand students are being placed. The reason is simple: the colleges prioritize on the comparative advantages. The students prefer the programs where they have comparative advantages. In other words, students’ preferences and colleges’ priorities are on the same line. Therefore, it is not surprising that the college optimal and student optimal solution generate almost the same result.

We introduce the COA and SOA algorithms in section 2. We introduce the data–set and examine the relationship between the comparative advantage and student preferences in section 3. Section 4 gives the concluding remarks.

2. COA and SOA

The descriptions and properties of the algorithms are given in detail by Balinski and Sönmez (1999). In this section, we will only describe how we apply these algorithms to the Turkish student placement system data–set of year 2005. The students have four types of test scores and can make 24 choices on 4022 different programs in their preference lists.\(^3\)

Placing with One Type: The COA and SOA will generate the same results if there is only one test score type. Here is how the algorithms work with a single test type: First we sort the students with respect to their test scores. Then we start the highest scoring student and continue until we have the lowest scoring student and apply the following procedure: Place the student to his most favorable program given that the capacity of the program is not already filled. For instance, if the student’s most favorable two programs are already filled by better scoring students but his third most favorable program has an unfilled seat, we place him to his third most favorable program.

Placement with COA:

Step 1: We pick a test score type. Say QS. We rank the students with respect to their QS. Then, we assign students to programs as we do in the one test case. That is, we assign the student to his most favorable program given that the capacity is not already filled. Then, we follow the procedure with the other types of test scores. Note that the students may be assigned to more than one program. If this is the case, we change the preferences as follows. For all students who are assigned, we find their most preferred choice. For instance, if the student is placed to his second and fifth choice, the best assignment for this student is his second choice. Then, we erase his less favorable choices than this program. Then we continue to the next step.

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2 Student optimal algorithm (SOA) was first introduced by Gale–Shapley (1962) and there are many papers related to this algorithm. For example, Kesten (2008) finds a more efficient algorithm than SOA in the context of the Boston public school choice. Chen and Sönmez (2006), Calsamiglia et al. (2010) compares SOA with Boston public school choice system via experiments.

3 We study the problem of the effect of restricting the student to 24 choices in Doğan and Yuret (2010).
Step k: We redo the same procedure but with the preferences formed in step k-1. If there are no students with more than one program assigned, the algorithm stops. Otherwise, algorithm continues to step k+1. The assignments become final placements.

Placement with SOA:

Step 1: We only look at the first choices of the students. Some students have their first choice in a program that requires QS, others in a program that requires VS, etc. We sort the students who have their first choice in a program that requires QS with respect to their QS. We start from the student with the highest test score and continue till the student with lowest test score and apply the following procedure. If the student’s choice is already filled with students who have higher test scores than him, then we reject the student. If it is not filled, then we place the student to this first choice. We repeat this exercise for the other test types. If there is at least one student who is rejected, we change the preferences as follows. We delete the first choices of the rejected students. In the newly formed preferences, the rejected students second choice become their first choice, their third choice becomes their second choice etc. Then we move on to the next step.

Step k: We repeat the algorithm that we described in step 1 with the preferences that are prepared in step k-1. If there are no rejected students, the algorithm stops and placements are final. If there are rejections, then we prepare the new preferences and move on to step k+1.

3. Data and Results

There are more than 1.8 million students who take the ÖSS exam in 2005. Only around 380 thousand students fill out preference lists which include a program in a college. The remaining students either cannot score above the threshold test score to be eligible to submit preference lists or decide to try their chances for the next year. Around half of the students who fill out the preference lists are placed in a program.

In section 2, we mention that, COA and SOA are equivalent if there is only one type of test score. Alternatively, if students have pure preferences then the algorithms are also equivalent. A student has a pure preference only if all his program choices require the same test type. For instance, if a student who has an engineering choice has all his other choices from QS programs, then we call his preferences pure. Otherwise, we refer to his preferences as mixed. Table 1 shows that students’ preferences are mostly mixed in this sense. In the first row of table 1, we consider all the students who state at least one QS program. Among them, 63% have pure preferences and do not state any VS, EW and FL programs. The students who states EW programs are mostly mixed. Merely 37% of them have a pure choice.

<table>
<thead>
<tr>
<th></th>
<th>QS</th>
<th>VS</th>
<th>EW</th>
<th>FL</th>
</tr>
</thead>
<tbody>
<tr>
<td>QS</td>
<td>0.63</td>
<td>0.00</td>
<td>0.37</td>
<td>0.00</td>
</tr>
<tr>
<td>VS</td>
<td>0.00</td>
<td>0.41</td>
<td>0.57</td>
<td>0.01</td>
</tr>
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<td>EW</td>
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<td>0.37</td>
<td>0.00</td>
</tr>
<tr>
<td>FL</td>
<td>0.00</td>
<td>0.07</td>
<td>0.06</td>
<td>0.87</td>
</tr>
</tbody>
</table>

Now, we look at the relationship between preferences and comparative advantage. Since EW is in the most of the mixed preferences, we compare QS with EW (comparison of QS with VS also produces a similar result). We take students who have QS and EW choices and compute their comparative advantages by dividing their QS to their EW. Then we compute the percentage of QS choices. For instance, if a student has six EW choices and four QS choices, then the percentage of his QS choices is 40%. In figure 1, we see that as the comparative advantage in QS improves the percentage of QS choices increases and rapidly converges to 1. This implies a strong relationship between preferences and the comparative advantage.
We use the Turkish student placement system data–set of year 2005 and determined the magnitude of the difference in the placements created by these algorithms. We see that the placement stays the same for all but six students. That is, it does not really matter whether one uses a student optimal algorithm as Balinski and Sönmez (1999) suggests or college optimal algorithm as ÖSYM applies. Since the comparative advantages and preferences of the students are on the same line, the two potentially different algorithms produce very similar results.

4. Conclusion

We use the Turkish student placement system data–set of year 2005 and find that the SOA and COA produce the same results for all but six students. Given the large number of students who are placed by the algorithms, six is a very tiny number. We can say that SOA and COA produce almost the same result. This is because the students’ preferences are in the same line with colleges’ priorities. Why a student who is good in math and science does not want to be in literature major? The reason is threefold. First, the student would be in a better engineering program than a literature program if his QS is better than his VS. He may choose to be in a good engineering program rather than stuck in a bad literature program despite his wishes to become a writer. Second, the student who wants to be a writer focuses on studying Turkish and not math or science when he prepares for the ÖSS test because the rewards for Turkish component are higher for literature programs. Therefore, the students who want to be writers lose their comparative advantage in QS. The students who want to be writers eventually become comparatively good at VS. Third, there is a positive correlation between the verbal capability and the desire to become a writer. Therefore, the students who are good at Turkish would also want to be writers. Therefore, the comparative advantage in VS and preference to be a writer are positively and strongly correlated.

References