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Cointegration analysis of gas consumption between economic growth and industrial structure

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ABSTRACT

Cointegration Analysis, Granger causality analysis and error correction are made based on a systematic study of the natural gas consumption factors of interaction between gas consumption and GDP, industrial structures. Cointegration analysis confirmed that the long-run equilibrium point of view, there are GDP and industrial structure of the positive role of natural gas consumption, indicating that China's sustained economic growth in the future will lead to increasing consumption of natural gas; Granger causality test confirmed the presence of natural gas is only a two-way causal relationship between consumption and GDP; industry bodies only unidirectional causality; error correction analysis, short-term fluctuations in GDP is a major factor in the short-term fluctuations in natural gas consumption, the short-term effects of the industrial structure is not obvious. Proposed national gas when planning long-term development strategy should pay attention to the long-term effects on GDP and industrial institutions, but more should pay attention to the short-term impact of economic changes on the domestic natural gas consumption due to the short term.

Keywords: natural gas consumption; economic growth; industry structure; Cointegration Analysis

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INTRODUCTION

With the gradual speeding up China's industrialization and urbanization pace, China's economy has kept a rapid development in five-second period, the first half of 2013, 2013 GDP 24.81trillion yuan, an increase of 7.6%, China has be among the world's most quick average growth rate of the country, rapid economic development will inevitably bring a sharp rise in fossil energy demand, however, consume a lot of fossil fuels has led to an increase in carbon dioxide emissions, global climate deterioration, in response to environmental requirements, developing countries around the world have launched a path of low-carbon economy. To meet our global low carbon developments, in the "five" plan also proposes a "thoroughly implement resource conservation and environmental protection a basic national policy, save energy and reduce greenhouse gas emissions intensity," a series of sustainable development initiatives. Natural gas as a low-carbon, environmentally friendly, energy-efficient, energy-deserved choice for the current low-carbon economy, which also led to the increasingly widespread use of natural gas, the demand continues to increase, in 2013, China's natural gas consumption of 161.6 billion cubic meters, an increase of 10.8% , but can not be ignored is that in 2013, China fossil energy sources, the fastest growth in consumption of natural gas (10.8%), followed by coal (4.0%) and oil (3.8%)[1].

Therefore, the growing demand for natural gas consumption and economic growth in the presence of what kind of relationship is becoming a hot topic in contemporary academia and the industry. In the long term, to explore China's economic growth, what kind of a dynamic relationship exists industry bodies and natural gas consumption, the impact among the factors conducive to the improvement of the existing model of economic development, the transformation of economic growth, energy conservation. At home and abroad, on economic growth and energy consumption relations scholars have done a lot of research, such as: Lin Baiqiang (2003) using Granger causality study found that there is a long-term relationship between China and the behavior of short-term fluctuations in

economic growth and energy consumption, the study also confirmed the Granger relationship from electricity consumption to income unidirectional[2];Ghali (2004) using the Johansen cointegration studied the dynamic relationship between GDP and energy consumption about Canada, researchers found that the relationship between the existence of a two-way Granger[3];Lee (2005) constructed a panel data model including GDP and energy consumption about eighteen developing countries, the findings confirm the presence of either or both, from energy consumption to GDP unidirectional causality[4];Zhao Xiaoqin, Kang Zhengkun et al point out the main factors associated with the consumption of natural gas has the national economy, energy policy, industry structure, population, etc., and were quantitatively analyzed using gray correlation method[5].

Many valuable conclusions are made from the domestic and international studies, providing a useful referencefor for the study of the relationship between energy consumption and economic growth,but not difficult to find that most of the literature is studied from the total energy the results are general and specifically for the study of a less fossil fuels, but not related to the dynamic causal relationship between each other, can not be effective and rational study of the various realities of energy consumption, this paper attempts to draw on the basis of the former studies break through this limitation, the energy freeze for natural gas, using Granger cointegration theory specific study economic growth, industrial structure and the interaction between the consumption of natural gas as well as the dynamic evolution has provided policy advice for the development of targeted.

2 The unit root test of GDP, industrial structure and natural gas consumption

In order to ensure that the results reflect reality as much as possible need to adopt a longer time series analysis,this paper uses the consumption of natural gas released about China's statistical yearbook[6] from 1996 to 2013 as a dependent variable,selecting China's GDP and the second industrial structure at the same time period as explanatory variables for cointegration and Granger causality analysis between the natural gas consumption and GDP,the second industrial structure.At the same time,in order to eliminate data volatility and overcome heteroscedasticity influence, making the model more practical sense, it need to take the logarithm for each data[7].For non-stationary time series, sometimes unrelated sequences between variables can test out a causal relationship, so the need for time-series for each unit root tests prior cointegration test, in order to avoid false causality. ADF test method herein with reference to other documents used in the time series for the unit root test, using the software for Eviews6.0, whose test results are shown in Table 1 to Table 3:

Table 1 The unit root test of China's natural gas consumption from 1996 to 2012

test sequence	significance level		t statistics	probability
lntrql	1%	-4.667883	-3.787	0.056
	5%	-3.733200		
	10%	-3.310349		
D(lntrql,1)	1%	-4.728363	-2.680	0.256
	5%	-3.759743		
	10%	-3.324976		
D(lntrql,2)	1%	-4.992279	-5.149	0.008
	5%	-3.875302		
	10%	-3.388330		

Table 2 The unit root test of China's GDP from 1996 to 2012

test sequence	significance level		t statistics	probability
lngdp	1%	-4.886426	-3.453	0.0879
	5%	-3.828975		
	10%	-3.362984		
D(Lngdp,1)	1%	-4.992279	-1.562	0.7464
	5%	-3.875302		
	10%	-3.388330		
D(Lngdp,2)	1%	-4.886426	-6.864	0.0006
	5%	-3.828975		
	10%	-3.362984		

Table 3 The unit root test of the second industrial structure from 1996 to 2012

test sequence	significance level		t statistics	probability
	1%	-4.886426		
lncyjg	5%	-3.828975	-2.586	0.2902
	10%	-3.362984		
D(Lncyjg,1)	1%	-4.728363		
	5%	-3.759743	-2.987	0.1669
	10%	-3.324976		
D(Lncyjg,2)	1%	-4.800080		
	5%	-3.791172	-6.031	0.0015
	10%	-3.342253		

Tables 1 to 3 results confirmed the original sequence and first-order difference sequence about natural gas consumption, GDP and industrial structure is instability at the 5% significance level, there is a unit root,while the second order differential of three variables is significant at the 5% significance level, that reject the null hypothesis, prove second-order difference stationary instability, three variables are integrated of the same order,cointegration may exist between the variables,further analysis can be test by Granger causality.

3 Cointegration test and analysis of GDP, industrial structure and natural gas consumption

3.1 cointegration test and analysis

The cointegration test of variables can be seen from the results,we make cointegration between variables through simple and effective Engle-Granger two-step method,the test model of natural gas consumption and GDP are:

$$\Delta \ln trql_t = \alpha_1 + \beta_1 \Delta \ln gdp_t + \varphi_1 + \varepsilon_1 .....(1)$$

$$\Delta \ln gdp_t = \alpha_2 + \beta_2 \Delta \ln trql_t + \varphi_2 + \varepsilon_2 .....(2)$$

Which Δ is the difference; α、β on behalf of the constant term; φ is a trend term; ε is the error term.Whether the φ is zero in the stationary time series, the null hypohthesis is not exist cointegration between two variables,the result can be determined by seeing the probability value with a significance level of size.Cointegration between natural gas consumption and industrial structure is same to the above theory, the test results are shown in Table 4 - Table 5:

Table 4 Cointegration test results of natural gas consumption and GDP

null hypothesis	Trace test statistic	5%critical value	probability
Cointegration is not exist	18.93951	15.49471	0.0145
Exists at most one	0.158022	3.841466	0.6910

Table 5 Cointegration test results between natural gas consumption and industrial structure

null hypothesis	Trace test statistic	5%critical value	probability
Cointegration is not exist	16.65127	13.3208	0.0137
Exists at most one	0.168132	3.941566	0.7132

The test results about Table4 and Table5 shows, at the 5% significance level, there is a cointegration gas consumption and GDP; the same token, there is cointegration between gas consumption and industrial structure. Eviews6.0 software using time series using least squares linear regression method was as long-run equilibrium (3) shown in the regression model equation:

$$\ln trql = -5.757 + 1.075 \ln gdp + 0.378 \ln cyjg + et .....(3)$$

(0.0046) (0.001) (0.0411) R^2=0.997； DW=1.58

From the linear regression effect, the coefficient values is significant at the 5% significance level, while the R-squared value of the regression equation can be seen to fit well, DW close to two illustrates auto-correlation phenomenon does not exist.From future long-term trend,GDP has a positive effect on natural gas consumption, GDP per unit increase will cause a corresponding increase 1.07 units in natural gas consumption,indicating that China's sustained economic growth will lead to increasing consumption of natural gas in the future;Meanwhile, the second industry bodies also play a positive role in the consumption of natural gas,the proportion of secondary industry industry in the national economy increases 1% will cause a corresponding increase in natural gas consumption

37.8%,indicating that the increase of China's secondary industry also gradually to rely on natural gas consumption in the direction of development.The constant term represents the average consumption level of spontaneous,its value is negative,indicating that in the long run,China's natural gas production can not meet consumer demand,future natural gas consumption still needs large quantities' import from abroad.

3.2 Granger causality test

Although the above results confirm the existence of long-term co-integration relationship between the natural gas consumption and GDP, the industrial structure,but whether there is a two-way interaction between each other and did not give up, and therefore the causal relationship between two variables can be tested by Granger causality, the test results follow Table 6:

Table 6 Granger causality test about lngdp, lncyjg and lntrql

null hypothesis	F statistics	probability
Lntrql does not Granger Cause lngdp	12.841	0.0001
Lngdp does not Granger Cause lntrql	7.0254	0.0038
Lntrql does not Granger Cause lncyjg	2.6732	0.0786
Lncyjg does not Granger Cause lntrql	5.6735	0.0436

Test results can be seen from Table 6,at the 5% significance level, there is a two-way Granger causality between the second order lag gas consumption and GDP;and there is only a single between gas consumption and industry bodies Granger causality to the industrial structure is caused by changes in natural gas consumption due Granger.

3.3 Error Correction Model

The test results of 3.1 and 3.2 only confirmed the long-term cointegration relationship between variables,but due to changes in the external environment,there are short-term fluctuations in the variables,while the effect of short-term fluctuations will also affect the accuracy of the model,in order to explore the impact of each variable on short-term fluctuations in natural gas consumption due to the need to build an error correction model for short-term fluctuations in the analysis,the results of error correction processing through Eviews6.0 follow Table 7:

Table 7 Error correction results

variable	coefficient value	F statistics	probability
C	-0.0171	-2.6197	0.0547
D(LNGDP)	1.1820	5.6822	0.0001
D(LNCYJG)	0.7563	1.4805	0.1645
ECM(-1)	-1.0249	-4.5506	0.0007
R^2	0.8368	DW	1.6104

The results in Table 7 show that R-square value of the error correction model is relatively large, indicating that better fit the equation, DW confirmed among nearly two variables do not exist auto-correlation,ecm coefficient is negative in line with the principle of reverse correction,but can also be seen from the results in Table 7,only the coefficient of GDP is significant, the coefficient values of the industrial structure is not significant,indicating that the impact from short-term fluctuations in natural gas consumption is mainly the effect of short-term fluctuations in GDP, while the short-term fluctuation effects of GDP in natural gas consumption is even larger than the long-run equilibrium can be seen from the equation (3).

CONCLUSION

We use Granger causality test and error correction model to study the interaction between the specific gas consumption and GDP, industrial structure on the basis of researching to the factors affecting natural gas consume.Passed cointegration analysis confirmed that under long-term development perspective,there are GDP and industrial structure of the positive role of natural gas consumption,indicating that China's sustained economic growth in the future will lead to increasing consumption of natural gas,and the second industry increase the added value also evolved to depend on the direction of natural gas consumption;Granger causality test confirmed the presence of two-way causal relationship between gas consumption and GDP;and there is only a one-way causal relationship between the consumption of natural gas and industrial institutions, through error revised analysis shows that short-term fluctuations in GDP is a major factor in the short-term fluctuations of natural gas consumption,the short-term effects of the industrial structure is not obvious,therefore,the planning of gas' long-term development strategies should pay attention to the long-term effects of GDP and industrial organization,but in the short term should pay attention to the short-term impact of economic changes on the domestic natural gas, appropriate measures must be adopt to avoid the emergence of short-term gas shortage,and effectively solve the problem of short-term supply and demand contradiction.

REFERENCES

[1] **2014** "BP World Energy statistical Yearbook "[EB / OL].
http: //www.bp.com/zh_cn/china/reports-and-publications/bp_**2014**.html]].
[2] Lin *based management* World, **2003**, (11): 18-27.
[3] Ghali KH, EI-Sakka MIT..*Energy Economics*, **2004**, (26):. 225-238.
[4] Lee short term, long term, CC *Energy Economics*, **2005**,27, (3):. 415-427.
[5] Zhao Xiaoqin, Kang Zhengkun etc. *oil and gas storage and transportation*, **2008**,27 (8): 5-8
[6] China Statistical Yearbook -2013 [EB / OL] .http: // www. stats.gov.cn/tjsj/ndsj/**2013**/indexch.htm.
[7] He Lihua, Xu Yu, Xu Yongxiang, Lihong Xun. *economic Issues*, **2013**, (4): 70-73.