

67



Can economic instruments regulate noise pollution in locations near airports?

Thierry Bréchet and Pierre Picard

December 2007

ENVIRONMENTAL ECONOMICS & MANAGEMENT MEMORANDUM



UCL
Université
catholique
de Louvain

Chair Lhoist Berghmans
in Environmental Economics
and Management

Center for Operations Research
and Econometrics (CORE)

One objective of *Brussels Studies* is to encourage debate around scholarly articles containing proposals for public action. With this issue, under the heading "double vision", we are inaugurating a new formula – a dialogue between academics from different disciplines – in this case two economists and a geographer – on the highly controversial issue of noise pollution caused by air traffic at Brussels National. The former propose creating a market for noise emissions as a regulatory instrument, while the latter evokes political responsibility to regulate the matter, based on the principle of limiting the number of people submitted to noise from aircraft.

I. Can economic instruments regulate noise pollution in locations near airports?

by Thierry Bréchet et Pierre Picard

p. 1

II. A few comments on the text: "Can economic instruments regulate noise pollution in locations near airports?"

by Frédéric Dobruszkes

p. 5

III. Response to the comments made by Frédéric Dobruszkes

by Thierry Bréchet et Pierre Picard

p. 10

Translation: Gail Ann Fagen



double vision

Brussels Studies debates

The *Double vision* series is a compilation of articles for debate which bring together academics from different disciplines to provide converging or diverging views of the same issue.

Pierre Picard and Thierry Bréchet

Can economic instruments regulate noise pollution in locations near airports?¹

Translation: Gail Ann Fagen

Authors

Senior Lecturer, University of Manchester UK, Pierre M. Picard is graduated as a civil engineer at the University of Louvain, obtained a M.B.A. at the Katholieke Universiteit van Leuven and a Ph.D. in the department of economics at the University of Louvain. He now teaches micro-economic theory, industrial organization and managerial economics. He is interested in topics linking the fields of public economics, industrial organization, spatial and regional economics and economic geography. He is currently holding a RIB (Research In Brussels) grant to visit ECARES, Free University of Brussels on a project about regulation of airport noise and noise permits.

Thierry Bréchet is currently Professor of Economics at UCL and holder of the Chair Lhoist Berghmans in Environmental Economics and Management. He is also member of the Center for Operations Research and Econometrics (CORE) and of the Strategic Management Unit (POGE-IAG) for its research activities. In 2000, he received his PhD from the University of Paris I Panthéon-Sorbonne. He worked as a consultant (1999 to 2001), mainly on research projects related to development, environmental and sustainability issues, before joining the UCL in 2002 at the opening of the Chair Lhoist Berghmans.

They recently published 2007/45, *The price of silence: tradeable noise permits and airports*. <http://www.uclouvain.be/cps/ucl/doc/core/documents/Brechet-Picard-COREdp.pdf>

The issue of noise pollution near the Brussels National airport has turned into a highly political topic. Until now decisions on the number and location of flights over various municipalities were taken by a federal institution (ministry or government) entrusted to federalise the viewpoints of the regional and economic entities involved and to manage the economic and social impacts, especially the health of the residents. In the light of present difficulties, it might be useful to present some economic reflections on this subject. These thoughts revolve around the question of efficiently managing the external effects of airport activity.

When an airline company inaugurates a connection, it organises a flight that enables passengers to travel, but one that also causes disturbing noise in residential areas. While the "internal" agents of the airline company derive the profits of this flight (revenue minus the costs), the noise pollution must be borne by "external" agents outside this company. Indeed, neither the stockholders, directors, workers or travellers are affected by the noise of this flight. In economic terms, noise pollution is therefore a "negative externality", for it undermines the well-being of the agents not involved in the company's economic activity.

The origin of the problem with an external effect, or externality, caused by an economic activity lies in the fact that its *economic and social* costs and benefits are not borne by the same agent. Daily life provides numerous examples of externality. A typical example is a dance party planned by your neighbour which will keep you awake. In this case the externality arises because the producer of the nuisance is not concerned by your well-being (a night's sleep). Economic theory nevertheless points to efficient solutions to this type of problem. One consists in granting you a

¹ This project was conducted with the support of Research In Brussels, Institut d'encouragement de la Recherche Scientifique et de l'Innovation de Bruxelles (IRSIB – IWOIB), Université catholique de Louvain (Catholic University of Louvain), CORE and CRECIS, Louvain School of Management and Chair Lhoist Berghmans "Environmental Economics and Management".

Contacts :

Thierry Bréchet, Thierry.Brechet@uclouvain.be

Pierre Picard, pierre.picard@manchester.ac.uk

Michiel Hubert (ed. in chief.), 02/211 78 53 – 0485/41 67 64
hubert@fusl.ac.be

Thierry Bréchet and Pierre Picard, "Can economic instruments regulate noise pollution in locations near airports?", comments of Frédéric Dobruszkes, *Brussels Studies*, issue 12, 2007 december the 3rd, www.brusselsstudies.be

right to silence. In this case you have the right to ask for compensation on the night of the dance party, for example the cost of a hotel room. If your neighbour considers the cost too high compared to the utility derived from his dance party he will give up the idea. Note here that cancelling the dance party is an efficient result from the social point of view, since it shows that your neighbour's utility is less than your "dis-utility". A second solution consists in giving your neighbour the right to make noise. You can then pay him to rent a dance hall if you really wish to stay in that night, and once again the same argument applies. This is the theory of Ronald Coase, winner of the 1991 Nobel Prize for economy: *the combination of (i) a transaction between agents and (ii) a definition of the property rights on the source of an externality can restore economic efficiency.*

It is interesting to apply this economic argument to airport development. Two questions are therefore relevant: is there such a thing as allocation of rights to silence between noise emitters and receivers? Is there a possibility for negotiation and transaction between these two actors? Several notions can be stressed:

First, in most airport sites the property rights to noise belong to neither the local residents (or residents associations or municipalities) nor to the airline companies (or the airport). Therefore socio-economic efficiency is naturally not involved.

Second, a small number of airports either compensate local residents (the Orly airport for example), or the airlines pay a noise tax (such as Tokyo Haneda, Amsterdam Schiphol or Sydney airports). Unfortunately, in this latter case, there is generally no explicit link between the costs borne by the local residents and the airlines' profits.²

Third, an argument frequently misused asserts that the property prices and rental of real estate in areas inflicted with airport noise are diminished to compensate the owners and/or tenants for nuisance from the aircraft noise. As a matter of fact this argument does not influence efficiency and the socio-economic desirability of airport activity. The money is actually transferred from owner to owner or between owners and tenants; they are not transfers of value between the emitter and the receiver of the noise. Under Ronald Coase's analysis, to achieve economic efficiency the drop in real estate prices must be completely reflected in the airlines' profits.

Lastly, the same remark applies to the NIMBY (*Not In My Back Yard*) argument whereby individuals (unrightfully) refuse to suffer local disadvantages (in their backyard) arising from a common good that has an overall benefit (for their local area and region). This is the case at hand where we have an airport that causes nuisance for residents living in the flight corridors, but at the same time facilitates the journeys of national and foreign (transiting) travellers. Here again, under Ronald Coase's analysis, to have socio-economic efficiency the residents' disadvantages, especially the resulting lower real estate prices, must be completely reflected in the airlines' profits.

Economic texts unfortunately have relatively little to say about the choice of economic instruments and institutions that would allow an efficient management of

² FABUREL Guillaume, CHATELAIN Florent, GOBERT Julie, LEVY Lisa, MANOLA Théodora and MIKIKI Foteini (2006), "Les effets des trafics aériens autour des aéroports franciliens" (The effects of air traffic around the airports of the Ile de France region), Centre de Recherche Espace Transport Environnement et Institutions Locales, Institut d'Urbanisme de Paris, Université Paris XII.

noise pollution caused by airports. Nonetheless, as early as 1972, William Baxter and Lillian Altree³ proposed two solutions. The first consisted in setting up a private airport company that would not only handle the airport's economic activity, but would also own the adjacent property subject to the noise. This company would naturally find a balance between its economic development and the value of its real estate holdings. Prospects of higher property value would entice this company to arrange for less noisy flights or else sanction flights with the highest "noise/profit" ratio. This solution however hardly seems realistic because it would exacerbate the problem of airport financing and it would also accentuate the airport's monopoly power over the airline companies.

Baxter and Altree's second solution would be to set up an independent, not for profit, institution that would be responsible for yearly evaluations of the variations in property value in the air corridor zones and for compensating the owners for earnings lost. The advantages of this scheme lie in the absence both of the need to finance this institution and of monopoly power. There are several drawbacks however, both methodological and legal. On one hand it is quite hard to distinguish the impact of noise pollution on property value among other effects (such as regional decline, real estate bubble, etc.). On the other hand it is even harder to reach an agreement among the various stakeholders on the compensation to be handed out. If, in the first solution above, such a decision could be taken unofficially by the private airport company (between its "Development" and "Real Estate" divisions), in this second solution it would have to be officialised in the structure proposed by William Baxter and Lillian Altree. Obviously several legal appeals could be expected from the party summoned to pay. Thus both of these economic proposals appear hard to implement.

In view of the political and legal complexity of the issue of noise management and Zaventem airport, we felt it would be useful to expand our range of regulatory modes. We propose an original solution⁴ that considers the notion of a market in tradable noise permits (or silence permits) to manage the noise pollution generated by the aircraft flying into or out of an airport. Such a market would enable airlines, responsible for noise emissions, to compensate the local residents who are harmed. Thus the local residents are granted a right to silence and the negotiation between these residents and the airlines is organised around this market. Participation by the municipalities or resident associations located along the air corridors would also make it possible to implement the optimal socio-economic number and spatial distribution of flights among routes. This market could be managed "in complete neutrality" by a computer programme, such as those already employed in markets on energy or carbon dioxide quotas. Involvement by the political authorities is thus unnecessary. Organisation of such a market would not entail the drawbacks of the two solutions proposed by Baxter and Altree. Indeed, it does not require heavy financing or a regular empirical study of the impact of noise on property value; it does not increase the airport's monopoly power, nor does it lead to litigation on the damages

³ BAXTER William and ALTREE Lillian (1972), "Legal Aspects of Airport Noise", *Journal of Law and Economics* 15, 1-113.

⁴ Thierry BRECHET et Pierre PICARD. "The price of silence: tradable noise permits and airports", CORE discussion paper 2007/43 (<http://www.uclouvain.be/cps/ucl/doc/core/documents/Brechet-Picard-COREdp.pdf>).

to be paid. Nonetheless, as in any market, proceeds are generated and they are distributed to certain groups of residents as well as to the most cost effective flights. Furthermore this solution nevertheless meets the conditions of socio-economic efficiency, and this without the intervention of political authorities.

The idea of granting local residents a right to silence may seem provocative. But Ronald Coase's message must be clearly understood. If the airport activity is unable to survive after the residents are granted this right and can sell them back to the airline companies, this means that the socio-economic costs of air transport exceed the benefits. Thus there is a strong presumption that the socio-economic benefits of the airport exceed its costs. Indeed, Brian and David Pearce, researchers at the University College of London estimated that a very low tax (less than 2%) on air fares would suffice to compensate for the whole set of environmental effects (noise pollution, air pollution, etc.) caused by activity at Heathrow Airport.⁵ In the case of Brussels National airport, it has been shown that a permanent airport tax of € 12.5 per passenger would yield revenue equivalent to the rental cost of the whole residential area under one of the two air corridors used by Brussels National in 1999.⁶ In other words, the problem of noise pollution could be completely solved by using just a small part of the revenue from airport activities.

A tradable noise permit market would lead to an optimal socio-economic situation. An academic discussion on this subject will take place at the "Workshop on Regulation of Airport Noise", held at the Université Libre de Bruxelles (ULB) on 10 December 2007.⁷

⁵ Brian PEARCE and PEARCE David (2000) "Setting Environmental Taxes for Aircraft : A case study of the UK", CSERGE Working Paper GEC 2000-26, Centre for Social and Economic Research on the Global Environment, University College London.

⁶ Pierre PICARD "12,5€ de compensation par passager" (€ 12.5 compensation per passenger), *La Libre Belgique*, 30/09/2005.

⁷ For registration and information on this workshop contact Nancy De Munck, ndemunck@ulb.ac.be.



Frédéric Dobruszkes

A few comments on the text: “Can economic instruments regulate noise pollution in locations near airports?”

The text presented has the merit of discussing a highly topical question of airport nuisance. Although it is thought-provoking, it seems to raise more questions than it solves. We shall ignore the fact that the authors make no distinction between day-time and nighttime flights, or that they only speak of passenger flights while night flights, the source of the worst disturbance, are primarily cargo flights. More basically, the text raises serious questions in so far as on one hand it approaches the issue outside the realm of social relations, and on the other it confines itself to the issue of noise pollution without dealing with public safety. We shall try to develop these two remarks in an accessible and non-polemic manner.

The solution proposed is a scheme directly derived from concepts and methods used in a certain form of economics that works in and with a world that is regular, isotropic and socially neutral, in other words in a bubble divorced from social realities, and in the case at hand, geographic realities since the issue of airport nuisance by definition is part and parcel of physical and human space. Consequently, the solution proposed – a market for noise rights – disregards the social relations that make up our society and that form the diversity of the Brussels region. It appears as an apolitical solution to a problem that is clearly political, even if technical constraints linked to air traffic procedures must be taken into account. At a time when the by-word is cross-cutting disciplinarity, something seems to be missing here.

So, when we take into account the social and geographical facets of the issue under discussion, what can we observe? During the day, 45% of the flights taking off head towards the east of Brussels and its periphery (Evere, Woluwe, Kraainem,...), and as many towards the north/northwest of Brussels (Laeken, Grimbergen, Wemmel,...). The rest fly over densely populated neighbourhoods in the centre (Schaerbeek, Pentagon, Molenbeek,...) – the "Chabert" weekend route and the jumbo jet route – and over the neighbourhoods located to the north and east of the airport. During the night, planes take off over the east (27%), the north (36%), the centre of Brussels via the "Canal", or "Onkelinx", route (14%) and over the neighbourhoods to the north and east of the airport (24%) (see figure below for an ap-

Author

Frédéric Dobruszkes, a Doctor in Geography, is a lecturer at ULB-IGEAT and researcher in transport geography at ULB. He is the author of an article entitled "Éléments pour une géographie sociale de la contestation des nuisances aériennes à Bruxelles" (Elements for a social geography of protests regarding airport nuisance in Brussels), to be published in *Espace Populations Sociétés*, n°1-2008.

Contacts :

Frédéric Dobruszkes, fdobrusz@ulb.ac.be

Miichel Hubert (ed. in chief.), 02/211 78 53 – 0485/41 67 64
hubert@fusl.ac.be

Thierry Bréchet and Pierre Picard, "Can economic instruments regulate noise pollution in locations near airports?", comments of Frédéric Dobruszkes, *Brussels Studies*, issue 12, 2007 december the 3rd, www.brusselsstudies.be

proximate idea). Procedures leading to flights over Brussels's eastern and northern neighbourhoods and peripheries were introduced in 1971 to reduce the number of people living in the flight corridors, compared to the former routes that flew over Brussels.

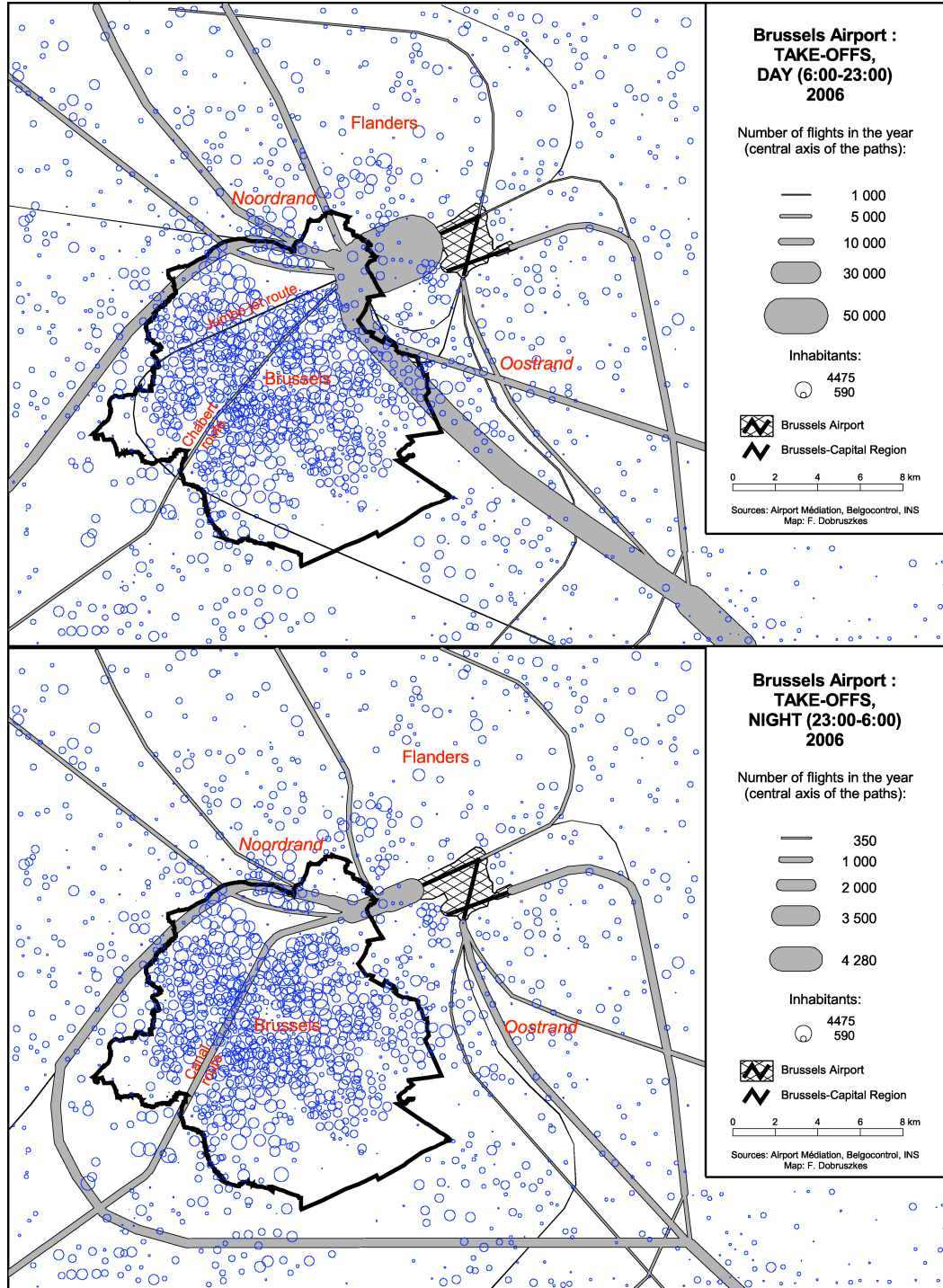
This simplified geography of flight paths (thus nuisance) reflects a fairly clear-cut social geography: the Eastern neighbourhoods or peripheries, as for a large part the North/Northwest, are particularly well-off areas, while in the central neighbourhoods the population is much denser and tend to be lower-income or else middle class.

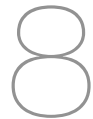
In such a context, what can be said about the solution of a market for rights to make noise? For such a market to be fair, the stakeholders would have to be on equal footing. But all stakeholders are equal only in simplistic theories. It is hard to imagine how rich and poor citizens, or their public representatives, could be on equal footing to negotiate compensation or avoidance of nuisance in exchange for cold, hard cash. One may expect that the lower-income residents will be tempted to accept the nuisance in exchange for additional revenue, either direct (if the money is distributed personally) or indirect (if the money is invested in their neighbourhood). The possibility becomes even clearer in the light of studies showing that populations exposed to noise may well not objectivise the consequences, even as they unconsciously suffer from them (perturbed sleep, lack of concentration,...). Therefore it would be hard to claim that citizens were accepting financial compensation in full awareness of the facts. On the other hand, the residents of better off neighbourhoods a priori have little need for extra money, and would even be able to pay to be free of this nuisance. Consequently, implementing a noise permit market in Brussels entails the risk of a deconcentration of flight paths to the detriment of the lower-income and densely populated areas of Brussels.

This leads us to also approach the debate in terms of risk to the residents' safety. Indeed, no one would like to see an airplane crash in Brussels or its periphery, but this possibility cannot be excluded. Beyond the possibility of an accident due to technical or human error, the risk of a terrorist act cannot be ignored. Need we recall that Brussels is the headquarters of NATO and the EU, international institutions that are not necessarily "appreciated" everywhere in the world. Along these lines, when the term "market for noise pollution" is replaced by "market for risk of death", the solution of a market in flight paths sounds even less fair, if not completely cynical. Can we seriously accept, if only from a moral standpoint, that poor populations should be paid to take the risk - clearly infinitesimal, but a risk nevertheless - of perishing after a plane crash in their neighbourhood? And, how to justify the human consequences of an accident in a heavily populated area? Might the cynical reply be that the higher number of victims, compared to a less populated but well-off neighbourhood, reflects the optimal balance obtained through a market whose transactions established and "validated" the geography of the flight paths? In such a case, the only conclusion would be that poor people set less store on life than others...

In any case, the money transfer from the producers of the nuisance¹ to its victims eliminates neither the disturbance - whether conscious or not - caused by the noise, nor the risk in case of an accident. The sole result would be a price for the citizens' silence...

¹ Or from their clients, by passing on the costs in plane fares.





Furthermore, several questions can be raised as to how a market in rights to make noise would be applied. In the first place, the territory concerned by this market would have to be determined, and this inevitably involves a prior political decision. Unless the market's boundaries were circumscribed, nothing would prevent someone located 50 km from the airport who perceives the far-off noise of an airplane from claiming his due. Secondly, would the negotiation be left up to the citizens or to their political representatives? In the first case, what would happen if just one resident refused flights overhead while the neighbours accepted (or even called for) these flights in exchange for financial compensation? In the second case, the role of politicians obviously would be acknowledged, at the same time raising the question of method (role entirely entrusted to the elected officials, concertation with the citizens, etc.). And going a bit further, should the citizens have a weighted voice (from the sheer point of view of noise, would a mother on maternity leave who is home most of the day count more than her husband working in another neighbourhood, or an elderly person who is hard of hearing)? How would the noise and risks borne at the work place or at school² be factored in?

Lastly, the neutrality of a noise permit market solution seems illusory since it disregards the social realities and social relations present in the territory of Brussels³. The geography of airport nuisance arises from technical constraints as well as from a complex interplay of social and political relations in which social inequality enters fully, as seen in the geography of protests against noise pollution which we discuss in other documents. It was only a strong structuring of the higher-income neighbourhoods and an institutional power ratio disadvantageous to the Brussels-Capital Region that made it possible to create or reactivate flight paths over the central, dense and lower-income neighbourhoods of Brussels. In this context, we feel that the issue of airport nuisance precisely should be regulated on the basis of political choices, and even more precisely on the basis of a simple, but a priori objective and easily objectivisable criteria: that of minimising the volume of the population exposed to noise and the risk of accident, regardless of its social and linguistic configuration⁴.

We also feel that the illusion of a market solution, instead of state regulations, is not adapted to the problem of airport nuisance. The absurdity of the idea emerges more clearly when we transpose it to other areas where environmental problems are at stake. Take for example the case of nuclear waste. It would be enough to establish a market involving the nuclear power stations operators along with all the countries of the world, or even their citizens directly (to avoid political intervention) in the aim to dispatch cumbersome wastes to the few countries that would be willing to accept them, in other words, the poor countries in sad need of currency. What is more, this exercise should not be difficult, given the differences in living standards and costs of living. Neither should this raise too many objections at the local level: illiteracy and lack of access to information in these countries is such that control of

² It may be perfectly feasible that noise bothers people more at their workplace or school than at home.

³ Or in any other territory if the solution were transposed to other places.

⁴ Which would not spare public authorities the task of conducting a more reasonable regional planning policy, in particular as regards building permits granted to build housing in the noise zones of the northern and eastern peripheries. This obviously opens the debate on compensating the owners of land zoned for housing, but not yet built.

the information would at best be asymmetrical. And moreover, in the case of concerns about local conditions for nuclear waste management then rules for public safety would have to be imposed. One more distortion hampering a free and neutral market...

All this might well sound amusing, except that at the end of the day what is truly at stake is the future of state regulations. Their dismembering, an ongoing activity since the neo-liberal turnabout that occurred in the early 1980s, obviously musters scientific theories that justify this process and help make it possible. What is important lies not so much in their truth as in the political use made of them. In this context, a market for the right to make noise is a sign of the times. But is it truly reasonable to replace State authority, a costly relic of centuries past, by a few computers to lead us to Market Equilibrium?

The author is grateful to Pierre Marissal and Gilles Van Hamme for their helpful remarks.



Thierry Bréchet and Pierre Picard

Response to the comments made by Frédéric Dobruszkes

We thank Frédéric Dobruszkes for his interesting remarks.

First we should like to point out that our article intended to underline the fact that noise pollution is an externality involving local residents (of all social-demographic groups) and the airline operators. According to Coase, this externality can only be resolved by granting one party a right to produce this nuisance and allowing the possibility to compensate the other party. The alternative to such a definition of noise rights is a mechanism called "order and control" by which a regulator deemed to be "benevolent" assembles and processes all the information concerning the social cost of nuisances and their distribution, as well as their benefits for the operators and, if relevant, the workers. This *top-down* alternative does not seem credible in a federation where successive federal governments have not been able to negotiate true measures (no compensation system has been implemented, for instance), where the regions are unable to reach an agreement on noise level standards to evaluate the nuisance, and lastly where the situation is determined by various jurisdictional decisions. In contrast, the permits market represents a *bottom-up* solution as the framework for local residents representatives and airline company operations to seek an equilibrium between compensation and nuisance. This solution avoids potential conflicts of interest (of the Communities, for example) by giving the same right to each representative of individuals (ex: Dutch-speaking, French-speaking) living under the flight paths. In his comment, Frédéric Dobruszkes does not seem to demonstrate how a political solution would be more apt to work in concrete terms compared to the market solution.

Contrary to Frédéric Dobruszkes's comments, the equilibrium of a noise permits market is fully compatible with a distribution of flights over less densely populated zones. Indeed, for each flight the representative of a less populated zone would request a lower overall compensation for it must be distributed among a small number of residents. In other words, in order to have the same overall level of compensation for his zone this representative would have to accept a greater number of flights. This inverse ratio between population density and number of flights is a feature not only of the socially efficient solution but of the permits market solution as well.

Furthermore, the permits market solution is perfectly compatible with a time segmenting of flights and permits. As Brechet and Picard have explained (CORE Discussion Paper, UCL, 2007), it is desirable to create one market for day flights (6:00-22:00) and a second for night flights (22:00-6:00). As the disturbance, for the same traffic volume, is greater at night than during the day, the price of noise permits would be higher at night. Some airlines will find that it is not profitable to fly at night and will modify either their schedules or their activity structure. Here again, the market solution will be efficient and socially optimal. It does not call for any political involvement, as in the DHL case.

In his comment, Frédéric Dobruszkes evokes other arguments that are interesting but somewhat beside the point. For example, he highlights the problem of fairness between residents of different socio-demographic origins subjected to the noise. Like Mr Dobruszkes, we also feel that the various flight paths inevitably will pass over populations of different socio-demographic origins. And like Mr Dobruszkes, we fully acknowledge that the markets lack the capacity to promote fairness among individuals with different income levels. Nevertheless, it is not justified to claim that redistribution among socio-demographic classes must come about through spatial allocation of air routes. It is also unjustified to condemn solely the (potential) noise permits market for lack of fairness while all other markets equally lack this capacity. To be completely consistent Frédéric Dobruszkes would thus have to propose eliminating other markets such as the stock market or real estate, consumer goods, etc. In the present context, the issue is to ensure the efficient allocation of flights over urban areas. Fairness generally comes about through redistribution of income and through taxation.

In his comment Frédéric Dobruszkes also highlights a public health problem; that citizens incorrectly evaluate the impact of noise pollution on health and that this inaptitude is more frequent among the poorest and least educated social classes. In our proposal, the actors in the permits market are local representatives of the residents, for example acting on behalf of residents associations or the municipalities located in the flight paths. Consequently, there is a certain degree of collectivity and democracy in which the debate on public health must be addressed. In actual fact, this issue is indeed present in the demands supported by the residents associations and elected officials of the various municipalities involved.

Lastly, Frédéric Dobruszkes evokes the problem of a single resident being able to block air traffic by exercising a right of veto or by requesting too high a compensation. This eventuality does not appear in our proposal for several reasons. The first is due to the fact that the residents' compensation requests are collective and organised by zone. The position of one resident unconditionally opposed to aircraft noise would be mitigated by that of other residents more inclined to accept a certain level of disturbance and receive compensation. The second reason relates to the fact that several routes are open and that total blockage of air traffic implies the blockage of each and every one. The third reason relates to the fact that the residents will always accept a first flight as long as the compensation is high enough. This hypothesis is verified empirically in most hedonic price models¹. The final reason illus-

¹ For example, the low level of air traffic at the Tempelhof Airport (Berlin) does not seem to perturb the residents who have called for it to continue its activity.

trates the originality of our proposal which eliminates the problem of the "tragedy of the commons" among the zones located along a flight path. In our proposal, a zone has effectively no incentive to exaggerate the impact of noise pollution and claim an exaggerated compensation for it will not entirely benefit from the revenue of its action.

Environmental Economics & Management Memoranda

69. Thierry BRECHET et Pierre PICARD. Economische instrumenten voor de regulering van de geluidshinder in de omgeving van luchthavens? Brussels Studies, nummer 12, 3 december 2007
68. Thierry BRECHET et Pierre PICARD. Des instruments économiques pour la régulation des nuisances sonores autour des aéroports? Brussels Studies, numéro 12, 3 décembre 2007, www.brusselsstudies.be.
67. Thierry BRECHET and Pierre PICARD. Can economic instruments regulate noise pollution in locations near airports? Brussels Studies, issue 12, 2007 december the 3rd, www.brusselsstudies.be
66. Pierre-André JOUVET, Pierre PESTIEAU and Gregory PONTIERE. Longevity and Environmental quality in an OLG model. September 2007 (also available as CORE DP 2007/69).
65. Raouf BOUCEKINE and Marc GERMAIN. Impacts of emission reduction policies in a multi-regional multi-sectoral small open economy with endogenous growth. February 2007 (also available CORE DP 2007/11).
64. Parkash CHANDER and Subhashini MUTHUKRISHNAN. Green consumerism and collective action. June 2007 (also available as CORE DP 2007/58).
63. Jakub GROWIEC and Ingmar SCHUMACHER. Technical opportunity, long-run growth and convergence. July 2007 (also available as CORE DP 2007/57).
62. Maria Eugenia SANIN and Skerdilajda ZANAJ. Environmental innovation under Cournot competition. June 2007. (also available as CORE DP 2007/50)
61. Thierry BRECHET and Stéphane LAMBRECHT. Family altruism with a renewable resource and population growth. October 2006 (also available as CORE DP 2006/35).
60. Thierry BRECHET, François GERARD and Henry TULKENS. Climate Coalitions: a theoretical and computational appraisal. February 2007 (also available as CORE DP 2007/3).
59. Thierry BRECHET. L'environnement dans tous ses états. *Regards Economiques*, n° 50, 26-32, Avril 2007.
58. Thierry BRECHET and Susana PERALTA. The race for polluting permits. March 2007 (also available as CORE DP 2007/27).
57. Giorgia OGGIONI, Ina RUMIANTSEVA and Yves SMEERS. Introduction of CO₂ emission certificates in a simplified model of the Benelux electricity network with small and industrial consumers. Reprint from *Proceedings of the International Conference on Clean Electrical Power*, Capri, Italy, May 21-23, 2007.
56. Agustin PEREZ-BARAHONA. The problem of non-renewable energy resource in the production of physical capital. January 2007 (also available as CORE DP 2007/8).
55. Thierry BRECHET, Benoît LUSSIS. The contribution of the clean development mechanism to national climate policies. *Journal of Policy Modelling*, 28(9), 981-994, December 2006.
54. Ingmar SCHUMACHER. Endogenous discounting via wealth, twin-peaks and the role of technology. November 2006 (also available as CORE DP 2006/104).
53. Ingmar SCHUMACHER. On optimality, endogenous discounting and wealth accumulation. October 2006 (also available as CORE DP 2006/103).
52. Jakub GROWIEC, Ingmar SCHUMACHER. On technical change in the elasticities of research inputs. November 2006. (also available as CORE DP 2006/63).
51. Maria Eugenia SANIN. Market Design in Wholesale Electricity Markets. October 2006 (also available as CORE DP 2006/100).
50. Luisito BERTINELLI, Eric STROBL and Benteng ZOU. Polluting technologies and sustainable economic development. June 2006 (also available as CORE DP 2006/52).
49. Marc GERMAIN, Alphonse MAGNUS. Prices versus quantities: Stock pollution control with repeated choice of the instrument. October 2005. *Journal of Computational and Applied Mathematics*, 197 (2006) 437-445.
48. Agustin PEREZ-BARAHONA. Capital accumulation and exhaustible energy resources: a special functions case. September 2006 (also available as CORE DP 2007/9).
47. Philippe TULKENS, Henry TULKENS. The White House and the Kyoto Protocol: Double standards on uncertainties and their consequences. May 2006 (also TERI School of Advanced Studies WP Series #1).

46. Thierry BRECHET, Pierre-André JOUVET. Environmental innovation and the cost of pollution abatement. January 2006 (also available as CORE DP 2006/40).
45. Fabien PRIEUR. The implication of irreversible pollution on the relation between growth and the environment: The degenerate Kuznets curve. February 2006.
44. Thierry BRECHET, Marc GERMAIN, Philippe MONTFORT. Allocation des efforts de dépollution dans des économies avec spécialisation internationale. *Revue Economique*, 57(2), Mars 2006.
43. Ingmar SCHUMACHER and Benteng ZOU. Habit in Pollution, A Challenge for Intergenerational Equity. March 2006 (also available as CORE DP 2006/6).
42. Jean-Charles HOURCADE, P.R. SHUKLA and Sandrine MATHY. Cutting the Climate-Development Gordian Knot – Economic options in a politically constrained world. September 2005.
41. Urs LUTERBACHER. Climate Change, the Kyoto Protocol, and Transatlantic Relations. November 2005.
40. Parkash CHANDER and Henry TULKENS. Cooperation, Stability and Self-Enforcement in International Environmental Agreements: A Conceptual Discussion. July 2005.
39. Paul-Marie BOULANGER et Thierry BRECHET. Le Mécanisme pour un Développement Propre tiendra-t-il ses promesses ? *Reflets et Perspectives de la Vie Economique*, Tome XLIV – 2005 – N° 3, 5-27.
38. Paul-Marie BOULANGER and Thierry BRECHET. Models for policy-making in sustainable development: The state of the art and perspectives for research. *Ecological Economics*, 55, 337-350, 2005.
37. Johan EYCKMANS and Henry TULKENS. Optimal and Stable International Climate Agreements. October 2005. Reprint from "*Economic Aspects of Climate Change Policy : A European and Belgian Perspective*", a joint product of CES-K.U.Leuven and CORE-UCL, edited by Bert Willems, Johan Eyckmans and Stef Proost, published by ACCO, 3000 Leuven (Belgium)
36. Thierry BRECHET and Benoît LUSSIS. The Clean Development Mechanism in Belgian Climate Policy. October 2005. Reprint from "*Economic Aspects of Climate Change Policy : A European and Belgian Perspective*", a joint product of CES-K.U.Leuven and CORE-UCL, edited by Bert Willems, Johan Eyckmans and Stef Proost, published by ACCO, 3000 Leuven (Belgium)
35. Vincent VAN STEENBERGHE. The impact of banking on permits prices and compliance costs. October 2005. Reprint from "*Economic Aspects of Climate Change Policy : A European and Belgian Perspective*", a joint product of CES-K.U.Leuven and CORE-UCL, edited by Bert Willems, Johan Eyckmans and Stef Proost, published by ACCO, 3000 Leuven (Belgium)
34. Johan EYCKMANS, Denise VAN REGEMORTER and Vincent VAN STEENBERGHE. Kyoto-permit prices and compliance costs: an analysis with MacGEM. October 2005. Reprint from "*Economic Aspects of Climate Change Policy : A European and Belgian Perspective*", a joint product of CES-K.U.Leuven and CORE-UCL, edited by Bert Willems, Johan Eyckmans and Stef Proost, published by ACCO, 3000 Leuven (Belgium)
33. Johan EYCKMANS, Bert WILLEMS and Jean-Pascal VAN YPERSELE. Climate Change: Challenges for the World. October 2005. Reprint from "*Economic Aspects of Climate Change Policy : A European and Belgian Perspective*", a joint product of CES-K.U.Leuven and CORE-UCL, edited by Bert Willems, Johan Eyckmans and Stef Proost, published by ACCO, 3000 Leuven (Belgium)
32. Marc GERMAIN, Stef PROOST and Bert SAVEYN. The Belgian Burden Sharing. October 2005. Reprint from "*Economic Aspects of Climate Change Policy : A European and Belgian Perspective*", a joint product of CES-K.U.Leuven and CORE-UCL, edited by Bert Willems, Johan Eyckmans and Stef Proost, published by ACCO, 3000 Leuven (Belgium)
31. Ingmar SCHUMACHER. Reviewing Social Discounting within Intergenerational Moral Intuition. June 2005.
30. Stéphane LAMBRECHT. The effects of a demographic shock in an OLG economy with pay-as-you-go pensions and property rights on the environment: the case of selfish households. January 2005.
29. Stéphane LAMBRECHT. Maintaining environmental quality for overlapping generations: Some Reflections on the US Sky Trust Initiative. May 2005.
28. Thierry BRECHET, Benoît LUSSIS. The contribution of the Clean Development Mechanism to national climate policies. April 2005.
27. Thierry BRECHET, Stéphane LAMBRECHT, Fabien PRIEUR. Intergenerational transfers of pollution rights and growth. May 2005 (also available as CORE DP 2005/42).
26. Maryse LABRIET, Richard LOULOU. From non-cooperative CO₂ abatement strategies to the optimal world cooperation: Results from the integrated MARKAL model. April 2005.

25. Marc GERMAIN, Vincent VAN STEENBERGHE, Alphonse MAGNUS. Optimal Policy with Tradable and Bankable Pollution Permits : Taking the Market Microstructure into Account. *Journal of Public Economy Theory*, 6(5), 2004, 737-757.
24. Marc GERMAIN, Stefano LOVO, Vincent VAN STEENBERGHE. De l'impact de la microstructure d'un marché de permis de polluer sur la politique environnementale. *Annales d'Economie et de Statistique*, n° 74 – 2004, 177-208.
23. Marc GERMAIN, Alphonse MAGNUS, Vincent VAN STEENBERGHE. Should developing countries participate in the Clean Development Mechanism under the Kyoto Protocol ? The low-hanging fruits and baseline issues. December 2004.
22. Thierry BRECHET et Paul-Marie BOULANGER. Le Mécanisme pour un Développement Propre, ou comment faire d'une pierre deux coups. *Regards Economiques*, Ires n° 27, janvier 2005.
21. Sergio CURRARINI & Henry TULKENS. Stable international agreements on transfrontier pollution with ratification constraints. In C. Carraro and V. Fragnelli (eds.), *Game Practice and the Environment*. Cheltenham, Edward Elgar Publishing, 2004, 9-36. (also available as CORE Reprint 1715).
20. Agustin PEREZ-BARAHONA & Benteng ZOU. A comparative study of energy saving technical progress in a vintage capital model. December 2004.
19. Agustin PEREZ-BARAHONA & Benteng ZOU. Energy saving technological progress in a vintage capital model. December 2004.
18. Matthieu GLACHANT. Voluntary agreements under endogenous legislative threats and imperfect enforcement. November 2004.
17. Thierry BRECHET, Stéphane LAMBRECHT. Puzzling over sustainability: an equilibrium analysis. November 2004.
16. Vincent VAN STEENBERGHE. Core-stable and equitable allocations of greenhouse gas emission permits. October 2004. (also available as CORE DP 2004/75).
15. Pierre-André JOUVET Philippe MICHEL, Pierre PESTIEAU. Public and private environmental spending. A political economy approach. September 2004. (also available as CORE DP 2004/68).
14. Thierry BRECHET, Marc GERMAIN, Vincent VAN STEENBERGHE. The clean development mechanism under the Kyoto protocol and the 'low-hanging fruits' issue. July 2004. (also available as CORE DP 2004/81).
13. Thierry BRECHET, Philippe MICHEL. Environmental performance and equilibrium. July 2004. (also available as CORE DP 2004/72).
12. Luisito BERTINELLI, Eric STROBL. The Environmental Kuznets Curve semi-parametrically revisited. July 2004. (also available as CORE DP 2004/51).
11. Axel GOSSERIES, Vincent VAN STEENBERGHE. Pourquoi des marchés de permis de polluer ? Les enjeux économiques et éthiques de Kyoto. Avril 2004. (also available as IRES discussion paper n° 2004-21).
10. Vincent VAN STEENBERGHE. CO₂ Abatement costs and permits price : Exploring the impact of banking and the role of future commitments. December 2003. (also available as CORE DP 2003/98).
9. Katheline SCHUBERT. Eléments sur l'actualisation et l'environnement. March 2004.
8. Marc GERMAIN. Modélisations de marchés de permis de pollution. July 2003.
7. Marc GERMAIN. Le Mécanisme de Développement Propre : Impacts du principe d'additionnalité et du choix de la baseline. January 2003.
6. Thierry BRECHET et Marc GERMAIN. Les affres de la modélisation. May 2002.
5. Marc GERMAIN and Vincent VAN STEENBERGHE. Constraining equitable allocations of tradable CO₂ emission quotas by acceptability, *Environmental and Resource Economics*, (26) 3, 2003.
4. Marc GERMAIN, Philippe TOINT, Henry TULKENS and Aart DE ZEEUW. Transfers to sustain dynamic core-theoretic cooperation in international stock pollutant control, *Journal of Economic Dynamics & Control*, (28) 1, 2003.
3. Thierry BRECHET, Marc GERMAIN et Philippe MONTFORT. Spécialisation internationale et partage de la charge en matière de réduction de la pollution. (also available as IRES discussion paper n°2003-19).
2. Olivier GODARD. Le risque climatique planétaire et la question de l'équité internationale dans l'attribution de quotas d'émission échangeable. May 2003.
1. Thierry BRECHET. Entreprise et environnement : des défis complémentaires ? March 2002. Revue Louvain.

Environmental Economics & Management Memorandum

Chair Lhoist Berghmans in Environmental Economics and Management
Center for Operations Research & Econometrics (CORE)
Université catholique de Louvain (UCL)
Voie du Roman Pays 34
B-1348 Louvain-la-Neuve, Belgium

Hard copies are available upon request : env@core.ucl.ac.be

Papers are available in pdf format on line : <http://www.uclouvain.be/en-16845.html>