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The introduction of a single-use carrier bag charge in Wales: Attitude change and behavioural spillover effects

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ABSTRACT

Wales is the first country in the United Kingdom to have introduced a charge for single-use carrier bags. A 2 × 2 quasi-experimental field study was set up to evaluate the effectiveness and further attitudinal and behavioural impacts of the charge. Independent nationally representative quota samples were interviewed before and after the introduction of the carrier bag charge in Wales and at the same times in England ($n = 500$ each). England, where no carrier bag charge was introduced, served as the comparator for the study. The study found increases in own bag use in both countries. However, the increase was much greater in Wales than in England. The study also found evidence for the policy becoming more popular after its implementation in Wales. While support for the carrier bag charge was already high before its introduction, the Welsh population became even more supportive afterwards. Although no support was found for positive behavioural spillover, the study found changes in self-reported environmental identity that could produce positive spillover effects in the longer term. The theoretical and policy implications of the findings are discussed.

1. Introduction

1.1. Background

Wales is the first country in the United Kingdom to have introduced a charge for single-use carrier bags. From the 1st of October 2011 onwards, shoppers in Wales have to pay a compulsory five pence for each single-use carrier bag at point of sale.[1] The charge was introduced to prevent littering and to reduce the amount of waste going to landfill (Welsh Assembly Government, 2010). A quasi-experimental field study was set up to evaluate the effectiveness of the charge to reduce carrier bag use amongst the general public, and to explore further attitudinal and behavioural responses to the charge. More specifically, the introduction of the carrier bag charge in Wales was used as a natural experiment to examine whether environmental policies may become more popular after their introduction and lead to *behaviour spillover*, i.e., promote pro-environmental behaviours other than the one(s) directly targeted by the policy.

1.2. The effectiveness of policies to reduce single-use carrier bag use

Over the past decade a remarkable shift in the international norms associated with disposable carrier bags has taken place. Single-use carrier bags – plastic ones in particular – are increasingly seen as an environmental hazard threatening human and animal welfare, rather than as a benign modern convenience. Many national and local governments have therefore either banned or put restrictions on the sale or use of disposable plastic bags (Clapp & Swanston, 2009). The success of these countries to reduce plastic bag use among the general public has led to other countries, states and local communities following suit with comparable measures (e.g., Convery, McDonnell, & Ferreira, 2007).

While there have been many initiatives to reduce single-use carrier bags, very few of them have been evaluated. The available evidence suggests that a tax or a charge on disposable carrier bags can be highly effective.[2] Research by Convery et al. (2007) shows that plastic bag tax introduced in the Republic of Ireland in 2002

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[1] Single-use carrier bags are designed to hold purchases for a single journey to take them home. This includes bags made of any material (e.g., plastic, paper, or plant-based materials such as starch) which are generally not suitable for multiple usage.

[2] The difference between a tax and a charge is that the revenues of a tax go to the government while the revenues of a charge go to the retailer. In Wales, retailers are suggested to donate the proceeds to a charity of choice.

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(the 'plastax') reduced plastic bag use by more than 90% and raised revenues in the order of €12–14 million for the Environment Fund. However, this conclusion was based on evidence from multiple sources, not on a systematic evaluation of the policy. A national plastic bag charge introduced in China in 2008 led to a 49% reduction in the use of new plastic bags (He, 2010). In this study, independent samples of shoppers were interviewed before and after the implementation of the policy. However, without a comparable control or comparator group, the research was not able to separate the effects of the policy from more general trends in plastic bag use.

There are different ways in which the effectiveness of a tax or a charge on carrier bags can be understood. Economists see a carrier bag tax or charge as a typical market-based instrument that internalises the costs of environmental pollution. The effectiveness is therefore based on the pricing of the external costs of pollution that were not previously part of the consumers' decision to use disposable carrier bags. The functioning of market-based instruments is well supported by economic theory (Tietenberg, Button, & Nijkamp, 1999). According to economic theory, 'emissions' (i.e. number of bags used) will be reduced to the point where the marginal benefits of internalisation equal the marginal costs of abatement (Convery et al., 2007). However, while the pricing certainly forms part of the explanation, a singular economic focus may ignore important psychological processes that could contribute to the success of a tax or charge to change behaviour.

The functioning of the carrier bag charge can also be understood from a 'habit discontinuity' perspective (Verplanken, Walker, Davis, & Jurasek, 2008). The use of carrier bags may – like many other waste-related behaviours – be strongly habitual (i.e. automatic, frequent and 'cued' by stable contexts; Verplanken, Aarts, van Knippenberg, & Moonen, 1998). The introduction of the charge can be seen as a 'context change' after which bag use needs to be renegotiated. While previously consumers may have 'unconsciously' grabbed a single-use carrier bag at the cashier till, a carrier bag charge or tax forces them to make a conscious decision as to whether they want to use one or not. People are then prompted to adapt their behaviour to either avoid the charge, as argued by economic theory, or to bring behaviour in line with their values, as posited by the self-activation hypothesis (Verplanken et al., 2008). The old wasteful habit then may (or may not) be replaced by the new behaviour of bringing a re-usable bag to the shops, which in the longer term may become a habit in its own.

1.3. Attitudinal responses to environmental policies

In addition to the intended changes in the targeted behaviours, environmental policies appear to elicit a number of other less well understood attitudinal and behavioural responses. Despite Irish consumers being somewhat resistant to the plastic bag charge prior to its introduction (Drury Research, 2000), Convery et al. (2007) reported that they became more positive about the policy after its implementation. Convery et al. (2007) even label the policy as "the most popular tax in Europe". Similar positive attitudinal changes were observed for other environmental and behavioural change policies. Smokers as well as non-smokers have been found to be more supportive of a smoking ban after the benefits became apparent (Borland, Owen, Hill, & Chapman, 1990; Owen, Borland, & Hill, 1991; Seo, Macy, Torabi, & Middlestadt, 2011); and a number of congestion charges have become more popular after they came into force (Schuitema, Steg, & Forward, 2010; Transport for London, 2004).[3]

Attitude change brought about by behaviour change policies can be explained by well-established social psychological consistency theories, such as *cognitive dissonance* (Festinger, 1957) and *self-perception theory* (Bem, 1967). Cognitive dissonance theory posits that people have a motivational drive to reduce discrepancies between attitudes and behaviour, as such discrepancies produce feelings of discomfort. This can be done by either changing attitudes or behaviours. According to self-perception theory, people infer their own attitudes from observing their own behaviour. Attitude change may therefore occur if policies are successful in changing behaviour.

An alternative explanation for the positive attitudinal changes is that parts of the public have unrealistic expectations regarding the consequences of the proposed policies. These views may then be adjusted after people have experienced the benefits of a policy and/or have been able to adapt to the policy without much difficulty (Ölander & Thøgersen, 1995).

1.4. Behavioural responses to environmental policies: spillover effects

A possible side effect of cognitive dissonance and self-perception processes is that the policies and their accompanying attitude and behaviour changes may lead to further behavioural responses. The spread of effects from a targeted behaviour to other associated behaviours is known as *behavioural spillover* (Thøgersen, 2004; Thøgersen & Crompton, 2009) or *response generalisation* (Ludwig, 2002; Ludwig & Geller, 1997). According to Bem's self-perception theory (1967) people do not only infer their attitudes from their behaviours; they also use their behaviours as 'cues to their internal dispositions'. This means that engagement in pro-environmental behaviour may encourage changes in people's values and identity, which then may lead to further behavioural changes in line with the revised identity (Whitmarsh & O'Neill, 2010). If people stop using single-use carrier bags and start bringing their own reusable bag to the shops, they may see themselves as being more waste conscious and thus are more likely to make other waste-conscious decisions.

Response generalisation theory argues that reinforcement effects may spread to other functionally similar behaviours (Ludwig, 2002). The use of behavioural spillover processes to promote environmentally sustainable lifestyles change has gained some traction in policy circles. It is hoped that certain 'catalytic' or 'wedge' behaviours may serve as entry points in helping people to make additional changes (Defra, 2008). However, while behavioural spillover or response generalisation has been observed for safety behaviours (Ludwig & Geller, 1997), there is little empirical evidence of spillover effects in the environmental domain. Most of the evidence in the environmental domain is still predominantly correlational (Barr, Gilg, & Ford, 2005; Poortinga, Spence, Demski, & Pidgeon, 2012; Thøgersen & Noblet, 2012; Whitmarsh & O'Neill, 2010). While response generalisation may have contributed to the covariance between the different (types of) environmental behaviour, a causal relationship can only be established via (field) experimental research.

It also has to be considered that changes in a target behaviour might not necessarily lead to additional attitude and other behavioural change. People need to change their behaviour voluntarily and for the 'right' reasons. If behaviour change is (perceived to be) imposed or associated with external contingencies, the behaviour could become extrinsically rather than intrinsically motivated (Deci & Ryan, 1985). This is then unlikely to produce changes in identity and other associated behaviours. Also, evidence is emerging that

[3] Congestion pricing or congestion charges are a system charging motorised vehicles for entering a particular zone in periods of high demand to reduce traffic congestion.

spillover effects can only be expected if policies appeal to environmental rather than self-interested reasons for behavioural change (Evans et al., 2013).

There are further risks associated with relying too much on behavioural spillover processes to establish further changes in lifestyle. Adopting particular pro-environmental behaviours may establish 'moral credentials' (Thøgersen & Crompton, 2009) which may lead to *negative spillover* through a '*licensing effect*' (Mazar & Zhong, 2010). By engaging people in one salient environmentally significant act (e.g., recycling), they may feel they earned the right to engage in other more wasteful behaviours (e.g., a flight to an exotic destination).

1.5. Aim of the research

The overall aim of the study was to investigate the effectiveness and further attitudinal and behavioural impacts of the single-use carrier bag charge in Wales. The focus of the research was fourfold. First, the study examined the effectiveness of the charge to reduce its target behaviour of single-use carrier bag use. It was hypothesised that people in Wales are more likely to bring their own reusable shopping bag/s to supermarkets and other shops after the introduction of the carrier bag charge (Hypothesis 1).

Second, the study examined attitudinal changes brought about by the charge. It was expected that due to self-perception and cognitive dissonance processes, people in Wales would become more positive about the carrier bag charge after its introduction. The specific hypotheses being tested were: people in Wales will become more supportive of the charge after its introduction (Hypothesis 2a) and will develop more positive attitudes towards the charge after its introduction (Hypothesis 2b).

The third aim of the paper was to explore potential changes in identity as a result of the carrier bag charge. It was hypothesised that, as a result of self-perception and cognitive dissonance processes, a waste-conscious/environmental identity will become more prevalent in Wales after the introduction of the carrier bag charge (Hypothesis 3).

Fourth, the study explored possible spillover to other waste and non-waste related environmental behaviours. It was hypothesised (Hypothesis 4) that the carrier bag charge will produce changes in other waste-related behaviours (e.g. recycling) but not in non-waste related environmental behaviours (e.g. energy use).

2. Method

2.1. The study

A quasi-experimental field study consisting of independent samples was set up to evaluate the introduction of the single-use carrier bag charge in Wales. Telephone surveys were conducted in Wales before ($n = 500$) and after ($n = 500$) the introduction of the charge. Similar telephone surveys were conducted in England at the same times ($n = 500$ in both the before and after sample). The interviews conducted in England, where no carrier bag charge was introduced, served as the comparator for the study. The 'before' telephone interviews were conducted from 19 to 30 September 2011 in Wales (two weeks prior to the introduction of the charge) and from 19 September to 8 October 2011 in England. The 'after' telephone interviews were conducted from 8 April to 1 May 2012 (approximately six months after the introduction of the charge).

A quota sampling strategy was used to obtain nationally representative samples. Broad quotas were set for gender, age and urban–rural location. The independent samples were then weighted to the known socio-demographic profile of the Welsh and English populations as recorded in the 2001 Census. The 'before' and 'after' Welsh and English samples were therefore comparable in terms of socio-demographic composition. There were only small differences between the Welsh and English samples. Income levels were somewhat lower in Wales than in England, and the Welsh samples were more rural than the English ones (see Table 1). These differences reflect differences in the makeup of the respective populations.

2.2. Measures

The questionnaire contained 32 questions on the topics of own bag use; support for and attitudes towards the carrier bag charge; waste-related and non-waste related environmental behaviours; self-reported environmental identity and concern; waste knowledge; and socio-demographic background information.

Current levels of own bag use were assessed by asking (1) 'At your last visit to the supermarket, did you bring your own bag?'; (2) 'How often do you take your own bag/s to the supermarket?'; and (3) 'How often do you take your own bag/s to other shops?'. Respondents could answer the first question with 'yes', 'no', or 'don't know'. The latter two questions could be responded to by answering 'always', 'often', 'occasionally', or 'never'. The scale was dichotomised, contrasting 'always' to all other responses.

The acceptability of the single-use carrier bag charge was assessed by asking respondents 'How strongly do you support or oppose a five pence charge on single-use carrier bags?'. The five-point response scale ranged from 'strongly support' to 'strongly oppose'. The scale was dichotomised, contrasting support ('strongly support' and 'tend to support') to all other responses.

Attitudes towards the charge were indicated by responses to the following three statements: 'Charging five pence for each single-use carrier bag is a good way of reducing waste'; 'Charging five pence for each single-use carrier bags helps to reduce litter'; and 'I

Table 1
Characteristics of the weighted before and after samples in Wales and England (%).

		Wales		England	
		Before ($n = 500$)	After ($n = 500$)	Before ($n = 500$)	After ($n = 500$)
Gender	Male	48	48	48	48
	Female	52	52	52	52
Geographic location	Urban	65	65	81	83
	Rural	35	35	19	17
Age	16–24 years	14	14	14	13
	25–34 years	16	16	18	18
	35–44 years	18	18	19	19
	45–54 years	17	17	17	17
	55–64 years	14	14	13	13
	65+ years	22	22	20	20
Income band per annum	Under £10,000	19	23	26	25
	£10,001–£20,000	23	21	23	18
	£20,001–£30,0000	13	12	13	11
	£30,001 or more	12	11	13	17
	Prefer not to say	25	25	21	23
	Don't know	9	8	5	7

am more willing to pay a five pence charge for a single-use carrier bag if the money goes to charity'. The five-point response scale had the following scale points: 'strongly agree', 'tend to agree', 'neither agree nor disagree', tend to disagree' and 'strongly disagree'. The three items could be combined into an internally consistent scale (Cronbach's $\alpha = 0.77$).

The questionnaire included four agree–disagree statements designed to assess respondents' waste and environmental identity (e.g. 'I think of myself as a waste conscious person' and 'I think of myself as someone who is very concerned about environmental issues', respectively). The four statements formed a reliable self-reported environmental identity scale (Cronbach's $\alpha = 0.87$).

The following waste-related and non-waste related environmental behaviours were included in the survey: buying products with less packaging; recycling household waste; repairing or maintaining an item to avoid buying something new; walking or cycling short distances (i.e. trips of less than 3 miles); turning off the tap while brushing your teeth; buying energy-saving light bulbs; and washing clothes at 30° or less. Respondents indicated if they 'always' 'often', 'occasionally', or 'never' took these actions. No reliable scales could be constructed from these behaviours. Potential spillover effects were tested for each of the seven waste-related and non-waste related environmental behaviours.

2.3. Statistical analysis

The data were analysed using two-way Analysis of Variance (ANOVA). The 2 × 2 factorial design included 'stage' (before versus after the introduction of the carrier bag charge) and 'country' (Wales versus England) as the fixed factors. Full-factorial analyses were conducted with own bag use, support for the carrier bag charge, attitudes to the carrier bag charge, self-reported environmental identity, and waste-related and non-waste-related behaviours as the respective dependent variables. The full-factorial analyses estimated simultaneously the main effects of two fixed factors and the interaction between them. Both the main effects and the interaction effects of the full-factorial analyses are presented. Interaction effects show non-additive effects of the two fixed factors that can be attributed to the carrier bag charge. Simple effects analysis was used to explore the nature of the found interactions. The effect sizes are presented in Cohen's *d*.

3. Results

3.1. Own bag use

When respondents were asked if they brought their own bag to the supermarket at their last visit (see Fig. 1), a significant difference was found between the before and after samples, $F(1, 2173) = 81.37$, $p < 0.001$. Overall, respondents were more likely to report bringing their own bag after the introduction of the charge. A significant difference was found between the Welsh and English samples, $F(1, 2173) = 12.18$, $p < 0.01$. The Welsh respondents were, overall, more likely than the English to report taking their own bag to the supermarket at their last visit. A significant Stage × Country interaction effect was found, $F(1, 2173) = 4.21$, $p < 0.01$. A simple effects analysis showed that, while own bag use increased in both samples, the increase was greater in Wales ($d = 0.48$, $p < 0.001$) than in England ($d = 0.27$, $p < 0.001$).

Fig. 2a shows the percentage of respondents 'always' bringing their own bag/s to the supermarket. A significant difference was found between the before and after samples, $F(1, 2199) = 42.84$, $p < 0.001$. Respondents were more likely to always bring their own bag/s to the supermarket after the introduction of the charge than before. Respondents in the Welsh samples were more likely to always bring their own bag/s to the supermarket than those in the English samples, $F(1, 2199) = 13.68$, $p < 0.001$. A significant Stage × Country interaction effect was found, $F(1, 2199) = 12.25.135$, $p < 0.001$. A simple effects analysis showed the interaction was due to a significant increase in people always bringing their own bag/s to the supermarket in Wales ($d = 0.43$, $p < 0.001$). The increase in England was not statistically significant ($d = 0.10$, $p = 0.11$).

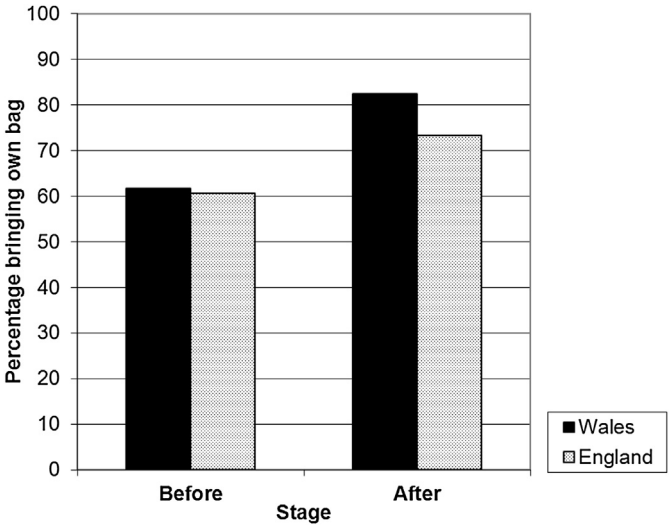

Fig. 1. Percentage bringing their own bag to the supermarket at their last visit in Wales and England before and after the introduction of the carrier bag charge.

Fig. 2b shows the percentage of respondents reporting 'always' bringing their own bag/s to other shops. Respondents were more likely to always bring their own bag/s to other shops after the introduction of the carrier bag charge as compared to before, $F(1, 2199) = 14.05$, $p < 0.001$. Overall, respondents in the Welsh samples were more likely to always bring their own bag/s to other shops than those in the English samples, $F(1, 2199) = 36.68$ $p < 0.001$. The Stage × Country interaction effect was statistically significant, $F(1, 2199) = 27.59$, $p < 0.001$. A simple effects analysis showed a significant increase in people always bringing their own bag/s to other shops in Wales ($d = 0.34$, $p < 0.001$). The decrease in England was not statistically significant ($d = -0.11$, $p = 0.07$). Overall, these findings confirm Hypothesis 1 that people in Wales would be more likely to bring their own reusable shopping bag/s to supermarkets and other shops after the introduction of the carrier bag charge.

3.2. Support for the carrier bag charge

Fig. 3 shows there was more support for a five pence charge in the after samples than in the before samples, $F(1, 2199) = 9.04$, $p < 0.01$. It also shows that people in Wales were generally more supportive of a charge than people in England, $F(1, 2199) = 33.82$, $p < 0.001$. The Stage × Country interaction was statistically significant, $F(1, 2199) = 4.00$, $p < 0.05$. A simple effects analysis showed the interaction was due to an increase in support in Wales ($d = 0.23$, $p < 0.01$). The increase in support was not significant in England ($d = 0.07$, $p = 0.28$). These results are in line with Hypothesis 2a that people in Wales would become more supportive of the charge after its introduction.

3.3. Attitudes towards the carrier bag charge

Fig. 4 shows the average scores of the scale combining the three attitude statements. Attitudes to a five pence carrier bag charge

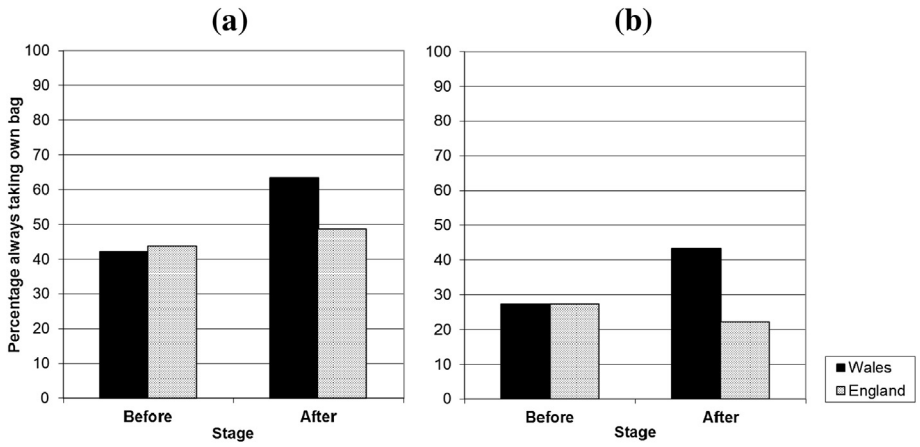

Fig. 2. Percentage always taking their own bag/s to (a) the supermarket and (b) other shops in Wales and England before and after the introduction of the carrier bag charge.

were found to be more positive after the introduction of the charge, $F(1, 2199) = 11.51$, $p < 0.001$. Overall, attitudes to a five pence charge were more positive in Wales than in England, $F(1, 2199) = 15.05$, $p < 0.001$. However, no interaction effect was found, $F(1, 2199) = 0.34$, $p = 0.56$. A simple effects analysis confirmed that attitudes to the carrier bag charge improved in Wales ($d = 0.16$, $p < 0.01$) as well as England ($d = 0.12$, $p < 0.05$). These results are not in line with Hypothesis 2b.

3.4. Self-reported environmental identity

Fig. 5 shows that, overall, there was no significant difference in self-reported environmental identity before and after the introduction of the carrier bag charge, $F(1, 2199) = 0.26$, $p = 0.61$, and that self-reported environmental identity was slightly higher in the Welsh samples than in the English samples, $F(1, 2199) = 5.23$, $p < 0.05$. The analysis revealed a significant Stage × Country interaction effect, $F(1, 2199) = 8.13$, $p < 0.01$. While self-reported environmental identity increased in Wales ($d = 0.14$, $p < 0.05$), no significant change was observed in England ($d = -0.10$, $p = 0.11$). These results confirm Hypothesis 3 that a waste-conscious/environmental identity would become more prevalent in Wales after the carrier bag charge was introduced.

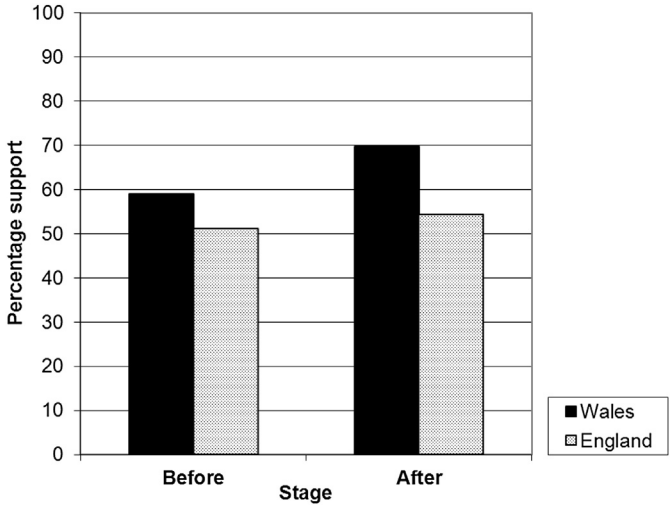

Fig. 3. Percentage support for a five pence charge on single-use carrier bags in Wales and England before and after the introduction of the carrier bag charge.

3.5. Waste-related and non-waste related behaviours

No evidence for behavioural spillover was found in this study. There was an increase in recycling household waste, $F(1, 2199) = 10.09$, $p < 0.001$. However, the Stage × Country interaction was not significant, $F(1, 2199) = 0.01$, $p = 0.91$. A simple effects analysis confirmed that recycling increased in both Wales ($d = 0.13$, $p < 0.05$) and England ($d = 0.14$, $p < 0.05$). Somewhat surprisingly, the frequency of people buying energy-saving light bulbs dropped between the before and after samples, $F(1, 2199) = 4.44$, $p < 0.05$. Again, the Stage × Country interaction was not significant, $F(1, 2199) = 1.85$, $p = 0.17$, although a simple effects analysis suggests that the drop was somewhat bigger in England ($d = 0.15$, $p < 0.05$) than in Wales ($d = 0.03$, $p = 0.62$). The study could not confirm Hypothesis 4.

4. Discussion

This study aimed to evaluate the introduction of the single-use carrier bag charge in Wales by comparing changes in attitudes and behaviour in Wales with those in England, where no charge was

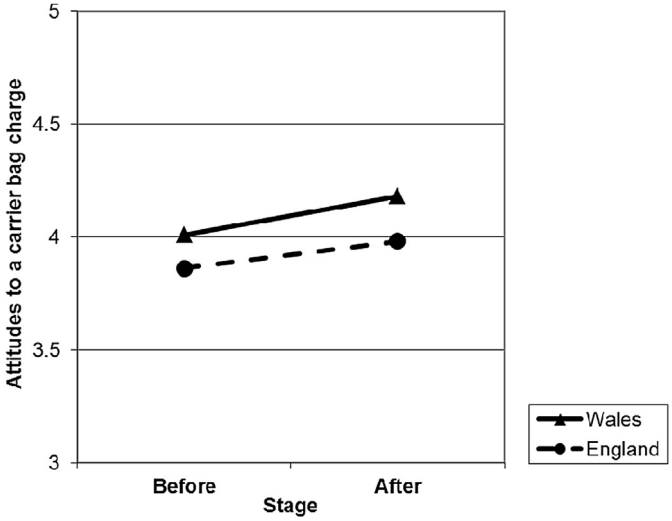

Fig. 4. Mean attitude to a carrier bag charge in Wales and England before and after the introduction of the carrier bag charge (1–5 disagree–agree scale; higher scores indicate a more positive attitude).

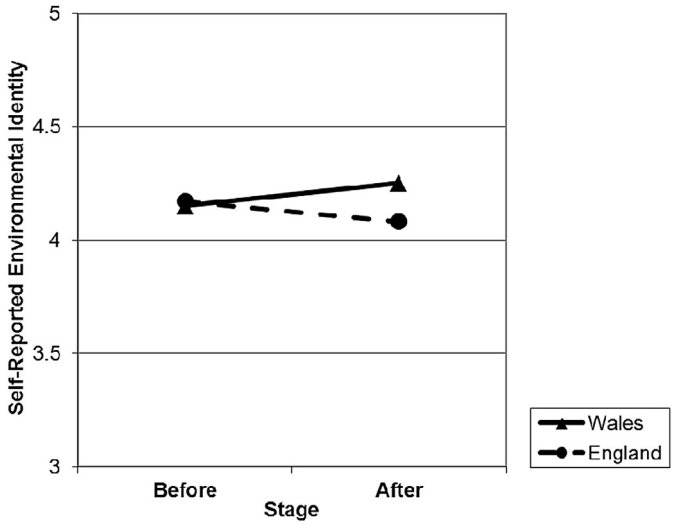

Fig. 5. Mean self-reported environmental identity scores in Wales and England before and after the introduction of the carrier bag charge (1–5 disagree–agree scale; higher scores indicate a stronger environmental identity).

introduced at the time of the study. Key objectives of the study were to examine the effectiveness of the charge to reduce the use of single-use carrier bags (as indicated by own bag use); changes in support for and attitudes towards the charge; potential changes in identity as a result of the carrier bag charge; and potential behavioural spillover effects brought about by the charge.

The charge appeared highly effective in changing its target behaviour of carrier bag use. Own bag use in Wales increased from 62% before to 82% after the introduction of the carrier bag charge. While own bag use also increased in England, the increase was much smaller than in Wales. The carrier bag charge appears to have established a change of habits in Wales. Many people in Wales now 'always' bring their own bag to the supermarket (an increase from 42% to 64%) and to other shops (an increase from 27% to 43%). The increase in 'always' bringing a reusable bag to the supermarket was much smaller in England. England even saw a decrease in shoppers 'always' bringing a reusable bag to other shops.

Although it cannot be assumed that all frequent behaviour is habitual (habits are also defined by their automaticity and being cued by a stable context; Verplanken et al., 2008), it would be likely that people who 'always' bring a reusable bag to the shops have developed some habitual routine of bringing a bag in the six months after the introduction of the charge. Indeed, research on habit development indicates that new behaviour becomes habitual on average 66 days after initiation (Lally, van Jaarsveld, Potts, & Wardle, 2010). Initially, the charge will have made the decision to bring a reusable bag deliberate. Then at some stage bringing a reusable bag will become the new habit by building it into the routine of going to the shops (cf. Verplanken & Wood, 2006). More qualitative and experimental research is needed to show how such habit discontinuity effects unfold. It will be particularly useful to explore according to which principles waste-related habits are broken and re-created.

The study identified a number of attitudinal responses to the charge that may be informative for environmental policy-makers. While support for the single-use carrier bag charge was already high before its introduction, the Welsh population became even more supportive of the charge after (from 59% before to 70% after). In England, support for a five pence charge remained stable over the same period. These results are in line with the predictions and consistent with cognitive dissonance and self-perception processes.

The observed changes in self-reported environmental identity reflect the patterns of behaviour change in England and Wales and are also consistent with the increased support for the carrier bag charge in Wales. While self-reported environmental identity increased in Wales, it did not significantly change in England. However, not all attitudinal changes were as expected. Even if attitudes to the single-use carrier bag charge became more positive in the wake of its introduction in Wales, a similar improvement was found in England. It is therefore likely that these results reflect a wider change in norms relating to disposable carrier bags in the UK, rather than being attributed to the policy itself or associated cognitive dissonance/self-perception processes. It is possible that attitudes in England have been contaminated through the introduction of long-life bags in supermarkets or through reports in the media (see e.g. BBC, 2012).

The study found no support for behavioural spillover. Very few real changes in waste-related and non-related behaviours were observed after the charge was introduced in Wales. The absence of such effects may have important policy implications as it questions the viability of behavioural spillover as a strategy to promote more substantial lifestyle changes.

However, there could be a number of alternative methodological and theoretical explanations for the absence of behavioural spillover effects. Due to space restrictions it was only possible to include a small number of waste-related and non-waste related environmental behaviours in the survey. It is therefore possible that the effects may have spilled over to behaviours that were not included in this study. It would be worthwhile to conduct a behavioural mapping exercise to identify the most likely candidates for behavioural spillover in advance. An alternative explanation is that bringing your own bag is not an appropriate 'catalytic' or 'wedge' behaviour to bring about further behavioural changes. Cognitive dissonance will only emerge and thus lead to other changes if the changed behaviour is *diagnostic* of an internal disposition (namely, environmental values or identity). The change in self-reported environmental identity would argue against this explanation. A related explanation as to why spillover may not have happened is that the behaviour change may have been motivated by cost avoidance rather than by environmental values. Engagement in the more pro-environmental behaviour is then externally rather than internally attributed (Deci & Ryan, 1985). As observed in both the response generalisation and spillover literatures, this would militate against change in non-targeted behaviours.

The study has a number of methodological weaknesses that need to be addressed in future research. Most notably, the study used *independent* samples to evaluate the effectiveness and further attitudinal and behavioural impacts of the carrier bag charge in Wales. It was therefore not possible to conduct detailed individual-level analyses. Longitudinal research is needed to show which individuals are the most likely to change their attitudes and behaviour and under which conditions these changes may come about (cf., Evans et al., 2013; Ludwig & Geller, 1997). This could show whether environmentally concerned individuals are more likely to change their behaviour in accordance with their values, as can be expected from a self-activation perspective (Verplanken et al., 2008); how (differential) experiences of the benefits and drawbacks of the new situation can bring about attitude change (cf., Schuitema et al., 2010); and whether individuals who change their behaviour for 'intrinsic' environmental reasons are more likely to engage in further behaviour change than those who change their behaviour for 'extrinsic' financial reasons (cf., Deci & Ryan, 1985; Evans et al., 2013).

The current study primarily focused on environmental identity as a mechanism for change. However, there is a wider variety of mechanisms at play that could contribute to attitude and

behaviour change. By engaging in a pro-environmental behaviour, individuals may acquire knowledge or learn skills that make other pro-environmental behaviours easier to conduct (Thøgersen & Crompton, 2009). The response generalisation literature provides an alternative perspective on how the reinforcement of a single behaviour may spread to other functionally similar behaviours (Ludwig, 2002). According to Stokes and Baer (1977) response generalisation to functionally similar behaviours is part of a wider reinforcement effect that take place across different settings, time, and stimuli. This opens up interesting new avenues for behavioural spillover research in the environmental domain. Spillover effects may also occur to other persons, settings, time, and as a response to resembling policies. For pragmatic reasons, our research relied on self-reports rather than on objective measures of behaviour. While self-reported measures may reflect inflated estimates of actual behaviour, this would likely have been consistent across both the intervention and comparator groups. Other research on the Welsh carrier bag charge that used more 'objective' behavioural measures reported consistent effects as a result of the introduction of the charge (WRAP, 2012).

Despite these limitations, the study has made a contribution to understanding the attitudinal and behavioural implications of environmental policy. The evidence regarding behavioural spillover has so far been predominantly associational, while evidence regarding attitude and behaviour change tends not to include a comparator group. This study constitutes the first quasi-experimental evidence of the effectiveness of a carrier bag charge as well as for an environmental policy becoming more popular after its implementation.

The attitudinal responses to the carrier bag charge observed in this study suggest that environmental policy-makers may be bolder in implementing policies that have a certain level of support and are easily adapted to. While the study did not find any support for spillover effects to other environmental behaviours, it also did not find evidence for negative spillover or 'licensing'. Furthermore, the observed changes in self-reported environmental identity could suggest that the carrier bag charge may bring about behavioural spillover in the longer term.

There is now a need for further research to study the long-term effects of behaviour change policies as well as in-depth field-experimental research to examine the processes and specific conditions under which attitude change and spillover effects may or may not occur. Such research will be vital for policy-makers in other countries currently considering introducing carrier bag charges, and those who are considering using behavioural spillover as a strategy to bring about further lifestyle changes.

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Appendix A. Mean values for the dependent variables in the weighted before and after samples in Wales and England.

Dependent variable	Values	Scale	Wales		England	
			Before ($n = 500$)	After ($n = 500$)	Before ($n = 500$)	After ($n = 500$)
At your last visit to the supermarket, did you bring your own bag?	% yes	0–100	61.6	82.4	60.7	73.4
How often do you take your own bag/s to the supermarket?	% always	0–100	42.2	63.5	43.8	48.7
How often do you take your own bag/s to other shops?	% always	0–100	27.2	43.4	27.4	22.4
How strongly do you support or oppose a five pence charge on single-use carrier bags?	% strongly/tend to support	0–100	59.0	69.7	51.2	54.4
Attitudes to a five pence carrier bag charge scale	*M* (SD)	1–5	4.01(0.99)	4.18(1.02)	3.86(1.03)	3.98(0.96)
Self-Reported Environmental identity scale	*M* (SD)	1–5	4.15(0.80)	4.25(0.75)	4.17(0.75)	4.08(0.82)

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