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Fair allocations

Making markets work without prices

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Prices can be extremely helpful in creating a good balance between supply and demand. But what if the availability of certain goods should not depend on income or wealth? Christian Basteck explains how allocation in the education sector, for example, can be made fair and efficient without using prices.

Who gets what? In a nutshell, this is one of the key questions explored by economists. Ideally, the answer should be guided by the desire to achieve both efficiency and equity.

In practice, most goods are allocated via markets, or more precisely via prices. And there are good reasons for this – at least in terms of efficiency. Many economists will remember having defended such an allocation method by pointing out that it results in a scarce good getting to be enjoyed by those who value it most. They will also remember some listeners incredulously shaking their heads at this proposition. Does the buyer really reap a greater benefit from a good than those who did not buy it at the same price? After all, they may have simply had a lower income. But this interpretation misses the point. It is not about comparing different potential buyers; it is about one person weighing different goods. The purchased good is worth more to the buyer than other goods they could have purchased for the same amount of money.

Buying decisions at given prices thus reveal the relative value individual consumers attribute to different goods, in other words: their individual preferences. If, for reasons of equity, for example, certain goods are to be allocated regardless of income or wealth, that is, without resorting to a pricing mechanism, those preferences must be determined by other means. Otherwise, inefficient allocation is almost inevitable.

For example, spots in government-funded daycare are usually not allocated via the market lest a child's educational opportunities become even more dependent on their parents' income. Consequently, these spots are allocated in an uncoordinated manner in many municipalities, with parents applying to individual daycare centers. Given the low chances of admission, parents often apply to multiple daycare centers, not only to the one they like best (compared to other daycare centers). Thus, it can easily happen that a family who prefers daycare A to daycare B (due to proximity to home or work, for example) applies to both centers, and another family who prefers B to A does the same. If the child of family one is accepted by daycare B and the child of family two by daycare A, the allocation of daycare spots is inefficient – it would obviously be better for both families to be able to use the spot at the respective other center.

This can be remedied by a centralized allocation process in which parents can indicate multiple daycare centers to which they are applying while also stating their preferences in the form of a wish list. There are quite a few municipalities in Germany that already carry out such centralized matching procedures, either on their own or with the support of providers of specialized administrative software such as Little Bird or kitaplus. The KitaMatch program, developed and managed by Thilo Klein and Gian Caspari at the Leibniz Center for European Economic Research in Mannheim, now also supports various municipalities, including Kaiserslautern and Tübingen, in the allocation of daycare spots.

A distinctive feature of the process offered by KitaMatch is that strategic aspects are considered. When determining preferences, for example, it is not necessarily enough to give parents the opportunity to state their preferences; it should also be in the parents' interest to do so truthfully. In KitaMatch, a so-called strategy-proof mechanism (specifically, the Gale-Shapley algorithm) is used for this purpose, that is, a mechanism that can be shown to never disadvantage individuals who submit their true preferences. In the first round of the automated procedure, all parents apply to the daycare center they have indicated as their first choice. If some of them must be rejected for capacity reasons, they apply in the second round to their second-choice daycare – together with those provisionally accepted there in the first round. Since parents applying to a center in a later round have the same chances as those already provisionally accepted there, there is no incentive to submit a false wish list to secure a spot in the first round, for example. The allocation is not guaranteed for each center until the process is completed and allocations have been finalized for all.

Many other widely used algorithms, by contrast, include incentives to falsify preferences for strategic reasons. For example, many secondary schools around the world allocate spots using a method known as "first-preferences-first," "immediate acceptance," or "Boston mechanism" - named after the city where the method first attracted the attention of social scientists (it could have just as well entered the research vocabulary as the "Barcelona," "Beijing," or "Berlin" mechanism, because it has been used in all of these places). In this obvious procedure, applicants' first-choice requests are considered first and met as far as possible. If there are more applicants than spots at a school, the second-choice requests of the rejected applicants are considered in a second round and again met as far as possible, and so on. As the number of available spots at a school decreases from round to round, it is possible to be rejected in the second round at a school that would have accepted you if you had applied there in the first round. It may therefore be in the interest of applicants not to put their actual first-choice school at the top of their list (for example, because families fear it will be in excessive demand, giving them little chance of admission) and instead to name a school they expect to be in less demand as their alleged first choice.

However, if false preferences are stated for individual strategic reasons, the outcome of the allocation process will frequently be inefficient, failing to reflect applicants' true preferences. Moreover, a procedure in which individual advantages may be gained from strategic behavior may be considered unfair – at least if an optimal application strategy requires a detailed, above-average understanding of the allocation mechanism or access to additional information, for instance regarding the expected demand at individual schools.

It is mostly for these reasons that strategy-proof mechanisms are preferable – that is, procedures in which it is always to one's advantage to submit one's true preferences. However, even with such matching mechanisms, applicants are frequently observed to submit false wish lists – for example, in economic experiments where participants' choices are immediately visible but also in real-life datasets, such as applications for university admission. One possible explanation is that applicants seek to avoid rejections: Obviously, they derive an additional benefit from the sense of achievement of being accepted at their alleged first choice – regardless of whether it is really their first choice.

Of course, such cases may simply reflect errors on the part of the applicants resulting from a lack of understanding of the allocation mechanism. That is why there is now an extensive and growing literature that attempts to formulate and empirically test formal criteria for the simplicity and transparency of mechanisms. One approach is to provide applicants with a better understanding of the schools that are in fact within their reach from an individual perspective, for instance by making the allocation mechanism dynamic. This method repeatedly gives applicants the opportunity to adjust their wish list. Alternatively, there are efforts to come up with an easy-to-understand explanation of why established strategy-proof mechanisms, such as the aforementioned Gale-Shapley algorithm, offer no manipulation incentives (as existing mathematical proofs are difficult for most users to comprehend). Interestingly, an analogy to pricing mechanisms is helpful here: As consumers, we are accustomed to the fact that our individual buying decisions do not change our income or prevailing prices, given the miniscule weight of our individual demand in the overall market. Strategy-proof matching mechanisms can be explained in similar terms: The number of schools within the reach of an individual applicant results from the wish lists submitted by the other applicants, and thus, like prices and income in the market, cannot be influenced by the applicant themselves. The purpose of one's own wish list then is to make an optimal selection from this set of schools – stating false preferences may therefore, when it comes down to it, only lead to an inferior selection from the same set of alternatives.

Allocating limited goods to interested parties in an optimal manner is anything but simple. And not using prices to govern allocation does not make it any easier. Some approaches have been presented above. In addition, there is still the reasonable hope that, as such allocation methods, facilitated by digitalization, become more widespread over time, users will also become increasingly familiar with them, resulting in fewer errors. Gradually, stating our educational preferences may become as natural for us as choosing among different yoghurts in the supermarket by comparing the different price tags.

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