

**Motivation crowding in real consumption decisions:
Who is messing with my groceries?**

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Abstract

We present evidence of motivation crowding in real purchasing decisions in a large supermarket chain. The experiment tests whether different instruments induce switching behaviour in consumers, from a publically non-preferred product to a preferred one. We compare three instruments: a label, a subsidy and a neutral price change. Most interestingly a subsidy framed as an intervention is less effective than either a label or a neutrally framed price change. We argue that this provides a new explanation for crowding behaviour: consumers are resistant to having the line of demarcation between public and private decision making moved - in either direction.

Keywords: Motivation Crowding; Field experiment; Consumer Behaviour; Intervention.

JEL codes: C93, Q18, Q54, Q58, H23, H41

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1. Introduction

The role of intrinsic motivation in the private provision of public goods, e.g. in the form of charitable giving, volunteering and many other contexts, is well established.² There is also substantial evidence that intrinsic motivation can interact with regulatory interventions in the form of monetary rewards, fines or minimum contributions, either positively (crowding-in) or more commonly negatively (crowding-out).³ So far crowding effects have been observed either when moving from a non-market to a market situation⁴, or in principal-agent settings⁵. The latter usually does not involve provision of a public good but of effort that benefits the principal at the cost of the agent. Whether motivation crowding exists within purely market contexts has been controversial (Fehr and Falk 2002, Ariely et al. 2009) but has remained an untested hypothesis. However, the presence of this effect can interfere with the effectiveness of environmental regulation intended to stimulate pro-social behaviour, making this issue relevant for both researchers and policymakers.⁶

We provide here the first experimental evidence of motivation crowding in the context of real purchasing decisions.⁷ Using the actual food purchases of more than five hundred customers at a leading UK supermarket, we compare the impact of regulatory interventions on the choices of grocery consumers. Climate change mitigation, in the form of a product's carbon footprint, serves as the public good. The consumption decisions focus on common grocery shopping decision-making (regarding cola, milk, meat and butter/margarine).

In order to identify crowding effects in purchasing decisions we focus on the identity of the intervenor more than the nature of the intervention. Because we look at market goods where prices change as a matter of routine, a small change in price in and by itself would not be expected to give rise to crowding effects. There is no meaning to be attributed to a price change in the absence of the information on how it came about. Crowding out, however, may occur when there is an actor who is

² See e.g. Andreoni (1989), Frey (1997), Meier and Stutzer (2008), Bénabou and Tirole (2010) and Corgnet (2012).

³ For surveys of the literature on motivation crowding see Bowles (2008) and Frey and Jegen (2001).

⁴ See e.g. Frey and Oberholzer-Gee (1997), Gneezy and Rustichini (2000a,b), Heyman and Ariely (2004), Meier (2007), Mellström and Johannesson (2008), Charness and Gneezy (2009), Ariely et al. (2009) and Leuven et al. (2010).

⁵ See e.g. Frey (1993), Fehr and Schmidt (2000) and Falk and Kosfeld (2006) and Arce (2007) for an evolutionary explanation.

⁶ Banerjee and Shogren (2012) analyse the effect of motivation crowding in the context of species protection.

⁷ Landry et al. (2011) have recently tested for crowding out in naturally occurring labour markets and do not find evidence of crowding out.

seen to be deliberately altering the incentive system of the agent. The key component of most crowding theories - an explicit intervention by a principal (government, employer, fundraiser, parent, etc.) to change the incentives faced by an agent - has a direct equivalent in market contexts; market prices (and choice sets) are frequently modified through government interventions.⁸

We wish to analyse how consumers respond to such government interventions within the marketplace. As a consequence, our experimental treatments focus on the context of otherwise equivalent changes in prices. The context for changes in prices is important for two reasons. The first is the additional information transmitted by information on the intervention, which might trigger a strategic response by consumers (Bénabou and Tirole, 2003; Sliwka, 2007; Ellingsen and Johannesson, 2008). The second reason is a pure “framing effect”. Knowing that a change in price is not caused by a deliberate intervention might trigger psychological mechanisms such as over-justification (tangible extrinsic motivation crowds out intangible intrinsic motivation), or a reduction in perceived self-determination (Deci and Ryan, 1985).

We are not the first to investigate how context affects responses to changes in prices (Kahneman et al., 1986; Eckel and Grossman, 2003) or choice sets (Falk and Kosfeld, 2006; Schnedler and Vadovic, 2011). However, Kahneman et al. (1986) use survey data and do not refer to intrinsic motivation. Eckel and Grossman (2003) compare two functionally equivalent subsidy schemes for charitable giving, both of which are explicit interventions. Kallbekken et al. (2011) provide experimental evidence that acceptance of a Pigouvian tax can be substantially reduced merely based on the fact that it is called a ‘tax’ rather than a ‘fee’. Falk and Kosfeld (2006) and Schnedler and Vadovic (2011) investigate crowding effects in a principal-agent model where the principal can restrict the agent’s choice set.⁹

Our fundamental results can be summarised as follows: First, we find that information provided via a label allows consumers to consider pre-existing intrinsic motivation to contribute to a public good in their grocery choices. Labelling induces a significant shift in the direction of the socially

⁸ Examples include deposit/refund laws and various “sin taxes” on commodities such as alcohol and tobacco.

⁹ The closest study is our own, Goeschl and Perino (2012), which compares price and quantity-based instruments with neutrally framed controls, but in a classroom setting not as a real consumption decision.

beneficial consumption decision.¹⁰ On the other hand, we find that an explicit subsidy which combines information with a monetary incentive results in less socially beneficial behaviour than either information or an equivalent but neutrally framed price change. Obviously this is an example of consumption-based *crowding-out*: where the impact of norm activation and the response to a relative price change are seen to be sub-additive.

More striking is the fact that an instrument which combines a monetary reward with information is actually having *less* of an impact than a neutrally framed price change, a phenomenon we label *over-crowding*. In other words, the subsidy results in intrinsic de-motivation. We interpret this to mean that consumer-based decisions within traditionally private realms, such as grocery shopping, are potentially arenas in which agents actively disengage with policy-making interventions. That is, some realms of life are simply not meant to be messed with.

The remainder of the paper is structured as follows. Section 2 describes the experiment. Section 3 provides a simple model of consumption choices in the presence of intrinsic motivation, resulting in testable hypotheses on the effect of different regulatory interventions. Section 4 presents results. The last section discusses the policy implications of our findings and concludes.

2. The Experimental Setup

The experiment was conducted in seven Sainsbury's supermarket¹¹ stores in the Greater London area¹² in February and March 2010.¹³ The experiment had two parts. The computer-based first part

¹⁰ The context of the experiment, the capacity of instruments to channel intrinsic motivation of consumers towards climate change mitigation, is highly relevant for policy making. Food production significantly contributes to the emission of greenhouse gases and diet choices are therefore an important determinant of a household's carbon footprint. However, relatively little work has so far been done on how to induce consumers to switch to less greenhouse gas (GHG) intensive diets. The non-point source character of most agricultural emissions make downstream regulation, *ceteris paribus*, more attractive compared to upstream alternatives like e.g. the European Union's Emission Trading System. We therefore investigate the ability of instruments to complement rather than substitute intrinsic motivation in public goods provision.

¹¹ This retailer chain accounts for around 27% of the total market share in the study area (Information available on <http://www.j-sainsbury.co.uk/index.asp?pageid=451>), and 16% in all the UK. Sainsbury's also has a well developed internet shopping facility that reaches 88% of the total UK population, with over £ 500 millions worth of sales in 2009 (Information available on http://www.j-sainsbury.co.uk/files/reports/ar2009_report.pdf, page 5. This value only includes food and grocery products, as the non-food area has only been launched in 2010).

¹² The stores were chosen by means of moving along the circumference of a radial approximately 7 miles from the center of London, in order to provide a geographically dispersed sample from the London metropolitan area. The precise stores used were located in Walthamstow, New Barnet, Edgware, Chiswick, Merton, and Lewisham. Each store was surveyed for 8 hours a day for 2 days, with the exception of Edgware, where the experiment lasted 4 days.

took place in the entrance area of a store and participants made purchasing decisions with carbon footprint information and prices controlled by randomly assigned treatments. This part was intended to mimic on-line grocery shopping decision-making, a common-place in the UK.¹⁴ The second part of the experiment was the actual shopping trip in the main part of the supermarket. Payment was conditional on actual purchases being in line with the decisions made in the first part. In this way the decisions made in the first part of the experiment were enforced.

A table with laptop computers was placed in the entrance area of the stores and a sign announced the opportunity to earn a £5 voucher in exchange for participation in a university-sponsored grocery shopping study. Anyone interested in participating was given a leaflet stating the eligibility criteria and the payment procedure (see Appendix B). The purpose of the experiment was described as “studying how people make REAL LIFE grocery shopping decisions”. No other information on the purpose of the experiment was provided. In particular, environmental motivations were not mentioned at any point during the recruitment phase. Interested shoppers were only turned down if they a) did not intend to buy any of the product categories listed (cola in cans, butter, beef or milk), b) did not speak or read English, c) were not at least 21 years of age or, d) had participated in the experiment previously. While our sample cannot be claimed to be randomly sampled from the London metropolitan region, participants certainly did represent a diverse sample of the supermarket shopping public and reflected a very diverse set of socio-economic backgrounds. The age range was 21-80 years of age (mean: 37 years) and included a wide range of incomes, educational backgrounds, and political, ethnic and religious groups.

The computer-based part of the experiment was constructed to closely resemble an online-shopping portal. With the cooperation of the grocery chain concerned, in each of four categories (cola drinks, butter/margarine spreads, fresh meat products and milk) products with the largest market shares available in their stores were included in the online shopping experiment. The prices, sizes and

¹³ In the classification of Harrison and List (2004) the experiment is somewhere between a framed and a natural field experiment. It involves a non-standard subject pool (supermarket customers), field context in commodity (grocery products), task (purchasing these products) and information (on prices, availability and characteristics of products) and is conducted in an environment where subjects usually undertake this task (in the supermarket during the actual shopping trip). However, subjects were aware of participating in an experiment.

¹⁴ Online grocery shopping is prevalent in the UK with over a third of adults shopping for food online in 2009, and a significant proportion of UK consumers do most of their grocery shopping in this manner (Intel, 2009).

photos of the products were identical to those available in the store, and displayed in a manner as close as possible to the store's own online portal. The objective was to create a real but at the same time controlled and incentive compatible choice environment as close as possible to consumers normal shopping experience (online and in-store).

The portal was set up in-store to ensure that the purchasing decision was a real one. Incentive compatibility was achieved by conferring a £5 voucher only upon those who both participated fully in the online experiment and engaged in the purchases they indicated in their answers to the experiment¹⁵ (see the "Consumer Contract" attached in Appendix B). The experimenter personally checked that the actual purchases in the shopping basket were in line with the choices made in the experiment at the time of conferment of the voucher.¹⁶ Participants were informed about this procedure before they entered the experiment, and agreed to the conditions. The compliance rate was 96%.

Once participants had entered the experiment they could make purchasing decisions through the shopping portal with regard to one or more of the four product categories set out in Table 1. In each of these categories they were presented with a range of varieties/brands. These alternatives were intended to provide the participant with a range of options that might satisfy their fundamental (private) consumer interest, but also with very different public good components. For example, participants shopping in the cola category could choose from a total of six different varieties (differentiated by brand and nutritional characteristics). The public good dimension was added by making each of variety available in two different packagings: six-pack of aluminium cans and a single PET bottle, both containing the same total amount of cola. Cola purchased in cans has twice the carbon footprint of cola in a bottle.

¹⁵ This means that compensation (in form of a £5 shopping voucher) was received only if participants completed all stages of the computer-based experiment, had their choices recorded on a paper slip, signed off by the experimenter, returned to the experimenter (stationed at the store's exit) with their slip, purchasing receipt and shopping basket at the end of the shopping trip.

¹⁶ In the case of the Subsidy and the NeutralPriceChange treatments, the consumers also received the difference between the price announced in the computer-based part of the experiment and the real (unaltered) in-store prices – in addition to the £5 voucher – if they purchased any subsidised option.

Participants saw photographs of all of the products listed in Table 1 and their current in-store prices (see Appendix B). Each participant was asked to make an initial decision concerning its preferred shopping choices in each product category selected. This first choice constitutes their *baseline*, and was elicited before participants were exposed to different treatments and hence the setting was identical for all participants.

After the baseline choice, all participants were given the option to obtain more information on environmental and nutritional matters associated with their purchasing decisions. These information options explained in general terms the information that is provided on food labels – the meaning of nutritional information or the meaning of carbon footprint information – but did not give any product specific details. The information provided was the same across all treatments.¹⁷

Table 1: Products offered in the experiment

Product Categories	Quantity	Options	Carbon Footprint (in CO ₂ e)	Subsidy/Price Reduction	Brands/Varieties
Cola	2 l	Cans (six pack)	1,020g		Coca Cola, Pepsi Cola, Diet Coke, Diet Pepsi, Coke Zero, Pepsi Max
		PET bottle	500g	5p	
Milk	2 pint	Whole	1,800g		Sainsbury's own brand fresh milk
		Semi-skimmed	1,600g	3p	
		Skimmed	1,400g	6p	
Meat	Various weights	Beef	16,000g / kg of beef		minced meat, casserole steak, braising steak
		Chicken	5,000g/kg of chicken	21p/kg	chicken breast, mini chicken fillet, drumsticks
Spreads	500g	Butter	11,900g		Lurpak, Anchor, Countrylife, Kerrygold, Sainsbury's own brand
		Margarine	675g	43p	Lurpak, Anchor, Flora, Clover, Sainsbury's own brand

¹⁷ The dummy variables *Envinfo* and *Nutrinfo* recording whether a participant has opted to see the corresponding type of information have been used as controls in the regressions reported in section 4 but coefficients are not reported as they are not significantly different from zero at the 10%-level.

Then participants were randomly assigned to one of three treatments and had a second opportunity to make their shopping decisions now subject to the policy instrument treatments.¹⁸ Each treatment corresponded to one of the two instruments (Labelling, Subsidy) or the neutrally framed control (NeutralPriceChange). This second choice allowed the consumer to revise their initial choice based on the new information/incentives imposed by the treatment. Having a baseline and a treatment choice for each participant is essential as it allows isolating the impact of treatments on behaviour from any unobserved differences in treatment groups. Treatments can then be compared using a difference-in-difference analysis focusing on differences in behavioural change across treatments.

The Labelling treatment was intended to be as simple and non-leading as possible and presented consumers with two sets of information. The nutrition labels were a simple replication of the fine print on the actual labels that appear on these goods and included accurate information on calories, protein, carbohydrate, fat and salt content. The carbon footprint label followed the design provided by the Carbon Trust UK. It is already in use by another major supermarket chain in the UK for own brand products (but not for these product categories) and by a small number of other producers. The label has the form of a stylized footprint and shows the amount of carbon dioxide equivalent greenhouse gas emissions caused over the life-cycle of the product in grams.¹⁹ The consumer would then be given the option of revising her choices after reviewing the labels.

The Subsidy treatment offered a small decrease in the price of the designated products together with the information that the government intervened by providing a subsidy to the indicated product on account of its lower carbon footprint. The instructions for the Subsidy treatment (here for cola) state "*There has been a price change. Products in plastic bottles have a 5p discount due to a GOVERNMENT SUBSIDY received on account of its low carbon footprint*". This is to be contrasted with the non-interventionist NeutralPriceChange treatment that was identical to the Subsidy treatment

¹⁸ Participants who selected more than one product category completed the first choices for all categories before moving to the second choices and were subject to the same treatment throughout.

¹⁹ A graphical representation of the label can be found in the experimental instructions provided in the appendix. We wish to thank the Carbon Trust for their cooperation and assistance.

with the exception of the motivation given for the price change (market conditions rather than government intervention). The instruction for the NeutralPriceChange treatment read (again for cola) "*There has been a price change. Products in plastic bottles have a 5p discount because of a change in the price of materials*".

Note that in the price treatments there are two differences between the intervention treatment and its control: a) the explicit interventionist character and b) information about the relative ranking of products with respect to their carbon footprint. The control treatment has neither while the Subsidy treatment has both (intervention and information).

Following the experiment, socio-demographic details on the respondents were also collected. A total of 570 shoppers completed the task and complied with all terms and conditions of the enforced experiment, and hence are included in the sample analyzed. The number of participants and hence independent observations per treatment were: 237 for Subsidy, 248 for NeutralPriceChange and 85 for Labelling²⁰. In the sample, 333 participants chose only from one product category, 154 made choices in two, 66 in three, and only 17 made purchases from all four categories. This resulted in a total of 907 pairs of purchasing decisions.

3. A Model of Switching Behaviour with Intrinsic Motivation

In this section we develop a simple model of switching behaviour of intrinsically motivated consumers to derive testable hypotheses. We wish to examine the behaviour of consumers in their private capacities to use consumption decisions to determine their consumption of both private and public goods. To obtain a clear benchmark, intrinsic motivation is assumed to be independent of the regulatory instrument (Heyes and Kapur, 2011). This implies that the hypotheses derived are based on the assumption that there is no motivation crowding of any sort.

²⁰ The Labelling treatment was split in three versions differing in the carbon footprints provided. This paper only includes version 1, which used the true values. This explains the lower number of participants in the Labelling treatment. Inclusion of all three versions does not change any of the results presented in this paper.

We are focusing on the case of climate change mitigation as the public good context, and we are ranking the “publically preferred” options as those consumption goods with the lowest carbon emissions per unit of private good consumed (i.e. the “carbon footprint” of the product concerned). The lower the carbon footprint, the greater the contribution to the provision of the public good per unit of private good consumed. In order for the intrinsic motivation to contribute to the provision of a public good to be behaviourally relevant, participants require information that allows them to discriminate between products and to know the publically preferred ranking of these private goods. We use the carbon footprint (defined above) to delineate the publically preferred order of consumption.²¹

As participants are choosing between everyday products and they declared an interest in such products prior to participation, it seems reasonable to assume that they were familiar with the products they selected. We also assume that consumers were not aware of the relative performance of products with respect to carbon footprints at the start of the experiment. This is reasonable since for the products included in this study carbon footprints were neither in use in any UK supermarket nor widely publicised.²² Allowing for prior knowledge of carbon footprints for the products studied by at least some participants does not affect the qualitative content of the hypotheses derived below. This will be the case unless the distance between rather than the ranking of products matters and participants initially overestimate the advantage of clean products and update them based on the information provided in treatments. We will consider this latter alternative when discussing the results.

Consumption of a particular product yields utility in the form

$$U(X_i, D_j) - P_i + \delta \cdot M(X_i, D_j), \quad (1)$$

²¹ Note that for the carbon footprint of a product to have an impact on the consumption choice of a consumer, she need to care not only about the environmental public good affected (mitigation of climate change) but also has to have at least some form of intrinsic motivation to contribute to this cause. Intrinsic motivation is a necessary condition since the relevant population of the climate mitigation game is in the order of billions and hence close enough to infinity to drive the Nash contribution down to zero (Andreoni, 1988).

²² Although the carbon footprints for milk were taken from Tesco (another major supermarket in the UK) they only used footprint labels (similar to those in this study) on the following four product categories: orange juice, potatoes, light bulbs and laundry detergents. No carbon footprint labels were in use at Sainsbury’s at the time the study was conducted in any of the product categories included in the experiment.

where D_j are characteristics of consumer j , and X_i and P_i are product specific characteristics and the price of product i , respectively. M is intrinsic motivation to buy a product that has a lower carbon footprint compared to other products in the same category. $\delta = 1$ for “publically preferred” products in each category given that information on the relative ranking of products with respect to their carbon footprint is provided, otherwise $\delta = 0$. U and M are measured in monetary units. Note that intrinsic motivation M can vary both across consumers and products, however, when deriving hypotheses we assume that M is non-negative.

Participants that chose a publically non-preferred product initially meet the following condition,

$$U(X_i^d, D_j) - P_i^d \geq U(X_i^c, D_j) - P_i^c, \quad (2)$$

where the superscripts d and c indicate publically non-preferred (“dirty”) and publically preferred (“clean”) varieties, respectively. For participants that chose a preferred variety the opposite is true. Note that information on carbon footprints was neither widely publicised for the products used in this experiment nor provided as part of choice 1. Hence, we initially assume that $\delta = 0$ for all participants and products.

After participants made the baseline choice regarding their consumption decisions, they were then exposed to one of three treatments. In order to test whether information on carbon footprints of products activated intrinsic motivation, the Labelling treatment presented the carbon footprints and nutritional information of products without any change in relative prices.

Participants previously uninformed about the preferred ranking of products but endowed with pre-existing intrinsic motivation (and who initially bought a non-preferred product) are potentially induced by the information to switch to a preferred one. The switching condition in the Labelling treatment is

$$U(X_i^d, D_j) - P_i^d < U(X_i^c, D_j) - P_i^c + M(X_i^c, D_j). \quad (3)$$

Since the information provided by the label is the only difference between the two choice situations, intrinsic motivation is assumedly the only systematic driver of any switches observed.²³

Hypothesis 1

Information on the relative public good contributions of various product choices will induce some participants to switch from a publically non-preferred to a publically preferred product. Participants initially opting for a preferred product would not have their decisions impacted by the provision of such information.

The NeutralPriceChange treatment tests whether participants respond to small changes in relative prices. For that purpose all preferred products received a reduction in prices. The price reductions for preferred varieties in each product category are given in Table 1. Participants were not made aware that the price change had anything to do with environmental characteristics of the product. Hence, δ remains equal to zero for all products in the NeutralPriceChange treatment. The switching condition in the NeutralPriceChange treatment is therefore

$$U(X_i^d, D_j) - P_i^d < U(X_i^c, D_j) - P_i^c + S, \quad (4)$$

where S represents the price reduction.

Hypothesis 2

A price change will induce some participants to switch from a publically non-preferred to a preferred product. The choices of participants initially opting for a preferred product would not be affected by such a price change.

²³ Note that it does not matter whether consumers perceive the clean product to become better or the dirty product to become worse. All that matters is the change in relative terms.

In the Subsidy treatment participants learned that the government has introduced a monetary reward S which reduces the price of publically preferred products. Hence, consumers faced a new set of relative prices, were able to rank products in each category according to their carbon footprint (i.e. only the cleaner options qualify for the reward) and are aware of the interventionist character of the price change. Except for the latter two aspects, the Subsidy treatment is equivalent to the NeutralPriceChange treatment.

Given the above, participants switched to a publically preferred product if and only if

$$U(X_i^d, D_j) - P_i^d < U(X_i^c, D_j) - P_i^c + S + M(X_i^c, D_j). \quad (5)$$

The monetary reward, *ceteris paribus*, increased the attractiveness of the preferred product as does any pre-existing intrinsic motivation ($\delta = 1$ for preferred products).

Comparing switching behaviour in the Subsidy and the NeutralPriceChange treatments allows isolating the effect of an explicit intervention on intrinsic motivation. The parameter M is the only difference between conditions (4) and (5). Compared to the Labelling treatment (condition (3)), the change in relative prices S creates an additional incentive to switch. This gives rise to the following hypotheses:

Hypothesis 3

- (a) *The subsidy (for publically preferred products) will induce some participants to switch toward preferred products. Participants initially opting for a publically preferred product will be unaffected by the subsidy.*
- (b) *The subsidy will induce more participants to switch from non-preferred to preferred varieties than in either the Labelling or the NeutralPriceChange treatments.*

Hypothesis 1 – 3a make within-subject comparisons and conjecture a systematic impact of treatments on participants' behaviour compared to the baseline (choice 1). Hypothesis 3b makes between-subject

comparisons and predictions about systematic differences between impacts of treatments. The latter requires differences-in-differences analysis. All hypotheses make predictions about changes in behaviour induced by treatments and not about initial choices. This focus on behavioural change allows us to abstract from issues like which product is more expensive in absolute terms and focus on changes in relative prices instead.

4. Results

This section presents the evidence for the different effects of treatments on intrinsic motivation. After a brief description of the switching pattern, we start testing the hypotheses formulated in section 3. First, we verify whether a carbon label activates intrinsic motivation, and if a change in relative prices induces participants to substitute toward the now cheaper good. Next, we test the interaction of price and information in the form of a subsidy on the publically preferred products.

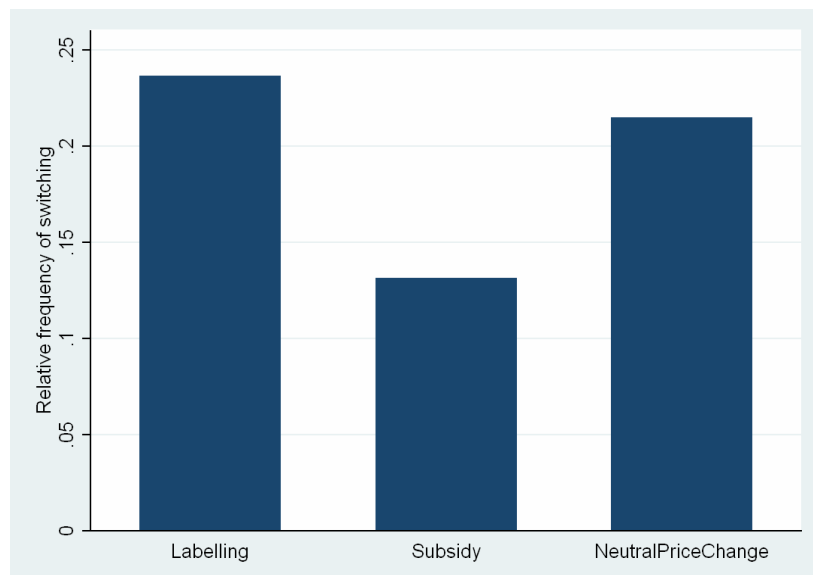


Figure 1: Relative frequencies of switches to preferred varieties. All product categories pooled.

Table 2: Relative frequency of switching from a non-preferred to a preferred variety

(by product category).

	Labelling	Subsidy	NeutralPriceChange
Cola	36.4%	27.3%	58.7%
Butter/Margarine	61.5%	16.1%	20.0%
Meat	21.1%	12.0%	14.8%
Milk	12.0%	8.5%	13.4%
All products	23.7%	13.2%	21.5%

Switching behaviour is presented by treatment in Figure 1 and by treatment and product in Table 2. Labelling and NeutralPriceChange had approximately the same proportionate level of impact, but this varied significantly across products. This variability is explicable by reason of the relative elasticities of substitutions across product choices. For example, as would be expected, the rate of switching between “cola in cans” and “cola in plastic” is much higher than that for switching between “beef” and “chicken”. There seems to be greatest resistance to switching away from the consumer’s initial choice in milk variety, and least resistance to cola packaging.

The most striking regularity in the general results is the response to the price subsidy. The Subsidy treatment induces fewer switches in all product categories than both the NeutralPriceChange and the Labelling treatments. We will return to the meaning of this general outcome in our discussion of the overall results of the experiment in section 5 below. Here we examine the specific outcomes of particular aspects of the experiment, and their implications for our Hypotheses above.

4.1 Activation of Intrinsic Motivation

The Labelling treatment provided two sets of information to participants: nutritional information on calories, fat, carbohydrates and salt copied from the products' packages and information about carbon footprints. We first analyse the impact of nutritional information before we turn to carbon footprints and intrinsic motivation.

As expected, the nutritional information had only a small impact on participants' choices. This is most obvious for the cola category where nutritional and environmental variables were perfectly orthogonal. All nutritional aspects were driven by the variety (e.g. Coke vs. Diet Coke) consumed while the carbon footprint was determined by the packaging (bottles vs. cans). All varieties were offered in both forms of packaging. 36.4% of participants with a dirty baseline choice (4 out of 11) changed to the cleaner packaging option while only 8.7% of participants buying a cola drink (2 out of 23) changed variety after information on nutrition and carbon footprints was provided. For all product categories pooled together, the only significant difference between nutritional aspects of first and second choices exists for calories and fat (which are correlated with carbon footprints for all product categories except cola) for the subgroup that moved from dirty to clean options but not for those that didn't. This is despite there being substantial variation (up to two orders of magnitude) between nutritional aspects of varieties within both the clean and dirty options. The irrelevance of nutritional information is intuitive as it is available on product labels and hence participants that strongly care about these attributes already took them into account in their baseline choice.

Participants that are intrinsically motivated to make a private contribution to climate change mitigation by buying products with a low carbon footprint (compared to substitute goods) may switch from a dirty to a clean product in the Labelling treatment (Hypothesis 1).²⁴ To test for such a pattern we compare the two choices made by participants for milk and the other three products separately. The reason for this split is twofold. Firstly, milk has three different categories (whole/dirty, semi-skimmed/medium and skimmed/clean) while the other products have only two (dirty and clean

²⁴ The carbon label might induce an experimenter demand effect. To reduce confounding we had introduced information on nutritional characteristics of products at the same time as the carbon footprint information. Moreover, the tests of Hypothesis 3 below suggest that experimenter demand effects are not driving our results.

options).²⁵ Secondly, participants for all products except milk were pre-selected based on whether they were intending to buy milk, cola in cans, butter or beef (i.e. the dirty variety in each category with the exception of milk).²⁶

Out of the 57 participants buying milk, six switched from dirty to clean while no one changed from clean to dirty as a result of the provision of the carbon footprint information (see Table A.2). The null hypothesis that the carbon label had no impact on choices is rejected but only at the 10%-level (Bhapkar test for marginal homogeneity²⁷, $p = 0.0528$).

For the other three product categories, 37.2% (16 out of 43) of initial dirty choices but only 10% (3 out of 30) of initial clean choices were reversed after the label was introduced (see Table A.3). This is significant at the 1%-level (Bhapkar test for marginal homogeneity, $p = 0.0015$).

This evidence confirms Hypothesis 1 and hence gives rise to the following first result.

Result 1

Providing information on the relative environmental performance allows participants to act on pre-existing intrinsic motivation and induces switching towards publically preferred products.

4.2 Response to a (Pure) Price Change

We proceed with testing Hypothesis 2, which states that a change in relative prices induces switching towards products that became cheaper. For the milk subsample (175 participants) 21 changed as expected and seven changed in the opposite direction (see Table A.4). The null hypothesis of marginal homogeneity is rejected at the 10%-level (Bhapkar test, $p = 0.0958$). For the other product

²⁵ Here and elsewhere we of course ignore changes from one dirty (clean) to another dirty (clean) variety, e.g. from Coca Cola in cans to Pepsi Cola in cans. Only switches that have an impact on carbon footprints are considered as switching.

²⁶ The relatively large number of participants (177 across all three treatments) choosing clean products in the first choice (for cola, meat and butter/margarine) is most likely due to participants who entered the experiment because they were willing to purchase one of the above in exchange for the £5 voucher. While this suggests that some participants might have pursued a strategy that minimised expenditure, this cannot explain any of our results as there is no price change in the Labelling treatment, and the NeutralPriceChange and Subsidy treatments did not move the cheapest item from dirty to clean (or vice versa).

²⁷ The Bhapkar test of marginal homogeneity (Bhapkar, 1966) is a more powerful version of the Stuart-Maxwell test

categories (233 observations, see Table A.5) in the NeutralPriceChange treatment, there were 45 switches from dirty to clean and 19 from clean to dirty. The null hypothesis that the price change had no systematic effect is rejected at the 0.1% level (Bhapkar test for marginal homogeneity, $p = 0.0009$). This confirms Hypothesis 2, an unsurprising result.

Result 2

Participants respond to a change in relative prices by substituting towards products for which prices were reduced.

4.3 Subsidies and Intrinsic (De-) Motivation

Having established how participants respond to information on relative environmental performance of products and to relative price changes we now investigate the effect of combining the two drivers of behaviour. The Subsidy treatment provides exactly the same monetary incentive as the NeutralPriceChange treatment but combines it with an explicit rationale (framing). The subsidy is paid to increase the attractiveness of products with relatively low carbon footprints. Participants hence learned the relative ranking of products with respect to their carbon footprint. Both effects, price change and intrinsic motivation, work in the same direction and are expected to reinforce each other (Hypothesis 3b). Before explicitly testing this proposition, we test Hypothesis 3a by checking whether a subsidy has a significant effect on behaviour.

Surprisingly, the null hypothesis that the subsidy had no systematic impact on choices cannot be rejected for either sample (Bhapkar test for marginal homogeneity, no milk: $p = 0.4342$ and milk: $p = 0.4346$). For cola, butter/margarine and meat, only 18.4% (23 out of 125) of dirty initial choices but 19.8% (18 out of 91) of clean initial choices were reversed after the subsidy was introduced (see Tables A.6 and A.7). The subsidy hence has no statistically significant effect on purchasing behaviour. This result is not driven by differences in initial choices between the Labelling, NeutralPriceChange

and Subsidy treatments. A Kruskal-Wallis test on equality of populations in choice 1 yields a p - value of 0.5267 (0.4068 for milk subsample).

We investigate this further by testing Hypothesis 3b, which requires a differences-in-differences analysis and a focus on dirty initial choices. Are people more likely to switch from dirty to clean products in the Subsidy treatment than in the Labelling or NeutralPriceChange treatments? To compare the likelihood of switching we first perform pair-wise Fisher’s exact test and two-sample tests of equality of proportions using the null hypothesis that the frequency of switching is the same in the Subsidy and the NeutralPriceChange/Labelling treatments. All of them reject equality of frequencies.

Table 3: Test results on equality of switching frequency across treatments.

	Fisher’s exact test	Test of proportions
Subsidy vs. NeutralPriceChange	0.011	0.009
Subsidy vs. Labelling	0.021	0.017

Regressions (1) and (2) in Table 4 present results from logit regressions that control for a number of observable differences e.g. product types and socio-demographic characteristics of participants²⁸. The coefficients confirm that the likelihood of switching from a dirty to a clean product is significantly lower in the Subsidy treatment than both in the NeutralPriceChange and the Labelling treatments.²⁹ This finding not only rejects Hypothesis 3b, but confirms the exact opposite. Instead of outperforming, the instrument that combines both drivers of switching behaviour performs worse than if each driver is applied separately.

²⁸ The sample used in this regression is restricted to observations with ‘dirty’ baseline choices in all product categories.

²⁹ While there is no significant difference between switching frequencies in the NeutralPriceChange and the Labeling treatments, the null hypothesis that the coefficients of the *Labelling* and the *Subsidy* dummies are the same is rejected at the 1%-level ($p = 0.0088$).

Table 4: Logit regressions on drivers of switching from dirty to clean products in Labelling, NeutralPriceChange (baseline) and Subsidy treatments. Dependent variable: Switching dummy (1 if participant switches from dirty to clean product), clustered at participant level, 493 independent observations.

	(1)	(2)	(3)
	Twenty controls&	Eight controls&	Interaction Term
Subsidy	-0.687** (0.011)	-0.759*** (0.003)	1.409 (0.205)
Subsidy x Log of Income			-0.669* (0.052)
Labelling	0.253 (0.433)		
Milk	-1.864*** (0.000)	-1.872*** (0.000)	-1.899*** (0.000)
Meat	-1.548*** (0.000)	-1.572*** (0.000)	-1.583*** (0.000)
Butter	-0.962*** (0.004)	-0.979*** (0.004)	-1.050*** (0.002)
# of children in household	-0.295** (0.034)	-0.225** (0.046)	-0.213* (0.068)
Male	-0.0603 (0.808)		
Unemployed	-0.713 (0.286)		
Retired	0.379 (0.627)		
Log of Income	0.0979 (0.589)		0.268 (0.171)
Observations	666	666	666
Pseudo R^2	0.133	0.126	0.132
chi2	79.08	72.86	75.75

p -values in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

& Count excludes treatment dummies and a constant. List of variables and descriptive statistics in Appendix A.

Regression (3) in Table 4 includes an interaction term between the *Subsidy* dummy and *Log of Income*. The results indicate that the crowding-out in the Subsidy treatment is mainly due to participants with average and above average income, as for them the negative interaction term dominates the positive direct effect (the mean of *Log of Income* is 3.2). The effect of income on crowding is intuitive since poorer consumers face a tougher trade-off between money and an urge to resist government intervention.

Taken together, the tests of hypotheses 3a and 3b provide evidence of crowding-out of intrinsic motivation. The pre-existing intrinsic motivation activated by information on the relative ranking of products with respect to their carbon footprints, is no longer inducing any additional changes. Quite the contrary: the sensitivity to a change in relative prices is reduced if the price change is framed as an explicit intervention in the form of a greenhouse gas abatement subsidy. Hence, the combined effect of a price change and information is sub-additive

$$(S + M)^{(5)} < S^{(4)} + M^{(3)} \quad (\text{crowding - out}),$$

where superscripts refer to the switching condition in section 3 the terms are taken from. More remarkably, it is smaller than each of the components individually

$$(S + M)^{(5)} < M^{(3)} \text{ and } (S + M)^{(5)} < S^{(4)} \quad (\text{over - crowding}).$$

The latter implies that a subsidy can replace, at least at the aggregate level, intrinsic motivation ($M > 0$) with intrinsic de-motivation ($M < 0$).

Result 3

A subsidy combining a price change and information on relative environmental performance of products via an explicit intervention crowds-out and 'over-crowds' pre-existing intrinsic motivation.

This observation would be in line with 'rational' crowding based on signalling of the size of the environmental advantage of clean products by the regulator and Bayesian updating of prior beliefs by

consumers (Bénabou and Tirole, 2003) under two conditions: A substantial share of participants a) held prior beliefs about the carbon footprints of products and b) perceived the level of the subsidy (but not the actual footprint provided in the Labelling treatment) as a signal to correct that belief downwards. As we have argued previously, there was not much information on carbon footprints available of the products used prior to our experiment. Moreover, if the above conditions would be met, we would also expect to see a difference between the Subsidy and the NeutralPriceChange in the number of switches from clean to dirty because the same updating mechanism would induce some participants to switch from clean to dirty as dirty appears no longer as bad as perceived when taking the baseline choice in the Subsidy. However, there is no evidence of such an effect. The only product for which there is a significant difference (at the 10% level using Fisher's exact test and a test of proportions) is cola but in the opposite direction. Hence, participants do not appear to have arrived at the experiment with an overestimation of the climate benefits of clean options compared to the dirty ones and the vertical signalling based crowding proposed by Bénabou and Tirole (2003) hence not suitable to explain our findings.

One potential problem with this result is that the information provided in the Labelling and Subsidy treatments is not exactly the same. The former presents actual carbon footprints while the latter only identifies the relative ranking of products. While this could explain sub-additivity, it cannot be the sole reason of over-crowding and the failure of a subsidy to induce switching. Furthermore, there is evidence that participants did not pay close attention to the size of the difference in carbon footprints³⁰. It therefore seems reasonable to assume that information on relative rankings of products is sufficient to trigger intrinsic motivation (or the 'warm glow' of contributing).

³⁰ The Labeling treatment was run in three different versions which differed in the carbon footprints provided (only the version with the true footprints is reported in this paper). There was no systematic effect of the scale of potential GHG reductions on participants switching behaviour. Furthermore, all results presented on the Labelling treatment would hold if all three versions of it would have been included.

5. Discussion: who is messing with my groceries?

What explains our results? Crowding-out of intrinsic motivation by a price intervention is in line with a number of different theories, including signalling between the regulator and consumers (Bénabou and Tirole, 2003; Sliwka, 2007; Ellingsen and Johannesson, 2008), between consumers themselves (Bénabou and Tirole, 2006), over-justification (Bem, 1967) and loss of self-determination (Deci and Ryan, 1985). What is, however, somewhat more surprising is the extent of the crowding observed and the effective conversion of intrinsic motivation into de-motivation under a subsidy. While such cases have been covered in the literature (Bowles and Hwang, 2008), we are not aware of a convincing explanation for the underlying changes.

It is our hypothesis that the primary distinction between our three treatments is the exposure of the consumer's private decision-making to government intervention. In the first treatment, the consumer was afforded the opportunity of an intervention through the opportunity to make use of label-based information, but the consumer could elect whether to expose its decision-making to this intervention, or not. The consumer could choose to ignore the information entirely, and so in this sense any exposure of the grocery-shopping decision-making was entirely voluntary. In the second treatment the price-change was involuntary, but it was made clear that it was a market-based phenomenon. The consumer's decision making was subjected to it, but it was not the decision by some external agent that was imposing the intervention (only the facelessness of market forces). Consumers responded to these interventions in the expected ways.

The final treatment combined the involuntary nature of a price change with the imposition of an intervention. Here, the consumer's formerly private decision making realm was being impacted without the consent of the consumer. Although the consumer's welfare was unambiguously improved by reason of both the increase in its private budget (the subsidy) and the proposed increase in the public good (the public benefits from reduced climate change), the reduction of the private realm of consumer choice was rejected.

It is interesting that consumers might be contesting the division between the private and the public realms of choice and behaviour. This is another, potentially competing explanation for the

phenomenon of crowding out. It could be that widely proclaimed intrinsic motivation to provide public goods is in fact based not in the desire to provide these goods through public methods alone, but rather an in-built belief that there should be a separation between the private and the public realms of choice. Citizens might be defending their boundaries around the private realm of behaviour as much as they are the public realm.

6. Conclusions

Our findings provide the first direct evidence of motivation crowding in a field experiment based on real consumer purchasing decisions. We find an explicit price intervention crowds-out (and even ‘over-crowds’) intrinsic motivation.

To summarize the key results, information provision through labelling is able to induce shoppers to switch to more climate friendly product varieties by activating their pre-existing intrinsic motivation to contribute to climate change mitigation. However, combining information on the relative environmental performance of products with a monetary reward for switching is less effective than information alone. Moreover, using a subsidy as an explicit regulatory intervention performs worse than an equivalent but neutrally framed price change. This result indicates that the framing of otherwise equivalent changes in the incentive structure matters for intrinsic motivation.³¹ Hence, the negative effects of a price intervention seem to be broadly similar for taxes and subsidies.

From a policy perspective we are investigating the ability of various instruments to complement intrinsic motivation in public goods provision within the context of private consumption decisions. In other words, what works to activate consumer’s public-spiritedness within the realm of private decision-making?

Our initial finding is that labelling can be an effective element in the utilisation of the intrinsic motivation of consumers toward socially beneficial consumption choices.³² It is interesting to note that

³¹ Goeschl and Perino (2012) observe crowding-out of pre-existing intrinsic motivation by an environmental tax compared to a neutrally framed price change.

³² This is in line with evidence on the effect of labelling in other contexts (Bjørner et al., 2004; Noussair et al., 2004).

approximately twenty per cent of consumers require only information to give effect to socially beneficial behaviour. Our second finding is that a change in relative prices is also able to have a clear beneficial effect. Private consumption behaviour responds to price changes in an expected fashion.

More interestingly, a government intervention operating via a forced price change does not have this positive impact. In fact, the neutrally framed price change effect can vanish if presented as an explicit regulatory intervention. This means that combined information/price interventions have less impact than either one alone.

This finding represents clear evidence in support of the standard “crowding out” effect, i.e. the effect that adding the subsidy to the information does not improve performance of the instrument. More practically, it means that a governmental intervention that is highly visible to consumers might be less effective than a more ‘hidden’ tax or subsidy.³³ More interestingly, it might also mean that there is a more fundamental cause of some of these observed “crowding” effects. The resistance of consumers to forced interventions, even those representing unambiguous increases in welfare such as a subsidy, is indicative of a resistance of consumers to altering the line between private and public decision making – in either direction. It could be that consumers are as interested in keeping governmental interventions outside of certain realms of normally private decision-making, as they are in keeping market-based interventions outside of certain realms of normally social decision-making.

Taken together, the results from this experiment suggest that a government working in an area of consumer choice imbued with both public and private good characteristics should proceed carefully in its selection of instruments. Not all instruments have the same effect when operating around the boundaries between private and public goods, simply because citizens (and consumers) might resist the alteration of that boundary.³⁴

³³ This complements findings by Kallbekken et al. (2011) who establish an aversion against interventions labelled as a ‘tax’ compared to an equivalent with a different name. These findings do not contradict results by Chetty et al. (2009) as they compare changes in taxes already included in the product’s price with taxes that are added at the check-out.

³⁴ A number of caveats are in order. Firstly, by design the experiment can only capture short term effects. Switching patterns might be different in the long-run. Secondly, the credibility of the framings can be questioned on the grounds that participants were fully aware that they were participating in an experiment and that any subsidy or price change would not be permanent, and that any government involvement is hypothetical. However, if participants would indeed have found the framing unconvincing, we should not have found any significantly different effects between the Subsidy and the NeutralPriceChange treatments. The fact that we did, indicates that the setup did work as intended.

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Appendix A

Table A.1: Variable Descriptions

Variable	Description
Treatment dummies	
Labelling	Dummy: 1 if participant was subject to Labelling treatment, 0 otherwise
Subsidy	Dummy: 1 if participant was subject to Subsidy treatment, 0 otherwise
NeutralPriceChange	Dummy: 1 if participant was subject to NeutralPriceChange treatment, 0 otherwise
Product dummies	
Milk	Dummy: 1 for milk, 0 otherwise
Meat	Dummy: 1 for meat, 0 otherwise
Butter	Dummy: 1 for butter/margarine, 0 otherwise
Location dummies	
L.NewBarnet	Dummy: 1 if observation is from store in New Barnet, 0 otherwise.
L.Edgware	Dummy: 1 if observation is from store in Edgware, 0 otherwise.
L.Chiswick	Dummy: 1 if observation is from store in Chiswick, 0 otherwise.
L.Merton	Dummy: 1 if observation is from store in Merton, 0 otherwise.
L.Walthamstow	Dummy: 1 if observation is from store in Walthamstow, 0 otherwise.
Socio-demographic variables	
Envinfo	Dummy: 1 if participant opts to read the environmental information sketching the problem of climate change and the meaning of a carbon label, 0 otherwise.
Nutrinfo	Dummy: 1 if participant opts to read the nutritional information

sketching the health impact of energy, proteins, carbohydrates, fat and salt referred to on food labels, 0 otherwise.

# of children in household	Number of children (below 12 years old) in the household
# of persons in household	Number of persons living in a household
Male	Dummy: 1 if participant is male, 0 otherwise.
Age	Age of participant
Student	Dummy: 1 if participant is a student, 0 otherwise.
Ncsec	Socio-economic class, based on participants' occupation in accordance with UK Office for National Statistics 2005 guidelines.
Unemployed	Dummy: 1 if participant is unemployed, 0 otherwise.
Retired	Dummy: 1 if participant is retired, 0 otherwise.
Edu1	Dummy: 1 if participant does not have any university-level education, 0 otherwise.
Log of Income	Log of household income (in thousand GBP)

Table A.2: Choices in Labelling Treatment (Milk)

		Choice 2			
		Whole	Semi-skimmed	Skimmed	
Choice 1	Whole	15	2	2	19
	Semi-skimmed	0	29	2	31
	Skimmed	0	0	7	7
		15	31	11	57

Table A.3: Choices in Labelling Treatment (Cola, Butter/Margarine and Meat)

		Choice 2		
		Dirty	Clean	
Choice	Dirty	27	16	43
	Clean	3	27	30
		30	43	73

Table A.4: Choices in NeutralPriceChange Treatment (Milk)

		Choice 2			
		Whole	Semi-skimmed	Skimmed	
Choice 1	Whole	45	11	1	57
	Semi-skimmed	3	88	9	100
	Skimmed	2	2	14	18
		50	101	24	175

Table A.5: Choices in NeutralPriceChange Treatment (Cola, Butter/Margarine and Meat)

		Choice 2		
		Dirty	Clean	
Choice	Dirty	105	45	150
	Clean	19	64	83
		124	109	233

Table A.6: Choices in Subsidy Treatment (Milk)

		Choice 2			
		Whole	Semi-skimmed	Skimmed	
Choice 1	Whole	54	5	0	59
	Semi-skimmed	3	72	7	82
	Skimmed	1	2	9	12
		58	79	16	153

Table A.7: Choices in Subsidy Treatment (Cola, Butter/Margarine and Meat)

		Choice 2		
		Dirty	Clean	
Choice	Dirty	102	23	125
	Clean	18	73	91
		120	96	216

Table A.8: Summary Statistics

Variable	Mean	Std. Dev.
Labelling	0.14	0.35
Subsidy	0.41	0.49
NeutralPriceChange	0.45	0.50
Milk	0.42	0.49
Meat	0.18	0.38
Butter	0.23	0.42
L.NewBarnet	0.06	0.23
L.Edgware	0.17	0.38
L.Chiswick	0.19	0.39
L.Merton	0.30	0.46
L.Walthamstow	0.11	0.31
Envinfo	0.37	0.48
Nutrinfo	0.58	0.49
# of children in household	0.64	1.02
# of persons in household	2.94	1.65
Male	0.35	0.48
Age	37.4	12.13
Student	0.08	0.27
Ncsec	8.53	4.22
Unemployed	0.04	0.21
Retired	0.04	0.20
Edu1	0.40	0.49
Income (in '000 GBP)	30.45	18.14