

A new method to reduce the emissions of greenhouse gases

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Abstract

Market prices can serve as efficient information carriers of resource costs in complex economic systems. However, a necessary condition for long-term sustainability is that the cost of externalities are internalized in the economy.

With prices including sufficiently high fees on emissions of, for example, greenhouse gases it is possible to achieve a control function in the economy which can reduce the emissions of greenhouse gases to a long-term sustainable level.

In this paper a method to 'reveal' the cost for reducing environmental pollutant emissions and to distribute the emissions reduction so that societal cost efficiency is achieved not only spatially but also temporally.

The method can be applied nationally as well as internationally. For obvious reasons the best result is achieved if the method is applied globally.

The method has the advantage that the long proven and efficient system of the Swedish CO₂-fee can be retained and further developed. The method may serve as a complement to the European Emissions Trading Scheme for the sectors outside the trade system.

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1 Introduction

1. In most cases it is difficult to evaluate the long-term societal economic costs which have been and which will be caused by pollutant emissions. The fact that the alternative costs for the pollutant emissions also vary both in time and in space makes the evaluation extremely uncertain. Uncertainty about real costs and the lack of concrete prices will in turn cause uncertainty in economic decisions. The result is that vital, long-term sustainable, investments are withheld or become severely delayed due to lack of incentive.

2. However, there exists a simple and general principle for the evaluation of a 'clean environment'. The principle is to let the average alternative cost to avoid pollutant emissions determine a fee which is charged on the emissions.

3. A fee on emissions, which reflects the average cost of emissions reduction, will give firms, with higher abatement costs than the average, a time span, in other words an opportunity to a well planned adjustment or liquidation to the smallest possible cost and capital destruction, and firms with lower abatement costs than the average, a sufficient incentive to reduce their emissions.

4. This means that the 'practically impossible' task of evaluating the total societal cost of millions of individual emissions, can be reduced to the 'manageable' task of finding the average cost of emissions reduction.

5. The simplified task to find the average cost can be solved by the use of an efficient and well proven instrument – a futures market.

2 A new market economic method

1. Here a new market economic method to internalize costs is described.
2. If the emission fee for a certain substance is much higher than the cost of emissions reduction this will of course result in a swift reduction of the emissions of this substance, which could be very beneficial for the environment, but there is a risk that the environmental improvement is accompanied by a societal economic loss which is greater than the environmental gain. This could happen through capital destruction due to an premature shut-down and scrapping of well functioning plants, machinery, processes, etc.
3. On the other hand, if the fee is much lower than the cost of emissions reduction the emissions will continue which could result in even higher societal economic costs.
4. Somewhere in between these extremities there is an emissions level which is the optimum for the achievement of economic efficiency in the development towards a long-term sustainable system.
5. From the reasoning above the conclusion is that the needed emission fee for societal cost efficiency can be expected to be strongly correlated to the average cost of emissions abatement.
6. A futures market is primarily a price and cost insurance market and as such it elicits a price and cost revealing behavior of the actors. Therefore it is feasible to utilize a futures market to find the wanted optimal level of the emission fee.
7. The trade in emission futures contract on an Emissions Fee Futures Market can function according to the same principles as the trade in futures contract on a Commodities Futures Market. This form of trade has proven to be able to provide good liquidity and low transaction costs – essential conditions for efficient resource allocation. The rules

and regulations since long established on the futures markets can be directly applied on the Emissions Fee Futures Market.

8. When an Emissions Fee Futures Market has been established firms and individual actors can include the known future cost of emissions in their budgets and without unnecessary risk taking invest in long-term emissions reducing measures. Their individual actions on the emissions futures market will reveal the average cost of emissions abatement.

9. The following terms are valid for the emissions fee futures contract:

A. The Futures Contract is a binding agreement between buyer and seller about the delivery of the emissions fee, for the stated amount, for the stated substance, for the stated time period, to a determined price – the price of the futures contract at the time of the agreement. B. Delivery is meant a simple clearing procedure on the day when the contract expires.

10. By utilizing the two, above stated, conditions for the futures contracts, the buyer and the seller can trade the cost of future emission fees.

11. From a trade technical aspect the emission fee futures contracts are identical to 'common' futures contracts of the same type as are traded on the commodities market COMEX in New York. Emissions fee options, that is options on emission fee futures are in all aspects identical to 'common' options.

12. Those actors finding it cheaper to reduce their emissions than to pay the current future emission fee (the price of the contract on the market), will be willing to sell contracts to reduce their risk. Those finding it cheaper to pay the emission fee will be willing to buy contracts for the same reason. Of course there is also room for speculators whose activities, for the most part, can reduce fundamental errors in the pricing of the contracts. Since the emission fees, in a

suggested scenario, has to be paid to the IRS every month the necessary basic conditions for a functioning futures market are fulfilled.

13. On the expiry date the contracts are cleared between sellers and buyers based on the difference of the contracted price and the expiry price.

14. During each emission fee period all registered firms pay the emission fee determined by the market on the expiry date. This principle is general and valid irrespective of the actions of firms and other actors on the market and independent of the number of contracts bought or sold. The advantage of this is that the present Swedish rules and regulations concerning the CO₂ emission fee on fossil fuels can be continued without any change.

15. The function of the emission fee futures market is to provide a sufficient number of contracts for a certain time period to enable an actor, whom so desires, to freeze the cost, at the current cost for the emissions fee futures contract, for emissions during the same time period. Although the final, and different, emission fee, for the time period is paid, the trade on the futures market will generate a gain or a loss exactly covering the difference in the emission fee cost.

16. The opportunity to freeze future costs for emissions, through trade on the emission fee futures market, can create an investment climate favoring long-term environmentally compatible investments.

17. A closer analysis of figure 1, showing a hypothetical distribution of the population as a function of the amount of emissions per individual, reveals that circa two thirds of the population in Sweden would benefit from a CO₂-fee which was repaid in equal shares to all, since there are a greater number of individuals with emissions below than above the average amount of emissions per person. Another way of expressing the same thing is to state that there are always, in all emissions distributions, a tail stretching upwards in the amount per individual. A

tail moving the average amount of emissions upward since there is a lower bound at zero emissions.

18. In some developing countries the resource and emissions distribution is so uneven that more than four fifths of the population would benefit from a CO₂-fee if the income from the fee was repaid in equal shares to all. Such a redistribution will favor those with little resources, who through the redistribution will gain access to more resources and greater purchasing power. This redistribution is societally beneficial. Although those with an abundance of resources are disfavored they have both the freedom and the means to change their consumption pattern so that they also become favored. Of course this is exactly this change in the consumption pattern which is the whole point of introducing emission fees.

19. The fact that such a redistribution of emission fees will always favor the majority of the population will of course simplify the introduction of sufficiently high emission fees by democratic means.

20. Observe that fully repaid emission fees are budget neutral.

3 Standardized emission fee futures contracts

An example of information in a standardized emission fee futures contract:

1. Underlying asset:

The emission fee for the specified substance, in the specified amount, during the specified time period.

2. Substance: Carbon dioxide, CO₂

3. Amount: 1000 kg

4. Fee time period: Month of May 2012

5. Date of expiry: Last trading day in April 2012

6. Conditions:

A. The futures contract is a binding agreement between the buyer and the seller where the seller is bound to deliver the underlying asset to the agreed price at the expiry date.

B. With a delivery is here meant a clearing operation on the expiry date of the futures contract.

4 The level of the emission fee

1. An important aspect for the balance on the emissions fee futures market is that it is profitable to sell contracts when the alternative cost to reduce the emissions is lower than the price on the market and to buy contracts when the alternative cost is higher than the market price.
2. Without the opportunity to secure the emission abating investments, firms investing in new and cleaner technology or alternative measures risk being out-competed by more speculative firms which do not invest and therefore have an advantage in the form of lower costs in case the level of the emission fee falls. The opportunity for firms and private persons to insure against price changes in the emissions fee, and to be able to invest and secure their investment, is conducive to a societally cost effective resource allocation.
3. The potential sellers of contracts have emissions whose abatement cost is lower than the emission fee and the potential buyers of contracts have emissions whose abatement cost is higher than the emission fee.
4. These two complementary strategies among the actors on the market contributes in the price of the emission fee futures contracts being controlled, although with fluctuations, towards the average cost of emission reduction.
5. Figure 2 shows a hypothetical distribution of the emissions of CO₂ in Sweden versus the alternative cost of emissions reduction. Since the area of the 'wide' bars is proportional to the amount of emissions there is a balance, between the amount supplied and the amount demanded, around the 'narrow' bar showing an accumulated amount of 50 percent.
6. Since the emission fees affect the whole population it is self-evident that the opportunity to trade on the Emission Fee Futures Market is open to all actors. It should be possible even for individuals to make

private investments without taking unnecessary risks when the price on the market makes that profitable.

7. An example: It is wise to invest in a heat pump to reduce the use of fossil fuel in a heating system of a house, if the emissions fee is so high that this is profitable. At the same time this would be a risk if there were no opportunity to sell emission fee contracts on the market covering the amount of the emissions reduction from the investment.

8. The emissions fee futures contracts give firms and other actors the possibility to insure against fluctuations in the price of the emission fee.

9. It is the distribution of costs and risk between actors with different conditions, through a trade in futures contracts, which control the level of the emission fee in the direction towards the optimum in the economy. It is this cost-revealing' market function which is the primary argument for an emission fee futures market.

10. An emission fee futures market can just as a commodities futures market function even without speculation and exclusively with actors trading only for the purpose of hedging against price changes. However, some degree of speculative trading can be beneficial for the liquidity of the market.

5 Beneficial effects from trading on the emissions futures market

1. Apart from the fact that the emissions of environmentally harmful substances will successively be reduced, when emissions reductions, to a cost lower than the emissions fee, becomes profitable, the market also has other beneficial effects.
2. The emission fee futures market will reflect the cost for firms to reduce their emissions but the market will also elicit and be affected by analyses of the economic influence of the emission fee on firms and on society.
3. The emission fees will have to fluctuate, in order to make it possible for the fees to reflect the different and varying costs of the actors and the information about the environmental effects of the emissions which is available and which is constantly changing, deepened and refined.
4. The emission fee futures market will just like a commodities futures market, be exposed to false information. This is necessary in order to maintain the ability of the actors to critical analysis and evaluation of the information which is of relevance for the price of the emission fee. A 'sterilized' flow of information, free from all misleading information may have a devastating effect on the 'immune system' of the market against disinformation and harmful speculation.
5. With a functioning emissions fee market it will become profitable to invest in research, both wide and deep, resulting in new knowledge which of course will have an influence on the market. This is desirable since the information about and the knowledge about real effects on the environment are the basis for efficient decisions.
6. It is not only research about the environmental effects of emissions which will be stimulated by an emissions fee futures market but also the research and development of new technologies for emissions reduction and for alternative production methods. This information

and development will emerge without the need for lengthy political debate and slow moving bureaucracy.

7. An emissions futures market of the type proposed in this paper can be interpreted as a new form of market – it is an immaterial market. And as such it has the potential to internalize harmful externalities and to harmonize private interest with common long term interest and micro-economic actions with macroeconomic action.

8. The positive potential of this new market can hardly be overstated. It will in addition relieve the politicians from the democratically impossible task of making the unpopular decisions needed regarding the environmental problems threatening the existence of millions of people.

9. If the thought of a market control of the price of emissions cannot yet be accepted by the decision makers and the population the emission fee can be set by political decree for as long as is needed. In such a situation an emissions fee futures market will emerge spontaneously and it may serve as an instrument showing the expectation of the direction of the price of emissions.

10. Most of the beneficial societal effects accompanying an emissions fee futures market of the proposed type will still be present even if compromise solution is preferred for some time.

6 Questions and answers

1. The emissions fee market is based on simple market economic principles but since it is also based on a certain amount of new knowledge there are some objections and questions:
2. **Question 1:** A functioning market requires that all who are affected by the market must be able to affect the market price by showing their preferences. How can that happen on the emission futures market?
3. **Answer 1:** The claim and the question are based on a misunderstanding about the way a market functions. In the claim there is a implicit demand that the actors should be able to affect or control the price according to their desires and preferences. For example by choosing to act as buyers with the intention to raise the price.
4. The price of emissions ought not and should not be controlled in such a way since that would mean a totally speculation controlled market. This would violate the basic principles of a free market where supply and demand are controlled by real costs.
5. It is not the desires of the actors to control or to influence the market which should be the basic price controlling principle on a free market but instead individual decisions about buying or selling based on cost analysis of alternatives.
6. To a hedger on the market a simple straightforward analysis of the required number of contracts to buy or sell in order to hedge against risk is sufficient.
7. For a trader the conditions are different and without sufficient knowledge and competence about fundamental price-driving factors the trade will become a loser on the market in the long run.
8. The commodities markets do function although only a small minority of the population are active on those markets. Most people live their life completely unaware of the price movements on the

commodities markets. Moreover the size of contracts are mostly too large for small scale private hedging. Despite this fact resources are distributed efficiently as a result of the all pervading price signals in a market economy.

9. Of course, it is also possible to make the size of the contracts on the emissions fee market so large that they are beyond the reach of the majority of the population as is the case on the commodities markets. But since the emissions fees will have a substantial influence on the economy of individuals in the future it could be motivated to make the size of the contracts relatively small.

10. Nobody has to be forced to make deeper economic analyses in a market economy to make rational decisions as long as there are price signals.

11. **Question 2:** Who is going to determine the price of the emission fee futures contracts and who is going to determine the total amount of emissions and the rate of the emissions reduction?

12. **Answer 2:** This question is based on a misunderstanding about the nature of the emissions fee futures market. Who determines the total amount of a certain goods and who determines the price on the same goods? It is best to let supply and demand determine that. Experience shows that large scale planned economies have suffered from severe inefficiency problems and negative side effects.

13. On the emissions fee futures market the supply and demand will determine the price. This price will affect the total amount of emissions, the distribution of emissions and the rate of emissions reduction.

14. Since the future is unknown an emissions fee futures market, where the price is allowed to fluctuate freely and where the price of the contracts determine a fee on the emissions, which has to be paid by law, will elicit a behavior of the actors which indirectly show (an

average of) their individual cost for emissions reduction through their decisions to buy or sell emissions fee futures contracts.

15. The societally optimal emission fee will be found somewhere around the average cost of emissions reduction and the actions of the actors will control the price towards this level.

16. The price on the market can be interpreted as a weighted average of all available, relevant, varying and often uncertain information. It may at first sight be difficult to accept such an imprecise decision making with such a imperfect system. However, nobody has so far been able to prove that there exist a more efficient system of evaluation and pricing. Even the most respected experts may differ in their opinion.

17. The new method described here can also be utilized to radically improve the functioning of many markets such as the stock market and the real estate market. Markets which time and time again are afflicted by a herd behavior of the actors. In practice the method is applied by introducing a fee on the act of buying and where the fee is paid by the buyer directly to the seller. This will create a new market with the objective of analyzing and evaluating the primary market.

18. **Question 3:** Is it compulsory for all firms with pollutant emissions to buy emission fee futures contract covering the full amount of their emissions?

19. **Answer 3:** No the emissions fee futures market is open for all actors but it would be extremely expensive and inefficient to measure the emissions from all individual sources. The most efficient solution is to keep track of fossil carbon by utilizing the Swedish 'upstream system' where all firms importing (or extracting) fuels containing fossil carbon are registered. But even though all those firms are required by law to pay a CO2 fee directly in proportion to the amount of fossil carbon sold they will be free to choose if they wish to hedge or trade on the emissions fee futures market.

20. **Question 4:** What prevents firms and other actors to push down the market price by selling an arbitrarily large number of contracts when the requirement of delivery at the expiry date is not present?

21. **Answer 4:** The counteracting forces against unlimited speculation are:

1. The real cost of reducing emissions.
2. The margin always required from the actors and which is proportional to the number of contracts sold. This margin cost is strongly coupled to the real cost of emissions reduction – a powerful brake against speculative dumping of the market price through large scale selling.
3. The leverage increasing without limit to the advantage of the buyer when the market price of contracts approaches zero since the buyer can never lose more than the total price paid for the contracts. The potential loss for the seller on the other hand has no upper limit when the market price of contracts are rising.
4. The continuous elimination of bankrupt speculators.
5. The speculation which over time eliminates all observable systematic price fluctuations and all trends not depending on real fundamental costs.
6. The accumulating collective knowledge and experience of the actors.
7. The free flow of information which, of course, also can contain the information about counter forces mentioned here.

22. There is no fundamental difference between the Emissions Fee Futures Market and a Commodities Futures Market. Note that the cash (margin) deposit always required when selling a futures contract will set an absolute upper limit for the maximum number of contracts that can be sold since the total amount of financial capital is limited.

23. Practically all functions on the Emissions Fee Futures Market are also present on a Commodities Futures Market and practically all objections and questions arising on the subject can be answered by reference to the general rules for futures markets.

24. **Question 5:** What prevents the market to be influenced by rumors, false information, etc?

25. **Answer 5:** Nothing. It is inadvisable and in a long-term perspective harmful to 'protect' the market against disinformation. What is needed is information about the risks coupled to speculation and about the value and the necessity of competent and critical analysis of all market influencing information. In this respect there is no difference between the Emissions Fee Futures Market and an 'ordinary' Futures Market.

26. **Question 6:** Is it advisable to repay the emission fees to the firms?

27. **Answer 6:** It is fundamentally difficult to repay the emission fees due to the difficulty to find an objective principle for such a repayment. Also there is no natural law requiring the income from emission fees to be returned to sectors from which this income has been extracted.

28. There is a long-term sustainable principle for the evaluation of product utility. This is the decisions by the consumers to buy or not to buy of those products on a free market. Note that this principle, indirectly, results in a repayment of the emission fees to the firms on the condition that their products really are desirable. A conclusion can be drawn that the repayment of the emission fees should be made to the consumers and preferably in equal shares to every individual.

29. Of course, the incomes from emission fees can also be used, in full or in part to reduce taxes on income from labor.

30. **Question 7:** Won't the trade on the Emissions Fee Futures Market stop when all the firms have made their hedges to eliminate their risks?

31. **Answer 7:** The risk that the trade on the Emissions Fee Futures Market should stop is no more present than the risk that a share on the stock market will not be traded once it has been emitted by a firm or the risk that the trade on a commodities futures market should stop. There will always be a market for hedging of risk irrespective if the risk is coupled to investments or the cost of emissions.

32. **Question 8:** Won't the market pricing of pollutant emissions become faulty when the price on the Emissions Fee Futures Market does not have a direct coupling to the real cost for the environmental damage due to the pollutant emissions?

33. **Answer 8:** No, the Emissions Fee Futures Market does not exist to put a price on the environmental damage caused by pollutant emissions. The Emissions Fee Futures Market is meant to put a price on the pollutant emissions so that the underlying causes to the damage can be eliminated in a societally cost efficient way.

34. The environmental problems do not exist only because our knowledge about the harmful effect are insufficient or because there is a lack of technical means to reduce the emissions. We already know that immediate measures need to be taken. What has been lacking are democratically viable efficient methods with sufficiently strong economic control signals making effective emissions reduction sufficiently profitable.

35. **Question 9:** Don't emission fees become far too expensive if the required reduction of emissions is to be achieved? Isn't it better to use a Cap and Trade system to achieve the required reduction of the emissions?

36. **Answer 9:** The question is based on a misunderstanding. If the differences in transaction costs and political challenges are ignored the cost to achieve a certain reduction with trade permits is the same as with an emission fee. The total cost of the emission fees is exactly the

same as the total cost of the trade permits at a certain total amount of emissions. For a firm in the system it is economically equivalent if an emission fee is paid or if an emission permit is paid for a certain amount of emissions.

37. However, the differences in transaction costs and the challenge of political implementation clearly favors the emissions fee method.

38. In Sweden the efficient and well proven system with a CO₂-fee can, with advantage, be retained and improved by allowing more frequent adjustments of the fee.