

An Overall Evaluation of the Chinese Admission System

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Abstract. In the last two decades, China has experienced a radical shift in its admission system to the Chinese parallel mechanism, which is expected to provide a better allocation of existing educational resources, and also improve the admission outcome. In this paper, an overall assessment of the current matching system has been made in an attempt to test the effectiveness of this major transition. At the same time, this paper compares the admission policy in China and in foreign countries to give a further evaluation of the overall performance of the China parallel mechanism. From the currently available data and statistics, the new admission system is proven to bring significant improvements in the admission outcome. This paper may offer some references for the demonstration of new admission system and the reform of Chinese admission policies.

1 INTRODUCTION

Ever since the centralized college admission system was implemented in China, there are over 10 million high school graduates enrolled in the *gaokao* each year and waiting to be assigned to their target universities [1]. The college admission problem is affecting every individual in the economy since it not only concerns the field of education but also has a profound implication on the overall performance of the labor market. With the intense debate on the adoption of different admission systems in the past 20 years, a large part of China has gradually transformed from the immediate acceptance mechanism to the parallel mechanism in an attempt to achieve a less manipulable and more stable admission outcome.

The aim of this paper is to discuss the effectiveness of the current college admission system in China. Starting with a detailed introduction of the three main admission mechanisms (IA, DA, and CP), the first part of the paper will be focusing on comparing each of these systems and discuss the incentives of the transition from the IA system to the PA system. Then, by referring to the recent literature and statistics, this paper explores to what extent this transformation has improved the recent college admission outcomes. Lastly, a comparison between the Chinese admission system and the US admission system is being made in order to assess the overall performance of the centralized admission system under a larger context. By all the approaches stated above, this paper is targeting to give a more thorough evaluation of the current admission system, which in turn, can be a possible source of reference for future adjustments and changes in the admitting process.

2 OVERVIEW OF THE CHINESE COLLEGE ADMISSION SYSTEM

2.1 Current admission mechanisms

Before 1952, when the centralized admission system was yet implemented by China, most of the provinces in China are relying on the decentralized admission system to match students to the colleges. However, the embedded weaknesses of this algorithm have led to poor coordination between universities and students and eventually caused a low admission ratio [2]. Later in 1952, it was replaced by a new admission system, namely the centralized admission system. In this system, all the high-school graduates were asked to take the National College Entrance Exam (NCEE) or sometimes called *gaokao* [3]. Based on their scores in this standardized examination and their preferences ranking of the university, the students are assigned to the colleges through one of the three mechanisms: immediate acceptance (the sequential mechanism), deferred acceptance, and the Chinese parallel mechanism depending on the policies of the particular province they belong.

2.1.1 Immediate acceptance (The sequential mechanism)

The immediate acceptance mechanism or the Boston mechanism was the dominant admission mechanism in China during the 1980s and 1990s. The algorithm mainly works as follows: Given the preference ranking of each student and their standardized test scores, in the first round of matching, each school only considers the students who have listed it as his/her first choice. Then, according to the preference of the school, each school admits the student

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with the highest priority and rejects the rest. Those who were rejected enter the next round of matching, in the second round, the same steps in the first round are repeated. The matching keeps on until all schools have reached their full capacities or no students are left unmatched. Importantly, in the IA mechanism, the assignments in each round are fixed [4].

IA mechanism has been criticized for years because of its vulnerability toward strategic manipulation [5]. The most common complaint about the IA mechanism is that sometimes the students with lower test scores can get a better assignment than those with a higher test score if a good strategy is used, in this sense, a high test score in *gaokao* does not really put the student into an advantageous position. Consequently, the allocation of educational resources is usually inefficient and the system leaves students with no choice but to strategically propose their preference ranking in order to compete against those who have reported their preferences untruthfully.

2.1.2 Deferred acceptance mechanism

Different from the IA algorithm, the deferred acceptance mechanism gives a much more stable matching outcome, which usually referring as the student-optimal stable mechanism proposed by Gale and Sharpley.

The DA mechanism works in a similar fashion as IA, but the assignments in each round are temporary. Given the same condition, each student applies to his/her top choice and the school only admits the student who has the highest priority. The rest of the students are rejected and enter the next round. In this round, those who get rejected apply to his/her second-best choice, each school considers both the new applicants and the one it temporarily holds from the previous round, then admit the student with the highest priority and rejects the rest. This matching goes on for several rounds and terminates until there is no new proposal made by the student [6].

In 2005, the Boston Public School replaced the IA mechanism which has been used for years by the new DA mechanism. This decision was followed by many other regions and was expected to increase the chance of truth-telling when student submit their preferences [7]. However, this policy was not widely accepted in China because it does not seem to be practical in the large social context. In the DA mechanism, students have to submit their preference ranking over all colleges as a parallel option which can cost a tremendous amount of money and make the system nearly impossible to operate [8].

2.1.3 Chinese parallel mechanism

After 2000, China experienced an important reform in its college admission system. Starting with the Hunan Province, a large part of China has gradually switched from the IA mechanism (the sequential mechanism) to the Chinese parallel mechanism [3]. This brought a significant improvement in the national admission outcome. By 2019, all provinces in China have transformed into the CP mechanism.

The CP mechanism works in a way that lies between the IA mechanism and the DA mechanism. In the CP mechanism, students have two tiers of universities to choose from and they have to list two or more parallel options in each tier in decreasing desirability. In the first tier, the student with the highest test score is assigned to his/her first choice, then the student with the second-highest score is assigned to his/her first choice. The assignment goes on for all of the students, the university can admit students up to its upper quota, but if the university has no vacant seat, then the student who is applying to this school gets automatically sent to his/her next parallel choice in the same tier. The assignment is terminated in each tier, which means the student who did not get an assignment in the first tier will enroll in the next round of assignments in the second tier [2].

In the parallel mechanism, students with high test scores get to retain their advantage since the impact of students' preferences is much limited compared to their score in *gaokao*. In this system, the student with a higher score always has a higher priority over the rest, thus, there are fewer incentives and chances for manipulation and the matching of student are much more efficient and socially desirable [3]. In the CP mechanism, students are also able to take the risk to pursue a better university while having several universities in the same tier as their backup option. Either way, the admission outcome is always better than the outcome in DA and IA mechanisms.

2.2 The aggregate performance of the recent CP mechanism

With an increasing interest in the CP mechanism, this newly emerged system has quickly become popular and is adopted by many regions in the world either in its original form or its variants to solve the school choice problem.

The major transformation from the previous IA mechanism to the CP mechanism in China has not only improved the overall admission outcome but also promote the efficiency of the admission system as a whole. A system that enables a high-quality matching outcome and is cost-effective at the same time is seen to be some of the most favorable and critical properties by most of the countries when selecting a suitable admission mechanism. Especially for countries with huge population bases like China, a truly efficient system is strongly demanded in order to run the admission process that involves millions of high-school graduates each year.

Besides the improvement in efficiency, in the paper written by Shiyu Bo and his colleagues, the chance of mismatch is assessed [8]. By observing the difference between a student's percentile in the ability distribution of college starters and the percentile of the corresponding college in a student-weighted distribution of college quality, their results have proved that the Chinese parallel mechanism has less chance of mismatch compared to other mechanisms. Simply put, by utilizing the CP mechanism, students are more likely to get admitted to a university that matches his/her academic ability. This improvement is critical since it largely avoids the miss allocation of educational resources and allowed a more

fair and effective matching between students and colleges. Furthermore, in the paper written by Yan Chen and his colleagues verified the increased chance of truth-telling when students are proposing their interests under the CP mechanism [1]. According to the statistics published by the Sichuan Educational Examination Authority, Yan Chen and his colleagues compared the admission outcome in 2008 and 2009 in the Sichuan province. Then via a series of calculations, they found that the students are more willing to list the more prestigious school as their top choice in the CP mechanism than in the previous mechanism because students have a stronger sense of insurance and fewer worries about the occurrence of manipulation like in the IA mechanism.

Overall, having an effective admission mechanism matters since it ensures every individual in society can get an adequate number of educational resources and maximize everyone's educational experience. An effective allocation of educational resources can improve the quality of the labor base and is beneficial to the Chinese economy in the long run. In this part of the paper, when comparing the CP mechanism with other mechanisms, the Chinese parallel mechanism shows significantly higher stability and a low rate of manipulation. Setting tiers of parallel options guaranteed students' advantages in high scores can be retained, thus giving out a more socially desirable and fair matching between students and universities. Although there are several aspects of the CP mechanism have not yet been tested, from all of the statistics published so far, the CP mechanism - either at the theoretical level or in real practice - is believed to be effective and efficient at least under the current social context of China.

3 Comparison with the US college admission system

As mentioned above, a major part of the United States has also experienced a radical reform in its school admission system - the abandonment of the immediate acceptance mechanism. Starting in 2005, the Boston school in the United States switched from its long-used IA system to the deferred acceptance mechanism which is proposed by David Gale and Lloyd Shapley in 1962 [9]. Followed by other regions like New York and Seattle, the GS algorithm has gradually replaced the previous IA mechanism in many regions of the U.S. in the following years [10].

Different from the previously adopted mechanism, the GS algorithm achieves higher stability in its outcome by only allowing the assignment to terminate when there is no further proposal made by students or the student has been rejected by all of the schools. On a theoretical level, this reduces the impact of strategic manipulation on students' preferences on the result, however, this condition only stands when there is a limit on the number of schools in the students' ranking list [7]. In other words, the greater the number of choices a student can make, the less vulnerable the constrained version of the student-optimal stable mechanism is to manipulation. Although the DA mechanism might not always be strictly better than the IA under all circumstances, it is still more favorable than the

IA mechanism by having an overall higher immunity towards untruthfulness in telling the preferences.

The reason that China does not choose to implement the DA mechanism may due to the differences in political priority and the structural differences in the society. To select an optimal mechanism to use, there are three criteria to be considered: the elimination of justified envy, the strategy-proofness, and the Pareto efficiency [2]. Justified envy refers to whether the system has helped to retain an individual's priority when this person has scored a high score on the test; the strategy-proofness is basically concerning the incentives for manipulation; lastly, the Pareto efficiency is about the welfare of the agents involved in the matching. Policymakers in each country should combine those criteria and the overall social condition of the country to determine an optimal system that best fits the context. In this sense, different countries might adopt various mechanisms since the one that is effective domestically might not be practical when practiced in another country.

4 Conclusion

The school choice problem should always be prioritized by policymakers in all countries because it is strongly affecting the fundamental component of the economy, namely the labor force. In the current day, educational resources are still far from the level of abundance, an effective allocation of educational resources is therefore crucial to enable the maximization of benefits.

The major shift in the admission system in China after 2000 has profoundly changed the fate of millions of high school graduates. A transition from IA mechanism to CP mechanism is expected to improve the college admission outcome, after years of testing its performance is eventually acknowledged by the scholars and general public. In the theoretical discussion, the new CP system displayed much higher stability and strategy-proofness than the other two systems. In the CP mechanism, students are more willing to tell their preferences truthfully without being fearful of losing their score advantages. This change has gained positive feedback from many of the families by reducing the 'justified envy' and also benefits the policy maker by allowing them to obtain the truthful thoughts of the agents in the matching to further adjust and improve the country's policy.

There might seem to be no intentions for other countries to practice the same system, however, an optimal mechanism should always be the one that best fits the features of that particular country. The U.S. is still implementing the DA mechanism might because it does not conflict with any of the political priorities at the moment. Once it does, the same for all of the countries, there may be another radical shift in the style of admission again.

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References

1. Chen, Y., Kesten, O. From Boston to Shanghai to Deferred Acceptance: Theory and Experiments on a Family of School Choice Mechanisms. In: Coles, P., Das, S., Lahaie, S., Szymanski, B. (eds) Auctions, Market Mechanisms, and Their Applications. AMMA 2011. Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering, vol 80. Springer, Berlin, Heidelberg, (2012).
2. Zhu Min College Admissions in China: A Mechanism Design Perspective, No 1327, Working Papers, Groupe d'Analyse et de Théorie Economique Lyon St-Étienne (GATE Lyon St-Étienne), Université de Lyon, (2013). <https://EconPapers.repec.org/RePEc:gat:wpaper:1327>.
3. Chen, Y., Jiang, M., & Kesten, O. An empirical evaluation of Chinese college admissions reforms through a natural experiment. *Proceedings of the National Academy of Sciences of the United States of America*, 117(50), 31696–31705 (2020). <https://doi.org/10.1073/pnas.2009282117>.
4. Harless, P. A School Choice Compromise: Between Immediate and Deferred Acceptance (2014).
5. Kojima, F., Ünver, M.U. The “Boston” school-choice mechanism: an axiomatic approach. *Econ Theory* 55, 515–544 (2014). <https://doi.org/10.1007/s00199-013-0769-8>.
6. Pathak, Parag A., and Tayfun Sönmez. "School Admissions Reform in Chicago and England: Comparing Mechanisms by Their Vulnerability to Manipulation." *American Economic Review*, 103(1): 80-106 (2013).
7. Roth, A.E. Deferred acceptance algorithms: history, theory, practice, and open questions. *Int J Game Theory* 36, 537-569 (2008). <https://doi.org/10.1007/s00182-008-0117-6>.
8. Bo, Shiyu & Liu, Jing & Shiu, Ji-Liang & Song, Yan & Zhou, Sen. Admission Mechanisms and the Mismatch between Colleges and Students: Evidence from a Large Administrative Dataset from China. *Economics of Education Review* (2018).
9. Gale, D., & Shapley, L. S. College Admissions and the Stability of Marriage. *The American Mathematical Monthly*, 69(1), 9-15 (1962). <https://doi.org/10.2307/2312726>.
10. Ergin, H., & Sönmez, T. Games of school choice under the Boston mechanism. *Journal of Public Economics*, 90, 215-237(2006).