Revamping India's Answer to the Rohingya Crisis

Arjun Soin

Abstract

Hundreds of thousands of Rohingya Muslims, described by Amnesty International as "one of the most prosecuted minorities in the world" have been forced to flee from their homes in Myanmar. By virtue of it's location in the Subcontinent, India has emerged as a natural destination for many Rohingya refugees. In exploring the possibility of another, more systematic avenue for the Rohingya crisis in the form of two-sided matching, this paper critically examines certain matching markets and the challenges in implementing them in the world's largest democracy. With international refugee matching having been theorized in the western world, a country like India presents a set of varying design challenges that are evaluated from the perspective of optimizing design metrics for the novel refugee resettlement market, within the ambit of policy constraints. Alternatives in the form of one- sided matching are also presented.

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Introduction to the Rohingya Crisis

Often called a textbook example of 'ethnic cleansing', the Rohingya Crisis has emerged as a result of thousands of Rohingya Muslims being forced to flee from their homes in Myanmar. More than one million people from this mainly-Muslim minority group lived in Myanmar at the start of 2017, with the majority in Rakhine State.[1] The government of Myanmar, a predominately Buddhist country, has for long claimed that Rohingya people are illegal immigrants from neighboring Bangladesh and has denied them citizenship, leaving them stateless. By virtue of their locations in the Subcontinent, India and Bangladesh have emerged as natural destinations for many Rohingya refugees. Around 60,000 ethnic Rohingya have already found themselves in India after crossing the border, whereas in Bangladesh the number is as high as a million (with over 500,000 having crossed at the height of the crisis between August and October 2017).

Refugee Resettlement Policy in India

India is not a signatory to any international convention on refugee resettlement. Even still, India has always maintained a sort of open door policy to refugees, as a result of which there are Tibetan, Afghani, and even Burmese refugees well-settled within their borders. Even though India has been home to a large number and variety of refugees throughout the past, it has dealt with refugee issues on a bilateral basis. It has observed a refugee regime which generally conforms to the international instruments on the subject without, however, giving a formal shape to the practices adopted by it in the form of a separate statute.[2] Refugees in India are legally foreigners. They are dealt with under existing Indian law, both general and special, which are otherwise applicable to all foreigners. For the same reason, applications for refugee status are considered on a case-by- case basis. UNHCR has often played a complementary role to the efforts of the government, particularly with regards to verification about the individuals' background and the general circumstances prevailing in the country of origin.

In the face of an escalating crisis and the absence of any soundly designed resettlement program, the Central Government of India decided in August 2017 that ethnic Rohingya should be deported and others should not be allowed to enter. It was claimed by the Home Ministry to be a "national security threat".[3] Given all of this, the U.N's refugee agency, the UNHCR has not had

much say in convincing the government to accept these refugees for permanent resettlement.

Matching as a Solution in India

For the vast number of Rohingya refugees who have already made way to India and Bangladesh, their assimilation into various communities lies largely in the hands of a bureaucratic machinery working with limited or no information to assign a refugee to a particular location. In fact, in 2015, the government of Bangladesh proposed a relocation plan for the Rohingya refugees in Bangladesh to the remote island of *Thengar Char* in the Bay of Bengal.[4] The plan was pushed back following criticism by human rights activists and the UNHCR. India proposed several such relocation plans but again they were hinged on the idea of establishing a single base for all refugees.

That where refugees end up long-term is hugely consequential on lifetime outcomes is almost never a part of the long-drawn and inefficient bureaucratic process for assigning resettlement. Economists Emma Stewart and Gareth Mulvey demonstrate the imperfections of extant integration policies in the United Kingdom, many of which spring from the difficulties a government faces in taking particular individualized needs and aspirations into account. The same outcome has been unfolding with the 14,000 Rohingya already being relocated in some way by the Indian government.[5] Drawing from noteworthy ideas in matching theory and modifying them to suit the priorities and bandwidth of India specifically, I will examine the feasibility of two-sided matching as well as propose new mechanisms for the government to consider when implementing relocation schemes for Rohingya refugees. As an aside, I have chosen to focus on India not because it is the only destination for Rohingya refugees (I have already shown how pivotal Bangladesh is), but because it is a relatively smaller destination (in terms of number of Rohingya expected) and makes for more optimal testing grounds for initial hypothesizing. With international refugee matching having been theorized in the western world, a country like India presents a different set of design challenges. While Jones and Teytelboym proposed a centralized matching system for refugees, similar to what is used in many places for school choice - I will also reevaluate the notion of similarity to school choice since it is a matching market that barely exists in India, in the process of building onto refugee resettlement.[6]

Motivations, Comparisons, and Status Quo of Matching

Before diving into conceptualizing refugee resettlement and its associated design for the Rohingya in India, it's useful to consider the matching algorithms and techniques currently in limited use in the Indian market. India is not a nation where matching theory has been put into practice too often. Population size and high levels of illiteracy, as well as historical and cultural factors render the implementation of market design techniques for overall gains inefficient. In this section, I will evaluate existing algorithms but also aim to solidify a thus far vague understanding of where they fall short in an Indian context. To begin with, consider the following matching markets and their shortcomings.

In the National Resident Matching Program, an algorithm to optimize how resident medical interns get their positions at hospitals is used. In the absence of a formal application process that could facilitate some form of the NRMP, a vast majority of Indian medical students end up doing their residencies abroad, popularly in the US, UK, and Canada. For those who choose to stay in India, the process of getting a residency typically involves reaching out directly to a hospital and hoping for a vacancy.[7] Though formal application processes exist as a part of procedure for various medical divisions (especially in private hospitals), any proposed resident matching market would almost have to go back in time and undo the murky state of affairs in intern placement.

A centralized matching market for schools does not exist, except for in higher level engineering programs.[8] India is home to a multi-tier school system that includes exorbitant private schools (usually attended by upper and upper-middle class students) complemented by much more affordable government run schools. These government run schools are subsidized for students from the lowest socioeconomic backgrounds. Any matching market would first have to distinguish between these distinctive systems of schooling. Furthermore, private school attendance is not decided by virtue of location/proximity. Parents enroll their children at virtually any private school within an acceptable radius. Once admitted at the beginning of their schooling career, the student is more likely than not to stay in the same school till attending college. Most private schools in India are K-12. An added source of inefficiency in the private schooling system

is the inadequate number of schools available even to cater to the top 20%. This leads to the creation of widespread false admissions cycles in schools during unexpected times in the academic year. Government school attendance, on the other hand, is rife with different problems. Since these schools are more heavily attended by students living within their tehsils (a local administrative district), a matching market hinged on locational preferences has been thought of as more conceivable for government schools. However, here again, educational infrastructure has not evolved in tandem with population growth. Citizens record commute times of over 3 hours to government schools closest to their districts in remotest areas of the country. Moreover, given that agriculture still remains a source of income for more than half the country, children in rural areas are pressured into working on the fields or in other unskilled low-wage pursuits from an early age. According to the latest Census in India, 1 in 4 children of school-going age is out of school.[9]

Let us now look at a market in India that is in practice a matching one but faces gross inadequacies. Engineering school admissions in India function through a centralized matching market in which students with differently privileged backgrounds, such as different castes, are treated with different admission criteria. Students have different preferences over which admissions criteria they are admitted under. Therefore, students may prefer not to reveal their caste and tribe information while applying. Besides this strategic burden on students, the current system suffers from a crucial market failure: the centralized assignment mechanism fails to transfer some unfilled seats reserved for under-privileged castes and tribes to the use of remaining students. Hence, it is vastly wasteful and Pareto inefficient.

It is not surprising that India is often referred to as the world's biggest organ market. Though there has been a substantial crackdown on illegal exchange markets, a new kidney exchange scam is exposed frequently. There are far too many hurdles to kidney donation even in terms of a legal exchange.[10] Police clearance from patients' respective districts and submission of an affidavit before the tehsildar (principal administrator of tehsil) are almost cardinal. Furthermore, donors and recipients have to often appear in front of a panel of doctors to solidify their case for a transplant. The entire exercise takes months. At this rate, over 50 percent of

people with renal failure are unlikely to survive over a period of 5 years. Before 2009, one could not receive an organ from a non-family member regardless of match in blood group and tissue type. Since 2009, the Paired Kidney Exchange (PKE) has been legalized under the amended *Human Organ Transplant Act of India*. Ever since, there have been attempts to use technology, mainly mobile apps, to introduce swapping/matching facilities.

A popular model/platform gaining traction in India is one where relatives of a kidney patient can find a right match and get the kidneys swapped with one of another family's members. However, in the face of inefficient registration processes and illegally paid donors, the market for kidney exchange in India is still as undeveloped and problematic as it was in 2009 post legislative changes.

The aforementioned list is merely a subset of matching markets that have not thrived in India as a result of social, cultural, historical and demographic factors that are far too deeply ingrained in society. In all cases, we see that the size of such a potential market matching is so huge that the problems it entails are equally formidable to design a centralized system for. But in the case of Rohingya refugee resettlement, we narrow down to a potential market where we would have to reverse fewer trends/policies from the past and design a system for fewer agents (40,000-50,000). Moreover, since these 40,000 refugees constitute the first wave of Rohingya Muslims seeking asylum in India, a sound centralized matching market, if implemented can set a viable precedent for future refugee crises. Unlike in the other cases outlined above, designing a two-sided matching can well be our starting point for finding optimal matches.

Refugee Resettlement

There is clear evidence that India needs both a successful matching market and an innovative approach to it's relocation policy. Without international conventions on refugee resettlement, a centralized market for refugees to match them to localities or communities does not compromise existing policy, at least from a UNHCR perspective. In fact, UNHCR already often acts as a matchmaker similar to the public school board by processing applications and

suggesting refugees for resettlement in countries that have agreed to take the refugees.[11] The current matching process, however, is not systematically designed to achieve desirable properties of two-sided matching. While the UNHCR acts as a conduit for the vast majority of resettlement applications, it does not take into account the preferences of refugees and the priorities of countries in any systematic way. UNHCR typically suggests a family for resettlement in a particular country and the country processes the application it receives. Given that India has little institutional experience with matching processes, implementing the UNHCR match without considering any further properties may not be ideal.

Why Matching?

The UNHCR and other activist groups contend that a country of 1.2 billion people should be able to provide ample opportunity to another 40,000, especially since the the central government issued an order to all state governments to identify and deport illegal immigrants, including Rohingya on August 8, 2017.[12] This is likely to mean that more and more Rohingya will be diverted to Bangladesh; but that the 40,000-60,000 believed to have entered India over the last two years and already in some process of acquiring identification can legally be integrated through some policy instrument.

Government reports suggest that about 14,000 Rohingya in India have been recognized as refugees by the office of the United Nations High Commissioner for Refugees.[13] This recognition has allowed refugees to procure long term visas, and helped them gain access to education, healthcare, and housing. One of the main challenges in assigning these facilities, nevertheless, is that refugees do not naturally seek areas with more jobs and housing, but instead prioritize living close to their fellow Rohingya since the community is so closely-knit as a minority group. For immediate and sentimental reasons, this homogeneity of experience makes sense but it is bound to harm long term outcomes. Consider Sweden's experiment in 1990 of deliberately placing refugees randomly around the country, in the hope for better integration. The research done at Uppsala University based on this experiment decisively shows that initial placement of refugees into less prosperous communities lowers their job prospects, health,

income levels, and education.[14] Now, according to data from the United Nations Development Programme (UNDP), Sweden is around 82 spots better than India on the world inequality index determined by various metrics. This implies the amplified inequity of a similar attempt for Rohingya in India.[15] By random allocation, they would be subject to communities that are detrimental to any form of upward mobility. The goal for India, on a humanitarian level, is to avoid creating conditions (at the behest of complete randomization) such that the existing Rohingya refugees voluntarily choose to head back to Myanmar.

The Proposed Market

Before discussing the necessary components for applying matching theory in this situation, certain theoretical definitions need to be considered.

Even beyond the idea of economic and market-driven processes, a variety of situations in society require pairing/matching one agent to another. The agent can take the form of an individual or any other entity that offers something that can be incorporated as a form of exchange. The first foray into such work was in 1962 was by D.Gale and L.S. Shapley who focused on college admissions (matching colleges to students) and marriage (matching men to women and vice-versa) as a class of processes that would classify as two-sided matching models.[16] A matching is two-sided if:

1. *There are two sets of agents*

2. *If an agent from one side of the market can be matched only with an agent from the other side*

3. *Both sets of agents must agree to duly match for a match to be made*

4. *A centralized application process, as does not exist for many potential Indian matching markets, exists in the system*

5. *There is no unit of comparison in that agents have preference orderings over the other set of agents instead of values*

Furthermore, the preferences, $>_x$, of agent x for set P of p agents on one side of the market and set Q of q agents on the other side are strict total orders over:

· $P \cup \{q\}$ for agent q

· $Q \cup \{p\}$ for agent p

Ever since Gale and Shapley's marriage model, several goals of a fair and optimal allocation (or successful matching) have been identified. The notions of fairness and optimality are captured in:

1. **Pareto Efficiency:** No one should improve in the allocation without harming others. There is no potential trade made between two agents being matched that would make anyone better off without making anyone else worse off. The better and worse off can be corresponded simply to happier and unhappier.

2. **Stability/No Justifiable envy:** The process of justifiable envy is as follows: If p envies q's match, then q's match prefers q to p. Should this be removed, Rohingya refugees would not end up satisfied with their matches and would pursue under the table re-matching. This could prevent our designed matching intervention from breaking down.

3. **Algorithmic:** The algorithm to find suitable matching should be solvable in polynomial time.

4. **Strategy-Proof (for the agent being matched):** This design outcome implies that reporting true preferences maximizes the rank of final match. Again, in line with our approach this would mean refugees should not have any incentive to lie about their preferences over localities/communities hoping for better assimilation within India.

With these considerations of theory and achievable outcomes, I shall now proceed to how matching can well be a turning point in the Rohingya refugee resettlement process within India's borders.

Matching for the Rohingya

On one side of the proposed matching system are Rohingya refugees. *Does this mean each refugee enters the market as one agent on one side?* It does not take much analysis to confirm that these refugees are already going through grave amounts of trauma. Splitting families up would only amplify the ordeal. Hence, one agent on the refugee side would correspond to an

entire family. A crucial element of the resettlement process is that refugee status is decided by the UNHCR and government agencies. For the purposes of matching, it will be taken as given.

The other set of agents comprises localities/communities, which in India are identified by as tehsils. The Rohingya have been found to create self-organized social safety nets, through literacy programs and other such campaigns. However, Delhi and other parts of urban India are often the preferred destinations for refugee groups that fall within the UNHCRs mandate.[17] In the capital, these groups have the possibility to get refugee certificates and access to certain support services, such as education, health, livelihoods, and legal counseling. It is for this reason that the Rohingya lawyers and the central government of India are in the midst of a legal battle at the Supreme Court where the government contends that offering the best of urban settings to these refugees poses a security threat to the state. Matching is also capable of softening the terms of this legal battle if it is recognized that a more equitable and fair allocation of refugees to areas (not necessarily all urban) poses both less of a security threat and less burden on the tehsils that will accept Rohingya.

Matching Market Structure

Once regulatory authorities can definitively ascertain that a certain number of Rohingya have to be resettled, and that *tehsil* administrations can confirm that they can host a certain fraction of this number, we should be ready to implement the match. With the highly de-centralized structure of government, the way this would work is that the central government would earmark certain areas deemed fit for accommodating refugees (based on the latest Census and proximity to Myanmar border).

For information to be processed before any allocation is made, a centralized clearinghouse would have to exist. Both sets of agents - refugees and tehsils - will submit a ranking to this centralized clearinghouse: refugees (as family units) would submit their preferences over where they wish to go, and communities their priorities as to which categories of refugees they feel equipped to help. To be clear, Tehsils would not rank Rohingya families individually - they would rank categories of refugees that their available resources can accommodate. Not only is there no way for administrators to know specific characteristics of incoming refugees that make them

attractive for acceptance, but ranking individually would send the system into an ethical spiral. Even 70 years after independence and partition between India and Pakistan, India is divided into Hindu-majority and Muslim-majority regions. Individual family names, can hence be used to identify ethnicity and may adversely affect stability of outcome, whereby a tehsil administration may prefer a different refugee status but ends up lying due to ethnic favoritism.

Instead of ranking families individually, *tehsil* representatives and administrators would rank priority categories based on capacity, which is expected to be a function of resources available for the district to provide new livelihoods. Each district will have what is called a 'priority structure', which is the complete ranking made by one agent on any side of the market. More specifically speaking, the priority categories could arise from say, a district with more entry-level jobs available or more hospitals/medical facilities available having highest priority for refugee categories seeking entry-level jobs or more urgent medical assistance.

In an Indian context, other priority categories I would recommend are: family size for necessary housing accommodations, or number of children in Rohingya family versus private/ government schooling infrastructure and presence of NGOs for refugee support. The prerogative of which categories to include in the matching market is necessarily that of the central authority for reasons of uniformity. As a caveat, a precursor step should be to finalize which priority categories leave no room open for ranking based on immoral intentions by existing residents of the district. The UNHCR and other resettlement agencies have substantial data on vulnerability and particular need of the 40,000-60,000 refugees already in India.[18] For the Rohingya refugee match, the Indian government could simply make the possible priority categories correspond to categories based on this vulnerability and need-based data.

We will find that it is mandatory to assign a two-fold priority system to tehsils, one that highlights total capacity in size units and another that highlights the true priority aspect. One must recognize that some of these services, though well-offered, may not be able to cater to every possible capacity of incoming refugees. This two-fold system would also avoid overfilling quotas in any category. Bestowing the power of deciding a priority structure on the tehsils also eliminates a cumbersome bureaucratic process from the capital New Delhi. Yet another reason for discretion is that tehsils or localities are bound to have non-uniform priorities. Therefore, it is

wise to allow some degree of discretion over priority structure. For example, one district might want to prioritize rare medical conditions over family connections, whilst another might have a very different ranking. The Rohingya refugee match duly allows both refugees and *tehsils* to decide for themselves what is most important to them.

Matching Logistics

Before describing what the algorithm would look like, it is imperative to impose some requirements without which the process would bear no fruit. In order for the preference orders to be meaningful in any way, the central government must ensure that refugees receive accurate and comprehensive information about districts in order to help them make a decision. Partnering with support groups and NGO's is my suggested best way to go about it, based on the deeper grass roots connection these groups tend to possess in a hugely populous country like India. Many a time, this will include presenting information in a valid format, i.e. translation to Rohingya language which happens to be closely related to Bengali (one of India's most widely spoken languages).

Though not formalized through a known refugee resettlement program, the Indian government is bound to resettle at least 14,000 Rohingya refugees, just based on UNHCR recognition (the others making up the previously stated 40,000-60,000 have not gained recognition/status yet). It is likely these 14,000 refugees were a part of the first wave of Rohingya redirected from Bangladesh around August of 2016. Should our Rohingya refugee match find allocations satisfying certain properties, India's plans to deport other Rohingya may change in some shape or form. It is largely because of the absence of any sound matching system that the government is reluctant to adequately resettle these refugees (along with security issues as mentioned earlier).

Voluntary participation should ideally not be an option, simply because of a possible sentiment of aversion towards these refugees. The government will have to earmark certain districts and force participation, and raise financial support available at the state level in tandem. This is expected to hold because the initial matching system will be tried with the assumption that the government can commit to hosting only 14,000 Rohingya with guaranteed status from

UNHCR. It should also be clearly delineated by government representatives that tehsil administrations have an incentive to participate in the scheme especially when they believe that few other tehsil administrations are participating. When the system is less competitive from their perspective, they are likely to get particularly apt matches given their priority structures. Other incentives for tehsils include increasing financial support from the centre per refugee, more infrastructure projects as reward for entering the match and a better utilization of existing infrastructure - all captured within the theme of growth prospects for the particular region.

Since we have decided the matching system will run on 14,000 Rohingya (split into families), we are entering what is called the Refugee Number Target system, where payments are determined by a convex function (see figure 1).[19] After the government has set a number of refugees, the system determines the cheapest allocation of that number. Tehsils will announce a minimum number they would be willing to accept and should be willing to accept further refugees up to their actual total capacity. As opposed to a Spending Target system where the government would decide an overall amount it is willing to spend, a smaller number of tehsils or districts are likely to host large numbers of refugees in this Refugee Number Target system.

Fig. 1. Refugee Number Target System

Payment Level

Number of Refugees Taken
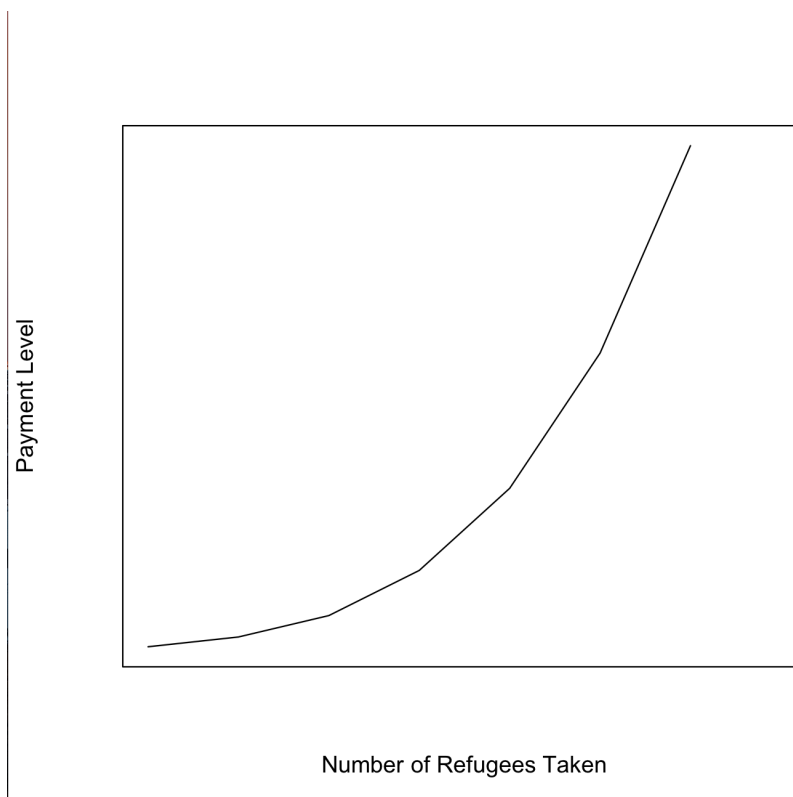
One cannot emphasize enough how crucial it is to ensure that refugees do not get lost in a pool of information and in turn, lose the ability to make sound decisions about their rankings. In a way, presenting them with two-sided matching is already stressful enough. The idea is to relieve that stress wherever possible. The government would need to approach this on both sides of the market: on one hand, pre-select a reasonable number of tehsils that are found to be functional for certain services and on the other ask refugee families to rank only a subset of the tehsils. These steps can hugely simplify the process. They can also bridge the gap between this overwhelming matching market and the intrinsic personalities and needs of Rohingya.

Refugees are in dire need of relocation assistance. Running the match on say, yearly intervals, would be counter-productive. The goal will be to reduce intervals to ensure immediate protection but not to the point that matching is done so frequently that refugees who are deemed to have higher priority at an earlier clearing round end up with lower priority than a set of refugees entering the system later. If the system matches too frequently, Rohingya refugees may end up damaging their own interests and that of other refugees in the Rohingya Refugee Match. This leads to the question: *Will refugees be able to game the system by entering a later round?* We will avoid this problem by asking the Indian government to allow refugees to submit preferences with ample amount of time to think about their decisions, but to not inform them which batch they will enter.

We have already seen the desirable characteristics of two-sided matching outcomes. However, no two-sided matching market has so far been found to satisfy all outcomes.[20] As a result, we will aim to build a sense of the subset of desirable properties we deem more important. Some evaluation would lead us to feasibility, strategy-proofness and Pareto efficiency as the most important properties for our purposes.

- Whilst **efficiency and feasibility** are clearly desirable to avoid political controversy and disarray, they will also be necessary to present for the Government to be willing to act as clearinghouse.
- **Strategy-proofness** will be needed because refugees naturally have unequal levels of access to information about different districts and, if the system is gameable, more

informed refugees may have an undue advantage.

· **Stability should not be too important** because under the table re-matching should anyway be legally prohibited or made exceptionally costly to deter refugees/districts from indulging in it. However, giving up stability would mean losing the power to do much about an unstable/unfair outcome - one where refugees can see that there are more desirable districts in which they would have had a higher priority.

Following the above considerations, it must be made clear to refugees that they cannot make themselves better off by being untruthful about their preferences of tehsils. This ensures a level playing field. We will be hoping for diverse preferences. Despite the previously described homogeneity of religious areas in India, diversity at the lower level (districts which we would ask refugees to rank) is still large. Given the set up of this matching market, the more diverse preferences are, the more we stand to gain by using a two-sided matching process. Another way to think about this is: Regardless of which algorithm we use, if all districts have similar priority structures, then the system is likely to let refugees decide their own fates.

Algorithms

With the theoretical and practical considerations behind us, we must now consider how the centralized clearinghouse would run this matching. I will outline sample matches using the following algorithms:

Gale-Shapley Algorithm (Tehsil/District-Proposing): Assume there are there are three Rohingya families, referred to as R_1, R_2, R_3 and three tehsils, referred to as T_1, T_2, T_3. For purposes of this example, let each district accommodate at most one refugee family. Furthermore, assume that preferences of the Rohingya families are as follows:

$$R_1 : T_1 > T_3 > T_2 \tag{1}$$

$$R_2 : T_2 > T_1 > T_3 \tag{2}$$

$$R_3 : T_2 > T_1 > T_3 \tag{3}$$

where $>$ means 'strictly prefers.' Now, consider the indirect preferences of the three tehsils (keeping resources and matching family needs in mind):

$$T_1 : R_2 > R_1 > R_3 \qquad (4)$$

$$T_2 : R_1 > R_2 > R_3 \qquad (5)$$

$$T_3 : R_1 > R_2 > R_3 \qquad (6)$$

With these preferences in mind, this is how the District-Proposing version would work:

1. T_1 proposes to R_2, T_2 to R_1 and T_3 to R_1.
2. Tentative acceptances are made based on preferences of Rohingya families, and rejected districts keep proposing in sync with their specified priority structures.
3. No families are rejected - all tentative acceptances are made final.

This leaves us with the stable outcome $(T_1 - R_1, T_2 - R_2, T_3 - R_3)$. However, we have clarified earlier that stability is not the most important property to satisfy. Furthermore, the stable outcome is not efficient since T_1 and T_2 would want to swap the refugee families currently assigned to them. Let us pivot to an algorithm that can move us towards one of the other properties we would favor.

Top-Trading Cycles Algorithm: In every round, every Rohingya family points at its favorite district, and every district points at its highest-priority family.

Running the TTC, we have the following cycle: $T_1 \rightarrow R_2 \rightarrow T_2 \rightarrow R_1 \rightarrow T_1$. We follow the strategy of assigning families in the cycle to the *tehsils* they immediately point at. So, T_1 gets R_2 and T_2 gets R_1. This leaves the assignment of T_3 to R_3.

This gives us the outcome $(T_2 - R_1, T_1 - R_2, T_3 - R_3)$. Notice that this outcome is not stable since R_1 and R_2 can coordinate an under the table deal and swap districts to make each better off. If previous suggestions on making such deals legally prohibited/costly are followed, this deal should be virtually impossible to conduct. But the outcome is efficient, no refugee family can get assigned relocation in a more suited district without rendering some other refugee family worse off in the process.

One-sided Rohingya matching - Irvin's Algorithm: Though the focus of this paper has been on two-sided matching theory, it is important to leave alternatives open. Suppose the government is reluctant to implement a proposal that requires tehsils to enter a matching market, and instead chooses to pre-specify districts where it would want to place Rohingya refugees. Taking this as given, I propose we can still use matching theory to keep refugees satisfied. Here, there will be a matching between refugee families as opposed to between families and districts. Irvings algorithm for the stable roommate problem from 1985 can be thought of as a motivator for this one-sided refugee matching.[21] For the sake of comparison, refugee families can be thought of as roommates and tehsils can be equated to room/accommodation. The problem can be described as follows: A set of n potential families, each with ranked preferences over all the other potential families, are to be matched to tehsils, x families per tehsil.

The process would be formulated slightly differently. It would be made clear to refugees that the districts to which they will be assigned are pre-decided and not open to choice. Instead, they can choose which other families they want to live with by entering this single-sided market and ranking each other. The 'x' is attained by continuously running the match on family pairings and treating them as a single unit at each subsequent round. For instance, X and Y are found to be stable co-residents in one matching. Then X and Y will join forces in the next round and act as a singular family unit hoping to find a stable assignment in another pair acting as a single family, say P and Q (where P and Q was a stable assignment from the previous round).

A matching is stable if there is no Rohingya family, R_1, that would rather be matched to some other co-resident family, D_2, than to their current co-resident, R_2, where the other family, D_2, would rather be matched to R_1 than to their current co-resident family, D_1. The algorithm takes place in two phases.

In phase 1, potential co-resident families take turns sequentially proposing to the other families. Each family who is proposed to can accept or reject the proposal. A family accepts if it currently has made no better proposal which was accepted to another family. If a family has accepted a proposal, and then receives a better proposal, it rejects the old proposal and substitutes

in the new proposal. In phase 2, we begin by eliminating all potential family co-resident matches which are worse than the current proposals held. Once a match is made after a number of rounds, refugee families can be assigned to pre-decided districts keeping in mind the family pairings from the one-sided Irving like algorithm. The above algorithms have been described as though there is active proposing, rejecting and accepting. In reality, we will have computer software implement the matching system, much like in the one-sided matching case. What should be even more striking is that different algorithms can lead us to different properties, some more attractive than others. With the theory laid out, it will be up to the pertinent government organization to decide whether to take a matching theory approach to expand on the aforementioned ideas. The presence of families may require some difficult trade-offs to be made. For example, it is unclear whether a single individual satisfying priority categories X and Y should be matched ahead of a two-person family with one member in priority category X and one member in Y. It can be left up to the regulating authority's discretion once a presentation is made. More such final considerations are highlighted in the next section.

Conclusion

As this paper shows, designing and implementing matching systems in emerging markets with weak institutions poses a substantial challenge. In exploring the status quo of matching in India before outlining the Rohingya refugee match, my effort has been to take a step in that untapped direction. It would be too far-fetched to claim that matching is the ideal solution for the Rohingya refugee crisis in India. The reason I emphasized legal measures earlier on is to be able to conclude by reiterating that no amount of market design can triumph a simple lack of desire by society or government to accept refugees. Moreover, it cannot be applied to all contexts. If, for some reason, the government decides to let refugees seek aid in India through local sponsors, it is much less likely that a matching system can then act as a viable intervention.

At the same time, however, the matching system is a more efficient and humane way of dealing with a crisis like that which the Rohingya face. The tehsils that families are matched to

are more likely to get them started on a path of integration and upward mobility. As a result, the overall quality of life a district can offer is expected to be higher in most cases. The system in itself is an incentive for further participation, especially for the districts. Seeing favorable results and neighboring regions flourish is bound to get more local administrations excited about entering a matching system to accept Rohingya. Better integrated and more content refugee populations are expected to foster communities within districts that are more confident about their ability to host refugees in future. Yet another benefit is the immediacy of the outcome with matching. In the current system, the government is making little or no progress even in relocating Rohingya refugees with guaranteed status. For a matching market, an allocation is immediately decided once the priority structures on both sides are aggregated by a centralized clearinghouse. The intervals at which to facilitate this matching are also up to our discretion.

Last but not least, this system is almost unprecedented in how humanizing it is. It would give a historically neglected and now displaced community more control over its own fate. This system would be even more direct than systems that purportedly take the best interests of refugees into account in helping them find a suitable region to resettle - like the existent system of bureaucratic machinery reviewing a dearth of refugee family information to make arbitrary decisions. We expect a fundamental right to choice across all walks of life within the constraints of what is available. The government of India must realize that Rohingya Muslims too, at the very least, have that right to choice.

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Notes

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