The brief explanations of the long term steady equilibrium

In order to analyze whether there is a long-term equilibrium between economic growth and gas consumption, firstly, we perform generalized least square regression on the variables and obtained the residuals e_t. Using the generalized least square fit to make regression estimate of panel model, therefore, the residuals e_t are obtained and the estimate results are as followed:

$$\ln Yit=-2.157898+ + \ln Kit+ \ln Lit+ \ln Eit, \quad (11)$$

R2=0.986683 F-statistic=1858.223 Prob(F-statistic)= 0.000000.

Secondly, we should prove that the e_t series is steady, which means the existence of long-term equilibrium between the economic growth and gas consumption. The unit root test on e_t were carried out to study the smooth between economic growth ln (Y) and gas consumption ln (E). The result shows that e_t series is smooth and there is a cointegration relationship between ln (Y) and ln (E), which indicates the long-term equilibrium relationship between the two.

The brief explanations of the short-term steady equilibrium

The certain long-term equilibrium relationship between natural gas consumption and economic growth of China, Japan and Korea cannot indicate the specific causality relationship and its direction cannot be determined. According Table 5, in the aspect of short-run causality relationship, only in China, natural gas consumption and economic growth have a one-way causal relationship, China's economic growth measurement variable Y is not only affected by the consumption of natural gas, but also by the previous gas consumption $\ln E_{t-1}$. The coefficient of $\Delta \ln E_{t-1}$-0.175 value reflects the elasticity of previous gas consumption on Y. The greater the deviation from the previous period, the greater the amount of correction in this period, that is, the system error correction mechanism works. Consequently illustrating the short-term dynamic causal relationship between the gas consumption and economic growth of China. Meanwhile, The table 5 also shows system error correction mechanism of Japan and Korea don’t work well, thus demonstrating there is no short-term causal relationships.