Study influence factors of the virtual currency based on Gray correlation analysis

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ABSTRACT: In this paper twelve factors from macroscopic and microcosmic aspects were selected to analyze their influence of the virtual currency. Then factors of strong positive and negative correlation degree with virtual currency were discovered, such as the C2C E-commerce market, the third-party online payment platform.Finally useful supervision suggestions were given based on the gray correlation analysis.

KEYWORDS: ***gray correlation analysis$_1$; influence factors$_2$; virtual currency$_3$; supervision suggestion$_4$***

I. INTRODUCTION

Gray correlation analysis method mainly does quantitative analysis in the system dynamic development process[1]. It measures how much factors are close to each other on the base of the similarity or difference of their dynamic developing situation:the closer of their developing situation, the larger of their correlation degree. Through the correlation degree analysis, we can distinguish the main factors and potential factors, the advantages and disadvantages, so as to provide correlative information for the system development. This analysis method has low requirements on the quality and the distribution rules of the system sample that it is suited to analyze the characteristic of the gray system with the imperfect information[2].

The virtual currency has emerged with the development of Internet in recent years. Nowadays conducting the accurate statistical analysis on the virtual currency is very difficult because the research data are lacked and the samples were inaccessible. Therefore the gray correlation analysis method is of much feasibility and practical significance in analyzing the influence factors of the virtual currency.

II. RELATED INDICATORS AND DATA SOURCES

A. Indicators of virtual currency

Select Tencent's virtual currency Q coin as a sample.Q coin is one virtual currency of the earlier emergence. With the largest market share and wide using range, it is good representative of domestic virtual currency.

B. Indicators of influence factors

The development of the virtual currency is influenced by the state, the industry and the Internet company. Therefore twelve indicators were selected both from the macroscopical and microcosmic aspects, which were shown in Table Ⅰ.

C. Data Source

The analyzing data are collected from the authoritative source: China Statistical website, CNNIC's 20th Chinese Internet Report, 'iResearch 2004-2006 Tencent Financial Analysis Report','iResearch 2003-2006 Chinese Online Banking Briefing','iResea-rch 2004-2005 Chinese Online Payment Briefing' issued by the iResearch consulting company. The data are shown in the TABLE Ⅱ and TABLE Ⅲ.

TABLE I. Q COIN INFLUENCE FACTOR TABLE

Influence factor	Indicators of influence factors		
	Class 1	*Class 2*	*Symbol*
Macroscopical factors	Economic Environment	Gross Domestic Product (GDP)	A1
		Money supply	A2
	Industrial Development	Internet popularizing rate	A3
		Number of Internet users	A4
		Amount of online payments	A5
	Industrial Competition	Amount of personal e-banking transactions	A6
		Amount of third-party online payment platform transactions	A7
		Amount of C2C E-commerce market transactions	A8
Microcosmic factors	Company Operation Situation	Company total revenues	A9
	Related Business Situation	mobile and telecom value-added business revenues	A10
		Tencent's online advertisement revenues	A11
	Company users' number	Tencent's instant messaging users' accounts	A12

III. MACROSCOPICAL FACTORS GRAY CORRELATION ANALYSIS

A. Definitions

- Correlation coefficient between $X_i(k)$ and $X_0(k)$ were given as follows:

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TABLE II. MACROSCOPICAL INFLUENCE FACTOR DATA [5,6,7,8]

Factor Symbol	Annual Macroscopical Influence Factor Data				
	2002	***2003***	***2004***	***2005***	***2006***
Q coin Transaction Amount	0.4	2.3	4.5	7.8	18.3
A1	120332.7	135822.8	159878	183084.8	210871
A2	185007	221222.8	254107	298755.7	345577.9
A3	4.60%	6.20%	7.30%	8.50%	10.50%
A4	5910	7950	9400	11100	13700
A5	18	37	75	161	327
A6	2610	1000	4000	24000	39000
A7	4	11	23	55	115
A8	8.8	11.6	38.9	137.1	231

TABLE III. MICROCOSMIC INFLUENCE FACTOR DATA [5,6,7,8]

Factor Symbol	Quarterly Microcosmic Influence Factor Data							
	2005 Q1	***2005 Q2***	***2005 Q3***	***2005 Q4***	***2006 Q1***	***2006 Q2***	***2006 Q3***	***2006 Q4***
Q coin Transaction Amount	1.5	1.7	2	2.6	4.4	4.6	4.9	4.4
A9	3	3.4	3.6	4.3	6.4	7	7.4	7.1
A10	1.3	1.4	1.2	1.3	1.6	1.8	1.7	1.9
A11	0.2	0.3	0.4	0.4	0.4	0.6	0.8	0.8
A12	4	4.4	4.7	4.9	5.3	5.5	5.7	5.8

- Number of Internet users were measured by ten thousand
- Other indications were measured by hundred million
- Q denotes quarter

$$\xi(k)=\frac{Min_i Min_k|X_0(k)-X_i(k)|+\rho Max_i Max_k|X_0(k)-X_i(k)|}{|X_0(k)-X_i(k)|+\rho Max_i Max_k|X_0(k)-X_i(k)|}$$

- Correlation degree γ_i was calculated by the mean of the correlation coefficient :

$$\gamma_i=\frac{1}{n}\sum_{k=1}^{n}\xi_i(k), i=1,2,...n$$

- Correlation polarity

$$\sigma_i=\sum_{k=1}^{n}kX_i(k)-\sum_{k=1}^{n}X_i(k)\sum_{k=1}^{n}k/n, \sigma_k=\sum_{k=1}^{n}k^2-\left(\sum_{k=1`}^{n}k\right)^2/n$$

If $\mathrm{sgn}\left(\frac{\sigma_i}{\sigma_k}\right)=+\mathrm{sgn}\left(\frac{\sigma_j}{\sigma_k}\right)$, X_i had the positive correlation with X_j ;

If $\mathrm{sgn}\left(\frac{\sigma_i}{\sigma_k}\right)=-\mathrm{sgn}\left(\frac{\sigma_j}{\sigma_k}\right)$, X_i had the negative correlation with X_j ;

B. Results

We took the amount of Q coin transaction as the reference array X_0 ,other macroscopical factors as the comparing array X_i （i=1,2,..,n） and $\rho=0.5$. Then we got the results as shown in TABLE Ⅳ.

C. Influence factors analysis

Macroscopical factors in the comparing array all have strong correlation with the Q coin transactions in the reference array. Among all the correlation degrees, the largest is the amount of third-party online platform payments (0.8074), the smallest is the gross domestic product (GDP) (0.6798).

TABLE IV. CORRELATION DEGREE 1

Influence factor	Factor Correlation Degree	
	Factor Symbol	*Correlation Degree*
Macroscopical Influence Factors	A1	0.6798
	A2	0.6808
	A3	0.6838
	A4	0.6839
	A5	0.7464
	A6	0.7190
	A7	-0.8074
	A8	-0.7949

- Industrial Competition: With the largest negative correlation degree (-0.8074), the amount of the third-party online payment platform transactions checks and constrains Q coin transactions. The amount of personal e-bank transactions also has negative correlation degree (-0.7190), but its influence is smaller. Therefore it can be concluded that the main competitor of the Q coin is the third-party online payment platform .On the contrary, the C2C E-commerce market transactions have promoted the Q coin transaction with the positive correlation degree (0.7949).
- Industrial Development: All the industrial factors analyzed have the positive correlation with the Q coin transactions, among which the largest is the amount of online payments (0.7464).Therefore improving the level of the payment industry is the key point for the Q coin development.
- Economic Environment: Economic environment has a smaller influence on the Q coin transactions. As the money supply has a larger impact than the GDP, it can be concluded that the development of finance will promote the online transactions and provide economic foundations for the development of virtual currency.

IV. MICROCOSMIC FACTORS GRAY CORRELATION ANALYSIS

A. Results

Definitions are the same as that in the part Ⅲ.In the same way, we took the amount of Q coin transaction as the reference array X_0 ,other microcosmic factors as the comparing array X_i （ i=1,2,..,4 ） and we defined $\rho = 0.5$,then got the results as shown in the TABLE Ⅴ.

TABLE V. CORRELATION DEGREE 2

Influence factor	Factor Correlation Degree	
	Factor Symbol	*Correlation Degree*
Microcosmic Influence Factors	A9	0.7440
	A10	0.5860
	A11	0.7009
	A12	0.6220

B. Influence factors analysis

Company Operation Situation, Related Business Development and Number of company users all have positive correlation with the Q currency transactions. We can draw the conclusions as follows:

- Since the company's total revenues have the largest correlation degree (0.7740), it means that issuing virtual currency depends on the company's financial abilities. This has proved the monopolization characteristic of virtual currency in accordance with the fact that the current virtual currency are mainly issued by the large Internet companies.
- In the two related business, the online advertisement has a greater impact. It has proved the limitation of the virtual currency in accordance with the fact that all the current virtual currency are based on the given business within one Internet company, none of them could be circulated among different companies' websites.
- The larger correlation degree between the number of company user and the Q currency transactions has showed that Q currency transactions has owed a lot to the company's large scale users. It could be predicted that the amount of the Q currency transactions would become larger with the growth of the company's users.

V. CONCLUSIONS AND SUGGESTIONS

Through the analysis above it has been fully proved that virtual currency was influenced by the macroscopical and microcosmic factors. Considering these factors, some useful conclusions and suggestions are given for the effective supervision of the virtual currency.

A. Actively promote the development of the third-party payment platform.

It has been proved that the amount of the third-party payment platform transactions has a strong negative

correlation with the Q coin transactions (-0.8074). Therefore, the third-party payment platform, taken as the main competitor of current virtual currency, can effectively restrict the excess development of virtual currency. The similarities between the third-party payment platform and the virtual currency are that they are both virtual online payment methods. The differences lie in the circulating system. The virtual currency can only be used in one specific website without any guarantee and credibility mechanism. Whereas, the third-party payment platform provides the payment platform as well as settlement service to sellers and buyers, with the guarantee of goods quality, transaction credibility, refund and so on. Compared with the virtual currency, the third-party payment platform has more advantages and restrictions for the sellers and buyers. Promoting the development of the third-party payment platform will contribute a lot to the whole country's payment system.

B. Strengthen the supervision of C2C E-commerce market.

It has been shown that the amount of C2C E-commerce market transactions has a strong positive correlation with the Q coin transactions (+0.7949).

The main reason is that C2C E-commerce market has become an important channel for the Q coin trading. This can be manifested by the statement[3] entitled 'United fighting against the network theft and safeguarding the healthy development of the game industry'by large Internet companies Netease, Shanda, the ninth city,Jinshan,Tencent on January 8th 2007.The statement had regarded the C2C E-commerce market, full of frequent trading of virtual property, as the main resource of virtual property theft crime. It had pointed out that a virtual property theft industry chain, consisted of 'producing computer viruses -spreading computer viruses -stealing online accounts-selling stolen goods on the third-party platform' had come into existence. The C2C E-commerce market, as one kind of third-party platform, is the key segment in the theft industry chain and attracted many theft crimes in the business interest. Lacking strict supervision, the C2C E-commerce market was used by the villain to commit online theft. Therefore the supervision of C2C E-commerce market should be strengthened so as to create a good virtual trading environment.

C. Improve the level of China's payment system.

As the strong positive correlation with Q coin transactions (+0.7464) shown in the macroscopical factors analysis, the level of China's payment system has an important impact on the virtual currency. Researches [4] had shown that virtual currency, as an online payment method, only found its success in China. Main online payment methods are bank and third-party payment platform in the United States, Japan and Europe, even in Korea. In fact, the electronic money issuing, the money rule making, the daily supervision could only be conducted by the central bank. Virtual currency like Q coin has emerged due to deficiencies of China's current payment system, such as lacking a seamless and convenient electronic payment method, lacking a uniform electronic currency issued and supervised by the government .Therefore, it is suggested that the government should improve the level of China's payment system, especially the electronic payment system in order to meet the increasing Internet payment demands.

D. Supervise the issue of virtual currency focusing on the large-scale Internet company .

As the strong positive correlation with Q coin transactions shown in microcosmic factors analysis, the company operation situation and users' number contributed a lot to the big amounts of the Q coin transactions. Virtual currency has been monopolized by the large-scale Internet company with the abundant operation revenues and the enormous users. The key supervising attentions should be given to these companies in order to effectively control the resource of the virtual currency. In this way excess virtual currency and virtual currency fraud can be avoided and the consumers' legal rights can be guaranteed in the online payment

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