

THE POTENTIAL ROLE OF MARKET-BASED INSTRUMENTS IN THE ECONOMIC OPTIMISATION OF INVESTMENT IN FLOOD RISK MANAGEMENT

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PREFACE

The origin of this research report was the publication in March 2005 of an academic article by Chiung-Ting Chang (Chang, 2005a) then a post-graduate student in the Department of Environment at the University of York. This article subsequently became an integral part of her PhD thesis (Chang, 2005b). Chang proposed a novel development of the market-based instrument known as the transferable permit to be used in the field of flood risk management (FRM). She described this market-based instrument as the transferable (or tradable¹) flood permit (TFP).

There has been a continuing public interest in market-based solutions to environmental policy problems that can be traced back at least as far as the 1990 environment white paper (H M Government, 1990). Since that time, governments of both political hues have been interested in the subject. Perhaps the most prominent example of a successful market-based instrument introduced since the current administration came to power in 1997 is the London congestion charge. Until recently, however, there has been little specific interest in the possibility of applying market-based instruments to the problems of flood risk management.

Against this background, Professor Charles Perrings, now of the University of Phoenix, Arizona but then at the Department of Environment at the University of York, kindly agreed to the holding of a one-day seminar in his department. This was held on Friday 8 July 2005 and was designed principally for Environment Agency staff working in the field of flood risk management.

This seminar generated a good deal of interest within the Agency; the emphasis on stakeholder involvement in the preparation of flood risk management strategies for river catchments and estuaries and the pressure on funding for investment in flood risk management were probably the two major factors here. Where, for example, it might be possible to put in place an arrangement whereby those benefiting from 'soft' forms of flood defence would somehow compensate those generating them. Largely because of this interest, external research into the potential role of transferable flood permits (TFPs) was commissioned by the Agency. The research aims and objectives as set out in the original terms of reference for this research are to be found at Appendix 1.

It is fair to record here that this research project has not been without its problems. It had been known in advance that Charles Perrings would move to the University of Phoenix in August 2005. Later, at the end of 2005, Chiung-Ting Chang took up a post at the Institute of Water Education in Guelph in the Netherlands. Perhaps inevitably, this gave rise to logistical problems. Also, the focus of the research changed somewhat because it was realised within the Agency that the idea under scrutiny was potentially highly germane to the problem of how to optimise FRM investment in the strategic context of estuaries and river catchments. The title and content of this report reflects that changed emphasis.

The net result of these changes has been that the report itself was largely written in house within the Environment Agency. The focus of the report has also changed; whereas originally it was to focus on TDRs and TFPs exclusively, it became clear during the course of the research that a more general coverage of the potential role of market-based instruments in flood risk management would be appropriate. In particular, the relevance of market-based instruments to the economic optimisation of investment in flood risk management is currently of considerable interest within the Agency, notably in the context of the preparation and delivery of catchment and estuarine strategies. These factors together account for the somewhat belated discussion of TDRs and TFPs in the main body of the report.

¹ The terms 'transferable' and 'tradable' (otherwise spelt 'tradeable') are used interchangeably throughout this report. Transferable rights are defined as rights that can be defined, defended, and divested or transferred voluntarily to other right holders (Yandle, 2006).

The report itself builds on interim reports produced earlier by the consultants. It is important to record here the contributions made by Ece Ozdemiroglu and Helen Johns of the environmental economics consultancy group, eftec, by Professor Kerry Turner of the University of East Anglia, and by colleagues in the Environment Agency. Finally, I should like to thank Professor Robert Sugden, also of the University of East Anglia, for having, at rather short notice, peer reviewed an earlier draft.

By way of a disclaimer, it is important to record that I am to blame for any remaining errors. Also, nothing in this report should be construed as representing Agency policy; any views expressed are those of the author.

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EXECUTIVE SUMMARY

Introduction

1. This report is predicated on the assumption that the Environment Agency is facing three distinct but related economic problems in the field of flood risk management (FRM). These are:
 - The need to ensure economic efficiency in FRM expenditure where planning is increasingly being conducted on a long-term basis through the development of river catchment and estuarine strategies.
 - The need to find alternative sources of funding for FRM investment against a background of (i) global warming and sea level rise and (ii) substantial cuts in the DEFRA block grant for FRM.
 - The increasing recognition of the importance of wider environmental impacts, both positive and negative, arising from FRM investment and the need to find ways to give them their due weight in decision-making.

(1) Economic Efficiency in FRM Expenditure

2. Expenditure on FRM accounts for half of the Environment Agency's budget. As such, it is a significant public expenditure programme. Like other forms of public infrastructure investment, such as highways and transport infrastructure generally, FRM is subject to economic appraisal designed to ensure economic efficiency in the use of public funds. Thus FRM projects have long been subject to a (constrained) optimisation procedure (known as the PAG decision process) designed to ensure economically efficient standards of protection.
3. The case for long-term, strategic planning of FRM investment on a river catchment and estuary basis has become widely accepted. This case has been reinforced with the advent of the EC Water Framework Directive with its emphasis on river basin planning. As with individual projects, the desirability of identifying and putting in place economically optimal solutions for FRM investment on a catchment or estuary-wide basis is also recognised. However, the appraisal guidance, notably PAG2, used for the purpose offers precious little detailed practical guidance on precisely how this is to be done. Nevertheless, it is clear that optimisation in a strategic context is something that goes beyond the determination of the 'right' standard of protection.

(2) Alternative Funding Sources

4. Historically, going back centuries, the Beneficiary Pays Principle (BPP) governed the funding of FRM investment. More recently, particularly with the advent the DEFRA block grant-in-aid, FRM investment has largely been funded through the Exchequer (H M Treasury) from general taxation.

Despite increasing flood risks generated by global warming and sea level rise, the DEFRA block grant is now subject to substantial pressure and cuts. These pressures are expected to increase in the near future. This lends added urgency to the need to identify alternative sources of funding.

5. Given that the extent of the reductions in the DEFRA block grant, it seems almost inevitable that policy will increasingly refocus on the BPP as the key to making up the difference. The implication is that, in future, the market will have a more prominent role to play in FRM than has been the case in the recent past. And this approach implies a stronger involvement of and role for 'stakeholders' in the planning of FRM.

(3) The Environmental Dimension to FRM Investment

6. Environmental Assessment (EA) is routinely carried out as an integral part of FRM project and strategy appraisal. Environmental mitigation, enhancement and compensation are commonly built into FRM project and strategy plans. Also, 'Environment' is one of the three components, along with 'People' and 'Economics', of the DEFRA Priority Score.
7. Yet, at present, there is no satisfactory means of ensuring that the environment is given its due weight in decision-making about FRM investment. This is despite the advances that have recently been made, or are in prospect, in the valuation of environmental costs and benefits and their integration into appraisal and decision-making processes. In recognition of this problem, the Environment Agency and DEFRA are currently conducting a series of pilot projects within a multi-criteria analysis (MCA) framework to explore how best to give the environment its due weight in decision-making. They have also commissioned research on the use of environmental valuation in FRM appraisal.
8. Since the publication of the 1990 environment white paper, it has been recognised that 'making the market work for the environment' is often the best way to address this kind of problem. Market-based instruments (MBIs) can be used to secure environmental policy objectives, and can do so more cost-effectively than (command-and-control) regulation.

Market-based Instruments for FRM

9. Against this background, this report considers the potential role of MBIs in FRM. Two principal categories of MBI are (i) environmental taxes and charges and (ii) tradable (or transferable) permit regimes. Environmental taxes and charges are often attractive in that they can generate substantial revenue. On the other hand, transferable permit regimes can be a more reliable way of delivering a pollution reduction target or safeguarding environmental policy objectives. Both kinds of MBI can help to achieve economically optimal solutions to environmental problems by making the market work in a way that better reflects the resource costs and benefits involved.

Environmental Taxes and Charges

10. The potential role of environmental taxes and charges in generating alternative sources of revenue for FRM investment has been the subject of a number of official reports and consultancy studies. For example, the OXERA (Oxford Economic Research Associates, 2001) report proposed two kinds of tax and charge that, if implemented, would conform to the BPP.
11. OXERA's first proposal was for section 106 agreements to include a published tariff of charges to cover the FRM costs of new developments in the flood plain. (It is recognised that the rights and wrongs of development in the flood plain is a controversial subject. However, this proposal is simply based on the premise that, where development in the flood plain is permitted, the BPP should apply and developers should pay the full – i.e. including external – costs of their development in terms of impacts on FRM.)

12. OXERA's second proposal recognises the nature of FRM as a 'public good'. In particular, it recognises that, although each individual property owner in a built-up area might be willing to pay their share of FRM costs, there exists no satisfactory way of ensuring that all property owners in any particular flood cell actually do pay. Consequently, it becomes difficult to persuade individual property owners to part with their money. The solution proposed to this problem is a levy on local council tax bills geared, so far as possible, to the situation pertaining in each individual flood cell.

Transferable Permit Regimes

13. Transferable permit regimes are the other principal category of MBI. They have the advantage of being generally more reliable than environmental taxes and charges where it is important that say a pre-determined overall environmental pollution reduction target be met. On the other hand, for obvious reasons they do not usually have the revenue generating properties of taxes and charges.
14. Transferable permit regimes are now widely used in the control of air pollution, in the rationing of water abstraction, and for addressing a wide variety of other environmental problems. What is perhaps less well-known in the UK is that a species of this kind of MBI, namely the transferable development right (TDR) is used, notably but not exclusively in the USA, for land use planning purposes.
15. Well-known examples of TDRs in the USA are Montgomery County in Maryland (launched in 1980) and the New Jersey Pinelands (launched in 1981). The idea of TDRs is to promote the conservation of areas with high environmental value, such as biodiversity-rich natural habitat, by shifting development to other areas. Development is permitted only by the exercise of development rights that are initially allocated to landowners on a per hectare basis. However, getting permission for development costs substantially more in terms of development rights in conservation zones than in development zones. Consequently, TDRs allocated on an equal per hectare basis across the whole area can stimulate trading in development rights. Also, development rights exercised in the development areas ensure permanent conservation elsewhere because development rights exercised in development areas cannot also be available to be exercised in conservation areas.
16. It is fair to point out that any proposal to introduce TDRs into the UK would face a substantial institutional hurdle in the form of the provisions of the 1947 Town and Country Planning Acts that effectively nationalised land development rights. Since 1947, land development rights have been re-privatised on a partial and discretionary basis only through the grant of planning permission. In most other jurisdictions, including those in which TDR regimes are in place, the right to develop resides with the landowner, but may be exercised only in compliance with land use planning regulations. This apparently minor distinction is important as a TDR regime implies a right to develop provided the prospective developer acquires the requisite quantity of TDRs for the location in question.

Transferable Flood Permits

17. Transferable development rights (TDRs) are one of three species of MBI under the general heading of **transferable flood permits** (TFPs) proposed by Chang (2005a and b) for use in FRM in the context of catchment and estuarine strategies. Essentially, the purposes of these instruments are as follows:
 - In the FRM context, **transferable development rights** on the US model summarised above would be used to discourage development in the floodplain and to encourage it in flood-free or less flood-prone areas. This objective is, of course, one that has been sought by the Environment Agency for some time;
 - **Transferable flood reduction permits** (TFRs) would be used to internalise the positive environmental externalities associated with 'soft engineering' FRM measures like managed realignment and upstream storage and negative environmental externalities associated with more traditional 'hard engineering' FRM measures. A TFP system might, for example, be used on the

Humber Estuary as a means of encouraging soft engineering investment such as managed realignment to create salt marsh habitat and flood storage capacity temporarily to store flood water on the incoming tide at places like Alkborough so as to economise on hard engineering in towns and cities further upstream;

- **Transferable risk neutral permits (TRiNes)** have a somewhat similar function to TFRs. When new development is proposed, hard engineering for FRM is often essential, but where the externality in terms of increased flood risks downstream is expected to be substantial, soft engineering to generate flood storage might be a key component of FRM. In the TriNe permits system, rights to undertake hard engineering for flood defence or mitigation or to develop could only be secured if sufficient soft engineering measures were undertaken fully to offset the incremental downstream flood risks involved. A TriNe system might be used at places like Oxford or Maidenhead if say a flood relief channel were expected to generate increased flood risks downstream.

Who Would Buy and Who Would Sell TDRs/TFPs?

18. The concepts of TFRs and TriNes are entirely new. Although they are superficially attractive, it became clear during the course on this research that there were serious technical flaws in the concept (Appendix 4 refers). Consequently, we have reluctantly had to reject the possibility of taking the concept forward to a pilot stage. However, it would be wrong to think that problems with introducing TFPs are limited to the robustness of the concept itself. Critical to an understanding of how any transferable permit system might work is the question of who would buy and who would sell the permits. In the light of US experience with TDRs, the answer to this question is clear; sellers of TDRs would be those holding land development rights in the flood plain, because it would become more expensive to develop in such areas. Conversely, as it would become cheaper relatively to develop outside the flood plain, prospective developers in such areas would have an incentive to buy to TDRs.
19. In the case of TFRs and TRiNes, the permit market would have to be arranged in such a way that those generating positive externalities benefit and those generating negative externalities lose out. Essentially, what this means is that it would become relatively more expensive to put in place hard engineering solutions and to develop land requiring hard engineering for FRM purposes. On the other hand, it would become relatively cheaper to invest in soft engineering solutions such as managed realignment. To achieve this outcome, the permit market would have to be so arranged that there was an incentive for the former group to buy flood permits and the latter group to sell them. Given that FRM investment has, in recent years, been largely funded from general taxation, it is not clear how such a market could be organised.

The Way Forward

20. Ever since the publication of the 1990 environment white paper, it has been accepted that, potentially, MBIs offer a flexible and cost-effective alternative to command-and-control regulation. The reason is that markets offer the possibility of efficiency improvements in the allocation and use of resources. Nevertheless, it would be idle to pretend that MBIs can always be easily put in place. The use of emissions permits as a means of implementing the EC Large Combustion Plants Directive and the use of a congestion charge to reduce road traffic in central London both had to be preceded by a great deal of preparatory planning and analysis. MBIs for use in flood risk management would be no different.
21. There are two major institutional issues hurdles relating to the practical possibility of introducing MBIs into FRM. First, land development rights in the UK are vested in the state. This would complicate the introduction of TDRs as a way of diverting development away from the flood plain or, indeed, for the purposes of biodiversity or other forms of conservation. Nor would it make it altogether simple to introduce the kind of FRM tariff for flood plain development OXERA have proposed (OXERA, 2001).

22. Second, there is the problem that, in recent years, the public sector has been assuming an apparently ever-greater share of the responsibility for the financial burden of FRM investment. Perhaps the most obvious manifestation of this is the DEFRA block grant-in-aid for FRM. This is currently subject to public expenditure cuts. This, together with the ever-increasing flood risks associated with global warming and sea level rise, points to the desirability of adopting market-based solutions sooner rather than later.
23. The development of FRM strategies such as the Thames and Yorkshire Ouse Catchment Strategies and the Humber Estuary and Thames Estuary 2100 Strategies provide an opportunity to plan for the introduction of MBIs in FRM. These strategies are taking a 100 years time horizon. Over such a period, it is not simply the physical conditions on the ground that will change, although obviously they will. No, it is also the legal and institutional background that will change.
24. In principle, the land use planning system in the UK might be modified to allow the introduction of TDRs whether for FRM or for other land use planning purposes. There is also scope for considering how to improve the regulations governing section 106 agreements so that the OXERA proposal that developers should routinely be made to pay for the FRM consequences of their development proposals might be put into effect. The latter proposal is also of relevance to the Lyons review of local government funding, as is OXERA's other proposal to charge for FRM investment through local council tax levies.
25. Proposals along these lines would inevitably take time to introduce. Moreover, it is hard to see how a more market-oriented approach to FRM investment can be put in place without greater adherence to the beneficiary pays principle. A recurring theme of this report is that, if MBIs are to be used consistently in the FRM context, this must be in conjunction with an acceptance of the BPP.