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New institutional framework for global climate change prevention: A fossil fuel firm's perspective in light of a theory of the global commons

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Purpose. This conceptual paper takes the firms' perspective about practical implications of the theory of the global commons. Global commons are the areas and resources defined as those being beyond national jurisdictions. Their governance, today, however, is still coordinated largely by national states.

Design/Method/Approach. This paper introduces a firm's perspective based on the global commons approach.

Findings. At present, companies deal with national governments concerning their emissions and, perhaps, the international emissions trading scheme. Theory argues about the need to shift the responsibility from the national to global governmental levels, i. e. the United Nations.

Theoretical implications. Given the input orientation put forward by this approach, companies – except fossil fuel extractors – would not actually have to deal with any governmental or regulatory bodies but can focus their capabilities on what they are best at: serving the needs of their customers. Fossil fuel extracting companies, in order to sell these fossil fuels, will have to purchase the amount of emission rights *before* they sell the fuel into the economic cycle. This approach establishes an economic incentive for companies to employ technologies with low or zero fossil fuel consumption while making the transition path predictable. The underlying concept, therefore, can also be referred to as an *immissions scheme* (from Latin *immissio*, "to let in").

Originality/Value. Governing a global common through national structures is inappropriate and does not reflect the nature of the underlying resource. This paper proposes a solution to the problem of global climate change.

Further research. Further research is needed to address the effect of this strategy on different industries, and how those are affected based on the degree to which they employ fossil fuels.

Paper type – conceptual.

Keywords: entrepreneurship; climate change; corporate governance; sustainable management; global economic policy.

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Нова інституціональна модель попередження глобальної зміни клімату: точка зору фірм, що пропонують викопне паливо, в світлі теорії загального надбання людства

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Мета дослідження – оглянути точку зору фірм, що пропонують викопне паливо, на теорію загального надбання людства (theory of global commons). Спільне надбання людства охоплює сфери і ресурси, що виходять за рамки національних юрисдикцій. Тим не менш, на даний момент їх управління здійснюється національними державами.

Дизайн/Метод/Підхід. В данній статті запропоновано підхід до загального надбання людства з точки зору фірм.

Результат: На сьогоднішній день компанії взаємодіють з національними державами щодо емісії вуглекислого газу і, ймовірно, міжнародних схем торгівлі квотами на емісію. Розглянута теорія пропонує перенести відповідальність національного рівня на міжнародний рівень управління, тобто на Організацію Об'єднаних Націй.

Теоретичне значення дослідження: При зміщенні механізму контролю в бік палива, що надходить в економіку, більшість компаній (крім видобувних компаній) зможуть сконцентруватися на тому, на чому вони і повинні концентруватися – на задоволенні потреб своїх клієнтів. Компанії ж, що видобувають викопне паливо, будуть зобов'язані купувати права на емісію палива до того, як це паливо потрапить в економічний цикл. Даний підхід створить економічний стимул для компаній застосовувати технології з низьким або нульовим рівнем споживання викопного палива і дозволить зробити перехід від викопного палива легко планованим. Таким чином, запропонований механізм може називатися іммісійною схемою (від латинського *immissio*, "впускати").

Оригінальність/Цінність: Управління спільним надбанням людства на рівні національних держав є мало прийнятним, а також не відображає природу використовуваних ресурсів. Дана стаття пропонує одне з рішень проблеми глобальної зміни клімату.

Перспективи подальших досліджень. Буде потрібно дослідження застосованості даної схеми до різних видів промисловості, а також у прив'язці до різних типів викопного палива.

Тип статті – теоретична.

Ключові слова: підприємництво; зміна клімату; корпоративне управління; стале управління; глобальна економічна політика.

Новая институциональная модель предупреждения глобального изменения климата: точка зрения фирм, предлагающих ископаемое топливо, в свете теории общего достояния человечества

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Цель исследования – рассмотреть точку зрения фирм, предлагающих ископаемое топливо, на теорию общего достояния человечества (theory of global commons). Общее достояние человечества охватывает сферы и ресурсы, выходящие за рамки национальных юрисдикций. Тем не менее, их управление осуществляется на данный момент национальными государствами.

Дизайн/Метод/Подход. В данной статье предложен подход к общему достоянию человечества с точки зрения фирм.

Результат: На сегодняшний день компании взаимодействуют с национальными государствами касательно их эмиссии и, вероятно, международных схем торговли квотами на эмиссию. Развиваемая теория предлагает перенести ответственность национального уровня на международный уровень управления, то есть на Организацию Объединенных Наций.

Теоретическое значение исследования: При смещении механизма контроля в сторону топлива, поступающего в экономику, большинство компаний (кроме добывающих компаний) смогут сконцентрироваться на том, на чем они и должны концентрироваться – на удовлетворении потребностей своих клиентов. Компании же, добывающие ископаемое топливо, будут обязаны приобретать права на эмиссию топлива *до* того, как это топливо попадет в экономический цикл. Данный подход создаст экономический стимул *для* компаний применять технологии с низким или нулевым уровнем потребления ископаемого топлива и позволит сделать переход от ископаемого топлива легко планируемым. Таким образом, предлагаемый механизм может называться *иммисионной схемой* (от латинского *immissio*, "впускать").

Оригинальность/Ценность. Управление общим достоянием человечества на уровне национальных государств является мало применимым, а также не отображает природу используемых ресурсов. В данной статье предложено одно из решений проблемы глобального изменения климата.

Перспективы дальнейших исследований. Потребуется исследование применимости данной схемы к различным видам промышленности, а также в привязке к различным типам ископаемого топлива.

Тип статьи – теоретическая.

Ключевые слова: предпринимательство; изменение климата; корпоративное управление; устойчивое управление; глобальная экономическая политика.

Introduction: Why Climate Change Prevention is still not globally enforced?

With the emissions trading schemes currently installed, a firm's management is confronted with a multitude of players and high levels of complexity when trying to comply with existing emission standards.

This paper introduces a trading scheme based on the theory of the global commons that considerably reduces this complexity. After a full implementation, companies will not even have to purchase emission rights anymore, as all emissions will be covered by an *immissions scheme* addressing the point where the fossil fuel enters the economic cycle rather than trying to monitor emission leaving the economic cycle. The current discussion on climate change prevention, also in light of the results of the UN Climate Summit 2015 in Paris, still circles around "cap and trade" approaches. It is challenging to have many nations agree on maximum emission levels. Trickling down further to national levels, *Quaschning (2016)* shows that in order to reach the ambitious goals put forth and ratified by 170 states in New York in April 2016, considerable changes in production technologies and corporate product and production policies are required. Taking into account product cycles for cars and heating systems, for instance, producers would have to make immediate changes in their production lines foreseeing that governments would have to prohibit the production and registration of combustion engine driven cars by 2025. For heating systems, typically having product life cycles of 20-30 years, fossil fuel based systems would have to go out of production by 2020. Given the complex contexts and multiple logics companies in this sector are embedded in, it seems unlikely to reach an easy settlement (*Helms et al., 2012*) and it appears that not only production companies but also more knowledge-based firms will find it difficult to comply to such rather rigid rules (*Anand et al., 2007*)[2].

The current approach to emissions reduction can also be questioned looking at prices at which emission rights are traded. They are only a fraction of what they would be if maximum emission levels were actually enforced. Using this as a base, however, the paper suggests a scheme that is easier to enforce, because it reduces the currently countless emission channels to a relatively small number of relevant immission routes[3]. The economic policy effectively reducing global emissions (by controlling immission into the global industrial complex) can be called "cap, auction, and dividend". The structure of the remainder of the paper is as follows. In the next section the problem is described. The subsequent section represents the core part of this paper, where the economic policy is developed and explained as well as the principles elaborated on which it resides. The conclusive section discusses implications, practical questions as well as avenues for further research.

Research Question

What does the introduction of the proposed cap, auction and dividend mean for companies?

Results

Global commons are areas and resources defined as being beyond national jurisdiction (*Vogler, 2012*). The scientific and public debate is centering around and in its current form incepted by *Hardin's (1968; 1998)* seminal works describing what he calls the tragedy of the commons. The basic reasoning is that in primordial societies, inhabitants of a region shared and jointly used commons. Rural ponds for fishing, hunting grounds as well as land for living or breeding animals. The main problem in this scenario is that, with a growing population, the danger and systematic threat of free-rider problems arises. This, in short, is what Hardin refers to as the tragedy. Modern economic theory suggests property rights to solve the problem. Private ownership can guarantee that the owner makes sure a common good is used only to an extent to which its sustainability is not endangered, which then is in the own private interest of its owner.[4] This, however, has led to a number of new problems, for instance speculation and asset price inflation. The founder of contemporary equilibrium theory has therefore suggested letting commons not be *owned* by *private* individuals but by a *public* institutions and be granted for private use temporarily with *usage rights*, in the particular case of land suggesting long leases (*Walras 1896/1990*). Measures like these have been successfully implemented in many regions and cities, for instance in London and New York.[5] Reforming fossil fuels administration and designing the management of the atmosphere in a more incentive-based way will be more efficient, less harmful for the environment and could free up funds to finance universal access to water and other basic goods (*Presse 2015; Jakob et al., 2015*). Applied to the case and natural resource under discussion in this paper, namely the atmosphere and its capacity to absorb carbon dioxide emissions, private ownership is currently not discussed. In light of the challenges private ownership has caused in the allocation of other resources, it is therefore suggested to apply a policy of public ownership combined with granting private usage rights. In some analogy to Walras´ suggestion from 1986, published in a new edition in 1990, for long leases, i.e. for timely limited usage rights that have to be renegotiated after a certain amount of time, it is proposed to grant usage rights, in this case emission rights, on an annual basis. This also corresponds to the perceived need for timely action in order to meet the agreed climate change prevention goals. Annual renegotiation, as we will see in the form of annual auctions, also grant policy makers the opportunity to adapt and adjust. This may be appropriate as changes occur such as new insights about climate change, which may make it apparent that even more timely action is required (*Schelnhuber, 2015*) or, potentially, that climate change prevention goals can be met at reduced speed without harming the planet's atmosphere.

Oliver (1991) presents ten institutional factors influencing the strategies of actors to react to policy measures like the one developed in this paper. These strategies range from acquiescence and compromise over avoidance to defiance and manipulation. These strategies are not positive or negative *per se* with respect to a desired outcome. The policy model suggested here accommodates for all kinds of strategies. While acquiescence and compliance are required and even enforced on an operational level, actors have the possibility to actively influence and manipulate on overarching policy levels. For instance, corporations can build their own sinks to receive the permission to sell emission

[2] At first glance, such organizations seem to be less affected than the production industries. However, take the example of consulting firms, embedded in such complex environments, how will they be affected by rules prohibiting or substantially increasing the costs of extensive travelling?

[3] While emissions are measured by the property of the chemical substances they produce when being emitted into the atmosphere, immissions are addressing the substances that are introduced *into* the economic cycle at the beginning of the value chain. I. e. only the first company in the value chain has to purchase emission rights in order to be allowed to introduce a substance like a fossil fuel into the value chain, and the costs for that are passed on along the value chain and finally carried by the consumer (please see below for a further elaboration of this effect).

[4] Semantically, the word 'private' stems from the Latin word 'privare' which means 'stealing' or 'depriving'. In the case of commons, depriving others of their original right to use a common can be reimbursed.

[5] A considerable amount of New York ground is owned by the New York Port Authority, a public body, managing their properties in a market-based way in the public interest. The City of Westminster, just west of the City of London, is owned by the Earl of Westminster, and is also administrated in a market-conform way.

rights into the market, or they can lobby to influence the total volume of emission rights being auctioned and traded afterwards. *Ansari et al.* (2013) arrive at the conclusion that for the emergence of an institutional perspective and a commons logic in a transnational field, three conditions must be fulfilled: (1) the key actors view their fates as being interconnected, (2) these actors perceive their own behavior as contributing to the problem and (3) they take collective action to address the problem. The global climate change prevention policy set forth in this paper provides a conceptual framework for condition (3). While relying on conditions (1) and (2), the model allows to take concrete measures on a supranational level. The research question addressed in this paper therefore is: how are private corporations affected by the proposed cap, auction and dividend scheme?

Model Development

The model developed in this paper is based on three principles: sufficiency, efficiency, and equivalence, each of which is assigned to an operational level on which climate change prevention measures are to be addressed and implemented. Sufficiency is the first and most important principle. For the particular purpose of designing a global climate change prevention policy, it translates into a concrete measure referred to as 'cap', i.e. the effective enforcement of upper emission thresholds. The purpose of those thresholds is that, once they are met and not exceeded, the concentration of carbon dioxide in the atmosphere can be halted or even reversed and a certain (global average) temperature can be maintained.

Sufficiency: Introducing globally binding immission thresholds

We assume that globally binding thresholds ought to be the prime directive of any climate change preventing policy. The first principle, sufficiency, is therefore assigned the highest priority and applied to an operational level at which the effective limitation of emissions globally ('cap') is possible. The international community has reached an understanding on this level in Paris in 2015, agreeing on upper levels for emissions. The next level, however, is even more challenging to obtain: global emissions trading schemes are currently extremely dysfunctional. The upper level theoretically agreed on has not been and is not enforced. As a result, emission prices globally are only a shadow of what they should and would be if the two degrees Celsius goal were a globally enforced policy.

Current emission prices are low because there is no global emissions scheme effectively enforced. One main reason for this is that there are an almost infinite number of emission sources, in private households as well as corporate settings, agglomerating on national levels. Arriving at a globally binding regime, following the emission reduction paradigm, requires the effective control of a vast number of emission points. This paper, building on previous works and considerations on this particular aspect (*Rahmeyer, 2004*) suggests a paradigm shift, turning the points of reference for a global climate change preventing policy upside down: controlling for and limiting immissions rather than emissions.

The reasoning is as follows: for each molecule of carbon we know the exact amount of carbon dioxide that is emitted when it is burned. For 1 g of carbon, 3,67 g of carbon dioxide are set free. Combusting one kg of coal sets free about 3,7 kg of carbon dioxide, one kg of natural gas about 2,7 kg (as it contains hydrogen as well). The values for oil are in-between, depending on the specific properties (*Eisenbeiß, 2007*). These are the amounts set free when those substances are used as fossil fuels and burned, which represents approximately 90 % of their use. In other words: rather than trying to control the countless points of emissions, we should control the relatively small number of immission channels applying an upstream approach: "Whoever sells a ton of oil or coal into the economic cycle is only allowed to do so when proven that a corresponding amount of emission rights have been purchased". One disadvantage of this approach is that companies extracting fossil fuels will not be held accountable for the quantities of fossil fuels they use themselves. For the problem exists currently no entirely satisfying answer. One part of the answer can be that the amounts they use compared to the amounts they sell is much smaller. Another part of the solution can be that those companies will be under scrutiny for their emissions. For this, the international control body could install independent verification of how much fossil fuels these companies are using for their operations. A third option is that already the extraction of fossil fuels is only permitted if the extracting companies prove they have purchased the equivalent emission rights. Compliance of metering – i. e. do they meter and report all they extract – seems to be a key issue to be addressed if this third option is being implemented.

Before moving on to the next element of the model, some more explanation about the idea of immission instead of emissions control follows. To avoid misunderstanding: the model suggested here builds on the *status quo*, which is 'cap and trade'. In addition, this scheme suggests not simply trade but first auction-off emission rights globally and redistribute the revenues per capita (see below). The effective way to enforce the auctioning of only the amount that the atmosphere can bear, controlling immissions rather than emissions suggested for several reasons (for another brief discussion of this point please also refer to the implications and discussion section in the end of the paper). One is the considerably smaller number of immission points than emission points, the other is the upfront or upstream control of the amounts emitted by controlling the amounts immitted in the first place. In other words: Emission rights are auctioned and traded – but compliance is not enforced at emission points but at immission points. To be even clearer: For the policy to be effectively enforced, those market participants selling fossil fuels introducing them into the economic cycle have to purchase the emission rights for the amount of emissions that will occur if those fuels are burned.[6] As mentioned above, for the first sale of a ton of oil into the economic cycle the combustion of which will result in the emission of three tons of CO_2, the vendor will then have to have purchased emission certificates for three tons of CO_2. The buyer can only buy *bona fide* if he receives the documentation from the seller that the amount of emission rights equivalent to his purchased volume has been bought.[7]

In effect, because of the nature of the underlying commodity, this approach then allows overcoming nation-based regulations: instead of the never-ending debate on emissions and how to avoid emissions, one can embark on a fruitful discussion of the (relatively small) number of immission channels and how to control and regulate them.

Efficiency: Applying a transparent global auctioning system

At the heart of the problem we currently find the following question: Are national regulations the appropriate systemic locus when dealing with a globally volatile atmosphere not knowing

[6] Not all fossil fuels are directly consumed in combustion engines. Some volumes are used for producing many kinds of products, from tires to cosmetics. Compared to the combusted amounts, however, those amounts (1) appear negligible, (2) some of these will be also burned at the end of their life cycle, for instance not-recycled tires, (3) asking to purchase emission rights for those volumes does not substantially increase the prices of end products, as these are mainly caused by the manufacturing process (take, for instance, cosmetics again) and (4) since also this policy, despite all efforts, might incur some spill-overs, so not every "drop" of combusted fossil fuels might be properly monitored and accounted for, it is suggested to compensate this partially by including all volumes of fossil fuels introduced into the economic cycle.

[7] Emission certificates can be forged. But this is a challenge already today and methods for effectively avoiding forgery can be applied. One web-based approach is the latest blockchain-technology shortly discussed later in the paper.

national boarderlines? One major reason nations find it difficult to come to actually binding agreements is that corporate lobby groups, in fear of increased costs, force them not to. The solution must be found on a different systemic level. Monbiot (2007) draws on Hillmann and Fleming suggesting a solution 'giving' emission rights per capita to each nation, who then redistribute to each citizen. The effects of a policy like this can be empirically observed in formerly communist countries shortly after their transitions: employees, after privatization, received a share in the corporations they had worked for, not knowing how much they were worth or how they could be traded. The effect was that traders and speculators, sometimes paying only a fraction what the shares were worth, collected large holdings of a particular company. Some corporations went bankrupt; other holdings gave rise to the new so-called oligarchs. If we want to avoid such effects in global emissions trading, it is not the emission rights but their economic value, i. e. the money, that should be redistributed per capita.

Here the problem arises again that the market value of emission rights, with an unenforced policy as it is now, does not reflect its actual value. This brings us to the discussion about the appropriate systemic locus for a global emissions trading scheme: not single nations and mercantile exchanges but a global body, the United Nations (UN), who are overseeing the negotiations currently, should be in charge of auctioning-off emission rights globally at the level of the previously established upper emission limits.

This way the UN would have a systematic and globally binding institutional arrangement at hand, which can be enforced with controls on a random basis. Global emission certificate trading can be put back on its feet: The basically agreed upper limits for emissions ('cap', as is the aforementioned current state of the art) are recalculated as upper limits for immission to be allowed into the economic cycle. The trade is still with emission rights, but emission rights have to be purchased prior to immitting these amounts of coal, oil or gas (or any other fossil fuel) into the economic cycle as an input for production.

This procedure satisfies the second condition or principle postulated above: efficiency. The highest readiness to pay for these auctioned emission rights will be from corporations for which avoiding emissions is most costly. Emission rights as a globally scarce recourse will be allocated at the point of its highest, most efficient, and economic use. Of course, on the basis of emission rights once issued (and each year anew), they can be traded at international exchanges. Efficiency is obtained on the operational level, auctioning off emission rights globally.

Equivalence: Redistributing the financial value of the atmosphere to its 'owners'

In light of this proposed scheme, another question arises, which brings us to the dividend aspect of 'cap, auction and dividend': Who should be the benefiter of the proceeds obtained in the auction process? The answer is produced first, and then a discussion of its justification ensues. The answer is: The money should be redistributed per-capita to individuals *globally*. There is a three-fold reasoning behind this part of the model: (1) an economic reason, (2) a political reason and (3) a nature inspired reason. Each of those reasons differ in terms of their conceptual and normative contribution, reason three undoubtedly being the most normative. The three reasons combined establish the implementation of the third principle mentioned above: equivalence (Presse, 2010; Presse et al., 2011; Jordan et al., 2013). It is established by way of granting every individual the payout equivalent to the value of her or his "share" of the atmosphere as a common good, constituting a basic income to all individuals globally.

The most obvious reason for the per-capita redistribution is an economic one (1): As is the case for all climate change preventing policies, higher costs are incurred in the production process. Corporations must pass these increased costs on to their customers and try to avoid those costs by employing more environmentally friendly production technologies and input resources. This is precisely the desired economic incentive-effect that needs to be reached in order to bring about an actual change in the way production is taking place. But also the change of production technology towards a more environmentally-friendly one is costly, and it takes time until it pays off. This proposed regime leads to environmentally friendly inputs being cheaper than fossil fuels, thus making them *economically superior* to fossil input factors. In any case, corporations have to pass on higher costs along the value chain to their customers and, finally the consumer. Therefore, the systematic addressee of the proceeds obtained from those higher costs, incurred through higher prices that are imposed by a global auctioning mechanism enforcing the actual emissions price, is the one who pays the higher price in the first place: the consumer.

Since all human beings are consumers (and relatively equal in terms of what they need to survive), redistributing the proceeds per capita is rather straightforward. For a discussion on the means of payment please refer to the implications and discussion section. By applying this policy, the individual consumer can determine herself to which degree she wishes to consume environmentally friendly products. But their decisions from then on are taking place in an institutional arrangement that systematically promotes and ensures that who consumes environmentally damaging products is paying more and who consumes environmentally friendly products is paying less (net benefit).[8] The model strengthens systematic economic superiority of environmentally friendly products and makes non-fossil fuels more competitive. Ecological sustainability and economic reason are better aligned. Let's assume the same product (quality, functionality, purpose etc.) comes in two versions, one more and one less fossil fuel-dependent. Due to different production technologies, they today might have the same price. By way of this policy, the more fossil-fuel dependent product will become more expensive and economically less beneficial to use.

The policy developed in this paper allows to determine the value of the carbon dioxide emission absorption capacity of the atmosphere once a global cap has been established. This paper is not discussing how such a globally binding cap can be established. The most likely path, however, is that the international community is reaching an agreement, probably involving the UN, and based on latest scientific findings what those upper limits can be in order to avoid further harm for the atmosphere. In addition, it is suggested to redistribute this economic value per capita. The amount paid out per capita therefore depends on the auction price of the emission rights and the number of emission rights sold. Fig. 1 depicts combinations of emission prices and emission volumes.

At any given demand, the emissions price will be higher the smaller the amount of auctioned emission certificates. For example, an emissions volume of 50 Gt, once enforced with the upstream policy described above, may lead to a price of 20 USD/t or EUR/t. If 50 Gt are auctioned at a price of 20 USD/t or EUR/t the total revenue is 1 trillion (trio) USD or EUR.[9] Divided by 7 billion people this yields about 143 USD or EUR annually or about 12 USD monthly.[10]

[8] This is currently the other way round. If one wishes to 'neutralize' the environmental damage incurred flying or taking a train, one can opt to pay more to the carrier who is then promising to purchase an equivalent amount of emission rights.

[9] Prices can also be given in USD. For reasons of simplicity of this base case let us assume that USD and EUR are at par, so that 1 EUR equals 1 USD. USD and EUR are usually used synonymously in this paper.

[10] The exact figure will depend on the amount of emission rights auctioned and the auction price obtained. Based on the history of emission price

Decreasing volumes of auctioned emission certificates in this example lead to similar auction revenues: after 20 years, in this case, emissions reduced to 30 Gt, so an auction price of 40 USD/t or EUR/t yields a total revenue of 1.2 trio USD or EUR, thus also accommodating a gradual population increase with stable payouts.

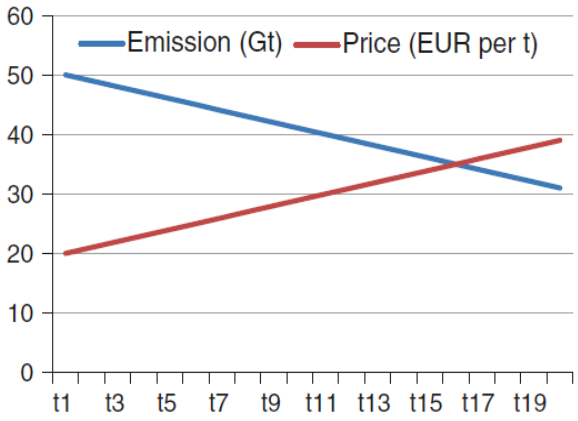

Fig. 1. Combinations of Emission Volumes and Emission Prices; reduction path (in Gt) and certificate price (in EUR per ton)

Despite price fluctuations over time, the total value and the payout can be stable. If the global population grows, the value will have to be redistributed to a larger number of recipients. A growing world population, however, at the same time might result in an increase in demand for emissions, as more goods are being demanded and produced. Higher demand results in a higher emissions price at a given volume auctioned, so the total financial value available for redistribution would increase as well, thus leaving the per-capita payout stable.

For a first iteration for calculating the value of the carbon dioxide emissions absorption capacity of the atmosphere and the resulting payout let us use the following formula, where *EV* denotes the emissions volume (in t) and *EP* the emissions price (in USD/t or EUR/t). *GP* is the number for the global population.

$$\frac{EV \times EP}{GP} = PpC$$

Emission volume times emission price divided by the number of population yields the payout per capita (*PpC*). The poorest of the poor live on less than one USD or EUR per capita per day (Sachs 2005, 174 ff.). An economic policy like the one produced in this paper, giving an additional 12 USD or EUR per month into their hand, is a substantial increase.

The second reason for per-capita redistribution is a political one (2): Climate negotiations before Paris failed and even after Paris are not enforced because economically less developed countries would have to reduce their emissions at no obvious benefit, still being a result of the 1992 Kyoto-Protocol and the herein engraved "grandfathering" arrangements. Emissions as are (or as were) were used as a basis for calculating future emission reduction goals and paths. In other words: economies like China and India could not and cannot agree to binding arrangements that force them to reduce emissions, while two thirds of their inhabitants are still living in poverty. The scheme proposed in this paper overcomes this problem: developing economics can agree to binding arrangements because they know that through a per-capita redistribution they will be, by way of their large populations, economic benefiters of the model.

The third reason discussed for the per-capita redistribution is nature-inspired (3) and, as mentioned before, perhaps the most normative one. It is based on the answer to the question: Who owns the planet? Answers on this point may differ widely. Suffice to say that the atmosphere is not produced by man but 'given' by nature. A naturalistic view would therefore argue that it belongs to mankind in its entirety. To make it operational and economically feasible, private claims to it can be made possible via emission rights as developed in this paper. The economic rent of the scarcity of the absorption capacity of the atmosphere can, through auctioning and redistribution, be given to its 'owners' equally. Those who use it beyond average, by way of this policy, systematically reimburse financially those using it below average. Based on this – clearly normative – view one could argue that, as all individuals are co-owners, they are entitled to the economic proceeds when it is annually auctioned.

In summary, the global auctioning and redistribution process can be described as follows. Like in any other climate change protection policy, the international community has to come to a consensus, based on scientific findings, how much emissions the planet can bear. This amount is then auctioned globally (Step 1, see fig.2).

An international governing body, it is suggested this to be the United Nations, establishes within its structures a fund. The revenues from globally auctioning emission rights flow into this fund. It is understood that prior to this process, the international community would have to reach an agreement to let the UN carry out this procedure. In step 2, the proceeds from the auctioning process are redistributed per capita globally.

Companies downstream the value chain, for instance manufacturers, service companies etc., purchase from the fossil fuel extraction companies the fossil fuels they need for their operations and production. If in their production process, they employ technologies allowing them to emit fewer carbon dioxide per ton than would have to be expected in the case of a regular combustion, and if this is documented and certified, they may then sell the emission volumes not used by them (step 3). Potential buyers of these 'additional' emission rights are again the oil extracting companies, as buying back these emission rights enables them to extract more oil. This buying-back process can either take place through a direct sale, or within an emissions trading scheme like it already exists today. The difference to today is that the amount of allowed emissions globally will have been effectively enforced via the auctioning process, in which only the amount of emissions allowed for this particular year will have been auctioned.

Some examples can help explain how the model works for several industries involved. We choose an oil company, a plastic producer and a metal smelter as examples. The oil company, in order to be allowed to sell the oil, must have purchased the amount of emission rights that is equivalent to the amount of emissions set free when the oil they sell is combusted.

development it is assumed that at 50 Gt allowed emissions the price will be around 20 USD or EUR per ton (Sijm et al. 2006), leading to a revenue of 1 trillion USD or EUR from the auctioning process. One trillion USD or EUR divided by about 7 billion yields about 143 USD or EUR annually and therefore about 12 USD or EUR per capita per month. 50 Gt annually are far beyond what this planet can sustainably take. It is an entry starting at current emission levels that can then be reduced gradually, for instance one Gt annually over 30 years to reach 20 Gt (compare fig. 1), a still high but more bearable amount that can be reduced further. The precise price reactions are to be established by further research in a thorough elasticity analysis taking the effects of the proposed policy (technology and therefore demand changes) into account.

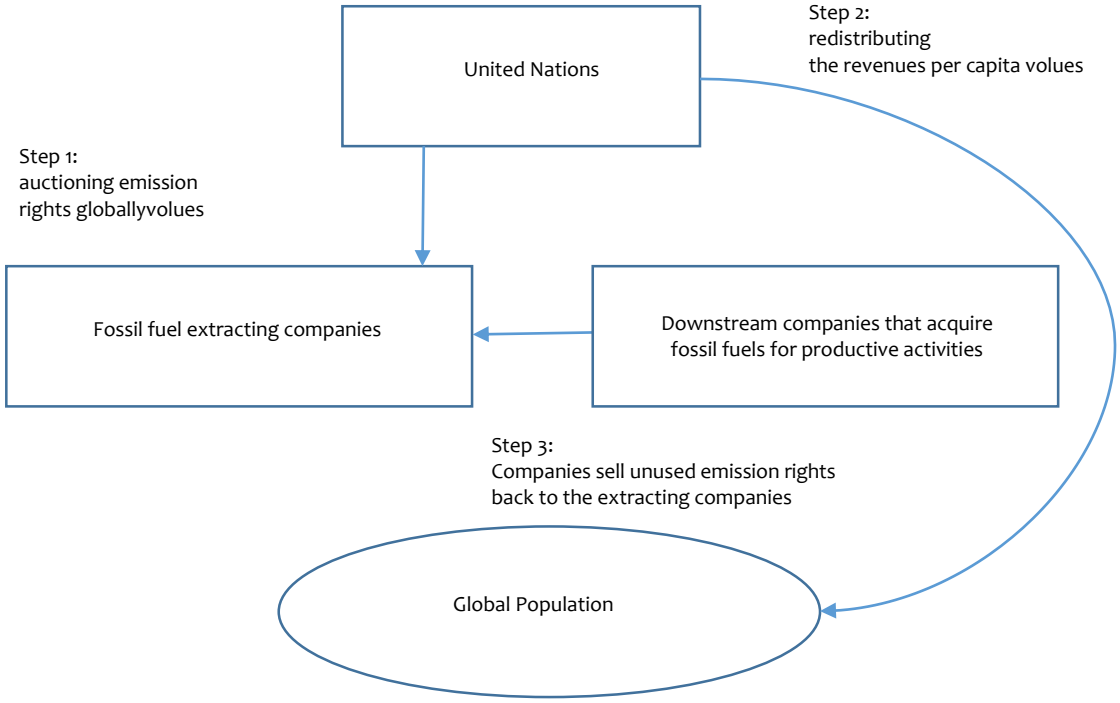

Fig. 2. Global Auction and Global Redistribution

The oil company will forward the emissions price to its customers (mainly business customers who then forward it further along the value chain to the consumer).

A plastic producer, needing oil as one of the main ingredients in the production of plastic, buys the oil from the oil company and, by doing so, has paid the emission rights the oil company has purchased in order to be able to sell the oil to him. A metal smelter, needing coal as one of its major ingredients, will purchase this coal from a coal mining company. This coal mining company, in analogy to the oil company, has to purchase for each ton of coal it sells the amount of emission rights for the emissions that are set free if the coal is burned, and includes the costs in its sales price. As it is a factor price increase, all mining companies face the same situation and therefore can include the emissions costs in their prices even in competitive situations. So in effect, the metal smelter, when buying the coal from the mining company, is paying for the emission rights purchased by the mining company and implicitly rolled-over to him via an increased sales price for the coal.[11]

Implications and Discussion

One effect of the policy is that emission reduction goals and individual consumption incentives are systematically aligned. Emission reduction goals can be reached in a transparent way thanks to the relatively limited number of immission points, while previous policy suggestions mainly focus on countless emission points. It becomes systematically more beneficent financially to consume goods and employ technologies causing smaller amounts of emissions, and the emission rights for these emissions have been paid at the inception of the value chain upstream at the point of immission. The pragmatic consequences of this can be demonstrated using an example Monbiot (2007) makes. He states that travelling in general and flying in particular, you "sacrifice […] the biosphere and the lives of the poor". Once the policy developed in this paper is successfully implemented, this reads as follows: You can travel with a good conscience, as you can be certain that the emissions you cause are in line with the global upper emissions threshold (immission orientation). Fossil fuels only enter the market when the equivalent amount of emission rights have been purchased. You can expect to pay around ten per cent more for travelling[12], while at the same time knowing you receive a payment of about 12 USD or EUR per month per-capita dividend. So if you do not travel at all, you have a financial net benefit, if you travel heavily, you are a financial net contributor and if you travel average, your per-capita reimbursement will compensate your increased costs. This is the kind of incentive structure we assume a necessity for an effective global climate change prevention policy, linking global upper thresholds to individual consumption and production behavior in a transparent and self-determined way.

Some related questions require considerable attention and further research. Some initial answers shall be given for starting the discussion:

How does the proposed scheme make handling emissions and emission rights easier?

A firm's management has to take into account the implications of two elements that affects its interaction with emissions and emission rights. One are the emissions itself, which companies

[11] This and other examples taken from (*Presse, & Paetzold, 2017*).

[12] This is under the first and very rough assumption that the proposed emissions auctioning and trading scheme with enforced emission thresholds leads to a price of 20 USD or EUR per ton of CO2equivalent. Depending on the specific density of the fuel and therefore the weight of a barrel, it is further assumed that one ton contains the equivalent amount of about seven barrels of crude oil. Then assuming that for each ton of oil three tons of emissions are incurred, the price for one ton or seven barrels of oil increases by 60 EUR, therefore increasing the price per barrel by about 9 USD or EUR. Also take into account that not all costs of travelling are fossil fuel costs.

today seek to reduce employing technology helping them to reduce emissions. The other is the process of purchasing emission rights. The proposed scheme represents a considerable shift and simplification of the processes involved in dealing with those two.

First, avoiding the emission itself remains the prime directive for companies seeking to realize an environmentally friendly and sustainable production. Today, however, corporations are concerned with reducing emissions, which cannot actually be reduced for any given amount of fossil fuels they employ in their production process. Emissions can be contained and stored elsewhere rather than emitting it, but it remains a given chemical fact, a natural law if you want, that for each ton of oil or coal or gas burned a certain amount of carbon is remaining, either in the air or in other storages. So, today, corporations are bound to purchase emission rights (or receive them granted from governments), as shown in fig. 3 below.

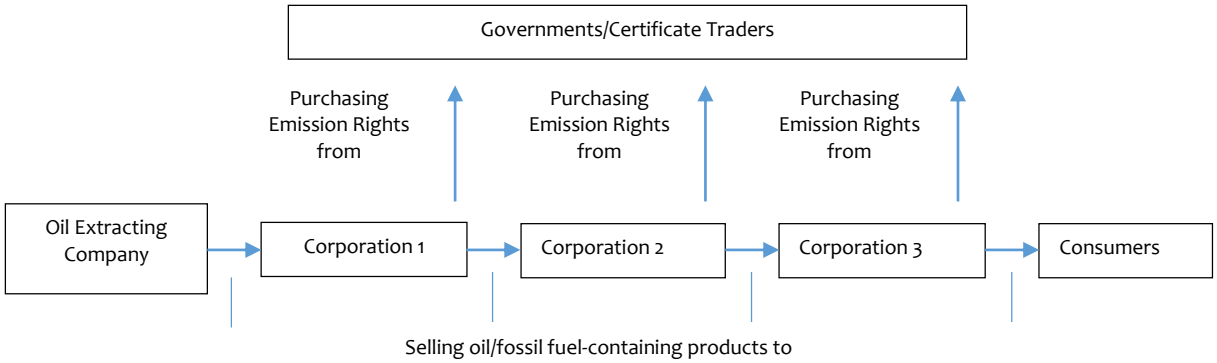

Fig. 3. Carbon Certificate Management Process before Immissions-Cap-Auction-Dividend Scheme

With the *immissions* management scheme proposed in this paper, this focus changes. The primary concern for the general economy and governments remains how to reduce emissions. The means of management however – the operational level if you want – shifts from emissions to immissions. Corporations no longer have to purchase emissions certificate from goverments or exchanges and modify the way they dispose of carbon (trying to reduce air pollution by simply storing it elsewhere) but can focus of avoiding the creation of carbon in the first place. I. e., they will focus on shifting their production towards technology that avoids producing carbon itself. No longer will they purchase emission rights, but by purchasing fossil fuels from fossil fuel extracting companies have implicitly purchase for the introduction of the fossil fuel into the economic cycle (fig. 4).

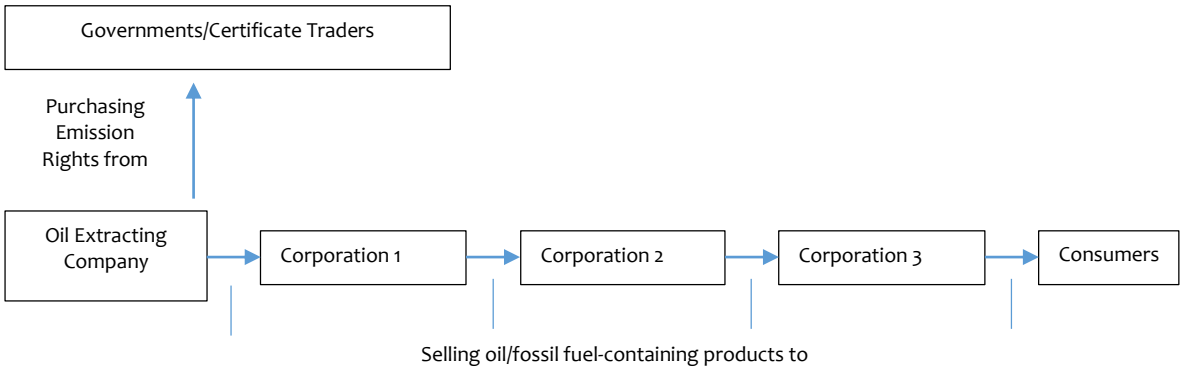

Fig. 4. Carbon Certificate Management Process with Immissions-Cap-Auction-Dividend Scheme

Carbon Certificate Management with the Immissions-Cap-Auction-Dividend Scheme Corporations will have paid the price for emissions because the extracting companies have to purchase emission rights (and forward the costs for that to their customers) in order to be allowed to introduce (immit) carbon or the the fossil fuel carring it into the economic cycle. So by the time it leaves the chimneys and exhaust pipes, the equivalent amount of emission rights has already been paid before or when the carbon entered the economic cycle. This approach can also be referred to as an upstream management approach.

How can an amount of 12 USD or EUR per month be redistributed per capita to 7 billion[13] individuals?

The answer for many of those individuals, the wealthiest and the poorest, is surprisingly simple. In developed economies, almost every individual has a bank account today and for the EU, a bank account is discussed to be mandatory (*European Union, 2013*). Each individual has a tax number linked to that bank account, where tax payments or reimbursements are typically handled. So the

[13] Population growth is likely to be reduced by the model, ensuring that even the poorest of the poor have this payout as a retirement plan and therefore do not 'have to produce' many children in order to, at a given infant mortality, ensure there are at least one or two children taking care of them when they are old.

infrastructure is in place in developed (and most of the developing) countries. Also in India, every citizen is intended to receive her or his individual identification number (*Nilekani,* 2009). Micro-credits have shown that is possible to procure basic banking services even to the poorest of the poor. In other words: If a person is entitled to 12 USD or EUR monthly bank charges of micro credit or online banks. We leave this discussion at this point to the financial technology industry and to future research evaluating and implementing the options and establishing the modularities for the payments.

For those who neither live in developed countries nor in countries with sufficient banking services for the poorest of the poor, the money can be given to national governments in the meantime, similar to the suggestions by Monbiot (2007), but with the clear charter to establish those banking services. Then, however, the question needs to be answered what we should do in countries with governments known to be corrupt. For this fourth case, we could potentially turn to blockchains again, this time via 'colored coins' that can only be used for the purchase of food. Colored coins are a form of digital money that is coded in such a way that it can only be used for specific applications, similar in concept to a loyalty rewards scheme from a specific store[14]. Alternatively the money can be provided to the UN World Food Program that makes sure that also in those countries those in need have access to food and at the same time can exert pressure on these countries to implement rendering the banking services mentioned. The very favorable side effect for the United Nations is that, in food crises as they occasionally appear, they need not further – or at least less so – draw on member states 'begging' for money to help the poor. The UN then has means of their own to supply the services and food support to those most in need.

How can reluctant nations be made to join the policy?

This question appears reasonable and understandable. However, it still roots in the paradigm that this book paper seeks to overcome: thinking in national borders. It is acknowledged that most policy decisions were and still are today made on national levels (Murdoch & Sandler, 1997). This undisputable fact is more part of the problem than it is a part of the solution for the global climate challenge. Of course it must be taken into account when building a globally practicable solution path. The most practicable pathway for its implementation is that leading nations, e. g. the G7 or the G20, which account for roughly 80% of global wealth, income and emissions, agree on this globally binding policy. It is an element of leadership that is required in the leading figures and heads of state. If a policy is acknowledged, first in theory and then by policy makers, as a technically and economically feasible pathway, future ecological, economical, and social challenges will increasingly call for its implementation. It is desirable not to limit the knowledge and support for the policy to scientists and policy makers but to extend it to a wider audience ultimately influencing or at least inspiring policy makers. This is one reason for publishing the policy in this book.

Can the Policy be applied to other Greenhouse Gases as well?

Yes. Other greenhouse gases such as methane and Freon (used in air conditions) contribute to climate change as well and in smaller quantities. The policy described in this paper can be applied to those gases, too.

How does the Policy influence or consider Population Growth?

The effect of population growth on accordingly increasing emission prices and hence a stable income per capita has already been discussed above. However, some readers may fear an increase in the world population that would exceed the adaptive capacity of such a system once even the poorest of the poor receive a monthly payment helping them to survive. One aspect of population growth in particular in developing countries is that couples see the number of their children as an increased security for their retirement. In other words: at a relatively high child mortality rate, a higher number of children makes it more likely that enough of them grow up to then support their elders. How will a policy change this, which makes sure even the poorest of the poor can count on a monthly payment helping them to survive? It can be assumed that with increased income stability, people are less worried about retirement. On the other hand, with every child born a family receives 10-12 USD or EUR per month, so potentially birth rates could also rise. Further questions like the credibility of this policy arrive at this point. These questions are not policy-specific, but of course they have to be addressed in an orderly and convincing way, providing one avenue for further research on this topic.

Immissions- or emissions trading?

This paper elaborated on the proposition to focus on immissions rather than emissions on the policy level. Given the current state of discussion and the way market participants are accustomed to think about emission rights, rather than immission rights, it appears more feasible to auction and trade emission rights. This approach makes it also easier for downstream market-participants to purchase additional emission rights if they engage in activities involving higher volumes of carbon dioxide. It also allows provides of additional sinks to issue emission rights. Finally, it does not affect the immissions-based upstream input-regime developed above to trade with emission rights. Therefore it is suggested to stick with the terminology and concept accustomed to current market participants and policy makers.

Conclusions

The proposed economic policy model is different from other currently discussed proposals in four ways:

1. It suggests to focus global climate change policy on *immissions*, applying an upstream approach targeting the limited number of input channels at which the source-material of later carbon dioxide emissions is first introduced into the global industrial complex, rather than controlling for emissions at countless emission points.
2. It suggests a *global* auctioning of the previously established and allowed emission volumes. Rather than giving it to nation states who then can use them more or less as they please, global auctioning centralizes the process for establishing a globally unified price for emission rights, and hereby the market value of the resource.
3. The model promotes a global per-capita redistribution: a Climate Change Prevention Dividend. This ensures that each individual receives the economic value of their 'share' of the atmospheres' absorption capacity. The resulting income of an estimated USD 12 per month would have a tremendous impact in particular on the "bottom of the pyramid" population of about 1 billion individuals that live on USD 2 or less per day, and that are both most vulnerable and least culpable for climate change. Hence, effective climate protection measures would be combined with systemic and democratic development support for the poor; a key deliverable for the UN. The

[14] I thank the editors for introducing this possibility

implications of 2 and 3 lead to an increased relevance of the following point:

4. Not single nations are disposing of the use of the resource and its economic value but a global organization like the UN. This is appropriate for the handling of a resource which itself does not 'know' any national borders. Therefore, the current climate challenges train us to overcome thinking in national borders, a goal supported and systematically ensured by the proposed global policy model.

With the model developed in this paper, production and consumption choices are drawn towards a more sustainable equilibrium. This equilibrium includes ecologic-, entrepreneurial-economic- and social sustainability. Technologies like blockchain, systematically connecting economic and environmental links of the global value chain, potentially provide the operational base and working tool to implement the solutions in a practicable way.

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