Based on the Granger Causality Tests the Research About the Relation Between the Real Economy and Virtual Economy in Our Country

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Abstract

In this paper, we use the data of total volume of stock, bonds issued the final balance, total volume of futures and funds total turnover from 1994 to 2012 to represent virtual economy index, using GDP on behalf of the entity economy index, using the unit root test, cointegration test and granger causality test method to explore the relationship between virtual economy and real economy of our country in recent years. As a matter of fact, there is two-way causal relationship between China's real economy and virtual economy now, the real economy development is advantageous to the virtual economy, virtual economy growth, in turn, promotes the development of the real economy, the future of economic development at the same time to pay more attention to the coordinated development between real economy and virtual economy.

Key Words: virtual economy; the real economy; unit root test; cointegration test; Granger causality test

1. Introduction

Since the reform and opening up in the 1978 years, China's economic development situation is good, the steady rise of comprehensive strength, after three decades of spectacular growth, China has finally surpassed Japan, became the world's second largest economy after the United States. Since the 1990s, our country with the establishment of the Shanghai stock exchange and Shenzhen stock exchange, the stock market, bond market development speed, stepping up the development of virtual economy scale expanding gradually. But the virtual economy is the "double-edged sword", on the basis of its development is based on credit, as Marx said: "in all links in the process of reproduction is based on credit system in the production, if credit suddenly stopped, only cash payments are effective, the crisis will occur obviously"[1], so the excessive development of virtual economy will be buried a hidden danger for the development of world economy, if uncontrolled, make market speculation, lead to the bubble economy and the economic crisis, eventually cause the global financial crisis[2]. Japan's economic bubble burst in 1989 triggered the financial crisis; Mexico financial crisis in 1994; Southeast Asian financial crisis in 1997; The 1998 financial crisis in Russia; Brazil's financial crisis of 1999, and since the second half of 2007 by the U.S. subprime mortgage crisis triggered the global financial crisis, all those has relations with the expansion of the virtual economy development[3], so it is meaningful to study of the relationship between the real economy and virtual economy in our country at present.

2. The real economy and virtual economy in our country, and the empirical analysis

Between the real economy and virtual economy mutual promotion and mutual restriction relationship, from the perspective of empirical analysis, this paper selected the sum of total volume of stock, bonds issued the final balance, total volume of futures and funds total turnover to represents the virtual economy (XNJJ), selects GDP on behalf of the entity economy, using the method of unit root test, cointegration test and granger causality test method to discuss the relationship between virtual economy and real economy in our country in recent years. [4]

Table 1：**Virtual assets total and GDP (unit: RMB one hundred million)**

Year	Total volume of stock ①	Bond ending balance②	Total volume of futures ②	Funds total turnover④	XNJJ ①+②+③+④	GDP	LNXNJJ	LNGDP
1994	8127.62	3063.8	31601.41	357.5	43150.33	48197.86	10.672	10.783
1995	4036.45	5655.4	100565.3	510.19	110767.3	60793.73	11.615	11.015
1996	21332.17	7468.75	84119.16	1566.5	114486.6	71176.59	11.648	11.173
1997	30721.83	9658.75	61170.66	807.91	102359.2	78973.03	11.536	11.277
1998	23544.25	13563.76	36967.24	1016.89	75092.14	84402.28	11.226	11.343
1999	31319.6	17768.11	22343.01	2485.48	73916.2	89677.05	11.211	11.404
2000	60826.65	21264.91	16082.29	2801.84	100975.7	99214.55	11.523	11.505
2001	38305.18	24152.48	30144.98	2561.88	95164.52	109655.17	11.463	11.605
2002	27990.45	29390.2	39490.28	1166.62	98037.55	120332.69	11.493	11.698
2003	32115.27	34253.6	108396.59	682.65	175448.1	135822.76	12.075	11.819
2004	42333.95	40657.6	146935.32	479.47	230406.3	159878.34	12.348	11.982
2005	31664.78	48477.1	134463.38	773.15	215378.4	184937.37	12.28	12.128
2006	90468.89	57178.29	210063.37	2002.65	359713.2	216314.43	12.793	12.284
2007	460556.23	89767.3	409740.77	2002.65	962067	265810.31	13.777	12.491
2008	267112.66	99304.45	719173.33	5831.05	1091421	314045.43	13.903	12.657
2009	535986.77	128213.11	1305142.9	10340.02	1979683	340902.8	14.498	12.739
2010	545633.54	156361.21	2269852.2	8996.44	2980843	401202	14.908	12.902
2011	421649.73	188145.01	937503.89	6365.81	1553664	471564	14.256	13.064
2012	314667.42	262000	1711000	8123.85	2295791	519322	14.647	13.16

Data sources: China's securities and futures statistical yearbook

2.1 Unit root test

Unit Root Test is the basis of whole relationship existence test and the discussed of sequence volatility persistence, we use the ADF method for Unit Root Test, through EVeiws software, this paper analyses whether the sequence between entity economy and virtual economy is smooth, given the absolute large values of the entity economy and virtual economy, we take log of the real economy and virtual economy for LN (GDP) and LN (XNJJ), and to get the logarithm of the results of Unit Root Test Augmengted Dickey - Fuller (ADF) Unit Root Test. Test results in the following table:

Table 2：**LN（GDP）ADF TEST（2 difference / Intercept）：**

Null Hypothesis: D(LNGDP,2) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on SIC, MAXLAG=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.223862	0.0061
Test critical values:	1% level	-3.959148	
	5% level	-3.081002	
	10% level	-2.681330	

*MacKinnon (1996) one-sided p-values.

We can see from the table above LN (GDP) of the inspection results, after the second order difference, in 1%, 5% and 10% significance level three, unit root test of Mackilmon threshold respectively -3.959148, -3.081002, -2.68133, t test statistical value of -4.223862, t test values are less than the corresponding critical value, show that after the second order difference of LN (GDP) ,there is no unit root, at all levels are smooth.

Table 3: LN（XNJJ）ADF TEST 2 difference / Intercept）:

Null Hypothesis: D(LNXNJJ,2) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on SIC, MAXLAG=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.574428	0.0005
Test critical values:	1% level	-3.959148	
	5% level	-3.081002	
	10% level	-2.681330	

*MacKinnon (1996) one-sided p-values.

We can see from the table above LN (XNJJ) of the inspection results, after the second order difference, in 1%, 5% and 10% significance level three, unit root test of Mackilmon threshold respectively -3.959148, -3.081002, -2.68133, t test statistical value of -5,574428, t test values are less than the corresponding critical value, show that after the second order difference of LN (XNJJ) ,there is no unit root, at all levels are smooth. It can be seen from the above analysis that for the time series of LN (GDP) and LN (XNJJ), after a second order differential, there is no unit root, they are smooth, meeting the conditions of the two variables cointegration, both may be a cointegration relationship.

2.2 Johanse cointegration test

Cointegration test is used to determine whether there is a long-term equilibrium relationship between variables, if there is a co-integration relationship between variables, then the variable is a long-term equilibrium between change trend. From the above, we know both may be a cointegration relationship, before cointegration, we should establish VAR model first to determine the optimal lag order number of the model. Through EVeiws measurement software analysis and according to the AIC and SC of the two statistics size to choose the optimal lag, when the two statistics under the same lag order value reaches the minimum at the same time, we choose the optimal lag order number to test cointegration relationship, from the following test result, the optimal lag order number of LN (GDP) and LN (XNJJ) VAR model is two.

Table 4:The optimal lag order number

VAR Lag Order Selection Criteria
Endogenous variables: LNXNJJ   LNGDP
Exogenous variables: C
Date: 10/25/13   Time: 19:55
Sample: 1994 2012
Included observations: 17

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-23.68060	NA	0.070353	3.021247	3.119272	3.030991
1	28.63245	86.16267	0.000241	-2.662641	-2.368565	-2.633409
2	37.84522	13.00627*	0.000134*	-3.275908*	-2.785783*	-3.227189*

 * indicates lag order selected by the criterion

After determining the model of the optimal lag order number, we use Johansen cointegration test to test the virtual economic growth and the real economic growth's cointegration relation. Due to the cointegration analysis of two variables, we set to test the null hypothesis is $H_0 = 0$, no cointegration relationship; opposite hypothesis is $H_1 \neq 0$,there are at least one cointegration relationship. If the result reject null hypothesis, the hypothesis of opposites, there is a cointegration relationship between two variables. Now through EViews software to Johansen cointegration of two variables, software analysis results in the following table.

Table 5: Johanse cointegration test

Date: 10/25/13   Time: 22:13
Sample (adjusted): 1997 2012
Included observations: 16 after adjustments
Trend assumption: Linear deterministic trend
Series: LNGDP LNXNJJ
Lags interval (in first differences): 1 to 2
Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.801547	27.37937	15.49471	0.0005
At most 1	0.089724	1.504121	3.841466	0.2200

 Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
 * denotes rejection of the hypothesis at the 0.05 level
 **MacKinnon-Haug-Michelis (1999) p-values
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.801547	25.87525	14.26460	0.0005
At most 1	0.089724	1.504121	3.841466	0.2200

 Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
 * denotes rejection of the hypothesis at the 0.05 level
 **MacKinnon-Haug-Michelis (1999) p-values

From the above, Johansen cointegration test shows that under the condition of the significance level of 0.05, mark (trace) statistics of 27.38 < the critical value of 15.49, reject H0 = 0, trace statistic of 1.5 < the critical value of 3.84, accepting hypothesis H1≠0 indicates there is at least one cointegration relationship; largest Eigen values (Max - Eigen) statistic is 25.86 > the critical value of 14.26, reject hypothesis H0 = 0, the maximum Eigen value statistics of 1.5 < the critical value of 3.84, accept hypothesis H1≠0 indicates there is at least one cointegration relationship. The above two variables showed there is at least one cointegration relationship, so the two variables, LN (XNJJ) and LN (GDP) ,there is a long-term co-integration relationship sequence, namely there is a long-term cointegration relationship between real economic growth and virtual economy growth.

2.3 Granger causality test

Granger causality tests reveal the guide of relationship between variables, because of the two variables without unit root in this article , and thought Johansen cointegration test we obtain long-term cointegration relationship between two variables, but we need Granger causality tests to determine how guide the relationship between the two. Now through EViews software on two variables Granger causality test, software analysis results in the following table:

Table 6 : The test of granger causality test results

Pairwise Granger Causality Tests
Date: 10/26/13   Time: 22:32
Sample: 1994 2012
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LNGDP does not Granger Cause LNXNJJ	17	4.02279	0.0460
LNXNJJ does not Granger Cause LNGDP		8.90406	0.0043

From the table we know that LNGDP does not Granger Cause LNXNJJ of the probability is 0.046, and 0.954 the probability of LNGDP is LNXNJJ Granger Cause, indicates that the development of the real economy caused the virtual economy fluctuation;

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At the same time, LNXNJJ does not Granger Cause LNGDP of probability is 0.0043, and under the probability of 0.9957 LNXNJJ is LNGDP Granger Cause, shows that virtual economy caused fluctuations in the real economy. Knowing from the above, the development of the real economy has caused the development of the virtual economy, the development of virtual economy also has caused the development of the real economy, at present, China's real economy and virtual economy exists the two-way causality.

2.4 The empirical test

It can be seen from above, in our country there is a two-way causal relationship between virtual economy and real economy for a long time, we can establish a linear model which LNXNJJ (LNGDP) as the explained variable and LNGDP (LNXNJJ) as the explained variable, respectively we can draw LNXNJJ = 1.78518123179*LNGDP - 8.81146216492 and LNGDP = 0.507493740315*LNXNJJ + 5.59534465554 , $R^2 \approx 0.91$. As can be seen from the regression results, in the case of a significant level of 0.05, $R^2 \approx 0.91$, indicates that the degree of fitting is very good, but when the real economic could increase by 1%, virtual economy could grow by about 1.79%; When virtual economy grew by 1%, real economic increased by about 0.51%, the real economy and virtual economy exists a two-way causal relationship.

3. Ending

Entity economy is the foundation for the development of the virtual economy, economic development determines the virtual economy, scale and operation condition; The moderate development of virtual economy at the same time satisfy the inside need of economy development, is advantageous to the enterprise to optimize the allocation of resources, reduce costs, improve economic efficiency of the real economy, so at the same time in the economic development we must guarantee the coordinated development between the real economy and virtual economy . [5] From the above method of Granger causality, we can conclude that the virtual economy and real economy are coordinated development in our country at present, but it can be seen that the speed of virtual economy development of our country is faster than the speed of the entity economy development significantly, by the end of 2012, the ratio of virtual economy and real economy is about 4.42, through the gray analytic hierarchy process we can predict that the ratio of virtual economy and real economy in our country will reach 5.54, and the trend of rising, along with real estate investment gradually evolved into a speculative tools, the amount of the virtual economy in our country will further widens the gap between the amount of the real economy.

As an important supplement of the real economy, the moderate development of virtual economy focus on the real economy effectively guard against and defuse financial risks, but with the development of economy, the development of virtual economy in our country gradually evolved into a speculative investment tools which made the financial risk, once the money appears chain scission on industry could trigger a series of crises. So when developing the economy at the same time, the first thing we should increase the virtual economy market supervision, to strengthen the research of virtual economy, made the financial and economic "theory of dialogue"[6] . Secondly we should perfect credit system, strengthen the virtual economic statistics, build a virtual economic statistics system; again, expanding the scope of the monetary policy objectives, focus on virtual capital price[7]; last proposed that the relevant departments to establish the early warning index system of virtual economy[8], makes the virtual economy and real economy maintain a long-term harmonious development.

References

Marx.《das capital》(volume 3) [M]. Beijing: people's publishing house, 1975 edition.

Kun Chen. Chinese virtual economic disequilibrium problem research [D]. Central China normal university, master thesis, 2011.

Xiaoying Zhang. Virtual economy to the financial crisis conduction study [D]. Lanzhou master degree theses of master of business school, 2011.

Junhua Dong. Study on the relationship between the virtual economy and real economy [D]. PhD thesis of northeast university of finance and economics, 2011.

Yingying Zhou. Impact on the real economy and virtual economy and real economy coordinated development research [D]. PhD thesis of China university of mining, 2011.

Chongwen Zhong. Virtual economic impact on the real economy research [D]. Jilin university doctoral thesis, 2011.

Yedong Wang. the research of the relationship between virtual economy and real economy development in China Dissertation, department of nanjing university of aeronautics and astronautics, 2011.

Guiying Yang. The essence of virtual economy and its impact on the real economy [D]. Master degree theses of master of Jinan university, 2011.