The Can Challenge: Exploring the Best Way to Incentivise Pro-Environmental Behaviour

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School of Economics, University of East Anglia Working Paper April 2019

Abstract

In light of a report published by The Voluntary and Economics Incentives Working Group in February 2018, the UK Government is currently in consultation over how to viably operate a Deposit Return Scheme (DRS) on drinks containers. This field experiment looks at two possible incentive mechanisms by which this could be conducted and assesses how likely each incentive is to yield a greater level of participation and engagement. The first of these is a piece-rate system, similar to that already used in some European countries, whilst the second uses a lottery-based system that the literature in behavioural economics has shown to be very effective. Both were implemented across three different locations across Norwich. For environmental economists, this study invites some interesting questions on how to best increase the public involvement in recycling. This is a particularly relevant question for the UK given they have a desire to implement a Deposit Return Scheme without having committed to an implementation strategy. Our findings show that the lottery incentive scheme is extremely effective in raising people's engagement with recycling in one location, whilst in another location neither scheme outperforms the other to any great extent.

Key Words: Recycling, Incentives, Behavioural Economics, Contests

JEL Codes: D47, D71 D91, Q53

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1 Introduction

In its report published in February 2018, The Voluntary and Economics Incentives Working Group write that:

"There is some evidence from other countries that well-designed and well-run deposit return schemes can deliver an estimated increase of around 20% in the reported amount of beverage containers collected for recycling, and deliver a better quality of captured material (i.e., less contamination) than is currently estimated as happening in the UK for beverage packaging."

EIWG Report (2018, p.2)

In response to this report, and in light of the growing public awareness regarding the global environmental damage being caused from single-use plastics, the UK Government opened its public consultation on whether a Deposit Return Scheme (DRS) could and should be introduced. Their vision is that, with general approval, such a scheme could be operational as early as 2020.

However, from the standpoint of experimental economics, the opportunity to introduce this new market presents an exciting challenge. The UK is one of the leading nations when it comes to implementing behavioural economics into policies, with no better demonstration being the expansive work of the Behavioural Insights Team for nearly a decade in both domestic and international policy-making (www.behaviouralinsights.co.uk). This demonstrates the willingness of the UK Government to make decisions informed by the empirical findings from behavioural economics research.

Using the example of recycling, behavioural economics can provide a robust set of reasons as to why a simple 'piece-rate' incentive mechanism might not work as efficiently as other options. A set of justifications for this are provided in Section 2. As a consequence, this field study sought to test whether the UK could learn lessons from behavioural economics in the way it devised and implemented its DRS.

To achieve this, we have run a field study in three different locations in Norwich: Norfolk County Hall, student flats at the University of East Anglia and council housing in Norwich. In each location, we offered one set of participants a piece-rate return for recycling aluminium cans, a reward more akin to the schemes already in place across much of Northern and Western Europe, and another set of participants a Tullock Contest-style lottery scheme. For a risk-neutral participant, each scheme offered a payoff-equivalent return to recycling. By including a non-incentivised baseline scheme, this study creates a means to compare and contrast how people engaged with recycling across the three different schemes. In this paper we present the findings relative to the Norfolk County Hall and the students flats as we are still running the experiment in the council houses. In total 1000 respondents took part in these two trial settings for a total of 20 weeks.

Our first hypothesis is that incentivising people will induce greater propensities to recycle. However, we can also apply behavioural theories as to why this uptake might be greatest when incentives are presented as a lottery. This can be because they adhere to 'boundedly rational' behaviours such as being risk-loving or exhibit 'excessively' competitive attitudes. Our results confirm the former conjecture in both treatments, and the latter point is

seemingly demonstrated for Council employees, with lottery treatments here outstripping their counterparts by a considerable margin.

In the student setting, the response to incentives was far less pronounced, and here it was in fact piece-rate rewards that proved marginally more effective for average recycling uptake. Overall, we feel that this work provides some useful ideas for the UK Government to contemplate, and further believe that giving people the option to engage in a lottery contest could be a novel option to pursue that would not only improve the approval of DRS, but also create greater environmental spill-overs as a consequence of its implementation. The work here gives a clear indication of how behavioural economics could be incorporated in environmental and social public policy in order to enhance the effectiveness of schemes such as DRS.

At this stage, we wish to highlight to readers that the actual experiment we conducted does not fully reflect that of a Deposit Return Scheme. Logistically, we had no way to add money to the original receptacle at the time of purchase. Thus, the payment we offered was not a true 'rebate'. Nevertheless, we believe that our results are indicative of how effective these two incentive schemes will be if implemented in a DPR. On this note, we hope that this work (and that still to come) can serve as a spring-board for research which assesses empirical responses to incentivising people to act in a pro-social way and can be used to guide and stimulate associated policy.

2 Background & Literature

The Relationship between Incentives & Effort

There is a wide existing literature for assessing how to most successfully motivate individuals to participate in an activity. 'Contest Theory' illustrates situations where individuals "expend effort to increase their probability of winning a given prize" (Dixit, 1987). In such 'contests', multiple players use resources in order to secure a prize and a crucial strand within this field explores how incentives impact upon the player's resource-expenditure decision. Interestingly, it has been found that contests typically create an over provision of effort relative to the level which is deemed rational and socially optimal. Such over provision (Konrad, 2009 p.55) is accentuated in applied settings and evidence shows the extent to which respondents engage in actual contests consistently exceed the thresholds predicted by theory (Davis & Reilly, 1998).

Tullock Contests are no exception to this rule (Tullock, 1980). In this type of contests, the probability of player i winning a given prize (X) is determined by the effort (s_i) they exert relative to the total efforts exerted by all participants in the competition (j). This relationship is given by Equation 1:

$$\Pr(i = 1) = \frac{s_i}{\sum_{j=1\ldots M}^{j} s_j} . X \qquad (1)$$

Equation 1 shows that a player i can only raise their chance of winning by increasing s_i relative to the effort s_{-i} exerted by the other players. The symmetric Nash Equilibrium is to exert the effort level as shown by Equation 2. However, experimental evidence has shown that people entering this type of contest far exceed this threshold. There are several behavioural explanations for this, ranging from competitive drive or a joy of winning (Goeree et al, 2002) to behavioural traits such as risk-seeking or risk-loving preferences (Kahnemann & Tversky, 1979).

$$s_i^* = \frac{(n-1)}{n^2} X \qquad (2)$$

If these results hold in our field setting, a lottery-style method to incentivise recycling could yield a greater level of uptake than its piece-rate counterpart. Morgan & Sefton (2000) find that lottery-liked prizes are indeed more successful in funding public projects than piece-rate returns and further experimental evidence suggests that over-dissipation is most likely when employing a pure Tullock Contest (Chowdhury et al, 2014).

The Use of Groups to Look at Public Goods

The activity of recycling shares numerous properties with a public good, including the potential for 'free-riding'. First explored by Olson (1971), it is clear that although there are large societal gained from people recycling at greater propensities, in the current situation the (cognitive or extrinsic) costs can easily outweigh the private benefits from one's individual decision to actively recycle goods and materials.

The literature regarding the free-rider problem is vast, both in theoretical (Arnott & Small, 1994), empirical (Olson, 1971) and experimental (Andreoni, 1988; Weimann, 1994) fields. These papers typically describe a 'pure' public good, yet there are many instances when one can derive a private utility stream through their actions. These impure public goods (first coined by Samuelson in 1954) may begin to partially offset the free-rider problem, as now individuals have a greater incentive to contribute. Although incentives may be monetary, payoffs could be intrinsic or psychological in nature, with examples including the social identity or reputation-based value one attributes to their action (Goldstain et al, 2008; Cameron et al, 2012; Sexton & Sexton, 2014).

The Impure Public Goods model is algebraically explored by Cornes & Sandler (1994). They illustrate that the extent to which the private element of an impure public good can tackle the free-rider problem largely hinges upon the degree of complementarity between the private and public aspects. In our setting we can imagine that non-monetary incentives may already exist from recycling, yet before a DRS is implemented there are no direct financial rewards from this action. We cannot say the extent to which we feel that a DRS 'crowds out' such intrinsic motives (for example in Frey & Oberholzer-Gee, 1997) but certainly we note the increased motivation for people to now engage in recycling once the DRS is in existence.

This intriguing interplay between private and public incentives was one of our key reasons for implementing the study to groups of respondents. By doing so, we believe it enables there to still remain a visible element of altruistic behaviour in ones decision to recycle (and at the same time retain opportunities to free-ride), yet the DRS makes salient the financial implications of this activity to both oneself and to those in wider society.

The Effectiveness of Current DRS Schemes

The aforementioned EIGW Report (2018) provides a comprehensive overview of where the implementation of a DRS has been hugely successful in increasing the rate of recycling. In Germany, Norway and The Netherlands this has created receptacle recycling rates which exceed 95% (EIGW Report, 2018, p.42). The Netherlands themselves recently published an in-depth report which assessed the relative viability and scope of suggested DRS extensions (CE Delft, 2017) and note that benefits can accrue at consumer, local and regional levels.

However, whilst there is compelling evidence to show that DRS schemes can be successful, up until now the major focus has been on the appropriate levy from which to provide a per-unit rebate. Although beyond the scope of this study, the range of returns both suggested and implemented is vast and this is of course a valid consideration for the UK Government to decide upon before it introduces any such scheme. The key point here is that to our knowledge, no nation has attempted to approach a DRS through a mechanism other than a 'piece-rate' return. To this end, we believe that by exploring the relative effectiveness of a rival mechanism, namely that of a Tullock-style lottery, we are afforded the chance to see if the UK can install a DRS in a novel and yet more publicly engaging way.

3 Methodology & Experimental Design

In order to try and fully explore the role that incentives can play and do so across both groups and individuals, we implemented a 3x3 design, simulating a DRS-style recycling scheme among three different treatment groups and imposing the two types of incentive mechanism against a baseline group. Table 3.1 illustrates this situation, but faded out those treatments which are not discussed as part of this paper.

	Norwich City Council	Norwich County Council	University of East Anglia	
Incentives Period Treatment	Groups of c.100	Individual Flats (1-4 people)	Individuals in Student Halls	Groups of c.10 in Student Halls
Lottery	CG-L (n ~200)	CI-L (n ~180)	SI – L (n ~65)	SG – L (n ~65)
Pay-Per-Can	CG-P (n ~200)	CI-P (n ~180)	SI – P (n ~65)	SG – P (n ~65)
Baseline	CG-B (n ~200)	--	SI – B (n ~65)	SG – B (n ~65)

Table 3.1: Treatments Overview

Due to the logistics and co-ordination involved when implementing this project with Norwich City Council, the 'Council Individual' (CI) treatment began later than the other two groups and, at this time of writing, we are still running the field experiment in this location. It is predominantly for this reason that we also omit the individual student (SI) treatment given that we have so little comparable information on individuals until the completion of the CI treatment. Therefore, for the remainder of this paper we will be analysing the results of the Council Group (CG) and Student Group (SG) treatments.

At this point, it is useful to note that these two treatments are not 'directly' comparable. The SG treatment involved students who were living in halls of residence at the University of East Anglia (UEA) whilst the CG treatment involved workers at the County Council. This implies that recycling in the first treatment occurred in participants' domestic setting, whilst in the second treatment this occurred in their working setting. Thus, we acknowledge there could be differences based upon the environment in which people are using this facility but, as we shall see later in this paper, this in itself may create some interesting behavioural responses for both the study of how to incentivise people and for a DRS-style policy more generally.

In all treatments we have both a within and between subjects baseline. The former involved a 10 week 'monitoring period (M)' before payments were introduced, whilst the latter involved a one third of each treatment group receiving no payments in the second 'Incentives Period (I)' cycle. The other two thirds were randomly split into a piece-rate 'Pay-Per-Can' (P) and Lottery (L) incentive scheme during this second phase. Importantly, no participants in the M period were told of the opportunity to earn (or win in L-treatments) money until the I period began. This was done to try and accurately gauge pre-incentive recycling and to prevent any motivation to hoard cans in the monitoring period in order to then receive greater reimbursements in the incentive period. Table 3.2 confirms these timelines accordingly:

	Monitoring Period [M] (10 Weeks)	**Break (4 Weeks)**	**Incentive Period [I] (10 Weeks)**
Students Groups (SG)	25/09/18 – 14/12/18	15/12/18 – 14/01/19	15/01/19 – 25/03/19
County Council (CG)			

Table 3.2: Timeline of Treatments

Before the monitoring period began, a new recycling bin especially for aluminium cans was installed into communal areas. For the SG treatment, this required no additional information as all of those taking part in the study would be arriving to this accommodation for the first time in late September 2018 and thus knew of no time when the bins had not been there. For the CG treatment, staff were emailed notifying them of the additional bin and, in both locations, signage was provided to confirm which items were to be recycled here. We believe this served as a sufficient yet not excessive promotion of can recycling. Anecdotally, cleaning staff reported very few cans being present in the standard recycling

bins. This means we feel confident the monitoring period had provided an accurate picture of general can recycling pre-intervention.

Cans were collected, counted, and recorded each week and then disposed of discretely, to ensure subjects did not question the need for them to use the new bin. In the week before the incentive period started, in both treatments participants were emailed by the council or university accommodation department respectively to notify them of the change in system and associated opportunity to earn money from recycling. This was combined with providing a set of simple instructions to explain how payment could occur and posters to make it visually salient that there was a new system in place.

During the incentive period, each student flat (or council floor) would have their cans counted and an associated number of raffle tickets delivered to indicate how many cans they had recycled. For the Pay-Per-Can treatments, this was a simple way to track how many cans on aggregate they had recycled, and thus their cumulative earnings over time. For Lottery treatments, raffle tickets of all the participating flats would enter a fortnightly lottery, thus acting as 'effort tokens' as in a Tullock Contest. Draws were recorded and videos were posted online for subjects to view as a means of authenticating the lottery results.

Throughout the trial, a unique and anonymous email account was available for students or council staff to email with any questions or queries. After the 10 weeks, participants were reminded of how and when they could receive their earnings. For the CG participants, this was orchestrated through floor managers whilst student flats needed to visit the UEA Accommodation Office or email the researchers to arrange alternative collection.

Whilst a time-consuming initiative, both monitoring periods ran smoothly and participants seemed to actively engage with the process and trial. We are also extremely thankful for the supreme co-operation of host organisations and cleaning staff in making access and the counting process easy to undertake.

4 Results

Figure 4.1 reports the results for the County Hall. Six floors took part in the experiment. Two floors were randomly allocated to the Lottery incentive treatment (L), two floors to the Pay-Per-Can and the remaining two to the Baseline treatment. We monitored the recycling of these floors for ten weeks before implementing the incentive period. Figure 4.1 and the top section of Table 4.1 report the total number of cans recycled by treatment in each period. To ease the comparison between monitoring and incentive periods, we also report the data per treatment in period 1 despite there being no incentive schemes in place at this stage.

We see that the total number of cans recycled in the first week of the monitoring period is quite heterogenous across floors. This heterogeneity persists throughout the duration of the monitoring period despite floors not being paid for what they recycle. Both the Lottery and Pay-Per-Can floors recycle significantly more than the Baseline floors (Mann-Whitney test,

$p < 0.01$ in both cases). We find, however, no evidence of a difference between Lottery and Pay-Per-Can floors at this stage (Mann-Whitney tests, $p = 0.33$). During the monitoring period, we observe a mild decreasing trend for the Baseline and Lottery floors and an increasing trend for the Pay-Per-Can.

In week 1 of the incentive period, only Pay-Per-Can floors exhibit an increase in cans recycled compared with week 1 of the monitoring period. However, by week 10 of the incentive period we observe increased recycling across all floors except in the baseline, which is in line with what we expected.

The number of cans recycled in the incentive period is greater than that in the monitoring period for all floors (Wilcoxon test, $p < 0.02$, $p < 0.01$, $p < 0.04$ for the Lottery, Pay-Per-Can and Baseline floors respectively). Table 4.1 shows that the average number of cans recycled is always greater in the incentive period than in the monitoring period. Surprisingly, this trend also holds for the baseline floors, where recycling was not monetarily incentivised in either period.

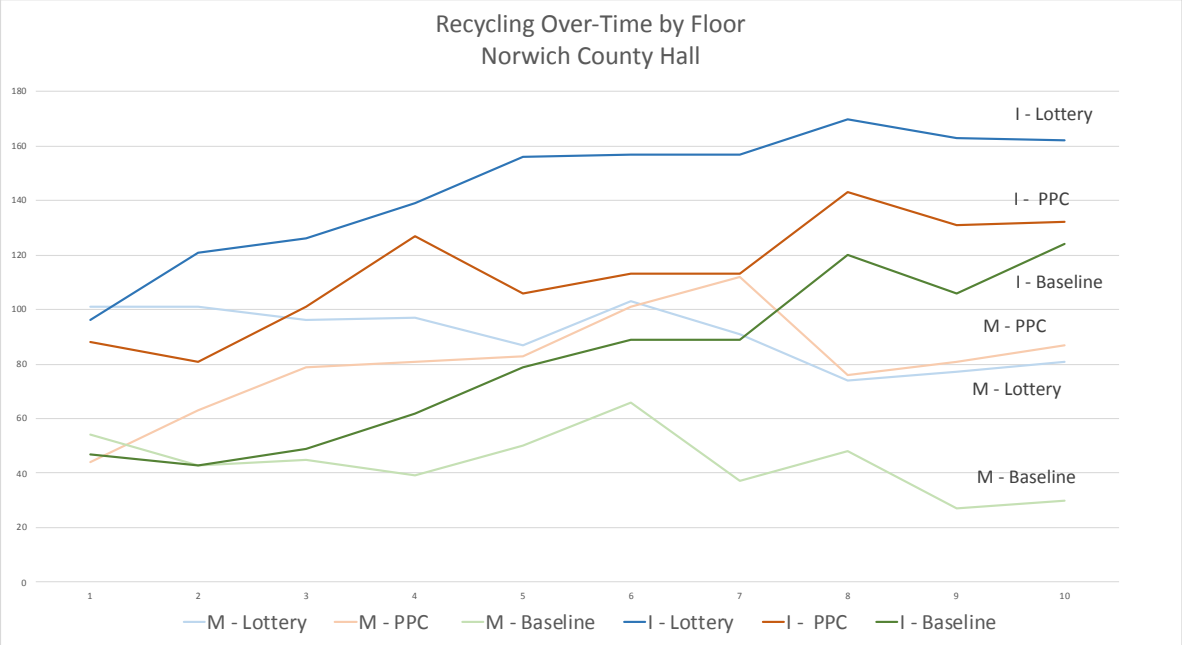

Figure 4.1: Cans recycled by week and by treatment for both Monitoring Period (M) and Incentive Period (I) - County Hall

Period	Treatment	week 1	week 2	week 3	week 4	week 5	week 6	week 7	week 8	week 9	week 10
Monitoring	M - Lottery	101	101	96	97	87	103	91	74	77	81
	M - PPC	44	63	79	81	83	101	112	76	81	87
	M - Baseline	54	43	45	39	50	66	37	48	27	30
Incentives	I - Lottery	96	121	126	139	156	157	157	170	163	162
	I - PPC	88	81	101	127	106	113	113	143	131	132
	I - Baseline	47	43	49	62	79	89	89	120	106	124
Monitoring	All floors	66	69	73	72	73	90	80	66	62	66
Incentives	All floors	77	82	92	109	114	120	120	144	133	139
Incentives	Paid Floors	92	101	114	133	131	135	135	157	147	147

Table 4.1: Cans recycled by week and by treatment for both Monitoring Period (M) and Incentive Period (I) – County Hall

Table 4.2 shows the average recycling levels by treatment. The Lottery floors increase their can recycling by 59% compared to the monitoring period. The increase in the Pay-Per-Can floors is still noticeable, but lower than the extent to which Lottery and Baseline floors increase their recycling. However, these changes should be taken with a pinch of salt given that they are computed using different base values. To make them more comparable, we have computed them again, relative this time to the average number of cans recycled by all floors in the monitoring period. These percentages are shown by the final three rows of Table 4.2. Lottery floors recycle about 100% more cans, the Pay-Per-Can floors increase recycling by 58% and the Baseline ones by about 12% more. Mann-Whitney tests results confirm that Lottery floors recycle more than both other treatments ($p<0.01$ in both cases) and that Pay-Per-Can floors recycle significantly more than the Baseline floors (Mann-Whitney tests, $p<0.01$).

Overall, these results offer strong evidence that incentives are quite effective in increasing can recycling and that the Lottery in particular is more so. In fact, while no difference in recycling behaviour is observed in the monitoring periods between the lottery and Pay-Per-Can floors, once incentives are introduced, the lottery floors recycle significantly more than the Pay-Per-Can floors.

Treatment	Average cans recycled	Percentage Increase
M - Lottery	90.80	-
I - Lottery	144.70	59.36%
M - PPC	80.70	-
I - PPC	113.50	40.64%
M - Baseline	43.90	-
I - Baseline	80.80	84.05%
Monitoring Period	71.80	-
I - Baseline	80.8	12.53%
I - Lottery	144.70	101.53%
I - PPC	113.50	58.08%

Table 4.2: Average number of cans recycled in County Hall

The results from the student accommodation show a very different story. Because reporting all the data in one figure lacked clarity, we present data separately for each treatment. In all three treatments we observe no clear pattern and no obvious difference in behaviour between monitoring and incentive periods.

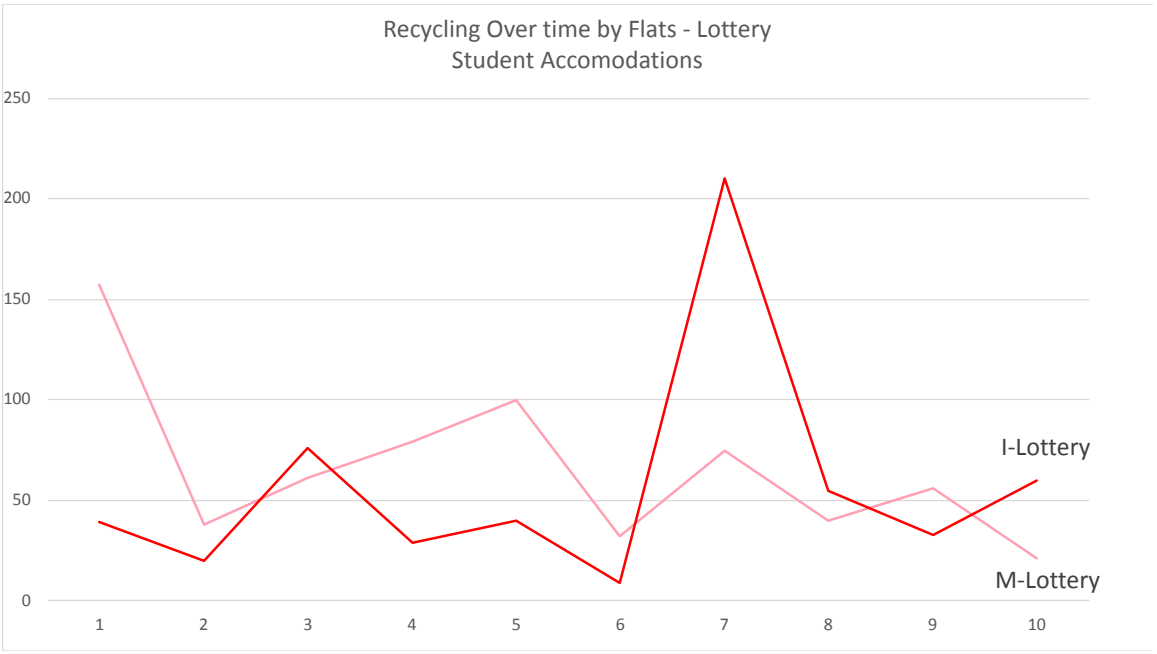

Figure 4.2: Can recycling in the Lottery flats in the Monitoring and Incentive periods– Student Accommodation.

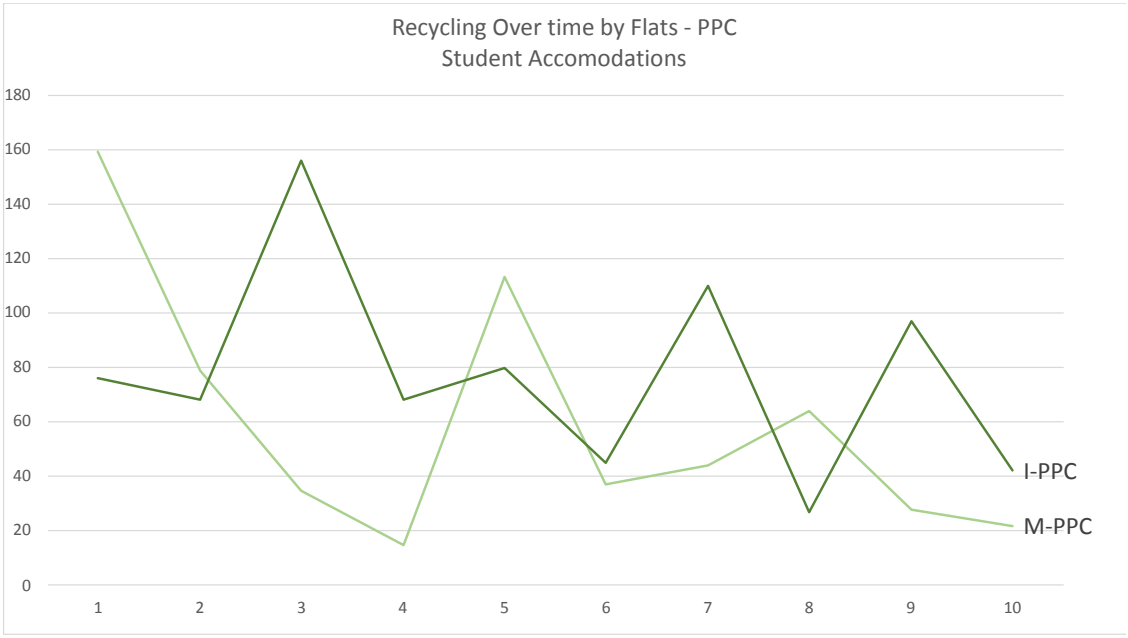

Figure 4.3: Can recycling in the Pay-Per-Can flats in the Monitoring and Incentive periods – Student Accommodation.

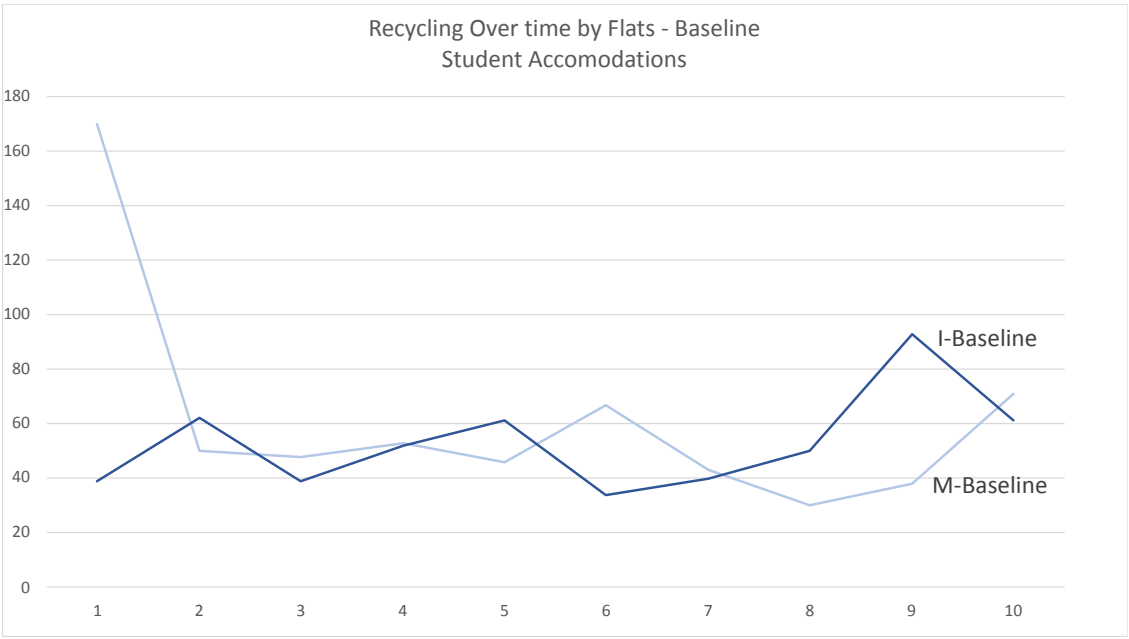

Figure 4.4: Can recycling in the Baseline flats in the Monitoring and Incentive periods– Student Accommodation.

In the monitoring period we observe no difference across any two pairs of treatments (Mann-Whitney tests: $p = 0.73$ for Baseline v Lottery; $p = 0.41$ for Baseline v Pay-Per-Can; $p = 0.54$ for Lottery v Pay-Per-Can).

Period	Treatment	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10
Monitoring	M-Lottery	157	38	61	80	100	32	75	40	56	21
	M-PPC	159	79	35	15	113	37	44	64	28	22
	M-Baseline	170	50	48	53	46	67	43	30	38	71
Incentives	I-Lottery	39	20	76	29	40	9	210	55	33	60
	I-PPC	76	68	156	68	80	45	110	27	97	42
	I-Baseline	39	62	39	52	61	34	40	50	93	61
Monitoring	All flats	162	56	48	49	86	45	54	45	41	38
Incentives	All flats	123	50	53	32	66	38	99	50	33	51
Incentives	Paid Flats	58	44	116	48	60	27	160	41	65	51

Table 4.3:Cans recycled by week and by treatment for both Monitoring period (M) and Incentive period (I) – Student Accommodation

At the start of the incentive period we observe a very different response across flats. The Lottery and Baseline flats recycle less than before while the Pay-Per-Can flats recycle slightly more when compared against the monitoring period. However, if we use the same benchmark to calculate the change in recycling behaviour across flats, as we did for the Council floors, we observe an increase in the average weekly number of cans recycled of about 8% in the Lottery flats and of about 35% in the Pay-Per-Can ones. The Baseline flats instead recycle about 15% less.

Treatment	Average cans recycled	Percentage Increase
M - Lottery	65.95	
I - Lottery	57.10	-13.42%
M - PPC	59.60	
I - PPC	76.90	29.03%
M - Baseline	61.58	
I - Baseline	53.10	-13.77%
Monitoring Period	62.38	
I - Baseline	53.10	-14.87%
I - Lottery	57.10	7.53%
I - PPC	76.90	34.68%

Table 4.4: Average numbers of cans recycled – Student Accommodations

However, these differences in recycling behaviour shown by Table 4.4 across the two periods are not statistically significant (Wilcoxon test, $p = 0.96$, $p = 0.39$, $p = 0.44$ for the Baseline, Lottery and PPC flats respectively). Looking at Figures 4.1 – 4.3 suggests that reason for this lies in high volatility in cans recycled over time.

These results indicate that incentives do not positively impact on students' recycling behaviour. Whilst initially this might seem surprising, when running the field experiment we gathered an impression that students were not really engaging with the task and certainly not in any consistent manner over time. This impression was further enhanced on the payment day, where only 4 flats out of 20 (20%) collected their earnings.

Because of the disparity in effects we see between the County Council and the student accommodations, we now eagerly anticipate the results for the social housing treatment. If they replicate the findings of the County Council in Figure 1, this provides us with stronger evidence that not only could a DRS stimulate a greater propensity to recycle, but that doing so through a lottery system offers a unique alternative system for enhancing pro-environmental outcomes. If, on the other hand, the social housing participants react similarly to students, we might conclude that the impacts of DRS are not so influential when imposed upon people in domestic or residential settings.

5 Discussion

These two treatments offer some interesting and diverse findings, each of which has interesting policy implications, in particular for the notions of the process and logistics when implementing a scheme like DRS in the UK.

Incentives Schemes

From the CG Treatment, it is clear that the Lottery treatment has a far larger impact on behaviour that its Pay-Per-Can counterpart and participants from this treatment show

significantly higher responses to being incentivised in this way. It indicates that, in this setting, the notion of 'over-dissipation' is relatively strong and one might assume there were fewer instances of free-riding on what was a communal pot of money. Of course, there are several caveats to this conclusion. The first is that we do not know the exact distribution of contributions within a floor of the Council and thus we cannot truly identify if and to what extent null contributors exist. Secondly, it is true that the tendency for free-riding is more probable in the piece-rate treatments because monetary rewards are certain once recycled. By contrast, the Tullock contest of the Lottery treatment offers an additional (albeit near negligible) cost to free-riding as this shrinks both the prize pot ***and*** the chance of your floor winning that prize. Thirdly, employees are free to move from one floor to the others, and this renders our experimental control less than ideal.

These results are certainly of interest for economists beyond the topic of recycling here. It shows that attitudes and subsequent behaviour could be manipulated quite considerably by the incentive mechanism which is presented to people and thus could induce greater overall engagement with a task. Whilst many aforementioned experiments have attempted to show this, we believe that doing so in a field setting offers an additional layer of external validity to the existing body of work.

One logical question is of course to ask why it is that the Lottery scheme was more attractive to people than its piece-rate alternative. Our conjectures span two behavioural notions. The first is linked to the risk-seeking and risk-loving preferences of people, as the lottery offers an additional encouragement to recycle through the thrill participants obtain via the uncertainty that is embedded within this mechanism. The second, perhaps interlinked reason, is that the Lottery treatment offers a potentially larger prize albeit with uncertainty. This prize, although only probable, is a substantial incentive compared to the certain but negligible reward from the piece rate treatment. This conjecture is in line with the experimental findings within the contest literature in which subjects over-dissipate. From the viewpoint of constructing schemes such as DRS, it appears logical to ensure that such characteristics of an incentive scheme are retained in order to meet the objective of maximising the public engagement with returning recyclable products.

Explaining our Treatment Differences

Our results show clear disparities in the responses between CG and SG treatments. The students showed only minor responses to the payment incentive and we consequently see nothing like the degree of change in behaviour as was witnessed in the CG treatment. Although perhaps beyond the scope of this paper, this would invite questions over whether the field of experimental economists can reliably use a narrow demographic, such as students recruited for economic studies, to represent the behaviour of wider society, as has been assumed in so many of its experiments historically. More importantly for this paper, it asks us what characteristics of a group are required in order to engage them in something like DRS. These results imply (somewhat surprisingly) that income *per se* is not one of these such characteristics, as otherwise students, a low-income demographic, would have recycled considerably more.

One possible argument for our treatment differences, is that at the Council, a place of work, there was an opportunity to bring in empty canned drinks from home once an incentive existed in phase two (this however contradicts what you were saying about income). Thus, in actual fact, recycling rates might not have risen at all, but this just constituted a redistribution of cans from home to the workplace. This opportunity was not afforded to students, where bins were placed in their living environments. However, this disparity might instead pertain more to the lifestyle differences between students and working-age adults. If so, this would reinforce the prior comment on how representative a student cohort are for measuring incentives-based responses more generally.

These unanswered questions may be partially tackled by seeing the results of the "CI" treatment, whose final phase will conclude in July 2019. These respondents will be engaging with this process at their place of residence, like students, but from a demographic perspective, they are probably more similar to the council hall participants. Thus, if they exhibit recycling tendencies more similar to council workers, we would feel more confident in our conjecture that incentivising people does indeed influence a wide sector of the UK population. However, if instead the social housing responses mirror those of the student group, then we would be more likely to conclude that the results of the council workers were driven more by the unique workplace-setting, as opposed to their demographic attributes. It is for this reason that we keenly await the results of this final phase of the project.

Recommendations for Deposit Return Schemes

In light of the current proposal by the UK Government on introducing a DRS over the coming year, we feel that this work offers some interesting and unique insights that might be useful at this stage of planning.

The first is that any incentives-based system needs to make it clear and obvious why the scheme is being introduced and what the exact financial benefits could be to individuals. Whilst the general environmental gains from recycling seem to be widely understood in the UK, this clarity relates more to the requirements and onus placed upon the consumer, and ensuring they recognise how they can personally benefit from engaging with the act of returning drinking receptacles.

More specific to this project, our early findings indicate the potential gains from investing in a lottery-based DRS in conjunction with (or even instead of) a standard piece-rate return system. Reinforced by behavioural psychology, the risk and rewards that people pursue with a lottery could create greater responses than a typical risk-free yet uniform pay-per-can scheme. This could thus improve the overall levels of recycling, which is the ultimate objective of this policy.

We envisage some further logistical advantages to offering a lottery-based DRS in the UK. For one, if operated in supermarkets, there is the opportunity to encourage retailer-level competition by delegating both prize allocation and the management of recyclable material to these firms. Loyalty and voucher schemes are already a heavily employed strategy for this industry, and such delegation could be used as an additional tool for attracting new or

retaining existing consumers. Furthermore, this would alleviate the transactional costs that would otherwise be entrusted to the Government or local authorities. If the UK were to offer both piece-rate and lottery schemes simultaneously, this would in no way restrict personal choice and yet would have a mechanism to ensure that deposit-return recycling opportunities were appealing to a wider demographic within the population. We could imagine that a loyal or habitual user of a store might lean towards a lottery system, whilst a travelling or visiting resident might be more likely to opt for the piece-rate payment.

Conclusion

Understanding how best to incentivise people towards fully engaging in consumer habits or achieve desirable behavioural changes have long been a crucial area of research within the fields of both psychology and economics. In more recent times, behavioural economics has offered new insights in this regard, and showed that employing notions of the a 'boundedly rational' individual can greatly help in understanding and adjusting real-world decision-making.

We use these insights to consider if using alternative methods of rewarding people to recycle drinks cans will yield different levels of uptake and engagement. Within the literature of experimental economics, lotteries implemented as contests have been identified as key drivers for raising people's propensity to exert effort well above the levels predicted by the standard model of rationality. In this study we employ the opportunity to transfer these findings from those relatively artificial laboratory settings to real world participants via a field trial.

We present the results from two of our three treatment sites. These show that incentivising people can considerably increase how much they recycle and that the way in which this is done also makes a significant difference. For workers in Norfolk County Council, rewarding people through a form of Tullock-style lottery system proved considerably more effective with regards to the volume of cans recycled than a piece-rate reward or no incentive at all. Contrary to our predictions, for our student sample neither of incentive schemes were effective. The piece-rate led to an increase in cans recycled but the effect was not statistically significant.

Whilst we now eagerly await the results of the final treatment, these initial findings invite some interesting conjectures on how one can use incentives in field settings in order to maximise pro-social and/or pro-environmental action. We relate this study specifically to the imminent implementation of a UK Deposit Return Scheme (DRS). Although our two incentive mechanisms may invite different levels of engagement, we acknowledge they are not mutually exclusive and could be offered one alongside the other.

Our findings in one location imply that providing a choice of incentive scheme and allowing the market to manage and incentivise the lottery process could be a highly successful strategy for raising the level of involvement with returning drinks receptacles in the UK. However, the response from student participants show that this might not be the case. The results in the social housing treatment will shed light as to whether the general public will more actively engage in cans recycling when a lottery incentive scheme is offered. We believe that alongside our impending results, future research should consider exactly how one can most optimally design and manage a system such as DRS. Furthermore, we believe that work needs to focus upon experimenting with incentives schemes across a greater variety of field settings, as this will allow behavioural economists to contrast the robust laboratory literature on the impact of contests and public goods to associated and relevant real-world settings.

Acknowledgements

We wish firstly to express our thanks to the Economics Department at the University of East Anglia for their generous financial support for this project and their patience in ordering the vast volumes of necessary equipment! We also would like to thanks Alex Carter (UEA Accommodation Office), Alun Housago (Norfolk County Council) and Michelle Steil (Norwich City Council) for their immense help and co-operation in making this field project run so smoothly.

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