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Energy investment risk assessment for nations along China's Belt & Road Initiative

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ABSTRACT

Overseas energy investment as an effective way of securing energy supply is being favored by the world's leading energy consuming countries. However, energy investment has the potential high risk on multiple forms, including political and regulatory risk, currency, liquidity and refinancing risk as well as resource risk and so on. To effectively evaluate overseas energy investment risk, this study proposed a new indicator system from six dimensions. Furthermore, a fuzzy integrated evaluation model based on the entropy weight was constructed to rate the energy investment risk for 50 nations along China's "Belt & Road initiative". The findings indicate that resource potential and Chinese factors have become the main determinant of energy investment risk, while environmental constraints and political risk should also be considered for investing decisions. In conclusion, Saudi Arabia, United Arab Emirates, Pakistan, Kazakhstan, and Russia are the most ideal choices for China's energy investment balancing resource potential and investment environment.

1. Introduction

On September 10, 2013, Chinese General Secretary Xi Jinping successfully proposed the construction of two major initiatives during a visit to Central Asian and Southeast Asian nations: a "Silk Road Economic Belt" and a "21st Century Maritime Silk Road", which were collectively called the "Belt & Road initiative". The main objectives of the "Belt & Road initiative" were to maintain the global trading system and its security, to realize the developmental path of cooperation and mutual benefit between nations, and to promote the development of an open world economic system by strengthening interregional cooperation. The proposal of this initiative attracted the attention of relevant nations and regions, and even received global attention. Up until now, there has already been cooperation and discussions between China and the 65 nations along the "Belt & Road initiative". The "Belt & Road initiative" is centered on interregional cooperation, with energy cooperation as its focal point. Given the constant rise in China's energy demands and China's increasing dependence on foreign countries for oil, overseas energy investments have become China's core energy strategy. The "Belt & Road initiative" has provided a new platform for the development of China's overseas energy investment and has had important implications for maintaining regional energy security and stability.

There is a greater potential for cooperation given that countries under the "Belt & Road initiative" have considerable gaps in their endowment of energy resources and strong economic complementarity. Countries under the "Belt & Road initiative" include Mongolia in East Asia, 5 countries in Central Asia, 10 countries in the Association of Southeast Asian Nations (ASEAN), 8 countries in South Asia, 18 countries in West Asia and Northern Africa, 7 countries in the Commonwealth of Independent States (CIS) including Russia, and 16 countries in the Middle Eastern Europe. According to the EIA statistics, the proven reserves of oil, natural gas, and coal in nations under the "Belt & Road initiative" make up 58.8%, 79.9%, and 54.0% of the world's total, respectively. A plentiful amount of energy resource reserves have also provided the possibility and foundation for the initiation of energy cooperation between nations.

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Energy investment is the main means by which energy-demanding countries guarantee a stable external energy supply. According to the IEA (2014) statistics, the worldwide investment in energy surpassed US $1.6 trillion in 2013. According to the prediction made by IEA (2014), by 2035, investments in the mining, transportation, and refinement of fossil energy will be close to US $23 trillion. Two-thirds of this investment is concentrated in emerging countries. Areas in which investments have focused have expanded from China to other parts of Asia, Africa, and Latin America.

However, the high risk of overseas energy investment has already become the primary factor, thereby obstructing the realization of investments because of two main characteristics of energy investments: the investment period is long and investment uncertainty is high. The associated risk factors are also rather complex. Given that energy resources are mainly concentrated in nations and regions in the Middle East, Central Asia, and Russia and many resource-rich countries have singular economic structures, the political risks are prominent, the financial technology is lacking, and the energy industry is developmentally behind such that overseas energy investment comes with a great risk. Therefore, a comprehensive evaluation of energy investment risks in nations under the "Belt & Road initiative" is a prerequisite for ensuring the energy investment proceeds smoothly. This also allows us to provide policy recommendations for the allocation of China's overseas energy investments.

Energy investment risk assessment is a hot topic on the field of energy risk management. For example, many literatures have evaluated the potential investment risks on power plants or grid systems. Dockner et al. (2013) investigate the risk of system operator on energy grids by considering investment, firm value and firm risk. They find firm risk without investment option is non-linear and determined by the short option positions. Pringles et al. (2015) employ real option analysis to evaluate power transmission investments considering substantial irreversibility and uncertainty. Zhang et al. (2016) propose a real options model for evaluating renewable energy investment by considering uncertain factors such as CO2 price, non-renewable energy cost, investment cost and market price of electricity. Tietjen et al. (2016) compare investment risks in power markets generated by different energy types between fossil fuel and renewable energy. They find the profits of renewable energies power plants are most affected by the power price risk. Hach and Spinler (2016) assess the effect of capacity payments on investments in gas-fired power plants in the presence of different degrees of renewable energy technology penetration. Gal et al. (2017) study the effect of natural-gas fuel cost uncertainty on capacity investment and price in a competitive electricity market. Mayer et al. (2017) consider risks and uncertainties in early stage investment for electricity generation and cost calculation methodologies of different complexity. Farfan and Breyer (2017) introduce a new sustainability indicator to monitor the development of national power system and the risk of standard investment.

In addition, risk assessment on fossil energy industry investment is also investigated. Chorn and Shokhor (2006) combine the Bellman equation for dynamic programming with a real options valuation algorithm to assess the non-repetitive investment decisions for a Central Asian gas condensate filed. Fan and Zhu (2010) also employ a real options based model to assess China's overseas oil investment decisions. Chen et al. (2016) employ a real-options approach to analyze the uncertainty of subsidy for CCS retrofitting investment in China's coal power plants. Some research also analyzes the impact of clean-development mechanism and carbon emission on energy investment (Strand et al., 2014; Hieronymi and Schuller, 2015; Mo et al., 2015; Jones, 2015; Cadarso et al., 2016; Cucchiella et al., 2017). Xu et al. (2017) test the relationships between investment and different factors using panel data for 5 sectors in China and demonstrate that investment did not become green and mainly relied on GDP.

Above literatures review shows that the previous research on energy investment risk assessment is still mainly focused on specific sector or project and some micro-level risk factors are involved. To the best of our knowledge, this will be the first paper to evaluate the overall national risk on general energy investment from the worldwide scope and country-level risk factors are considered. Most of the early national risk ratings were quantitative analyses related to the risks of debt default (Feder and Just, 1977; Kharas, 1984). Afterwards, scholars began to initiate studies using the rating results of leading global rating organizations (Standard & Poor's, Fitch Group, and Moody's) as substitute variables for the risk of each nation as a whole (Feder and Uy, 1985; Brewer and Rivoli, 1990). The International Country Risk Guide (ICRG) is the oldest risk rating guide. Beginning in 1982, national risk ratings were published each month based on three types of risk: political, economic, and financial. The overall risk was calculated by taking the weighted average of each of these three types of risk. Kim and Hwang (1992) rated the overall national risk of the corporate overseas investment from three perspectives: political, economic, and social. Miller (1992) constructed the international environmental risk awareness model, which measured the investment risk of the host country based on three levels: the macro-environment, the industrial environment, and the corporate micro-environment. Hammer et al. (2006) used nine economic indicators and three political indicators to rank in order the risk of 69 countries. Agliardi et al. (2012) used 34 indicators in the three main categories (political, economic, and financial) to construct a model that evaluated the sovereignty risk in emerging countries. Sánchez et al. (2014) used nine economic indicators to categorize the sovereignty of 27 nations in the European Union. Brown et al. (2015) select four different aspects (political, economic, operational, and social) to construct a more comprehensive risk index.

There were also some scholars who thought that Chinese overseas investments were more concerned with natural resources and that this variable played an important role in explaining China's overseas investment behavior. Li et al. (2012) used a decomposition hybrid approach to predict the national risk of major crude oil exporting countries. Tan (2013) analyzed the scope of the Chinese foreign investment in the energy realm as well as its main risks in order to provide related recommendations. Sun et al. (2014) introduced the investment situation of the Chinese sovereign wealth fund in the energy field. Conrad and Kostka (2017) and Liedtke (2017) analyze recent trends in Chinese investment in the European energy sector discussing unfair competition and economic risks.

However, the above literature indicates that most of the work primarily investigated the nation's general investment risk. There are relatively few studies that address the risk assessments for energy investment and a significant lack of studies on the risk of Chinese overseas energy investments. As the world's primary importer of oil and gas, China's current dependency on the import of oil and gas from abroad surpasses 60% and 30%, respectively. This serious dependence on foreign countries for energy resources has prioritized the Chinese overseas energy investment as an important strategy to maintain its energy security. The energy cooperation between China and nations along the "Belt & Road initiative" has become an important component in implementing this strategy. However, the Chinese government's current assessment of the risk factors for nations along the "Belt & Road initiative" is not fully developed as it lacks comprehensive scientific theoretical evidence