Economics Bulletin

Volume 34, Issue 1

An anti-bullying and keeping-friendship school enrollment lottery

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Abstract

School enrollments are sometimes decided by lottery. However, students may wish to enter the same school or different schools for their social relationship needs so as to maintain good friendships, or avoid continuously being victims of bullying. While recent developments in non-traditional rationing lotteries (Chen et al., 2010; Tseng & Ngamsomsuke, 2012) can meet such social relationship needs, these kinds of lotteries apply to situations where the number of slots is less than the number of applicants. However, in other situations, the number of slots may be identical to the number of applicants when there are several schools available but each school has different qualities. In this paper, we develop a new lottery that works in both situations, satisfying such social relationship needs, while maintaining the equal opportunity that supports educational equality, a point emphasized by Allen et al. (2013). The new lottery may also work under demand and supply uncertainties. Korean elementary school graduates entering the next stage of their education are used as an example to show that this new lottery indeed works and improves well-being.

Citation: Wei-chun Tseng and Shuhui Chiu, (2014) "An anti-bullying and keeping-friendship school enrollment lottery", *Economics Bulletin*, Vol. 34 No. 1 pp. 1-15.
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Submitted: April 29, 2013. **Published:** January 01, 2014.

1. Introduction

Lotteries can be used and have been used in school enrollments (Seog, Hendricks, and González-Moreno, 2011) to equalize the educational opportunities. Besides meeting the goal of promoting equity (Stasz and van Stolk, 2007; Kim, Lee, and Lee, 2008), lotteries are also used to resolve oversubscription (e.g., Garrison and Bromley, 2004; Doyle and Feldman, 2006; Opfer, 2006; Stasz and van Stolk, 2007; Lubienski, Weitzel, and Lubienski, 2009). For example, public charter schools in some states/districts in the U.S. such as Alaska, Virginia, Washington DC, Arkansas, and California require the use of a lottery when oversubscription occurs (NAPCS, 2013).

However, because students have social relationships, they may be required to enter the same school or else different schools. For example, having good friends or to benefit from car pooling to reduce the parents' burden are two reasons why certain students may wish to enter the same school. Many children have a sad feeling when they graduate from a school because they have to leave their good friends/classmates. Meanwhile, it is often the case that important friends are made in schools. Thus children are usually happy if they can enter the same school.

Not getting along with others is also a reason for entering different schools. It is better if the students can finally work out a way, probably with the assistance of teachers or their school, to get along with others. However, if it does not work out, entering different schools for the next stage of their education could be beneficial to both types of students. Being against bullying is another and an even stronger reason for entering different schools. Rend, Vassallo, and Edwards (2011) found that bullying in school also affects future criminal behavior. In addition, victims of bullying who take revenge can even cause mass deaths as has on occasion happened in US schools. This clearly demonstrates how severe the bullying issue can be. Various methods can be used to combat bullying in schools such as the curriculum (Elenia, Didaskalou, and Vlachou, 2007), healthy relationships or conflict/peace learning, and surveillance. However, things do not always work out. Thus being separated from the bullies can provide victims with a new opportunity to have a better educational environment.

These social relationship needs of children, such as the desire to enter the same school or different schools vis-à-vis certain other individuals, however, cannot be satisfied in the traditional lottery. Recent developments in non-traditional rationing lotteries (Chen, Yang, Tseng, and Chen, 2010; Tseng and Ngamsomsuke, 2012) can, nevertheless, meet such social relationship needs. These non-traditional rationing lotteries may be applied to rationing situations (i.e., when the number of slots is smaller than the number of applicants, which is also known as oversubscription in school administrations). However, in some school administration lotteries, the number of slots may be identical to the number of applicants but there are at least two schools (with different qualities). Thus the lottery becomes an "assignment" process.

In this paper, we develop a new lottery that can perform both the assigning and rationing tasks, while at the same time satisfying the social relationship needs that are important for the children's education. Thus the new lottery represents an improvement in efficiency over the traditional lottery in broader situations.

2. Educational Equality and both Merits and Downsides of Lottery Mechanisms

Income inequality measured by the Gini coefficient shows that income inequality has risen in countries that account for 80% of the world's population, while there has been an improvement in income distribution in countries that only make up 4% of the world's population. This phenomenon has in turn given rise to inequality in many different respects as well. Educational equality, social insurance, and housing policies have been among the main mechanisms adopted to counter the increasing inequity. A 3-year-old child (Baumard, Mascaro, and Chevallier, 2012) or even a 15-month-old infant (Schmidt and Sommerville, 2011) is sensitive to fairness. Ironically, the inequality in education begins early. Differences in support for cognitive and emotional development due to different socioeconomic conditions begin even during pregnancy (Heckman, 2011). In addition, early childhood education has a stronger effect than later education, while about half of the inequality in lifetime earnings is determined by age 18 (Heckman, 2008).

There are several ways in which education can improve equality. One is to provide financial subsidies for children from poor families or even subsidies for all children if the government is rich. While most EU countries do well by fully subsidizing their elementary and secondary education, it is recognized that not every part of the world can afford to do so. In some countries, one of the few chances a poor family has to improve its future is to invest in its children's education. Thus, an equal chance of receiving an education is emphasized. In other words, students, regardless of their gender, race, socioeconomic conditions, national origins, or religious affiliations, have the same opportunity for education. Heckman (2011) found that investment in early-childhood education for disadvantaged families can both improve equality as well as be efficient because each dollar invested will have an annual rate of return of about 7~10% as it increases future productivity and reduces the social burden.

There has long been a debate on enrollment mechanisms, for example, standardized tests, past class rankings or grades (Stone, 2008), or a mix of them. All the mechanisms that have been mentioned have their strengths and drawbacks (Zwick, 2007). Lotteries are good candidates when it comes to considering equal opportunity and an equal quality of education. Consequently, the social mobility is strengthened. In other words, the linkage between the children's quality of schooling and the parents' income or human capital are reduced (Allen et al., 2013).

The downside of lotteries is that they may first suppress the freedom to choose a school. They usually neglect the students', parents', and schools' preferences. This is a limitation and the severity depends on how the process of choosing takes place. Second, lotteries may not be consistent in some cultures that have a long tradition of test-based enrollment mechanisms or other enrollment mechanisms. Third, lotteries are not distance-based. Thus those who win the slots may not be those with the shortest travel costs. Therefore, the total travel costs will be higher in the case of the lottery enrollment mechanism than in the case of the distance-based enrollment mechanism.

Meanwhile, lotteries depend on pure luck and are not effort-rewarding or capability-based. Consequently, they may reduce the competition. Thus, they may both reduce stress (the positive side) and the efforts (the negative side) of students. This is both an advantage and a disadvantage. Therefore, they might be good for younger students who need basic courses and where fairness is more important, but will often be less appealing when applied to older students who need more in-depth courses and where interest and ability are more important.

It is not within the scope of the current paper to argue which enrollment mechanism is best. We therefore analyze the new lottery and its superiority over the traditional lottery based on the assumption that a lottery will be used.

3. Method

The current paper develops a new lottery. This new lottery is inspired by Scrogin (2005), Koh et al. (2007), and Scrogin (2009), as well as non-traditional rationing lotteries such as those referred to by Chen et al. (2010), Liao, Lin, and Tseng (2011), and Tseng and Ngamsomsuke (2012) We call it the social-relationship-needs rationing-assigning lottery (SRNRAL) since this new lottery can perform the tasks of assigning (where the number of applicants is equivalent to the total number of vacancies) as well as rationing (where the number of applicants is larger than the number of total vacancies) and thereby satisfying the children's social relationship needs. The structure of the SRNRAL is fundamentally different from that of the lotteries introduced by Chen et al., Liao et al., and Tseng and Ngamsomsuke. These non-traditional rationing lotteries use boxes and nests, while the SRNRAL constructs a "designed random priority". We use a simple example and equations to introduce the SRNRAL.

Suppose there are three types of applicants: the Together type: who wish to enter the same school; the Separate type: who wish to enter different schools; and the Individual Type:

who wish to enter a school. For illustration purposes, suppose there are 1,000 applicants and they form 510 (either together-type or separate-type) groups or individuals (Table I).[1] Assume for simplicity that there are at most three persons in a group.

Table I: The number of groups in each type

Number of persons in a group	Separate type		Together type		Individual type
	S^2	S^3	T^2	T^3	I
1					170
2	50		140		
3		50		100	
Subtotal	100		240		170

Note: The superscript denotes the number of persons in the group.

In the SRNRAL, applicants first declare their preferences regarding whether other students should enter the same school or different schools compared with that for the applicant. Each group of the Together type will have a single initial point to represent it, each group of the Separate type will also have a single initial point to represent it, and each Individual type will have a single initial point to represent him/her.

Second, 510 positions of initial points

$$I_t \text{, t = 1, 2, …, 510} \tag{1}$$

are randomly drawn to represent groups or individuals along an interval [0, 100], using the command of random draws from a uniform distribution of a computer software such as GAUSS.

Third, for each group of the separate type with two persons, one person is randomly assigned to a position at a distance of 50 away from the initial point (ex. 79.45) while leaving another person at the initial point (i.e., 29.45) (see Figure 1).

Denote those being arranged 50 away as

$$S_t^2 \text{, t = 1, 2, …, 50} \tag{2}$$

[1] A constraint is that the number of persons in the Separate type is not larger than the number of all applicants divided by the slots in the largest school.

Figure 1: The initial point and the arranged point for a group of Separate types with 2 persons

For each separate group type with three persons, one person is randomly assigned to a position at a distance of 33.33 away from the initial point, and one person at a distance of 66.66 away from the initial point, while leaving the third person at the initial point. Denote those being arranged 33.33 away as

$$S_t^3,\ t = 51, 52, \ldots, 100 \qquad (3)$$

In addition, denote those being arranged 66.66 away as

$$S_{t'}^3,\ t = 51, 52, \ldots, 100 \qquad (4)$$

Fourth, suppose that there are three schools. School A has 500 slots, school B has 300 slots, and school C has 200 slots. Then randomly arrange the order of the three schools. For example, suppose the order is BAC.

Finally, randomly draw a point along the interval [0, 100], and suppose it is 58.63. Then all applicants whose position is after but among the top 300 closest to 58.63 enter school B. Assume that the 300th person who enters school B is at 86.54. Then all applicants whose position is after but among the top 500 closest to 86.54 enter school B. Not until after 100 does this process continue to 0. Suppose that the 500th applicant who enters school A is at 37.22. Finally, all applicants whose position is after 37.22 but before 58.63 enter school C (see Figure 2).[2]

[2] There are technical details. For instance, if a Together-type group happens to locate itself on the border of two schools (say, B and A) and the number of persons in this group is an odd number (say, 3 persons, and two are assigned to B and one is assigned to A), then all persons in this group are reassigned to the majority school, B. If the number of persons in this group is even (say, 2 persons), then they are randomly assigned to school B or school A. For example, suppose they are assigned to school B. Since the applicants who are now permitted to enter school B exceed the number of slots, those one or two separate types or individual types whose position along the interval [0,100] is closest to the BA border are reassigned to school A to balance the numbers.

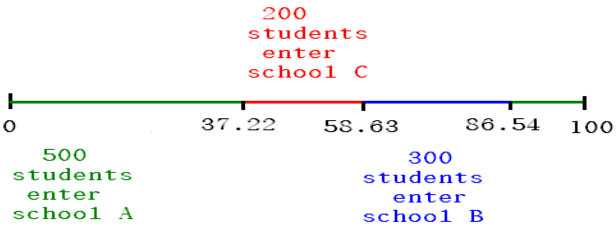

Figure 2: The locations of the representative points determine their schools

We illustrate this with three types. However, a mixture is also possible and can be conveniently handled. For instance, friends L and M wish to go to the same school, while also wishing to enter different schools from a bully N. Then N is assigned to a school at a distance of 50 from the initial point where L and M are located.[3]

3.1. The chances to enter each school remain the same for all applicants in this lottery mechanism

Take the chance of entering school B as an example. The chance entering of school A or the chance of entering school C can be proved likewise.

Step 1. Define range K as "a point after but among the top ones (top 300 applicants) closest to 58.63".

Step 2. Denote the probability of an initial point I_t that falls into K as π. Note that π is the same for all 510 initial points for it is a random draw (i.e., $\pi = \frac{3}{10}$).

Step 3. For the together type or individual type, the initial points will be the final points, indicating the priority they attach to entering school B. Also note that the opportunity is independent of the group size. The only disturbances come from the separate type. (e.g., in our example, they come from S_t^2, S_t^3, and $S_{t'}^3$). However, these disturbances are random and thus are neutral in terms of their effects on the priority of the together type or individual type.

More specifically, there are 100 separate types that stay at their initial points I_t. They do not affect the priority of the together type or individual type. The only disturbances come from those separate types that are arranged. (e.g., in our example, they come from S_t^2, S_t^3, and $S_{t'}^3$).

[3]Meanwhile, a cap on the number of persons in a group, e.g., 5 persons, is recommended so that the result will be better.

Take the effects of the separate types with two persons in their groups as an example. The chance that an initial point I_t falls inside K but its S_t^2 is arranged outside K is the product of two probabilities. The chance that I_t falls into K is π, $\pi = \frac{3}{10}$. However, it is now arranged outside K for sure. Thus the chance that an initial point I_t falls inside K but its S_t^2 is arranged outside K is

$$\pi * 100\% \tag{5}$$

and it is equivalent to $\frac{3}{10}$.

On the other hand, the chance that an initial point I_t falls outside K but its S_t^2 is arranged inside K is the product of two probabilities. The chance that an initial point I_t falls outside K is 1-π, 1-$\pi = \frac{7}{10}$. However, now the chance that it is arranged inside the range is $\frac{\pi}{1-\pi}$, $\frac{\pi}{1-\pi} = \frac{3}{7}$. Thus the chance that an initial point I_t falls outside K but its S_t^2 is arranged inside K is

$$(1\text{-}\pi) * \frac{\pi}{1-\pi} \tag{6}$$

Furthermore, it is equivalent to $\frac{3}{10}$. Therefore, these disturbances are neutral in terms of their effects on the priority of the together type or individual type.

Likewise, one can prove that the disturbances of the separate type with three persons on the priority of the together type or individual type is neutral. Thus the overall chance for the together type or individual type to enter school π_B is $\frac{3}{10}$.

Step 4. For the separate type, the chance of entering school B is also equivalent to $\frac{3}{10}$. Let us take an arbitrary person of the separate type with two persons in their groups as an example.

The chance that his/her initial point I_t falls inside K but that he/she does not randomly move outside K is $\frac{3}{10} * \frac{1}{2}$. The chance that his/her initial point I_t falls outside K but that he/she randomly moves inside K is (1-π)*$\frac{\pi}{1-\pi} * \frac{1}{2}$.

Therefore, his/her chance of entering school B is

$$\pi * \frac{1}{2} + (1-\pi) * \frac{\pi}{1-\pi} * \frac{1}{2} \quad (7)$$

and is equivalent to π. In other words, it is $\frac{3}{10}$ in our example.

Likewise, we can perform the proof for an applicant in the separate type with three persons in the group.

Thus the overall chance for the separate type entering school (i.e., π_B) is $\frac{3}{10}$.

3.2. All those who wish to enter the same school or different schools have a much higher chance of doing so

Meanwhile, all those who wish to enter the same school enter the same school, reflecting a much higher probability than in the traditional lottery. For example, suppose there is a together type with 2 persons, E and F. In the traditional lottery, the chance they have to enter the same school is the chance that they will both enter school A, plus the chance that they will both enter school B, plus the chance that they will both enter school C, and it is equivalent to

$$(\pi_A)^2 + (\pi_B)^2 + (\pi_C)^2 \quad (8)$$

It can be calculated as $(\frac{5}{10})^2 + (\frac{3}{10})^2 + (\frac{2}{10})^2$ and it is equivalent to 38% in our example. Meanwhile, those who wish to enter different schools also have a much higher chance of entering different schools than in the traditional lottery. For example, suppose that there is a separate type with two persons, G and H. In the traditional lottery, the chance that they will enter different schools is equivalent to the probability that G enters school A while H does not, plus the probability that G enters school B while H does not, plus the probability that G enters C while H does not, and is equivalent to

$$\pi_A * (1-\pi_A) + \pi_B * (1-\pi_B) + \pi_C * (1-\pi_C) \quad (9)$$

It can be calculated as $\frac{5}{10} * (1-\frac{5}{10}) + \frac{3}{10} * (1-\frac{3}{10}) + \frac{2}{10} * (1-\frac{2}{10})$ and it is equivalent to 62%. According to this new mechanism, the chance they will enter different schools is almost 100% in the same example. Therefore, the benefits for both types are high (increasing from 38% to 100%, and increasing from 62% to almost 100%). Since the benefits from this new lottery are high, the benefit is thus likely to be higher than the additional operating costs compared to the traditional lottery.

So far this section has described the SRNRAL and how it applies to assigning (where demand is equivalent to supply). If one wishes to use SRNRAL for rationing (i.e., in situations where demand is greater than supply; e.g., oversubscription in a single school enrollment), it is only necessary to replace the slots in school A as the supply (while there are no schools B or C), with the other procedures remaining the same, and so on and so forth. Similarly, the SRNRAL can also be applied to rationing in oversubscription with enrollment in two schools. It is only necessary to replace the slots in schools A and B as the supply (when there is no school C).

4. Real World Example that Can Apply to the New Lottery: Korean Elementary School Graduates

The competition for education is very intense and begins with early childhood education in East Asian countries including Korea (a.k.a. South Korea), Taiwan, Japan, Singapore and China. All these countries are strongly influenced by Confucianism, and many young students study until midnight to enter better schools in the hope that they will eventually enter good universities. The reason for this is that the societies of these countries attach a high value to higher education and reward those who are successful both in terms of future economic earnings and social respect. Therefore, private tutoring and outside-school learning are common (Kim et al., 2008). Consequently students from these countries perform extremely well in global tests for mathematics and science (e.g., Hanushek and Luque, 2003).

Korea's equal opportunity policy is a significant example that has involved a regime-level change from test-based enrollment to lottery-based enrollment. The purpose of Korean junior high enrollment is to promote equal opportunity and an equal quality of education, while at the same time reducing the competition to enter better schools.[4] Thus Korean law requires that all elementary school graduates be assigned to public or private middle schools (grades 7-9) in the residence-based school districts through the use of lotteries (Kim et al. (2008). There are 179 middle school districts in the nation (Kang, 2007). The area of a typical district is quite large (Kim et al., 2008). On average there are 15.19 middle schools in a district, and about 801 students per school. Without loss of generality, let us assume that 12,000 elementary school graduates are to be randomly assigned to 15 schools for a specific district with 800 students per school.[5]

The procedure is as follows.

Step 1, suppose these 12,000 applicants declare their preferences and form 4,117 (together-type, separate-type, or mixed-type) groups or individuals.

Step 2, randomly draw 4,117 positions of initial points to represent groups or individuals

[4] Interestingly, a lottery can be used to increase the competition among schools in some countries such as in New Zealand's secondary school policy.

[5] However, this mechanism can be applied to any number of applicants or any number of groups and individuals in a straightforward manner.

along an interval [0, 100]. Table II shows a portion of the initial points.

Step 3, for each group of the separate type with two persons, randomly assign one person to a position at a distance of 50 away from the initial point, while leaving another person at the initial point. For each group of the separate type with three persons, randomly assign one person to a position at a distance of 33.33 away from the initial point, and the second person to a position at a distance of 66.66 away from the initial point, while leaving the third person at the initial point, and so on and so forth.

Table II: The initial points for the 1st ~30th groups or individuals

Order of group or individual	Initial point	Order of group or individual	Initial point
1	80.415	16	94.087
2	67.196	17	4.313
3	39.650	18	16.508
4	67.197	19	19.716
5	68.309	20	43.705
6	68.269	21	48.329
7	51.700	22	54.616
8	34.583	23	86.703
9	32.562	24	75.870
10	20.695	25	51.516
11	54.120	26	79.381
12	49.917	27	91.635
13	71.366	28	51.555
14	13.224	29	98.970
15	66.079	30	30.391

Notes: 1. A total of 4,117 groups or individuals. 2. The mean of the 4,117 initial points is 49.844, while the standard deviation is 29.174.

Step 4, there are many combinations for a group in the mixed type. For example, a group with 2 friends and a bully (we may denote it as [2 1]) is the only possibility for a group with three persons. Then we have [3 1], [2 2], [2 1 1], for a group with four persons, and [4, 1], [3 2], [3 1 1], [2 2 1], [2 1 1 1] for a group with five persons.

Each of the [2 1], [3 1], [2 2], [4, 1], [3 2] can be viewed as two subgroups. Randomly assign a sub-group to a position at a distance of 50 away from the initial point, while leaving another sub-group at the initial point.

Each of the [2 1 1], [3 1 1], [2 2 1] can be viewed as three subgroups. Randomly assign a sub-group to a position at a distance of 33.33 away from the initial point, and a subgroup at a distance of 66.66 away from the initial point, while leaving the third subgroup at the initial point. Finally, [2 1 1 1] can be viewed as four subgroups, and so on and so forth.

Step 5, randomly assign the order of 15 schools. Step 6, randomly draw a point along the interval [0, 100]. It is 8.964. All applicants whose position is after but among the top 800 applicants closest to 8.964 enter the first school. The 800th person who enters the first school is at 15.621. Then all applicants whose positions are after but among the top 800 closest to 15.621 enter the second school, and so on and so forth.

In this SRNRAL lottery mechanism, the opportunity for each student to enter a specific school remains the same, regardless of whether he/she is in a together group or a separate group, or is an individual. Meanwhile, Table III demonstrates the superiority of the new lottery, SRNRAL, over the traditional lottery. Column 1 lists the number of persons in each group.

Table III: The superiority of the new lottery (SRNRAL) over the traditional lottery (TL)

	Chance Separate types all enter different schools		Chance Together types all enter the same school		Chance Mixed types all happy with their social relationship needs	
Number of persons in a group	TL	SRNRAL	TL	SRNRAL	TL	SRNRAL
2	93.30 %	100%	0.44%	100%	--	--
3	80.88%	100%	0.03%	100%	<100%	100%
4	64.70%	100%	0. 0019%	100%	<100%	100%
5	47.44%	100%	0.00013%	100%	<100%	100%

Note 1. These probabilities are options for applicants in the SRNRAL and thus the higher they are, the better. It is evident that the SRNRAL dominates the traditional lottery.[6] Note 2. Three persons is a minimum group size for a mixed-type group because there are at least two friends and at least one bully.

Column 2 depicts the chances that all students in the separate type will enter different schools under the traditional lottery, and column 3 the chances under the SRNRAL. One can see that as the number of persons in a group of the separate type increases, the chance that they will enter different schools decreases (ranging from 93.30% to 47.44%). By contrast, all

[6] In fact, the SRNRAL also dominates the non-traditional rationing lotteries. The SRNRAL is especially sound considering that the cost of executing it is likely to be lower than in the case of non-traditional rationing lotteries.

those who wish to enter different schools enter different schools in the SRNRAL. Column 4 presents the chance that all students in the together-type group have of entering the same school under the traditional lottery, and column 5 the chance that they have under the SRNRAL. One can see that as the number of persons in a group increases, the probability of their wishes being met is decreasing. For example, for the together-type group, the chances that those within the group will enter the same schools are small (ranging from 0.44% to 0.00013%). By contrast, all those who wish to enter the same school enter the same school under the SRNRAL. Finally, we cannot calculate the probabilities for the mixed type since there are many possible combinations for a given number of persons in a group. However, they all are happy with their social relationship needs when enrolling in the schools using the SRNRAL. Again, they are better off compared to using the traditional lottery.

5. Discussion and Conclusion

Suppose that an education authority wishes to use the lottery to assign students to schools to promote equal opportunities. The current paper purposes a new lottery mechanism, the rationing-assigning lottery (SRNRAL), which can meet such a purpose, while satisfying students' preferences regarding who should enter the same schools or enter different schools compared to him/her. Using a real world example for Korean elementary school graduates, we have found that this new lottery can fully satisfy these goals. With these new functions, the new lottery is still in line with the goals of equality, diversity and anti-social selection. We have kept the math and the proof simple so the example is transparent and easy to understand. The design of a new lottery rationing mechanism by us in this paper is an echo of Scrogin's viewpoint that rationing lotteries remain under-investigated (Scrogin, 2005; Scrogin, 2009).

In addition, this new lottery mechanism can handle both demand side and supply side uncertainties when it is applied to rationing (e.g., oversubscription in education), since the fundamental nature of the SRNRAL is a "designed random priority". The designed part is in order to meet the needs of the together groups and the needs of the separate groups, and the random part seeks to ensure an equal chance, while the priority order part can take care of the uncertainty. Therefore, if demand (e.g., the number of applicants) is reduced for certain reasons, then the subsequent applicants on the priority line obtain the beneficial outcome. In other words, a student who did not win in the lottery, but who is at the top of those who lost, has a higher and more determined priority order to fill seats when lottery winners are declined admission offers. If the supply (e.g., the number of slots) is reduced for some reasons, then likewise the priority would be to decide who is next in a pre-announced way. In education, the supply and demand uncertainties together form the waiting list.

The capability to handle uncertainty is especially important in many situations such as the medical and military fields. For example, the demand for a super flu vaccine has various uncertainties, for when the toxicity of the virus is more realized, the side effects of the vaccine are more well understood, and even the number of dead persons may increase. In a military manpower situation, the uncertainty can be caused by the war proceeding and by the increase in the number of dead persons. This is the advantage of this new lottery compared to the non-traditional rationing lotteries such as those referred to by Chen et al. (2010), Liao, Lin, and Tseng (2011), and Tseng and Ngamsomsuke (2012).

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