
The Role of Tradable Planning Permits in Environmental Land Use Planning: A Stocktake of the German Discussion

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1. Introduction

The idea of tradable planning permits is subject to broad discussion in some developed countries such as Switzerland (for example, see [1]), but particularly in Germany (for example, see [2]).

The German federal government intends to reduce the daily land consumption to 30 ha per day in 2020 [3]. In 13 years between 1993 and 2010, land consumption in Germany was significantly higher than 100 ha per day. In the other 5 years, the undershooting of the 100 ha mark has been mostly due to lower economic growth rates or an economic slump [4]. Particularly rural areas were affected by excessive land consumption. Almost 50% of the converted land is sealed [5].

In order to achieve the 30 ha target, there is a broad consensus about the necessity to support planning by means of economic instruments. In this discussion, tradable planning permits turned out to be the instrument of choice, at least among the scientists. In Germany, a lot of research has been underway on this issue for years now (for example, see [6]). Among others, a pilot project is also in preparation [7, 8], as it was planned in the coalition agreement of the current federal government [9].

The idea of tradable planning permits stems from the concept of tradable CO₂ rights, more accurately the cap and trade system. Within the cap and trade regime, pollution rights should be limited in quantity and made tradable. Due to the cap on the pollution possible, the system is considered ecologically effective. If the mechanism is applied to the field of land use planning, the communal development plans are only legally valid if they are backed by planning permits, which have to be held by the communes. The communes – as

the planning authorities – and not the land owners are the holders of the planning permits. This is an important difference from “tradable development rights”, where private-sector actors are the sellers and buyers (for example, see [10]).

Due to the trade, the scheme is also regarded as being efficient because only those actors with the lowest marginal abatement costs reduce the emissions. The permits can be bought and sold by the communes on an organized trading platform.

The cap on the permits helps to circumvent rationality traps (game theory) which otherwise would appear. In Germany, for instance, communes competed against each other to attract new inhabitants and industries in order to get more tax revenues and higher shares out of the financial equalization scheme. This competition was a race to the bottom in many cases. Among others, the results in many cases have been almost empty residential or commercial areas and high infrastructure costs. However, if a community waives the preparation of new building areas, the neighbouring municipality takes the chance.

Within the cap and trade scheme, such rationality traps might be broken up [11]: Due to the costs of the permits, only such communes whose benefits of land development exceed the costs of the permits will buy planning permits and carry out land development. If land conversion can be avoided at costs below the costs of the planning permits, communes waive the right to further development. Maybe they can also reconvert the land into a natural state. Hence, if there is no need for holding permits, such communes will sell them to other communes (for example, see [12]). If they do not sell the “free” rights, they will suffer opportunity costs. This means that communes with high marginal abatement costs (tax revenues, jobs etc.) are the buyers of the rights, while communes with low marginal abatement costs are the sellers. In the end, all marginal abatement costs equalize at the price of the tradable permits. In the trading planning permits scheme, the secondary market is the institutional heart of the mechanism.

Although it sounds quite appealing at first glance, we want to show that the application of the cap and trade scheme to land use planning is anything but self-evident and not a promising approach per se.

2. Hypothesis: No magic bullet

Tradable planning permits are considered to be a sort of magic bullet. On the one hand, the cap on development permits makes the system effective. On the other hand, only those communes with the highest benefits (additional taxes and shares from financial equalization schemes) carry out the development. Communes with low opportunity costs waive the right to development. Hence the scheme is also efficient, because the planning rights are used at the locations with the highest benefits.

However, contrary to what intuition would suggest, we want to show that effectiveness and efficiency don't harmonize if the concept is applied to land use planning. In contrast, the cap and trade approach cannot meet the goals of efficiency and effectiveness at the same time (“incompatibility thesis”) [13]. The argument is based on the following two statements:

- In order to be efficient, a cap and trade system needs wide system boundaries. At least in small or medium-sized countries, such wide system boundaries go hand in hand with a unified planning permit and a unit price.
- In contrast to CO₂, effective land use planning doesn't require control of a scale, but of a structure. A land use structure cannot be controlled effectively by a single planning permission with a single price.

3. Theoretical issues and review of literature

There is a central difference between the cap and trade on CO₂ and the cap and trade on planning permits. Considering the consequences for global warming, it does not matter where the CO₂ is emitted due to the diffusion characteristics of the greenhouse gas. Hence the task is to control a scale (maximal CO₂ emissions anywhere) by capping the quantity of emissions. However, regarding land use planning, not only the scale but also the structure of land use has to be controlled. The quantity of land as a whole can hardly be extended. Instead, the relevant issue relates to changes in the structure of land use, which is for instance forestry, agriculture, industry, settlements etc. It is of central importance where the land use takes place and for which purpose. Hence CO₂ permits are a homogenous good, but land use rights shouldn't be.

3.1. Consensus: Primacy of planning

At present, the structure of land use is controlled by the planning system. According to the proponents of the tradable development rights idea, land use planning should not be substituted but supported by the economic tool ("primacy of planning") [14].

Planning is necessary to break up a possible Nash equilibrium [11] caused by the behaviour of land owners: If, in the absence of any planning, only the willingness to pay decides about land use patterns, a spatial disaster may result and people may run into a rationality trap. If, for example, German people were allowed to realize the favoured model of the detached one-family house in green surroundings, urban sprawl would happen, with negative ecological, economic and social impacts.

At the same time, planning is necessary to protect such forms with weak financial endowments which cause important positive external effects. If no plan provided public spaces e.g. for kindergartens and schools, such forms would have to compete with actors with a high willingness to pay (e.g. banks). Hence they could not be realized. However, without such facilities, the value of the area would often be lower than with them. Good planning should consider the variety of functions of land (e.g. ecological, spiritual). Such forms of land use that move beyond efficiency and profitability are not only important for the cohesion of the social system, but in many cases also for the resilience of the ecological system (for example, see [15]). Planning has to balance the competing demands of various stakeholders, including groups with low budgets and the protection of nature.

3.2. Thesis: Efficiency needs wide system boundaries

Although the primacy of planning is wide consensus, in recent debates it has been argued that tradable planning permits may counteract land use planning [13]. The “incompatibility thesis” is based on the required design of a cap and trade regime. A major justification of the system is its efficiency. The efficiency of the cap and trade system is caused by differences in marginal abatement costs:

- Those communes with high marginal abatement costs buy planning permits on the market at the lower market price. The difference is the benefits from the cap and trade system.
- On the other hand, such communes with low marginal abatement costs reduce their harmful activities and sell the free certificates on the market. The difference between market price and marginal abatement costs is the profit from abatement.

In the end, the marginal abatement costs of all the actors equal the market price of the planning permits. The higher the differences of marginal abatement costs of the acting communes, the higher the efficiency potential of the regime will be.

However, high differences in abatement costs can be achieved by a wide design in terms of space, time, participants and the objects of trade:

- In categorical terms, diverse spatial categories (living, commerce, mixed use, traffic etc.) have to be gathered in one single planning permit (“universal” certificate). This is any land for human settlement and transport infrastructure without regard to its different components;
- Regarding the market participants, the discussion is about also including individuals or NGOs instead of only permitting communes as traders;
- In spatial terms, scientists agree that the trade boundaries have to be as wide as possible (e.g. whole of Germany, no single states);
- Considering the time dimension, banking and borrowing is also discussed in order to use differences in the marginal abatement costs over the timeline.

In Germany, in the last decade the preferred design is characterized by

- A country-wide regime (although the pilot project mentioned above will only comprise selected communes) which incorporates the administrative support of the different states of the federation [16].
- A universal certificate which comprises the whole area for settlement and traffic [16].
- Banking should be allowed (at least the transfer into the following provisional period), in order to allow long-term development strategies for the communes. In contrast, there is much scepticism with regard to providing the opportunity to use the rights before owning them (borrowing) [17].
- Regarding the market participants, an extension of participants beyond the communes has not been discussed seriously so far.

Hence the efficiency potential can only be exhausted if the target is “scale” instead of “structure” (which would make sub-markets necessary). The scale target has to fix wide

system boundaries (in contrast to other tradable development rights schemes; for example, see [13]). The scale target and the wide system boundaries are mutually dependent.

There is also another reason why a working trade system would not be possible without wide boundaries: Narrow markets cause high price volatility of the permits. The higher the price volatility, the more insecure the economic success of abatement activities and the less abatement activities will take place. Thus the target is to set the condition for organized trade of the permits.

3.3. Thesis: Controlling structure by economic tools needs tightly segmented sub-markets

Having shown the necessity for wide system boundaries in a cap and trade model, the next question is whether a land use structure – not a scale – can be controlled within such a system. We want to illustrate the problem within figure 1 below. The land use plan sets the allowed land use A (e.g. industry) at the maximum of C_A . The maximal land use B (e.g. housing) is limited by C_B . The marginal abatement costs (MAC) are MAC_A for land use type A and MAC_B for land use type B. For simplification purposes, the illustration doesn't include more land use types.

If a commune waives the right to development of additional sites, it has to suffer marginal abatement costs. Such marginal abatement costs are mainly opportunity costs. If, for instance, a residential area is not realized, a German municipality gets lower shares of the income tax revenues, lower property tax revenues and lower revenues out of the fiscal equalization scheme. If an industrial site cannot be realized, the opportunity costs also comprise lost business tax revenues. Also indirect effects have to be considered, such as income multiplier effects which otherwise would have been initiated by construction activities. All these interrelations and effects are quite complex and include feedbacks within the system. Basically, the scale of opportunity costs is not quite clear. Fiscal impact analysis could provide for more cost transparency, but it is in an early stage. Some fiscal impact tools used so far for residential areas turned out to have quite different performance; for industrial areas no reliable fiscal impact tool is available so far. Also within the above-mentioned pilot model of tradable development rights the development of reliable fiscal impact analysis tools is acknowledged to be important in order to get a better idea about the marginal abatement costs.

However, in the subsequent figure we assume, contrary to the facts, that there is an accurate idea about the volume of the marginal abatement costs of land use type A and B. Hence we can derive a mathematical function of MAC, being dependent on the scale of land use of the different types.

First, let's assume that the caps for land use type A (C_A) and B (C_B) are set according to the land use plans. We assume that the land use planning also properly computes the marginal damages (MD), which are illustrated with the dotted line for both types of land use. With this theoretical "trick" we can take into account that planners care for quantity as well as for

quality of land use (for example, see [17]). Therefore, the planning target (C_A and C_B) corresponds perfectly with the intersection of marginal abatement costs and marginal damage of land use type A (E_A) and B (E_B).

Moreover, theoretically the marginal damage of land use type B can be expressed in equivalents of the marginal damage of land use type A. Such equivalents are useful for the definition of a universal cap. Analogous equivalents are also used in the greenhouse gas emission permit schemes. In the Kyoto regime for instance, global warming potentials (GWPs) are used in order to express the global warming potential of the other greenhouse gases in relation to CO_2 , whose GWP is standardized to 1. Hence, if caps for different land use types should reflect such equivalents (for simplification purposes a linear function is used below), we get for instance a function such as:

$$C_B = e \times C_A \quad (1)$$

The total cap results by aggregation of the caps of the individual land use types:

$$C_{A+B} = C_A \times e + C_A \quad (2)$$

It is important to note that the equivalents only reflect an average consideration. However, different communes may have different structures of land use; thus the equivalents don't represent their individual situation.

In the subsequent diagram, the added marginal abatement costs (MAC_{A+B}) show the aggregate demand curve, and the aggregated cap (C_{A+B}) shows the aggregate supply curve of all land used for settlement and traffic, set by the planning authorities. The intersection point determines the unit price of the universal development right P^* [13]. The illustration holds true for an individual municipality as well as for the aggregation of municipalities.

The figure shows why a unit price causes economic incentives to violate the land use plans:

- Regarding land use type A, the mayor in charge will extend the land use until the intersection point (I_A) of the unit price P^* and the marginal abatement costs MAC_A . From this point on, the costs for additional planning permits exceed the benefits from additional land use. However, regarding the land use plan (and the marginal damage), more development of land use type A would be possible (up to E_A and C_A respectively). Insofar there is a loss of welfare, indicated by the gap between M_A and C_A . In order to support the land use planning, price P_A would be necessary instead of the unit price P^* .
- Looking at land use type B, the mayor increases land development until his/her benefits of additional development MAC_B equal the unit price of the development P^* (in point I_B or M_B respectively). However, this is much more than the land use plans have fixed (C_B). If the caps reflect the intersection point E_B of marginal damage function MD_B and marginal abatement costs MAC_B , this point I_B is also far beyond efficiency (in E_B). In order to get an effective and efficient result, price P_B would have been necessary.

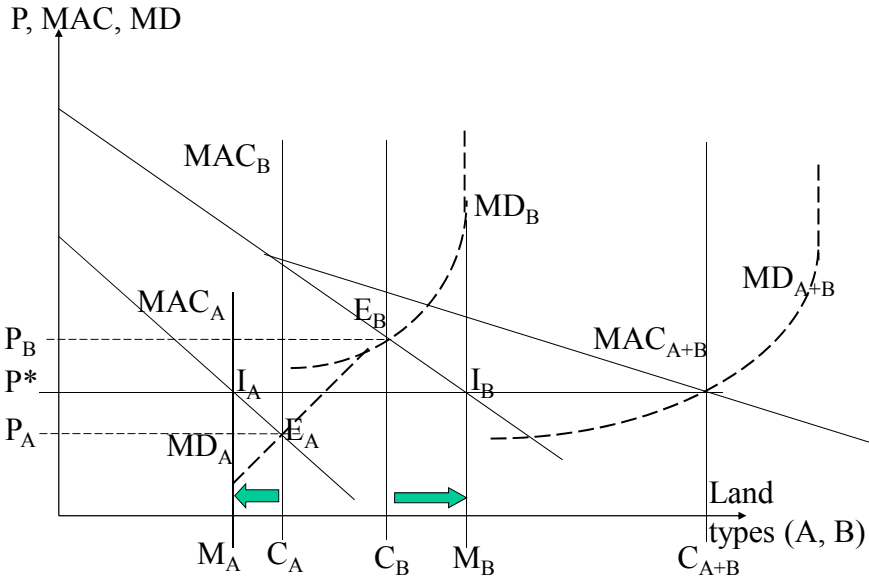


Figure 1. Aberrations with a universal planning permit (adapted from [13])

From the figure above we may derive two important results:

- The trading model, which is based on wide system boundaries and a single tradable planning permit, is not able to support land use planning. With a unit price, it is only able to control scale but not structure.
- Nonetheless, the supporters assert effectiveness. Obviously, they refer to the CO₂ blueprint and only consider the control of scale, but ignore the necessity to control structure. There is no assessment of the welfare losses which are caused by overshooting and undershooting of the planning targets so far (differences between $M_{A,B}$ and $C_{A,B}$). Therefore, also no proper statement about the net efficiency gains (efficiency gains minus the welfare losses, due to overshooting and undershooting) of the cap and trade system can be provided.

Sometimes, supporters suppose that the deviations and aberrations are negligible. Depending on the price of the permits, the position of the caps and the marginal abatement costs, the aberrations and welfare losses can be randomly quite high or low. There is no evidence for a correction mechanism, which might be able to reduce such aberrations systematically. Hence, overshootings and undershootings probably don't equalize in aggregation. The system is as effective as a poor marksman who is currently missing the target in different directions. Aggregating the shooting errors doesn't turn the poor marksman into a champion.

3.4. The "incompatibility thesis"

Against this background, we can describe the central system conflict as follows:

- The rationale of the cap and trade regime is efficiency. However, efficiency can only be achieved within a wide design of the system, among others based on a universal certificate (including all categories of land for human settlement and transport infrastructure);
- In contrast, the required primacy of planning can only be maintained within a tightly structured system. In contrast to the controlling of the scale of CO₂ emissions, the settlement structure cannot be controlled by one cap (certificate) and one price, but needs a diversity of prices with a diversity of certificates.
- If a structure is “treated” with a single price, welfare losses have to be expected due to overshooting and undershooting of the planning targets. Hence the net efficiency gains and net welfare effects of a cap and trade regime for land use policy are not clear at all.

The supporters of the tradable planning permits claim that planning should impose a correcting action if necessary. However, our argument is that precisely due to the counteracting economic signals, planning cannot impose such an action.

The problem could theoretically be solved by a variety of tightly segmented sub-markets with diverse price settings. Sub-markets which adapt the categories of land use planning (market segmentation in categorical terms) have been discussed e.g. by Henger and Schröter-Schlaack [17]. Spatial boundaries which limit the trading rights to regions with similar protection status (market segmentation in spatial terms) have been addressed e.g. by Williams [18], Walz et al. [16], Henger and Bizer [19]. However, in most countries such markets would be too small and thus inefficient [17]. At least in the German discussion, the conflict of goals which appears in the cap and trade scheme was decided in favour of efficiency and against market segmentation. Within a system with wide boundaries, such an incompatibility could perhaps be avoided in a few countries with high population and centralized land use planning systems, such as China. However, so far there is no sound research about the minimum size of such markets and the requirements for the land use planning system.

3.5. Addendum: Initial distribution

Within a cap and trade system, the initial distribution might be done by auction or by providing the permits to the communes without costs (according to alternative allotment formulas). Simulation experiments with German municipalities related to the cap and trade scheme also showed that the initial distribution of rights is quite a critical issue, which may endanger acceptance [20]. In order to guarantee the *acquis* of the communes, discussions have so far favoured “grandfathering” schemes, in which the status quo of land consumption is not touched. However, such grandfathering schemes are probably less efficient than auction schemes [13, 17].

4. Results and discussion

Basically, the required primacy of planning is not compatible with the system of tradable planning permits. If the basic idea of capping planning permits should be kept, a redesign of the regime is necessary.

4.1. Cap and auction

In order to support the planning system (“primacy of planning”), the planning permits should best be defined in a tight manner which is in line with the categories of the planning system. For instance, if planners are thinking in categories such as residential, industrial or mixed areas, traffic etc., the planning permits should also follow these categories. This also facilitates the handling of the system. Planning permits should basically be mandatory for all sorts of developed areas. For instance, recreational space may have also negative ecological impacts.

The caps could be administered on different administrative levels, e.g. at the level of the states, even at the level of regions (or in other countries: at county level). However, the administration needs a certain human capacity. In Germany, the 30 ha cap might be broken down into lower administrative levels without problems.

However, within a tight definition of a variety of planning permits at a low administration level (e.g. region), the “markets” for each right would be quite narrow. Hence the allocation mechanism shouldn’t be based on the secondary market (trade – “horizontal coordination”) but on the primary market, namely auctions (“vertical coordination”). The auction of planning permits to the communes could be done periodically. Giving the focus to auction doesn’t mean a complete ban on trade but a reduction of its significance. Due to the tight design of the sub-markets, organized trade wouldn’t be possible anyway. Instead, over-the-counter trade would be feasible, regulated by the planning permits administration. Within the proposed design, different types of planning rights (residential, industrial etc.) were auctioned and traded at different prices.

The administration should also guarantee that it will take back the planning permits for a fixed price (based on the auction price). Thus communes could also think about changing the land use plans and the redevelopment of shrinking areas into the natural state. Deconstruction would be encouraged, because the communes could be sure about the compensation.

A system which is based on auction might be designed tightly with regard to space, time, participants and objects of the design. The system may work with only a few participants. It may work even at regional level. Within the auction, the development rights are allocated to those communes that can make the best use of them. Moreover, without the overshooting and undershooting of the cap and trade regime, welfare losses also are avoided.

Despite the segregation of sub-markets, the system is also efficient. However, in terms of efficiency it is not clear if such a cap and auction system will or will not compete with a cap and trade system, which is based on a single, universal development right. Nonetheless, if in doubt, recognizing the primacy of planning within the conflicts of goals means subordination of efficiency. From a system theory point of view, economic efficiency shouldn’t be a guiding value [15] of superior significance anyway, at least not in land use management. Instead, the guiding value of efficiency has to be balanced with other guiding values.

4.2. Completion by means of a financial equalization scheme

The regime sketched out above has to face some serious counterarguments relating to political viability: In an auction, the powerful communes with a high willingness to pay will prevail. Moreover, the financial situation of the communes would be even more strained and the municipalities' *acquis* would be encroached (see section 3.5.). Hence the question is how to increase the acceptance of a cap and auction model.

On the one hand, certain transition regulations such as free development rights for existing settlements would certainly be helpful, but not nearly enough on their own.

On the other hand, the view of the discussion about climate policy might be promising. Within the Kyoto regime, it has not been possible to put in place effective caps, mainly because the problems of distribution and "climate justice" have not been solved yet [21]. The regime was based on "grandfathering". Hence those countries with the most aggressive occupancy of the atmosphere and most responsibility for the climate problem got most rights. This was considered as being unjust by countries with developing and emerging economies. Basically, the same holds true in terms of land use permits.

However, many of the objections mentioned above could be countered by establishing a redistribution mechanism. Within such a redistribution mechanism, the money paid by the communes in the auction could be firstly collected in a fund ("land trust"), which is administered by the affected communes. Second, the money is redistributed to the communes, preferably according to the number of their inhabitants (other redistribution keys are also possible). In this respect, all inhabitants are considered as "co-owners" of the planning permits, and thus they should participate in equal shares from the revenues of the auction. Considering the CO₂ emission trading schemes, this idea has been popularized by Peter Barnes [22]. Applied to land use planning, a similar redistribution scheme has already been suggested by Krumm [23]. However, his proposal was based on a price-steering basis: Basically, communes should be charged for any new land conversion using a fixed rate per square meter. The money should be pooled in a fund and redistributed to the communes, preferably according to the number of citizens.

If redistribution to the communes were carried out according to the population, the payments into the "land trust" would be according to the land used per capita, whereas the redistribution would be according to the average use per capita. Hence, besides the cap, an additional incentive for a sustainable land use is implemented:

- If the actual land use per capita is higher than the average land use, the commune in charge is a net contributor to the "land trust";
- If the actual land use per capita is lower than the average, the responsible commune is a net beneficiary;
- If the actual land use corresponds to average land use, there is no difference compared with the status quo.

Because every commune tries to get net benefits out of the land trust, there will be a current dynamic incentive to carry out efficient and effective land use management. In terms of

microeconomics, the dynamic incentive is pushed by the substitution effect, whereas the income effect is eliminated by the redistribution scheme (“Slutsky equation”, see [24]).

Moreover, within this redistribution mechanism, an average access to the planning permits is granted, also for financially weak communes. The redistribution mechanism serves as an ecological financial equalization scheme between the municipalities. Not unlike a lease mechanism, communes with land consumption rates above average pay to communes with land consumption rates below average.

The effects of the redistribution system are far reaching. To mention just some of them:

- Currently, for instance, some German communes can take some “fiscal rents” due to their location, at the expense of other municipalities. This holds true particularly for the communes in the wealthy commuter belt of bigger cities (“Speckgürtel”). They benefit from the migration out of the bigger cities (e.g. young families), which are “bleeding”. In such peripheral communes, land prices are often lower and the environmental conditions are often better than in the big cities. However, a great deal of the attractiveness is caused by uncompensated spillovers. According to the central locations principle [25] the bigger cities provide a variety of public goods at the commuter belt’s benefit. Thus urban sprawl is fuelled, and the financial performance of bigger cities gets weaker and weaker. However, in the proposed regime, the whole fiscal surplus will be skimmed off dependent on the type of auction. The willingness to pay of the commuter belt’s communes includes the expected fiscal rents (from spillovers). The fiscal rents are redistributed to all communes according to the number of the people, also to the bigger cities. Due to the higher density of population, the redistribution scheme will compensate the bigger cities for their efforts.
- The model is applicable in situations of growth as well as in shrinking areas. In aging societies such as Germany, in particular rural regions are affected by shrinking. However, land conversion and land consumption is highest ex urbia. Urban sprawl turns out to be luxury which is increasingly difficult to finance. The redistribution model may stimulate migration to more compact settlements, with a higher supply of public goods. The system would provide an incentive for renaturation measures in rural communes. This would have positive side effects, considering e.g. vacancy rates and the value of existing properties.
- By skimming off the rents from certain types of land use, communes get more indifferent towards land use alternatives. On a regional level, coordination between municipalities and the allotment of certain functions (industry, tourism etc.) towards different communes is easier than today. Thus, integrated approaches of regional development might be put in place without high resistance of the communes affected.

With regard to the technical implementation of the system, some minor problems have to be solved. For instance, in order to create equal conditions in the auction, the communes should pay into the land trust in the same “logical second” as the redistribution happens. This means the communes are only charged or rewarded by the balances (net position of pay-in and pay-out). Moreover, it has to be figured out on which administrative level the

system should be applied. Basically, the redistribution mechanism should be tied to the scope of the cap and auction scheme.

One should be clear about the fact that no money for natural protection would be raised within the redistribution scheme. However, modifications are possible: If, for instance, a natural park as a common public good has to be financed, the redistribution could be carried out after first deducting the expenses for covering the park. Such decisions depend on the land trust and the planning authorities. A legal basis for the cooperation arrangement is necessary.

The proposed model may be appealing, but it is not a “silver bullet”. The framework has to be completed by other instruments. For instance, the price of real estate may rise due to successful capping of planning rights. Thus, access problems for socially weak groups might be caused. Hence a suitable land taxation system which transfers shares of land rents and land value to the community would be desirable for example.

5. Conclusions

The concept of tradable planning permits transforms the idea of the CO₂ cap and trade regime to spatial planning. Analyzing the tool, we have at least to refer to effectiveness (planning, ecology), allocation (economy) and distributional aspects (social).

Regarding effectiveness, there is a broad consensus about the primacy of planning. Any economic tool should support planning instead of substituting it. However, planning land is not the same as planning the maximum permissible load of CO₂ in the atmosphere. The former requires a planning of structure, the latter a planning of scale, since it is irrelevant where the emission takes place.

Planning the structure of land use cannot be supported by a unit price, as a result of a universal certificate for all types of land use (for settlement and traffic). In contrast, a variety of sub-markets are necessary, with a different price setting. Meanwhile, more and more planners are also becoming sceptical about the supporting effects of a cap and trade regime.

Supporting the planning of a structure within a variety of sub-markets may be inferior compared with the efficiency of a cap and trade system with wide system boundaries. On the other hand, efficiency losses due to overshooting or undershooting might be avoided. The efficiency losses might be minimized by auctioning the permits to the needy communes on the primary market (“vertical allocation”). Although trade shouldn’t be forbidden, an organized secondary market is dispensable (subordination of a “horizontal allocation mechanism”). Moreover, both systems would have to prevent strategic acquisitions of permits (impediment of development in other communes by an artificial shortage of supply), e.g. by a current devaluation of the permits.

Regarding the blueprint of CO₂ trade, a comprehensive arrangement on a global scale has so far failed due to distribution disputes. Also a cap and auction system for planning permits wouldn’t be acceptable particularly for communes with a weak financial endowment if there were no correction. This is the reason why the cap and auction regime should be completed by a redistribution mechanism which is based on equal stakes in the scarce land use opportunities.

However, more research is necessary in order to deal with the details of the counter-proposal outlined in this article. So far, in Germany politics has supported the cap and trade approach; as has the allocation of research funds. Critics who pointed out the incompatibility between effectiveness and efficiency in the cap and trade approach have been pushed aside. This also holds true for the combination of caps, auction and redistribution, which couldn't be assessed so far. However, in experimental simulations the acceptance of the cap and trade regime among the practitioners was obviously not very high. Among others, the results of the cap and trade game turned out to be quite sensitive in terms of an increase of the complexity of the framework [20]. In contrast, at least the redistribution approach of Krumm was highly accepted (here, basically, also no fiscal impact assessment is necessary) [26]. Maybe it is time to widen the scope of the research paradigm to extend beyond the cap and trade regime.

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