A study on carbon reduction to prevent climate change by futures and options trading in ASEAN

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Abstract. This paper presents a conceptual study of ASEAN countries, explore the possibility of developing carbon trading futures and options market from an economic perspective. Owing to market-based complementarity and an invisible hand in the economic market to influence the market and the difference in the development level of ASEAN countries, the joint planning of carbon trading mechanism (carbon trading emission rights mechanism) has become a great trend in the future. The ASEAN countries are currently at a stage of high industrial development; it also brings many pollution problems. How to maintain economic stability and even growth without prejudice to the environment is one aspect of the hard work of scholars studying environmental protection and economists jointly. This paper sets a framework for a carbon trading mechanism to study what impact it will have on the market economy and the environment. It is hoped that this creative idea will be realized and benefited mankind and nature in the future.

1. Introduction

In recent years, the greenhouse effect has drawn the attention of most people. How to reduce carbon emission through financial management methods has become an important direction worthy of thinking in today's society. The right to emit carbon in the carbon trading system is classified as a tradable object and is traded on the open market. This kind of transaction is very similar to the model in which securities can be purchased and sold freely in the financial market. Therefore, companies can choose to buy carbon credits at the right time so that companies won't limit their own development because of the lack of carbon emission rights. This approach is considered feasible and has been implemented for some time.

In order to promote the cost-effectiveness of greenhouse gas emission reduction, the Kyoto Protocol has established three methods: emissions trading, joint emission reduction, and the Clean Development Mechanism. The joint emission reduction and Clean Development Mechanism are to promote the development of carbon emission reduction technology, while the emissions trading is the research focus in this study.

As mentioned above, the use of carbon emission rights as tradable targets on the open market is a practice similar to futures or options. The option system is a derivative of the financial market, that is, the enterprise can choose to purchase or sell a certain commodity at an agreed time in the future, and then the carbon emission right can also become an underlying asset of trade. The company can decide whether to exercise according to the situation at that time. This is a trading model that not only considers the company's own development but also better utilizes carbon emission rights to expand corporate profits. Carbon markets have the effect of putting a price on what was until very recently free and this change is likely to have financial consequences for firms in the longer term [1]. But it is believed that such a change is a trading mechanism that promotes the development of market effectiveness and greatly mitigates environmental deterioration.

ASEAN is an important economic system. The influence of ASEAN is growing. They are also facing the consequences of pollution brought about by economic development. Can the introduction of a carbon trading system really help them resolve the contradiction between protection and development? If this system is going to be built, what other parties are we paying attention to?

Therefore, this study makes a more in-depth discussion on this issue, and the content discussed includes the following:

1. Can the use of two types of trading, futures and options, contribute to a reduction in carbon emissions?
2. Is it feasible to promote carbon emissions trading systems like futures and options in ASEAN?
How to take measures for carbon emissions trading?

2. Literature review

2.1 Carbon trading system

Carbon trading lies at the centre of global climate policy and is projected to become one of the world's largest commodity markets. For the new term of carbon trading, many experts are studying how it works and why it fails outlines the limitations of an approach to tackling climate change which redefines the problem to fit the assumptions of neoliberal economics [2]. However, the EU's largest carbon market, the EU Emissions Trading System (EU ETS), has not been able to limit emissions. This over-emission situation has led to a growing greenhouse effect so that the carbon trading system is caused by the total amount of carbon emission control requirements after the greenhouse effect was aware [3]. The premise that a carbon trading system can exist is that the government sets a certain amount of total emissions. [4] The number of emissions from the enterprise must be determined by the company. At present, carbon trading has become an emerging industry that can be represented by carbon finance. Because of the demand for carbon trading, localities were established for carbon exchange. Many carbon exchanges have been established around the world, while the hottest regions are dominated by the European Union. Meanwhile, China is the second-largest region following the EU [5- 8]

2.2 Futures and Options

For the definition of futures and options, combined with the combination of financial terminology and carbon trading mechanisms. Futures are standardized, tradable contracts that are subject to certain mass products and financial assets. Under the mechanism of carbon trading, carbon emission rights are the underlying assets. Futures are commodities that are directly traded. It is a natural way to regard carbon emission rights as tradable goods. Unlike futures, an option is a right. It is the right to buy or sell a product at a specific price for a certain period of time in the future. If the company believes it has the need, it can purchase the option first and then sell it when the company finds it necessary futures and options provide a creative space for companies to think about when choosing a carbon emission control strategy.

2.3 ASEAN's carbon trading status

A recent study reveals that there is a lot of particulate matter to the atmosphere in Eastern Asia due to the carbon combustion which causes the carbon dioxide and fine particles emitted to the atmosphere[9] [10]. The ASEAN countries also fall into the category of developing countries, which have a large population and many various types of industry. Presumably, there should be a lot of space to develop, when it comes to the carbon emission reduction transaction. However, there are ten countries in this region, including Malaysia, Indonesia, Thailand, Philippines, Singapore, Brunei, Vietnam, Laos, Myanmar and Cambodia. These countries have different levels of industrial development and each has its own regulations. Therefore, when implementing carbon trading, to ensure the reliability of data is a point to think about.

3. Research methods

3.1 Feasibility study of carbon trading platform and its construction

Building a platform for carbon trading? It is the first step in promoting a carbon trading system. There are already many carbon exchanges operating around the world, so which trading system is better and should be evaluated in-depth. The main function of the carbon trading management platform is to develop trading rules and establish a trading and settlement system. At present, the global carbon trading market is roughly divided into two categories, including regulated markets and voluntary markets. Since we are building a carbon trading market that can drive the market to operate more efficiently, we must not only consider the different systems of ASEAN countries in the market but also establish a strict control system.

3.2 Annual trading volume analysis

The volume of transactions per year has a lot to do with the existence of carbon trading volume. The determination of trading volume is an important step. Excessive trading volume can't achieve the purpose of controlling carbon emissions. On the contrary, insignificant trading volume can't promote the effectiveness of the market or make the company's profit reach a considerable value. This trading model can be compared to the stock market, where the appropriate trading volume depends on the number of players willing to participate. Under the premise that the control environment does not deteriorate further, the more units involved, the greater the annual transaction volume generated, and the greater the opportunities for investors and enterprises to benefit from.

3.3 Possible areas of participation

Those areas that may be involved are important considerations for promoting carbon trading systems in the region. The carbon trading system must have an open and transparent monitoring mechanism, so it is very important to get support from the local government. Japan, South Korea, China and ASEAN countries all have their own legal systems, so countries that choose to implement carbon trading must abide by a unified carbon trading contract to facilitate international supervision and control.

3.4 Carbon trading and government management system

The premise of carbon trading is to prevent further deterioration of the global environment. Therefore, it is important to control the total volume of carbon trading. The government intervention is indispensable, which must be in control of the sources and emissions. Since carbon emissions are a commodity-like presence, the government needs to create a separate inventory of carbon emissions to record the location of carbon emissions trading. All trading volumes must also be reported to the competent authority and registered in the GHG emissions management account. There are criteria for a measurable and checkable system.

4. Results and discussion

4.1 Cost Effectiveness and Feasibility Analysis of Carbon Trading System

The emissions trading system is derived from the Coase theorem proposed by Coase in 1959 [11]. The theorem states that if the external environmental property rights can be defined and traded, and in the absence of transaction costs, the different users of the environment will negotiate the results by free negotiation to achieve efficient allocation of environmental resources. In other words, it will reach the realm of the most appropriate pollution reduction level in society.

The carbon trading system approves the emission of greenhouse gas emissions from emission sources through emission credits, thereby achieving the total control goal of national greenhouse gas emission. The Emissions Trading System determines carbon offsets through the carbon market, creating carbon reduction values and promoting greenhouse gas reduction activities.

Ronald Coase contributed in transaction costs and won the 1991 Nobel Prize in the original text of Coase Theorem is as follows:

If the trade-in an externality is possible and there are no transaction costs, bargaining will lead to an efficient outcome regardless of the initial allocation of property rights. In practice, obstacles to bargaining or poorly defined property rights can prevent.

The theorem points out that the above-mentioned social optimal pollution level has nothing to do with the allocation of emission rights. That is to say, whether the emission rights are distributed to polluters or distributed to the polluted person does not affect the most suitable allocation of social resources. And in the absence of transaction costs, different users of the environment negotiate freely, and the efficient allocation of environmental resources can be achieved. That is to reach the realm of the most appropriate pollution level in society. This is similar to the market for commodity trading. Regardless of the proportion of resource allocation in the market, it tends to be a vendor or a consumer. In the absence of external transaction costs, each entity in the market will maximize its own interests. At this time, the market will guide resources to the most effective aspects between supply and demand, according to the natural changes in prices, forming an "invisible hand."

However, in practice, the transaction cost of bargaining is high, and the definition of environmental property rights is not easy. This constitutes the core issue of the emissions trading system, including how to reduce transaction costs? And how to distribute emissions rights fairly and efficiently? The following section will analyze the operational mechanisms of typical emissions trading systems and their cost-effectiveness.

Because direct command and control have high implementation costs, and it is unable to increase the incentives for emissions sources. This is the main weakness of the direct control system. On the other hand, the “cost-effectiveness of the emissions trading system” has become the most relied upon policy tool for governments to respond to greenhouse gas emissions. The so-called “cost-effectiveness” refers to meeting the government's environmental goals at the lowest cost. The following diagram illustrates the concept of cost-effectiveness.

Assume that the government manages a total of 15 units of emission reductions. MC1 and MC2 represent the marginal control costs of the two manufacturers, as shown in Figure 1.

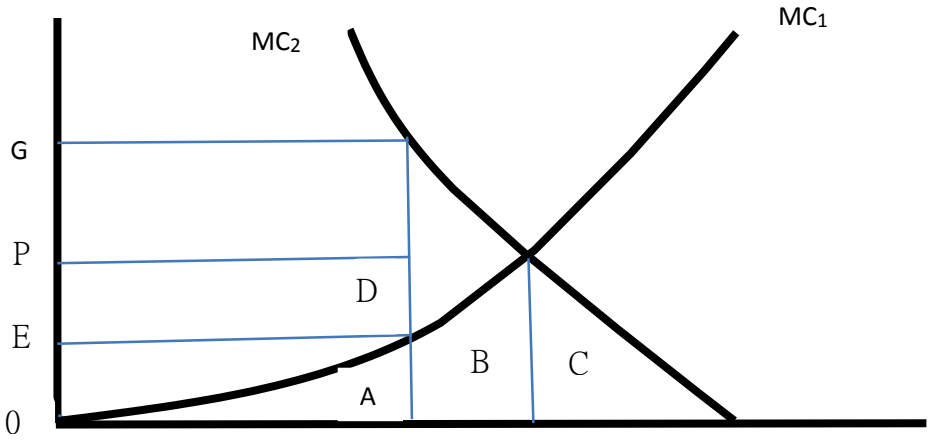

Figure 1. Emissions trading and cost-effectiveness [12]

Direct control
Vendor 1: Specify 7 units of emission reduction, 8 units of permitted emission, and the total control cost is the area of A.
Vendor 2: Designated 8 units of emission reduction, 7 units of permitted emission, and the total control cost is the area of B+C+D.

Under the direct control policy of the above two manufacturers, in order to achieve 15 units of emission reductions, the total control cost is the area of A+B+C+D.

Emissions trading system: Assume that the market emission rights are paid as P
Vendor 1: Specify 7 units of emission reduction, 8 units of permitted emission, and the total control cost is the area of A.
Vendor 2: Designated 8 units of emission reduction, 7 units of permitted emission, and the total control cost is the area of B+C+D.

Under the direct control policy of the above two manufacturers, in order to achieve 15 units of emission reductions, the total control cost is the area of A+B+C+D.

4.2 Whether carbon trading can promote emission reduction?
Carbon emission rights are like land ownership. When land can be traded freely, different land can be optimally utilized through the price mechanism. Similarly, how can companies with emission rights use this right to enable them to develop healthily? The higher cost of buying carbon credits and actually using control technology to reduce emissions will cause business operators to make different considerations. [13]

Many people questioned that carbon trading is just a scorpion. Can it really contribute to carbon reduction? From the company's perspective, when it conducts a pollution prevention plan, it will do internal cost analysis and choose the lowest cost and most efficient solution with the lowest cost. For example, a company is choosing between using high-efficiency pollution control technology, low-cost pollution prevention equipment, and directly paying a fine for pollution discharge as its pollution prevention plan. The first type has the highest cost and not necessarily all companies will adopt it. If the low-cost pollution prevention equipment cannot meet the regulatory requirements, and the fines for pollution discharge are far below the high-efficiency pollution control technology, not affecting the continuous operation of the enterprise, the enterprise will choose to pay the fine for pollution discharge

directly. After receiving the fine, the government can use this money to do other related pollution prevention efforts. From the perspective of the overall economic effect, it is conducive to environmental protection.

However, this method is not directly related to the effectiveness of pollution prevention and control. That is to say, although the company has paid a fine, the actual emissions continue to increase with the permission of the government. Therefore, this is a way to legally guarantee emissions through public power. It is necessary for us to think about how to make more reasonable emission reductions from the perspective of economics, and the carbon trading system is one of the feasible methods.

Under the carbon trading system, total carbon emissions are fixed amounts, while no enterprise is allowed to increase the emissions. To increase the emissions, the enterprise must prove that it has found the appropriate object located in the same area, transferring part of the number of emissions it has allowed this new source. This provides the opportunity for the company to choose an alternative amount of emission rights elsewhere if it is difficult and expensive to make emissions reductions in the newly expanded plant. Because in other places, the cost of performing the same amount of emission reduction is only half of that of the new plant, the company prefer to purchase the right directly under the comparative advantage.

In the case where the emission credits can be transferred, sources of low control costs will find it advantageous to increase emissions control. Conversely, sources controlling high-cost will find it more beneficial to buy emissions credits in the market. In this way, we can achieve cost-effective goals through the market trading system. In addition, the price of carbon trading will also affect the investment decisions of enterprises. Carbon emissions are closely related to the company's ability to operate. If the company does not have the assurance that can be discharged, it must change its investment plan, choosing a lower carbon process or changing the process of emissions disposal.

From the point of view of total control, emissions control through the carbon trading system can ensure that total emissions will not increase and meet the requirements of total greenhouse gas control. From the perspective of macroeconomics, the use of lower-cost control technology can achieve the purpose of pollution emission reduction and is also beneficial to the sustainable development of the economy. To what extent the effectiveness of this reduction mechanism can achieve depends on whether the designed carbon trading system can induce sufficient communication between enterprises and whether it can match the best mix to achieve a win-win result.

4.3 Image interpreting carbon trading can promote emission reduction and maximize corporate profits

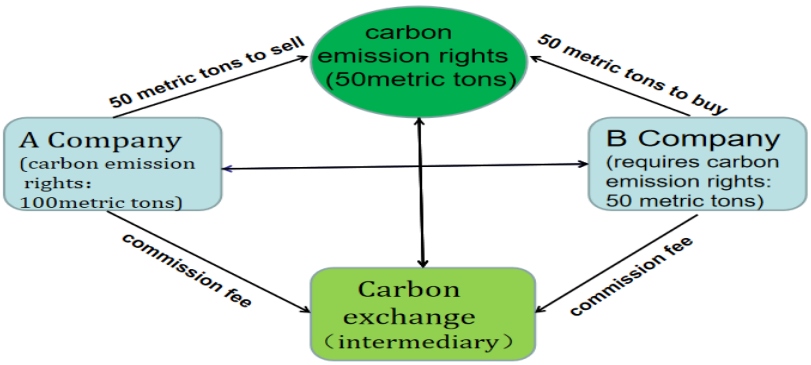

Figure 2. Flow chart of carbon exchange and price determination

A carbon exchange is an intermediary similar to a securities or options exchange. It is able to determine the size of the carbon trading volume through professional and environmental conditions. Suppose there are two companies in the market, A and B, both of which need to emit carbon for their production or operation. We all know that the market cannot guarantee absolute fairness, and the market cannot fully distribute resources fairly. If an A company initially had 100 metric tons of carbon emission rights, and

Company B did not have carbon emission rights, then Company A and Company B had reached a consensus: Company A sold carbon emission rights to Company B 50 metric tons. Then A has 50 metric tons of carbon emission rights and costs of selling carbon emissions to B. Company B has 50 metric tons of carbon emission rights (both A and B companies need to pay commissions to carbon exchanges. Company A can use sales carbon credits) The cost of the amount to reset or buy high-tech equipment to reduce pollution. B will also get the right carbon emissions, company B to obtain this from the difficult carbon emission rights and then use more environmentally friendly pollution-reducing equipment to produce. This has achieved our original goal: to ensure the goal of reducing carbon emission rights and to meet the conditions of ensuring corporate profits while maintaining the balance between supply and demand of products in the market.

4.4 Carbon emission reductions in ASEAN countries

Most of the countries in Southeast Asia are developing countries, but the market for Clean Development Mechanism (CDM) is very competitive. Developing countries can provide a large amount of emission reduction credits and are therefore playing the indispensable roles in carbon trading. Only some countries need to comply with the total emission control under the Kyoto Protocol. Meanwhile, the total emissions of the three major emitters (US, China, and the European Union) account for only 52% of the total carbon emissions. Therefore, in order to achieve further reductions in greenhouse gases, it is necessary to include total control in developing countries. The current situation is that developing countries can participate in transactions as well, but they do not have to bear the responsibility for reduction.

Some people will doubt that it makes no sense for these non-binding countries in ASEAN to participate in carbon trading, mostly because carbon trading is relatively difficult as these countries have not yet established a baseline and verification system. But from another perspective, these countries have a deductible amount to buy and sell, so they must follow internationally recognized regulations to ensure the benefits they can receive from emissions trading in order to ensure the profitability of their reductions. Therefore, how to establish the baseline and emission certification mechanism is the primary issue for ASEAN countries to establish a carbon emissions trading system.

4.5 Mathematical derivation

Suppose that *P* is the *production quantity*, *E* the *carbon efficiency*, and *B* the ratio of the two, which is the output of carbon emissions per unit (usually one unit is one metric ton), this output can usually be applied to measure the country's Gross national product (GDP) in the field of economics. We define *B* as *carbon efficiency*. Generally speaking, we can use the value of *B* to measure the efficiency of a company's carbon emissions. The higher the value, the higher the efficiency.

$$B = \frac{P}{E} \tag{1}$$

Based on Equation 1, we searched the professional data network, collected the national GDP data and carbon emissions in 2017 (the latest data update), calculated the *carbon base*, and found the corresponding law. The results are tabulated as follows.

Table 1. The Carbon Efficiency in the ASEAN countries

	GDP [14](US$:Billion)	CO_2Emission [15](MtCO2)	$B = P/E$
Thailand	455.276	331	1.375
Malaysia	314.707	255	1.234
Vietnam	223.78	199	1.125
Myanmar	66.719	25	2.669
Indonesia	1,015	487	2.084
Philippine	313.62	128	2.450
Singapore	338.406	65	5.206
China	12,143	9,839	1.234

4.6 Indicator use

According to Table 1, Singapore has the highest emission efficiency (5.206) in carbon emissions, while China and other Southeast Asian countries are relatively inefficient (ranging from 1.125 to 2.669), showing lots of room to improve for these countries.

One of the purposes for introducing the carbon efficiency is to monitor the efficiency of carbon emissions after using the carbon trading system in a wide range in the future, and as an auxiliary indicator to assess environmental improvement. Another purpose is to develop a standard emission base internationally. This data is used as a standard. Countries below this standard will pay a fine every year to the international environmental supervision department as a warning. After receiving the fine, the relevant departments need to use the funds to carry out national carbon emission planning, or to help countries with relatively low emission bases to carry out industrial upgrading, forming a profit cycle to achieve the sustainable development of emission reduction and environmental protection.

5. Conclusions

The carbon finance market is the best policy tool to improve the cost-effectiveness of greenhouse gas reductions. The economies of ASEAN countries are catching up. At the same time as their economic developments, it is possible and always important to pay attention to environmental protection. Therefore, we introduce in this work a carbon trading system, which enables participating companies to perform environmental protection work with economic incentives.

This study discusses several main questions, including whether the use of futures and options can lead to a reduction in carbon emissions; and whether it is feasible to promote carbon emissions trading systems for futures and options in ASEAN. We also suggest the way to properly implement and efficiently operate a carbon trading system, providing the benchmark utilized to measure operational efficiency. Since ASEAN countries are now becoming closer to each other, it is expected to combine all of them together, forming a regional trading center based on their complementary geographical location and conditions.

As a means of trading, futures and options can easily achieve the goal of using carbon emission rights to reduce carbon emissions. Although there is a certain degree of uncertainty in this approach, its development space is worth considering compared to this uncertainty.

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