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Comparative Analysis of Emission Trading Institution: Based on Experimental Economics Method

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Abstract

As China's economic development enters a new stage, the government demands the enterprises with high energy consumption and high pollution to save energy and reduce emission. Although the improvement and promotion of the emission trading institutions between enterprises has been proved to be an effective way to control pollution, but only the emission trading theoretical research and practical support can promote China's environmental protection work in a long term. Using the method of experimental economics with the same market structure, this paper compares and analyzes the features of deal price, transaction volume and market efficiency of enterprises under several different transaction mechanisms, such as double auction, bid auction and offer auction, and provides some reference opinions for the current emission trading market.

Keywords: experimental economics, emission trading, double auction, label price

1. Preface

In recent years, due to the large amount of automobile exhaust emissions, as well as the combustion of sulfur compounds, the total amount of sulfur dioxide and carbon dioxide emissions in the air has gradually increased. In order to effectively control and reduce sulfur dioxide and carbon dioxide in air pollution, China's research and application of the emissions trading institution has been deepened. In July 2002, the General Administration of Environmental Protection of China selected Shanghai, Jiangsu, Shandong, Tianjin, Shanxi, Henan and Liuzhou as the seven regions to carry out pilot projects on total air pollutant emission control and emission trading in order to find suitable ways to improve air quality. However, emission trading has not yet been fully launched in China so far.

The typical case of early emission trading in China is the emission trading in Shanghai and Liuzhou. The success of emission trading in Shanghai and Liuzhou plays a positive role in guiding the improvement of regional environmental quality and saving the pollution control costs. However, compared with the treatment of emission trading abroad, especially the practice of the United States, China still has many imperfections.

2. Theoretical Basis of Emission Trading Economics Experiment

2.1 Research Status of Emission Trading

Emission trading mechanism is an environmental policy based on the role of market mechanism. Under this policy, the environmental management department, according to environmental management objectives, establishes legal pollutant emission rights, uses various distribution methods and market trading mechanisms to enable polluting enterprises to obtain emission rights equivalent to their pollutant discharges, and promotes enterprises to change from passive governance to active governance. In 1960, Ronald Coase, an American economist, put forward the famous Coase Theorem, which says that as long as the transaction cost of the market is zero, no matter how the initial property right is defined, the market transaction can always achieve the optimal allocation of resources, and that the externality problem of pollution can also be solved by the definition of property right and market transaction. In 1968, Dales applied Coase's theorem to the study of water pollution

control. In 1972, Montgomery proved theoretically that market-based emission trading institution was obviously superior to traditional environmental governance policies (such as Pigou tax). Emissions trading first took root in the United States, and then gradually blossomed in the European Union and other parts of the world. Since the 1980s, Environment Protection Agency (EPA) has gradually applied the emission trading institution to lead phase-out plan, ozone depleting substance reduction plan, California regional clean air incentive market plan and sulfur dioxide permit trading plan to solve the problem of acid rain. Since the emission trading mechanism was applied to the total emission control of sulfur dioxide in 1990, it has achieved tremendous economic and social benefits. At present, Germany, Australia, Britain and other countries have learned from the emission trading mechanism of the United States to varying degrees, and effectively reduced the emission of greenhouse gases such as carbon dioxide.

China also began to introduce this mechanism in the 1990s, realizing the first example of emission trading in 2001, and establishing the first pilot project of paid use of enterprise emission rights in Jiaxing, Zhejiang Province in 2007.On November 10, 2016, the General Office of the State Council issued *the Implementation Plan of the Permit System for Controlling Pollutant Discharge*, which has greatly promoted the development of emission trading. However, the market mechanism of emission trading is not perfect in China. The reason is that China's market economy system has many basic flaws in the system. When local governments are both rule-makers and market participants, the emission trading market is easy to be in a chaotic state. Each administrative region has its own total amount control target, so there will be no cross-provincial emission trading in the market, and the liquidity of trading directly affects the activity of the market.

In order to successfully design the emission trading system, how to organize the market trading mechanism of emission trading is one of the core decision-making variables that should be considered. It mainly involves the selection of emission trading system, considering the impact of market power and transaction costs, the design and selection of trading mechanism. Smith (1981), Plott (1982), and Davis and Holt (1993) used experimental economics as an important variable to examine the impact of market institutions on market performance. Thus, the SCP analysis framework that has long been used in traditional industrial organization theory has been revised to a large extent. This conclusion has also been applied to the research of the design of the emissions trading market institutions. Of course, so far, this type of research is still in the process of continuous maturity and improvement, and belongs to the frontier of the discipline in general.

2.2 Theoretical Basis of Trading Institution

Trading mechanism should be the core variable in emission trading. Before experimental economics, the research of industrial organization theory mainly focused on the market structure and enterprise competition behavior, and regarded market performance as completely determined by market competition. If there was no competition and competitive behavior; the market would have low efficiency. This tradition of taking competition as the only reason for market efficiency can only partially explain the formation of market efficiency, while ignoring the influence of the power comparison between the two sides of the transaction and the transaction process on market efficiency. The emergence of experimental economics provides a research tool for the study of trading institution. So far, the trading mechanism invented and used by human society mainly include double auction, decentralized trading, label price and so on. The differences of different market transaction mechanisms are reflected in four aspects: first, the number of buyers and sellers; Second, who will set the price proposal or quotation; Third, the sequence quotation or the simultaneous quotation; Fourth, the way of contract confirmation, which forms different market trading mechanisms through different combinations of these factors. Any market transactions must be completed under a certain trading mechanism, market trading system is not just the rules of market operation, but also the organizational mechanism of buyers and sellers, the core of which is the price formation mechanism. From the perspective of transaction, market performance is not only the allocation efficiency and production efficiency, but also the price formation model, the number of transactions realized and the distribution of benefits between buyers and sellers (Plott, 1982).

Vernon (1962) proved that even under the condition of few buyers and sellers and insufficient information of supply and demand, the double auction market can reach the competitive equilibrium predicted by theory, the only difference is that the speed of equilibrium is different. Satterthwaite and Williams (1989) pointed out the speed of the auction market tending to equilibrium from the number of participants, their paper also points out that in the bid double auction, with the increase in the number of traders, their influence on the price will gradually weaken. When the number of people is large enough to reach equilibrium, the price quoted by each trader is their real psychological price. Kagel and Vogt (1993) verified Satterthwaite and Williams (1989) by experiments. The experimental results show that the market efficiency increases from 92% to nearly 100% when there are only two sellers and two buyers to eight sellers and eight buyers. Davis and Williamson (1986)

compared the efficiency of label auctions with that of their earlier double auctions, the former 82% and the latter 96%. Davis, Harrison and Williamson (1993) compared the institution under the condition of supply and demand movement, and found that the average efficiency of the label price auction market is only 66%.

To sum up, most of the literature aims to study the impact of market trading institution on market performance, even if there is a comparison between double auction and label price and the market performance of these two trading mechanism, its purpose is to show that market system and market structure together determine the performance of the market. On the basis of this conclusion, this paper compares the market performance of two trading systems commonly used in experimental economics, double auction and label price, under the same market conditions.

3. Experimental Design and Process

3.1 Brief Introduction of Emission Trading Institutions

3.1.1 Double Auction

Double auction is the most commonly used mechanism in laboratory markets, and it is also a trading institution similar to organized securities and commodity exchanges in economic experiments. The basic rule of its experimental design is: when the auction begins, any buyer can bid freely from low to high, and any seller can ask freely from high to low. As long as one party accepts the other party's bid, the two can reach a transaction. There can be more than one session, the transaction price is always between the initial bid and the initial offer price. During the whole transaction process, the price information is public.

In each round, both buyers and sellers can raise their hands to participate in the bidding, when the auction host points to you, please state your number, quotation and quantity, each buyer's quotation must be higher than the previous buyer's quotation, and the seller's quotation must be lower than the previous seller's quotation. Each session ends when there is no offer.

When you enter the next session of transaction, all previously published bid and offer information is invalidated. The negotiation continues until the end of the preset time. In the course of the transaction, participants must not discuss with each other.

3.1.2 Label Price

In the label price, there can be more buyers and sellers involved in the transaction. For example, in the offer auction market, the seller quotes, and the price can't be changed after the quotation, the buyer can't bargain. If there is more than one seller, the price is quoted back to back at the same time, and the buyer buys the goods in a certain order.

Taking the bid auction as an example, three students were randomly selected by drawing lots before the beginning of the experiment, and the role they played in the experiment was stipulated to be the buyer, while the role of the other three students was the seller. Under the bid auction, each session is quoted back to back by the buyer, the seller can't bargain, when the buyer completes the quotation in each round, the seller decides the sale order by drawing lots. When there is no seller's quotation, this session ends.

3.2 Introduction of Experiment Design

3.2.1 Overview of the Experiment

The experimental design of this paper mainly refers to the experimental design method of Y. Hizen and T. Saijo (2001) on the design of greenhouse gas emission trading institutions in *Kyoto Protocol*. We recruited 12 students from different majors in different colleges to participate in this experiment, six of the participants participated in the preliminary experiment, and six participants participated in the formal experiment, all of them had no previous experience in this kind of experiment. To avoid speculation and information search, the participants did not receive any notice before the experiment, the experiment in this paper consists of three sessions: E1, E2, and E3, there are two rounds of experiment in each sessions，the specific design of the experiment is shown in Table 1.

Table 1. Design of the experimental session

Number	Name	Trading Institutions
1	E1	Double Auction
2	E2	Label Price (bid auction)
3	E3	Label Price (offer auction)

3.2.2 Experimental Environment

The experiment was carried out in the multimedia classroom of Jinan University. In order to avoid communication and thus prevent the occurrence of collusion, the participants sat well according to the designated positions, which were separated one by one in the experiment. There are two experimenters, one presides over the experiment, and the other is a supervisor. During the experiment, the participants were forbidden to communicate with each other, and raised their hands to ask questions, which were answered by the host and the supervisor.

3.2.3 Experimental Incentive Mechanism

The entrance fee for each participant is 10 Yuan, and the other income should be calculated and distributed according to the final results of the experiment in a certain proportion. The higher the income in the experiment, the more payoffs the participant will get in the end. Therefore, the participants have to choose strategies to maximize their own benefits. Before the experiment, the participants were told not to communicate, and if the communication was found, the final income of the participants would be 0 Yuan.

3.2.4 Profit Mechanism

We define the market price as P, and the marginal emission cost curve of the enterprise coincides with the vertical axis as L. As shown in Table 2, there are three scenarios.

Table 2. Description of profitability

Number	Transaction Status	Profitability
(1)	P > L	Sell for profit
(2)	P < L	Buy for profit
(3)	P and L coincide	Not Profitable

At present, it is assumed that an enterprise must have the corresponding unit's emission rights to produce a unit's goods, and when the transaction price P is higher than L, the emission manufacturer sells the excess emission rights to make profits. The profit obtained is shown in Figure 1(1). When the transaction price P is lower than L, the polluter buys the emission right from other manufacturers, so that he can produce the corresponding products and make a profit. The profit obtained is as shown in Figure 1(2). When the transaction price P and L overlap, the manufacturer has no incentive to trade, therefore, there is no trading of emission rights, and the profit of each manufacturer is zero.

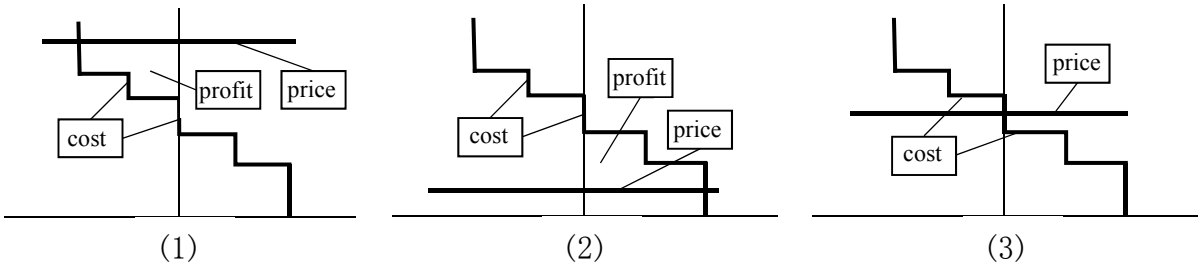

Figure 1. Profitability diagram

3.2.5 Setting of Experimental Parameters

In the experiment, we assign an initial emission right to each participant, and the number of emission rights allocated is 80, 50, 44, 28, 18 and 8 in turn. Because each manufacturer's initial emission right will affect the setting of marginal emission cost, and also affect the market efficiency of each participant, to simplify experiments and control variables, we set only one group of initial emission right in the whole experiment.

Table 3. Marginal emission costs of pollutant producers

A		B		C		D		E		F	
-80 ~ -74	217	-50 ~ -41	217	-44 ~ -35	217	-28 ~ -25	250	-18 ~ -11	250	-8 ~ 0	250
-73 ~ -68	167	-40 ~ -31	167	-34 ~ -21	135	-24 ~ -18	200	-10 ~ 0	217	1 ~ 3	200
-67 ~ -58	117	-30 ~ -21	117	-20 ~ -11	100	-17 ~ -17	184	1 ~ 10	184	4 ~ 17	184
-57 ~ -35	84	-20 ~ 11	84	-10 ~ 0	67	-10 ~ 0	167	11 ~ 20	135	18 ~ 27	150
-34 ~ 10	67	-10 ~ 33	34	1 ~ 13	17	1 ~ 30	135	21 ~ 30	84	28 ~ 37	100
11 ~ 20	34	34 ~ 50	17	14 ~ 17	0	31 ~ 40	100	31 ~ 37	0	38 ~ 47	84

3.2.6 Experimental Process

We have established a market composed of buyers and sellers, and the commodity traded is the emission right. Trading is divided into three sessions: E1, E2 and E3, each session contains two rounds of experiments, except for the first round of the E1, which is 13 minutes, the other rounds of experiments are 10 minutes. The whole emission trading experiment will be carried out in the following order:

Taking the formal experiment E1 as an example, after introducing the corresponding experimental rules, six participants randomly select the experimental data recording paper recording their number and marginal emission cost, and then sit down in turn according to the serial number. After the start of each session of experiments, the buyer and the seller will quote each other and negotiate independently until no one quotes or reaches the prescribed time. Whenever a transaction is concluded, the recorder will record the deal price and quantity, and publish the current transaction price.

The next E2 experiment uses the label price system, in this experiment, the participant A, B, C are the sellers, D, E, F are the buyers. Under the bid auction, each round is quoted back to back by the buyer, the two sides can not bargain, when the buyers complete the quotation in each round, the sellers draw lots. After drawing lots, they can follow the number they drew out. Starting from the 1st, each seller is asked whether they accept the offer of one or several buyers, of course, the seller can also reject the quotes of all buyers and choose not to trade. When the seller accepts a quote, the transaction can be reached. This session of experiment is conducted in two rounds, each round lasts 10 minutes.

The procedure of E3 is basically the same as that of E2, except that the bid auction market is changed to the offer auction market, in which the price is quoted by the seller and the buyer can't bargain.

4. Experimental Data and Statistical Analysis Indicators

In the analysis of the results of the experiment, this paper selects three indicators to compare and analyze the three types of emission trading namely, deal price, transaction volume and market efficiency of emission trading experiment.

4.1 Main Experimental Analytical Index

(1) Deal price of emission right (P): The deal price is the price when the supply curve of emission right intersects the demand curve, and the price reflects the scarcity of emission right. The higher the deal price, the higher the cost of emission right purchased by the manufacturers, indicating that the emission right is more valuable.

(2) Transaction volume (V): Because the shares of emission rights initially allocated to each enterprise are different, the marginal emission costs of enterprises are also quite different, the enterprises with lower treatment cost can take measures to reduce the emission of pollutants, and the remaining emission rights can be sold to those enterprises with higher environmental treatment cost, thus increasing the transaction volume. To a certain extent, the volume of transactions reflects the flow of emission rights among enterprises.

(3) Market efficiency (E): To measure the efficiency of the market, the market efficiency in emission trading can be defined as the ratio of the actual income of each experimenter to the theoretical maximum profit.

$$E = \frac{R_i}{R_0} (i = 1, 2, 3, 4, 5, 6) \quad (1)$$

Where E is the market efficiency, R_i is the actual income obtained by the ith enterprise in each transaction, and R_0 is the theoretical maximum income obtained by the enterprise in each auction.

According to the description of equilibrium price and equilibrium quantity in the Competition Equilibrium Model and refering to the marginal cost curve of each enterprise, the demand curve and supply curve are arranged and combined according to the order from high to low. Then the price corresponding to the intersection point of demand curve and supply curve is the equilibrium price, and the corresponding quantity is the

equilibrium quantity. According to the experimental data in this paper, the final equilibrium price is 100 Yuan, and the equilibrium quantity is 102 emission rights. The total income of each seller below the equilibrium price and the total income of each buyer above the equilibrium price can be calculated to calculate the theoretical maximum income of the ith enterprise in each transaction.

R_i is the actual profit obtained by the manufacturer, and the calculation process of R_i is shown in the profit mechanism mentioned above.

4.2 Analysis of Experimental Data and Statistical Indexes

4.2.1 Deal Price

Table 4. Statistical description of deal price

Name	Mean absolute deviation	Standard deviation	Coefficient of variation	Average price
E11	34.442	41.594	0.334	124.713
E12	28.855	33.362	0.272	122.59 8
E21	22.250	28.525	0.216	132.171
E22	21.679	25.394	0.207	122.889
E31	26.734	29.439	0.225	130.606
E32	7.984	7.071	0.051	138.952

The average price under the offer auction is higher than that of double auction and bid auction. As can be seen from Table 4, the average price of the two rounds of E3 under the offer auction system is 130.606 and 138.952. While the average price of the two rounds of E1 under the double auction system is 124.713 and 122.598, which is significantly lower than the average price in E3. The average price of the two rounds of E2 under the bid auction system is 132.171 and 122.889, which is lower than those under the offer auction system.

The price fluctuation under the double auction system is obviously greater than that under the label price. From Table 4, we can see that the coefficient of variation of the two rounds of deal price in E1 under the double auction system are 0.334 and 0.272, which are obviously higher than those of E2 under the bid auction. It is also larger than the 0.225 and 0.051 of the two rounds in E3 under the offer auction. It shows that speculative behaviors in double auction market are more serious.

4.2.2 Transaction Volume

Table 5. Comparison of transaction volume in three sessions of experiments

Name	E1		E2		E3	
	E11	E12	E21	E22	E31	E32
Transaction Volume	122.00	117.00	105.00	99.00	99.00	62.00
Average Transaction Volume	119.50		102.00		80.50	

In terms of transaction volume, the transaction quantity of double auction system is larger than that of bid auction and offer auction. According to the statistical calculation of the transaction volume of the experimental data in Table 5, it can be found that the transaction volume of the two rounds in E1 under the double auction system is 122 and 117, which is obviously larger than the 105 and 99 in E2 under the bid auction system, and also larger than the 99 and 62 in E3 under the offer auction system.

4.2.3 Market Efficiency

Table 6. Market efficiency calculation result

	E11	E12	E21	E22	E31	E32
A	1012	2115	1029	1288	1427	0
(1490)	(0.6792)	(1.4195)	(0.6906)	(0.8644)	(0.9577)	(0.0000)
B	1137	831	815	928	716	605
(820)	(1.3866)	(1.0134)	(0.9939)	(1.1317)	(0.8732)	(0.7378)
C	165	97	173	110	266	0
(330)	(0.5000)	(0.2939)	(0.5242)	(0.3333)	(0.8061)	(0.0000)
D	257	234	371)	100	515	115
(1050)	(0.2448)	(0.2229)	(0.3533)	(0.0952)	(0.4905)	(0.1095)
E	840	790	60	290	440	428
(1190)	(0.7059)	(0.6639)	(0.0504)	(0.2437)	(0.3697)	(0.3597)
F	1608	1482	1742	1552	1172	959
(1976)	(0.8138)	(0.7500)	(0.8816)	(0.7854)	(0.5931)	(0.4853)
Total.	5019	5549	4190	4268	4583	2107
(6856)	(0.7321)	(0.8094)	(0.6111)	(0.6225)	(0.6685)	(0.3073)

When we analyze the market efficiency of the three sessions of experiments, we find that the market efficiency of double auction is higher than that of label price, and market efficiency of bid auction and offer auction are similar, but the market efficiency of offer auction market may fluctuate greatly.

4.2.4 The Experimenter's Income

The non-parametric test does not require the population distribution to be characterized by certain parameters like normality, etc., so it is used more widely. Therefore, the Wilcoxon signed rank test is used to study the influence of different market institutions on the experimenter's income. The following Table 7 is the income statement of the experimenters in each experiment. If the trading mechanisms have no effect on the market allocation, the income of each experimenter in each round has no significant difference. Here, SPSS software is used to carry out non-parametric test on the data of each group.

Table 7. Average income of experimenters

	E1	E2	E3
A	1563.50	1158.50	737.00
B	984.00	87/1.50	660.50
C	131.00	141.50	133.00
D	245.50	235.50	315.00
E	815.00	175.00	434.00
F	1545.00	1647.00	1065.50

The Wilcoxon signed rank test is performed on the income of the experimenter in the E1 and E2. The null hypothesis is that the average income of E1 is equal to the average income of E2, and the alternative hypothesis is that the average income of E1 is greater than the average income of E2, According to the test result, $P = 0.249$, which is greater than the significance level of 0.05, hence the null hypothesis cannot be rejected. Therefore, we believe that the double auction and bid auction have no significant impact on the experimenter's income.

Using the same method to compare E1 and E3, E2 and E3, we found that the double auction and the offer auction had no significant effect on the experimenter's income, bid auction and offer auction have no significant effect on the experimenter's income. Therefore, we believe that the three trading institutions studied in this paper have no effect on the income of experimenters.

Table 8. Per session income for experimenter

	E11	E12	E21	E22	E31	E32
A	1012	2115	1029	1288	1474	0
B	1137	831	815	928	716	605
C	165	97	173	110	266	0
D	257	234	371	100	515	115
E	840	790	60	290	440	428
F	1608	1482	1742	1552	1172	959
Total	5019	5549	4190	4268	4583	2107

When comparing the incomes of each experimenter, we find that the incomes of sellers A and C are zero in session E32. The reason for this result may be that under the offer auction market, the seller who has more emission rights has the right to quote at this time, and the buyer cannot bargain after the quotation. In the process of back-to-back quotation, there are some behaviors which the seller quotes lower price than other sellers to occupy market share and squeeze out the interests of other sellers. Compared with other market institutions, the offer auction is more likely to cause market allocation failure and inefficiency because of competitive pricing behavior such as "malicious quotation", which leads to the reduction of total social income.

5. Summary of Experiments and Prospect of Future Research

5.1 Analysis and Summary of the Experiment

This paper compares and analyzes several common trading institutions of emission rights by adopting the method of standardized experimental economics. The paper selects three market mechanisms: double auction, bid auction and offer auction, and studies the influence of these three different market mechanisms on deal price, transaction volume and market efficiency of emission rights trading market. The higher the price of emissions rights, polluters will cherish the use of such rights. The greater the n transaction volume, the more pollutant companies can take measures to reduce pollutant emissions, and the remaining emission rights can be sold to those enterprises that need the right to discharge. The higher the market efficiency, the higher the ratio of the actual return of the emissions trading to the theoretical maximum.

In this paper, according to the experimental parameters of China's emission trading market, three indicators are used to compare and analyze the transactions of the three experimental sessions, and then compare the trading characteristics under these different trading institutions. The main conclusions of this paper are as follows:

(1) In terms of deal price, the market price under the offer auction system is higher than that under the double auction and the bid auction system and the deal price under the double auction system is similar to that under the bid auction system. In the offer auction market, in order to obtain higher profits and occupy market share as far as possible, the seller's initial quotation is relatively low, which limits the trading of other sellers, and this relatively low price is still above the average market price. This leads to the failure of market allocation, and the market price is difficult to fall back to the equilibrium price. In the bid auction market, the buyer wants to lower the price at first in order to obtain more profits, however, due to the seller's market power, the price gradually rises to reach or even exceeds the equilibrium price.

(2) In terms of transaction volume, the transaction volume under the double auction system is greater than that under the label price system. There are two reasons for this. First, in the fixed 10 minutes of trading time, under the double auction system, both buyers and sellers can quote and accept the other party's quotation to complete the transaction, the price of the buyers and the sellers can be matched faster, but under the label price system, it takes more time for the buyers or the sellers to quote and the speed of matching between buyers and sellers is slower, so the volume is less. Second, under the double auction system, the price is constantly approaching the market equilibrium price, while the price under the label price system moves at a slower rate. For example, in the extreme situation of the E32, the transaction price is almost not close to the equilibrium price. This situation caused the buyers and sellers to have fewer profits or even no profits, so they gave up the transaction.

(3) In terms of market efficiency, the market efficiency obtained under the double auction system is close to that of the perfect competitive market, while under the label price system, the market efficiency fluctuates greatly, which may be quite different from that of the effective market. Through the Wilcoxon sign rank test, we find that there is no significant relationship between the average income of each experimenter in each round and the market institutions. Through comparing the income of each experimenter, we find that under the offer auction system, the total social income may be reduced due to "malicious bidding".

5.2 Reflection and Prospect of the Research

Using its unique advantages, the experimental economics method can effectively analyze and solve the above problems in the study of emission rights market trading institutions. By setting up a reasonable and standardized emission trading market in the laboratory, researchers can set up different trading systems according to their own research objectives, repeatedly carry out experiments, so as to accurately compare the efficiency of various trading institutions and their advantages and disadvantages, and find out the trading institutions with the highest efficiency and the greatest feasibility, and then improve it. It can be seen that the use of experimental methods to study the emission trading system is an important breakthrough in research content and research methods, and is of great significance to the establishment of emission trading market in China.

At present, the problem of environmental pollution in China is becoming more and more serious, and the

traditional methods of environmental governance can only play a weak role, so the application of emission trading institutions in environmental governance is a very important issue. However, China's market mechanism itself and the relevant legal systems are not perfect, hence Chinese researchers in the design of emission trading institution should have a more cautious and scientific attitude. Before the implementation of a specific trading institution, scientific research methods should be used to repeatedly compare, analyze and experiment, and only after determining that a trading institution can produce the highest efficiency can it be implemented in practice. Only in this way, can we reduce the blindness of the implementation of relevant policies as far as possible, thus reducing the cost of policy operation, and then give full play to the advantages of the emission trading institution. Therefore, the study of the emission trading institution in combination with experimental economics is of great significance to developing countries such as China, where the market economy is still improving.

On this basis, the author believes that in the future, when we study the establishment of emission trading market mechanism, we should mainly examine these variables, such as the comparison of different trading institutions including trading volumes, transaction prices, market efficiency, etc.; the influence of monopoly factors and market power including the causes, effects and consequences of monopoly behavior, ways to reduce the adverse effects of monopoly behavior, etc.; the impact of transaction costs such as the different impact of transaction costs in different trading institutions, etc. In addition, whether to allow inter-temporal deposit and loan emission rights and their impacts are also important research directions.

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