

A Study on the Coordinated Development of Virtual Economy and Real Economy

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Abstract. The uncoordinated development of virtual economy and real economy will cause potential risks to the economy. The real economy is the cornerstone of economic development, and the phenomenon of "real to virtual" will lead to insufficient motive force and increased risk of economic development. In order to ensure the healthy operation of the economy, promote the successful transformation of the real economy, "virtual to real" will be an important task of economic development at present. Based on relevant theoretical research, this paper analyzes the development of virtual economy and real economy from 2000 to 2018 and constructs the coupling degree and its coordination correlation model. Then it analyzes the coupling coordination degree of virtual economy and real economy and gives the relevant suggestions.

1. Introduction

At present, the overcapacity lead to the decline of the return on investment in the real economy and the phenomenon of "real to virtual" appears. This phenomenon continues to evolve, it will lead to the risk of crisis. The central bank has forced financial institutions to leverage by raising interest rates and strengthening the evaluation system, which define the objectives of serving the real economy. But real economic development is not optimistic. The virtual economic sectors represented by financial industry tend to be sensitive to economic policies, while real economy is slow, which leads to a time lag between the financial tightening and the transformation of real economy, and the development of virtual economy and real economy is not enough. Tobin (1984) [1] put forward hypothesis of financial instability. Gaddy (1998) [2] held that virtual economy and real economy are interact with each other. Qin Xiao (2009) [3] divided real and virtual economy according to whether there are direct transactions between the financial assets and the production of products. Liu Yang (2015) [4] believed that the deviation between virtual economy and real economy will have impacts on the financial crisis. Luo Laijun (2016) [5] considered that the financing did not enter real economy, it continues to stay in virtual economy. Liu Jie et al. (2019) [6] put forward that more attention should be paid to the transformation of economic growth mode and the adjustment of industrial structure.

In summary. It has become a fact that the deviation between virtual and real economy will have a negative impact on China's economic development. This paper analyzes the development of virtual economy and real economy from 2000 to 2018, constructs the coupling degree and its coordination correlation model, analyzes the development of virtual economy and real economy.

2. Sources of Data and Variable Selection

2.1 Source of Data

The data in this paper come from the National Bureau of Statistics, the statistical yearbook of each year and all kinds of data released by the people's Bank of China.

2.2 Variable Selection

It can be seen from the relevant literature that the coupling relationship between virtual economy and real economy is a complex nonlinear relationship. Xu Dilong et al. (2014) [7] construct the evaluation

index system of virtual economic from the total index, stock index, flow index and proportion index of money market, capital market, financial derivatives market and real estate market. Su Zhi et al. (2017) [8] considered that the scale of virtual economy is mainly determined by stock market and real estate market. The construction index should revolve around the connotation of virtual economy, which takes capitalization pricing as the core and mainly focuses on the financial industry and real estate industry. The basis of comprehensive relevant literature research, this paper aims at ensuring the comprehensiveness and scientific nature of the index as much as possible, fully considers the availability of the index data, and divides the measurement index as shown in Table 1.

Table 1 Index selection of coupling coordination degree between virtual economy and real economy

system	First index	Secondary index
virtual economy	Capital market indicators	Market Capitalization, the ratio of Market Capitalization to the GDP, Share turnover, Shanghai (securities) composite index, Bond turnover, Fund turnover
	Real estate indicators	Value-added Index of the Real estate (last year = 100), The Ratio of Value-added of the Real estate to GDP
	financial institutions indicators	Loans from financial institutions, the ratio of loans from financial institutions to GDP, the balance of real estate loans
real economy	Sub-industry structure indicators	The ratio of value-added of Agriculture, forestry, animal husbandry and fishery to GDP, the ratio of value-added of construction industry to GDP, The ratio of value-added of industry to GDP.
	Total composition indicators	Total import and export of goods, total investment in fixed assets, total retail sale of consumer goods

3. Model Construction and Empirical Analysis

3.1 Econometric Model

3.1.1 Measurement of the Comprehensive Development Index

In this paper, SPSS22.0 is used to analyze the standardized processing indexes of virtual and real economy, and the weights of each index are determined. Use the linear weight method to calculate the comprehensive development index of real and virtual economy for 2000-2018, the formula is:

$$CDI_1(x) = \sum_{i=1}^n w_i x_i \quad CDI_2(y) = \sum_{j=1}^n w_j y_j \quad (1)$$

Among them, CDI1, CDI2 represents the comprehensive development index of virtual economy and real economy respectively, w_i, w_j represents the weight of each index to measure the development of virtual economy and real economy respectively, x_i, y_j is the standardized value.

3.1.2 Coupling coordination degree model

The coupling coordination degree model is constructed to judge the coordinated development between virtual economy and real economy.

(1) Calculate the coupling degree of virtual economy and real economy C:

$$C = \left\{ \frac{CDI_1(x) \times CDI_2(y)}{\left[\frac{CDI_1(x) + CDI_2(y)}{2} \right]^2} \right\}^{\frac{1}{2}} \quad (2)$$

(2) Calculate the comprehensive development index of virtual and real economic system CDI:

$$CDI = \alpha_1 CDI_1 + \alpha_2 CDI_2, \quad \alpha_1 + \alpha_2 = 1 \quad (3)$$

(3) The calculation expression of coupling coordination degree is as follows:

$$C' = \sqrt{C \times CDI} \quad C'' = \exp\left(-\frac{1}{C'}\right) \quad (4)$$

3.2 Empirical Analysis

According to the principal component analysis and the comprehensive development index model, the weights of each index and the comprehensive development index of the two systems are calculated in table 2 and 3 as following:

Table 2 Index system and weight calculation results of the virtual economic and real economy

virtual economic		real economy	
indicators	weight	indicators	weight
Market Capitalization	0.1066	The ratio of value-added of Agriculture, forestry, animal husbandry and fishery to GDP	0.1661
the ratio of Market Capitalization to the GDP	0.0870		
Share turnover	0.0891		
Shanghai (securities) composite index	0.0198	the ratio of value-added of construction industry to GDP	0.1495
Bond turnover	0.0959		
Fund Turnover	0.1016	The ratio of value-added of industry to GDP	0.1653
Value-added Index of the Real estate	0.0803		
the ratio of value-added of the Real estate to GDP	0.1013	Total import and export of goods	0.1693
Financial institutions deposit loans	0.1121	gross fixed asset formation	0.1752
the ratio of loans from financial institutions to GDP	0.1112	total retail sale of consumer goods	0.1746
the balance of real estate loans	0.1101		

Table 3 Comprehensive Development Index of Virtual economy and Real economy from 2000 to 2018

Year	virtual economy	the real economy	Year	virtual economy	the real economy
2000	1.1004	1.0521	2010	1.4298	1.5072
2001	1.0902	1.0671	2011	1.3509	1.5794
2002	1.1090	1.0936	2012	1.3908	1.6489
2003	1.1390	1.1282	2013	1.4384	1.7238
2004	1.1363	1.1251	2014	1.5797	1.7952
2005	1.1092	1.1759	2015	1.8152	1.8327
2006	1.1365	1.2303	2016	1.8028	1.8757
2007	1.2085	1.2839	2017	1.8581	1.9327
2008	1.2132	1.3371	2018	1.8476	1.9798
2009	1.3624	1.4440			

According to coupling coordination degree model, the coupling coordination degree of real and virtual economy from 2000 to 2018 is obtained. By seeking the table of coupling coordination grade classification and judging its coupling coordination degree level, the results are shown in Table 4.

Table 4 Coordination degree and type of coupling between virtual economy and real economy from 2000 to 2018

Year	coupling coordination	Grade degree	Year	coupling coordination	Grade degree
2000	0.3805	Mild maladjustment	2010	0.4390	Weak maladjustment
2001	0.3814	Mild maladjustment	2011	0.4400	Weak maladjustment
2002	0.3854	Mild maladjustment	2012	0.4467	Weak maladjustment
2003	0.3908	Mild maladjustment	2013	0.4539	Weak maladjustment
2004	0.3903	Mild maladjustment	2014	0.4650	Weak maladjustment
2005	0.3934	Mild maladjustment	2015	0.4771	Weak maladjustment
2006	0.4001	Weak maladjustment	2016	0.4790	Weak maladjustment
2007	0.4093	Weak maladjustment	2017	0.4843	Weak maladjustment
2008	0.4140	Weak maladjustment	2018	0.4865	Weak maladjustment
2009	0.4309	Weak maladjustment	-	-	-

3.3 Results Analysis

As shown in the table3, the comprehensive development index of China's virtual economy and real economy generally increased from 2000 to 2018. Due to the serious impact of the financial crisis on the economy in 2008, the comprehensive development of virtual economy was slow, and declined in the later period. After 2016, the central bank and other departments issued a series of policies to promote the economy to get rid of falsehood to reality, and the excessive expansion of virtual economy moderated. According to table 4,the coupling coordination degree of virtual economy and

real economy is rising from 2000 to 2018, and the coupling degree of the two is higher in the process of calculation, which indicates that the interaction between the two in economic development is obvious, and the coordinated contribution to economic development increases gradually, but the coordination degree of the two is still on the low side and only reaches the weak maladjustment.

4. Conclusion and Suggestion

By constructing the coupling coordination degree model of virtual economy and real economy from 2000 to 2018 and carrying out empirical research, this paper analyzes the coordinated development of virtual economy and real economy in China. It is found that the coupling coordination degree between virtual economy and real economy is rising but still on the low side, from 0.3805 in 2000 to 0.4865 in 2018. The coupling degree between virtual and real economy is high, which indicates that the interaction between the two is more obvious, and the contribution to the economic development is improved as a whole. Based on the conclusion, this paper makes suggestions as following:

(1) Rely on technology and strengthen Innovation, promoting the successful transformation of the real economy, it is necessary to solve the problem of insufficient power for the development of emerging industries and overcapacity in traditional industries that the real economy could develop and prosper more. The virtual economy should be based on the principle of serving the real economy.

(2) Improve analysis on the countermeasure of government intervention policy improvement in present real estate market and financial market. The two markets are sensitive to the change of policy and form, and the real economy often has certain delay, so it should make full use of big data, artificial intelligence and other technology to analyze the financial market and give feedback to the real economy, which led to stimulate the economic growth.

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