Analysis of the Impact of Carbon Emission Trading on Social and Economic Development under the Change of International Oil Price

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Abstract: The drastic fluctuation of international oil price has a great impact on social and economic development. It is of great significance for social and economic development to analyze the impact of carbon emissions trading under the fluctuation of international oil price on social and economic development. Johansen test and state space model are used to study the spillover effect of international oil price fluctuation on carbon market price change and yield. VAR model, impulse response and variance decomposition are used to explore the impact of carbon emissions trading on energy price and consumer price index fluctuation, so as to analyze the social and economic development of carbon emissions trading under international oil price fluctuation. The results show that there is a long-term equilibrium relationship between international oil price and carbon price, and the spillover of international oil price to carbon market and yield shows that oil price can lead to the change of carbon price, but because of the change of EU energy consumption structure and the continuous improvement of carbon trading mechanism, the spillover effect shows a downward trend. The fluctuation of carbon trading price under the change of international oil price constitutes energy. Source price fluctuation causes, but the impact on consumer price index (CPI) is small, which does not constitute the cause of affecting social and economic development. The carbon price has little impact on domestic oil price fluctuation, and has a positive effect.

Key words: International Oil Price; Carbon Emissions Trading; Economic Development; VAR Model; Johansen Test; State Space Model

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1 Introduction

Carbon emission trading is a market mechanism to promote global greenhouse gas emission reduction and reduce global carbon dioxide emissions. The United Nations Intergovernmental Panel on Climate Change adopted the United Nations Framework Convention on Climate Change on 9 May 1992 through difficult negotiations. In December 1997, Kyoto Protocol, the first additional agreement to the Convention, was adopted in Kyoto, Japan. The Protocol regards market mechanism as a new way to solve the problem of greenhouse gas emission reduction represented by carbon dioxide, that is to say, carbon dioxide emission rights are regarded as a commodity, thus forming the trade of carbon dioxide emission rights, referred to as carbon emissions trading. In October 2011, the National Development and Reform Commission issued the Notice on Carbon Emission Trading Pilot Work, which approved seven provinces and cities including Beijing, Shanghai, Tianjin, Chongqing, Hubei, Guangdong and Shenzhen to carry out carbon emission trading pilot work [1]. Over the past two years, under the guidance and support of the National Development and Reform Commission, Shenzhen has actively promoted the research and practice of carbon emissions trading. It has made great efforts to explore the establishment of a carbon emissions trading mechanism with Shenzhen's characteristics and adapted to national conditions. It has successively completed the work of system design, data verification, quota allocation and institution building. On June 18, 2013, Shenzhen Carbon Emission Trading Market took the lead in launching the transaction in seven pilot provinces and cities in. Over the past six months, Shenzhen's carbon market has been running steadily, and Shenzhen has played a role as a pathfinder in the application of market mechanism to achieve low-carbon development.

As a part of the financial market, the participants of carbon emission rights market include commercial banks, investment banks and other financial institutions. These participants are not only enterprises engaged in the real economy, but also virtual financial speculators. As an emerging market, the carbon emissions trading market has no barriers to currency trading, and can be arbitrarily converted between the carbon emissions trading market and the international crude oil market [2]. The contribution 3 is based on the CGE model to study the impact of various national energy-saving emission reduction policies on the market economy [3]. Taking China as the research object, first use the CGE model to construct an energy-economy-environment model, and then test the effects of different emission reduction policies on my country's carbon emissions. Impact, and its impact on my country's market economy. Studies have shown that carbon emissions trading in my country is conducive to effectively reducing social emission reduction costs and balancing economic development, and through certain measures to reduce the impact of carbon emissions on the regional economy, it can further improve the efficiency of energy conservation and emission reduction. The study did not conduct specific research on the depth of the impact of carbon emissions trading on the social economy. Literature 4 mainly uses Beijing-Tianjin-Hebei data as a survey sample to explore the impact of energy consumption and economic growth on carbon emissions, but the research is still not thorough and specific [4].When the price of crude oil fluctuates sharply, the return rate of capital fluctuates greatly. In order to ensure the safety of capital, investors and speculators flee the crude oil market quickly. Capital moves to the carbon emission market, which results in the fluctuation of carbon price. This fluctuation is the fluctuation after the fluctuation of oil price. Similarly, capital moves to the crude oil market, that is, the fluctuation of carbon price is affected by the fluctuation of oil price, and vice versa . This paper proposes a method to analyze the impact of carbon emissions trading on social and economic development under the international oil price fluctuation, and specifically analyses the relationship between international oil prices, carbon emissions trading and social and economic development.

2 Materials and methods

2.1 The connotation and significance of carbon emission trading

(1) The connotation of carbon emission trading

The concept of carbon emission right comes from the concept of "emission right" put forward by the famous economist Dales. It holds that the existence of externalities makes the market mechanism fail and causes environmental pollution . It is difficult to achieve good results by relying solely on government or market mechanism, so the two must be combined. Dales believes that the environment is a commodity and the government is the owner. As the owner of a commodity, the government can distribute the emission rights to each pollutant producer according to the amount of pollutants discharged from a certain area, and allow each pollutant producer to trade [5]. Through emission trading, the efficiency of environmental governance has been greatly improved. According to Dells' theory, economists propose to establish a carbon emissions trading market and internalize externalities through market mechanism to solve the problem of greenhouse gas emission reduction.

Establishing a carbon emission trading market is to capitalize and commercialize greenhouse gases such as carbon dioxide. Its operating mechanism is that the State formulates carbon dioxide emission limits and then allocates them to certain emission permits in various commercial fields, allowing them to produce a certain amount of carbon dioxide (or other polluting gases); and the emission permits are allocated by a government authority, which permits these emissions. Quotas can be sold, and companies across the world can trade emissions permits in an open market [6].

(2) The significance of establishing a carbon emission trading market

First of all, the establishment of carbon emissions trading market is conducive to changing passive position in the world carbon emissions trading market [7]. On the one hand, the carbon emissions trading market and standards are controlled by foreign countries and the solution of the problems in the trading process also depends on foreign legal documents; on the other hand, the professional ability and experience of carbon emissions trading in are seriously insufficient to grasp the dynamics of world carbon emissions trading. Therefore, it is necessary for to establish a carbon emissions trading market to change the situation of lack of voice. Secondly, the establishment of carbon emissions trading market can avoid the loss of carbon resources [8]. Since has not yet had its own carbon trading market, it is only in the supply position of carbon resources, and is the lowest end of the whole carbon trading industry chain. Has created a huge amount of emission reduction for the world carbon emission trading market, but it has been purchased by developed countries at a low price and packaged into higher-priced financial products for foreign trade, resulting in a serious loss of carbon resources[9]. The establishment of carbon emissions trading market will be able to curb the loss of carbon resources. Thirdly, the establishment of carbon emissions trading market is conducive to promoting energy conservation and emission reduction of enterprises [10,11]. From the connotation of carbon emissions trading, enterprises with lower marginal cost of carbon emissions will be in a very advantageous position. They can use the remaining part of carbon emission permits for trading, and thus obtain a certain income [12]. On the contrary, enterprises with higher marginal cost of carbon emissions have to pay a part of the cost to purchase carbon emission permits. Driven by the motive of maximizing profits, enterprises will try their best to strengthen their energy-saving and emission reduction capabilities, such as research and application of low-carbon technology, vigorous development and utilization of new energy[13].

2.2 Study on spillover effect of international oil price fluctuation on carbon market

The purpose of this section is to study the impact of international oil price fluctuations on carbon emissions trading market, mainly investigating the impact of oil price fluctuations on carbon price trends and yield [14]. Research on spillover effect of international oil price fluctuation for carbon market mainly involves the following indicators:

(1) Brent spot price FOB is used as the proxy variable of international oil price. Although many articles use WTI (West Texas Intermediate) price as the representative for describing the trend of international crude oil price, from the perspective of trend, WTI crude oil price

is susceptible to local supply and demand, and has nothing to do with the supply and demand fundamentals of the global crude oil market, so it is more like a regional oil price. Brent crude oil is generally stable in supply and is little affected by local factors. Therefore, from the perspective of international representativeness, this paper chooses Brent crude oil price as the agent variable of international oil price, which is recorded as B.

(2) Bluenext carbon spot price is used as the proxy variable of carbon market price trend, which is recorded as C_1. This paper chooses the data of the second stage of the European Union Emission Trading System (EUETS) from August 13, 2013 to March 4, 2017 as the sample interval (five-day system). The data interval of international oil price is consistent with this interval.

(3) The logarithmic return rate of Bluenext carbon spot price is used to measure the trend of carbon price change. The logarithmic return rate is positive, indicating that the carbon price rises, whereas the carbon price falls.

The logarithmic yield C_2 is:

$$C_2 = Ln\left(P_t / P_{t-1}\right) \tag{1}$$

Among them, t represents the monthly time point and P represents the daily closing price.

In order to eliminate the possible heteroscedasticity, B and C_1 are separately de-logarithmized and expressed by LnB and LnC_1 respectively; C_2 is the natural logarithm for logarithmic return, so data processing is not carried out.

The research ideas are as follows:

(1) The long-term equilibrium relationship between FOB spot price fluctuation of Brent crude oil and spot price fluctuation and yield in carbon market is studied.

(2) By using the state space model of time-varying parameters, the mean value of time-varying elasticity reflects the size of spillover effectiveness [15]. Based on this, the paper analyses the changing trend of spillover effect of international crude oil price fluctuation on carbon market and the reasons.

2.3 Analysis of the impact of carbon emission price on social and economic development under the change of international oil price

Based on the analysis of the impact of oil price fluctuation on carbon price trend and yield in the last section, the impact of carbon emission right price on social and economic development under the international oil price fluctuation is studied in depth [16,17]. The specific steps are as follows:

(1) Unit root test

Next, ADF unit root test is applied to carbon emission trading price, international crude oil price, domestic oil price and consumer price index. ADF unit root test controls high-order sequence correlation by adding lag difference term of dependent variable

$\Delta y_t = \alpha + \delta t + \gamma y_{t-1} + \varepsilon_t$ to the right of regression equation y_t. The corresponding test regression model Δy_t is:

$$\Delta y_t = \alpha + \delta + \gamma y_{t-1} + \sum_{i=1}^{l} \beta_i \Delta y_{t-1} + \varepsilon_t \tag{2}$$

Where l denotes the lag order of the dependent variable. α, δ, γ, β and ε are explanatory variables, and t is the time series parameter. The purpose of ADF unit root test is to test the stability of carbon price, international crude oil price, domestic oil price and consumer price index series [18].

(2) Lag item test

Before the Granger causality test of carbon price, international crude oil price, domestic oil price and consumer price index, the lag order is tested.

(3) Granger causality test

After completing the ADF unit root test and determining the lag order, Granger causality test is needed for CP, IOP, RSP and CPI. Granger causality test is used to determine whether there is a causal relationship between economic variables and the direction of influencing each other.

If the change of X causes the change of Y, then the change of X should occur before the change of Y. The basic regression equation of the test is as follows:

$$Y_t = \sum_{i=1}^{m} \alpha_i X_{t-i} + \sum_{j=1}^{m} \beta_j Y_{t-j} + \mu_t \tag{3}$$

$$X_t = \sum_{i=1}^{m} X_{t-i} + \sum_{j=1}^{m} \delta_j Y_{t-j} + v_t \tag{4}$$

Assuming that the random error term μ_t is not related to the random error coefficient v_t, the Granger causality test assumes that the economic variable X is not the Granger cause of the change of the economic variable Y.

(4) Impulse response

Impulse response function (IRF) is used to measure the impact of a standard deviation shock (impulse) from a random perturbation term of an endogenous variable on the current and future values of all endogenous variables in the VAR model [19]. A first-order VAR model with delay is established.

$$Y_{1t} = a_{11} Y_{1t-1} + a_{12} Y_{2t-1} + \varepsilon_{1t} \tag{5}$$

$$Y_{2t} = a_{21} Y_{1t-1} + a_{22} Y_{2t-1} + \varepsilon_{2t} \tag{6}$$

The basic principle is that if the ε_{1t} changes, the current value of the economic variable Y_{1t} will be changed. At the same time, the value of the next period of the economic variable Y_{2t} will be changed by the conduction of the model. Because of the lag effect, the change of Y_{2t} will cause the change of the future value of Y_{1t}. As time goes on, all endogenous variables in the model change more in the disturbance term [20-22].

(5) Variance decomposition

Variance decomposition is to decompose the variance of prediction error of each exogenous variable in the model into components related to each endogenous variable according to its causes, that is, to analyze the contribution of each shock to the change of endogenous variable, so as to understand the relative importance of each shock to the endogenous variable in the model [23-25].

3 Results and discussion

3.1 Results

3.1.1 Study on spillover effect of international oil price fluctuation on carbon market

(1) Co-integration test

Before testing whether there is a co-integration relationship between a set of time series of international oil price LnB and carbon spot price LnC_1, the monolith city of these time series should be tested first. In this paper, we test the co-integration relationship between two variables, requiring that the single integer order of the two variables is the same. By using ADF (Augmented Dickey-Fuller test) test method, the test results are shown in Table 1:

Table 1ADF test results of C_2、 LnC_1、 LnB

Variable	Original sequence statistic	1% critical value	T-statistics of first-order difference sequence	1% critical value	Conclusi on
C_2	-23.443*	-3.440			I~(0)
LnC_1	-2.850	-3.440	-23.427*	-3.440	I~(1)
LnB	-1.2615	-3.440	-25.670*	-3.440	I~(1)

Note: "*" is to reject the original hypothesis at 1% significance level (original hypothesis H0 is the unit root of the original time series, i.e. the sequence is not stationary); I ~ (n) represents the n-order difference stationary of the original time series; the test model does not contain constant term and trend term.

From Table 1, we can see that C_2 is a stationary sequence, that is, C_2~I ~(0); LnC_1 and LnB are first-order monolithic, which are recorded as LnC_1~ I~(1), LnB~I ~(1), respectively.

(2) From the above test, we can see that the sequence LnC_1 is a first-order stationary sequence, so LnC_2 is also stationary, and we only need to analyze the co-integration relation of (LnB , LnC_1). The following is an analysis of whether there is a co-integration relationship between the two variables. Johansen co-

integration test is applied here. The results are shown in Tables 2 and 3.

Table 2Johansen co-integration test results of LnB

Original hypothesis	Statistic	5% critical value	Prob.**	Conclusion
No	24.52	15.494	0.0017	Reject H0
At most one	2.4588	3.8414	0.1169	Reject H0

Table 3 Johansen co-integration test results of LnC_1

Original hypothesis	Statistic	5% critical value	Prob.**	Conclusion
No	22.061	14.265	0.0024	Reject H0
At most one	2.4588	3.8415	0.1169	Reject H0

Note: The original assumption that H0 is a co-integration relationship is 0, that is, there is no co-integration relationship; Prob. ** is the probability of accepting the original assumption; the lag order is 2.

It can be seen from Tables 2 and 3 that both trace test statistics and maximum eigenvalue statistics can reject the original assumption that the co-integration coefficient is 0 or at most 1 at the 5% significant level. Therefore, there is at least one co-integration relationship between LnB and LnC_1, that is, there is a long-term equilibrium relationship between international oil price and carbon spot price.

(3) Time-varying validity test

The above test results show that there is a long-term equilibrium relationship between international oil price fluctuation and carbon market price fluctuation and yield. In order to more accurately verify the spillover effect of international oil price fluctuations on carbon market price changes and returns, this paper uses the state space model with time-varying parameters to reflect the spillover effect with the mean of time-varying elasticity. The state space model between LnB and LnC_1, and the state space model between LnB and C_2 are established. The measurement results are shown in Table 4 and 5, where SV1 is the state sequence.

Table 4 State Space Model Results of International Oil Price Spillover to Carbon Market Price

	Coefficient	Standard error	Z statistics	P value

C_1	1.6287	0.1001	16.262	0
C_2	-3.802	0.0545	-69.807	0
	Termination state	Root MSE	Z statistics	P value
SV1	0.2145	0.0014	158.26	0
Log likelihood	309.32	Akaike info criterion		
Parameters	2	Schwarz criterion		-0.9066
Diffuse priors	1	Hannan-Quinn criter		-0.915

Table 5 State-space model results of spillover of international oil prices to carbon market returns

	Coefficient	Standard error	Z statistics	P value
C_1	-0.017	0.0121	-1.414	0.1573
C_2	-7.631	0.035	-217.9	0
	Termination state	Root MSE	Z statistics	P value
SV1	0.0038	0.0002	19.252	0.7295
Log likelihood	309.32	Akaike info criterion		
Parameters	2	Schwarz criterion		-4.7293
Diffuse priors	1	Hannan-Quinn criter		-4.7376

From Table 4 and Table 5, it can be seen that the model has achieved a good fit, and the parameters have passed the test significantly. The formal formulas of the state space model obtained are as follows:

Measurement equation: $InC_{1t} = 1.6287 + \beta_{1t} \times InB_t + \mu_{1t}$

State equation: $\beta_{1t} = 0.2145 \times \beta_{1t-1} + \varepsilon_{1t}$

(7)

Measurement equation: $C_{2t} = -0.017 + \beta_{2t} \times InB_t + \mu_{2t}$

State equation: $\beta_{2t} = 0.0038 \times \beta_{2t-1} + \varepsilon_{2t}$

(8)

According to the results of the state space model, the time-varying parameter trajectories of the international oil price on the carbon market price trend and the time-varying parameter trajectories of the international oil price on the carbon market yield are obtained as shown in Figure 1 and 2, respectively.

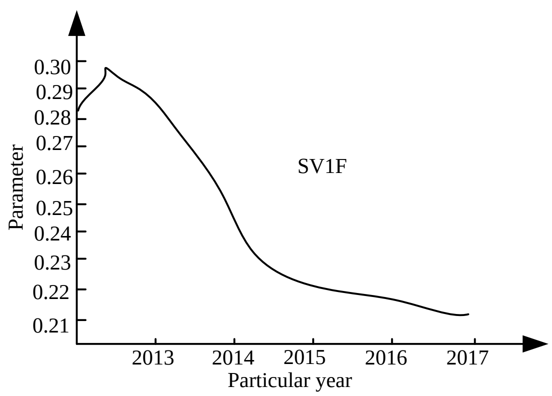

Figure 1 Time-varying parametric trajectory of the effect of international oil price on the price fluctuation of carbon market

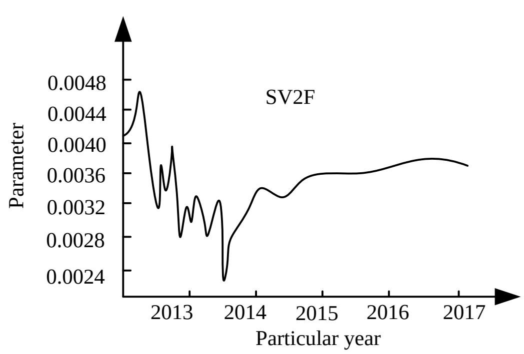

Figure 2 Time-varying parametric trajectory of the effect of international oil price on the price fluctuation of carbon market

Figures 1 and 2 show that international oil price fluctuations are spillover to the carbon market.

A. In the whole sample interval, the state sequence SV1F is positive, fluctuates between [0.214 565, 0.296080], with an average validity of 0.24073. From Figure 1, we can see that there is an obvious fluctuation in the state sequence. At first, the spillover effect is in an increasing stage, with a maximum value of 0.296080 in 2013, and then the effect gradually decreases, reaching a minimum of 0.214 565 in 2017. From the time-varying elastic mean, we can see that the fluctuation of international oil price can be used as a reason to explain the price fluctuation of carbon market; but from the average validity value, the contribution value of oil price fluctuation is as the cause of carbon market price fluctuation begins to decrease, which is consistent with the EU energy consumption structure.

B. In the whole sample interval, the SV12F of the state sequence is positive and fluctuates between [0.0025, 0.0046] with an average validity of 0.0037. As can be seen from Figure 2, the validity value reached its maximum value of 0.0046 in 2013, then reached its minimum value of 0.005 in 2017 under the downward trend of shocks, and the fluctuation trend of validity value slowed down in 2014 and beyond. Overall, the effect of international oil price on carbon market yield is not obvious; from its trend, the trend before 2014 is consistent with the trend of oil price fluctuation, and then stable, which is closely related to the continuous improvement of the EU carbon market trading mechanism.

3.1.2 Analysis of the impact of carbon emission price on social and economic development

(1) Unit root test

In the analysis of the impact of carbon emission right price on social and economic development, the ADF unit root test results of carbon price fluctuation (CP), international oil price fluctuation (IOP), domestic oil price fluctuation (RSP) and consumer price index (CPI) are described in Table 6.

Table 6ADF unit root test results of CP, IOP, RSP and CPI

Variable	Statistic	Prob.	
CP	2.07379	0.3546	No Interception Term and No Trend Term
D(CP)	45.6050	0.0000	No Interception Term and No Trend Term
IOP	6.75596	0.0341	No Interception Term and No Trend Term
RSP	8.46894	0.0145	No Interception Term and No Trend Term
CPI	50.1132	0.0000	No Interception Term and No Trend Term

As shown in Table 6, D(CP) represents the sequence after the first-order difference of the original sequence of carbon emission rights. The ADF unit root test for the original sequence is non-stationary, and the data after the first-order difference is stationary. The ADF unit root test for the original sequence is stationary. Through ADF unit root test on CPI, IOP, RSP and CPI, it is found that except IOP has intercept and trend items, there are no intercept and trend items in the other three columns.

(2) Lag order test

Before the Granger causality test of carbon price, international crude oil price, domestic oil price and consumer price index is carried out, the lag order is tested. The results are as follows:

Table 7 Lag order test results of CP, IOP, RSP and CPI

lag	AIC	SC
0	20.83402	20.95488
1	16.27957	16.88386
2	15.7815	16.86921
3	15.82428	17.39542

4	15.87505	17.92961

Table 7 shows that AIC represents Akaike Information Criterion, which is a standard to measure the goodness of fitting statistical models; SC represents Schwarz Criterion, whose test idea is to determine the appropriate length of lag period by comparing the goodness of fit of different distribution lag models. The test process is: adding lag variables to the model periodically, and then adding lag variables directly. Until the SC value no longer decreases, the lag period is chosen to minimize the SC value. According to AIC and SC minimization principle, the lag order is determined to be 2.

(2) Granger causality test

Table 8 is the result of Granger causality test on carbon price fluctuation (CP), international oil price fluctuation (IOP), domestic oil price fluctuation (RSP) and consumer price index (CPI):

Table8 CP、IOP、RSP and CPI Granger causality test results

Null Hypothesis	F-Statistic	Probability
IOP does not Granger Cause D(CP)	1.56172	0.21626
D(CP) does not Granger Cause IOP	7.71453	0.00088
RSP does not Granger Cause D(CP)	0.31146	0.73329
D(CP) does not Granger Cause RSP	3.31914	0.04136
CPI does not Granger Cause D(CP)	1.02868	0.36228
D(CP) does not Granger Cause CPI	0.27429	0.76084
RSP does not Granger Cause IOP	0.59149	0.55593
IOP does not Granger Cause RSP	8.88624	0.00033
CPI does not Granger Cause IOP	1.0275	0.36263
IOP does not Granger Cause CPI	0.2955	0.74498
CPI does not Granger Cause RSP	0.11848	0.88842
RSP does not Granger Cause CPI	0.30889	0.73514

From Table 8, it can be concluded that: CP $\Rightarrow$ IOP $\Rightarrow$ RSP, and CP $\Rightarrow$ RSP, that is, fluctuation of carbon price is the cause of fluctuation of international crude oil price, fluctuation of international crude oil price can lead to fluctuation of domestic oil price, and fluctuation of carbon price can be indirectly transmitted to fluctuation of domestic oil price, while neither carbon price nor oil price constitute the cause of fluctuation of CPI of consumer price index.

In theory, the fluctuation of crude oil price is affected by the fluctuation of crude oil price. The fluctuation of crude oil price will inevitably move to the carbon emission rights market, and the fluctuation of carbon price and oil price have feedback effect. However, our research results show that oil price does not constitute the cause of the fluctuation of carbon price, which is contrary to the theory. As a new financial market, carbon emission trading market has higher volatility and frequency than crude oil price. The main reason lies in the barrier-free entry and exit of "speculative capital" in emerging financial market. In the short run, carbon price has the same fluctuating trend as international crude oil price. In the long run, the trend of carbon price is opposite to that of oil price, and it is far more affected by speculative capital and macro-fundamentals than that of oil price.

The composition of consumer price index (CPI) does not include the data of oil price fluctuations. Petroleum-related products account for a small proportion of the CPI composition. Consumer price index is roughly 34% for food, 14% for entertainment, education, cultural goods and services, 13% for residence, 10% for transportation and communications, 10% for medical and health personal goods, 9% for clothing, 6% for household equipment and maintenance services, and 4% for tobacco, alcohol and supplies. The petroleum-related products are mainly residential and transportation products, accounting for 23% of CPI. The fluctuation of international oil price and domestic oil price has great influence on the consumption and economic growth of Chinese residents, but it is not directly reflected in the fluctuation of CPI. Therefore, the fluctuation of oil price does not constitute the cause of the fluctuation of CPI. Therefore, the carbon emissions trading under the fluctuation of international oil price does not constitute the cause of affecting the social and economic development. Participation in the international carbon emission trading market is relatively short, and the scale of participation is limited. Carbon price fluctuation has little impact on real economy and consumer prices, and does not constitute the cause of price fluctuation. Carbon price fluctuation is affected by the entry and exit of speculative capital without barriers, and capital may transfer to the international crude oil market at any time. Carbon price fluctuation affects the price fluctuation of international crude oil market. With the increase of energy dependence on foreign countries year by year, energy price is greatly affected by the fluctuation of foreign crude oil prices. In summary, CP $\Rightarrow$ IOP $\Rightarrow$ RSP is established.

(3) Impulse response

Based on the above analysis, we know that carbon price is the cause of fluctuation of international crude oil price, and also the cause of fluctuation of oil price. The impulse response analysis is carried out to study the lag period of the impact of carbon price on international crude oil price and oil price fluctuation. The results are shown in Figure 3, 4, 5 and 6.

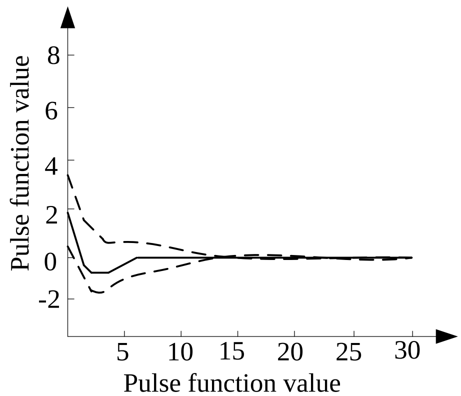

Figure 3 Response of CPI to RSP

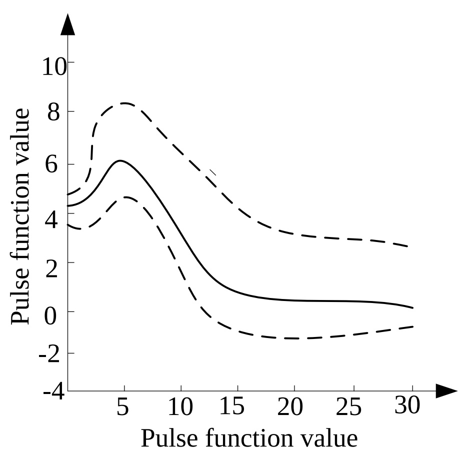

Figure 4Response of RSP to RSP

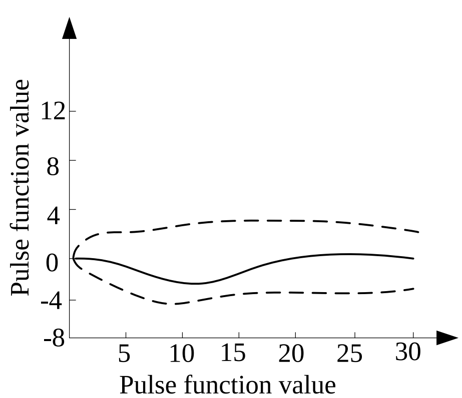

Figure 5 Response of IOP to RSP

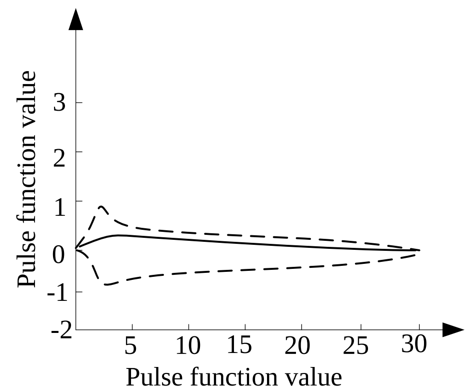

Figure 6 Response of D(CP) to RSP

As shown in Figure 3, 4, 5 and 6, domestic oil price fluctuation (RSP) is greatly affected by its own fluctuation, and both of them are positive, reaching the maximum in two months and basically reaching a stable value in 20 months. Consumer price index has little influence on oil price, and has a positive effect in the short term, rapidly turning into a negative effect, and reaching a stable level in three months. Oil price has little influence and negative effect, reaching a stable value in one year; carbon price has little influence on domestic oil price fluctuation, and has a positive effect, reaching a stable value in one year.

(4) Variance decomposition

We decompose the variance of domestic oil price fluctuations, and the results are as follows:

Table 9The results of variance decomposition of domestic oil price fluctuations

Period	S.E.	D(CP)	IOP	RSP
1	4.481368	0.104146	4.792426	95.10343

2	8.066227	0.622562	15.54853	83.8289
3	10.94703	0.357667	22.51694	77.12539
4	13.06	1.245665	25.82566	72.92867
5	14.52792	3.364596	26.00912	70.04015
6	15.49578	5.887941	26.00912	68.10294
7	16.09433	8.022704	25.00131	66.97599
8	16.43762	9.38199	24.12475	66.49326
9	16.62276	9.990797	23.59049	66.41871
10	16.72504	10.10828	23.38558	66.50614

CholeskyOrdering:D(CP) IOP RSP

Table 9 shows that Period is the period of variance decomposition, i.e. the prediction period of the standard deviation of domestic oil price fluctuation, where S.E. is listed as the standard deviation of domestic oil price fluctuation prediction, D(CP) is listed as the percentage of the prediction difference of domestic oil price fluctuation by the carbon price disturbance part, IOP is listed as the percentage of the disturbance part of international crude oil price fluctuation, and RSP is the self-disturbance part. It can be concluded in Table 9 that the percentage of self-disturbance is 95% in one-stage forecast. With the passage of time, the percentage of non-self-disturbance increases gradually, reaching a stable value in the seventh stage. That is to say, 67% of domestic oil price fluctuation is caused by self-fluctuation, 25% by international oil price fluctuation, and the contribution of carbon price fluctuation to domestic oil price fluctuation is 8%.

3.2 Discussions

In view of the content of this paper, the following effective ways to establish a carbon emissions trading market are put forward:

(1) Establishing a perfect carbon emission trading market system step by step

At present, carbon emissions trading market has developed rapidly, Beijing Environmental Exchange, Shanghai Environmental Energy Exchange and Tianjin Emission Rights Exchange have been established successively. However, carbon emissions trading market is still facing an important problem. The demand factors of carbon emissions trading market are not clear, that is, enterprises have not yet formed the demand to "buy" carbon emissions rights. For enterprises and other emission reduction units, the purchase of carbon emission quotas will only bring additional costs. Emission reduction units will not, or have no constraints or incentives to pay for carbon emissions. Therefore, in order to establish a carbon emissions trading market, we must first clarify the market demand. Based on the experience of European and American carbon emission trading markets, only by formulating and implementing mandatory emission reduction targets can clear market demand and market prices be formed. However, due to the weak ability and awareness of emission reduction entities, such as Chinese enterprises, and the imperfect market mechanism, must gradually establish a carbon emissions trading market in a step-by-step manner.

(2) Establishment of regional carbon emissions trading market layout based on decentralized management model

Our country has a vast territory and uneven distribution of resources. At the same time, due to the preferential policies of our country, there are great differences in the level of economic development and industrial structure in the east, middle and west of our country. How to coordinate the regional differences will also be one of the major challenges to establish a carbon emissions trading market. In this respect, the situation between provinces and municipalities in our country is similar to that among member states within the EU. Therefore, we can refer to the EU emissions trading system. First, according to the economic level between provinces and cities, the similarities and differences of industrial structure and policies, we can construct regional carbon emissions trading markets in several provinces and cities, and grant each regional carbon emissions trading market some autonomous decision-making power. Then, on the basis of the regional carbon emissions trading market, we can form a unified national carbon emissions trading market.

(3) Improving the regulations of carbon emission trading

Laws and regulations are the necessary means to ensure the healthy and orderly development of a market. However, the legal basis of carbon emissions trading market is still weak. There are no special laws and regulations to confirm the legal status of carbon emissions trading and solve the problems encountered in the process of carbon emissions trading. Therefore, our government must step up the promulgation of special laws and regulations on carbon emissions trading to determine the legal status of carbon emissions trading, and at the same time, we should make detailed provisions on the formulation, allocation, trading rules and penalty system of quotas in the process of carbon emissions trading. For the bankruptcy and merger of enterprises in the process of carbon emissions trading, we should also speed up the establishment of a sound procedural system.

(4) Improving the regulatory mechanism of carbon emissions trading

The biggest cost and defect of carbon trading market is the approval and control of carbon emissions. Because of the invisibility of carbon emission rights, it is impossible for the market to accurately confirm the carbon emissions of enterprises and other emission reduction units at a certain stage. Without the confirmation of carbon emissions, it is impossible to confirm the carbon emissions trading volume, and the carbon emissions trading can not proceed normally. At present, there is still a big deficiency in regulatory system, which will have a very negative impact on the orderly operation of carbon emissions trading market. Therefore, must establish a sound carbon emission regulatory mechanism. Firstly, we should establish a strict qualification examination system for emission subjects. Secondly, the corresponding reporting system should be established. The report includes all emission reduction units in the reporting period of carbon emissions, carbon emissions trading, etc. Thirdly is to establish a sound detection system. That is to detect the carbon emissions of enterprises and other emission reduction units, and to fully understand the carbon emissions of emission reduction units. Finally is to establish a trading tracking system. All trading activities in the carbon emission trading market should be registered and the use of carbon emission quotas should be tracked and investigated.

4 Conclusions

Aiming at the analysis of the impact of carbon emissions trading on social and economic development under the fluctuation of international oil price, this paper first studies the spillover effect of international oil price fluctuation on carbon market. The results show that there is a long-term co-integration relationship between international oil price fluctuation and carbon market price fluctuation and yield. On this basis, the state space model is established, it is concluded that the spillover effect of international oil price fluctuation on carbon market price fluctuation and its return rate is obvious, and the spillover effect on carbon price is decreasing gradually, which is closely related to the energy consumption structure and government policy of EU, the spillover effect on carbon market return rate is not obvious, because of the EU carbon emission trading mechanism. Continuous improvement, spillover effect began to show a smooth performance.

Then it studies the impact of carbon emission price on energy price and price fluctuation, and then analyses the impact of carbon emission trading on social and economic development under the fluctuation of international oil price. The results show that the fluctuation of carbon price under the fluctuation of international oil price constitutes the cause of energy price fluctuation, but has less impact on CPI, and does not constitute the cause of affecting social and economic development.

In summary, as a carbon quota trading market, it is a complex system, and its influencing factors are dynamic and non-linear changes, and other potential factors affecting carbon prices have not yet appeared in the carbon market, such as supply from the clean development mechanism market and joint performance mechanism market, etc. Therefore, it is necessary to study the causes of carbon market risk in depth. At the same time, as the largest clean development mechanism market in the world, how to establish and improve the carbon trading mechanism in line with national conditions is the basis for international carbon trading. We must strengthen legislative support, government supervision, play the role of financial innovation tools, and win the initiative in the process of carbon trading for our country. Plants can be very effective in reducing carbon emissions [26-33].

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