Analysis of E-commerce Tax Compliance Based on Grey Relational Model

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Abstract. In recent years, with the prevalence of new media, the live streaming e-commerce industry has also entered a fast lane of development. This article takes the relationship between e-commerce and tax revenue as the starting point, uses the grey correlation model to calculate the coupling coefficient of e-commerce tax compliance, and confirms that the coupling degree between value-added tax revenue and total e-commerce transactions is low, indicating that e-commerce tax compliance is low and the tax collection and management order is improper. And use real cases as secondary evidence to analyze the reasons for the low tax compliance in the live streaming e-commerce industry, and propose to improve tax legislation for corporate and government taxpayers respectively; Enterprises attach importance to business architecture design, standardize transaction agreements; Strict tax collection and management, measures such as increasing the illegal cost of tax evasion in the online live streaming industry, have been taken to raise awareness of e-commerce enterprises paying taxes in accordance with the law.

Keywords: Grey correlation model, E-commerce, Tax, Compliance

1 The New Business Model of E-Commerce

Live broadcast e-commerce is a "new e-commerce" format, which integrates Internet technology and conference marketing. It not only has the advantages of conference marketing, but also injects the advantages of Internet technology. Due to the rapid development in recent years, the academic community has not made an authoritative explanation for the live broadcast of e-commerce. The live broadcast obviously does not belong to e-commerce, but it belongs to e-commerce by carrying goods and providing services through live broadcast, which is the category of live broadcast e-commerce.

The industry operation mode is the issuer's live e-commerce promotion mode. In recent years, the live broadcast e-commerce with the advantages of strong interaction and high conversion rate has become a new trend of promotion in the e-commerce industry. The complex and changeable business model will also cause the complexity and diversity of tax collection and management. The issuer actively grasped the outlet of live broadcast with goods and reached cooperation with the head anchor with the help of kol4 with goods marketing mode. Live e-commerce promotion activities are generally divided into the following two modes: Cooperative promotion、Cooperative pricing[1].

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2 Analysis on Tax Compliance Of E-Commerce Enterprises

Grey system modeling mainly solves the uncertainty problems caused by small samples and poor information. Grey relational analysis (GRA) is one of the important grey system modeling methods. Its basic idea is to use all sequence data to form a system, and then judge the correlation degree between sequence data according to the similarity degree of curve geometry of sequence data. The higher the similarity degree, the greater the correlation degree.

In view of the wide range of e-commerce and the fuzzy compliance data of e-commerce subjects, the grey correlation model is more suitable for the calculation of the coupling coefficient of e-commerce tax compliance. Using this model to solve the problem of e-commerce tax compliance is more explanatory. This paper takes the relationship between e-commerce and tax revenue as the starting point, and uses three variables: the total amount of e-commerce transactions, wholesale and retail sales and value-added tax revenue to quantitatively evaluate the tax compliance of e-commerce [2].

2.1 Model Construction

Grey correlation analysis is to obtain the correlation degree of the interaction between factors through the dimensionless processing of system factors. Its basic principle is to analyze the correlation degree through the similarity and proximity of the geometric figures of the comparison sequence and the reference sequence. Its essence is to use the algebraic method to carry out a quantitative analysis of the analysis data. The larger the correlation degree, the higher the coupling degree. In this paper, the total amount of e-commerce transactions in several years is taken as the industry measurement factor, and the wholesale and retail commodity sales and value-added tax revenue data are taken as the economic measurement factor. It is judged that the correlation between the two is a typical small sample and poor information problem, so the GRA model is used to complete the relevant data processing.

Suppose there are m normalized time series data, and each series has n data points:

$$s_i = \{s_i(1), si(2), \dots, s_i(n)\}, (1 \le i \le m)$$

Assume that the reference time series data is:

$$s_0 = \{s_0(1), s_0(2), \dots, s_0(n)\}$$

Then, the grey correlation coefficient between Si ($1 \le I \le m$) and S0 at the K ($1 \le K \le n$) data point is:

$$\xi_i(k) = \frac{\min\limits_j \min\limits_l |s_0(l) - s_j(l)| + \gamma \max\limits_j \max\limits_l |s_0(l) - s_j(l)|}{|s_0(k) - s_i(k)| + \gamma \max\limits_j \max\limits_l |s_0(l) - s_j(l)|} \tag{1}$$

Of which, $\gamma \in [0, 1]$ is the resolution coefficient, and its typical value is 0.5; $1 \le I \le m$, $1 \le J \le m$, $1 \le K \le n$, $1 \le L \le n$. The average value of grey correlation coefficient of n data points is the grey correlation coefficient of time series Si ($1 \le I \le m$) and S0.

Table 1. Basic data of total e-commerce transactions, wholesale and retail commodity sales and VAT revenue.

(Unit: trillion yuan)

Year	The total amount of e-commerce transactions	Total sales of goods in wholesale and retail trade	The amount of VAT revenue
2015	21.79	51.56	3.11
2016	26.1	55.89	4.07
2017	29.16	63.02	5.64
2018	31.63	69.12	6.15
2019	34.81	78.25	6.23
2020	37.21	86.43	5.7

Calculate the correlation coefficient value of each year according to the data in Table 1, and calculate the correlation degree in combination with the correlation coefficient value. Let the correlation degree of the independent variable wholesale and retail commodity sales to the total e-commerce transactions of the dependent variable be R1, and the correlation degree of the independent variable value-added tax revenue to the total e-commerce transactions of the dependent variable be R2. According to the data in Figures 1 and 2. The model calculates the correlation degree R1=0.890, R2=0.855. Based on the analysis of the calculation results of the coupling correlation degree, the order of the coupling correlation degree between the total amount of e-commerce transactions and the sales of wholesale and retail goods, value-added tax revenue is: R1>R2

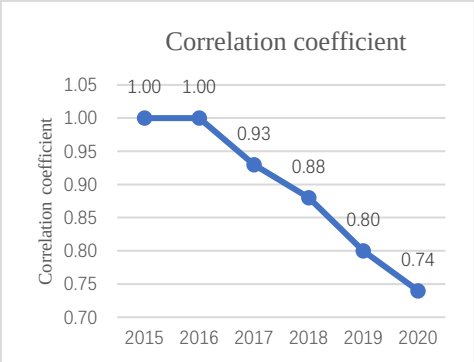

Figure 1. Total sales of goods in wholesale and retail trade

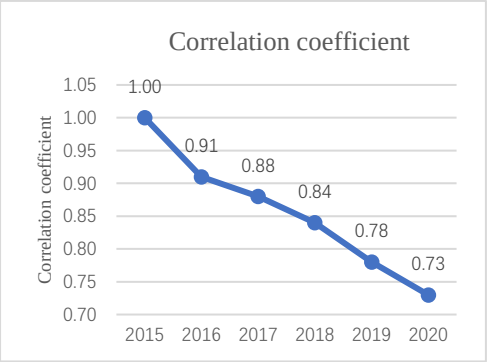

Figure 2. The amount of VAT revenue

In order to further reflect the tax contribution of e-commerce and the real economy, the value-added tax revenue is taken as the dependent variable sequence of the grey correlation model, and the total amount of e-commerce transactions and the sales of wholesale and retail goods are taken as the independent variable sequence of the grey correlation model, forming the model reference sequence and comparison sequence representing the system characteristics. According to the correlation coefficient values of each year in the series, let the correlation degree of the independent variable total e-commerce transactions to the dependent variable value-added tax revenue be R3, and the correlation degree of the independent variable wholesale and retail commodity sales to the dependent variable value-added tax revenue be R4. According to the

data in Figures 3 and 4. The correlation degrees calculated by the model are: R3=0.855, R4=0.876. Through calculation, it is found that R 4> R 3.

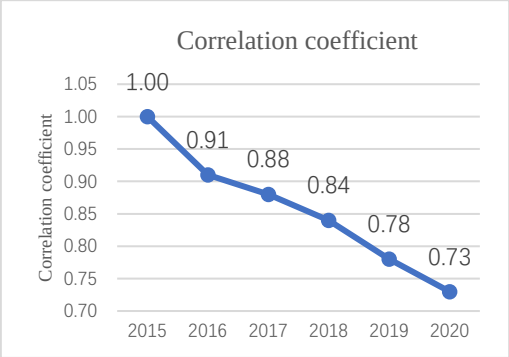

Figure 3. The total amount of e-commerce transactions

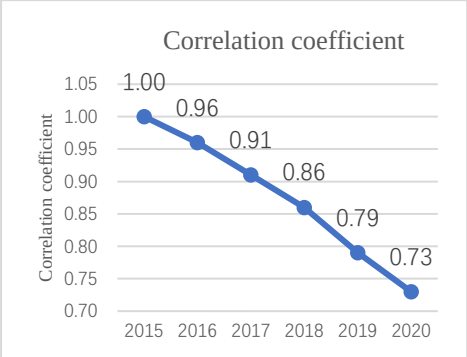

Figure 4. The sales of goods in wholesale and retail trade

2.2 Empirical Analysis

It is not difficult to find out from the grey correlation ranking of total e-commerce transactions, wholesale and retail commodity sales, and value-added tax revenue: R1> R2, the coupling correlation between VAT revenue and e-commerce mode is not high, indicating that compared with the e-commerce realization part included in the wholesale and retail industry, the smaller part of VAT is realized through e-commerce, that is, the current contribution of e-commerce to VAT is not large, that is, the tax compliance of e-commerce is not high.

R4> R3, the coupling degree between the value-added tax revenue and the total amount of e-commerce transactions is low, and the real economy contributes more to tax revenue. Although the total volume of e-commerce transactions grew rapidly by 1.542 billion yuan from 2015 to 2020, its role in increasing tax revenue was not ideal, and it did not fully fulfill its tax obligations matching its rapid development. The tax compliance of e-commerce was low, there were a large number of tax losses, and the order of tax collection and management was improper [4].

3 Grey Correlation Calculation Between E-Commerce and National Economy

3.1 Raw Data and Standardized Processing

Business annual data and national economic accounting annual data for various types of e-commerce transactions, total retail sales of consumer goods, wholesale and retail sales of goods in China from 2015 to 2020.

Table 2. Business Data and National Economic Accounting Data from 2015 to 2020.

(Unit: million yuan)

Year	Total transaction volume of ecommerce	Total retail sales of consumer goods	Sales revenue of wholesale and retail products	Value added of the primary industry	Value added of the secondary industry	Value added of the tertiary industry	Gross domestic product
2015	208200	300930	515567	57774	281338	349744	688858
2016	229700	332316	558877	60139	295427	390828	746395
2017	286600	366261	630181	62099	331580	438355	832035
2018	325500	380986	691162	64745	364835	489700	919281
2019	348100	372260	782500	70467	380700	534233	990865
2020	372100	392000	864300	77754	384255	553977	1015986

Although the units of each sequence data in Table 2 are the same, there is a huge difference in data size, which requires normalization and the following formula should be used for normalization.

$$s_i(k) = \frac{s_i(k)}{\max\limits_j s_i(j)}, (1 \le i \le m) \tag{2}$$

Among them, S represents raw data, and s represents normalized data. Formula 2 was used to normalize the data sequences in Table 2, and the results are shown in Table 3.

Table 3. Normalization Results of Business Data and National Economic Accounting Data from 2015 to 2020.

Year	Total transaction volume of ecommerce	Total retail sales of consume r goods	Sales revenue of wholesale and retail products	Value added of the primary industry	Value added of the secondary industry	Value added of the tertiary industry	Gross domestic product
2015	0.5595	0.7676	0.5965	0.7430	0.7322	0.6313	0.6780
2016	0.6173	0.8477	0.6466	0.7735	0.7688	0.7055	0.7347
2017	0.7702	0.9343	0.7291	0.7987	0.8629	0.7913	0.8189
2018	0.8747	0.9719	0.7997	0.8327	0.9495	0.8840	0.9048
2019	0.9355	0.9496	0.9054	0.9063	0.9907	0.9644	0.9753
2020	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

3.2 Calculation of Correlation Coefficient

As shown in Table 4, a grey correlation analysis was conducted on three evaluation items (total e-commerce transaction volume, total retail sales of consumer goods, and sales of wholesale and retail goods), as well as six data points. The primary industry added value was used as the

"reference value" (parent sequence) to study the correlation between three evaluation items (total e-commerce transaction volume, total retail sales of consumer goods, sales of wholesale and retail goods, and the primary industry added value (correlation degree). Based on the correlation degree, analysis reference was provided. When using grey correlation analysis, the resolution coefficient g was taken as a typical value of 0.5, and the correlation coefficient value was calculated using the correlation coefficient calculation formula. Based on the correlation coefficient value, the correlation degree value was calculated for evaluation and judgment. The last row is the average correlation coefficient of each data point, which is the correlation coefficient between each business data sequence and the reference sequence [3].

Table 4. The correlation coefficient between business data and value-added data of the primary industry.

Year	Total transaction volume of ecommerce	Total retail sales of consumer goods	Sales revenue of wholesale and retail products
2015	0.333	0.789	0.385
2016	0.370	0.553	0.420
2017	0.763	0.404	0.569
2018	0.686	0.397	0.735
2019	0.759	0.679	0.990
2020	1.000	1.000	1.000
Mean value	0.652	0.637	0.683

The last row of Table 4 shows the mean correlation coefficient of each data point. This mean is the correlation coefficient between each business data sequence and the reference sequence. Using the same method, the total e-commerce transaction volume, total retail sales of consumer goods, wholesale and retail sales of goods and their correlation coefficients with the value added of the secondary industry, the value added of the tertiary industry, and the GDP sequence are calculated sequentially.

Table 5. Mean Grey Correlation Coefficient Results between E-commerce and National Economy.

Statistical indicators	Total transaction volume of ecommerce	Total retail sales of consumer goods	Sales revenue of wholesale and retail products
Value added of the primary industry	0.652	0.637	0.683
Value added of the secondary industry	0.554	0.709	0.511
Value added of the tertiary industry	0.719	0.548	0.627
Gross domestic product	0.580	0.541	0.507

According to Table 5, the total transaction volume of e-commerce has the highest contribution to the value-added of the tertiary industry, and its indicators have a moderate coupling effect with the value-added of the primary industry, the value-added of the secondary industry, the value-added of the tertiary industry, and the GDP indicators. E-commerce has become an

indispensable component of economic development and has had a positive impact on the increase of gross domestic product. The total retail sales of consumer goods have the highest contribution to the added value of the secondary industry, while the sales of wholesale and retail goods have the highest contribution to the gross domestic product. The coupling effects are almost close to e-commerce indicators, indicating that offline transactions are still very important. When formulating policies to promote the development of e-commerce, functional departments should focus on offline commerce and promote the development of innovative commerce that integrates online and offline.

4 Case analysis

4.1 Basic Information of Weiya Case

According to the investigation, during the period from 2020 to 2021, the tax department found via big data analysis that Weiya was suspected of tax evasion. After repeated reminders and urging by the tax authorities, the rectification was still incomplete, so the case was filed and tax inspection was carried out in accordance with laws and regulations. It evaded 643million yuan of tax by concealing personal income and making false declaration of the nature of income from fictitious business conversion, while other taxes were underpaid by 60million yuan. Considering that on the one hand, Weiya can conduct self-examination on the behavior of hiding personal income tax evasion and submit an application for tax supplement to the tax authority, on the other hand, she still has the behavior of hiding income tax evasion and fails to take the initiative to pay back, which is of a bad nature. Finally, the tax authorities made a decision on tax administrative punishment, recovered taxes, imposed late fees, and imposed a total fine of 1.341 billion yuan.

4.2 Analysis on The Causes of Low Tax Compliance of Weiya

1. the revenue of the live broadcasting industry is diversified and virtualized. The business entities and taxpayers involved in the live broadcasting industry mainly involve network hosts, live broadcasting platform companies, network hosts brokerage companies, content production companies and performing arts enterprises. Especially involving the head anchor, whose income sources are diversified, which has brought unprecedented problems and challenges to the collection and management of personal income tax. How to scientifically define the business behavior and specific amount of goods brought by webcast at the tax level will be more complex [7].

2. the chaos of preferential tax policies in the live broadcasting industry. At present, in order to support the development of new types of business, some regions have carried out the verification and collection of enterprise forms such as sole proprietorship enterprises at a low tax rate, which also makes the abuse of tax verification policy become a common phenomenon in the live broadcasting industry. The approved collection is the statutory authority given to the tax authorities by the tax collection administration law, but the application of the approved collection to independent enterprises without distinguishing between specific circumstances may objectively lead to the loss of national tax interests. For the high-income live broadcasting industry, a comprehensive tax preferential policy may be contrary to the original intention of the preferential policy.

3. the network anchor lacks tax education. The anchor and employees' tax awareness and tax compliance need to be improved. Many people feel that as long as the law does not punish me, they will not consider themselves immoral. Paying taxes according to law is the obligation of every citizen, which is not only the requirement of law, but also the requirement of moral civilization [9].

5 Countermeasures

5.1 Perfecting Tax Legislation

China's tax legalization level has been continuously improved, the process of tax legislation has been continuously accelerated, and the tax legal system has been continuously improved. However, with the rapid development of China's economy, especially in the era of digital economy, the legislation in the field of Taxation still needs to be further improved. When dealing with tax disputes, "transaction characterization" is a very important concept. In practice, the business model conforms to business logic, and the transaction is objective and authentic. The tax authorities have not identified it as a tax violation. Therefore, paying attention to the design of business structure and making legal or reasonable interpretation of the terms of the agreement can reduce the tax related risk [5].

5.2 Strict Tax Collection and Management

The government urges e-commerce enterprises to pay attention to the authenticity and rationality of business, establish and improve the financial system and file system, and retain complete business data. Supervise its establishment and operation based on substantive operation, and avoid relying on the lack of legal basis for the application of approved collection or fiscal rebate policies. Keep an eye on high-income network anchors, and continue to strengthen close cooperation with banks and other financial institutions, so as to effectively control the real income of high-income network anchors, and truly realize the strictness of tax collection and management [8].

5.3 Increase Punishment

The main purpose of high-income network anchors' tax evasion is to grab improper property income and take part of the income that should be paid as tax for themselves. By increasing the punishment of illegal tax evasion in the online live broadcasting industry, we can increase the illegal cost of the parties, effectively curb the illegal intention of the parties, and have an immediate effect on combating tax evasion [6].

As a new business model, webcast e-commerce will have more and more impacts on China's economy and life. The improvement of tax collection and management of online live broadcast e-commerce enterprises is the general trend of tax collection and management in China. How to systematically collect and manage the income from live e-commerce has become the most important problem faced by the current tax authorities. Because the tax law system is not clear about the income tax collection and management of live broadcast e-commerce, it has a great challenge to the current online live broadcast e-commerce income tax collection and management. Therefore, it is of great significance to study the online live broadcast e-commerce enterprise tax collection and management.

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