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The Relationship between Vulnerability and Climate Changes

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Abstract

Facing the worsening ecological environment, the governments all over the world begin to think about the impact of the environment about fragile state. At the same time, all kinds of imprecise researches try to argue the relationship between vulnerability and climate changes. To measure the impact of climate change on a country's vulnerability, we first set up an initial model to characterize the vulnerability of a country and divided the results into very fragile, fragile and stable. Through the data of natural disasters and countries from the United Nations, we complete the final model. We identify the impact of different natural disasters on certain indicator of a country by the final model. To verify the feasibility of the model, we select ten of the most fragile counties to explore the impact of climates change. The result shows that these counties should have been stable if climate changes had been not existed. Besides, we found some critical pointsdeciding vulnerability of these countries. When P, Q > 0.7 , the indicator of FSI will produce crisis influence for ability of resist extreme climates. Furthermore, according to above conclusions, we suggest the leaders of governments should pay attention to investments of social security and economy. Otherwise, technology perhaps play a huge role not to be neglected. Eventually, ourfinal model apply to larger cities instead of smaller cities.

Keywords

Integrated Development; Special Influences; Matlab; SPASS.

1. Introduction

1.1. Problem Background

Climate change affects national security both directly and indirectly. On the one hand, climate change will directly threaten the goods and personnel of other countries, especially the coastal areas, and will directly impact the armed forces of various countries in varying degrees. On the other hand, climate change can trigger indirect security problems. As a kind of "threat multiplier," it will exacerbate the crisis of all kinds of resources through various channels. As a result, it may trigger a humanitarian disaster and lead to turmoil and conflicts. Particularly for those vulnerable countries, the consequences of climate change are even worse, which can lead to a wider range of security risks, including the threat of failed countries and terrorism. At present, the exploration of how climate change affects fragile states has become an important core issue for academics and policymakers in western countries to study the issues of global security, development, and poverty today.

Vulnerable countries studied in Western academia have taken a many Quantitative Methods to assess the vulnerability of all countries, mainly most developing countries, by constructing different Fragile State Index (FSI) in order to demonstrate the objectivity and the scientific of their research in fragile countries. There are two problems existing in these different FSI: the selection of indicators and the determination of index weights. They mainly describe the value

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of FSI in two ways. One is to calculate the average of all the standardized indicators, and the other is to add them. However, neither approach reflects the impact of different indicators on national vulnerability.

2. Symbols Description

Table 1. Symbols

symbol	Definition
Xj	The indicate of fragile state index
qp, q	The impact of natural disasters on indicators.
Ys	The value of national stability
Yf	The value of national vulnerability
$M\,H\,/\,M\,L$	The percentage of an increase/decrease in a single term.
Wh	The value of integrated development
Z	The types of climates change

3. The Initial Modeling

In order to solve the problem of FSI mentioned previously, we introduce two concepts in the model. "Special influence" means that the strength of a country in some ways can have a different impact when it faces an extreme climate. These influences are quantified in the model by M_H and M_L. For a country as a whole, it is important to develop comprehensively. We quantify it by W_k.

3.1. Definition

We define

$$Y_s = \frac{1}{Y_f} \tag{1}$$

to show that their values change in the opposite direction. Thus, we set up the initial model:

$$W_h(1+M_H)^{Q_1}(1-M_L)^{Q_2}Y_S = \sum_{j=1}^{m} X_j \,. \quad j=1,2,\cdots,m \quad m>10 \tag{2}$$

$Y_s$is defined:

$$Y_S = \frac{\sum_{j=1}^{m} X_j}{W_T(1+M_H)^{Q_1}(1-M_L)^{Q_2}} \,. \quad j=1,2,\cdots,m \quad m>10 \tag{3}$$

Q1: The number of stable X_j

Q2: The number of very fragile X_j

3.2. Determination of W_h

W_h depends on the level of overall development. If a country is balanced on various indicators, it has a more comprehensive capacity to combat natural disasters. However, a country focusing only one field is more vulnerable to natural disasters than other countries. We can say that if

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an indicator of the country is too high or too low, W_h will have a negative effect on the final result.

By calculation, we find that when the cutoffs are 1/2m and 2/m, there is almost no effect on the overall result. When the cutoffs are 1/ 4m and 4 / m, the effect on the whole is too significant. Therefore, we choose 1/3m and3/m as cutoffs.

4. The Final Modeling

In order to introduce effects of climate change on the initial model, we select a number of indicators to establish an initial model to observe their changes under several climatic changes.

4.1. Indicators System in Fragile Countries

Fields: military, international relations, security, science and technology, culture, population, resources, economy, and agriculture. Were measured by the following indicators:

Table 2. Indicators

Symbol	Indicators	Fields
X1	Military expenditure as a percentage of GDP	Military
X2	The amount of money to receive international aid	International Relationship
X3, X4	Crime rate and unemployment rate	Security (Public)
X5	Science project investment amount	Science Technology
X6	Religious citizens as a percentage of the total population	Culture
X7	Population density	Population
X8	Per capita water resources ownership	Resources
X9	GDP	Economy (Trade, knowledge)
X10	The level of agricultural development	Agriculture

4.1.1. Reasons for Choosing These Indicators

(1) Military: We choose the percentage of military expenditure as a percentage of GDP because it shows the importance attached to military investment in a country. The more a country's military power is stronger, the more secure it is.

(2) International Relationship: We choose the amount of money receiving international aid as an indicator because the more money a country receives in aid, the more countries that represent its friendly relations with him internationally. When it encounters the future as disaster strikes, the greater the amount of financial aid that can be expected, the more it will resist disasters.

(3) Security (Public): We choose the crime rate and the unemployment rate as indicators because the lower the crime rate and unemployment rate in a country, the more secure the country will be.

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(4) Science Technology: We choose the amount of investment in science projects as an indicator because it shows that a country places a great emphasis on science and technology. The more investment it attaches to it, the more scientific and technological achievements it makes the country more secure.

(5) Culture: As an indicator, the percentage of religious citizens in the total population is taken as an indicator. Religious citizenship represents the cohesion of a country. The more religious citizens, the stronger the cohesion and the stronger the resistance in the event of a disaster. The more countries Safety.

(6) Population: We select the population density of a country as an indicator. Population density is the number of people living on land per unit area. The population density affects the ability of this country to resist natural disasters.

(7) Resources: We select per capita water resource ownership as an indicator because the higher the per capita water resources are in the global environment, the more stable the people's livelihood and the more secure the country.

(8) Economy: We choose GDP as an indicator. GDP refers to the sum of the value of all final products and services produced by all resident units of a country (or region) over a certain period of time. It is often regarded as a measure of the economic status of a country (or region) The higher the GDP, the better the economic conditions in a country. The stronger his ability to resist natural disasters and the more secure the country are.

(9) Agriculture: We choose the level of agricultural development as an indicator (the level of agricultural development is equal to the increment of agricultural value as a percentage of GDP). The level of agricultural development represents the most basic ability of a country to solve the problem of citizens' survival. The higher the level of agricultural development, The higher the level, the more stable the country.

4.2. The Impact of Climate Change on National Vulnerability

Table 3. Climate change

Symbol	Indicators	Fields
Z1	The number of people killed each year in extreme weather	Extreme weather
Z2	The number of people affected by the earthquake each year	Earthquake
Z3	The number of people affected by floods each year	Flooding
Z4	The number of people affected by the annual drought	Drought
Z5	The number of people who die each year from infectious diseases	Infectious disease
Z6	Number of refugees	refugee

Therefore, in order to measure the impact of climate change, we selected the following six aspects to measure the vulnerability of countries, namely: extreme weather, earthquakes,

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droughts, floods, infectious diseases, and refugees. Respectively with the following indicators to measure:

4.2.1. Reasons for Choosing These Indicators

Reasons for choosing these indicators:

(1) Extreme weather: Indicators are the number of deaths due to extreme weather each year, the more deaths and the harder the country, the more vulnerable the country.

(2) Earthquake: If the number of people affected by the earthquake is the indicator, the more people affected, the more unsafe the country, the more vulnerable the country.

(3) Floods: Indicators are the number of people affected by floods. The more people affected, the more insecure countries are and the more vulnerable this country is.

(4) Drought: Indicators are the number of people affected by drought, the more affected people and the less secure the country, the more vulnerable this country.

(5) Infectious Diseases: Indicators are the number of deaths due to earthquakes, the more deaths and the less secure the country, the more vulnerable the country.

(6) Refugees: Indicators are the number of refugees who migrate to this country. The more refugees and the greater impact on the country, the more insecure the country and the more vulnerable the country is.

In a sudden natural disaster, the people in the affected areas may have feelings of dissatisfaction or even riots; at this time, other countries may take the opportunity to aggression against this country. Countries with stronger military capabilities can deal well with the potential riots in the country and the wars of aggression abroad and will have a positive weakened effect on the FSI as its value increases.

In the face of unexpected natural disasters, centralized state power, and religious countries, because managers have a more powerful authority and control over citizens, will effectively use state power to cope with changes and reduce social unrest and disaster expansion. Therefore, as a "special influence," this variable of culture has a positive effect on FSI as its value increases.

The number of countries that can receive international aid has a direct impact on his ability to deal with unexpected disasters. The greater the number of international aid recipients, the more effective the prevention of the spread of disasters and the reassurance of the people, which will have a positive effect on the FSI as its value increases.

Increases in crime and unemployment will lead to a deterioration of the security situation in the country. When a country encounters a natural disaster, this country will clash. Even the possibility of riots is extremely increased, making the country more vulnerable. With its value, the increase has a negative effect on FSI.

Science and technology are the primary productive forces. The rise of science and technology greatly increases the overall strength of the country. When a country encounters a natural disaster, a country with a high level of science and technology can stabilize its disaster in a short period of time and reduce its losses. As its value increases, it will have a positive impact on the FSI.

In the face of natural disasters, population density greatly affects the country's vulnerability. In countries with high population density, the number of people affected under the same conditions will be much larger than in countries with low population density, which greatly increases the possibility of clashes and riots, thus making the country more vulnerable. As its value increases, FSI has a negative effect.

Water resources are the necessities of people's lives. In a sudden disaster, the more stable the water-abundant countries are. Internally, civilians will not be riot-affected by the disaster and without external water being plundered or plundered. Therefore, FSI has a positive weakening effect as its value increases.

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The countries with high GDP have high economic level. When faced with natural disasters, they will have sufficient funds to face them. They will minimize the damage, stabilize the people's livelihood and make reconstruction possible in a short period of time so that people's lives will be restored to normal level. Therefore, FSI has a positive weakening effect as its value increases.

The level of agricultural development is also an indicator of the quality of a country's residents. High-level countries can transfer grain to the disaster-stricken areas in the face of sudden disasters, help the people in the disaster-stricken areas to weather the storm, comfort the citizens and increase their trust in the country, reducing friction and riots are more stable in the country and will have a negative effect on FSI as its value increases.

4.3. Definition

Through 5.2 shows that the impact of various types of climate change on X_j , we introduce the vector quantity $\theta_{P,Q}$. It means that the type of climate P makes an impact on indicator Q.

$\theta_{P,Q}$ is the weight vector given by Z_P to every indicator in $X_j, j = 1,2,\ldots,10, P = 1,2,..,6$. To simplify the calculation, we choice randomly 10 epidemiological events happened in 38 years in 20 countries (from attachments), and then calculate the change in Y_f before and after the epidemic and the effect on X_j . Calculating the average of these changes, we know how the climate changes affect the X_j . Therefore, the final model is:

$$Y_f = \frac{W_h(1+M_H)^{Q_1}(1-M_L)^{Q_2}}{\sum_{j=1}^{m}\theta_{P,Q}X_j} \quad (4)$$

$$j = 1,2,3,\ldots,m \ \ m > 10$$

By analyzing the data, we get six FSI models under the six types of climate changes.

Earthquake impact on FSI model:

$$Y_f = \frac{W_h(1+M_H)^{Q_1}(1-M_L)^{Q_2}}{\sum_{j=1}^{m}\theta_{2,Q}X_j}$$

Flood Impact on FSI Model:

$$Y_f = \frac{W_h(1+M_H)^{Q_1}(1-M_L)^{Q_2}}{\sum_{j=1}^{m}\theta_{3,Q}X_j}$$

Drought impact on FSI model:

$$Y_f = \frac{W_h(1+M_H)^{Q_1}(1-M_L)^{Q_2}}{\sum_{j=1}^{m}\theta_{4,Q}X_j}$$

Infectious disease impact on FSI model:

$$Y_f = \frac{W_h(1+M_H)^{Q_1}(1-M_L)^{Q_2}}{\sum_{j=1}^{m}\theta_{5,Q}X_j}$$

Refugee Impact on FSI Model:

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$$Y_f = \frac{W_h(1+M_H)^{Q_1}(1-M_L)^{Q_2}}{\sum_{j=1}^{m}\theta_{6,Q}X_j},$$

$$j = 1,2,3\ldots,m \quad m > 10 \quad Q = 1,2,\ldots,10$$

4.4. Discriminant Standard

Analyzing the data by K means cluster analysis, we design three intervals to determine the vulnerability of the country.

Table 4. Discriminant Standard

The value of *Yf*	vulnerability
Yf >0.207	very fragile
0.163<*Yf* <0.207	fragile
Yf <163	stable

5. The Vulnerability of Ten Countries

We select ten of the most fragile countries as our objects researched.

5.1. Sudan

Find $\theta_{P,Q}$ the flowing table:

Table 5. Sudan

Sudan	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
Z1	-0.08	0.17	0.34	0.1	0.08	-0.08	-0.07	-0.06	-0.01	-0.05
Z2	-0.34	-0.12	-0.08	-0.15	-0.11	-0.34	-0.46	-0.19	-0.05	-0.25
Z3	0	-0.12	-0.43	-0.07	-0.33	0.06	0.13	0.13	0.18	0.08
Z4	-1.15	0.45	0.36	0.89	0.75	-0.84	-0.41	-1.12	-1.05	-1.2
Z5	-0.07	-0.19	-0.2	-0.48	0.92	-0.03	-0.03	0.78	0.03	0.28
Z6	0.87	0.61	-0.45	-0.03	0.29	-0.11	0.52	0.64	-0.37	-0.55

As can be seen from the above table, for the Sudan, the three factors that extreme weather, earthquakes and floods have almost no impact on the country's vulnerability. Drought affects mainly Sudan's military expenditure as a percentage of GDP, and its level of agricultural development and per capita water availability. In the event of a drought, military expenditures as a percentage of GDP have fallen sharply. As a result of water shortages, the level of agricultural development and the per capita availability of water resources have also dropped drastically, increasing the vulnerability of the country. Infectious diseases have varying degrees of impact on all aspects of Saudi Arabia. In particular, the number of star per capita water resources is particularly significant, resulting in a decrease in the per capita availability of water resources and a significant increase in the country's vulnerability. The main impact of refugees on military expenditures as a percentage of GDP. The increase in refugees has led to an increase in national military expenditures and an increase in the vulnerability of the country.

5.2. Somalia

Find $\theta_{P,Q}$ the flowing table:

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Table 6. Somalia

Somalia	X1	X2	X3	X4	X5	X6	X7	X8
Z1	-0.06	0.16	0.22	0.36	0.05	-0.08	-0.09	-0.08
Z2	-0.49	-0.11	-0.12	0	-0.04	0	-0.23	-0.35
Z3	0	-0.22	-0.04	-0.07	-0.36	0.07	0.08	0.11
Z4	-1.04	0.65	0.81	0.25	0.81	-1.09	-1.03	-1.1
Z5	-0.14	-0.09	-0.49	-0.14	-0.52	-0.25	-0.54	-0.57
Z6	0.27	-0.75	0.46	0.78	0.15	-0.24	-0.08	0.61

It can be seen from the above table that for Somalia, the factor of extreme weather has almost no impact on the country's vulnerability. The earthquake has almost no impact on the country's vulnerability. The factor of floods has little effect on the fragility of the country. The drought has various impacts on various aspects of Somalia. Water resources per capita, GDP and agricultural development are particularly significant, making the per capita water resources less available, the economy slowing down and even the economy is sluggish the reduction of agricultural development has greatly increased the country's vulnerability. The factor of infectious disease had no significant effect on Somalia. The factor of refugees mainly affects unemployment and the economy. The increase in the number of refugees has led to an increase in the unemployment rate and slower economic growth, which has increased the vulnerability of the country.

5.3. Central African Republic

Find $\theta_{P,Q}$ the flowing table:

Table 7. Central African Republic

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
Z1	-0.08	0.33	0.1	0.33	0.24	-0.07	-0.01	-0.01	-0.08	-0.1
Z2	-0.43	-0.19	-0.07	-0.19	0	-0.32	0	-0.34	-0.41	-0.02
Z3	0.13	-0.31	0.06	-0.25	-0.05	0.19	0.08	0.03	0.18	0.09
Z4	-1.04	0.42	0.44	0.64	0.42	-1.08	-1.04	-1.08	-1.15	-1.1
Z5	0.86	-0.18	0.07	0.14	-0.36	0.35	0.66	0.07	0.47	-0.33
Z6	0.05	-0.57	0.35	-0.13	-0.37	-0.06	-0.25	0.01	0.31	-0.27

As can be seen from the above table, for the Central African Republic, the four factors of extreme weather, earthquakes, floods and refugees have almost no impact on the country's vulnerability. The impact of drought on Central African Republic's military expenditures as a percentage of GDP, religious citizens as a percentage of the total population, population density, water resources per capita, GDP, and level of agricultural development all have implications. The more serious the drought, the obstruction of the military development in the country and the consequent reduction of military expenditures; the reduction of the state's control of religion and the reduction of the religious population; the increase of the death rate of the population, the uneven distribution of population, the increase of the floating population in urban areas, the population density Drought will inevitably lead to the reduction of the per capita water resources. Drought will also cause the decline of GDP and agricultural development, and the output and storage of agricultural products will decline seriously.

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5.4. Yemen

Find $\theta_{P,Q}$ the flowing table:

Table 8. Yemen

Yemen	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
Z1	-0.05	0.31	0.39	0.13	0.22	-0.08	-0.09	-0.02	-0.07	-0.07
Z2	-0.34	-0.09	-0.07	-0.13	-0.14	-0.02	-0.46	-0.13	-0.39	-0.31
Z3	0.15	0.02	-0.13	-0.31	-0.25	0.1	0.05	0.06	0.17	0.2
Z4	-1.07	0.53	0.44	0.9	0.68	-1.08	-1.09	-1.07	-1.17	-1.19
Z5	0.32	0.17	0.14	-0.29	0.62	-0.25	0.37	0.22	0.06	-0.32
Z6	0.53	0.89	-0.2	-0.01	0.02	0.4	0.73	0.67	-0.06	0.3

As can be seen from the above table, for Yemen, factors such as extreme weather, earthquakes, floods and infectious diseases have almost no impact on the country's vulnerability. Drought is more serious, military development in the country is hampered, which in turn leads to lower military expenditures. Drought will also lead to an increase in unemployment. State control over religions will be weakened and religious population will fall. Drought will increase population mortality and population distribution will be uneven the urban population will increase and the population density will decrease. Drought will inevitably lead to the decrease of the per capita water resources. Drought will also cause the decline of GDP and agricultural development, and the serious decline of the output and storage of agricultural products.

5.5. Democratic Republic of Congo

Find $\theta_{P,Q}$ the flowing table:

Table 9. Democratic Republic of Congo

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
Z1	-0.08	0.33	0.14	0.27	0.37	-0.06	-0.08	-0.07	-0.03	-0.01
Z2	-0.15	-0.12	-0.09	-0.16	-0.18	-0.37	-0.44	-0.25	-0.37	-0.09
Z3	0.07	0.01	-0.05	-0.22	-0.03	0.05	0.02	0.17	0.06	0.07
Z4	-1.03	0.45	0.56	0.67	0.15	-1.19	-1.11	-1.2	-1.19	-1.1
Z5	0.4	0.11	-0.16	0.5	-0.27	0.86	0.36	0.04	-0.1	0.54
Z6	0.11	0.83	-0.19	0.19	0.31	0.64	0.8	-0.52	-0.03	0.24

As can be seen from the above table, for the Democratic Republic of Congo, extreme weather, earthquakes, floods and epidemics have almost no impact on the country's vulnerability. Drought is more serious, military development in the country is hampered, which in turn leads to lower military expenditures. Drought will also lead to an increase in unemployment. State control over religions will be weakened and religious population will fall. Drought will increase population mortality and population distribution will be uneven the urban population will increase and the population density will decrease. Drought will inevitably lead to the decrease of the per capita water resources. Drought will also cause the decline of GDP and agricultural development, and the serious decline of the output and storage of agricultural products. Refugees affect the population density of this country, indicating a larger number of refugees and a larger share of the total population. Increased refugees will cause a larger increase in the total population and an increase in population density.

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5.6. Syria

Find $\theta_{P,Q}$ the flowing table:

Table 10. Syria

Syria	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
Z1	-0.05	0.26	0.29	0.3	0.14	-0.05	-0.04	-0.02	-0.02	-0.02
Z2	-0.13	-0.19	-0.06	-0.05	-0.16	-0.07	-0.21	-0.07	-0.25	-0.14
Z3	0.17	-0.2	-0.16	0.12	-0.17	0.14	0.1	0.15	0.02	0.11
Z4	-1.13	0.59	0.43	0.82	0.12	1.13	-1.01	-1.02	-1.05	-1.05
Z5	0.2	0.13	-0.17	-0.04	0.2	-0.48	-0.17	-0.37	0.13	0.22
Z6	-0.01	-0.05	0	-0.03	0	0.61	-0.47	0.24	0.5	0.01

As can be seen from the above table, for Syria, the factor of extreme weather has almost no impact on the country's vulnerability. The earthquake has almost no impact on the country's vulnerability. The factor of floods has little effect on the fragility of the country. This factor of drought affects.

All aspects of Syria to varying degrees. Among them, military expenditures as a percentage of GDP, water resources per capita, GDP and agricultural development are particularly significant, making military expenditures as a percentage of GDP lower and per capita Reduce water resources ownership, economic development slowdown or even the situation of economic depression, agricultural development level is reduced. Greatly increased the country's vulnerability. The factor of infectious disease had no significant effect on Syria. The factor of refugees also had no significant effect on Syria.

5.7. Chad

Find $\theta_{P,Q}$ the flowing table:

Table 11. Chad

Chad	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
Z1	-0.07	0.03	0.18	0.36	0.04	-0.07	-0.04	-0.08	-0.09	-0.01
Z2	-0.43	-0.18	-0.05	-0.16	-0.06	-0.09	-0.46	-0.35	-0.17	-0.27
Z3	0.08	-0.47	-0.01	-0.05	-0.27	0.18	0.15	0.15	0.04	0.02
Z4	-1.14	0.59	0.19	0.96	0.31	-1.17	-1.12	-1.07	-1.07	-1.16
Z5	0.14	-0.15	-0.19	-0.9	0.3	0.16	0.45	0.75	-0.51	-0.54
Z6	-0.26	0.96	-0.57	-0.4	-0.63	-0.06	-0.02	0.8	-0.44	0.33

The earthquake has almost no impact on the country's vulnerability. The earthquake has almost no impact on the country's vulnerability. This factor of drought has varying degrees of impact on all aspects of Chad. Military expenditures as a percentage of GDP, water resources per capita, GDP and agricultural development are particularly significant, resulting in a decrease in military expenditure as a percentage of GDP, with per capita GDP Reduce water resources ownership, economic development slowdown or even the situation of economic depression, agricultural development level is reduced. Greatly increased the country's vulnerability. Infectious diseases, a factor that mainly affects the per capita availability of water resources and a decrease in the per capita availability of water resources, has added to the country's vulnerability. The factor of refugees mainly affects the amount of water resources per capita

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and the decrease of the per capita water resources, which increases the vulnerability of the country.

5.8. Afghanistan

Find $\theta_{P,Q}$ the flowing table:

Table 12. Afghanistan

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
Z1	-0.04	0.1	0.38	0.3	0.03	-0.02	-0.05	-0.04	-0.07	-0.01
Z2	-0.24	-0.12	-0.15	-0.06	-0.05	-0.26	-0.09	-0.29	-0.37	-0.11
Z3	0.14	-0.24	-0.25	0.15	-0.34	0	0.01	0.01	0.16	0.02
Z4	-1.15	0.5	0.47	0.95	0.49	-1.19	-1.03	-1.18	-1.14	-1.17
Z5	0.19	-0.4	0.69	0.09	0.69	0.45	-0.35	0.24	-0.5	-0.32
Z6	-0.23	0.48	0.42	-0.55	0.1	-0.61	0.17	-0.74	-0.01	-0.11

This factor of drought has varying degrees of impact on all aspects of Chad. Military expenditures as a percentage of GDP, water resources per capita, GDP and agricultural development are particularly significant, resulting in a decrease in military expenditure as a percentage of GDP, with per capita GDP Reduce water resources ownership, economic development slowdown or even the situation of economic depression, agricultural development level is reduced. Greatly increased the country's vulnerability.

The factor of refugees mainly affects the amount of water resources per capita and the decrease of the per capita water resources, which increases the vulnerability of the country.

5.9. Iraq

Find $\theta_{P,Q}$ the flowing table:

Table 13. Iraq

Iraq	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
Z1	0	0.1	0.02	0.22	0.37	-0.1	-0.01	-0.07	-0.07	-0.08
Z2	-0.07	-0.11	-0.02	-0.02	-0.09	-0.07	-0.24	-0.24	-0.27	-0.03
Z3	0.04	-0.15	-0.27	-0.47	0.02	0.08	0.18	0	0.13	0.07
Z4	-1.07	0.06	0.87	0.85	0.05	-1.04	-1.08	-1.09	-1.18	-1.03
Z5	0.37	0.85	-0.48	-0.02	0.6	-0.63	0.66	-0.25	-0.26	-0.05
Z6	0	0.53	0.33	-0.09	-0.13	-0.31	-0.48	0.5	0.5	-0.26

The factor of drought has varying degrees of impact on all aspects of Iraq. Among them, military expenditures as a percentage of GDP, per capita water resources ownership, GDP and agricultural development are particularly significant, resulting in a decrease in military expenditure as a percentage of GDP per capita Reduce water resources ownership, economic development slowdown or even the situation of economic depression, agricultural development level is reduced. Greatly increased the country's vulnerability.

5.10. South Sudan

Find $\theta_{P,Q}$ the flowing table:

As can be seen from the table above, for South Sudan, the factors such as extreme weather, earthquakes, floods, infectious diseases and refugees have almost no impact on the country's vulnerability.

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Drought has varying degrees of impact on various aspects of South Sudan, with military expenditure as a percentage of GDP, water resource per capita, GDP and agricultural development being particularly significant, resulting in a reduction in military expenditures as a percentage of GDP, Per capita water resources have decreased, economic development has slowed down or even a recession, and the level of agricultural development has been reduced. Greatly increased the country's vulnerability.

6. Detailed Application of the Model

According to the model established above, Saudi Arabia is selected as the object of study. Firstly, we find that Saudi Arabia has a weaker resistance to natural disasters and its Y_F is 0.173. It indicates that Saudi Arabia is a fragile country. Meanwhile, we find its W_h is 0.8, proving that Saudi Arabia is an unbalanced country. Then, find out $\theta_{P,Q}$, The following table:

Table 14. Saudi Arabia

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
Z1	-0.09	0.33	0.29	0.17	0.23	-0.08	-0.05	-0.05	-0.01	-0.04
Z2	-0.37	-0.05	-0.18	-0.04	-0.09	-0.25	-0.45	-0.4	-0.29	-0.21
Z3	0.17	0.01	-0.08	-0.06	0.1	0.09	0	0.04	0.2	0.11
Z4	-1.2	0.8	0.53	0.11	0.78	-1.08	-1.06	-1.12	-1.15	-1.11
Z5	0.7	0.37	-0.66	-0.5	-0.68	0.06	0.69	-0.07	-0.02	0.37
Z6	0.27	0.19	0.12	0.02	-0.08	0.17	-0.26	-0.06	-0.1	-0.47

As can be seen from the above table, for Saudi Arabia, the factor of extreme climate has almost no impact on the country's vulnerability. It's a factor that earthquake mainly affects the amount of water resources per capita and the level of agricultural development. In an earthquake, Saudi Arabia has become more vulnerable with a serious reduction in the level of water resources per head and development in agricultural.

It is well-known that Saudi Arabia is a water-scarce country. it might not experience natural disasters such as floods. Thus, floods have little effect on the vulnerability of this country as the table 14 showed.

This factor of drought mainly affects Saudi Arabia's military expenditure as a percentage of GDP and agricultural development. In a drought event, military expenditures as a percentage of GDP have dropped dramatically. Because of water scarcity, the level of agricultural development has a substantial decline and an increasing on the country's vulnerability.

Infectious diseases have different impacts on all aspects of Saudi Arabia. Water resource per capita, GDP and agricultural development are particularly affected. It made the per capita water resources less available, the economy slowing down and even the economy is sluggish. The state of agriculture has reduced its level of development and greatly increased the country's vulnerability. The factor of refugees mainly affects crime rates, unemployment and the economy. The increase in refugees has led to an increase in crime and unemployment, slowing economic growth and increasing the vulnerability of nations.

7. State Intervention

Countries can take the following interventions to mitigate the risks posed by climate change:

(1) Increasing the military expenditure as a percentage of GDP, the military strength is strong, the overall national strength of the country will also be raised, and the risk of climate change can be effectively alleviated.

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(2) Reduce the crime rate, the crime rate embodies the quality of the people from the side, the state can step up education, cultivate the national social morality, and reduce the crime from the ideology, which will lead to the stability of the country and effectively reduce the risk of climate change.

(3) The unemployment rate aims to measure the labor productivity in idleness. Through macro-control, the state should provide more employment opportunities for citizens, reduce their unemployment rate, lead to the stability of the country and effectively reduce the risk of climate change.

(4) Increase the amount of investment in science projects, the level of science and technology represents a country's level of development. The higher the amount invested; the more countries attach importance to it. The more stable the country, the less risk of climate change.

(5) For countries with a combination of politics and religion, the percentage of religious citizens to the total population should be increased appropriately to maintain a high degree of centralization of the rulers. When faced with difficulties, the state should facilitate unified management and speed up the efficiency, thus reducing the risk of climate change.

(6) Properly reducing population density in disaster-prone areas can reduce the damage caused by emergencies and keep fewer people at risk. This will lead to the stability of the country and effectively reduce the risk of climate change.

(7) Vigorously develop the economy and increase GDP, make up for the economy in times of disasters, help people to resist disasters, and have enough to face disasters and rebuild their homes recently after the disaster. Thus, reducing the risk of climate change.

(8) Vigorously develop the level of agricultural development, increase food production, solve people's food and clothing problems, improve people's satisfaction with the country and happiness, and help stabilize the internal environment of the country and reduce the dedication brought about by climate change.

8. Model Test

Using models to test larger or smaller 'countries', we looked at historical data from East Asia and the Pacific and Shanxi Province, China. During the process of finding and analyzing data, we found some data were extremely or very small in the small cities, there are data with local characteristics and no universal data. In the data of Shanxi Province, China, where military expenditures and international aid were not found, we had to exclude this indicator from the data processing because there was no accumulation in the model, so we could choose to exclude variables in case of incomplete data. In the process of observing the variables found in the non-existent data, the two sets of data comparison may appear too large or too small. After normalized processing, it is brought into the formula for verification.

Due to the fact that there is very little exchange and assistance among large national sellers in the regions of a country where Shanxi Province of China is located and there is no investment in armed capital of stalls, it is obviously inseparable from the policies and institutions of its host country, And due to the small size of the land, it is inevitable that there will be some kind of indicator that is relatively single in comparison with large countries. But it is closely related to its neighboring cities (all belong to one country). Therefore, we have changed the diplomatic aspect into the connection between regions and regions or between cities and countries. Of course, such a relationship should be much closer than the quality inspection between the state and the country. This is a supplement to make its resources too single. In searching for meteorological factors, Shanxi Province, because it is located in the mainland and in the central part of the country, does not have the so-called floods and refugees, so we will delete it.

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To bring the data into the model, we can draw the following conclusions: Shanxi Province: $y_s =$ 5.4 East Asia and the Pacific $y_s = 6.64$.

Table 15. Shanxi Province

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
Z1	-0.02	-0.1	0.06	0.17	-0.47	0.17	0.07	-0.39	0.21	0.08
Z2	-0.02	-0.17	0.05	-0.06	-0.49	0.36	0.33	-1.16	-0.11	-1.12
Z3	-0.02	0	-1.5	0.31	0.28	-0.2	0.34	-0.18	0.23	0.14
Z4	-1.11	0.56	0.36	-0.28	-0.03	-0.03	-0.44	-0.39	0.39	0.08
Z5	0.01	-0.77	0.62	0.28	-0.2	-0.64	-0.32	-0.22	-0.16	-0.44
Z6	-0.88	0.01	1	-0.91	-0.88	-0.57	-0.49	-0.38	-0.72	-0.46

From this we can see that, although some adjustments have been made to the data in Shanxi Province, it has still come to a relatively stable result. Moreover, the results of the data in this region in East Asia and the Pacific have been considered as good and in line with the actual situation, so this model is representative of the data of large samples. In small areas, due to the particularities and unity of small areas, some variables can not be found and can only be deleted according to the actual situation. So for a smaller sample of data processing For the special case of the city, the variables need to be properly selected and replaced, so that the model can work properly.

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