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GEOPOLITICAL ENERGY SECURITY EVALUATION METHOD AND ITS APPLICATION BASED ON POLITICS OF SCALE

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ABSTRACT:

This paper rebuilds geo-energy security evaluation model, and evaluates China's geo-oil energy security in Russia's pacific oil pipeline construction from 1995 to 2010 quantitatively. The results showed that: ① from the time point of view, the geo-oil safety index of China in the Russia's Pacific oil pipeline construction rising,; ② from the geopolitical relationship point of view, the China-Japan energy competition index tended to decrease, but the competition of energy imports of the two countries from Russia intensified; ③ Russia's energy export strategy has long been biased towards Europe, but it has been turned to the trend, the energy export strategy index of Russia has dropped significantly; ④ to a certain extent, the proportion stability of China's oil consumption and China-Russian friendly relations eased China's geo-oil energy security; ⑤ from the geographical structure point of view, the overall national strength of China increasing which driven by China's economic growth, will aggravates the North east Asia's geo-oil competition.

1. INSTRUCTION

Energy is the most basic power source of human social development (Lei zhang, 200). Recently, with the continuing high-speed development of China's economy, China has become the largest developing energy consumption and production country in the world and the energy issue has become a top priority among the many problems in China in the 21st century, the energy security issue being the core issue (Guotian cai et al, 2005). Domestic and foreign scholars have studied the energy security issue extensively from different points of view. Foreign scholars such as Larry Hughes (2009), Anil Markandya (2010), Mamdouh (2003), Helen Cabalu (2010) and Kruyt (2009) studied energy security with regard to its connotations, policy, measures, safety evaluation index and so on; a group of domestic scholars represented by Liu Yi (1996,1999), Zhang Lei (2012), Yihuan Lang (2004), Xianjie He (2010), et al., conducted research on China's energy security in terms of the aspects of concept, theory, the evaluation method, the supply and demand assurance method, countermeasures and so on, thus providing a basis for decision making related to national energy security and macro-control.

However, early in the 1930s, Daniel Yergin, chairman of the Cambridge Energy Research Associates and a celebrity of the international oil industry, described the European oil market at that time as follows: "oil consists of 10% economy and 90% politics". This is to say that research on oil or oil energy security cannot be separated from politics, especially geopolitics. However, until now, few people have truly applied the geopolitics theory to energy security evaluation. The paper's goal is for this.

2. THEORETICAL FOUNDATION

2.1 Politics of scale theory

scale has gained considerable progress in political geography. It can even be asserted that the attention that human geography devotes to scale originated with Taylor (1982) and Smith's (1990) groundbreaking research on scale in political geography.

The core of politics of scale theory is that according to their own benefits, different behavior subjects perform necessary scale conversion by using their own power or introducing third-party behavior subjects to expand their own power and by controlling and manipulating scale, thus selecting a scale that is beneficial to themselves.

2.2 Security theory

Security is one of the most prominent problems that humans face, whether it is personal security, national security or international security, and few deny the existence of this problem (Buzan,1991). Based on many scholars' understanding of security concepts, we can generalize the three properties of security: the subjective property, the objective property and intersubjectivity. To this end, the evaluation of security must consider the three properties of security.

2.3 energy security theory

The proposal of the concept of energy security stems from the oil crisis in the 1970s. After the establishment of the international energy agency in 1974, the concept of national energy security was formally proposed, the core of this concept being the stabilization of crude oil supply and price security. Thus, energy security is defined as a country or religion able to obtain a stable, adequate, economic and clear energy supply to meet demand, ensure stable economic and social operation, and

guarantee the ability and status of sustainable and coordinated development (Qin zhou,2011).

Therefore, currently, the evaluation of energy security is developed in terms of three aspects. One aspect is the stability of energy supply; another aspect is the security of energy use, which means that the consumption and use of energy should not threaten the human survival and development environment.

3. THE CONSTRUCTION OF THE GEO-ENERGY SECURITY EVALUATION METHOD

3.1 Ideas of geo-energy security evaluation

There is a link between geo-energy security and energy security, but there are more differences between them. The differences are reflected in the "geo-" and "behavior". The word "geo-" is used as prefix to modify energy security and illustrates the relation between energy security and geo-setting, which also indicates that the geo-energy security evaluation is not energy security evaluation. but rather, the evaluation of the impact of geo-setting on energy security.

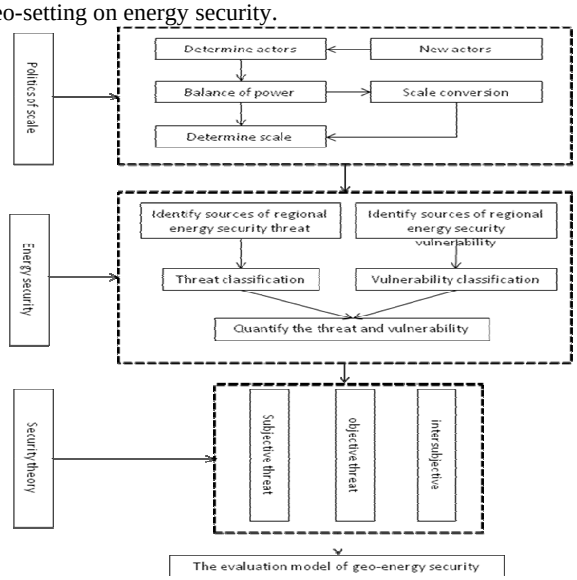

Fig.1 The evaluation of ideas of Geopolitical energy security

3.2 Evaluation model

For this purpose, we first introduce Klein's comprehensive evaluation equation of national strength as the basis of the geo-energy security evaluation model. He proposed a model of quantitatively evaluating and analyzing national power, the expression of which is as follows (Enyong wang, 2003):

$$P_p = (C + E + M) \times (S + W) \tag{1}$$

Therefore, we modify the model as follows:

$$GeoES_i = (B_i + C_i + D_i + E_i + F_i) \times (\alpha S_j + \beta W_{ij}) \tag{2}$$

In the formula, $GeoES_i$ (Geo-energy security) denotes the geo-energy security index of country i, B_i denotes the growth rate of energy consumption of country i, C_i denotes the structure index of energy consumption of country i or the ratio of oil consumption to total energy consumption if evaluating geo-oil energy security, D_i denotes the energy gap index of country i, E_i denotes the diverse index of energy imports of country i, F_i denotes the energy competition index between countries, α denotes the number of energy competitive countries, S_j denotes the geo-energy strategy index of energy-exporting country j, β denotes the geo-structure situation of the region and is expressed as the proportion of the economic strength of country i to the region, and W_{ij} denotes the geographical relationship of country i and country j and is calculated using the event analysis method for the national relationship.

$$C_i = \frac{m^k}{M} \tag{3}$$

in which m^k denotes the total consumption of k types of energy and M denotes total energy consumption.

$$D_i = \frac{M - N}{M} \tag{4}$$

in which M denotes total energy consumption and N denotes total energy production.

$$E_i = \sum_{k=1}^{3} \frac{g_k}{G} \tag{5}$$

In this expression, g_k denotes the amount of imported energy of the first three regions of a country importing energy from elsewhere in the world and the import regions must be the same. G denotes total energy import.

$$S_j = \frac{\mathrm{H}}{\Phi} \tag{6}$$

in which H denotes the total energy output of country j in other primary regions and Φ denotes the total energy output of country j.

4. MODEL APPLICATION: RUSSIA'S PACIFIC OIL PIPELINE CONSTRUCTION

4.1 data and their explanation

The calculation must include data on the following between 1995 and 2010: China's annual total energy consumption, total energy production, total oil energy consumption, total energy imports, and energy imports from different regions; Russia's total energy exports and total energy exports to different regions; Sino-Russian annual important international events; and the economic aggregate of China, Russia, Japan and South Korea.

Tab.1 Geo-oil energy security evaluation data set

时间	B_i	C_i	D_i	E_i	F_i	S_j	W_{ij}
1995	0.12	0.18	0.08	0.87	-	0.69	9.00
1996	0.09	0.18	0.01	0.86	-	0.71	7.84
1997	0.13	0.20	0.19	0.84	-	0.72	7.14
1998	0.06	0.22	0.24	0.83	-	0.73	6.62
1999	0.11	0.23	0.31	0.82	-	0.75	6.10
2000	0.09	0.23	0.35	0.80	-	0.76	5.55
2001	0.05	0.23	0.33	0.79	-	0.78	5.74
2002	0.13	0.23	0.39	0.76	-	0.81	5.55
2003	0.22	0.22	0.44	0.79	0.89	0.85	5.52
2004	0.28	0.22	0.53	0.77	0.86	0.83	5.67
2005	0.14	0.21	0.53	0.76	0.79	0.82	5.58
2006	0.15	0.20	0.58	0.73	0.70	0.81	5.43
2007	0.12	0.19	0.61	0.69	0.69	0.80	5.10
2008	0.02	0.19	0.59	0.70	0.69	0.78	5.09
2009	0.06	0.18	0.61	0.68	0.69	0.77	5.77
2010	0.09	0.18	0.61	0.66	0.67	0.70	5.59

Source: Author's computations.

4.2 Result analysis

(1) From the time point of view, China's geo-oil security index in the Russian Pacific oil pipeline construction rose continually, indicating that China was increasingly at a disadvantage in the oil energy politics of scale contention (figure 1).

(2) From the geographical relationship point of view, the energy competition index of China and Japan tended to decrease (F_i), but the competition between the two countries in terms of importing energy from Russia intensified.

(3) Russia's energy export strategy had long been biased toward Europe, but a steering trend emerged. As Russia's medium- and long-term strategy of energy is implemented, the trend will continue, which will decrease the threat of China's energy import to a certain extent.

(4) The proportion of China's oil consumption and the friendly relationship between China and Russia relieve China's geo-oil energy security.

(5) From the geo-structure point of view, the increase in the overall national strength driven by China's economic growth will intensify geo-oil competition in Northeast Asia.

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