Discussion Paper in Ecological Economics

94/4

Series Editor Dr. Clive L. Spash

ECONOMIC INSTRUMENTS AND WASTE MINIMIZATION: THE NEED FOR DISCARD- AND PURCHASE-RELEVANT INSTRUMENTS

R FENTON (University of Winnipeg, Canada) AND N HANLEY

MARCH 1994

Environmental Economics Research Group

Department of Economics

University of Stirling

STIRLING DISCUSSION PAPERS IN ECOLOGICAL ECONOMICS

1994 SERIES

94/1 Preferences, Information and Biodiversity Preservation
Clive L Spash and Nick Hanley, March 1994

94/2 The Benefits of Preventing Crop Loss Due to Tropospheric Ozone
Clive L Spash, March 1994

94/3 Sources of Energy and the Environment
Clive L Spash and A Young, March 1994

94/4 Economic Instruments and Waste Minimization: the Need for Discard- and Purchase-Relevant Instruments
Nick Hanley and R Fenton (University of Winnipeg), March 1994

94/5 The Effects of Information in Contingent Markets for Environmental Goods
Nick Hanley and Alistair Munro (University of East Anglia), March 1994

94/6 Cost-Benefit Analysis and the Greenhouse Effect
Clive L Spash and Nick Hanley, March 1994

Copies available from Departmental Secretary, Department of Economics, University of Stirling, Stirling FK9 4LA. The series is circulated on an exchange basis to academic and other institutions, while single copies are available at £3. Cheques/money orders in sterling should be made payable to **The University of Stirling**.

ECONOMIC INSTRUMENTS AND WASTE MINIMIZATION: THE NEED FOR DISCARD- AND PURCHASE-RELEVANT INSTRUMENTS.

R Fenton
Economics Department
University of Winnipeg

and

Nick Hanley
Environmental Economics Research Group
University of Stirling

ECONOMIC INSTRUMENTS AND WASTE MINIMIZATION: THE NEED FOR DISCARD- AND PURCHASE-RELEVANT INSTRUMENTS.

R Fenton and N Hanley

ABSTRACT

This paper provides a conceptual framework for categorizing economic instruments relevant to waste minimization. Instruments are categorized as purchase- discard- or jointly-relevant.

It is argued that a mix of instruments from the above categories will increase the ability of a waste minimization programme to achieve high waste reduction targets without imposing excessive cost on the economy. The exact mix will depend on the elements included in the strategy and the focal points for behaviourial change.

It is likely that the effective participation of householders could be increased by discard- or jointly-relevant instruments such as residential waste collection fees or potentially refundable product levies. We anticipate that Brand Owners will call for the implementation of such instruments to help in meeting their packaging recovery responsibilities.

1.INTRODUCTION

Although there has been extensive discussion of the role of economic instruments for waste minimization (see, for example, Pearce and Turner (1992) and Jenkins, (1993)), the question of the *mix* of instruments has not yet received adequate coverage. Typically, authors have sought to analyze the advantages of using individual policy instruments, such as a tax on packaging, rather than a complementary mix of policies. The aim of this paper is thus to discuss how such a blend of instruments might be identified; and how this mix might change as the balance of waste minimization activities shifts among reduction at source, reuse, recycling and energy recovery.

Our key argument is that an appropriate policy mix is one which provides the correct incentives to both consumers *and* producers, since neither face the full social costs of waste generation and subsequent disposal. If governments set internal recycling/re-use targets for packaging materials, then these targets are only likely to be met if both sets of agents face appropriate incentive structures. This is particularly important in the case of householders since householders must make two decisions: a purchase decision and a discard decision. A socially optimal purchase decision, brought about by purchase incentives, does not guarantee a socially optimal discard choice. The socially desirable discard option could require the householder to engage in costly effort to sort materials prior to discard and to participate in re-cycling programmes or in programmes which allow re-use of packaging. Disposing of all "waste" into a common dustbin is predominantly the lowest-cost alternative available to the household, given the current structure of incentives. Additional discard-relevant incentives might be necessary to induce the socially optimal discard choice. Examples of such discard incentives for households include marginal cost prices for waste collection (imposed by the waste collection authority), and/or deposit-refund systems.

In what follows, we first review some important UK legislative and institutional factors, before presenting a typology of economic instruments. We find the classification into discard relevant and purchase relevant instruments to be a helpful one. Alternative strategies for waste management (reduction and source, recycling or recovery of materials and energy recovery) are then considered. The relative advantages of two instruments (variable household disposal fees and potentially-refundable product levies) are then discussed in more detail, before we offer some conclusions to close the paper.

2. LEGISLATIVE AND INSTITUTIONAL BACKGROUND IN THE UK

The British Government, in line with current EU and OECD practice, has made economic instruments[1] a corner stone of its environmental protection policy. In the *Second Year Report* on its environmental strategy, it took the position that "in future, there will be a general presumption in favour of economic instruments". (UK DOE, 1992, para 3.46). In the solid waste area, the Government has commissioned a number of reviews on the question. These reports included work by Touche Ross in 1991 on the recycling credits scheme (Touche Ross, 1991) by Environmental Resources Limited in 1992 on a review of instruments to provide incentives for recycling (ERL, 1992), by Coopers & Lybrand in 1993 on methods of correcting distortions in landfill costing (Coopers & Lybrand, 1993) and by CSERGE in 1993 on externalities from landfill and incineration of waste (CSERGE, 1993). The subject was also reviewed by the Royal Commission on Environmental Pollution in its *Report on the Incineration of Waste* (Royal Commission, 1993).

The Government in Britain has already implemented one economic instrument for waste in the form of the recycling credit to be paid to Local Collection Authorities and groups engaged in waste collection for recycling. The credit is payable per tonne of materials diverted from a landfill and is based on the long run (avoided) marginal costs of landfilling waste. The Government also is considering a landfill levy to narrow the gap between the cost of landfilling and recycling or incineration, as part of its effort to meet the target of at least a 50% recycling rate for re-cyclable household waste by the year 2000.

A further element of the Government's (and the EU's) environmental policy is that pollution should be minimized to the extent possible using **B**est **A**vailable **T**echnology **N**ot Imposing **E**xcessive **E**conomic **C**ost (**BATNEEC**). The expectation is that over time technological improvement will permit pollution increasingly to be reduced without seriously damaging the economy.

The Government's focus on household waste, combined with the European Commission's initiative on packaging waste, has made the latter waste stream a priority. In keeping with the Polluter Pays Principle and with the need identified by ERL to change the

responsibility for waste management (ERL, 1992, p.66), the Government challenged the packaging chain to "... draw up a plan by which industry will take responsibility for ensuring that the majority of used packaging is not simply thrown away but returned to beneficial use" (UK DOE, 1993, p.1). "Taking responsibility" in this case means not only committing to meet a target of recovering between 50% and 75% of all packaging waste by the year 2000 ("recovering" here includes re-use, re-cycling and incineration with enrgy recovery) but also paying any additional costs of systems needed to meet the targets. [2] The Government must feel that the current BATNEEC permits a maximum recovery in this range, and has threatened compulsory targets if sufficient progress is not made by the packaging industry.

3.ECONOMIC INSTRUMENTS FOR SOLID WASTE MANAGEMENT

The need for Government intervention in waste management arises if socially optimal levels of waste minimization (ie prevention, recycling and energy recovery) do not occur in the market system. Such as situation could arise because the marginal social benefits of waste reduction (MSB_R) exceed the marginal private benefits of waste reduction (MPB_R) as shown in Figure 1.

figure 1 here

In the Figure, MPB_R is the private benefit arising from reduced waste disposal costs and any net revenue from sales of recyclable or reuseable materials. MSB_R includes the private benefits plus social benefits arising from any net reduction in environmental damage through reduced waste disposal (that is, net of the external costs of wast reduction, such as pollution costs from de-inking during paper recycling); and in the case of recycling or energy recovery any net reduction in the environmental damage caused by the extraction of virgin materials (such as soil erosion resulting from forest clearance for paper production). This definition of the social benefits of waste reduction leads to no divergence between the private and social marginal cost of reduction (MSC_R). These costs will simply be the market value of resources used to reduce the waste. W_0 is the inherent level of waste associated with a given level of gross domestic product before any waste reduction activity occurs.

Under the situation shown in Figure 1, market forces yield a reduction from W_0 to W_P rather

than the socially optimal W_S. The socially optimal level of waste minimization or waste generation can be achieved in theory by a Pigouvian tax on waste. Figure 1 shows the situation after the imposition of an optimal Pigouvian tax per unit of waste generated, which shifts the MPB_R curve to MPB_R'. This brings about an optimal level of waste minimization and disposal, at the point where the marginal damage from waste disposal is equal to the marginal cost of waste disposal reduction: W_S. For a fixed level of output, waste disposal reduction can occur through several processes: reduction at source, re-use of goods and purchase of more durable goods, recycling for materials recovery, composting and energy recovery. The tax is avoided on the additional amount of waste reduced, W_PW_S, by implementing the opportunities imposing a marginal cost less than the tax. Opportunities to reduce waste below W_S cost more than the tax and are not implemented.

In their 1992 paper, ERL categorized economic instruments into three groups:

* charging schemes which can be used both to internalize external costs and to raise revenues: these include raw materials charges, product charges, deposit refund schemes, waste collection charges and waste disposal charges.

*schemes which change the responsibility for waste disposal and encourage more recycling: changing manufacturers responsibilities so that waste management responsibility falls on them rather than local authorities; and trading-off amongst recycling targets for different materials.

* direct subsidies to collection authorities.

For our purposes six instruments will be considered: product or materials levies, recycling credits, disposal levies, quantity-variable refuse collection and disposal fees, shifting responsibility for waste to brand owners and potentially refundable product or material levies. These are the six instruments which ERL deemed worthy of detailed analysis. It is useful to categorize these as being **purchase relevant, discard relevant or jointly relevant**. The objective of this categorization is to focus attention on the consumer (either household or commercial) whose behaviour is critical to achievement of high recovery targets without

excessive cost, in the sense used by the Government in their BATNEEC philosophy. Our interest in the consumer's behaviour arises from North American experience which shows that continued efforts to encourage on-going public participation are necessary to maintain recovery rates of recyclable materials.[3]

Purchase relevant instruments stimulate differences in product characteristics or product prices and can result in changes in consumers choices between substitute products. For instance, product levies such as a packaging tax, which increase according to increasing waste management or other environmental impact, are purchase relevant. Recyclable goods or goods containing recycled materials might attract a lower product levy than similar goods not possessing these characteristics. Such levies would carry impacts for both Brand Owners and consumers. Brand Owners might raise prices to cover the levy or equivalently might reduce supply as profitability declines, or alter product characteristics to avoid the levy or reduce levy payments. In either case, the product levy will induce consumers to take account of environmental impact as they minimize the expenditure required for given level of utility.[4] (Making waste minimization the responsibility of Brand Owners, under threat of a product levy, will have an effect similar to that of a product levy.)

Discard relevant instruments work primarily at the time of discard. The consumer already has made the purchase, perhaps some considerable time previously, and is "locked-in" to the product in question. The only choices open to the consumer are the choice to discard or not and choices among the available methods of discard. Quantity-related refuse collection and disposal fees are the prime example here.[5] (These fees could influence purchase decisions if consumers recognize differential disposal cost at time of purchase.) The UK landfill disposal levy presently under discussion will be relevant to commercial generators who already pay quantity-related refuse fees. The levy will not be relevant to household and small commercial generators who do not pay such fees. The existing recycling credit is potentially discard relevant if it is marketed to consumers as a way to hold down increases in the community charge levelled by local authorities.

Jointly relevant instruments influence both purchase and discard decisions. The potentially refundable product levy is an example of this type. The consumer pays the levy

upon purchase and receives a portion of the levy back upon "appropriate" discard. While the most common example of this instrument is privately arranged deposits and refunds on refillable beverage containers, thinking of the instrument in these terms limits the perception of the possibilities. Such thinking also can mire the discussion in an interminable debate over trade restrictions arising from use of mandatory refillable beverage containers bearing a deposit and a refund for return.[6]

Table 1 summarizes the categories into which the six instruments fall. Those labelled potentially relevant require a complementary initiative to make them robustly relevant.

Table One here

The instrument *"Responsibility to Brand Owners"* warrants special mention since it is a major element of the Government's waste minimization policy. The instrument is **purchase relevant** in the same way as product levies are. Giving Brand Owners responsibility for meeting recovery targets will induce them to design products with characteristics which contribute to achieving the targets. Product prices might also be changed to encourage consumers to purchase such products. Shifting responsibility for waste to Brand Owners may be potentially **discard** (and thus **jointly**) **relevant**, if Brand Owners conclude that some incentive at the time of discard decision is also necessary. Such an incentive could arise if manufacturers ask local authorities to introduce discard-relevant instrument in return for accepting brand-owner responsibility.

4. STRATEGIES FOR WASTE MINIMIZATION

The strategies of waste minimization encompass the familiar reduction at source, reuse, recycling and recovery of energy. These activities are frequently discussed, and disputed, as an ordered hierarchy from most to least effective, but that debate need not concern us here. More important for this discussion is the way in which the mix of strategies calls for differences in the balance or blend of economic instruments. Consider each of the elements of the strategy in turn.

Reduction at source primarily is an activity for the brand owner and producer. The

consumer wants a product to meet a need and normally reduction at source activities will not influence the consumer's choice.

However reduction at source could be made relevant to the consumer. Source reduction can be sold to the consumer as a product characteristic designed to meet the consumer's need for "environmental protection". Excessive packaging, not reduced at source, could attract a higher levy under a product or material levy. Similarly such packaging would attract a higher fee if disposed through the quantity variable refuse fee system. The former impact would be purchase relevant, the latter discard relevant with the potential to be jointly relevant. Further more if the brand owner did undertake packaging reduction, concentrated laundry detergent in a smaller box for instance, any instrument which is relevant to the purchase decision could assist the sales of such a product.

The **reuse** activity has a number of aspects to it. Refillability in the context of beverage containers or laundry soap containers is one. A second is durability and reparability of products.[7] A third aspect is reusability in a context such as dry cells for consumer electronics and toys (rechargability). The goal of a purchase relevant instrument like a product levy, in such a case, could be to offset any price disadvantage of the reusable product compared to "disposable products". Depending on relative prices and costs, both purchase and discard relevant instruments could encourage the actual reuse of products designed to be reusable or repairable. In some instances, the electric dry cell for example, a jointly relevant instrument such as the potentially refundable product levy might provide extra incentive to use the return system. The basis of levy could be the quality rather than the quantity of waste to reflect the potentially hazardous nature of this material. [8]

Recycling or recovery of materials requires that Brand Owners make products that are recyclable and products that can use recovered secondary materials thereby creating a market demand for the recovered material. It also needs consumers who will buy recyclable goods or goods made from recycled materials and consumers who will participate in programs to collect materials for recycling. The first three elements of the list could respond to a purchase relevant instrument, the last element is more suited to a discard or jointly relevant instrument. The brand owner elements have been discussed under other headings. The

consumer's contributions will be discussed further.

Consider the purchase of paper products as an example of consumer reluctance to buy a good produced from secondary materials. If the consumer has always purchased white paper (towels, tissue or writing paper) there may be considerable inertial resistance to purchasing a less white paper product. This becomes relevant if the production of white products from secondary material is too costly or too environmentally damaging. A product levy on virgin bleached paper can encourage consumers to choose the less-white product. Measures to stimulate the demand for recycled goods are necessary if increases in the supply of recylable product are not to lead to precipitous declines in the price obtainable for such material, with consequent adverse short-run implications for the recycling infrastructure. A major failing of the German DSD system has been its failure to stimulate demand: such a failure will also be the result of the draft EC directive on Packaging and Packaging Waste if it is implemented by member states in its current form, since it too contains no demand stimulation measures.

If high recycling targets are to be achieved, it may be necessary to provide incentives to consumers to participate in collection programs for secondary materials. Admittedly a significant number of consumers might see recycling as a way to sustain a high consumption life style and might participate willingly at some level. But, to achieve high recycling targets, without imposing excessive costs, requires continuous effective participation of a large proportion of the households. Effective participation in this case means strict observation of sorting requirements: colour sorting glass for instance, or not including prohibited materials which must be sorted out at a material recovery facility and sent for disposal. Not all households will be willing to incur the inconvenience cost of participating in the scheme without some additional incentive. The incentive to participate must be even higher if the program is a bring collection system rather than a kerbside collection system. Discard or jointly relevant instruments can provide the necessary impetus.

Recovery of energy might be considered immune to either purchase or discard relevant instruments. After all, the consumer is not involved directly in the energy recovery process at all. In the old days of incineration of unsorted wastes, when incineration was

viewed primarily as a volume-reducing pretreatment of waste prior to landfilling, this may have been the case. However, in today's world of stricter environmental controls, competitive sales of energy recovered, and competitive tipping opportunities, the consumer must play a role and these instruments are very relevant.

A substantial portion of the investment for a waste incinerator is dependant on the quantity of waste flowing through the plant per hour. Non-combustibles such as metal, glass and ceramics add to the required level of investment by increasing the quantity of waste, but add no revenue from the recovery of energy. On the operating cost side, non-combustible materials will contribute to the quantity of ash residue which must be landfilled at some cost. If the materials handling facilities already include shredders and debaggers, magnetic separators can be introduced rather simply to remove the metal from the waste stream prior to burning. This is not the case if such facilities are not already in the plant or with materials like ceramics or glass. Thus **purchase relevant** instruments might be appropriate to encourage the use of combustible packaging. **Discard relevant** instruments to encourage source separation of non-combustible items from the balance of the waste stream also could be useful. The cost of environmental controls for the plant and the cost of ash disposal also can be reduced if certain materials are excluded from the waste fed into the incinerator. PVC plastics and packaging printed with inks containing heavy metals are two such materials. Again **purchase and discard relevant** instruments could be useful to keep such materials separated from the waste to be incinerated.

These four strategies are components of many waste minimization plans. Within each strategy various sub-elements will be relevant to the success of the activity. In terms of the categories of instruments discussed here, these sub-elements can be identified as product design, product choice, product use, program infrastructure and program participation.

Table 2 provides an overview of the previous discussion by summarizing the strategies and sub-elements of a waste minimization plan and the focal point for the impacts of economic instruments. For example in the Table, the element 'Program Infrastructure' for recycling would respond best to purchase relevant or jointly relevant instruments if the target group were the Brand Owners. If the target group for the same program were local authorities

a discard relevant instrument would be more appropriate. The element 'Program Participation' by consumers for recycling activities would respond best to discard relevant or jointly relevant instruments.

table 2 here

5.IDENTIFYING DESIRABLE POLICIES

As mentioned earlier, the Government has implemented a recycling credit scheme, announced the transfer of responsibility *for recovery of materials and energy from packaging waste* to Brand Owners and is considering a landfill disposal levy. Table 1 shows both the recycling credit scheme and the landfill levy scheme to be only potentially relevant under all three perspectives.[9] Shifting responsibility to Brand Owners is relevant for a purchase decision perspective but only potentially relevant from a discard decision or a joint decision perspective.

Table 2 indicates that product design decisions by Brand Owners and product choice decisions by consumers, under all four strategies in a waste minimization plan, would respond to purchase relevant instruments. Brand Owners also could be induced to provide infrastructure which would facilitate materials recycling and energy recovery by purchase relevant instruments .

Table 2 also indicates, however, that some elements of a waste minimization strategy, those requiring on-going active consumer involvement, might enjoy only limited success if the package of economic instruments includes only those which are purchase relevant. For instance, will consumers actually reuse reusable products or actually participate in separate collection programmes for recycling and energy recovery if they are not given some price signal at the time of discard.

This latter observation from Table 2 could have important repercussions for the ability of Brand Owners to meet their new packaging recovery responsibilities. And, together with the information from Table 1 about discard and jointly relevant instruments, suggests that Brand Owners might favour the introduction of *quantity variable user fees* for refuse

collection and disposal or *potentially refundable product levies* as complements to Brand Owner responsibility. The former would require action by central government to empower local authorities and then action by local authorities to implement those powers. The potentially refundable levies could be undertaken by individual Brand Owners or more effectively by trade associations. Action by central government could assist Brand Owners or trade associations to implement these instruments. In some cases, direct implementation by Government might be preferable.

Before turning to a consideration of each of these instruments, Figure 2 illustrates why both Brand Owners and Government might find it useful to add discard or jointly relevant instruments in to the mix along with Brand Owner responsibility. Figure 2 presents a long run marginal social cost of recovery curve (MSC_R) similar to that shown in Figure 1. The intercept with the horizontal axis indicates zero recovery of packaging waste for recycling or energy recovery. The increasing marginal cost of achieving higher recovery levels reflects the impact of two factors. First, additional facilities, equipment and operational expenditures are needed to make participation more convenient. Second, additional promotional and public education expenditure is needed to induce high levels of effective participation.

figure 2 here

The vertical lines at 50% and 75% indicate the lower and upper bounds of the Government's challenge to the packaging industry. The wording of the challenge indicates that the Government feels this range includes the maximum recovery possible using Best Available Technology without Excessive Economic Cost (**BATNEEC**).[10] However, the actual maximum level of recovery within that range is uncertain. Thus MSC_R is dashed over the interval of 50% to 75% indicating the uncertainty of the marginal cost in this range. If excessive cost is imposed in this range a discontinuity will occur with the higher marginal cost being demonstrated along MSC'_R. The actual target set is shown by the dashed vertical line in the target range. Its precise location in the range is unknown.

Total net cost to Brand Owners of waste reduction (and ultimately to the economy) is the shaded area under the MSC_R curve to the recovery target actually specified. Discard or

jointly relevant instruments could reduce the total cost of achieving the target by reducing the marginal cost of higher levels of recovery (flattening the MSC_R curve). Increasing participation and increasing the effectiveness of participation could also reduce marginal costs. The other impact of these instruments could be to increase the level of recovery before the discontinuity in marginal cost is reached; making a higher recovery target feasible under the Government's BATNEEC policy. Such changes would increase the total net social benefit created by waste reduction.

5.1 Quantity-Variable Refuse Fees

Quantity-variable refuse fees, as discard relevent instruments which could enhance the effectiveness of other activities, might be attractive to Brand Owners as a complement to their own activities in meeting their responsibilities for waste minimization. This has been the case in Canada where groups studying similar Brand Owner responsibility programs have proposed the introduction of quantity-variable refuse fees.[11]

The UK government appears to have rejected such fees as unhelpful in achieving their waste minimization goals. Officials have interpreted the ERL study to find that it "...did not consider this option to be a practical proposition to pursue" (House of Lords, 1993, Minutes of Evidence, 17 June 1993, p. 117). In fact, while ERL found "...their effectiveness to be uncertain" (ERL, 1993, p.34), waste collection charges were not among the five options that ERL ruled out for further consideration (ERL 1993, Table 2.1, p.18). Indeed in the Main Conclusions, the study states:

> "In general it is the case that if the economic instruments are set at a level to internalize long run marginal costs ... they are unlikely to offer sufficient incentives to stimulate the levels of recycling implied by government commitments....The impact on recycling is uncertain unless encouraged by other instruments such as targets." (ERL, 1993, p.35)

Thus it would seem that uncertainty concerning effectiveness is not a prominent feature of collection charges alone. (It also appears that ERL recognized the compatibility of a policy of recovery targets to be achieved by Brand Owners and other supporting economic

instruments.) The ERL study goes on to note "(g)iven these qualifications, among the instruments reviewed, waste disposal charges and collection charges both offer a number of strengths: they are fair and readily administered" (ERL, 1993, p.36).

The effectiveness of quantity variable refuse fees has been recognized in other places. Appendix material to the ERL study indicates that seven European countries have some kind of volume related collection or disposal charge for household waste.[12] In North America, quantity variable refuse fees for household waste are in operation in over 1000 communities. Several US states have made the implementation of such fees mandatory for municipalities within their boundaries. Others require municipalities to study the implementation of such fees when formulating new waste management plans (Skumatz and Zack, 1992).

In a recent monograph, Jenkins uses a generalized least squares regression model to estimate the effectiveness of quantity related refuse fees in the United States. For households, Jenkins concludes that a fee of US$1.00 per 120 litre can would reduce the per capita weekly discard by 15%. These results were based on data where bring systems were already operating to provide recycling opportunities. The study does not identify the impact on discards of packaging waste. (Jenkins, 1993, p. 128).

Quantity-variable collection and disposal fees for household collection need *not* add to the cost borne by householders on average. When communities adopt such fees, an equivalent level of cost can be removed from local tax payments supporting the current mode of waste collection and disposal. This is an important consideration given that the UK government has indicated that the incremental cost of achieving the packaging recovery target is to be borne by the Brand Owners. Additional cost of implementing the plan, such as extra enforcement costs during the initial transition period, could be covered by Brand Owners under their newly accepted responsibility. Other costs of implementation of quantity related refuse fees could be quite low if bag or tag schemes are used.[13]

Implementation of such fees must be done carefully to assure residents that they are not being charged twice for the same service, once under the variable fee scheme and once under existing municipal taxes. A typical implementation strategy involves identifying, as a

separate item on the tax bill, the cost of collection and disposal supported by the local council tax. In some cases the former expenditure on waste collection and disposal fees will continue to be shown on the bill as a credit to be subtracted in reaching the total bill for payment.

One of the weaknesses of the quantity variable refuse fee identified by ERL is the incentive it provides for fly-tipping (illegal dumping). Jenkins also recognizes that fly-tipping is a problem, particularly during the early months of the imposition of the quantity variable fees and in low income and rural areas, but notes municipal officials report that "... quick and consistent enforcement of anti-dumping laws soon dampens the illegal response" (p.130). So long as the expected value of the fine from being caught fly-tipping is set high enough (such that it exceeds the marginal cost of waste disposal by legal means for a risk-neutral individual), then fly-tipping will not occur. Since the expected fine is the product of the three variables (the probability of being caught, the probablility of being prosecuted if caught, and the average fine if prosecuted), then the regulatory authority can increase any of these variables to increase the expected fine. Presumably the choice of which variable to increase would depend on the relative costs of increasing each (including monitoring and enforcement costs), and political acceptability.

Another complaint against these quantity-variable fees is that they discriminate against low income households and large families. On these issues Jenkins finds that per capita waste generated is positively correlated with income and negatively correlated with family size. (p.82) Thus low income households would produce less waste than higher income and larger families would produce per capita waste than smaller families. In such circumstances there could be no a priori expectation of discrimination. But in any case, under the polluter pays principle households generating larger social costs by creating larger volumes of waste should be confronted with these costs. Low income or large family size does not automatically mitigate against household waste reduction activities.

It is not possible at this stage to precisely predict how useful quantity-variable refuse fees might be in achieving the UK government's goal of between 50% and 75% recovery of packaging waste. The American experience is a useful indicator but no doubt UK trials would be necessary to develop the appropriate price elasticity coefficients for waste reduction

responses.

5.2 Potentially-refundable product levies

A priori, it is difficult to assess the response of Brand Owners to this instrument.[14] Retailers have split on the issue with some major retailers supporting and others rejecting. Major American supermarket chains have in general rejected the idea of taking back refillable bottles through their stores. The soft drink industry in the United States and in the Canadian province of Manitoba has set up private companies to operate buy back centres to recover both refillable and non-refillable soft drink containers.

Although potentially refundable product levies could be implemented by industry alone, it would be best if government at least sanctioned the process by implementing "background legislation" codifying the rules of the game and setting a level playing field for all Brand Owners in a given market. This would discourage the adoption of free rider strategies by Brand Owners. The proposed legislation could be agreed in advance by business, consumers and environmental groups. It may even be desirable that the whole process be operated by government. For instance, if some goods were to be subject to a purchase relevant instrument in the form of a non-refundable product levy, collection costs could be reduced by having both types of levy paid to the excise division of Inland Revenue. Or if motor vehicles were subject to potentially refundable levies, these could be included in the initial vehicle registration and road tax charges and collected through the usual mechanism.

A potentially refundable product levy has an advantage over a non-refundable product levy in that it is discard relevant as well as purchase relevant. The potentially refundable levy also has the advantage over the quantity variable refuse fee because the levy does not provide any incentive to anti-social behaviour such as fly-tipping or littering. In fact, in addition to providing an anti-littering incentive (as improper disposal does not qualify for the refund), the refundable levy would assist litter clean up by providing an incentive for private individuals and groups to pick-up litter to claim the refund.

However, this levy does impose additional cost on the system. In addition to the regular collection costs, refund locations must be staffed or equipped with reverse vending

machines. This requirement is likely to result in a smaller number of discard locations than would be feasible and desirable with a conventional bring system for collecting recyclables. As a result the inconvenience cost to consumers of discard will increase. (Unless it is combined with a door-to-door product sales system, such as milk delivery, it seems unlikely that a potentially refundable levy system would work in the context of a kerbside recycling system.) Additional accounting and cash control costs also would be created relative to a traditional bring collection system. However, detailed analysis would be required to known if these accounting and cash control costs would exceed those required for quantity related refuse fees. Illustrative computations done in the ERL study show that costs to achieve a 90% return rate for beverage containers (approximately 1.07 million tonnes recovered) could range between £178 million (2 pence deposit per container) and £911 million (20 pence deposit per container). (ERL, 1993, Table 9.5).

6. CONCLUSIONS

When examining economic instruments for waste minimization it is useful to consider whether or not a particular instrument is purchase relevant, discard relevant or jointly relevant. It also is helpful to look at the mix of strategy elements the instruments are designed to assist. In addition, the target for action should be identified. The impact on the consumer's decision about discarding a good is important for reuse, recycling and energy recovery strategies. A successful strategy, with a mix of elements and targets, could require the application a mix of instruments. There is no a priori reason to expect that a single category of instruments will be adequate.

To date the economic instruments chosen by the UK government have not emphasized the discard decision of the consumer. Recycling credits and landfill levies could be made relevant to the consumer through the use of quantity variable refuse fees for the collection and disposal of household waste. Brand Owner responsibility for waste minimization can be made more cost effective by the addition of complementary policies which are discard or jointly relevant such as the variable refuse fee or potentially refundable product levies.

More debate and detailed analysis of these issues is necessary. Government and

industry have seen fit to fund demonstration projects for kerbside collection of waste. Perhaps it is time for the two to cooperate on a regional demonstration of the quantity variable refuse fee and potentially refundable product levies.

BIBLIOGRAPHY

anon. "Household attitudes to paying for recycling in Arizona ." *Resource Recycling*, 11, 12 (1992): 13.

Apotheker, Steve. "Recycling in Canada's big cities." *Resource Recycling*, 11, 12 (1992): 37-42

Apotheker, Steve. "Mixed waste processing head-to-head with curbside recycyling collection." *Resource Recycling*, 10, 9 (1991): 32-45.

Bagby, Jennifer et al. "Participation in Seattle's curbside recycling collection program." *Resource Recycling*, 11, 12 (1992): 64-71.

Baumol, William J. and Wallace E. Oates. "The Use of standards and prices for protection of the environment." In Bohn, Peter and Allen V. Kneese eds. *The Economics of the Environment*. Pp. 53-64. Essays Reprinted from the Swedish Journal of Economics vol 73, no. 1 March 1971. London: St. Martin's Press, 1971.

Bingham, T.H. et al. *An Evaluation of the Effectiveness and Costs of Regulatory and Fiscal Policy Instruments in Product Packaging*. Washington: US EPA, 1974.

Bohm, Peter. *Deposit-Refund Systems: The Theory And Applications to Evironmental Conservation, and Consumer Policy*. Baltimore: Johns Hopkins University Press, 1981.

Brisson, I.E. "Packaging waste and the environment: economics and policy." *Resource Conservation and Recycling*. 8 (1993): 183-292.

Brisson, I.E. "The government's recycling policy: optimal recycling?" *Integrated Environmental Management.*. 15 (1992).

Burrows, Paul. *The Economic Theory of Pollution Control*. Oxford: Martin-Robertson, 1979.

Cabaniss, Amy Dyer. "Recycling education: the critical link." *Resource Recycling*, 12 , 2 (1993): 62-65.

Coopers and Lybrand. *Landfill Costs and Prcies: Correcting Possible Market Distortions*. London: HMSO, 1993 .

CSERGE, Warren Spring Laboratory, EFTEL. *Externalities from Landfill and Incineration*. London: HMSO, 1993.

Environmental Resources Ltd. (ERL). *Deposit-Refund Schemes for Beverage Containers and Batteries*. London: HMSO, 1991.

Environmental Resources Limited (ERL). *Economic Instruments and Recovery of Resources from Waste.* London: HMSO, 1992.

Gareth Kirkby: "Used oil: end use controversy clouds developments in collection and re-refining." *Ontario Recycling Update.* 13, 1 (1993): 8-17.

Grogan, Peter L. "Closing the loop, ton by ton." *BioCycle*, 34 , 3 (1993): 86.

House of Lords, Select Committee on the European Communities. *Packaging and Packaging Waste.* (Session 1992-93, 26th Report). London: HMSO, 1993.

ICF Inc. *Recycling the Materials in Municipal Solid Waste: Estimates of the Elasticities of Secondary Material Substitution and Supply.* Washington DC: US EPA, 1979

Jenkins, Robin R. *The Economics of Solid Waste Reduction..* London: Edward Elgar, 1993.

Miedema, Allen K. et al. *The Case for Virgin Material Charges: A Theoretical and Empirical Evaluation in the Paper Industry.* Research Triangle Park NC: Reserach Triangle Institute, 1976.

Miedema, Allen K. "Fundamental economic comparisons of solid waste policy options." *Resources and Energy.* 5 (1983): 21-43.

Miedema, Allen K. et al. *Modeling the Effects of a Product Disposal Charge.* (Final Report). Research Triangle Park NC: Reserach Triangle Institute, 1980.

Miedema, Allen K. "Projected effects of a product disposal charge." Paper presented to a Conference on Materials Recycling and Composting. Albany NY: New York Legislative Commission on Solid Waste Management, 1985.

Mills, Edwin S. "Economic incentives in air-pollution control." In Goldman, Marshall I., ed. *Controlling Pollution, The Economics of a Cleaner America.* pp. 100-106 Englewood Cliffs NJ: Prentice Hall, 1967. Originally appeared in Harold Wolozin, ed. *The Economics of Air Pollution* New York: Norton & Company, 1966.

Mills, Edwin S. and Philip E. Graves. *The Economics of Environmental Quality*, 2nd edition. New York: W.W. Norton & Company Inc. 1986.

OECD *Product Durability and Product Life Extension: Their Contribtuion to Solid Waste Management.* Paris: OECD, 1982.

OECD. *Beverage Containers* Paris: OECD, 1978.

Ontario Waste Reduction Advisory Committee. *Resource Stewardship in Ontario: A Shared Responsibility.* Hamilton ON: Ontario Waste Reduction Advisory Committee, 1992.

Pearce, David & Inger Brisson. "Economic solutions to the packaging waste problem." Symposium on Packaging Waste, Budapest, June 9, 1993.

Pezzey, John. "Market mechanisms for pollution control: 'polluter pays', economic and practical aspects." In R.Kerry Turner ed. *Sustainable Environmental Management: Principles and Practices*. pp. 190-242. London: Belhaven Press, 1988.

Pigou, A.C. *The Economics of Welfare*, 4th edition. London: Macmillan & Co. Ltd., 1962.

Porter, Michael, "Beverage container deposits. *JEEM*, 5,4 (1978): 351-375.

Ramsay, Willima and Claude Anderson. *Managing the Environment: An Economic Primer*. London: Macmillan Press, 1972.

Resource Integration Systems Ltd. *Generator Pays Systems for Households: A Discusssion Paper*. Toronto ON: Ontario Recycling Advisory Committee, 1990.

Royal Commission on Environmental Pollution. *Incineration of Waste, 17th Report*. London: HMSO, 1993.

Schoenecker, Pat. "Residents are the key to successful multi-family recycling." *Resource Recycling*, 11, 9 (1992): 115-119.

Skumatz, Lisa A. and Philip A.Zach. "Variable rate initiatives at the state level." *BioCycle* 33, 12 (1992): 67-69.

Skumatz, Lisa A. and C. Breckinridge. *Variable Rates in Solid Waste: Handbook for Solid Waste Officials*. Washington DC: US EPA, 1990.

Touche Ross Management Consultants. *Waste Recycling Credits - Systems and Mechanisms Report*. London: HMSO, 1991.

UK Dept. of Environment. "DOE & DTI challenge the packaging industry" *Environment News Release*. London: July 27, 1993.

UK Dept. of Environment. *This Common Inheritance: The Second Year Report*. London: HMSO, 1992.

Williamson, Robert F. "Reduction strategy weight based MSW collection." *BioCycle* 34, 3 (1993): 76.

TABLE 1
SUMMARY OF CATEGORIZATION OF INSTRUMENTS

INSTRUMENT	PURCHASE RELEVANT	DISCARD RELEVANT	JOINTLY RELEVANT
Product or Material Levies	R		
Recycling Credits	PR	PR	PR
Disposal Levies	PR	PR	PR
Quantity Related Refuse Fees	PR	R	PR
Responsibility to Brand Owners	R	PR	PR
Potentially Refundable Levies			R

R=Relevant, PR=Potentially Relevant

TABLE 2
SUMMARY OF STRATEGIES AND FOCAL POINTS

STRATEGY	PURCHASE RELEVANT	DISCARD RELEVANT	JOINTLY RELEVANT
REDUCTION AT SOURCE			
Product Design	BO	BO (P)	
Product Choice	C	C (P)	
REUSE			
Product Design	BO	BO (P)	BO
Product Choice	C	C (P)	C
Product Use	C (P)	C	C
RECYCLING	(RECOVERY OF MATERIALS)		
Product Design	BO	BO (P)	BO
Product Choice	C	C (P)	C
Program Infrastructure	BO	LA	BO
Program Participation	C (P)	C	C
RECOVERY OF ENERGY			
Product Design	BO	BO (P)	BO
Product Choice	C	C (P)	C
Program Infrastructure	BO	LA	BO
Program Participation	C (P)	C	C

BO=Brand Owner, C=Consumer,LA=Local Authority (P)=Potential

ENDNOTES

1.The use of economic instruments for environmental protection has achieved a higher profile since the call in the Brundtland Report for integration of decision making about environment and economy. The present term "economic instruments" is an umbrella covering many of the basic ideas now being discussed that have appeared in different guises in the past. For instance: taxes to bring about the optimal level of externality (Pigou, 1962), "economic incentives in (air) pollution control" (Edwin S. Mills, 1966 p.100), "effluent fees" (Mills & Graves, 1986, Ch 10) "charges to induce efficient abatement" (Paul Burrows 1979 p.100), "eco-taxes" (Ramsay & Anderson, 1972 p.257)and "resource-use prices on waste emissions to achieve environmental standards" (Baumol and Oates, 1971 p53).

2. The Government also announced that government-industry "distributor responsibility" discussions are under way with other industries in addition to the packaging chain. Vehicles, electronic equipment, newspapers, tyres and batteries are mentioned explicitly.

3.See for example: Schoenecker (1992), Cabaniss (1993), Anon (1992), and Bagby (1992) discussing United States experience and Apotheker (1992) reflecting Canadian experience.

4. There is an extensive literature on the effectiveness and equity of input and product levies. See for example American work by Bingham et al.,(1974); Miedema et al., (1976); Franklin et al., (1979); ICF Inc., (1979); Miedema et al, (1980); Miedema, (1983); and Miedema, (1985). Recent British work includes: Brisson (1993), Pearce and Brisson (1993), Pearce and Turner (1993), Brisson (1992), Pearce and Turner (1992).

5.Quantity-variable user charges are used extensively in Europe and America. The literature contains numerous articles evaluating their effectiveness as well as the "down-side" or increased fly-tipping and littering. See for example: Jenkins (1993), Skumatz and Zach (1992), Skumatz (1991), Skumatz and Breckinridge (1990), Resource Integration Systems Ltd. (1990), OECD (1981).

6.The economics of deposit-refund systems has been studied extensively including analysis in ERL (1992) Ch 9.; ERL (1991); Porter (1978); Bohm (1981) and OECD (1978).

7. OECD has examined the impact of durability on waste streams. See OECD (1982).

8.Bohm (1981) discusses the conditions under which a deposit-refund system could accelerate the time of discard of a reusable product.

9.As mentioned earlier the large commercial and industrial generators of waste will find a landfill disposal levy directly relevant to their discard decision. This is because they already

pay quantity related waste collection and disposal fees. Competition among landfill operators might slow the impact of the disposal levy in the short run but in the longer run the levy will be relevant to the discard decisions of these generators.

10.In terms of Figure 1,the Government has implicitly said that the socially optimal level of reduction lies at the maximum that can be achieved without excessive cost to the economy.

11.See for example the Report of the Ontario Waste Reduction Advisory Group (1992).

12. They countries are: Belgium, Finland, France, Germany, Italy (related to dwelling size), Luxembourg and The Netherlands (ERL, 1992, Appendix 2).

13.Under a bag scheme, collector pick-up only material in plastic garbage bags identified by colour and/or logo of the Local Authority. Residents would purchase the bags in the High Street or at the Supermarket. The price of the bag would include manufacturing cost, distribution including retail mark-up and the cost of collection and/or disposal. Under a tag scheme, residents similarly would purchase tags or stickers to be attached to each garbage container. Collectors would pick-up only tagged material. Productivity of collection crews is generally higher with a bag scheme for most items. Some tags may be required for bulky or other oversized material.

ERL (ERL, 1992, p.111) reports on a trial in Western Australia using roll-about refuse bins which were dumped by a lift arm on the refuse collection truck. The lift arm was equipped with a weigh scale and billing computer at a cost of £43,000 per truck. Skumatz (1991) reports on a similar trial in Seattle Washington. Williamson (1993) discusses weight based charging schemes for household refuse being tested in the US Midwest.

14.Bohm (1981) reviews the usefulness to firms of deposit-refund systems as a matter of corporate strategy.

Figure one

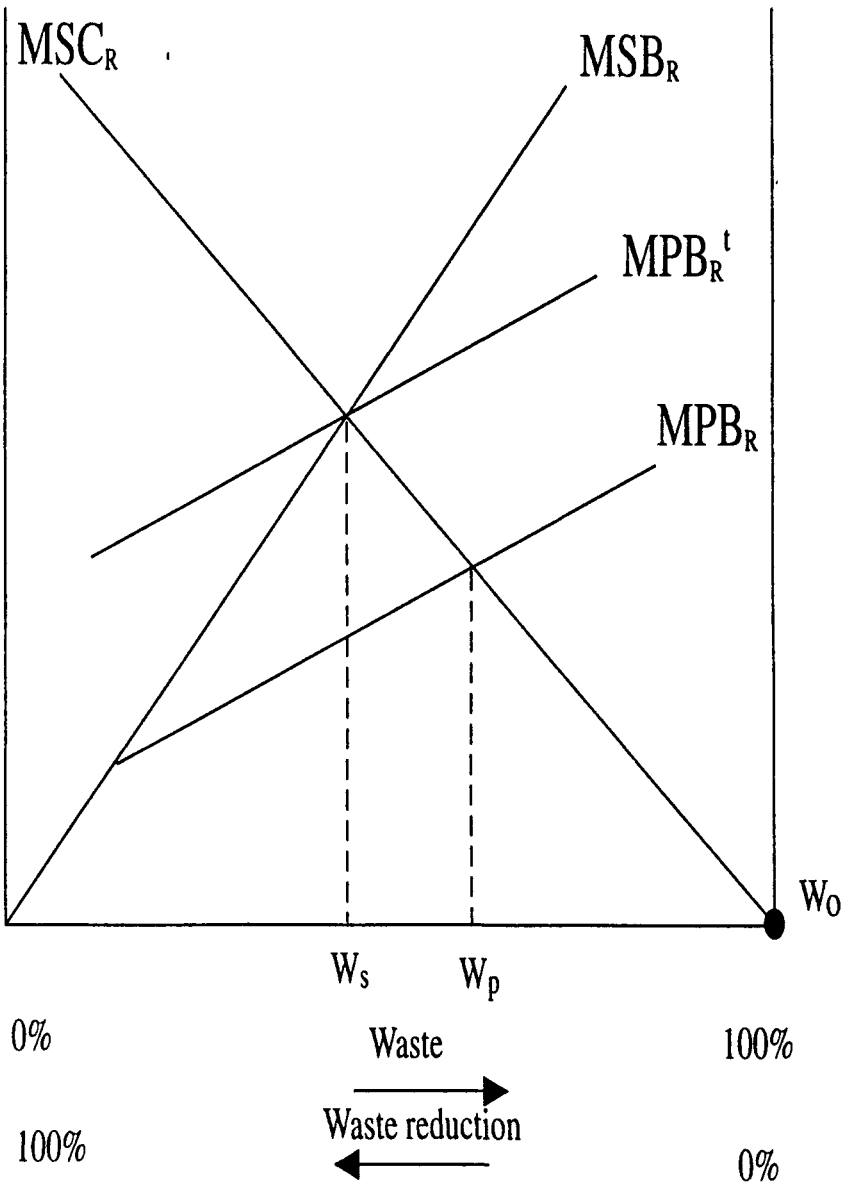
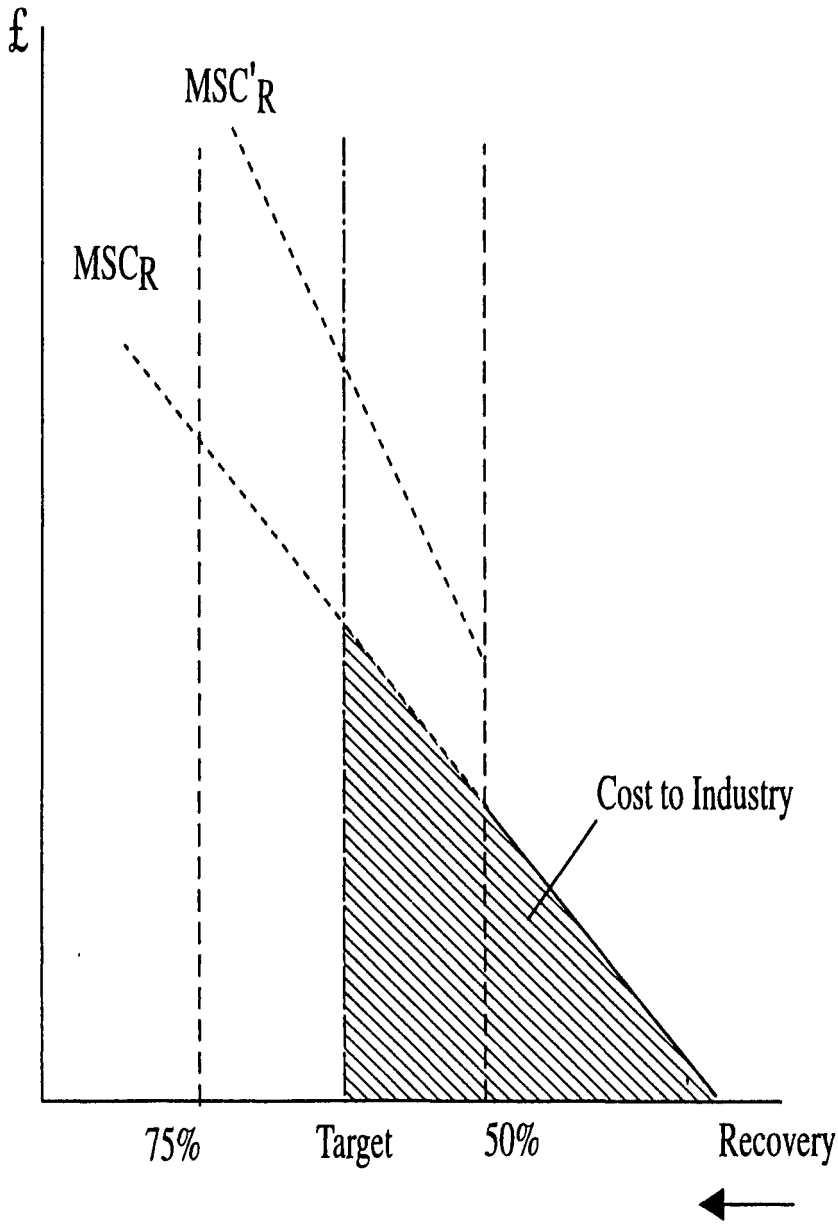

MSC_R
MSB_R
MPB_R^t
MPB_R
W_O
W_S
W_P
0%
Waste
100%
Waste reduction
100%
0%

Figure two



Department of Economics
University of Stirling
Stirling
FK9 4LA