Optimisation of pay-by-use domestic waste charges

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1. Introduction

In 2004 local authorities in Ireland were advised that all domestic waste charges should be within a pay-by-use (PBU) system from 1st January 2005, with permits for private waste collectors containing the new requirements when up for renewal by the local authority (DoEHLG, 2004). The role of economic incentives on household waste production and management in Ireland is examined in this paper. Rising waste levels, the EU polluter pays principle and Landfill Directive motivated the adoption of PBU domestic waste collection charges. The PBU charges have been adopted by waste collectors nationwide; however these charges have been implemented in different forms across the country with several different PBU systems (weight, tag, and differential bin size systems) used – both public and privately run. The study aimed to evaluate each PBU system in terms of its impacts upon waste disposal, recycling, and, in particular, source reduction in order to determine the most environmentally effective system or system components. In addition the study examined the attitudes of waste collectors and householders to PBU waste charges, and the individual PBU systems, with the overall research goal of identifying and recommending optimised pay-by-use (PBU) domestic waste charging systems for Ireland.

2. PBU domestic waste charging systems

Differential bin size systems require householders to subscribe to a weekly/fortnightly bin collection, for which they pay an annual charge. Tag-based systems involve householders purchasing tags to attach to their bag or bin with collectors picking up only those bags and bins with the appropriate tag attached (frequency based systems are grouped under the tag-based category as they operate on the same principle as tag-a-bin). Finally weight-based systems involve householders paying per kilogramme of waste placed out for collection.

There is a large literature on PBU domestic waste charges as these charges have been implemented in parts of the world since the 1970s. However there is little research comparing the impact of different PBU charging systems. In order to evaluate the different systems the findings of numerous studies, each examining the impact of a specific PBU charge within one geographical area, were compared with each other, leading to conclusions on the relative value of the three PBU in terms of their environmental impact.

Research into the impact of PBU domestic waste charges in Ireland (O'Callaghan-Platt and Davies, 2007) found that PBU charges have reduced domestic waste for landfill presentation rates, a finding that is consistent with results experienced in other countries/regions as reported in the international literature on PBU. However, the degree to which presentation rates were reduced in Ireland was found to be notably lower than reductions identified elsewhere. O'Callaghan-Platt and Davies (2007) found a 3.5% decrease nationally in waste presentation rates overall from 2003 to 2005 in local authorities with PBU charges. How does this percentage decrease compare to reductions elsewhere in the world and to reductions seen in pilot studies in Ireland? The majority of studies of pay-by-use charging conclude that they successfully decrease the amount of refuse collected in both the long and short term irrespective of whether the location was urban, rural or suburban (Dijkgraaf and Gradus, 2004; Linderhof et al., 2001; Sterner and Bartelings, 1999). However the extent of non-recyclable waste reduction varies widely amongst these studies with the cases recording reductions of between 6-56% (Bauer and Miranda, 1996; Dijkgraaf and Gradus, 2004; Dunne, 2004; Dunne, 2005; Fullerton and Kinnaman, 1995; Kinnaman and Fullerton, 2000; Linderhof et al., 2001; Miranda and Aldy, 1998; Nestor and Podolsky, 1998; Skumatz, 2000; Sterner and Bartelings, 1999). Examination of the literature reveals that regions implementing weight-based systems experienced a larger decrease in waste to landfill than regions implementing volume-based systems. These findings are consistent with the predictions of theoretical pay-by-use models that conclude that weight-based systems are the most effective in effecting change (see for example, Dijgkraaf and Gradus, 2004; Fullerton and Kinnaman, 1995).

3. Methodology

The study of potential optimised PBU domestic waste systems for Ireland required information from Irish waste collectors (private and public) implementing PBU charges, to determine their experiences of these systems. In order to gather these data two methods were used, a waste collector survey and examination of private waste collector Annual Environmental Reports (AERs).

There were two main aims of the survey and AER analysis:

- to analyse the implementation of PBU in Ireland, and
- to examine the impact of PBU systems on the environment.

A third aim of the waste collector survey was:

- to assess waste collectors' views and experiences of their systems (and others).

With this information, a picture of PBU implementation in Ireland can be developed, outlining which systems are most and least common, trends in their usage, the range of charges issued to householders within each system, the availability of kerbside recycling services, the frequency of bin collections etc.

In addition, the figures provided will allow for analysis of the impact of PBU systems on rates of waste disposal, recycling and on total waste levels (considering, for example, possible reductions in waste arisings due to charging systems). Furthermore the findings from the survey will indicate waste collectors' opinions and experiences of PBU systems, revealing what collectors consider the advantages and disadvantages of each system, whether or not they would recommend the system they use, any changes they are considering regarding charges etc.

Using data sets gathered from all local authorities that collect domestic waste and 56 private collectors the three forms of PBU used by domestic waste collectors in Ireland, tag-based systems, weight-based systems and differential bin size charges, were examined to determine their implementation, impact upon the environment, and impact upon waste collectors.

The objective of the household study was to evaluate the impact of all PBU systems on householders. In order to gather this data 790 households were surveyed. The survey gathered data on:

- The waste collection system used by surveyed householders
- The impact of PBU charges on their waste disposal behaviour.
- Their views on PBU charges.

4. Results

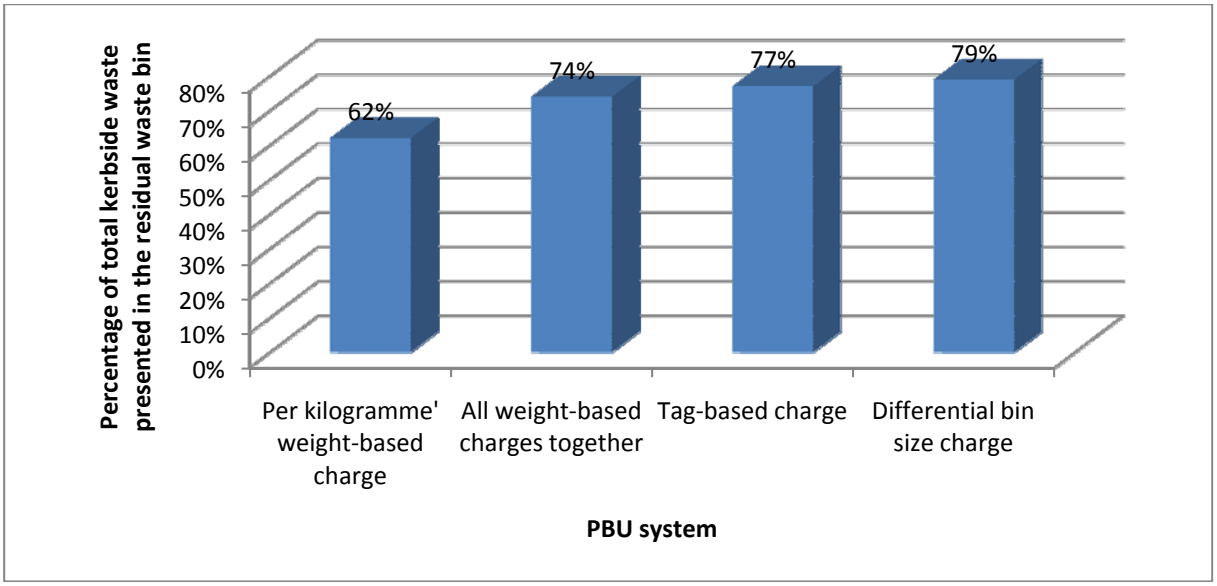
4.1 Impact of PBU charges on the environment

The research into the impacts of PBU systems on the environment found that in Ireland weight-based PBU charges are more effective than tag-based and differential bin size charges in reducing the negative impacts of domestic waste. These charges have prompted householders to divert waste from their residual waste bin more effectively than tag-based or differential bin size charges. Households using a weight-based charging system have a higher rate of recycling, and weight-based charges have been found to have lower average total waste levels, as presented at the kerbside, than either tag-based or differential bin size charges.

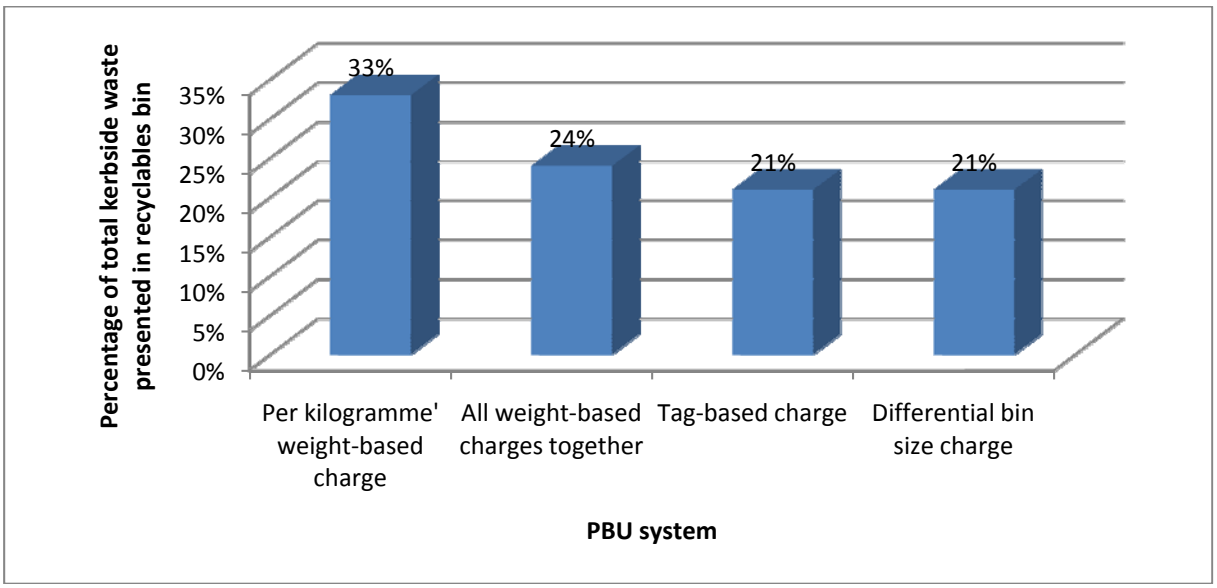
However the 'per kilogramme' form of weight-based charging is the most effective system in terms of kerbside recycling and total waste figures, with 'banded weight' and 'average weight' systems experiencing

less success with the 'average weight' system prompting figures similar to tag-based and differential bin size charges when the three weight-based systems are considered separately.

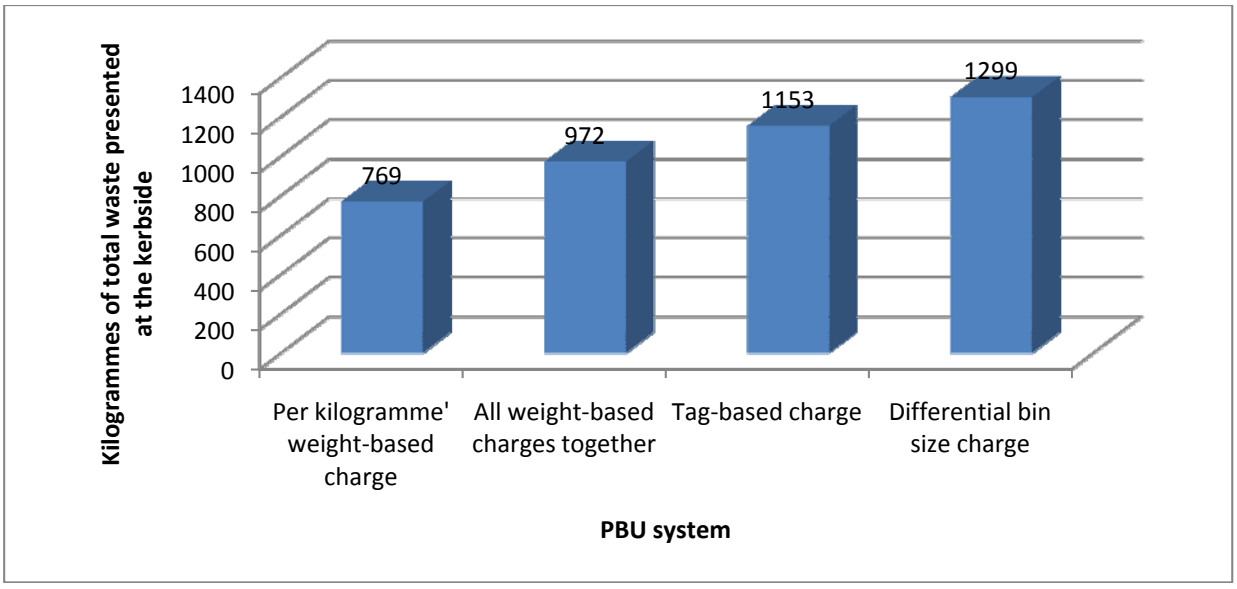
On average householders in weight-based areas placed 74% of their total presented waste into the residual waste bin. In comparison the tag-based householders placed, on average, 77% of waste in their residual waste bin, and the differential bin size householders placed 79% in this bin. However when only 'per kilogramme' weight-based charges are considered within the weight-based grouping only 62% of total kerbside waste is presented in the residual waste bin.



The data showed that households using a weight-based charging system had a slightly higher rate of recycling than households in either tag-based charging systems or differential bin size systems, with an average of 24%, to an average of 21% for the tag based collectors and differential bin size collectors. When only 'per kilogramme' weight-based charges are considered within the weight-based grouping the recycling rate is much higher with 33% of total kerbside waste presented in the recyclables bin.



The average weight-based household presents less waste at the kerbside in total than the average household using tag-based or differential bin size charges. The average figures were 972kg (weight-based), 1,153kg (tag-based) and 1,299kg (differential bin). Again taking the 'per kilogramme' form of weight-based charge separately results in a much lower total kerbside waste presentation figure of 769kg.



In addition to analyzing all collectors together within their PBU system grouping local authority data and private collector data were considered separately; finding that weight-based systems are the most effective PBU systems environmentally, followed by tag-based systems, with differential bin size charging the least environmentally effective of the three.

4.2 Impact of PBU charges on waste collectors

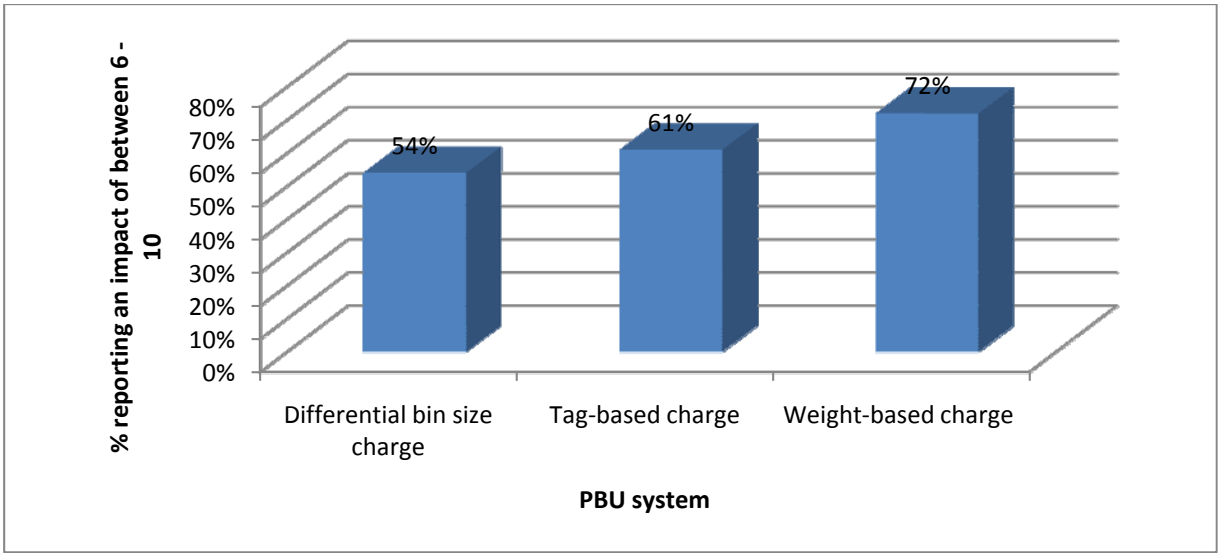
Weight-based charges can be considered preferable on the whole from the point of view of the environment. However the study found that there is no definitive answer to the question of which PBU system is preferable from the perspective of waste collectors. The best PBU system from a waste collector point of view depends entirely upon its priorities. For example, if the priorities of a collector are low set up costs and ease of administrative then a tag-based system would be favoured over a weight-based system. However if data gathering and reductions in waste to landfill are the priorities then a weight-based system is more suitable.

4.3 Impact of PBU charges on households

790 households were surveyed on PBU waste charges. 87% of these households have a waste collection service and 13% do not. All three PBU systems were represented, with 37% using a differential bin size system, 27% using a tag-based system and 16% using a weight-based system.

There is a high level of public acceptance of PBU charges, with 62% of respondents in favour of the charges prior to introduction and 72% in favour subsequent to their introduction. It appears that experience of PBU has increased householders opinion of the system. Households using a differential bin size system are less in favour of PBU system than weight or tag-based households.

The respondents were asked to rank the impact PBU charges have had upon their waste management behaviour on a scale of between one and ten, with one being 'not at all impactful' and ten being 'extremely impactful'. Just over a third state that charges have had a large impact on their waste management behaviour, while few claim that waste charges had a no/little impact on waste management behaviour. A greater percentage of respondents using a weight-based charge reported that their PBU charge had a large impact (impact rating 6-10) upon their waste management behaviour than was reported by respondents using either a tag-based system or a differential bin size system.



91% of respondents feel that PBU charges encourage them to recycle, with a slightly greater percentage of respondents with a weight-based charge stating that the charge encourages recycling than respondents from the other PBU systems. 80% of respondents feel that PBU charges encourage them to reduce waste production. Again a slightly higher percentage of weight-based households stated that the charge encourages waste reduction than for respondents with other PBU systems. 90% of households stated that PBU charge have made them more aware of the cost of waste disposal. A slightly greater percentage of tag-based households felt that their charges increased cost awareness. 69% of respondents feel that PBU charges encourage illegal waste disposal activities and 51% feel that PBU charges increase the hassle of waste disposal. Finally, 86% of households feel that PBU increased their awareness of environment issues.

5. Conclusion

Weight-based charges are the most effective PBU system from an environmental perspective. These charges have prompted the highest diversion rates from landfill and the lowest total kerbside waste figures. Households with a weight-based system also present the least waste at the kerbside. Weight-based charges can be considered preferable on the whole from the point of view of the environment. However the this form of charging only produces slightly higher recycling rates and slightly lower waste to landfill rates than the other PBU systems used. When the three forms of weight-based charging are considered separately we see that the 'per kilogramme' form of weight-based charging is the most effective system, with 'banded weight' and 'average weight' systems experiencing less success and the 'average weight' system prompting figures similar to tag-based and differential bin size charges. In light of this finding the research concludes that the most environmentally sustainable PBU system is the 'per kilogramme' weight-based charge.

There is no one PBU system that is optimal from the perspective of waste collectors. The best system for use depends upon the priorities of the collector and on this basis none of the three main PBU systems in use in Ireland can be considered the most advantageous in terms of impact upon the waste collector.

Households using a weight-based system felt that their PBU charge had a large impact on their waste management behavior, including recycling levels and waste reduction. In addition weight-based households expressed high levels of acceptance with PBU domestic waste charges. However households also had high levels of acceptance with tag-based charges.

'Per kilogramme' weight-based charges can be considered to be the optimal PBU system for use in Ireland; it is the most environmentally effective system, and accepted by households. Further research is underway gathering the opinions of Irish waste collectors to determine their acceptance of 'per kilogramme' weight-based charges.

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