Comparative Analysis on China, US and Japan's Systematic Risk of Crude Oil Imports

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Overview

With the increasing oil demand, China crude oil import dependency reached 57% in 2012, and oil import risk has been the policy focus of China's energy security. Generally, oil import risk mainly consists of price fluctuations and supply disruption, where the fluctuations of oil import price have great impact on the real economy of oil importing countries. This issue has received a great deal of attention from both governments and researchers. This research focuses on how to measure oil import risk, especially the systematic risk arising from price fluctuations, which helps make clear the situation of China's oil import risk compared with some other larger oil importers.

In the past decade, the fluctuations in international oil price have brought great challenge for oil importers. The international oil price is usually taken as a benchmark for oil trading price, and it is the major factor driving the fluctuations of crude oil import price. While taking account of the difference among oil exporters, the sensitivity of crude oil import price from different exporters to the fluctuations of international oil price is different. As a result, for an oil importer, the sensitivity of its average crude oil import price to the fluctuations of international oil price would not keep stable when oil import portfolio changes. Also, it is necessary to model the systematic risk of oil imports when considering this sensitivity. Therefore, this research first attempts to investigate the dynamic sensitivity of a country's average crude oil import price returns to the Brent oil price returns where Brent oil price index is selected as a proxy of international oil price benchmark. Then, a comparative analysis is carried out on China, US and Japan's systematic risk of crude oil imports, aiming at providing some meaningful suggestions for China's oil import policy.

Methods

The single factor capital asset pricing model of Sharp(1964) and Lintner(1965) is extended to measure oil import risk in the following form: $r_{i,t} = \alpha_i + \beta_i \times r_{B,t-1} + \varepsilon_{i,t}$, where $r_{i,t}$ is the return of the average crude oil import price for country i, $r_{B,t-1}$ is the return of the Brent oil price index for period t, and $\varepsilon_{i,t}$ is the disturbance vector. The slope coefficient beta, β_i, measures the sensitivity of a country's average crude oil import price return to the returns on the Brent oil price index. Beta usually is not a constant coefficient, and the DCC-GARCH model is adopted to estimate the dynamic beta. The systematic risk of country i crude oil imports can be expressed as: $\sigma_{i,t}^2 = \sigma_{B,t}^2 \sum_{j=1}^{n} x_{ij,t}^2 \beta_{i,t}^2$, where $\sigma_{B,t}^2$ is the variance of the monthly Brent oil price index returns, x_{ij} stands for the share of country i crude oil imports from supply origin j in t month.

Results

First, the dynamic betas provide more detail information on the changes of the sensitivity of a country's average crude oil import price return to the Brent oil price returns, and describes that the sensitivity will increase when Brent oil price index changes greatly.

Second, the average value of dynamic beta shows that the sensitivity of the US's average crude oil import price returns to the Brent oil price returns is the lowest, while China is the highest, indicating that China crude oil import price is much more susceptible to changes of the international oil prices.

Thirdly, the volatility of Brent oil price returns induced all countries' crude oil imports systematic risk fluctuate greatly, especially during the period September 2008 to May 2009 when global financial crisis spread. Among the three largest oil importers, the systematic risk of Japan crude oil imports is the highest because its oil import diversification is quite low.

Conclusions

This research investigates the dynamic sensitivity of a country's average crude oil import price returns to the Brent oil price returns, and then crude oil import systematic risk of China, US and Japan have been estimated. The results show that the sensitivity of the average crude oil import price returns to the Brent oil price returns is unstable, and China crude oil import price is much more susceptible to changes in international oil prices than US and Japan. Even so, China crude oil import systematic risk is lower than Japan for its high level of oil import diversification. US has kept its crude oil import systematic risk in stable by effectively controlling its oil import price and diversification. With the increasing oil imports, China should make more efforts on the fluctuations of oil import price as well as diversification to reduce crude oil import systematic risk in the future.

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