Problem Chosen	2023HSB MCM/ICM Summary Sheet	Team Number
B		MI00931

No Color Revolution

Abstract

To address problem 1, we collected and pre-processed the relevant data from 121 countries from 2002 to 2020, eliminated the unrealistic extreme value To address problem 1, we collected and pre-processed the relevant data from 121 countries from 2002 to 2020, eliminated the unrealistic extreme value data, filled the missing data with predictions through the K-nearest neighbor algorithm, and cleaned the after-filling in the changed data, Spearman's correlation coefficient analysis was conducted for each indicator to obtain the correlation size between each indicator, and finally, we used a stepwise regression model for causality analysis.

To address problem 2, using the data processing results in the first question, the weights of each indicator were derived through the TOPSIS model based on Then the scores of the three indicators for each country were averaged to divide the country's comprehensive stability index interval by the quantile method to derive the final comprehensive scores of each country. Then the scores of the three indicators for each country were averaged to divide the country's comprehensive stability index interval by the quantile method to derive the final comprehensive scores of each country and rank them overall. We analyzed the risk index distribution map for the correlation of the three major indices.

To address problem 3, we selected Ukraine as the object of analysis. The K-nearest neighbor algorithm is used to supplement the missing values of the data Then the TOPSIS model based on the entropy weight method is substituted to analyze the significant influencing factors and the Then the TOPSIS model based on the entropy weight method is substituted to analyze the significant influencing factors and the correlations among the indicators of Ukraine's national composite stability index, and the corresponding development strategies are given.

To address problem 4, we take Kazakhstan as the primary analysis object, combine the current social development problems of the outer Central Asia region and the significant issues in the internal history, and combine the TOPSIS model based on the entropy weight method established previously to evaluate The comprehensive stability index of Kazakhstan from 2002 to 2020, get the final score, and put forward practical suggestions on the risk issues of Kazakhstan in combination with current events.

To address problem 5, the establishment of the sales plan can be based on the research results of questions 1 and 4, give targeted improvement plans, To address problem 5, the establishment of the sales plan can be based on the research results of questions 1 and 4, give targeted improvement plans, predict customers according to the model of question 3, and finally give relevant suggestions to the sales department.

Keywords: Entropy method, TOPSIS, KNN, backward progressive regression, grey correlation analysis, spearman correlation, quantile method

I. Problem Restatement

1.1 Background Analysis

In recent years, the Biden government has vigorously promoted long-arm jurisdiction, intervened in the internal affairs of other countries, and In recent years, the Biden government has vigorously promoted long-arm jurisdiction, intervened in the internal affairs of other countries, and implemented unilateralism, which has increased the complexity and severity of the global environment. Its new trends, changes, and developments must arouse the high vigilance of all countries. Therefore, establishing a sound national risk early warning mechanism is the top priority to prevent Therefore, establishing a sound national risk early warning mechanism is the top priority to prevent paramount political security and ideological risks.

1.2 Problem Restatement

Question 1: The collected data were cleaned, missing values were added by KNN method, then the data of each index were normalized and normalized to ensure the non-negativity of the data, and then the correlation and causality between each index were analyzed by grey correlation analysis and stepwise regression, respectively.

Question 2: This question requires the establishment of a social early warning model, that is, the use of entropy-based TOPSIS comprehensive evaluation model, the first entropy method to determine the weight of each indicator, brought into TOPSIS to calculate the distance between the optimal target and the worst target, the closer the evaluation target to the ideal target, the better the program, and finally the country's comprehensive stability index of each country through the quantile method and then divided into interval brackets.

Question 3: This question is to select a typical country for social risk assessment using the above-mentioned model. Based on the results obtained earlier, substitute the processed data to derive the significant factors affecting the country's composite national stability index, and judge the level of risk and development of the country through the model built.

Question 4: Use an established early warning model of social stability to assess the social stability of a country or region that has attempted a color revolution to overthrow a regime. Point out the main reasons for the failure of the color revolution, determine the future trend of social stability, and make some recommendations.

Question 5: In order to prevent color revolution and maintain social stability, please put forward relevant suggestions.

II. Problem Analysis

2.1 Analysis for Problem 1

Question 1 requires cleaning the data and performing correlation and causality analyses on each indicator data. Since there are some gaps in the data, the data must be preprocessed

first, and the KNN algorithm is used to supplement the missing values. Since there are some gaps in the data, the data must be preprocessed first, and the KNN algorithm is used to supplement the missing values. Establish a social stability risk assessment index system composed of "economy-politics-society" through the literature. The data must be preprocessed first, and the KNN algorithm is used to supplement the missing values. Finally, a causal analysis was performed using a Finally, a causal analysis was performed using a stepwise regression model.

2.2 Analysis for Problem 2

Question 2 requires establishing a social early warning model, the TOPSIS comprehensive evaluation model based on the entropy weight method. first, the entropy weight method is used to determine the weight of each index, which is brought into TOPSIS to calculate the distance between the optimal and worst First, the entropy weight method is used to determine the weight of each index, which is brought into TOPSIS to calculate the distance between the optimal and worst The average scores of the three types of indicators of the country are averaged, and the national comprehensive stability index range is divided by the quantile method. The average scores of the three types of indicators of the country are averaged, and the national comprehensive stability index range is divided by the quantile method. Each country's final comprehensive score is obtained, the overall ranking is made, and finally, the risk index is visualized.

2.3 Analysis of Problem 3

The question is to select a specific country for social risk assessment using the model mentioned above and, based on the results obtained earlier, The question is to select a specific country for social risk assessment using the model mentioned above and, based on the results obtained earlier, substitute the processed data to derive the significant factors affecting the country's composite stability index and judge the country's level of risk and development through the model built.

2.4 Analysis of Problem 4

Question 4 takes Kazakhstan as the primary analysis object, combines the current social development issues in the outer Central Asian region and significant issues in internal history, and combines the TOPSIS model established above based on the entropy weight method to analyze Kazakhstan's The stability index is evaluated to obtain the final score, and practical suggestions are put forward for The stability index is evaluated to obtain the final score, and practical suggestions are put forward for Kazakhstan's risk issues in combination with current hotspots.

2.5 Analysis of Problem 5

In order to prevent color revolution and maintain social stability, put forward relevant suggestions.

III. Model Assumptions

Combined with the actual problem, in order to ensure the accuracy and reasonableness of the model solution, this paper excludes the interference of some factors and puts forward the following assumptions.

(1) Correlations greater than 0.999 are uniformly treated as 1.

(2) Assume that the data given in the question and the data consulted are true and reliable.

(3) Assuming that ratings of the purchase impact of electric vehicles are included in the eight indicator factors.

(4) The effect of information loss on the final results of the constructed model is ignored in the process of utilizing the principal components.

IV. Description of symbols

To facilitate the solution of the problem, the following notation is given in this paper.

Symbols	Description
O	Target layer
C	Guideline layer
P	Program level
CI	Consistency indicators
CR	Consistency ratio
c	Input Value
h_i	Implicit input values
h_o	Implicit output values
y_i	Output layer input values
y_o	Output layer output value
d_o	Desired output value
wih	Connection weights for input and intermediate layers
who	Connection weights of the implicit layer and the output layer
b_h	Implicit layer neuron threshold
b_o	Output layer neuron threshold

V. Construction of social stability index system

5.1 Construction of social stability assessment index system

5.1.1 Principles for the construction of social stability risk assessment

Index system:

Due to the differences in the amount of information reflected by different indicators and their contribution to the evaluation results, it is important to reasonably select and optimize the indicator system. In order to ensure that the social stability risk evaluation in the post-migration period can take into account the general requirements of risk evaluation and the characteristics of the evaluation object, and to achieve specific analysis of specific problems, the selection of evaluation indicators and the construction of the evaluation indicator system should follow the following principles.

(1) Targeted and representative. In the process of constructing the index system, some indicators reflecting the current situation of immigrant social environment and characterizing the possibility of social conflicts, indicators closely related to the recovery and development of immigrant groups in the post-immigration period and regional social stability, as well as subjective or objective indicators that can respond to social stability risk factors from the side, and the selected indicators are highly representative of the problems caused by a certain type of risk.

(2) Comprehensiveness and relative independence. The evaluation of immigrant social stability risk mainly focuses on the immigrant group's own state and the surrounding environment (economic, social, policy, natural) and other aspects, if the influence of other aspects is ignored and only one aspect is evaluated, the evaluation results can hardly reflect the degree of immigrant social stability risk accurately. At the same time, in a more complete and comprehensive preliminary index system, there may be a large overlap between the indicators, and changes in one indicator may have a greater impact on the rest of the indicators, leading to a decrease in the accuracy of the comprehensive evaluation results, which needs to be optimized through reasonable screening to enhance the independence of each indicator from each other.

(3) Comprehensive quantitative evaluation and qualitative evaluation. Social stability risk evaluation indexes need to meet the principle of combining quantitative and qualitative evaluation, so that the evaluation results are more comprehensive and fit the reality. Quantitative indicators can effectively reduce subjective dependency and obtain intuitive and accurate evaluation results; however, not every type of social stability risk issues can be measured by accurate objective data, and qualitative evaluation must be made through human perception to ensure the integrity of the evaluation process and the comprehensiveness of the evaluation results.

(4) Scientificity and operability. Social stability risk evaluation is mainly based on the system of "economic-political-social risk" cross-influence but relatively independent, and there are many influencing factors and different degrees of difficulty in obtaining measurement data, and there are also differences in data reliability. The applicability of the

indicator system and the credibility of the evaluation results can be enhanced by considering the scientificity of the indicator measurement method and the operability of the indicator data acquisition, and the indicators are generally selected so that objective data can be obtained or the degree of differentiation can be achieved through a more intuitive and reasonable subjective evaluation.

(5) Dynamicity principle. With social development, the impact of some risk factors will be largely diluted and eliminated, and some risk factors will be generated and expanded in real time, and the differences in policies in different regions will also lead to differences in the importance of each indicator to the results, so the evaluation indicators should be selected based on the current situation of social risks of regional migrants, and the indicator system should be updated in time to eliminate or replace evaluation indicators that are no longer applicable.

Since there is no universally accepted or unified definition of country risk, different institutions and scholars have different criteria for selecting indicators for country risk evaluation, but they mainly cover political risk, economic risk, social risk, sudden disaster risk, and military risk. In this paper, we refer to the World Bank evaluation system and select indicators such as corruption control, political stability, government effectiveness, quality of control, degree of rule of law, and citizen participation, etc.; for economic risks, we refer to Hu Junchao and other studies and select indicators such as GDP per capita, GDP growth rate, debt index, inflation rate, fiscal balance index, trade openness, etc. The first three indicators reflect the level of employment, education and medical care, while the last three indicators reflect the stability of the society. The first three indicators reflect the level of employment, education and health care, and the last three indicators reflect the level of social stability. Thus, this paper constructs a comprehensive assessment index system of "political-economic-social risk" of the country. The table shows the specific meaning of each indicator, the source of data, as well as the unit of the indicator and the positive and negative directions in the assessment system.

5.1.2 Construct social stability index system

Applying the social combustion theory to the selection of horizontal indicators of the two-dimensional matrix, the risks of security, economy and politics in the internal social risks of the country are similar to the combustion substances, the risks of social mutual adaptation and environmental integration in the external social risks of the project are similar to the combustion agents, and the risks of economic benefits and public interests in the external social risks of the country are similar to the ignition temperature. In the process of risk identification, the checklist method and big data analysis method are used in a comprehensive manner, and the specific steps are as follows.

(1) Literature analysis and information review. Through collecting the policies, systems and the spirit of relevant conferences and the results of socio-economic analysis reports of migrant areas , we can grasp the basic situation of engineering projects and migrant area society more comprehensively; summarize the theoretical results related to migrant social stability risks at home and abroad, and establish the theoretical basis and basic framework of risk identification.

(2) Big data analysis and in-depth excavation. For the economic and social development

of the migrant region and the overall situation of the project involving migrants, further indicator data and characteristics are obtained through accessing databases, big data opinion monitoring, etc. to examine the overall development level of each country in depth.

(3) Analysis of phenomena and summarization. According to the direct or indirect symptoms such as immigrants and other residents' demands, policy implementation hindrances, and the implementation of immigration management work, etc., summarize various types of possible potential risk factors and make reasonable classification, consult with experts in the immigration industry and decision makers of relevant departments, eliminate the wrong risk factors and supplement the omitted risk factors to make the risk factors more complete and guarantee the rest steps of social stability risk evaluation The remaining steps of the social stability risk assessment will be carried out smoothly.

5.1.3 Establishment of social stability assessment indicators

Table 2

System layer	Subseries Unified layer	Indicator Name	Indicator Meaning	Unit	Indicator Direction	Data source
Comprehensive Sability	Politics Sability	Corruption Control	Reflects the degree of government corruption, the smaller the value the more serious the corruption	Index	Positive	Global Governance Index (WB-WGI)
		Political Stability	Reflects regime stability, the larger the value the more stable	Index	Positive	WB-WGI
		Government Effectiveness	Reflects the implementation of public policies and systems	Index	Positive	WB-WGI
		Control Quality	Government's ability to govern and facilitate the market	Index	Positive	WB-WGI
		Degree of legal system	Reflects the degree of trust in and compliance with social rules	Index	Positive	WB-WGI
		Citizen Participation	Reflecting the degree of citizen participation and freedom of expression	Index	Positive	WB-WGI

Economy Sability	GDP per capita	Reflecting the level of economic development of a country	USD	Positive	World Bank and OECD databases
	GDP growth rate	Reflects a country's economic growth dynamics	%	Positive	World Bank and OECD databases
	Debt Index	Total government debt/GDP, a measure of the level of government indebtedness	Index	Negative	World Economic Outlook (IMF-WEO)
	Inflation rate	Reflects changes in a country's price level	%	Negative	IMF-WEO
	Fiscal Balance Index	(Fiscal revenue - fiscal expenditure)/GDP, show fiscal strength	Index	Positive	International Monetary Fund (IMF)
	Trade openness	Total imports and exports/GDP, a measure of trade dependence and openness	Index	Positive	World Development Index (WDI)
Socail Sability	Unemployment rate	Reflecting employment	%	Negative	International Labor Organization (ILO)
	Higher Education Enrollment	Reflecting the level of education	%	Positive	UNESCO
	Life expectancy	Reflecting the level of medical care	Year	Positive	World Development Index

				(WDI)
Crime Index	Number of murders per 100,000 people, reflecting the state of social security	%	Negative	United Nations Office on Drugs and Crime
Gini coefficient	Reflecting the gap between the rich and the poor in society	Index	Positive	World Bank

5.1.3 Interpretation of social stability risk assessment indicators

(1) Gini coefficient is an interval type indicator, the best interval is 0.3-0.4
(2) Inflation rate is an interval-type indicator, with a reasonable range of 3%-5%.
(3) Unemployment rate is an interval-type indicator, with a reasonable range of 4%-8%.
(4) The debt index and the number of murders per million people are very small indicators, while the other indicators are very large ones.

5.2 Correlation and causality analysis of the index system

5.2.1 Spearman correlation coefficient analysis

The Spearman correlation coefficient is used to reflect the degree of correlation of two fixed-order or rank variables. The calculation of the Spearman coefficient requires that the variable values be first ranked. After ranking the measured values of two paired measurements of variables X and Y, the Spearman correlation coefficient R_s is calculated using the same formula as the Pearson correlation coefficient. If the rank variables are sorted without knots, the formula for the Spearman correlation coefficient R_s can be simplified as

$$R_s = 1 - \frac{6\sum_{i=1}^{n} {d_i}^2}{n(n^2-1)}$$

Among them $d_i = x_i - y_i (i = 1, 2, \cdots, n)$

Hypothesis testing of Spearman's correlation coefficient

$$H_0: R_s = 0$$
$$H_1: R_S \neq 0$$

In the case of large samples, the statistic $R_s\sqrt{n-1} \sim N(0,1)$, the test value is calculated and the corresponding p-value is simply found for comparison with 0.05.

Table 3

	debt	fiscal balance	GDP growth	VoiceandAccountability	GDP per capita	trade index	Inflation rate	--
debt	1(0.000***)	0.058 (0.531)	-0.074 (0.420)	-0.012(0.892)	0.114 (0.214)	-0.046 (0.617)	0.066 (0.475)	--
fiscal balance	0.058 (0.531)	1(0.000***)	0.316(0.000***)	-0.326(0.000***)	-0.048 (0.602)	-0.234(0.010***)	0.219(0.016**)	--
GDP growth	-0.074 (0.420)	0.316(0.000***)	1(0.000***)	-0.4(0.000***)	0.434(0.000***)	0.117 (0.202)	0.41(0.000***)	-
VoiceandAccountability	-0.012(0.892)	-0.326(0.000***)	-0.4(0.000***)	1(0.000***)	-0.14 (0.125)	-0.038 (0.679)	-0.322(0.000***)	-
GDP per capita	0.114 (0.214)	-0.048 (0.602)	0.434(0.000***)	-0.14 (0.125)	1(0.000***)	0.381(0.000***)	0.189(0.038**)	-
trade index	-0.046 (0.617)	-0.234(0.010***)	0.117 (0.202)	-0.038 (0.679)	0.381(0.000***)	1(0.000***)	0.059 (0.523)	--
Inflation rate	0.066 (0.475)	0.219(0.016**)	0.41(0.000***)	-0.322(0.000***)	0.189(0.038**)	0.059 (0.523)	1(0.000***)	--
RuleofLaw	0.058 (0.524)	-0.178(0.050*)	-0.193(0.034**)	0.585(0.000***)	0.043 (0.640)	-0.136(0.136)	-0.464(0.000***)	--
gini index	-0.181(0.047**)	-0.152(0.096*)	-0.02(0.825)	-0.173(0.058*)	-0.06 (0.515)	0.206(0.024**)	0.182(0.045**)	--
Intentional homicides	-0.097 (0.288)	0.118 (0.198)	0.216(0.017**)	-0.16(0.079*)	0.148 (0.106)	0.04 (0.659)	0.119 (0.194)	--
RegulatoryQuality	0.108 (0.239)	-0.289(0.001***)	-0.339(0.000***)	0.659(0.000***)	-0.017 (0.850)	-0.119(0.192)	-0.508(0.000***)	--

The above figure shows the value of the correlation coefficient in the form of a heat map, mainly by color shades to indicate the size of the value, the darker the color, the stronger the correlation, as can be seen from the figure, the p-value of the correlation coefficient between Government and Rule of Law <0.05, rejecting the original hypothesis, so the correlation between the two indicators is significant.

5.2.2 Principal component analysis

5.2.2.1 Analysis of cumulative information contribution of indicators

The preliminary selection index system involves a large number of indicators, but some indicators reflect less variability of information among different evaluation targets, which has a weak impact on the evaluation results, and redundant indicators will increase the calculation volume of comprehensive evaluation as well as cause the evaluation system to be unresponsive to changes in information of individual indicators; at the same time, in the comprehensive evaluation of social stability risks in migrant regions, it is more beneficial to analyze some indicators with less variability

by eliminating At the same time, in the comprehensive evaluation of social stability risk in migrant areas, it is more beneficial to analyze the unbalanced development between different target groups and regions by eliminating some indicators with small differences.

The cumulative information contribution rate is based on the idea of the cumulative variance contribution rate of the principal components screened by the principal component analysis, based on the relative dispersion coefficient of indicators to reflect the proportion of the information content accumulated to a certain indicator to the information content of all primary indicators after sorting by the information content of indicators from high to low, and the indicators with very small information content are removed by the cumulative information contribution rate analysis, and the steps of the cumulative information contribution rate analysis are as follows.

With more than 100 countries and 18 indicators, we have a sample matrix of size $n \times p$ X :

$$X = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1p} \\ x_{21} & x_{22} & \cdots & x_{2p} \\ \vdots & \vdots & \ddots & \vdots \\ x_{n1} & x_{n2} & \cdots & x_{np} \end{bmatrix}$$

(1) First, the sample matrix is normalized.

The means $\overline{x_j} = \frac{1}{n}\sum_{i=1}^{n} x_{ij}$ and standard deviations $S_j = \sqrt{\frac{\sum_{i=1}^{n}\left(x_{ij} - \overline{x_j}\right)^2}{n-1}}$ are calculated by column, and the standardized data $X_{ij} = \frac{x_{ij} - \overline{x_j}}{S_j}$ are calculated, and the original sample matrix is normalized to

$$X = \begin{bmatrix} X_{11} & X_{12} & \cdots & X_{1p} \\ X_{21} & X_{22} & \cdots & X_{2p} \\ \vdots & \vdots & \ddots & \vdots \\ X_{n1} & X_{n2} & \cdots & X_{np} \end{bmatrix} = (X_1, X_2 \cdots, X_p)$$

(2) Calculate the covariance matrix of the standardized samples

$$R = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1p} \\ r_{21} & r_{22} & \cdots & r_{2p} \\ \vdots & \vdots & \ddots & \vdots \\ r_{p1} & r_{p2} & \cdots & r_{pp} \end{bmatrix}$$

Among them $r_{ij} = \frac{1}{n-1}\sum_{i=1}^{n}\left(X_{ki} - \overline{X_i}\right)\left(X_{kj} - \overline{X_j}\right) = \frac{1}{n-1}\sum_{k=1}^{n} X_{kj}X_{kj}$.

This results in a sample correlation coefficient matrix R for the x matrix

(3) Calculate the eigenvalues and eigenvectors of R. Let the eigenvalues be: $\lambda_1 \geqslant \lambda_2 \geqslant \cdots \geqslant \lambda_p \geqslant 0$, and the eigenvectors be $(a_{1i}, a_{2i}, \cdots, a_{pi})$

(4) The cumulative contribution rate is derived as

$$\text{Cumulative contribution rate} = \frac{\sum_{k=1}^{i} \lambda_k}{\sum_{k=1}^{p} \lambda_k} (i = 1, 2, \cdots, p)$$

According to the results, the indicators corresponding to the eigenvalues with a cumulative contribution of more than 80% are taken as the first, second, ---, and mth (m ≤ p) The i-th principal component is set as $F_i = a_{1i} X_1 + a_{2i} X_2 + \cdots + a_{pi} X_p (i = 1, 2, \cdots, m)$

For a given principal component, a larger coefficient in front of an indicator represents a larger coefficient in front of that indicator, representing a greater influence of the indicator on that principal component.

5.2.2.2 Model solving

Table 4

KMO test and Bartlett's test		
KMO value		0.851
Bartlett's sphericity test	Approximate cardinality	1666.542
	df	136
	P	0.000***

Note: ***, **, * represent 1%, 5%, 10% significance levels, respectively

The results of the KMO test showed that the value of KMO was 0.851, while the result of the Bartlett's spherical test showed that the significance p-value was 0.000***, presenting significance at the level and rejecting the original hypothesis that the variables are correlated and the principal component analysis is valid to the extent that it is suitable.

Table 5

Total variance explained			
Ingredients	Feature Root		
	Feature Root	Explanation of variance (%)	Cumulative variance explained (%)
1	0.951	5.594	74.009
2	0.369	2.172	93.705
3	0.314	1.845	95.55
4	0.273	1.609	97.159
5	0.194	1.142	98.301
6	0.14	0.823	99.125

7	0.083	0.491	99.615
8	0.038	0.224	99.839
9	0.027	0.161	100
		--	--

The above table is the total variance explanation table, which mainly looks at the contribution of the principal component to the variable explanation, that is, how many principal components are needed to express the variable as 100%, generally expressed to more than 90% before, otherwise the factor data should be adjusted. In general, the higher the variance explanation rate is, the more important the principal component is, and the higher the weight share should be.

In the variance explanation table, at principal component 1, the characteristic root of the total variance explained is lower than 1. The contribution of the variables explained reaches 74.009 and the variance explained is 5.594, which is a high variance explained and can be used as a principal component to explain the country's composite stability index.

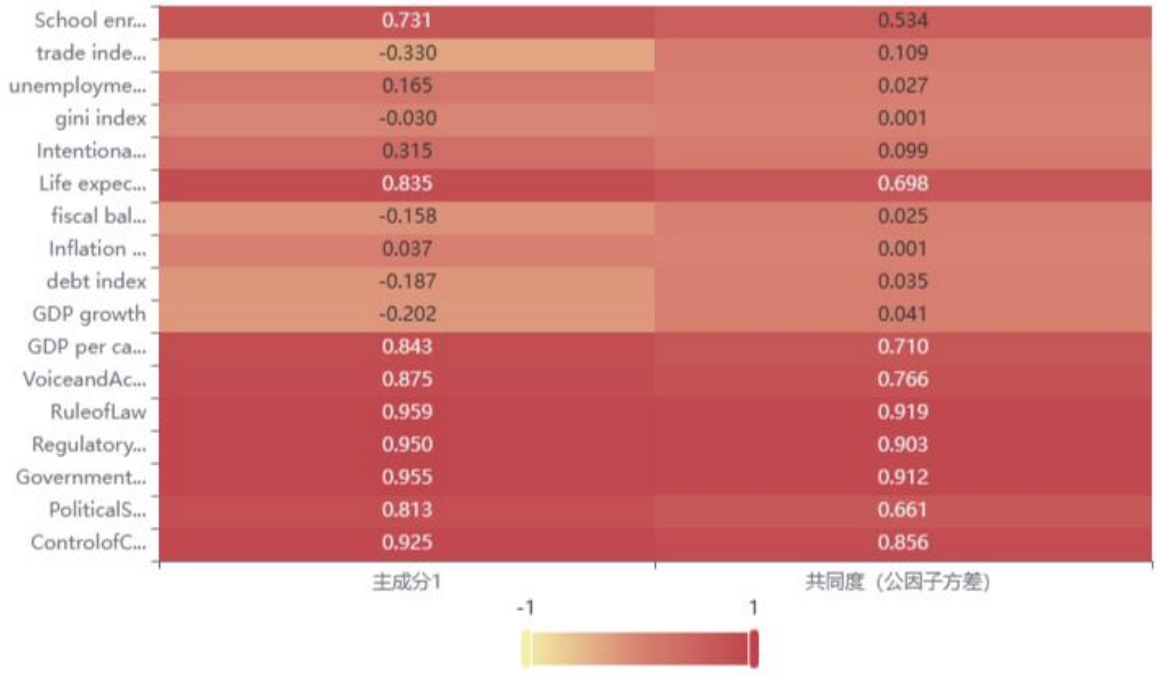


Table 6

Factor load factor table

	Factor loading factor	Commonality (common factor variance)
	Main component 1	
ControlofCorruption	0.925	0.856

PoliticalStability	0.813	0.661
GovernmentEffectiveness	0.955	0.912
RegulatoryQuality	0.95	0.903
RuleofLaw	0.959	0.919
VoiceandAccountability	0.875	0.766
GDP per capita	0.843	0.71

From the above table, it can be seen that the factor loading coefficients of Control of Corruption, Government Effectiveness, Rule of Law, and Regulatory Quality are high, which can be summarized as the relevant principal components for the political stability coefficient, and the political stability coefficient can better explain the composite national stability index.

5.2.3 Cause and effect analysis

Step1:Multiple linear regression equation establishment

The country composite stability index is set as the dependent variable y, and other indicators are set as independent variables to form the basic equation of the multiple linear regression equation of$(x_1, x_2, \cdots x_n)$,the

$$y = \beta_0 + \beta_1 x_1 + \cdots + \beta_n x_n + \varepsilon$$

whereβ_0, β_1, $\cdots$, β_n denotes the regression coefficient, for which the regression coefficient is fitted using the OLS method, the formula is

$$\hat{\beta} = (X^T X)^{-1} X^T Y$$

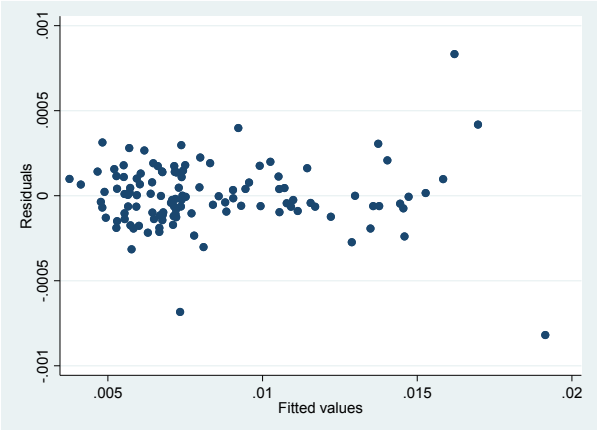
The regression parameters are obtained by calculating

Source	SS	df	MS	Number of obs	=	121
				F(17, 103)	=	3644.85
Model	.001194046	17	.000070238	Prob > F	=	0.0000
Residual	1.9849e-06	103	1.9270e-08	R-squared	=	0.9983
				Adj R-squared	=	0.9981
Total	.001196031	120	9.9669e-06	Root MSE	=	.00014

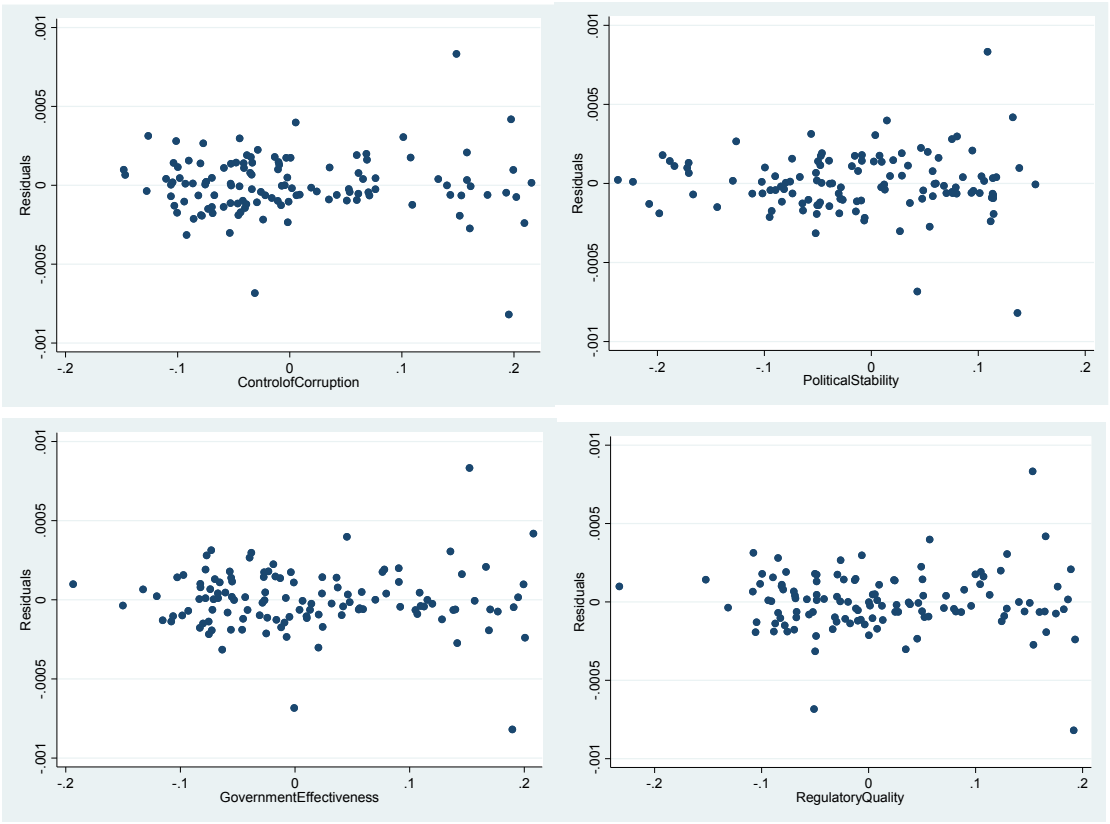
SB	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
ControlofCorruption	.0056473	.0005034	11.22	0.000	.0046488	.0066457
PoliticalStability	.0037971	.000246	15.44	0.000	.0033092	.004285
GovernmentEffectiveness	.0039683	.000573	6.93	0.000	.0028319	.0051047
RegulatoryQuality	.0018789	.0005716	3.29	0.001	.0007452	.0030125
RuleofLaw	.002834	.0007145	3.97	0.000	.001417	.0042509
VoiceandAccountability	.0039092	.0003402	11.49	0.000	.0032345	.0045839
GDPpercapita	.0191072	.0003343	57.16	0.000	.0184442	.0197701
GDPgrowth	.0015793	.0002357	6.70	0.000	.0011118	.0020467
debtindex	-.0003782	.0009328	-0.41	0.686	-.0022282	.0014717
Inflationrate	.00025	.0011712	0.21	0.831	-.0020728	.0025728
fiscalbalance	.0005035	.0003458	1.46	0.148	-.0001823	.0011893
tradeindex	.0011204	.0004991	2.25	0.027	.0001306	.0021102
unemployment	-.0008707	.000663	-1.31	0.192	-.0021856	.0004443
Schoolenrollment	.0024598	.0004468	5.51	0.000	.0015737	.0033459
Lifeexpectancy	-.0040784	.0030773	-1.33	0.188	-.0101816	.0020248
Intentionalhomicides	-.0000492	.0008567	-0.06	0.954	-.0017482	.0016498
giniindex	.0020105	.0006398	3.14	0.002	.0007417	.0032793
_cons	.0073505	.0003136	23.44	0.000	.0067286	.0079723

Step2:Test of equation perturbation term

From the above table, the p-value of the equation is 0.0000, so the equation as a whole is significant, but for whether there is heteroskedasticity in the perturbation term, a scatter plot needs to be drawn for a preliminary test.



From the figure, it can be seen that the residuals increase as the fitted value increases, indicating the possible existence of heteroskedasticity



Drawing a scatter plot of all the perturbation terms and explanatory variables shows that there is heteroskedasticity in the perturbation terms. If there is heteroskedasticity in the perturbation terms, then the regression coefficients estimated by OLS are unbiased and consistent, and the hypothesis test cannot be used, and the OLS estimator is no longer the most linear unbiased estimator. The heteroskedasticity problem can be solved by using OLS + standard error of the paper. The principle is that data with smaller variance contain more information, and we can give more weight to the data with more information.

Solving the heteroskedasticity problem using White's test,

Principle: Under conditional homoskedasticity, the robust standard error reduces to the ordinary standard error, and then the difference between the two can be used to measure the conditional heteroskedasticity, i.e., to test whether the robust standard error is similar to the ordinary standard error. Under the original assumption of homoskedasticity $H_0 = E(\varepsilon_i^2 \mid X) = \sigma^2$ and the alternative assumption of heteroskedasticity, the difference between the robust covariance matrix and the ordinary covariance matrix converges to a zero matrix.

$$\hat{S} - s^2 S_{XX} = \frac{1}{n}\sum_{i=1}^{n} e_i^2 x_i x_i' - s^2 \frac{1}{n}\sum_{i=1}^{n} x_i x_i' = \frac{1}{n}\sum_{i=1}^{n} (e_i^2 - s^2) x_i x_i' \xrightarrow{P} 0_{K\times K}$$

The advantage of the White's test is that it can test for any form of heteroskedasticity.

Results obtained.

Linear regression

Number of obs	=	121	
F(17, 103)	=	4829.86	
Prob > F	=	0.0000	
R-squared	=	0.9983	
Root MSE	=	.00014	

SB	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
ControlofCorruption	.0056473	.0003307	17.07	0.000	.0049913	.0063032
PoliticalStability	.0037971	.0002376	15.98	0.000	.0033258	.0042684
GovernmentEffectiveness	.0039683	.0004529	8.76	0.000	.0030701	.0048665
RegulatoryQuality	.0018789	.0005141	3.65	0.000	.0008593	.0028984
RuleofLaw	.002834	.0006774	4.18	0.000	.0014905	.0041774
VoiceandAccountability	.0039092	.0003009	12.99	0.000	.0033125	.004506
GDPpercapita	.0191072	.0009559	19.99	0.000	.0172113	.021003
GDPgrowth	.0015793	.0002624	6.02	0.000	.0010588	.0020997
debtindex	−.0003782	.0009569	−0.40	0.693	−.0022759	.0015195
Inflationrate	.00025	.0006156	0.41	0.686	−.0009708	.0014708
fiscalbalance	.0005035	.0003357	1.50	0.137	−.0001622	.0011693
tradeindex	.0011204	.0003329	3.37	0.001	.0004601	.0017807
unemployment	−.0008707	.0006938	−1.25	0.212	−.0022466	.0005053
Schoolenrollment	.0024598	.0006043	4.07	0.000	.0012614	.0036582
Lifeexpectancy	−.0040784	.0023889	−1.71	0.091	−.0088162	.0006593
Intentionalhomicides	−.0000492	.0007098	−0.07	0.945	−.0014568	.0013585
giniindex	.0020105	.0005096	3.94	0.000	.0009997	.0030213
_cons	.0073505	.0002118	34.70	0.000	.0069304	.0077706

After removing the heteroskedasticity, there were more p-values less than 0.05 and an increase in the number of significant independent variables compared to the previous multiple linear regression.

Test for multicollinearity: let the variance inflation factor be VIF.

Suppose there are k independent variables, then the mth independent variable

of $VIF_m = \frac{1}{1 - R^2_{1-\frac{k}{m}}}$

$R^2_{1-\frac{k}{m}}$ is the goodness-of-fit obtained by regressing the mth independent variable as the dependent variable on the remaining k-1 independent variables. VIF_m The larger it is, the greater the correlation between the mth variable and the other variables, defining the regression model of VIF_m as

$$VIF = \max(VIF_1, VIF_2, \cdots, VIF_k)$$

The rule of thumb is that if $VIF_m > 10$, the regression equation is considered to have severe multicollinearity.

After analysis, it was concluded that

Variable	VIF	1/VIF
RuleofLaw	26.48	0.037768
Governnment~s	16.83	0.059427
Regulatory~y	16.64	0.060099
ControlofC~n	13.15	0.076037
VoiceandAc~y	5.99	0.167040
Lifeexpect~y	4.89	0.204488
GDPpercapita	3.89	0.257141
PoliticalS~y	3.08	0.325044
Schoolenro~t	3.01	0.331685
GDPgrowth	1.84	0.542021
Intentiona~s	1.73	0.579460
giniindex	1.47	0.679169
fiscalbala~e	1.47	0.680083
unemployment	1.47	0.680939
Inflationr~e	1.22	0.817513
tradeindex	1.21	0.829531
debtindex	1.18	0.845486
Mean VIF	6.21	

The first four indicators of Rule of law, Government, etc. have multicollinearity, but this question is more concerned with the ability of the whole equation to predict the explanatory variables, and the whole equation is significant, although a few variables may have inaccurate estimates of the contribution of some individual variables due to multicollinearity, the overall effect of all variables can still be estimated more accurately.

Step3:Stepwise regression analysis

Stepwise regression is a method based on linear regression. The idea is to introduce variables one after another, and after a new variable is introduced, the old variables that have been included in the regression model are examined one by one, and the variables that are considered meaningless are removed until no new variables are introduced and no old variables are removed, thus ensuring that each variable in the regression model is meaningful. According to the specific situation of the model, backward stepwise regression is used, in which all variables are first put into the model, and then Try to remove one of the independent variables from the model to see if there is a significant change in the variance of the dependent variable explained by the whole model, and then remove the independent variables that have no explanatory power, and this process is iterated continuously to know that no independent variables meet the conditions for removal.

Table 7

Results of stepwise regression analysis (n=121)

	Non-standardized coefficient		Standardization factor	*t*	*p*	VIF
	B	Standard error	Beta			
Constants	0.008	0.000	-	24.065	0.000**	-
Control of Corruption	0.006	0.001	0.169	11.321	0.000**	9.739
Political Stability	0.004	0.000	0.093	12.387	0.000**	2.440
--	--	--	--	--	--	--
R^2	0.998					
Adjust R^2	0.998					
F	*F* (11,88)=3960.373,p=0.000					
D-W value	1.664					

Dependent variable: SB

* *p<0.*05 ** p<0.01

The R-squared value of 0.998 implies that all explanatory variables can explain 99.8% of the causes of changes in the country's composite stability index. In summary, the GDP per capita indicator has the greatest impact on the national composite stability index, so a social stability risk warning needs to focus on GDP per capita.

VI. TOPSIS social stability assessment model based on the entropy power method

6.1 Modeling of Problem 2

(1) The indicators in the indicator system are classified according to very large (benefit-based) indicators, very small (cost-based) indicators, intermediate indicators, and interval indicators, and then non-very large indicators are uniformly transformed into very large indicators, and very small indicators are positively.

$$\max - c_{ij}$$

Intermediate type indicators positive: $\widetilde{C}_i = 1 - \frac{|c_{ij} - c_{best}|}{M}\ M = \max\{|c_{ij} - c_{best}|\}$

Interval-based indicator normalization: $\{c_{ij}\}$ is a set of interval-based indicator series and the optimal interval is $[a,b]$, then the formula for normalization is as follows.

(2) Normalization of the normalization matrix to remove the influence of the magnitude, now there are i objects and m evaluation indicators that have been normalized, constituting

the following normalization matrix.

$$X = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1m} \\ x_{21} & x_{22} & \cdots & x_{2m} \\ \cdots & \cdots & \cdots & \cdots \\ x_{n1} & x_{n2} & \cdots & x_{nm} \end{bmatrix}$$

The matrix for which it is normalized is denoted Z. Each element in Z is

$$z_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{n} x_{ij}^2}}$$

(3) Determine whether there are negative numbers in the Z matrix, and if so, another normalization method needs to be used for X. The matrix X is standardized once to obtain the $\widetilde{Z}$ matrix, normalized as

$$\widetilde{z}_{ij} = \frac{x_{ij} - \min\{x_{1j}, x_{2j}, \cdots, x_{nj}\}}{\max\{x_{1j}, x_{2j}, \cdots, x_{nj}\} - \min\{x_{1j}, x_{2j}, \cdots, x_{nj}\}}$$

(4) Calculate the weight of the ith sample under the jth indicator and consider it as the probability used in the relative entropy calculation

Suppose there are n objects to be evaluated, m evaluation indicators, and the non-negative matrix obtained after the previous processing step is

$$\widetilde{Z} = \begin{bmatrix} \widetilde{z}_{11} & \widetilde{z}_{12} & \cdots & \widetilde{z}_{1m} \\ \widetilde{z}_{21} & \widetilde{z}_{22} & \cdots & \widetilde{z}_{2m} \\ \cdots & \cdots & \cdots & \cdots \\ \widetilde{z}_{n1} & \widetilde{z}_{n2} & \cdots & \widetilde{z}_{nm} \end{bmatrix}$$

Calculate the probability matrix P. The formula for each element of P p_{ij} is

$$p_{ij} = \frac{\widetilde{z}_{ij}}{\sum_{i=1}^{n} \widetilde{z}_{ij}}$$

Easy to verify: $\sum_{i=1}^{n} p_{ij} = 1$, i.e., the probability sum corresponding to each indicator is guaranteed to be 1

(5) Calculate the information entropy of each indicator, and calculate the information utility value, and normalize to get the entropy weight of each indicator, the definition of information entropy is: assume that a denotes a certain situation that may occur in event A, and p(a) denotes the probability of this situation occurring, which can be defined as: $I(a) = -\ln(p(a))$, because $0 \leqslant p(a) \leqslant 1$, so $I(x) \geqslant 0$, if the possible situations of event A are: $a_1, a_2, \cdots, a_n$, then the information entropy of event A can be defined as

$$H(A) = \sum_{i=1}^{n} [p(a_i) I(a_i)] = -\sum_{i=1}^{n} [p(a_i) \ln(p(a_i))]$$

From the above formula, it can be seen that the essence of information entropy is the expectation of the amount of information that can be proved when

$p(a_1)=p(a_2)=\cdots=p(a_n)=\frac{1}{n}$ When $H(a)$ takes the maximum value, then $H(a)=\ln n$

For the jth indicator, its information entropy is calculated by the formula

$$e_j=-\frac{1}{\ln n}\sum_{i=1}^{n}p_{ij}\ln(p_{ij})\ (j=1,2,\cdots,m)$$

e_j The larger the information entropy of the jth indicator, the greater the information entropy of the jth indicator, indicating that the jth indicator has less information.

The information utility value is defined as: $d_j=1-e_j$, then the larger the information utility value is, the more information it corresponds to, and normalizing the information utility value gives the entropy weight of each indicator as follows. $W_j=\frac{d_j}{\sum_{j=1}^{m}d_j}\ (j=1,2,\cdots,m)$

(6) Calculate and normalize the score of each evaluation object

Assuming that there are n objects to be evaluated and a standardized matrix of m evaluation indicators.

$$Z=\begin{bmatrix} z_{11} & z_{12} & \cdots & z_{1m} \\ z_{21} & z_{22} & \cdots & z_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ z_{n1} & z_{n2} & \cdots & z_{nm} \end{bmatrix}$$

Define the maximum value.

$$Z^+=(Z_1^+,Z_2^+,\cdots,Z_m^+)=(\max\{z_{11},z_{21},\cdots,z_{n1}\},\max\{z_{12},z_{22},\cdots,z_{n2}\},\cdots,\max\{z_{1m},z_{2m},\cdots,z_{nm}\})$$

Define the minimum value.

$$Z^-=(Z_1^-,Z_2^-,\cdots,Z_m^-)=(\min\{z_{11},z_{21},\cdots,z_{n1}\},\min\{z_{12},z_{22},\cdots,z_{n2}\},\cdots,\min\{z_{1m},z_{2m},\cdots,z_{nm}\})$$

Define the distance of the ith evaluation object from the maximum value

$$D_i^+=\sqrt{\sum_{j=1}^{m}w_j(Z_j^+-z_{ij})^2}$$

Define the distance of the ith evaluation object from the minimum value

$$D_i^-=\sqrt{\sum_{j=1}^{m}w_j(Z_j^--z_{ij})^2}$$

Then the un-normalized score of the ith evaluation subject.

$$S_i = \frac{D_i^-}{D_i^+ + D_i^-}$$

The final score was normalized to.

$$\widetilde{S}_i = \frac{S_i}{\sum_{i=1}^{n} S_i}$$

6.2 Model solution for Problem 2

Get weights.

Table 8

index	weight
ControlofCorruption	0.109
PoliticalStability	0.042
GovernmentEffectiveness	0.083
RegulatoryQuality	0.062
RuleofLaw	0.073
VoiceandAccountability	0.064
GDP per capita	0.31
GDP growth	0.029
debt index	0.014
Inflation rate	0.007
fiscal balance	0.033
trade index	0.01
unemployment	0.015
School enrollment	0.111
Life expectancy	0.001
Intentional homicides	0.013
gini index	0.022

The risk tertiles were then determined by quartiles as

0-0.26: extremely unstable

0.27-0.31: more unstable

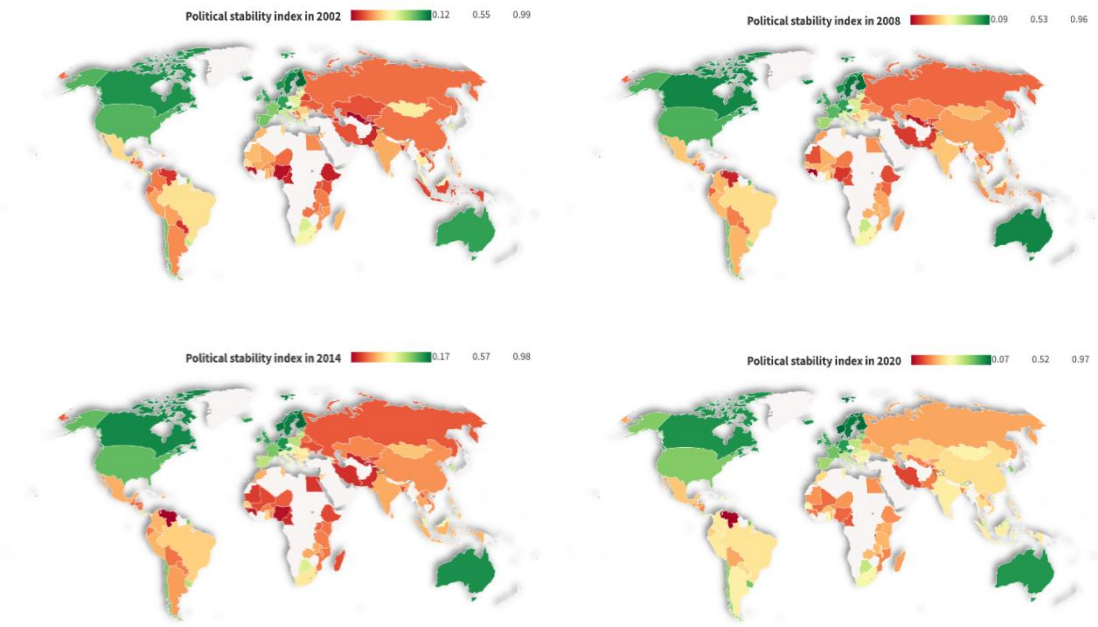
0.32-0.46: Alert interval

0.47-0.80: more stable

0.81-1: Very stable

The TOPSIS evaluation model based on the entropy weighting method is used to evaluate the final score recorded as the country composite stability index, and the combined score of each indicator is set as the country composite stability index, which is recorded as SB_j . The overall ranking of the national composite stability index is obtained by ranking the national composite stability index in descending order. Then, according to the classification of the social stability risk index system, the economic stability index distribution, political stability index distribution, and social stability distribution maps are made for each country under the economic stability index, political stability index, and rule of law stability index from 2002 to 2020, respectively.

6.2.1 Political risk assessment



The above figure shows the political stability coefficients of 121 countries in 2002, 2008, 2014, and 2020, and it can be seen that the political risks of different segments all show regionalized characteristics, and the political risks are mainly concentrated in the range of 0.07-0.57. From different segments, West Asia, North Africa, and East Africa are the regions with the highest political risks, and the average political stability index reaches 0.76, which is higher than the the average of the composite political stability index of 121 countries; followed by North America, Western Europe, and Oceania as the regions with the lowest political risk and a decreasing trend of the overall risk level from 2002 to 2020.

The combined scores of each indicator were obtained as follows.

Table 9

	Politics					
Rank	CC	PS	GE	RQ	RL	VA	PSI
1	Denmark	Luxembourg	Finland	Netherland	Finland	Norway	Norway
2	Finland	Iceland	Denmark	Finland	Norway	Denmark	Finland
3	Sweden	Finland	Luxembourg	Australia	Denmark	Sweden	Switzerland
4	Norway	Switzerland	Sweden	Denmark	Sweden	Finland	Luxembourg
5	Switzerland	Norway	Switzerland	Luxembourg	Switzerland	Switzerland	Denmark
117	Nigeria	Ethiopia	Uzbekistan	G.B	Burundi	Tajikistan	Nigeria
118	Burundi	Burundi	Paraguay	Belarus	Uzbekistan	Belarus	Cameroon
119	Tajikistan	W.B.G	Togo	Iran	Guinea	China	Iran,
120	Ven.	Nigeria	Tajikistan	Uzbekistan	G.B	Lao PDR	Burundi
121	G.B	Pakistan	Burundi	Venezuela	Venezuel	Uzbekistan	Venezuela

Shows the risk ranking of the top ten and bottom ten countries in the Political Stability

Index for 2002-2020, with the top ten countries being.

Norway, Finland, Switzerland, Luxembourg, Denmark. indicates that these countries have a high composite country stability index and a good level of social stability, and the top three countries are largely due to stable social security and government management systems, a higher standard of living for the people, and integrated governance across all sectors of the country which leads to a high composite country Stability Index ranking is higher. In addition, the bottom ten countries are Nigeria, Cameroon, Iran, Burundi, and Venezuel, whose low ranking in the Composite Country Stability Index is largely due to poverty and social unrest caused by political revolutions.

6.2.2 Social risk assessment

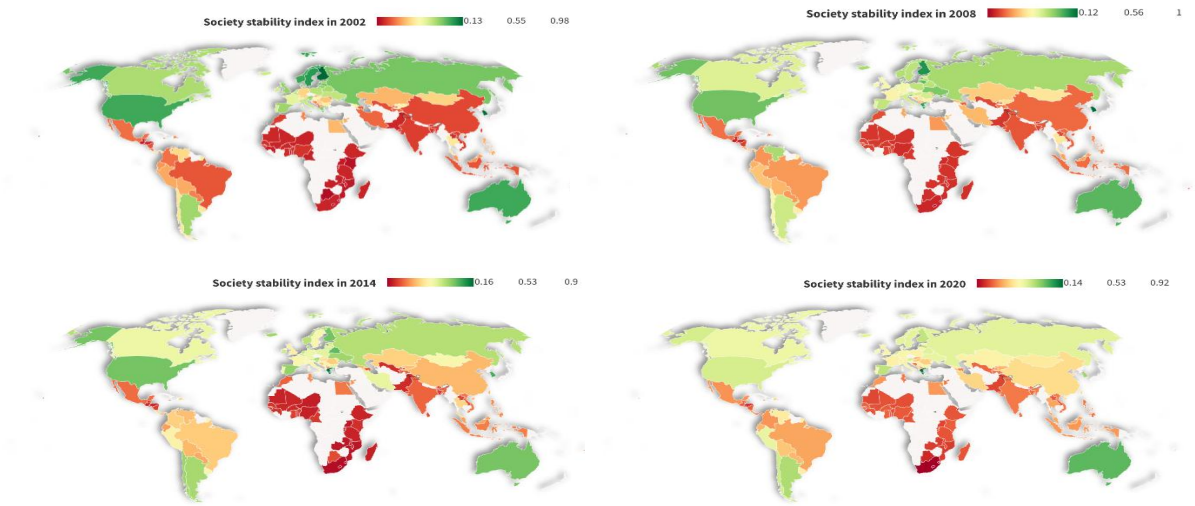


Table 10

	Society					
Rank	Unemployment	S.E	L.E	I.H	G.I	SSI
1	Thailand	Greece	Switzerland	Costa Rica	Slovenia	Greece
2	Vietnam	Korea	Iceland	Brazil	S.R	Australia
3	Benin	Australia	Italy	Venezuela	Ukraine	Korea
4	Belarus	Finland	Spain	Jamaica	Denmark	Argentina
5	Tanzania	U.S	Australia	D.R	Belarus	Latvia
117	South Africa	Burundi	G.B	Uzbekistan	Colombia	Botswana
118	B.H	Tanzania	Mozambique	Bulgaria	Eswatini	Djibouti
119	Eswatini	Gambia	Nigeria	India	Botswana	Lesotho
120	N.M	Niger	Eswatini	Australia	Brazil	Eswatini
121	Kosovo	Malawi	Lesotho	Poland	South Africa	S.A

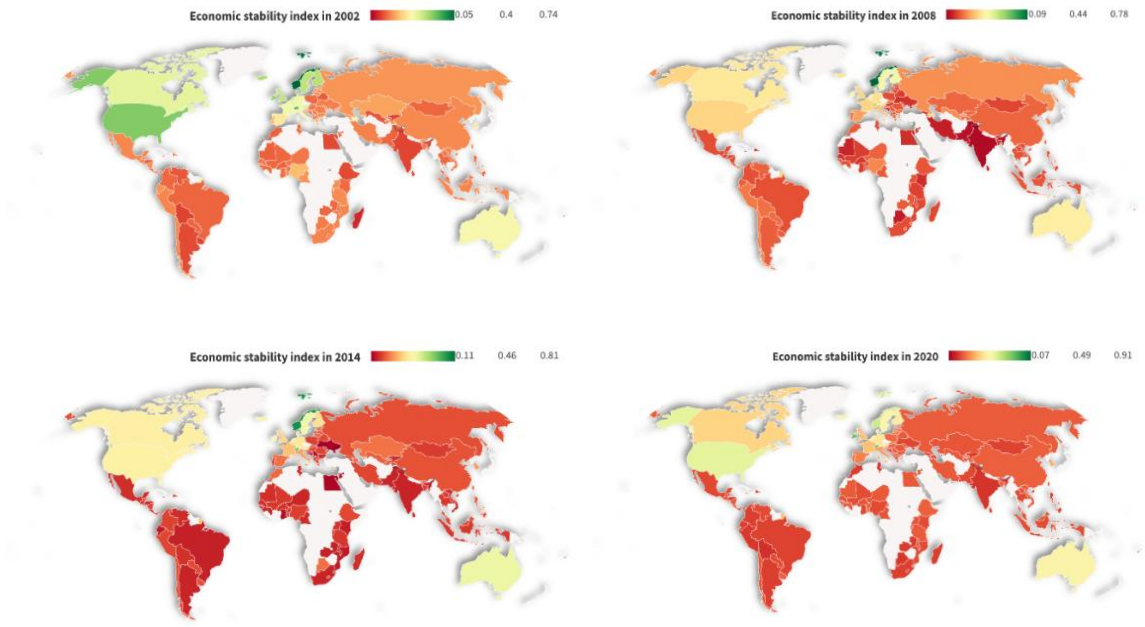
Shows the risk ranking of the Social Stability Index for the top and bottom ten countries for the period 2002-2020, with the top ten countries being.

Greece, Australia, Korea.Rep, Argentina indicate that this is a country with a high overall country stability index and a good level of social stability. The top three countries are largely due to a stable social security and government management system and a higher standard of living of the people, which in turn leads to a higher overall country stability index ranking. In

addition, the ten countries ranked last are :

Botswana, Djibouti, Lesotho, Eswatini, South Africa. These countries lagged behind in the Composite Country Stability Index overwhelmingly due to poverty issues and social unrest caused by social terror attacks.

6.2.2 Social risk assessment



The above figure shows the economic stability coefficients of 121 countries in 2002, 2008, 2014 and 2020, it can be seen that the global economic stability index has a low average level in all years, and the economic risk is mainly concentrated in the range of 0.05-0.49. From the spatial perspective, the regions of West Asia, South Asia, Central Asia and Africa are the regions with the highest economic risk, and the average economic stability index is only 0.19; in addition, the average risk in Canada, the United States and Western Europe is significantly lower than other regions. From a temporal perspective, from 2002 to 2020, the overall economic stability index shows a downward trend, and the global economy is downward due to the international political conflicts and the epidemic in 2020. According to the development trend of the epidemic, there is great room for the economic level of each country to rebound in the future.

Table 11

	Economy						
Rank	GDP.	GDP growth	debt index	IR	FB	TI	ESI
1	Luxembourg	Ethiopia	Guatemala	Switzerland	Norway	Venezuela	Luxembourg
2	Norway	China	Switzerland	Belize	W.B.G	Nicaragua	Ireland
3	Switzerland	Azerbaijan	B.F	Sweden	Azerbaijan	Chile	Switzerland
4	Ireland	Tajikistan	Indonesia	Finland	Kazakhstan	Guatemala	Norway
5	Denmark	Rwanda	Morocco	France	Korea, Rep.	Zambia	US
117	Niger	France	UK	Ethiopia	Burundi	Moldova	Bolivia

118	Ethiopia	Portugal	Ireland	Guinea	Venezuela	Madagascar	Belize
119	Madagascar	Jamaica	Spain	Belarus	Maldives	Bangladesh	Montenegro
120	Malawi	Italy	Iceland	Iran	India	Korea, Rep.	Fiji
121	Burundi	Greece	Greece	Venezuela	E.A.R	Pakistan	Maldives

The table above shows the top five and bottom five rankings of economic risk indicators for 2002-2020, with the top ten countries with the lowest risk being.

Luxuembourg, Ireland, Switzerland, Norway, US, indicate that these countries have a higher overall national stability index and a better level of social stability, and that the top three countries are largely due to a stable social security and government management system, a higher standard of living for their people, and a higher level of GDP per capita, which leads to a higher economic stability index ranking. In addition, the last ten countries in the ranking are In addition, the bottom ten countries are: Bolivia, Belize, Montenegro, Fiji, and Maldivas, which are ranked low in the Composite Country Stability Index, mostly due to social unrest and economic backwardness caused by poverty and historical problems.

Finally, after assigning weights to each indicator according to the TOPSIS model based on the entropy weighting method, the final scores were normalized to obtain the overall ranking of the country's composite stability index from 2002 to 2020 as follows.

Table 12

Score	Stability factor	Score	Stability factor
0.0183194	1	0.0140446	0.7043934
0.0173822	0.9351915	0.0137087	0.6811625
0.0170368	0.9113069	0.0135153	0.6677925
0.0159351	0.8351238	0.0132958	0.6526118
0.0152882	0.7903918	0.0129895	0.6314304
0.014715	0.7507547	0.012611	0.6052569
0.0144771	0.734299	0.0120843	0.5688376
0.0143999	0.728964	0.0116359	0.5378295
0.014349	0.7254453	0.0116046	0.5356662
0.0142429	0.7181068	0.0115114	0.529223

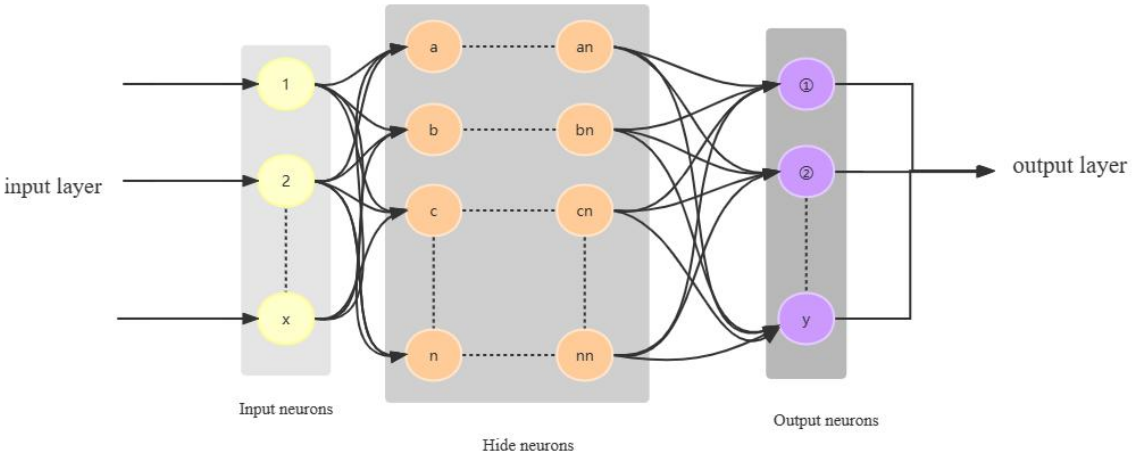
VII. Analysis of social stability of color revolutions

7.1 Modeling and solving Problem 3

7.1.1 Social stability analysis

Step1:Firstly, the discrete data are pre-processed and the interval variables are serialized

Step2: Given the training set $D=\{(x_1,y_1),(x_2,y_2),\cdots,(x_m,y_m)\},x\epsilon R^l$, i.e., the input example consists of d input neurons, and the output is l dimensional real-valued vector, a multilayer feedforward network structure is constructed as follows, the multilayer feedforward network structure has d input neurons, l output neurons, q hidden layer neurons of the multilayer feedforward network structure, where the threshold of the jth neuron of the output layer is represented by θ_j , the threshold of the hth neuron of the hidden layer is represented by γ_h . The connection power between the i-th neuron of the input layer and the h-th neuron of the hidden layer is v_{ih} , the connection power between the h-th neuron of the hidden layer and the j-th neuron of the output layer is w_{hj} , and the input received by the h-th neuron of the hidden layer is $\alpha_h=\sum_{i=1}^{d}v_{ih}x_i$, and the input received by the j-th neuron of the output layer is $\beta_j=\sum_{h=1}^{q}w_{hj}b_h$, where b_h is the output of the h-th neuron of the hidden layer.



Assuming that both the hidden layer and output layer neurons use the Sigmoid function, then for the training example (x_k,y_k) , the output of the neural network is assumed to be $\hat{y}_k=(\hat{y}_1^k,\hat{y}_2^k,\cdots,\hat{y}_l^k)$, i.e.

$$\hat{y}_j^k=f(\beta_j-\theta_j)$$

Then the mean square error of the network on (x_k,y_k) is

$$E_k = \frac{1}{2}\sum_{j=1}^{l}\left(\hat{y}_j^k - y_j^k\right)^2$$

There are $(d+l+1)q+l$ parameters to be determined in the network in the figure: $d \times q$ weights for the input layer to the hidden layer, $q \times l$ weights for the hidden layer to the output layer, q thresholds for the hidden layer neurons, l thresholds for the output layer neurons, and updated estimates of the parameters in each iteration using generalized perceptual machine learning rules, and updated estimates of any parameter v are given by

$$v \leftarrow v + \Delta v$$

7.1.2 Social stability influence factor analysis

(i) Poverty is widespread

In the early 1990s, the Confederation of Trade Unions of Ukraine set the poverty line at 95 hryvnia (about $50) per month, according to which some Ukrainians were living below the poverty line. In 1992, the inflation rate in Ukraine was 2150 percent, and in 1993 it soared to 10256 percent. Ukraine suffered its worst economic crisis since independence, and in 1998 Ukraine's GDP fell by 74% from the pre-independence level in 1990. By around 2003, almost all production indicators in Ukraine had fallen to the levels of the 1950s, 1960s, and even 1940s. The economic recession has greatly affected the standard of living of the population and poverty is becoming increasingly widespread

(ii) Unemployment exacerbates social unrest

There are various factors contributing to the growth of the unemployed population: large-scale privatization, economic recession, business closures, deterioration of economic conditions in agricultural and pastoral areas, free migration of the population and inadequate labor security system, etc.

The introduction of the market economy system in the economic transformation of each country and the large-scale privatization of state-owned enterprises have led to the dismissal of the surplus employees in state-owned enterprises in the planned economy, thus turning this part of the population from hidden unemployment to explicit unemployment. This kind of unemployment has structural contradictions and is difficult to avoid. And this trend will be strengthened with the deepening of privatization. The economic recession and the closure of a large number of enterprises have also exacerbated the unemployment of workers. At the same time, small and medium-sized enterprises in each country are still in their infancy, and their ability to create jobs is unable to meet the employment demand of society, while the development of large and medium-sized enterprises is relatively slow, resulting in a high level of unemployment, which has a negative impact on the

employment of workers.

(iii) Population issues plague social security

The rapid growth of the population is not compatible with the level of economic and social development. The number of population is much higher than the number of jobs that society can provide, which not only makes the employment pressure extra prominent, but also increases the social instability factors. The main manifestation is that the population is declining year by year and is unable to provide sufficient follow-up labor for the sustainable development of the country's economy and society. There are many factors that lead to the yearly decline of the population, such as: lack of necessary health care coverage, which creates a trend of high mortality and population decline; population decline due to emigration and transnational mobility of the population Post-independence Kazakhstan has been facing a very serious demographic crisis.

(iv) organized crime disrupting social order

The organization of state crime has intensified, involving an increasingly wide range of criminal areas, from fraud and drug trafficking to smuggling and terrorist activities, which seriously endanger social security. in 2000, 553,594 cases of various criminal offences were opened in Ukraine, mainly crimes against personal and property rights. In addition, crimes in the economic sphere have also increased, embezzlement, money laundering, financial fraud, embezzlement of state assets, etc., which not only caused huge economic losses to the countries, but also disrupted the normal economic order in the country. The increase in the crime rate and the youthfulness of the crime phenomenon have increased the factors of social instability.

(v) Corruption is prominent and the government has lost trust in the people

Corruption is widespread across Ukrainian institutions. The weakened role of the government and its inability to monitor the large-scale privatization of state-owned enterprises has provided opportunities for powerful government officials and leaders of state-owned enterprises. They used their power to turn state-owned assets into private wealth and made a fortune from privatization. The ruling authorities have not taken effective measures because too many of their members are involved in illegal activities. While government officials have become the biggest beneficiaries of the economic transition by taking bribes and embezzling state assets, the general public has to pay for the high costs of the economic transition.

7.2 Modeling and solving Problem 4

7.2.1 Problem 4 Model Solution

7.2.2 Problem 4 Cause Analysis

VIII. Color Revolution Proposal

8.1 Adhere to the principle of independent and autonomous

diplomacy, strengthen regional multilateral cooperation mechanisms, and bring in foreign aid

Through the mechanisms of international organizations in which it participates, such as the CIS Collective Security Treaty Organization, the Eurasian Economic Community and the Unified Economic Space, and the Shanghai Cooperation Organization, it has held numerous military exercises with China and Russia to deter reactionary forces that want to overthrow the current regime in the country, categorically rejecting Western demands for interference in internal affairs and insisting that foreign interference in the country's affairs is not allowed. The two countries signed a treaty of alliance with the West and formed a political alliance to prevent the spread of "color revolutions" in the country and to eliminate, as far as possible, the opposition forces that provoke conflicts in the country.

8.2 Strengthen and expand the party power of the former president and increase the deterrent effect of the executive power of the government

To build a strong pro-presidential party on the previous party system in order to strengthen the ruling base and facilitate the management of the government and the stability of state power. Pro-presidential parties and political forces to express a firm and strong political stance to deter the opposition that tries to provoke civil unrest

8.3 Strengthen the control of domestic opposition, NGOs and mass media by means of legislation

First, crack down or make peace with the domestic opposition, and divide and dismantle it. The government has taken various tough sanctions and increased control over NGOs and opposition candidate funding sources, which to a certain extent control or even cut off the sabotage activities of NGOs and effectively restrain the export of democratic ideas from Western countries and prevent "color revolutions". Finally, the government should strictly monitor the mass media to prevent them from being used by subversive organizations.

VII. References

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