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Analysis and Assessment of the Value of Carbon Assets Based on Monte-Carlo Simulation

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ABSTRACT: From the macro point of view, at this stage it mainly includes carbon assets of CDM emission reduction and carbon assets of quotas in developing countries. At present, China is the largest side of CDM carbon reduction supply. How to assess the value of CDM assets carbon related our investment decisions and value maximization of the project. CDM carbon emission reduction benefits is independent from the main revenue of the project, its value greatly influenced by the price of carbon emissions. Therefore, it is necessary to study a reasonable carbon price forecasting method. According to the characteristics of CDM carbon assets, the use of Monte Carlo simulation method to predict the price of carbon, and thus establish a carbon assets valuation model, is expected to more truly reflect the value of the CDM carbon emissions reduction assets. This is conducive to enterprise participate in CDM projects to price carbon emissions and it is in favor of domestic mandatory quotas trading companies to determine the value of quota carbon assets. It is conducive to enhance the Chinese voice in the international pricing of carbon trading, maximize the value of CDM carbon assets and promote the development of emission reduction in China.

KEYWORDS: pCER; carbon assessment; Monte-Carlo simulation.

INTRODUCTION

China is not responsible for mandatory emission reduction at present, however, the Chinese government clearly put forward, until the end of the 13th five year plan, namely 2020, the unit of GDP carbon emission should decline 40% - 45% than the start time of 11th five year plan, namely 2005; the unit GDP carbon emission should reduce17% in the 12th five year plan and CDM takes a large proportion. Meanwhile, the carbon trading market in China is at its beginning, the market pricing mechanism and management model is prematuration and the transaction subject is disperse. It makes the carbon trading price in China low 50% per ton than Europe, even low 2-3 euro than Indian. Therefore, study a carbon value model accord with China, promote emission reduction subject make scientific decision and get better advantage in international negotiation is very important.

Clean Development Mechanism (CDM) is the leverage of the international carbon emission permit market exploit new energy, transform energy type and increase energy efficiency which has been implemented in 2005 in China. The developed countries use CDM to conduct energy conservation and emissions reduction project investment and technology transfer to the developing countries in order to get carbon emission reduction limit in return [1]. Nowadays, China is the most important seller in CDM market, which occupies 84% parent certification emission reduction (pCERS) trade share. Assess the value of CDM assets not only concerns about the development of CDM market, but also has significance for China participate in international cooperation project involved CERS agreed price. But because of the strategic and complex of CDM project, it is necessary to study the reasonable CDM carbon value assessment model.

At present, most of the international and domestic researches of this problem originate from the influencing factors of the carbon price and the overall value of CDM project, which lacks of the in-depth study of carbon value individual value of CDM project. A.Denny Ellerraan and Annelfene Decaux (1998) used the EPPA model to analyze the international carbon trading pricing mechanism and the price of carbon emission rights in China [2]. Holtsmark and Maestad (2002) found the price of carbon emission rights market would raise a lot through scenario simulation if it limits to the sale amount of carbon emissions of the sellers [3]. Kanen (2006) believed that fluctuations in the price of electricity would ultimately affect the carbon price changes [4]. Mansanet-Bataller (2007) using a way of multivariate analyzed the natural gas prices, Brent crude oil price and the impact of the power price to the carbon price, found a big effect of energy prices on the price of carbon, and he also found that only the extreme weather would affect the carbon emissions prices [5]. Wei Yi-ming etc. (2008) studied the long-term and

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short-term interaction between EUETS carbon price and energy price by using the theory of co-integration, and pointed out that the energy price change was an important reason for promoting the carbon price change of the second stage [6]. Tan Ming (2010) constructed a game model to study the carbon price of CDM, and thought that the principal agent game model was more suitable for its characteristics [7]. Nie Li (2013) used game theory and information economics, analyzed the carbon emissions trading theory in China [8]. Ceng Yingmiao (2010) and Zhao Peipei (2010) studied the option value of CDM project based on the real options theory [1,9]. Chen Xiao-hong and Wang Zhi-yun (2012) conducted a theoretical analysis of the price of carbon emissions trading from three aspects, including the supply and demand and the market impact [10]. Ding Yang (2015) used the price of carbon quota which announced by Shenzhen Emission Rights Exchange as the object, and he analyzed and compared the factors affecting the carbon price using the GEN method [11]. Guo Wen-jun (2015), using the carbon quota price in China released by regional carbon emission exchange as the research object and the adaptive lasso method, searched the degree of regional carbon asset price affected by factors of different aspects [12].

CDM project is a long process which is close to enterprise development strategy. As the power of international and domestic emission reduction is bigger, CDM investment decision-making has more influence on business operation. CDM project investment has irreversibility like other large-scale investment, once put into would be hard to quite. CDM project initial investment and the risk it faces is very great and it is necessary to deep analyze the CDM carbon assets value assessment method and offer theory basic for scientific project decision. Because of the mortal uncertainty of CDM project, carbon emission reduction price in future is a difficulty. In many cases, decision maker can realize the exist of this uncertainty but can't calculate. This paper analyzes CDM carbon value's characteristic combined with carbon price change process of Monte Carlo simulation, makes the CDM carbon assets assessment accord with actual characteristic and supply theory support for CDM project decision-making scientification.

CARBON EMISSION MANAGEMENT MECHANISM AND CARBON ASSETS FORMATION MECHANISM

There are four kinds of carbon emission management mechanism domestic and overseas i.e. the forming way of carbon asset: C&T, B&C, JI and CDM project mechanism. Control the carbon emission in the form of a carbon tax and voluntary emission reduction trading mode are also included.

C&T, i.e. Cap and Trade, is a carbon emission control model based on quota. Some government in a place set a total carbon emission in some time and divide the total carbon emission into many equal emission quota to auction or directly assign to enterprise. The most trading markets take this way in China. Emission quota is the carbon emission right has been a intangible assets and bring benefit to the enterprise.

B&C, i.e. Baseline and Credit, is a carbon emission control model based on project. Every project (or industry) produce carbon emission baseline Q_b after investigating and assessing by authority department. Carbon emission baseline is per unit of economic output carbon intensity after the project put into production under current technology which means not initiative use new optional technology to enhance carbon use ration and reduce carbon emission. The hypothesis carbon intensity it get is the "baseline". When the per unit of economic output carbon intensity is inferior to the baseline in the production phase, relevant carbon credit is produced, which can be sell to the project or enterprise whose per unit of economic output carbon is overproof in the carbon bourse. Carbon credit is also called credit carbon assets which can be reserved or deal on credit in carbon market.

JJ Joint Implementation mechanism is a cooperative mechanism between the soviet union [7], the Eastern European transition countries and the developed countries based on project. Its inherent trading theory is to regard the developed countries as an integral whole, implement interior control and accomplish the emission reduction assignment as a whole. The developed countries can invest green house gas reduction project in the developed countries whose cost of emission reduction are low. The emission reduction is produced can charge against buy countries emission reduction obligation. But this mechanism can be implemented in the developed countries and is bilateral international transaction between them.

CDM PROJECT CARBON VALUE AND GENERAL MODEL APPLICAITON ANALYSIS

CDM Carbon Value Analysis

CDM is a win-win cooperation mechanism based on project. In general, the developed country sign an agreement and cooperate with the developing country, implement CDM project in the area of the developing countries and get the CER which signed and issued by the UN. The certification emission reduction (CER) is produced by the CDM project and is the trading object of the market. Among it, pCER means primary market certification emission reduction and sCER means secondary market certification emission reduction. pCER is the certification emission

reduction which the owner of the project directly deal with the international purchaser. If the international purchaser deal the purchased CER with another organization, this kind of CER is called the secondary market certification emission reduction.

CDM project value is different from other investment project, CDM project generates not only general merchandise earnings and policy subsidize revenue, but also homologous carbon emission reduction. This emission reduction forms CER after approving register and forms carbon emission reduction earnings after selling. CDM carbon emission reduction is also a kind special intangible assets whose earnings is independent of the cash flow a project generates. General intangible assets can't generate continue earnings separate from project and only can generate product earnings combined with tangible assets. CDM carbon emission reduction earnings fluctuate much which is easily affected by the international CER price, especially EUA price.

The process that the project developers participate in the CDM project [13] is: first, the participant sign cooperative intention agreement with the international purchaser. Under the support of the purchaser, both of them affirm the aptitude of the project and then get the reply by the host government. Register at the UN CDM executive board after authentication of the third party managerial setup. The project implementation is been given the CER by executive board under the certification procedure. Contracting parties carry out purchase agreement at the end. The project include these flow path called bilateral project and these is unilateral project in practice, i.e. the project developers use their own asset and technology to exploit CDM project and undertake all the risk. They also get the CER by the executive board. The developers sell the CER directly to the international purchaser Unilateral project carbon asset value assessment is more complex than bilateral project because cost of emission reduction and risk and selling price is particular.

The risk of CDM project runs through the whole life cycle which includes: CERs price change risk, exchange rate change risk, taxation policy risk, the quantity demanded from market to CERs risk. The non-economic risk includes: domestic authorization risk, international register risk, CERs sign and issue risk, international negotiation risk and so on. These risk may have influence on the project value. So the share option worth is important which includes: expanding share option, shrinking share option, business shut down or restart type share option. The selling of carbon emission reduction also include many share option combined with project risk. Therefore, in order to reflect the real carbon emission reduction value, the share option worth it concluded can't be neglect.

Applicability analysis of value assessment model

The basic model of intangible assets evaluation present earning value method is:

$$NPV = \sum_{i=1}^{n} \frac{K \times R_i}{(1 + r_i)} - I_0 \tag{1}$$

K means intangible assets share rate, R means sales revenue, r means risk discount rate, I_0 means initial outlay.
Formula (1) is the basic formula for intangible assets assessment present earning value method. The basic parameters of present earning value method are intangible assets share rate, cash flow, discount rate. One of the difficulty of income approach on intangible assets assessment is confirm the intangible assets contribution on the earnings. Because the earnings of carbon assets is independent of project itself, there is no need to confirm gain sharing. Initial outlay mainly happens to the implementation process of project. It doesn't need to think about initial outlay in the process of firm the carbon emission reduction value. In order to evaluate the cash flow correctly, it is necessary to make a reasonable prediction on the cost and earning in the whole project seniority. The development cost of carbon assets is relatively stead and it is easy to predict. While it is not easy to confirm the carbon earning and it is necessary to forecast CER price fluctuate in the project whole duration. Because international carbon trading price fluctuates much, CDM carbon emission reduction price, i.e. pCER price is hard to forecast. In order to assess CDM project carbon value reasonably, it is necessary to lucubrate the carbon price forecasting.

International carbon emission price

At preset, the European Union's emissions trading system (EUETS) takes 82.4% sum of business transaction in global carbon market and its transaction mainly based on the European climate exchange (ECX). ECX pushes out two standard trade categories: EUA and sCER, includes three contract: futures, option, prompt goods. Futures occupy the main body status because its detrusion time is long and transaction mechanism is completed. Although sCER and pCER are both the outcome of CDM, they are entirely different. sCER is guaranteed standard contract which has little risk while pCER is actual emission reduction department. Its price is the transaction both negotiated

pricing. Its contract is forward transaction and has much risk. Even it may be unable to deliver, sCER is the derivative product of pCER which don't newly increase emission reduction unit [14]. Figure 1 shows the price trend of international carbon market from 2008 to 2010. From it we can see: the price trend of international pCERs is basic the same with sCER and EUA while pCERs price is clearly low than carbon emission price in the second market. CDM carbon emission reduction main earnings are occupied by the developed countries.

Up to Sep 14th 2010, from the number of CERs which successfully register in EB, China is the biggest supply country which occupies 60.8% market share and outdistance other developing countries. Studying a more reasonable pricing method for CDM carbon value is significant to enhance the Chinese voice in the international pricing of carbon trading.

Figure 1. The price trade of international carbon market from 2008 to 2010.

MONTE CARLO SIMULATION ON PCER PRICE

Monte Carlo Simulation

Monte Carlo simulation is a computerization mathematical method which allow people to assess risk in quantitative analysis and decision-making. This method is widely used in many different fields such as finance, project management, energy, manufacture, insurance, petroleum and natural gas, transportation and environment. Monte Carlo simulation can offer a series of possible outcome and probability take any measures to decision maker. It explains all the possible consequence of the maximum likelihood decision, the soundest decision and compromise decision.

Monte Carlo simulation builds model for any element with inherent probabilistic possible outcome though replacing probability distribution, then carries out risk analysis. Use a group of different variate in the propagator to double count the result [15]. According to the number and scope of uncertainties specified for the random value, Monte Carlo simulation can carry out thousands of recount before accomplishment. So Monte Carlo simulation is able to generate the distribution of possible result value.

Though probability distribution, variable has different result of different probability. Probability distribution is a practical method to describe the uncertainties in risk analysis. In the process of Monte Carlo simulation, random selection on the value from initem probability distribution. Every sample is called once iteration and record the result the sample produce. Monte Carlo simulation can carry out hundreds or thousands this type of operation and the result is the probability distribution of possible result. This method can offer more comprehensive opinion on condition it may occur.

(1) The Theory of Monte Carlo Simulation

The basic thought of Monte Carlo simulation is: most pCER price actually come down to expectation discount from pCER to return periodic rate. If simulate the bidding pCER price various motion path as far as possible in risk and calculate the return mean value in every path result, then discount and final get the carbon value in whole period.

Long time pCER price expectation adopt time series and supply and demand prediction less but adopt Monte Carlo simulation to simulate the possible changing process of price. pCER price change model can be expressed by the wiener process and use this equation to describe the continuous fluctuate process of pCER price:

$$ds_t = \mu_t s_t d_t + \sigma_t s_t d_z$$

S_t means value in time t, d_z means normal random variable whose mean value is *0* and variance is d_t; μ means mean value when price changes; σ means standard deviation of price change rate. d_z is independent of before information and has random influence on price. From d_t we can know, the shorter the time interval, the smaller the variance and the smaller price changes. So the change of price is continuous decrease progressively with the shorten of time interval, vice versa.

(2) Application steps of Monte Carlo simulation

Assume the change of assets price submits to the random process of geometric brownian motion, there is:

$$dS_t = \mu_t S_t dt + \sigma_t S_t dy_t \qquad (2)$$

y_t meets standard brownian motion, then:

$$dy_t = z\sqrt{dt}$$

S_t means asset value in time t, z is the random variable meets standard normal distribution, parameter μ_t and σ_t mean instant drift rate and volatility. If we want to simulate the price change path of single asset, we first discretize formula(2):

$$\Delta S_t = S_t(\mu_t \Delta t + \sigma_t \varepsilon_t \sqrt{\Delta t}), \qquad (3)$$

$\Delta t = (T-t)/m$, t means present time, T means expiration time,m means the number of cutting simulated road, $\Delta S_t = S_{t+1} - S_t$, ε_t means random variable in standard normal distribution, so formula(3) can be rewrite:

$$S_{t+1} = S_t(1 + \mu_t \Delta t + \sigma_t \varepsilon_t \sqrt{\Delta t}), \qquad (4)$$

Give a value of asset in time t *St,* assess homologous parameter μ_t and σ_t , produce random sequence ε_t , $t = 1, 2, \cdots, m$, repeatedly substitute sequence into formula(4). Then we get the sequence path of price fluctuant S_{t+i}, $i = 1, 2, \cdots, m$. We finally get the asset possible value at time T: $S_T = S_{t+m}$. Repeat this process many times such as 10000 times, we can get 10000 possible value of asset or asset portfolio at time T, thus can get 10000 possible profit and loss.

pCER Price Trend Simulation

(1) Select pCER Earnings Pattern and Model Parameter

In a brownian motion model, price variance is a normal random variable which has two great defect: on one hand, according to this model, price may have negative value in theory, but in fact there are no negative value; on the other hand, no matter what the price starter is, price variance in the same time has the same normal distribution and it is apparently irrational. Geometric brownian motion model change price variance into change rage of price which can effectively avoid the defect use brownian motion to describe price behavior.

Choose 81 data from Jan 1st 2008 to Dec 9th 2009 and calculate its mean value (-0.00537) and volatility (0.072859) of historical yield. Substitute this mean value and volatility as the parameter of geometric brownian motion model into formula. Assume yield submit to normal distribution and this mean value and volatility is the mean value and volatility of normal distribution.

(2) Generate Random Number and Simulate pCER Price

Use matlab to generate 20 random number submit to standard normal distribution. Divide the duration into 20 section. Repeatedly substitute these 20 random number into the later formula. Apply geometric brownian motion model to simulate the next price. 10000 simulation can get 10000 simulated price at time T. The simulated price at time can be get by averaging these 10000 simulated data. The more times simulate, the result closer to the actual value. Its specific simulation process of the price trend is shown as follow:

$$S_{t+1} = S_t + S_t(\frac{\mu}{20}\Delta t + \frac{\sigma}{\sqrt{20}}\varepsilon_1\sqrt{\Delta t})$$

$$S_{t+2} = S_{t+1} + S_{t+1}(\frac{\mu}{20}\Delta t + \frac{\sigma}{\sqrt{20}}\varepsilon_2\sqrt{\Delta t})$$

$$S_{t+3} = S_{t+2} + S_{t+2}(\frac{\mu}{20}\Delta t + \frac{\sigma}{\sqrt{20}}\varepsilon_3\sqrt{\Delta t})$$

$$\vdots$$

$$S_{t+20} = S_{t+23} + S_{t+23}(\frac{\mu}{20}\Delta t + \frac{\sigma}{\sqrt{20}}\varepsilon_{23}\sqrt{\Delta t}) = F_T^1$$

(3) The Simulation Result of Model

The sample time is cut into two stages: historic stage and predict stage. The initial price is 10.25, it is the average price of pCER in Nov 23th 2009. Choose the price between Jan 1st 2008 to Nov 23th 2009 as the historic price and simulate the price from Jan 21th 2010 to Jan 21th 2012. Divide these time into 50 small time quantum and cyclic utilize the earlier stage data to simulate the next stage data and we can calculate 50 simulated data. Compare the simulated price to the actual price, the simulation result is shown as Figure 2.

Figure 2. pCER simulated price trend.

From the simulated price curve in Figure 2, the conclusion can be get: the simulated result can directly reflect the price entire trend. It means that the effect combined Monte Carlo simulation and geometric brownian motion model is reasonable.

Table 1. The result of pCER simulated price and actual price.

DATE	pCER price	Simulated price	DATE	pCER price	Simulated price
2010/1/21	10.2500	9.8500	2010/12/22	9.7750	9.9242
2010/2/3	7.3750	10.1092	2011/1/19	9.8000	9.7892
2010/2/17	9.2500	9.3642	2011/2/2	9.8000	9.7837
2010/3/3	9.1250	9.2115	2011/2/16	9.4500	9.1237
2010/3/17	9.1250	9.3225	2011/3/2	9.4500	9.7732
2010/3/31	9.1875	9.2205	2011/3/16	9.4500	9.6932
2010/4/14	9.1875	9.0750	2011/3/30	9.4500	9.9024
2010/4/28	9.1875	9.0750	2011/4/13	9.8000	9.9342

2010/5/12	9.5125	9.0750	2011/5/4	9.8000	9.4432
2010/5/27	9.5125	9.5323	2011/5/18	10.1375	10.3421
2010/6/9	9.5125	9.3214	2011/6/1	10.1375	9.5421
2010/6/23	9.5375	9.4926	2011/6/15	10.1375	10.3424
2010/7/7	9.6625	9.5572	2011/6/29	10.1375	10.2113
2010/7/21	9.6625	9.7162	2011/7/13	9.8000	10.3871
2010/8/3	9.6625	9.7832	2011/7/27	9.8000	9.3634
2010/8/18	9.6000	9.7648	2011/8/9	9.8000	9.2432
2010/9/1	9.6000	9.4371	2011/8/24	9.8000	9.9343
2010/9/15	10.0625	9.7837	2011/9/7	8.5750	9.3211
2010/9/29	10.1375	10.2310	2011/9/21	8.5750	9.0123
2010/10/13	10.1375	10.2723	2011/10/5	8.5750	8.3435
2010/10/27	10.1375	9.9823	2011/10/19	8.4500	8.4324
2010/11/10	10.1375	9.3824	2011/11/2	8.4500	8.2343
2010/11/24	10.1375	10.4739	2011/11/24	7.4500	8.2545
2010/12/8	9.7750	9.8232	2012/12/22	7.2875	7.6233
2010/12/22	9.7750	9.9242	2012/1/21	6.2500	7.1242

Jarque-Bera examination on simulated data

Jarque-Bera examination is used to verify the data whether submit to normal distribution statistic test.

$$JB = \frac{N}{6}[S^2 + \frac{1}{4}(K-3)^2]$$

N means sample size, S means sample skewness, K means kurtosis. The theory of Jarque-Bera examination is: under normal distribution, JB statistical magnitude gradually submit to χ^2 distribution whose freedom degree is 2. According to the theory of geometric brownian motion model, the simulated result submit to normal distribution. Have JB examination on simulated price, JB statistics critical value is 5.99 on 95% significance level. From Figure 3, the JB statistics is 1.367752 which is clearly less than critical value. The Skewness is negative but close to 0 and the Kurtosis is 2.943209 which is close to 3. Though the normal probability graph of simulated result, we can see the data is close to a straight line. Therefore, it is accessible that simulated price submit to normal distribution and the simulated result distribution reflect the reliability of simulation process.

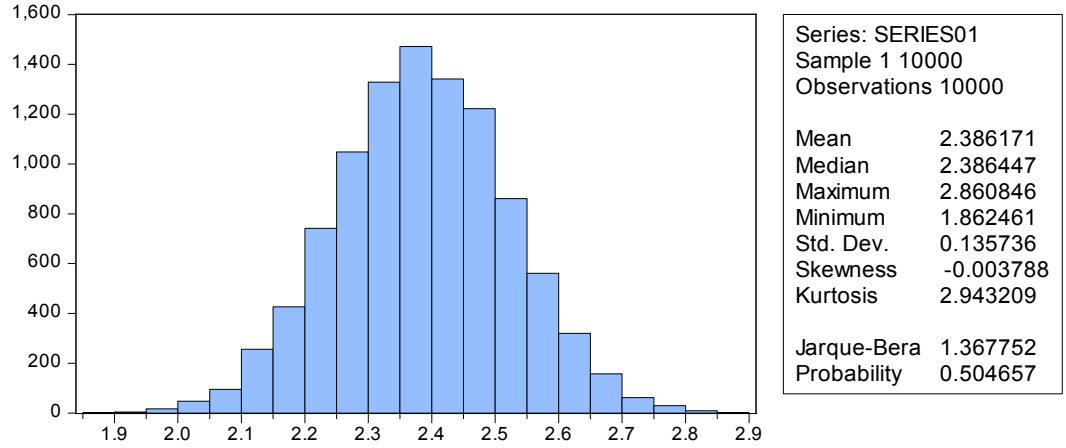

Figure 3. Jarque-Bera examination of simulated result.

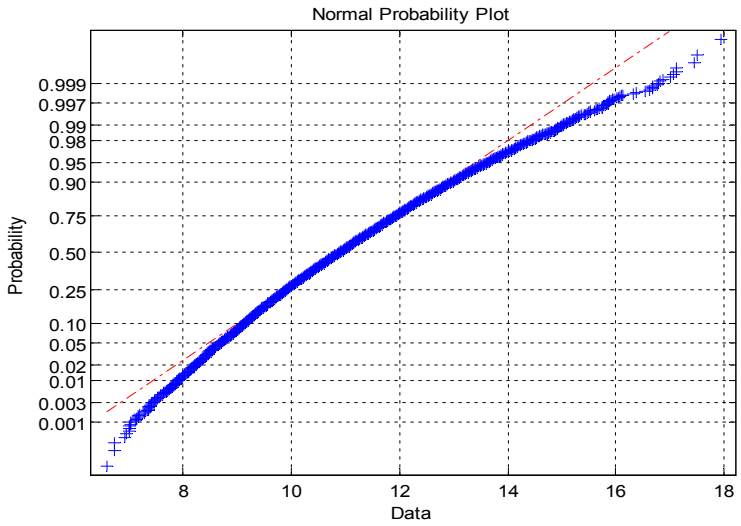

Figure 4. The normal probability distribution of simulated data.

CDM CARBON ASSETS VALUATION MODEL

Unilateral projects are different from bilateral CDM projects, which use to determine the buyer of further development and the buyer bear the transaction cost. Unilateral project are owners themselves bear pre-development cost and risk, then find a purchaser when the project is registered successfully. Therefore, the adoption of unilateral mode increases the autonomy on price reductions by project owners, but also helps purchaser avoid the risk reduction delivery, greatly increases the value of the project itself, at the same time inevitably have to bear the risks associated with project implementation and cost increases. In addition, under the unilateral mode, because CER price volatility exists, the project contains a lot of option value, we consider the necessary calculation of the option value items in the formula.

The above section is using Monte-Carlo simulation on the process of pCER price, using the above method can predict the pCER price for a given period, draw a series of forecasting prices P_1, P_2, P_3 ..... P_n. However, any method is not possible to accurately forecast the long-term price, combined the analysis on option value can improve forecasting accuracy value to some extent. Based on price forecasting of last section can further build value assessment model in different modes.

In addition to income side, we also need to consider carbon trading project costs F, including: EB management fees, CDM fees, CDM Treasury Fund fee (currently 2% of revenue extraction), DOE verification costs, project implementation consulting fees.

Unilateral mode

Project owner under unilateral mode mainly bears their own costs. It need to subtract the corresponding transaction costs from the incomes. Under unilateral mode, enterprises have a greater autonomous decision-making power, therefore, it is necessary to consider the option value.

Evaluation Model: $V_1 = \sum_{i=1}^{n} \frac{CF_i}{(1+r_i)} + u_i$

It quantifies the potential for growth in value based on option pricing model.

$$CF_i = P_i X_i - C(X_i)$$

$$P_i = \frac{F_i^1 + F_i^2 +, \cdots, + F_i^k}{k}$$

$$C(X_i) = 0.02 P_i X_i + C_1 + C_2 + C_3 + C_4$$

$$u_i = \begin{cases} 0, CF_i \geq 0 \\ P_0 N(d_1) - SN(d_2)e^{-\Delta tk}, CF_i \leq 0 \end{cases}$$

In the formula, CF_i is the net cash flow of carbon assets of the *i*-th; P_i is pCER price in the *i* year; X_i is CERs in *i* year; $C(X_i)$ is related transaction costs; $0.02P_iX_i$ is CDM fund fees; C_1 to C_4 are EB management fees, CDM fees, DOE verification fee and project consultancy; u_i is a simplified real Options item in value terms, use B-S model.

Bilateral Mode

In this mode, pCER price P_0 has been determined in the agreement, and the transaction costs is borne by the purchaser. v_i represents the value of the carbon assessment in project, i∈[1,n]. In addition, since the carbon market price fluctuations, when the breach of the benefits greater than the cost of default, it may have party defaults under bilateral mode, and this results in the cost of default C_0.

Evaluation Model: $V_2 = \sum_{i=1}^{n} \frac{CF_i}{(1+r_i)}$

Cash flow of each term:

$$CF_i = \begin{cases} P_iX_i - C_0, (P_iX_i - C_0) > P_0X_i \\ P_0X_i \\ P_iX_i + C_0, (P_iX_i - C_0) < P_0X_i \end{cases}$$

In the formula, three cases were: the seller defaults, normal transaction, the buyer defaults. CF_i is the net cash flow of carbon assets of the i-th; P_i is pCER price in the *i* year; X_i is CERs in *i* year; P_0 is agreed price; C_0 is cost of default.

CONCLUSION

The fierce fluctuation of international carbon emission reduction price has great influence on CDM project carbon value. Aim at the uncertainty of CDM project, this paper focused study the determination method on CDM carbon assets value.China is the biggest supply for international CDM carbon emission reduction, but most of CDM emission reduction earnings is occupied by the developed country purchaser. China is at the bottom of the carbon trading chain. China is lack of dominant right on actual pricing power of carbon emission and CDM project decision-making initiative right. The developed country purchaser use information asymmetry of different carbon emission trading market to realize arbitrage opportunity. Because they hold carbon emission spot goods to gain convenience earnings, they can get most economic earnings in carbon trading chain. This paper uses Monte Carlo simulation method to simulate the change and distribution for future carbon price and offers a better approach to confirm CDM carbon assets value. The application of pricing model in CDM assets pricing has offer beneficial mirror for Chinese CDM project to participate in enterprise price on carbon emission permit and domestic constraint rationing transaction enterprise to confirm quota carbon asset value. It is helpful to enhance Chinese voice in international carbon trading pricing, realize CDM carbon asset value maximization, promote the development of emission reduction in China.

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