Ostensible hypothecation: the effect on fuel expenditure of cash transfers to the elderly for fuel

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Abstract

This paper is concerned with how a transfer programme for the elderly, ostensibly for winter domestic fuel expenses, affected domestic fuel expenses and other spending. Eligibility conditions and levels of entitlement changed from year to year yielding natural experiments to provide identification using a pooled cross-sections of household budget surveys. The programme is, however, simply an age-contingent lump sum and, as such, we would not expect there to be any more than a minimal impact on fuel expenditure, fuel poverty,, or cold-related deaths. However, the announced intention of the policy was to ensure that the elderly were better able afford to heat their homes in the face of cold weather and, in this paper, we use arguments from the mental accounting literature to explain why, nevertheless the Winter Fuel Payment may be a worthwhile vehicle for lowering premature deaths. We also present evidence from household surveys that exploit the natural experimental variation in the payments.

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1. Introduction

This paper is concerned with how a cash transfer programme to the elderly, ostensibly for winter heating expenses, affected those expenses. The transfer programme is called Winter Fuel Payments (WFP)[1]. In understanding consumer behaviour, the demand function can typically be written as $x = x(\mathbf{p},m; F)$ where $\mathbf{p}$ represents prices, m is income while F represents the "frame" in which the consumer makes his or her choices. Within the standard, Hicksian model, x has certain properties, such as homogeneity of degree zero in prices and income taken together. The demand function is also normally assumed to satisfy a property of frame invariance – that is, changes in the frame do not affect demand. Relaxing this assumption, and replacing it with empirically supported alternatives, is the starting point for behavioural economics which, via experiments and the field, has furnished data, and a number of important theories, about the influence of frames on consumer behaviour. Behavioural approaches have become prominent in some parts of economics (e.g. finance), but within public economics there has been less interest (see Dhami and Ali (2003) and Kanbur *et al*. (2004). The focus of that interest has been largely on the impact of the standard economic tools of microeconomic policy (e.g taxes, expenditure and fines) given non-standard preferences. In contrast there has been less emphasis on the impact of manipulating the framing of economic policies: although, again, there are notable exceptions including the work on savings by Thaler and Benartzi (2004).

This paper explores the role of framing in public policy by analysing the impact of the Winter Fuel Payment in the UK. The allowance is an expensive programme with payments totalling around £2 billion in a full year. Introduced with the ostensible aim of reducing fuel poverty in the UK, and thereby cutting the number of premature deaths attributable to cold weather, this lump-sum payment (currently £200 per annum, and more to the very old) is payable to households containing one or more people over the age of 60. The peculiarity of the payment is that it is not in any way contingent on fuel expenditure, so that within the standard Hicksian model of the consumer, the payment is equivalent to an age contingent income transfer. Given the

[1] Previously called Winter Fuel Allowance up to 1998. Note that this is different from the Cold Weather Payment which is payable during long periods of very cold weather to people in the UK on very incomes low enough to be receiving Income Support and Pension Credit.

established availability of means-tested programmes[2] to change the income of the elderly who are also poor, and who are therefore also likely to be vulnerable to cold weather, the role of the Winter Fuel Payment (WFP) is therefore hard to understand without invoking bounded rationality on the part of one or more groups of political actors.

The policy was introduced in the 1997, although it was not until December 1999 that payments became large. Our analysis covers the period from 1997/8, when modest payments were first made, up to 2003/4 (the latest year currently available).

The plan of the paper is as follows: first the WFP system is explained in more detail, along with some broad features of uptake and expenditure. The following section examines the theory of the payment, both within standard models of the individual and from the perspective of mental accounting. A simple adaptation of Tversky and Kahneman's Prospect Theory is used to outline one reason why the payment might have a larger impact on behaviour than a simple lump-sum cash transfer. Section 4 produces empirical evidence on the impact and section 5 concludes.

2. WFP and the relevant literature

Unlike the US food stamps program[3] the WFP transfer is paid in cash, just once each year, the transfer is not means-tested, the procedure for claiming is straightforward, and participation rate is close to 100%. Eligibility conditions and levels of entitlement changed from year to year yielding several natural experiments to provide identification.

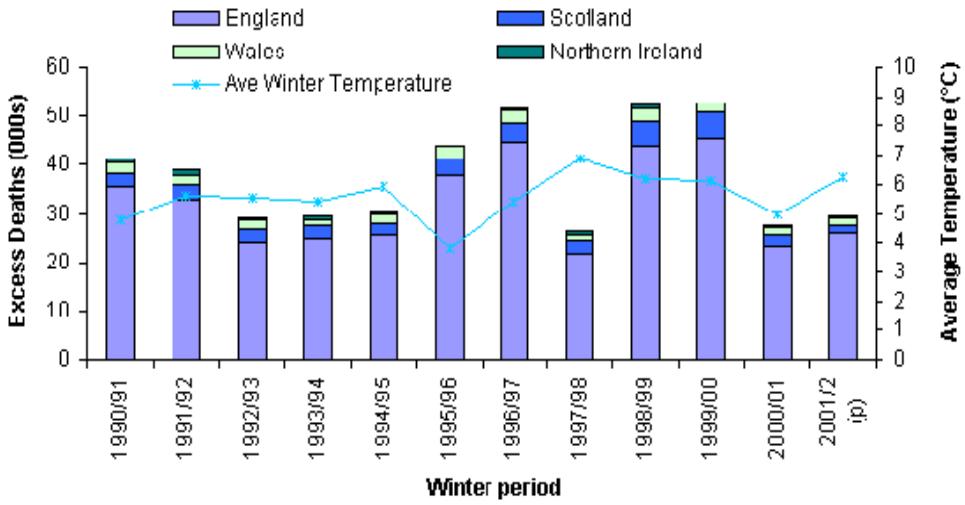
Along with Ireland, the UK has the highest percentage of excess deaths during the winter months in Europe. Figure 1 shows that mortality rates regularly rise during

[2] The Pension Credit, formerly the Minimum Income Guarantee, is paid to only low income households who are old enough to be in receipt of their state pension (Social Security) payments.

[3] There is a substantial US literature on food stamps which suggests that in-kind transfers do affect spending on food even though their value is less than the level of spending on food and so should be equivalent to cash (see Fraker (1995)). Explanations for this either relate to the fact that there is an effect of the recipient (food stamps are usually given to mothers) or because there is a difference in periodicity (food stamps are paid monthly while other income is often received with greater frequency). A smaller literature investigates the possibility of a labelling effect, associated with cash transfers where entitlement is associated with having children. Such an effect on child assignable goods has been found by Kooreman (2000) but not by Edmonds (2002). Indeed, Blow *et al* (2005) exploited various sources of exogenous variation in child benefit that occurred in the UK during the 1980's and 1990's and found that child benefit was spent disproportionately on *adult* assignable goods.

periods of cold weather and deaths are concentrated in the over 65s. The exact link between temperature and excess death rates for the UK are unclear. Hypothermia accounts for a relatively small number of the deaths, so most cold-related deaths are attributed to respiratory or circulatory diseases (see Aylin *et al*. (2001)). Hypothesised and investigated causes of the deaths include poor quality housing stock, lack of central heating, pensioner behaviour and activity rates as well as poverty. The Winter Fuel Payment has been clearly presented as a means of reducing excess mortality by allowing pensioners to spend more on their heating bills.

Figure 1. Excess deaths and winter temperatures in the UK



The policy was explicitly introduced in 1998 with the aim of ensuring that the elderly were better able to afford to keep their homes warm in the face of cold spells. Official sources state that WFP:

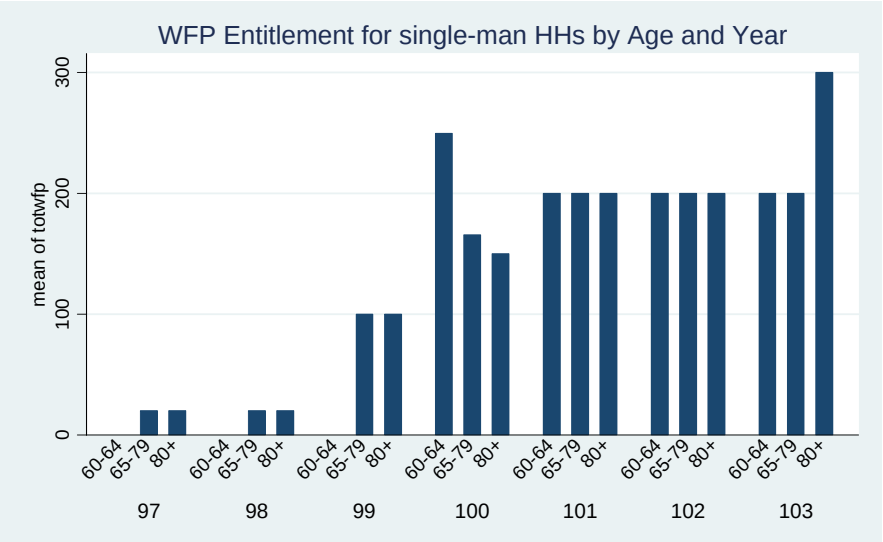
> *"....aims to ensure that the elderly can keep their homes warm in cold weather."*
>
> *".....are well-timed payments which demonstrate the Government's commitment to alleviating fuel poverty by providing help to older households toward their winter bills."*

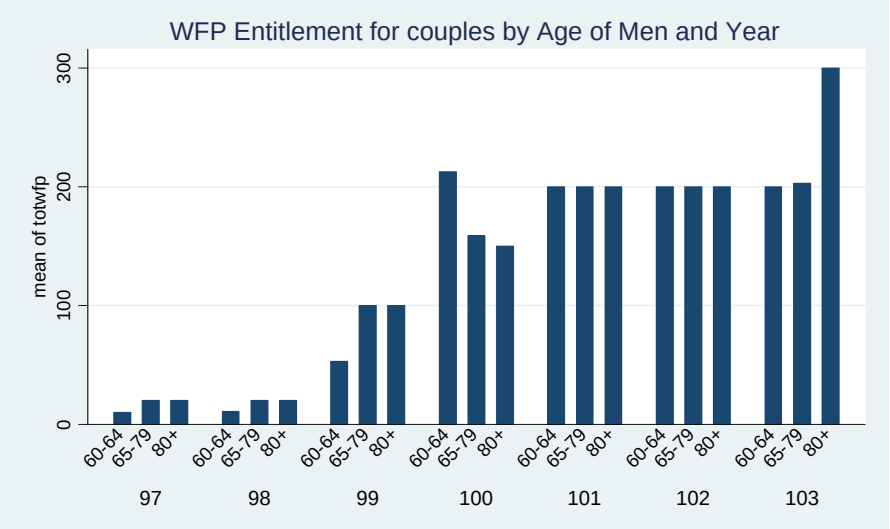
The allowance reflects official advice about keeping warm and health. For example, pensioners are advised by the government that:

> *"The ideal living room temperature for older people is 21°C. Once room temperatures start to drop the risks of respiratory illness, stroke, heart attack and hypothermia increase".*
>
> *"About half of all extra deaths in winter are due to coronary heart disease or stroke. About a quarter are due to respiratory disease. Blood thickens in cold conditions and makes circulation more difficult".*

Yet WFP was paid in cash to anyone aged 60 or over and normally living in the UK, regardless of level of income or savings[4]. The payment is non-taxable and does not affect social security benefit entitlements. A qualifying person living with a non-qualifying partner was paid twice the single rate. In 2003, a household containing some 80+ became eligible for the new 80+ Annual Payment. In almost all cases payments were made during late November and early December each year. Figure 2 shows the history of the program for an example household containing a single man and for a couple.

Figure 2 History of WFP



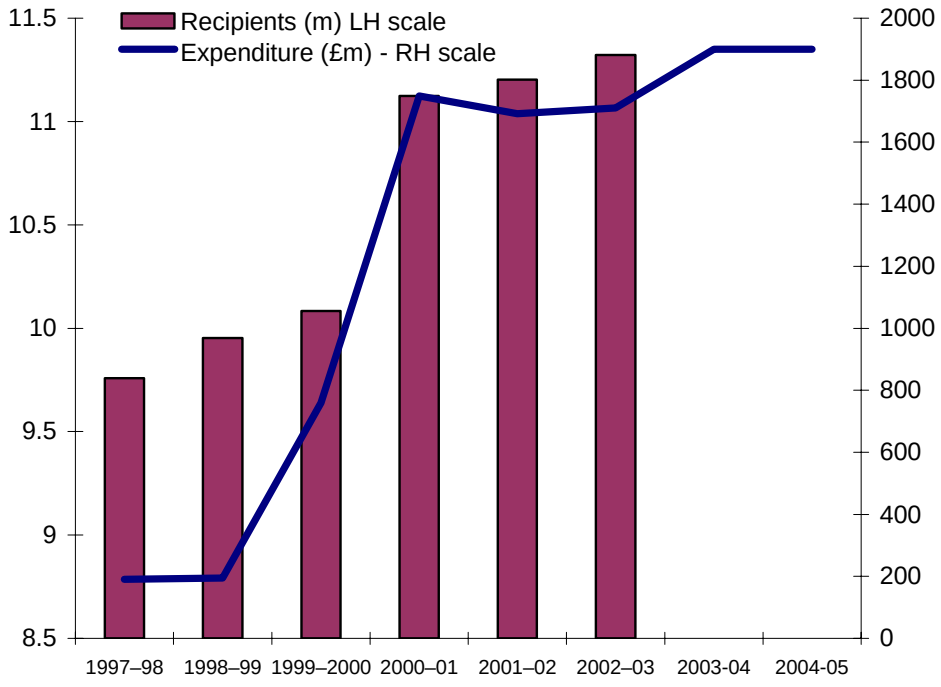


[4] Between 1997 and 2000, single men were only eligible if they were 65 or over. Someone over the qualifying age and lives in a care home would be paid half the normal rate if she did not get Pension Credit or Jobseeker's Allowance, and nothing at all if she did.

Notice that between 1997 and 2000 single men were only eligible if there were 65 or over, while single women were eligible at age 60. Originally the allowance was available to men over 65 and women over 60 living in the UK, but following a ruling by the European Court of Human Rights, all individuals over 60 are eligible[5]. This challenge in the European Court resulted in the UK government having to provide "backpay" to those men who would have been eligible were they women which is reflected in the figure.

Households who are not already in receipt of state benefits have to claim, but there is no income contingency, and there is no requirement that the money be spent on fuel bills. Once a claim is paid in one year, the payment is automatically made in subsequent years unless the Department for Work and Pensions (DWP) is alerted to a material change in circumstances. The UK government does not produce figures on the numbers potentially eligible. However, Figure 3 shows the data that is available - currently the total number of claiming households is over 8.5 million containing around 11.5 million eligible individuals and total expenditure is close to £2 billion.

Figure 3 WFP recipients and expenditure



[5] As are Britons living abroad in the EEA provided that they have claimed the allowance while living in the UK.

The availability of the payment is widely advertised, by central and local government, by individual Members of Parliament of the ruling Labour party and pensioner advocacy organisations such as *Age Concern*. As a result, up-take levels are probably very high, although no official figures are available for the proportion of eligible households who receive the benefit[6]. Our own analysis below of the Family Resources Surveys since 1997 suggest that, although there is a lag with the newly eligible, the take-up rate quickly approaches 100%.

3. Theory.

Within standard Hicksian theory the WFP is equivalent to a lump sum grant contingent solely on age (and the fact that the payment is claimed). As a result, the impact on heating expenditure ought to be minimal. Semi-parametric estimates in Blundell *et al.* (1998) suggest an income elasticity of around 0.5 – towards the upper end of the range of estimates in the literature. Since, a low income pensioner typically will have a total annual net income or around £10,000 and will spend about £500 p.a. on domestic fuel a WFP of £200 would, according to this estimate, be likely to increase fuel spending by around £5 p.a.

More fundamentally the existence of the Minimum Income Guarantee (now the Pension Credit) meant that when the WFP was introduced there was pre-existing vehicle for giving pensioners a lump-sum rise in income. The use of this existing policy vehicle would have avoided the significant costs of running the Winter Fuel programme and would have allowed the payments to be concentrated on the low income elderly. In other words, as an instrument of policy, the allowance was dominated by adjustments to pre-existing programmes.

If the programme is hard to explain on welfarist or fuel poverty reduction grounds, it is equally difficult to produce a sensible political economy explanation that

[6] From the House of Commons: "**John Thurso:** To ask the Secretary of State for Work and Pensions how many people eligible for a 2004–05 winter fuel payment needed to submit a claim to receive it; and how many of those have claimed, broken down by region. [206888] **Malcolm Wicks:** We estimate that approximately 700,000 individuals in Great Britain reached age 60 in the qualifying period for the 2004–5 Winter Fuel Payment. About half of these will be paid automatically but others, who are not in receipt of certain benefits, will need to make a claim. At the 10 December 2004 there have been 314,517 claim forms received. We are not currently able to give a reliable regional breakdown. Those eligible have until 30 March to make a claim and it is up to them whether they do so. We publicise the availability and eligibility for the payments through out the claim period." Hansard, *21 Dec 2004 : Column 1746W*.

does not at some point invoke bounded rationality. The three main groups of actors relevant to the programme are pensioners, non-pensioners and elected politicians. Suppose there was a political outcome in which Δ was paid in cash to all pensioners at a net cost of $\Delta+c$ to non-pensioners. Compare this to an outcome in which pensioners receive Δ at a cost $\Delta+c'$ where $c'<c$. Non-pensioners would prefer this second outcome provided their preferences satisfy non-satiation and provided the burden for each individual was lower under the second arrangement. Meanwhile pensioners would be indifferent or prefer the second arrangement if they were at all altruistic. Given this, politicians should also prefer the second arrangement, provided that their payoff was increasing in the utility of citizens.

One possible, though not necessarily plausible, explanation is based on asymmetric information. For instance, non-pensioner citizens might be against a lump-sum subsidy to pensioners but in favour of a targeted heating subsidy. If they are not able to distinguish between a heating subsidy proper and the WFP then there may exist a political equilibrium in which the WFP is made. One problem with this argument is the high level of publicity given to the programme: the government advertises it heavily, individual Labour party members of parliament localised figures on its uptake in their election material, and newspapers carry reminders to pensioners to claim. More fundamentally, in a world where some actors can choose whether information is asymmetric or not, asymmetric information cannot be a part of any equilibrium if that is not compatible with their incentives. In other words, if non-pensioners were unsure of the true nature of the payment, then there would be clear gains from "political arbitrage" in the sense that there would be returns to an opposition politician or indeed newspapers from passing on the information.

3.1 Mental accounts and mental budgeting.

Mental accounting is a term invented by Thaler (see, for example, Thaler (1981)) to describe models and rules that individuals use to organise their finances. It consists of three types of rules: those concerning the framing and perception of consumption and expenditure; and those concerning the assignment of spending to particular accounts and finally rules about how often accounts are audited and balances settled. Because of this, mental accounting might better be viewed as a

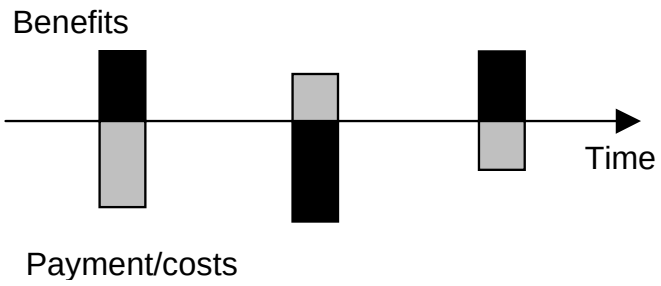
cluster of interacting anomalies and heuristics rather than a single effect. It provides an alternative explanation of the potential effectiveness of policies such as the WFP.

Much of the evidence presented in the mental accounting literature is compatible with the predictions of Prospect Theory. To see this, consider two transactions, x and y and a consumer's choice of whether to enter them as a single, combined transaction or place them into separate accounts. Let $v(x+y)$ be the value when x and y are integrated into one mental account and let $v(x) + v(y)$ be the value when they are treated as separate accounts. Recall that, under Prospect Theory, losses are weighted more heavily than gains and that the value function is concave for gain and convex for losses. Then we have the following properties:

1. $v(x) + v(y) > v(x+y)$ when both x and y are positive;
2. $v(x) + v(y) < v(x+y)$ when both x and y are negative;
3. $v(x) + v(y) > v(x+y)$ when x is a large gain and y is a sufficiently small loss;
4. $v(x) + v(y) < v(x+y)$ when x is a small gain and y is a sufficiently large loss.

In this framework, to maximize total value, subjects should separate gains, integrate losses, separate out small gains from losses, and integrate small losses into large gains. However, one of the weaknesses of the assumption that consumers have full control over the choice of accounts is in its implication for the treatment of gains. As Thaler (1992) points out, if a gain can be broken down into smaller and smaller gains then utility can be still higher and higher. Specifically, Property 1 implies that $n.v(x/n) > v(x)$ for $n > 1$, implying that the optimal treatment of a gain is to break it down into infinitesimal parts. Thus it seems more reasonable to suppose that consumers do not have full control over their ability to manipulate accounts or that there are costs associated with mental accounting frameworks. There is as yet no formal theory of how such a cost structure might be constructed, though the lessons from the literature suggest that it is easier to integrate two items of income or expenditure when the goods are similar or when the two events are close in time. Of particular interest here is the concept of mental budgets: that expenditure patterns can be related to the notional pattern of budgets and the moneys allocated to them, (Heath and Soll (1996)). For instance, if money is saved on entertainment expenses it is more likely to be spent on other forms of entertainment compared to when money is saved in some other way.

Figure 4 Mental accounting and the timing of consumption.



Prelec and Loewenstein (1988) investigate individual's desire to match expenditure and consumption over time. Consider Figure 4 which shows a pattern of consumption and its associated expenditure over time for one individual. For instance, the commodity might be a soccer or theatre season ticket and the expenditure could represent regular transfers from a bank account in payment. The solid bars indicate two instances of consumption (above the line) and one act of payment (below the line). In line with much of the literature on mental accounting, Prelec and Loewenstein (1988) argue that for many individuals there are simultaneous 'costs of consumption' and 'benefits of payment'. These are shown in grey; they represent hedonic echoes of the real transactions that in part cancel out the pain or pleasure of the original experience. Moreover, by manipulating the timing of consumption and payment, the consumer is able to affect the size of the offsetting to terms. To gain insight into how this occurs, Prelec and Loewenstein confronted 89 individuals with a ranking task involving the timing of payment and use of a hypothetical time share, where the individual had purchased 3 weeks of use of a resort apartment to be enjoyed over a period of four years at a total price of $3,000. Some options involved pre-payment, some involved use of the apartment in the early or years, some involved a matching of the timing of payments to the year of use etc. To elicit discount rates, they also asked their subjects to rank options involving only benefits or only payments.

Individuals with a positive rate of time preference - which characterised most subjects in their sample - should prefer consumption and payment patterns with the payments end-loaded. In fact, a majority of subjects did not rank such options highly. The largest group favoured either matching year of use to year of payment, but with

payment preceding use or preferred options with some pre-payment and then paying the rest of the fee in instalments prior to use.

Prelec and Loewenstein argue that this is indicative of a high cost of consumption when a good has not been paid for. But they also conclude that there is a higher benefit of payment when it is close to the period of consumption. This brings us to the final element of mental accounting: the control of the flow of savings and consumption over time. Thaler (1981) suggests that mental accounts represent one of the ways in which the controlling or planning part of the self can limit the temptation to consume rather than save. Labelling separate accounts as savings or capital accounts create psychological barriers to using money for day to day expenditure. Moreover, if payments into savings plans are automatically made, then they are not coded as a loss from current consumption, but instead are more likely to be integrated with the future gains from invested income.

With the WFP, the creation of the mental account is encouraged in three ways. First by the label itself. Secondly the promotional literature surrounding the payment emphasises its link to fuel and de-emphasises its non-contingent nature. The Department for Work and Pensions website states: "*A Winter Fuel Payment is a one-off payment to help older people with their winter heating bills*", and its promotional leaflet includes the statement that, "*The Government will again be making Winter Fuel Payments to provide financial help with heating bills this winter*". Thirdly the payment of the WFP is made in November, just as temperatures fall and energy use begins to rise towards its winter peak. This top of the fuel account may also be effective because of the effective temporal de-linking of consumption and payment for fuel under the standard (but not universal) means by which UK households pay for their energy: for many households payment is quarterly or monthly and is based on estimates of fuel consumption with retrospective adjustment. As Prelec and Loewenstein indicate, this is the kind of payment system that is often less preferred.

3.2 A formal theory.

Suppose that the account can be established through a process of labelling and timing of the payment. As we saw above, Prospect Theory is not entirely appropriate as a theoretical basis for mental accounts. However we can put forward a simple theory as follows. Suppose that,

1. Individuals assess the utility of different options using valuation functions[7].

2. In particular *w(x)* represents the utility from *x* (monetary) units of heating expenditure. Gains in income are valued by the function *u(x)* while *-v(x)* is used to value losses in income or expenditures. We take *u(0)=v(0)=0*. For all *x, u(x)* $\leq$ *v(x)* and *u′(x)* $\leq$ *v′(x)*, where ′ indicates a first derivative.

3. The valuation functions (*w, u* and *–v*) are concave (i.e. we assume diminishing marginal utility.

4. Where cash grants, *y*, are not named or associated with heating, then heating expenditures and cash grants are not integrated into one mental account. As a result *x* is chosen to maximize: *w(x) - v(x) + u(y)*.

5. Where cash grants are named or otherwise associated with heating, then heating expenditures and cash grants are integrated into a single mental account. As a result, *x* is chosen to maximize *V* where:

   $V = w(x) - v(x-y)$ for $x > y$

   $V = w(x) + u(y-x)$ for $y \geq x$.

Where expenditure and grant are not integrated, the level of *x* is set by the condition, $w'(x) = v'(x)$. When expenditure and grant are integrated, then the relevant condition is either, $w'(x) = v'(x-y)$ or $w'(x) = u'(y-x)$. The first case applies when heating expenditure exceeds the grant; the second case is relevant when the grant is greater than heating expenditure. Totally differentiating the first of these expression with respect to *y* yields,

$$\frac{dx}{dy} = \frac{-v''}{w'' - v''}.$$

Differentiating the second expression produces

$$\frac{dx}{dy} = \frac{u''}{w'' + u''}.$$

Given concavity of the valuation functions[8] both these total derivatives are positive. It follows from the properties of the valuation functions, that the chosen *x* is

[7] We shall take it that all valuation functions are twice differentiable.

higher when expenditure and grant are integrated, compared to its value when they are not integrated. Moreover, when they are not integrated, the value of x is independent of the value of y, but when they are integrated, heating expenditure rises with the grant level.[9]

The crucial feature which makes the policy more effective (in the sense of increasing x) is the creation of the mental account. With the WFP payment, the name provides one stimulus to the account's creation. In addition, some pensioners have to apply for the payment which may create some sense of obligation in them to spend the money received on heating.

4. The evidence on behaviour

In theory therefore, the method by which the payment is made may mean that it has a higher impact on fuel use than a purely lump-sum transfer. However, there is no perfect data source for assessing the impact of the allowance on behaviour. Of the three major UK household surveys, only the Family Resources Survey asks a specific question about receipt of the payments. However, this question was only introduced recently and as the survey does not ask questions about expenditure it is not possible to use it to estimate the impact of the allowance. It does however provide useful insight into take up rates.

According to the FRS survey for 2001-02, 93.7% of a sample of 14,081 adults over 60 claimed to be in receipt of the benefit when faced with a list of four benefits one of which was the WFP. None said that they were not in receipt of the benefit, though confusingly 6.3% denied receiving 'any of the above'. Of the 885 not in receipt, 267 were aged 60 at their last birthday and a further 314 were males aged 61-65 who under the original rules were not eligible to claim the benefit, but who were eligible after the European Court ruled invalid the differential treatment of men and women. So, in what follows we ignore issues of selection bias and we appeal to the FRS data to justify the working assumption that the up-take is near universal.

[8] In prospect theory, u is concave but v is convex in which case integration may lower heating expenditure for $x > y$. Munro and Sugden (2003) point out some of the other problems with using prospect theory as a model of consumer choice under certainty.

[9] Note that the assumptions made on the derivatives of u and v are consistent with an endowment effect. They imply that at $y=x$, demand for x increases with y, possibly discontinuously.

Neither the Family Expenditure Survey (FES, now called *Family Spending*) nor the British Household Panel Survey (BHPS) explicitly records receipt of WFP. However both surveys do ask questions about expenditure on fuel. The FES asks subjects to report their last bill for each energy source and, in most cases, respondents consult the bill. The BHPS asks households to report expenditure since a particular date. The staggered nature of the BHPS interviews means that some households are asked to recall the last 12 months of expenditure while others (a small minority) can be asked for expenditure over 20 months. The FES asks rather more questions about heating use, has information on the method of payment used, and it probably a good deal more reliable than BHPS. FES is also in the field continuously so that we can examine the importance of outside temperature. However, BHPS has the advantage of being a panel and has more information about the condition of the house.

For both FES and BHPS we select only single benefit-unit households surveyed after September 1997. We trim the aggregate fuel share to be between 0.5% and 50% of net income (excluding housing costs) and drop those with w/p (what's this ??) less than 20%. We exclude households without electricity[10] and drop the FES households from Northern Ireland since BHPS does not include this region. Basic summary statistics are in Table 1. The two datasets are broadly comparable.

[10] We require BHPS households to be observed at least twice post 1997. We require FES households to contain at least one person receiving the state ?? retirement pension, the period code for pension income to be observed, and the variable recording whether the household has one or more bank accounts to be non-missing. We also drop households who share rooms with other households and households who own a second home.

Table 1 Summary Statistics

	FES	**BHPS** (Original Sample Members Only)
Fuel share (%)	6.9	6.6
Prepayment (%)	5.0	-
Weekly fuel expenditure (£)	10.84	10.11
Weekly WFP (£)	2.77	2.59
Total net income (£ net of housing costs)	212.9	196.8
Receiving Benefits/Pension credit (%)	12.0	11.6
Owned Outright %	64.8	63.2
Owned with mortgage	6.2	6.5
LA/HA rented	25.6	25.8
Private rented	3.4	4.1
Number of rooms	5.2 (incl.kitchen)	4.0 (excl. kitchen)
Head of Household age	73.4	73.4
Head of Household male	61.3	57.9
Head of Household working	7.0	9.9
Head of Household over 80	11.3	18.0
Single Man household	14.3	13.6
Couple	47.0	46.8
One qualifier	58.7	63.2
Two qualifiers	41.3	36.8
Detached house	24.8	26.5
Semi-detached	31.4	31.8
Terraced	23.0	21.3
Flat	17.1	14.9
Other type of dwelling	3.7	5.3
No Gas	19.9	20.8
Gas central heating	68.9	70.0
Electric central heating	12.9	13.1
Other central heating	7.9	8.0
Having Satellite / Cable TV	19.7	17.8
Having home computer	15.1	15.4
Having freezer	90.8	90.1
Having tumble dryer	41.2	37.0
Having washing machine	88.0	86.7
Having dish washer	16.5	14.6
London & South East	25.3	25.8
Rest of England	60.3	59.6
Wales	5.4	6.0
Scotland	9.0	8.5
Northern Ireland	0.0	0.0
Observations	9,222	6,799

Note: All monetary measure in January 2004 prices.

4.1 Testing for a WFP effect

An informal test that WFP has an effect, over and above the effect of regular income, would be to see how fuel expenditure varied with WFP and compare this with existing estimates of the income elasticity. Such elasticity estimates could, for example, be obtained by semi-parametric methods while the effect of WFA could be obtained from a difference-in-difference method, or from panel data, and be viewed as a local approximation to some unknown relationship. Since eligibility might coincide with important changes in working behaviour it is likely to be important to control for this or, at least, to allow for variation with respect to age.

However, there are strong advantages from having estimates of the effects of both WFP and regular income variation for the same group of households over the same period of time. Blundell et al, (1998) provides semiparametric estimates of Engel equations and suggests that a parametric form that has the budget share as a quadratic function of log total expenditure provides a close approximation. Since we have clear evidence that we can approximate Engle curves by simple parametric forms there is little to be gained from not adopting a more structural approach. We allow for WFP to have a different effect from other sources of income by allowing it to carry a different weight in the share equation. In particular, we define the fuel share as a QUAIDS form

$$s_i = \left(\alpha\left(Z_i\right) + u_i\right) + \beta_1 \log\left(Y_i + \gamma W_i\right) + \beta_2 \left(\log\left(Y_i + \gamma W_i\right)\right)^2$$

where s_i is the share of income, Y_i, spent on fuel, W_i is the level of WFP, u_i is an error term, and Z_i is a vector of control variables which might include individual characteristics such as age and employment status, time varying covariates such as weather variables, as well as some characteristics of the house such as number of rooms and type of heating method.

This is a convenient specification since $\log\left(Y_i + \gamma W_i\right) \approx \log Y_i + \gamma\left(W_i / Y_i\right)$ if W_i is small relative to Y_i and such a specification allows us to test, in a straightforward way, the hypothesis of mental accounting that $\gamma > 1$, against the neoclassical null that $\gamma = 1$. Although the quadratic term necessitates the use of nonlinear estimation methods, it has been shown to be important in Blundell *et al*. (1998) and we include it here in our own analysis.

Indeed, such a parametric form would be consistent with a simple panel data, or difference-in-difference estimator. For example, in the simple case where β_2 is zero[11], holding everything else constant bar WFP, we could exploit the panel to estimate $\Delta s_i = \beta_1 \gamma . \Delta \left(W_i / Y_i \right)$ where Δ is the difference operator or, in level rather than share form, $\Delta e_i = \beta_1 \gamma \Delta W_i$ where e_i is fuel expenditure. Recovering γ still, however, requires an extraneous estimate of β_1. Alternatively we could exploit repeated cross-section data to construct a difference-in-difference estimator $\Delta\Delta^{TC} s = \beta_1 \gamma . \Delta \left(W / \bar{Y}^T \right)$ where Δ^{TC} is the difference between treatment (eligibles) and controls (ineligibles) (note that W=0 for ineligibles) and Y^T is the mean income of the eligibles.

4.2 Evidence from the BHPS

The BHPS tracks approximately 6,000 households in Britain. There is some attrition, some splitting of households and some replenishment, creating an unbalanced panel. For the purposes of this estimation we consider single benefit-unit[12] households with incomes below £50,000 (mean household income in the sample is just over £21,000) and above £3,000.[13] Previous experience from estimating Engle curves for fuel suggests that the specification is sensitive to demographics. We therefore omit households where there are children under 18 and all households where the oldest person is 30 or below. Given the measurement problems with the income variable, we omit households with incomes less than £3,000 and those with incomes greater than £50,000 and as indicated above, all households which reported spending more than 30% of their income on fuel. The result is an unbalanced panel with 16,387 observations. For the panel aspect of the model I use a random effects model rather than fixed effects, given the 'short and wide' nature of the panel. The results of this estimation are shown below.

[11] The case where $\beta_2 \neq 0$ is also straightforward.

[12] These are single person households or couples who are married or co-habiting. The most important effect of this selection is to drop those elderly individuals who live with their own children.

[13] Inevitably there are some coding errors in the data. Annual income or expenditure may be coded as monthly or vice versa for instance. This is our main reason for omitting the extremes of the income distribution. For the same reason we also eliminate households where fuel expenditure is more than 30% of total income, where the components of income exceed the recorded total and we also exclude all the self-employed whose income is probably particularly unreliable. We also omit all renters for whom heating and light is included in the rent.

For our analysis here we use six waves of data covering the years 1997-98 through to 2002-03, covering the years since the introduction of the allowance. Later data is not yet available, while fuel price changes make comparisons over earlier timescales hard to justify. Figure 5 plots the share of income spent on fuel against the age of the oldest person in the household for households where this person is over 50. A wide range of shares can be seen, but the overwhelming majority of households spend under 10% of income on fuel. Figure 6 shows absolute expenditure for households in 2001-02 where the oldest person in the household was 60 as of 31st December 2001.

Figure 7 shows a truncated plot of the share of income spent on fuel against the log of income (so that 9 corresponds to just over £8,000 while 10 is £22,000). There is a clear negative relationship that appears to be slightly non-linear, a point illustrated by the non-parametric kernel estimation presented in the figure.

Figure 5 Share of income spent on fuel vs age of oldest person in the household.

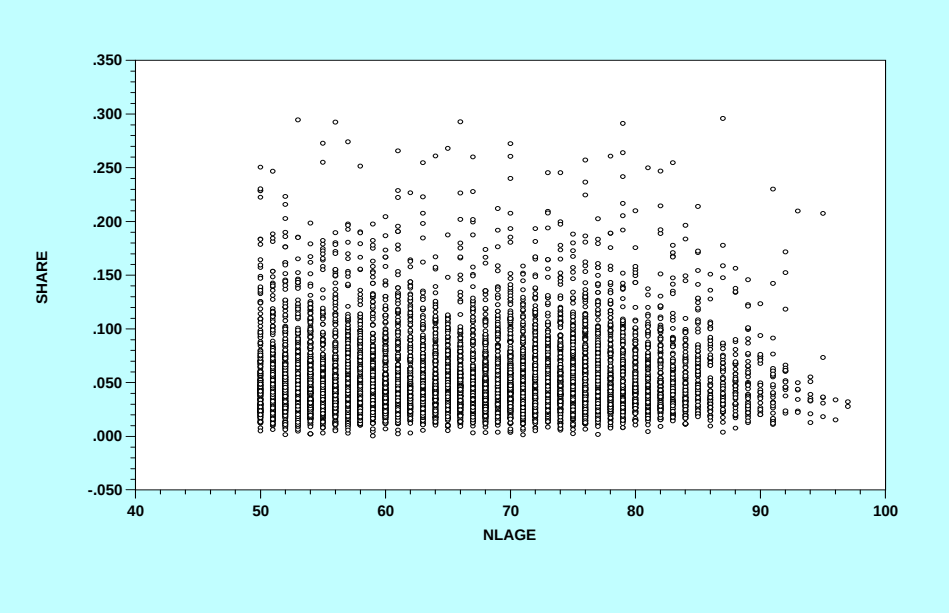


Figure 6 *Histogram of fuel spending for over 60 households.*

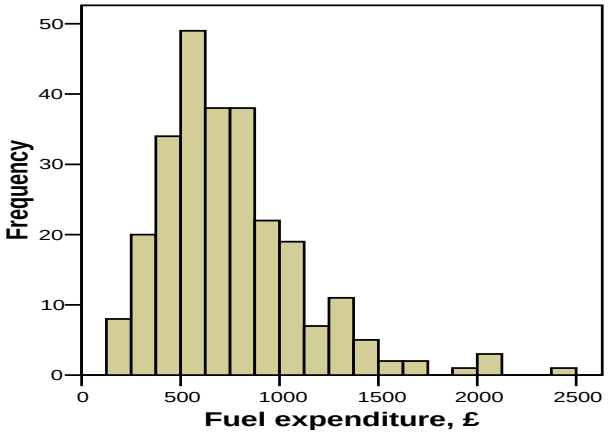
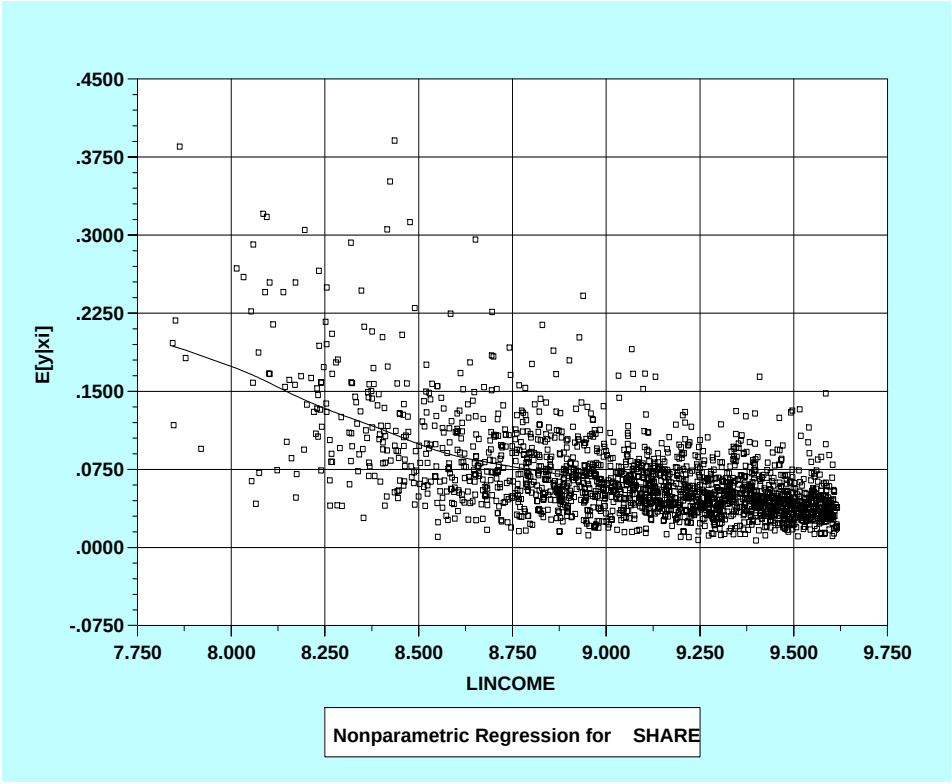


Figure 7 *Share of income spent on fuel versus the log of income*



A simple way of testing for a WFP effect is to utilise the fact that there is a September cut-off for eligibility for the WFP – individuals who are 60 after the last day in the third week of September are not able to claim it for that year and must wait until the following year. There are therefore two age groups with heterogeneous treatment:

A. Households where the oldest person is 60 on 31st December of the survey year

B. Households where the oldest person is 61 on 31st December of the survey year.

A complicating factor in the case of BHPS is the timing of the interviews, almost all of which take place in September and October – i.e. before the annual arrival of the WFP. A small number of interviews take place in December through to April after the allowance has been received. Thus it is possible that there will be little differential impact in group A, because the WFP will be received after the majority of the households have been interviewed. In group B, interviews take place around one year after some of the subjects have received the payment and there is more opportunity for the payment to have an impact. Figure 8 summarises the evidence for four age groups around the 60 year old threshold, where 'eligible' means reaching the relevant age before the last day of the third week in September. We use the 2003/3 data to avoid the complications associated with the back-pay arising from the EU ruling on gender treatment. A second complication is that, although we know that the take-up rate is, on average, very high, non-takeup among the very recently eligible tends to be low. The '59' and '62' age groups are therefore also a useful comparison.

The accompanying Table 1 provides formal tests of this evidence. None of the differences in means are large with the exception of those for the 61 year olds, where the null hypotheses is rejected at the 5% level against the alternative that those born before the September threshold date spend more on fuel. For this age group the difference in expenditure is £104.81, which taken at face value would imply that *half* the Winter Fuel payment was spent on extra energy consumption. However, it is this group were take-up is lowest and differential take-up by need might account for at least some of this difference.

Figure 8 Fuel expenditure in 2002-03.

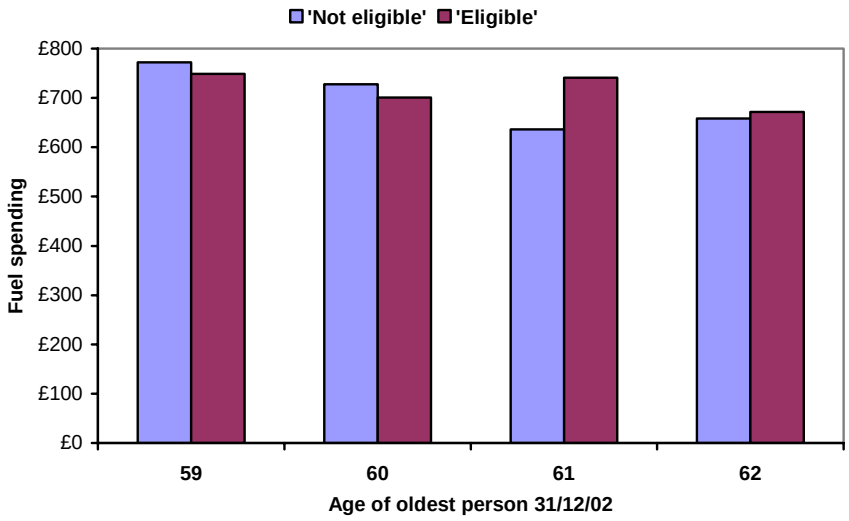


Table 1. Fuel expenditure for Households in 2002-03.

Age of oldest person on 31st December	Oldest household member is same age (in years) at cut-off date	N	Mean fuel expenditure (£)	Test and prob. value (1 sided test)
59	No	38	772.16	-0.377
	Yes	94	748.96	0.354
60	No	43	727.74	-0.479
	Yes	107	700.78	0.316
61	No	84	635.96	1.907
	Yes	115	740.77	0.029
62	No	24	657.79	-0.187
	Yes	97	671.44	0.427

4.3 Evidence from the FES

FES, although repeated cross-sections rather than a panel, has some advantages. Two important features of the data is the variation with temperature and variation across groups of households who have opted for different payment methods: prepayment (where households feed coins into a slot meter or, more usually, insert a plastic card which has been credited beforehand with a certain amount of cash); account (where households pay quarterly for the amount used in the previous quarter) arrears); and budget board (where households pay monthly, usually directly from a bank, a preset amount which reflects use in the previous year). Prepayment meters are often a choice that households make although these are often installed for households with a poor payment history[14]. Tables 2, 3 and 4 provide basic descriptive statistics.

[14] See Electricity Association (2001).

Table 2: Frequencies by payment methods, WFP eligibility and time period

	Prepayment		Quarterly arrears		Smoothed annual arrears	
	Not Entitled	Entitled	Not Entitled	Entitled	Not Entitled	Entitled
Pre-reform	241	251	1233	3959	875	1748
Post-reform	656	886	1989	6562	2089	4916

Note: The sample of "not entitled" includes households headed by someone 50 or over but under then qualifying age for WFP.

Table 3: Summary statistics by payment methods, WFP eligibility (post-reform period only)

	Prepayment		Quarterly arrears		Smoothed annual arrears	
	Not Entitled	Entitled	Not Entitled	Entitled	Not Entitled	Entitled
WFP	-	3.1	-	2.8	-	3.1
Total net expend	157.2	131.5	314.9	185.7	368.9	253.7
Total gross income	193.2	167.6	470.4	245.2	570.2	317.9
Total net income	165.7	158.2	365.8	220.1	436.7	277.8
Fuel	9.5	8.9	12.8	11.4	13.9	12.7
Alcohol	8.4	5.9	13.9	6.3	16.2	9.7
Clothing	7.6	6.6	17.5	9.5	21.5	13.7
Age of HoH	55.1	68.9	55.5	73.0	55.3	70.9

Note: All monetary measures are in pounds per week in January 2004 prices.

Table 4: Mean fuel expenditure by month, payment methods and WFP eligibility (post-reform period only)

	Prepayment		Quarterly arrears		Smoothed annual arrears	
	Not Entitled	Entitled	Not Entitled	Entitled	Not Entitled	Entitled
January	13.0	11.2	13.7	12.3	13.6	13.4
February	10.7	10.0	13.6	12.9	14.6	13.5
March	9.5	9.5	15.8	12.8	14.6	13.3
April	9.1	9.0	15.2	14.0	14.1	12.8
May	8.9	8.2	13.8	12.7	13.4	12.4
June	7.0	8.2	13.5	12.8	13.6	12.5
July	7.5	6.5	12.4	11.3	13.5	12.2
August	9.1	7.1	11.6	9.9	13.4	12.7
September	6.1	7.7	11.4	9.6	13.7	11.8
October	10.7	10.3	10.5	9.2	14.1	13.1
November	11.4	9.9	11.4	9.8	14.0	12.9
December	10.4	9.2	10.6	10.1	14.5	12.2
Total	9.5	8.9	12.8	11.4	13.9	12.7

Note: All monetary measures are in pounds per week in January 2004 prices.

Variation of expenditure with temperature is important. This is most obvious for those households who use prepayment since their expenditure is immediately sensitive to temperature. Figure 9 shows the region*month cell means of expenditure and mean daily maximum temperature, for prepayment households, and there is a clear and significant temperature gradient. Surprisingly, this is close to linear - a similar slope applies to just the winter quarter.

Figure 9 Expenditure temperature gradient

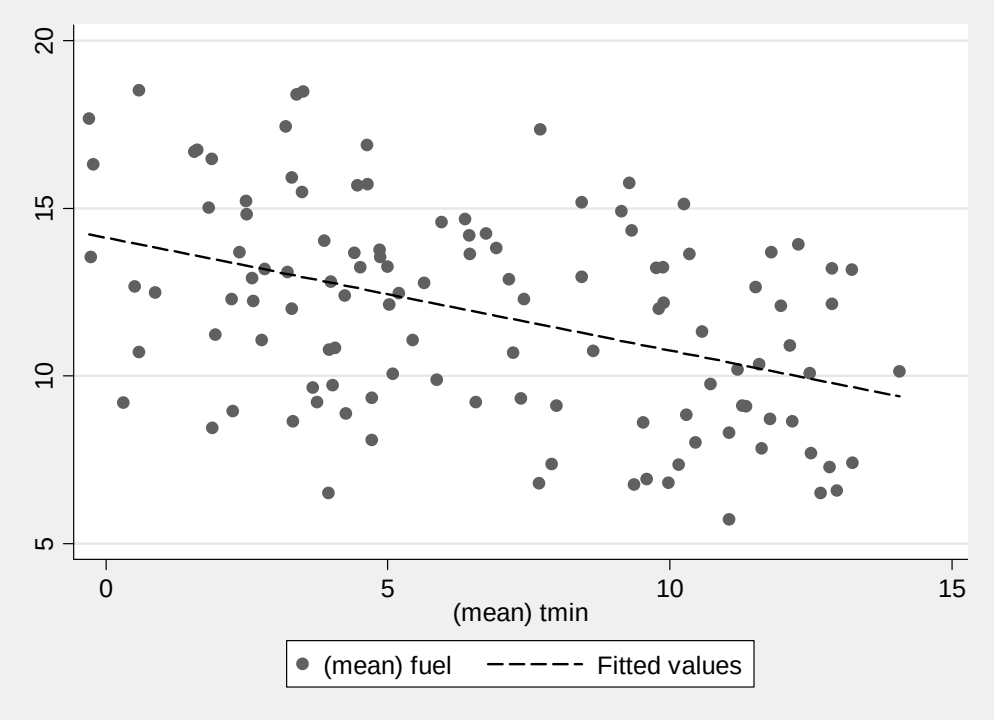
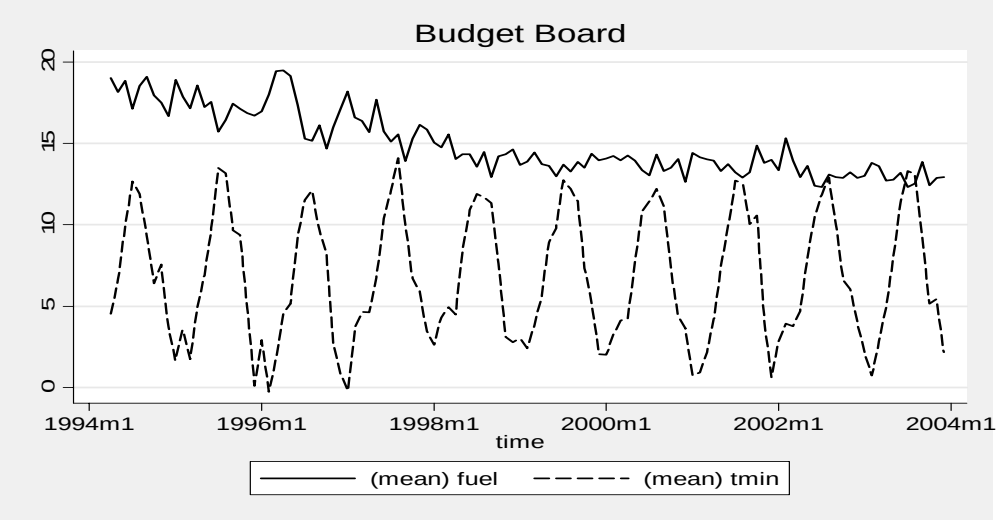
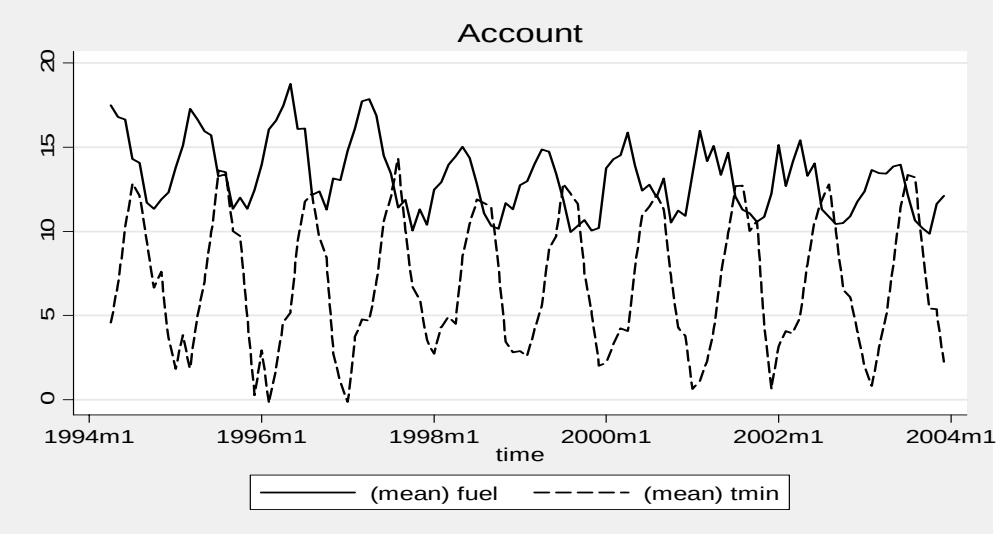
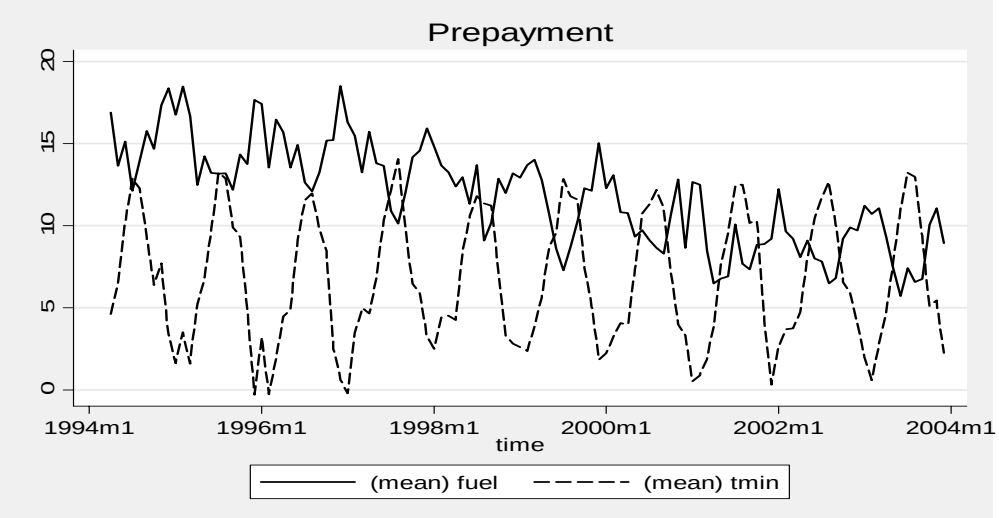


Figure 10 shows the average *monthly* spending on domestic fuel and average daily temperature since 1994 for the three payment types. There is a clear downward trend for each type, reflecting the falling real prices following deregulation. There is also a clear seasonality in the data – as in Figure 9 the prepayment group shows an immediate inverse relationship to temperature (*tmin*) , while the budget group show a short lag to temperature and the account group show a longer lag.

Figure 10 Seasonality in expenditure by payment method







4.4 Econometric Evidence

Table 5 presents estimates of the full quadratic model using the BHPS data corresponding to

$$s = \beta_0 + \beta_1 \log(p) + \beta_2 \log(y + \gamma w) + \delta(\log(y + \gamma w))^2 + ...$$
$$\approx \beta_0 + \beta_1 \log(p) + \beta_2 \log(y) + \beta_2 \gamma \left(\frac{w}{y}\right) + \delta(\log(y))^2 + \delta\gamma^2 \left(\frac{w}{y}\right)^2 + 2\delta\gamma \log(y)\left(\frac{w}{y}\right) + ...$$

where the structural parameters are β_0, β_1, β_2, γ and δ. The own-price elasticity is given by $\frac{\beta_1}{\overline{s}} - 1$, while income elasticity is given by $\frac{\beta_2 + 2\delta.\log(y)}{\overline{s}} + 1$. The estimates suggest that the quadratic specification is a significant improvement over the simple linear specification.

Table 5: Non-linear AIDS Estimates

Pooled BHPS	All observations		Excluding households on benefits
β_0	1.198 (0.029)	1.205 (0.029)	1.212 (0.029)
β_1	0.053 (0.020)	0.050 (0.020)	0.033 (0.021)
β_2	-0.379 (0.011)	-0.379 (0.011)	-0.379 (0.012)
δ	0.031 (0.001)	0.031 (0.001)	0.031 (0.001)
γ	1.338 (0.315)	1.395 (0.314)	**1.828** (0.333)
Seasonal dummies	No	Yes	Yes
Region dummies	No	Yes	Yes
N	6799	6799	6013
$\overline{R}^2$	0.486	0.491	0.494
Own-price elasticity	-0.250	-0.293	-0.534
Income Elasticity	0.099	0.097	0.076

Notes: Standard errors in parentheses.

5. Conclusions

This paper has been concerned with analysing the impact of an ostensibly hypothecated transfer payment – a cash payment that recipients are informed is for spending on fuel expenditure. We suggested behavioural mechanisms why such ostensible hypothecation might affect fuel spending and found some empirical evidence of this in preliminary econometric analysis.

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Appendix

Table A1 Summary statistics of the variables used in the regression

	FES	BHPS (Original Sample Members Only)
s	0.069	0.066
	(0.053)	(0.047)
Log(p)	-0.255	-0.252
	(0.021)	(0.024)
Log(y)	5.128	5.100
	(0.648)	(0.556)
w/y	0.019	0.018
	(0.017)	(0.017)
Log(y)^2	26.717	26.322
	(6.761)	(5.807)
(w/y) ^2	0.00066	0.00059
	(0.00154)	(0.00143)
Log(y)*(w/y)	0.092	0.086
	(0.069)	(0.069)
Spring (April-June)	0.227	0.001
	(0.419)	(0.038)
Summer (July-Sept)	0.245	0.754
	(0.430)	(0.431)
Autumn (Oct-Dec)	0.272	0.236
	(0.445)	(0.424)
London & South East	0.253	0.258
	(0.435)	(0.438)
Wales	0.054	0.060
	(0.226)	(0.238)
Scotland	0.090	0.084
	(0.286)	(0.278)
Obs	6,799	9,222

Notes: Standard deviations in parentheses. Omitted categories are Winter (Jan-March) and rest of England.