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| **Problem Chosen** F | **2020 MCM/ICM Summary Sheet** | **Team Control Number** 2017234 |

**Where there is rights and identity, there is home**

To study …, We build . We assume that/一小段话简单介绍背景提出问题To address this problem, a well-established market system is required that not only ,but also .

或者

Understanding is imperative—重要性. The objective of our team was to . To accomplish this goal, our team was tasked with building a model that evaluates the

To satisfy the requirement, our paper provides a detailed analysis based on/ We develop a model that

Using our model—解决了什么问题以及政策建议

将用到的算法加粗

Task 1: We

Task 2:

Task 3:

Task 4:

First,

Next,

Lastly,

In the end, we make sensitivity analysis and discuss the strengths as well as weaknesses of our model. Moreover, a policy memo is presented to the decision maker based on model.

**Keywords**: Private Information; Pricing Strategy; Dynamic System

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# 1 Introduction

1.1 Background

With global temperature rising by 4℃, 600 million people will lose their homes[1]. Unorgnized migration is full of terror and danger, let alone so many uncertainties in a new “habitat” they are heading for. Thus one of the paramount issues is to protect their human rights and culture of these climate refugees other than their basic needs, which means building a new “home” rather than simple “habit” for them. Although some countries are voluntarily naturalizing nearby refugees, climate change is causing more frequent environmental catastrophes, requiring the intervention of the United Nations to more effectively manage the growing scale of migrations.

As for the United Nations, the core question is when, why and how United Nations step in the climate refugees migration process to both preserve their human rights and culture and respect the welfare of host country’s people. Hired as advisors for UN, we started our “home reconstruction” journey here.

1.2 Our Work

·We first elaborate reasonable metrics on diverse factors that assess the risk level of different climate refugees, the acceptance ability of host countries and the welfare evaluation.

·And we clarify the scope of our model by not only defining the number and origin of climate refugees, but also the standard to be host countries and the decision on refugee quotas for each of them, hence determining the climate refugees set (CR set) and host countries’ set(HC set) and quotas.

·Besides, We devise the comprehensive maching model based on the analogy of Coulomb's Law, mapping the CR set to HC set with the goals of both protecting refugees’ human rights and cultural identity and the welfare of host countries’ people.

·Next, We evaluate the proposed policies by stochastic simulation and explain the potential impact of them. Then based on the basic model, we add the time and political factor into it.

·Finally, we evaluate the merits and demerits of our model and discuss the future work of our efforts.

Fig.1 Tab.1

Figure 1:

Sec 5.5

解决思路流程图

# 2 Metrics

气候难民危险指数

接纳国接纳度综合评估值

Having clarified those parameters and measures, we can step further to define notations that are used in our mathematical model.

# 2 Assumptions & Notations

2.1 Assumptions

To better quantify the problem, our model is based on several assumptions that hold true in most cases or are indisputably satisfiable under government regulation.

或Given those preconditions, we can set out to construct our model so as to figure out

或Since it is challenging to predict all variables and factors that may affect our model, we made certain assumptions to produce a working model.

**Assumption 1**. Are not taken into consideration（提假设的时候说一下假设的合理性/简化的必要性—难以衡量）Thus it is pragmatic to make such an assumption.

Leave out the condition that

Take no account of

**Assumption 2**. 加粗

下面具体解释—各种找资料试着证明假设是合理的，符合现实的

**Assumption 3**.

It is challenging to quantify events

**Assumption 4**.

are difficult to quantify or express in a model

**Assumption 5**.

Extrapolated to the year 2100, a retirement age of 70 is a reasonable estimate

**Assumption 6**.

Assumption 1 ensures that, thus it makes sense to . Assumption 2 guarantees that , which forms the basis of our model. By assumption 3 are made possible.

如果需要的话—Metrics

Taking all those parameters and measures into account, we can step further to define a set of notations in designing a mathematical model.

2.2 Notations

In this paper we use the notation in Table 1 to describe our model. Other symbols that are used only once will be described where they appeared.

Table 1: Notation

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| --- | --- |
| Symbol | Definition |
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# 

# 3 模型的简称—首字母缩写: Mathematical Model for

类似于问题分析—简介一下整个建模思路，绘制思路图

The overview of the entire framework and of it are illustrated in Fig.1.

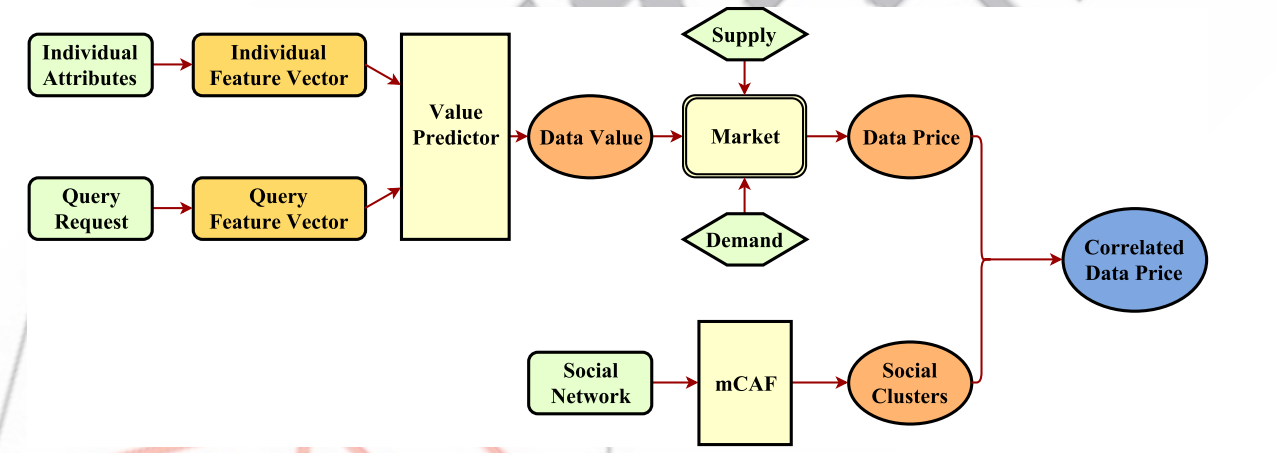


Figure 1: The schematic illustration of the entire model

3.1 The Scope of Comprehensive Maching Model

The United Nations needs to play an intermediary role between the EDP set and the host country set. Therefore, the most important issue is to define the specific scope of these two main bodies. Based on the definition of the refugee set, we will analyze the degree of their cultural loss.

3.1.1 Environmentally Displaced Refugees

The definition of environmental displaced refugees varies in different papers. As stated in the UN Environment Programme (UNEP)’s report in 1985, environmental refugees are “people who have been forced to leave their traditional habitat, temporarily or permanently, because of a marked environmental disruption that jeopardized their existence and/or seriously affected the quality of their life.”[3] Having considered different definitions by various researchers and the need to quantify our model, We define climate refugees as people who have no choice but to leave their disappearing or devastatingly-stricked homeland due to climate change. Specifically they are categorized into two groups:

·who need to be saved immediately due to frequent tsunami, hurricane, storm et cetera.

·who need to migrate to safe areas in order due to sea level rise.

3.1.2 The Prediction of Number of EDR:

为了决定我们的研究

3.1.3 The Risk of Loss of Cultures

The Maldives, Tuvalu, Kiribati, and The Marshall Islands

3.1.4 Host Country Set and the Refugee Quota

3.2 The Comprehensive Matching Model

The United Nations wants to protect the human rights and traditional culture of EDPs. On the one hand, the rescue of refugees facing short-term extreme climate disasters is necessary, and on the other hand, support for EDPs who had their country disappearing before long and reached the host country due to rising sea levels is also needed. It is ineffective to protect EDP’s human rights and culture when they have already arrived at the host countries, since racist sentiments and nationalism might be sparked by the cultural conflicts. In the end, these refugees are either assimilated or repatriated by the host countries if they insist on the preservation of original culture[1]. It is obvious that this the cost of this humanitarian negotiation surpasses the benefits, so this article creatively proposes that the problem must be solved at the "root and begining", that is, the two with the most similar culture should be matched by the help of United Nations.

This makes it easier for refugees to obtain their human rights and preserve their culture.

3.2.2 Comprehensive Attractiveness Based on Coulomb's law

3.2.3 Policy Recommendation Based on the Comprehensive Matching Model

3.3 The Evaluation of the Impact of Proposed Policy

3.4 Time and Political Factors

3.4.1 Time Factors

3.4.2 Political Factors

# 4 Results

不一定要分成不同Task去说，可以按照建模的逻辑归类说明结果

4.1 Task 1：

4.2 Task2:

4.3 Task 3:

4.4 Task 4:

4.5 Task 5:

4.6 Task 6:

4.7 Task 7:

# 5 Sensitivity Analysis

We also think about the influence of capacity of each node on our model, finding that when the capacity changes by a small maigin *±*5%, then the result of our model change by *±*2%, but when the capacity changes beyond *±*10%, then the result will deviate by larger than 4*.*7%.

# 6 Evaluation of the Model

6.1 Strengths

·我们的综合匹配模型通过在源头上更有效率的保障难民的人权和（项目符号）用了…方法，which simplifies our calculation and coincides with real data.

·we also make creative refinement about the attraction, and the result has been verified by real data, indicating that our model does have its value

·which backs up our reliability.

·thus our policy can be more convincing

·Our model incorporates many of the socioeconomic aspects of a civilization such as . This allows us to make informed predictions about and will enable us to prepare for the challenges that we predict from the model.

·Our agent-based model allows for different combinations to occur in every agent, such as age, sex, education, and income. Unlike a continuous model, where we are forced to generalize such combinations and quantify the interactions between different variables in a broad scope, an agent-based approach allows our model to better characterize the interactions that may occur and reveal outcomes that are often not quantifiable with pure mathematics.

·Our model is robust as it allows for economic considerations of large scale migrations over arbitrarily large time scales. Though we only rigorously tested our model’s efficacy for 100 years, we know that the model will continue to make predictions given that

* Our model utilizes metrics that are evaluated continuously, thus allowing us to observe the state of the economy and social welfare at different points of population stress. For instance, by the rise in the education metric. Thus, policy can be designed to not only address the initial population on Mars, but also analyze policy options for certain intervals in the model.

·Our model includes a large amount of dynamic elements over time. For example, every citizen is given a dynamic income, which is dynamically affected by sinusoidal inflation and taxation. By allowing characteristics to vary, we reduce the number of assumptions, and therefore reduce the number of possible invariant critical points that may break when the model is put under stress by varying population characteristics.

6.2 Weakness

·so we almost leave out the refugee flow on EB route, but actually there must be some refugees taking EB route.

·The distances in our model are approximated to be straight lines. We ignore the geological barriers on the routes, so there are some errors in calculating the distances.

·We leave out the redistribution of refugee flows after they enter Europe, but only determine the acceptance ratio according to the receiving data of the countries.

·We haven’t thought of the stowaways who enter Europe illegally as refugees, because we do not have the offical data source.

·Our model is heavily dependent on current census data of employment, inflation, income growth, percentage of bachelor degrees, and other Census data. Therefore, relatively small changes in this data can compound into large amounts of variation over 80 years.

·Our model is strictly economic in nature. Therefore our model does not take into account the physical infrastructure needed to facilitate a civilization on a large scale. In particular, our model may imply that a large initial population is more digestible than it may be in actuality. Our model is probabilistic in nature, meaning that it will return slightly different values when run under the same initial settings. Therefore, multiple trials of our model must be run to determine a value.

·Our model does not consider family structure. In actuality, there may be transfers of income and other interactions within a family that may not be accounted for in this model.

# 7 Conclusion and Policy Recommendation

~~（模型优缺点分析）~~We develop a complete that accurately estimates . Our method consists of three core components: .

One limitation of our current approach is that our model . A promising future direction is to .

Uncontrovertibly, there are many drawbacks in our model, such as incomplete inaccurate , etc., we have to do a lot more to improve our work.

Firstly, we do not get the effective which can be misleading to some extent. For example, So we need to take more impact factors into consideration to get a better simulation.

Secondly, we do not get enough data in terms of testing our model . Hence it is hard for us to use effective data to back up our model as it is no doubt that the more real statistics we have, the more helpful and reliable it can be in creating a better model.

Finally, we should try to get more information about the policy implemented by the countries involved .And hopefully when we know exactly what the politicians are planning to do, we can propose more feasible strategies.

另一种版本

We were tasked with the job of modeling and characterizing the . We began by creating model that characterized the combined effect of the personal initiative of every Martian citizen and the social welfare provided by the government. By defining the income, education, and equality metrics, we were able to .

We found that the best initial population had a mean age of 37 and a ratio of 1:10 of innovators to producers. The Martian society can also support more than 10,000 people in emergency situa- tions, assuming that there is adequate infrastructure. We also determined that a maternity leave length of 10 months and a paternity leave length of 3 months would be optimal. Furthermore, the minimum wage was determined to be optimal at around $70,000. Government control of inflation and a progressive tax system served to increase income inequality while keeping investment high and government debt low, allowing the government to provide for increased education and infrastructure needs. A happiness survey can be utilized to create a a strong, collaborative society working to reach common goals.

Given enough time, our group can extend the model to（结合缺点） include family structures by implementing an underlying network to simulate inheritance. We can also consider infrastructure as a potential parameter when considering mass migration from the Earth to Mars. To infinity and beyond!（比较有趣的结尾）

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**A Letter to UN: A Policy Recommendation For The World Concern**

Dear sir,

Upon hearing that the UN Commission is holding a policy strategy meeting to collect insights aiming to figure out a set of policies that ensures I and my fellow colleagues are honored to engage in clearly presenting our role and scope of engagement in the refugee crisis response as an aspiration of the whole human race. We have been working with great efforts so as to do something for the world concern of refugee crisis, and we do have some fruits by researching day and night these days, which we hope can be of help in providing

The proposed partnership and lead coordination role of different organizations will further enhance coordination to provide more thorough background information and break the culture division to an extent.

Best regards,

Sincerely

# 8 Appendix

1. **Computer program of 3.2—Improved K-means model**