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Nudge versus economic incentives

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Getting a healthy start? Nudge versus economic incentives

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Abstract

We compare the effects of economic incentives with a "nudge" (a policy intervention that aims to influence behaviour through changing the "choice architecture") in relation to improving dietary choices. We study a large-scale, nationally-implemented policy – the UK Healthy Start Scheme – that aimed to increase fruit and vegetable consumption. The policy combined standard economic incentives with elements of nudge, the most important of which is a potential labelling effect. We show that the scheme was successful; the estimated intention to treat effect indicates that spending on fruit and vegetables increased by 15 per cent, or roughly two-thirds of a portion per household per day. The response can be attributed entirely to the economic incentive effects; there is no evidence of any effect from the nudge aspects of the policy.

Key words: dietary choices; nudge policies; targeted benefits

JEL Classification: D12, I18

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1. Introduction

Increasing rates of obesity and diet-related disease are major challenges across the developed world, leading to growing interest amongst the policy community in how to improve dietary choices (Lancet, 2011, Gortmaker et al, 2011). One possible approach involves standard economic incentives, such as changing relative prices: taxes have been introduced on soda in many US States and Mexico; Schanzenbach (2013) proposes a price rebate for low-income recipients of the Supplemental Nutrition Assistance Programme (SNAP) if they purchase healthy foods. An alternative approach, that is getting a lot of attention in policy circles, is "nudges" or behavioural policies (Thaler and Sunstein, 2003, 2008). Unlike standard economic incentives, nudge policies do not alter individuals' choice sets, but attempt to influence behaviour through the way in which choices are made, exploiting behavioural biases. For example, whereas the standard view is that income is fungible, a behavioural view is that labelling funds can affect spending decisions. The general idea of using nudge policies is gaining ground in the heart of many governments: the UK Prime Minister's department introduced a Behavioural Insights Team and the Obama Administration has set up a similar "nudge unit" (New York Times, 2013). Dietary choices are one area where nudge policies are seen as potentially effective.[4] A number of small-scale nudge interventions showed promising results (Loewenstein et al., 2007; Downs et al., 2009; Wisdom et al., 2010), and the US government is now looking to fund a *Center for Behavioral Economics and Healthy Food Choice Research* (USDA, 2014).

In this context, it is increasingly important to understand the relative effectiveness of the two policy approaches at improving dietary choices. Our contribution in this paper is to compare directly the effects of economic incentives with those of a "nudge". We study the impact of a large-scale, nationally-implemented policy – the UK Healthy Start Scheme – that aimed to bring about widespread dietary change, with the specific intention of increasing individuals' fruit and vegetable consumption. The policy combined standard economic incentives with elements of nudge, the most important of which is a potential labelling effect. We use the fact that the two aspects of the policy affected different groups of recipients differentially to separately identify the impact of economic incentives from the impact of the nudge. We find that the policy was successful in increasing spending on fruit and vegetables by 15 per cent. We provide strong evidence that the response can be attributed entirely to the economic incentive effects; there is no evidence of an effect from the nudge aspects of the policy. Given that the policy was targeted at a low-income group, thought to be more responsive to nudges (see e.g. Banks, O'Dea and Oldfield, 2010; Abeler and Markheim, 2010; Benjamin, Brown and Shapiro, 2013), we regard this as a strong evidence against such an effect in

[4] http://www.theguardian.com/politics/2010/nov/12/david-cameron-nudge-unit

this setting.

The Healthy Start Scheme was introduced in the UK at the end of November 2006. It is a targeted benefit given to low-income households with young children. It is distributed in the form of vouchers (Healthy Start Vouchers) that can only be spent on specific healthy foods (fruit, vegetables and milk).[5] The vouchers provide economic incentives to increase spending on fruit and vegetables for a subgroup of "distorted" households, defined as those who would spend less than the value of the vouchers on fruit and vegetables if given an equivalent cash benefit. For other ("infra-marginal") households, the vouchers are equivalent to receiving cash benefits, implying an increase in spending on fruit and vegetables only in line with a standard income effect.

In addition to these economic incentive effects, the scheme had a number of nudge elements. The most important of these is the fact that the vouchers were given a prescriptive label ("*Healthy Start*"). Previous studies have suggested that labelling income affects the way it is spent, even in the absence of formal restrictions on spending (Kooreman, 2000; Thaler and Sunstein, 2008; Beatty et al, 2011; Benhassine et al., 2013). Alongside – and likely reinforcing – the potential labelling effect, health professionals (specifically community midwives) were given a pivotal gateway role in the scheme, and they provided information on the importance of a healthy diet. There is evidence that when it introduced the scheme the UK government was anticipating this type of (non-standard) effect, stating that parents would use the vouchers "for the benefit of their children as opposed to viewing the scheme simply as financial support" (Department of Health, Social Services and Public Safety, 2011).

To our knowledge, the Healthy Start Scheme is among the first large-scale policies to promote healthy eating that incorporates both economic incentives and a nudge. Our paper therefore provides a unique insight into the relative effectiveness of the two types of policy in relation to dietary choices. Our main interest is whether the effect of the reform varies across households that are distorted or infra-marginal, which we define using pre-reform levels of spending. The fact that the economic incentive effects apply only to distorted households, whilst the nudge should affect all voucher recipients, allows us to distinguish between the impacts of the two aspects of the policy. Our formal test compares the marginal propensity to consume (MPC) fruit and vegetables out of vouchers to the MPC out of regular income across distorted and infra-marginal households. Our

[5] The Scheme replaced the Welfare Food Scheme, which was introduced in 1940. The Welfare Food Scheme operated similarly to the Healthy Start Scheme, but vouchers could only be used to purchase milk. Reforms to the scheme were introduced to promote fruit and vegetable consumption, following recommendations made by the UK Committee on Medical Aspects of Food and Nutrition Policy (Department of Health, 2002) and the WHO (1990, 2003).

identification strategy is a triple differences approach. Specifically, we compare the change in behaviour (before/after the reform) for distorted and infra-marginal households among households that are eligible for the vouchers to the change in behaviour across the same groups among ineligible households. Eligibility is defined by age of children: low-income households with children aged 0-3, or where the woman is at least three months pregnant, are eligible. We use low-income households with a woman in the period before being pregnant or with children aged 4-8 as a control group of ineligible households.[6]

Figure 1 illustrates our main result. The top graph shows mean log monthly household expenditure on fruit and vegetables for distorted households, distinguishing between eligible (the solid line) and ineligible households, before and after the introduction of the scheme (represented by the vertical line). The bottom figure shows the same thing for infra-marginal households. We see similar trends in expenditure prior to the introduction of the scheme, but an increase in expenditure by eligible distorted households after the introduction, and no increase for ineligible distorted households, and no clear effects for infra-marginal households.[7] In the rest of this paper, we show that this result is robust to a large number of potentially important confounding factors.

Key to our analysis is the rich data we use. We have panel data including detailed and precise information on all food and groceries brought into the home, reducing concerns about measurement error and allowing us to identify the effect of the reform. The precise nature of the data allows us to cleanly identify purchases of products that can be purchased with the vouchers. Panel data allows us to control for unobserved heterogeneity across households. In addition, it allows us to use information on household spending prior to the introduction of the Scheme to cleanly distinguish between households that are likely to be distorted and those likely to be infra-marginal.

Our paper is closely related to an existing literature on the effect of targeted benefits (for an overview, see Currie and Ghavari, 2008). A number of papers on US Food Stamps (now called the Supplemental Nutrition Assistance Program) that are able to identify the exogenous effect of the programme find responses fully in line with standard consumer theory. Examining the initial roll out of the programme, Hoynes and Schanzenbach (2009) fail to reject that the vouchers had the same effect as cash benefits. Moffitt (1989) reaches a similar conclusion, investigating the cash out of

[6] Women become eligible to receive vouchers from week 10 of pregnancy. However, the majority of midwife appointments (where women are made aware of the Scheme) take place at 12 weeks gestation. We therefore consider pregnancy to start at 12 weeks.

[7] Whilst ineligible distorted households also show an increase in spending in the first month (December 2006), this is driven by the relatively high expenditures in December 2006 only, which drop continuously afterwards.

Food Stamps in Puerto Rico. Whitmore (2002) explores the randomized cash out of Food Stamps and finds that voucher recipients spent more on food than cash recipients, but only among the sub-group of recipients who are distorted. Cunha (2013) reaches a similar conclusion for Mexico. Our contribution to this literature is that Healthy Start Vouchers, in contrast to Food Stamps, were introduced explicitly to change dietary choices and promote healthy eating, and the scheme contained an additional nudge. There are some similarities with the recent Healthy Incentive Pilots, which trialled a 30% price subsidy for a randomly-selected sub-group of SNAP recipients and found a 25% increase in fruit and vegetables consumption (USDA 2013). In our analysis, we additionally study the potential for behavioural responses to Healthy Start Vouchers, as well as the economic incentive effects.

There is some evidence in the literature studying behavioural responses in other contexts, suggesting that they could be important. A number of studies have concluded that labelling cash benefits can increase spending on the labelled good by more than an equivalent cash transfer. For example, child benefit is more likely than cash to be spent on goods for children (Kooreman, 2000); Beatty et al. (2012) show that UK pensioners were more likely to spend their *Winter Fuel Allowance* on heating than they would an increase in income; Benhassine et al. (2013) use an RCT to study the effect of a small cash transfer in Morocco labelled as an "education support programme" and find large gains in school participation relative to a conditional cash transfer. We extend this literature by evaluating a large scale national policy that is directly related to food choice, examining whether the labelling of benefits can improve dietary choices.

Also related to our work are studies that investigate the effects of information or promotional campaigns in relation to healthy eating, which provide mixed results. For example, Bollinger, Leslie and Sorensen (2011) show that calorie posting in Starbucks decreased the average calories purchased per transaction, arguing this is due to learning and salience. Capacci and Mazzocchi (2011) find that the 5-a-day information campaign increased fruit and vegetable consumption, particularly among the lower incomes, although Stables et al. (2002) find that most of the increase in US fruit and vegetable consumption between 1991 and 1997 can be attributed to demographic changes in the US population, rather than information. Finally, a number of small-scale experiments suggest that nudging might be effective in improving individuals' dietary choices. For example, a field experiment that makes ordering healthy options in a fast-food chain slightly more convenient can reduce total calorie intake (Downs et al., 2009; Wisdom et al., 2010). Similarly, the frequency with which healthy foods are chosen increases when healthy foods: are made more visible in the school lunch room (Wansink, Just and Smith, 2011), and are first (rather than later) in line in cafeterias

(Wansink and Just, 2011). Relative to these studies, our contribution is to evaluate a large-scale, nationwide nudge policy, and to compare directly the effect of the nudge aspects of the policy with the effects of standard economic incentives.

The structure of the rest of the paper is as follows. The next section presents details of the scheme and discusses its likely effect on behaviour. Section 3 describes the data. Section 4 presents our empirical strategy and main empirical results, with further robustness tests in section 5. The final section summarises and provides some concluding discussion.

2. Healthy Start Vouchers

2.1 The scheme

The Healthy Start Scheme was rolled out nationally across the UK on 27 November 2006.[8] It provides vouchers to low-income pregnant women and households with children up to and including age three, which they can spend on plain fresh fruit and vegetables, cow's milk or infant formula. The Scheme was explicitly intended to promote healthy lifestyles by changing diets; this is in contrast to targeted food programs in the US, such as Food Stamps or the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), which primarily aim to ensure basic levels of nutrition. Under the Healthy Start Scheme, households receive weekly vouchers for each eligible household member; one for a pregnant woman and for children aged 1, 2 or 3, and two vouchers for each child in their first year. The monetary value of a Healthy Start Voucher was initially set at £2.80 ($4.70) per voucher per week, and increased to £3.00 ($5.05) in April 2008.[9] So a household with a child aged 5 months and another child aged 3 years would receive three vouchers, or the equivalent of £9.30 per week. The Healthy Start Scheme replaced the Welfare Food Scheme, which targeted the same households, but provided tokens which could only be exchanged for milk. The value of the Welfare Food Scheme was similar for one-child households at around £2.80 per week.[10] Table 1 compares the key features of the two schemes. Further information about both schemes is given in Appendix A.

Health professionals play a key gatekeeper role in the Healthy Start Scheme. In the UK, there is a comprehensive state-provided system of maternity and early years' healthcare. Every pregnant

[8] It was piloted from November 2005 in Devon and Cornwall. We drop households in the South West of England from our empirical analysis.

[9] As a comparison, the average funding available per recipient through the US Special Supplemental Nutrition Program for Women, Infants, and Children is $700 per year, compared to approximately £240 ($400) for the average family receiving Healthy Start Vouchers.

[10] Households were given tokens for seven pints of milk per week; this is worth £2.80 at a cost of approximately 40p per pint of milk in November 2006.

woman is allocated to a midwife unit in a Children's Centre, a GP surgery or hospital and will have up to ten antenatal appointments for her first child and seven appointments for subsequent children. Care continues after birth through the Healthy Child Programme, a series of regular reviews, screening tests and vaccinations led by a health visitor. The Healthy Start Scheme is administered by midwives and health visitors, and these health professionals were given a pivotal role in introducing households to the Scheme and countersigning the application form. Take-up of Healthy Start Vouchers is high, in part due to the way it was introduced through the existing healthcare system: according to official figures, 79-80% of all eligible households receive the vouchers, and 90% of the vouchers are used (Department of Health, 2009).

2.2 Effects on spending

Figure 2 illustrates the economic incentive effects of the Healthy Start Scheme. For simplicity we consider the case without the Welfare Food Scheme – we discuss below how the pre-existing scheme affects our analysis. The line A-A' represents the initial budget constraint, where the household decides between spending on fruit and vegetables and spending on other goods. The introduction of the vouchers shifts this budget constraint outwards, but also introduces a kink, since the extra income can only be spent on fruit and vegetables (the line A-B-B'). The budget constraint for an equivalent value cash benefit with no constraints on spending would be B''-B'.

Standard economic theory suggests that the effect of the vouchers on spending on fruit and vegetables is the same as cash benefits for "infra-marginal households" (represented by U_2). These are households who would spend at least the value of the vouchers on fruit and vegetables if they were given cash: their utility would shift from U_2^1 to U_2^2. By contrast, "distorted households" (represented by U_1) would spend less than the value of the vouchers on fruit and vegetables if they were given cash. For distorted households, the effect of the vouchers is to increase spending on the targeted good by more than an equivalent cash benefit would, leading them to consume at point B (Southworth, 1945). Targeted benefits impose a utility cost on distorted households relative to cash, but the effect is a larger change in spending behaviour and dietary choices.

In practice, the effect of Healthy Start Vouchers is complicated by the pre-existing Welfare Food Scheme, which provided households with tokens to spend on milk. However, the qualitative predictions of the effect of the Healthy Start Vouchers are unaffected by the presence of the previous scheme. The main reason for this is that milk can be thought of as an essential good for households with young children, and one that is consumed in relatively fixed quantities, depending on family size. We discuss this further in Appendix A, where we show that there is relatively little dispersion in the distribution of spending on milk among households with young children; we also

confirm findings in the COMA report (Department of Health, 2002) that very few households purchased the full amount of milk they were eligible to purchase with the tokens. In this case, as we discuss in Appendix A, the effect of introducing the Healthy Start Vouchers is still equivalent to an increase in income for infra-marginal households and a distortion of spending for households who would spend less on fruit and vegetables if given cash. However, the net value of Healthy Start Vouchers is less than a situation with no pre-existing scheme. In other words, when we estimate the marginal propensity to consume out of one £ of vouchers, we will underestimate the true response. We attempt to deal with this in the robustness analyses, where we estimate the 'true' value of the vouchers.

What about the nudge aspects of the policy, specifically the effect of labelling income? The precise way in which this sort of labelling might work has not been demonstrated, but the literature highlights a number of possible channels through which it might induce households to increase spending on the labelled goods by more than would be the case with cash benefits. One of these is "mental accounting" (Thaler, 1985, 1999; Currie and Gahvari, 2008), a process adopted by individuals to deal with the complexity of household budget allocation in which they allocate income and spending into separate (and non-fungible) pots of money. In this case, labelled benefits are spent differently to cash income because they are mentally allocated to specific, labelled categories. In its simplest form, this would imply that Healthy Start Vouchers would be allocated in full to *additional* spending on fruit and vegetables. An alternative channel that has been suggested is that labelling makes categories of spending more salient (Benhassine et al, 2013), or is taken as a signal for how the money should be spent (Thaler and Sunstein, 2008). Irrespective of the precise mechanism, the key is that the nudge would lead *both* distorted and infra-marginal households to spend more on the labelled goods than they would if given cash, as long as distorted and infra-marginal households do not differ on other important dimensions that are correlated with behavioural biases. We present strong evidence below that this is not the case.

There is some evidence that responding to nudges is more common amongst lower socio-economic groups, who may exert less control over their budgets or have lower levels of education and cognitive functioning (Banks, O'Dea and Oldfield, 2010; Abeler and Markheim, 2010; Benjamin, Brown and Shapiro, 2013). In our case, infra-marginal and distorted households among both eligible and ineligible households are drawn from the same low-income group on benefits; we present additional evidence that both groups are similar along a number of dimensions of their decision-making in relation to spending (in particular, the degree of planning and self-control) and their rate of time preference. We argue that there is therefore good reason to expect all recipients of Healthy

Start Vouchers to respond to the labelling effects of the scheme in the same way, if such effects exist.

The fact that we expect both distorted and infra-marginal households to respond to the nudge aspects of the policy in a similar way is key to our strategy for disentangling the economic incentive effects from any nudge effects. Specifically, we compare the spending response to the introduction of Healthy Start Vouchers to the spending response to changes in regular income across distorted and infra-marginal households (and we do the same thing across both eligible and ineligible households). If the effect of the vouchers works only though standard economic incentives, then the marginal propensity to consume fruit and vegetables out of vouchers (MPC_{HSV}) will be greater than the MPC out of regular income (MPC_{cash}) for distorted households but the MPCs will be equal for infra-marginal households. In the presence of nudge effects, however, the MPC out of vouchers will be greater than the MPC out of regular income for both groups. We take these predictions to data in our analysis below.

	Distorted households	**Infra-marginal households**
Economic incentives:	$MPC_{HSV} > MPC_{cash}$	$MPC_{HSV} = MPC_{cash}$
Nudge:	$MPC_{HSV} > MPC_{cash}$	$MPC_{HSV} > MPC_{cash}$

3. Data

We use data on all grocery purchases brought into the home, made by a rolling panel of households in the UK over the period December 2004 to November 2008, a period that runs two years prior to the introduction of the scheme (December 2004 to November 2006) and two years after the scheme was introduced (December 2006 to November 2008). The data are collected by the market research firm Kantar as part of their Worldpanel; they are similar in nature to the Nielsen Homescan data that are commonly used to study US consumer purchases (see, amongst many others, Aguiar and Hurst (2007) and in more aggregated form Berry, Levinsohn and Pakes (1995), Nevo (2001) and Dubois, Griffith and Nevo (2014)). Purchases are recorded at the individual transaction level using a handheld scanner in the home. The advantages of these data are that they are longitudinal, households typically remain in the sample for several years, and they provide very detailed data on the foods that households purchase and bring home, along with detailed demographic and attitudinal information. Standard consumer surveys, such as the Expenditure and Food Survey in the

UK or the Consumer Expenditure Survey in the US, are cross-sectional and do not record information at such a disaggregate level. In addition, the UK Expenditure and Food Survey does not record purchases made with Healthy Start Vouchers, whereas the Kantar data does. The Kantar data include rich demographic information, including the month of birth of all household members. This allows us to identify which households are eligible for vouchers based on the exact age and presence of children.

The detailed product information allows us to precisely identify which products can be purchased with the vouchers, and the transaction level data allows us to accurately identify the timing of purchases. One complicating factor is that not all households are required to scan loose items: around 20% of household-month observations only scan items that have a barcode, so they do not scan items such as loose fruit and vegetables, or meat and fish purchased over the counter. In the UK approximately 28% of all fruit and vegetable purchases consist of loose produce. We deal with this in two ways. First, all our analyses include household fixed effects, exploiting *within*-household changes in fruit and vegetables spending. As the requirement to scan loose items does not vary within a household, any differences in levels of spending are captured in the fixed effects. Second, in the robustness checks, we exclude these 20% of household-months that do not record loose fruit and vegetables from the sample, with no large differences in the results.

There are important advantages of using these data, but as with all data, there are potential concerns. Households record the data themselves, and while Kantar carries out a number of important checks, nonetheless the data might be subject to recording error. In addition, there might be concerns about selection into the sample, fatigue in reporting or attrition. These issues are considered by Oldfield and Leicester (2009) and Griffith and O'Connell (2009). They conclude that overall the data are consistent with other data sources, including industry data and government consumption surveys. A similar conclusion is reached regarding the US data by Einav, Leibtag and Nevo (2010).

One specific limitation of the data for our purposes is that we do not directly observe whether the household receives means-tested benefits (including the Vouchers), nor do we observe complete information on household income. We exploit the fact that the receipt of benefits in the UK is a function of the number of hours worked: benefits are only available to individuals who work less than 16 hours a week with a partner that is working less than 24 hours a week. The employment status of the head of household and the main shopper is recorded in the Kantar data in the following categories: not working, unemployed, in education, working less than 8 hours a week, working between 8 and 29 hours, and working 30 or more hours a week. We define households that we can

be confident are "on benefits" as those where the head (and the main shopper in couples) works less than 8 hours a week, or is unemployed. Our empirical analysis focuses on this set of households.[11] We use longitudinal data, where hours of work can vary over time. As changes in benefit status might affect household shopping behaviour, for example, due to differences in the availability of time, we only include households that are *always* on benefits. We examine the sensitivity of this restriction in the robustness analysis.

To assess how well our simple rule does in predicting which households are on benefits, we look at data from the Expenditure and Food Survey (EFS), which contains both hours worked and actual benefit receipt. We do a very good job in correctly assigning households that are in receipt of benefits. Among the households that we predict to be "on benefits" (i.e. where the head and spouse work less than 8 hours a week), 91.7% actually did receive benefits. Table B1 in Appendix B provides further details. However, some households on benefits are not captured by our definition. Using only hours worked, we identify 68.3% of all households who are actually on benefits. There are some selection effects among the households that we do capture: they are more likely to have a head who is not in work and not married. In addition, spending on milk, fruit and vegetables amongst the households that we do identify as being on benefits is lower than amongst those households that are on benefits but which we do not capture. As a robustness check, we also take a different approach and use a wider set of characteristics that are available in both the Kantar and in the EFS to predict the probability of being on benefits, and use this probability in two ways, both to define a discrete group that are on benefits and including all households and using the probability of being on benefit as a weight.

In order to identify whether any effects of the scheme come through standard economic incentive effects, as opposed to through a nudge, we distinguish distorted from infra-marginal households. We exploit the panel nature of our data and use information on households' spending on fruit, vegetables and milk prior to the introduction of Healthy Start Vouchers to identify which households are distorted and which are infra-marginal. We identify distorted households as those who spent less than the value of the vouchers on milk, fruit and vegetables *per 0-8 year old child* at any time prior to the introduction of the scheme, while infra-marginal households are those who never spent less than that amount on milk, fruit and vegetables per child. To mitigate any potential mean reversion, we only consider households who are observed at least four months prior to the reform. Using ineligible households as a control group provides an additional check for mean reversion. We

[11] In the robustness section, we also include households that are "not on benefits" as an additional control group (defined as those where at least one individual works 30 or more hours a week), thus excluding all households that work between 8 and 29 hours.

also consider the sensitivity of our results to alternative measures of distorted versus infra-marginal households.

Our full sample includes 266 households (4506 household-months) in the Kantar panel that are observed both before and after the introduction of the scheme, predicted to be on benefits, and have at least one child aged 8 or less or are pregnant at some point during the period December 2004 to November 2008. This is after dropping a small number of outliers, defined as observations in the top percentile of the expenditure and quantity distribution, households that never purchase milk, fruit or vegetables, households that spend less than £50 a month on all foods combined, or that have periods of non-recording longer than seven days. Based on the age and presence of children, 50% of the household-month observations are eligible for Healthy Start Vouchers (defined by the woman being pregnant or having young children in the house). The majority of these (67%) are eligible for one voucher; 25% are eligible for two, and 8% three or more. Based on household average spending prior to the introduction of the scheme, 62% of households are distorted, and 38% are infra-marginal.

Table 2 presents the means and standard deviations of a set of characteristics for households in our sample, which are all estimated to be on benefits. We show these separately for eligible and ineligible households (columns (1) and (2)), and for distorted and infra-marginal households (the top and bottom panels); the means and standard deviations for the full sample are given in Appendix B, Table B3.

We start with monthly spending on different foods, including fruit and vegetables. There are small differences between eligible (with young children) and ineligible households (with older children); the group of eligibles tend to spend more on fruit and vegetables, as well as on all foods together, and on fast moving consumer goods (food plus other things that are commonly purchased in supermarkets, such as toiletries and household products). Looking at household size we see that they are also slightly larger than ineligible households. In our analysis we control for household fixed effects, and therefore only identify the effects of the scheme from changes *within* households. We also account for time-varying household characteristics, including the number of adults and children in the household, and a second order polynomial in the age (in months) of the youngest and oldest child in the household. As a robustness check, we also allow the effects of these covariates on spending to change after the introduction of the scheme.

Crucially for our analysis, which relies on a triple differences approach (comparing the change before/after the introduction of the scheme in spending for distorted/infra-marginal across

eligible/ineligible groups), any differences in characteristics between eligible and ineligible households are similar for distorted and infra-marginal households. Indeed, a difference-in-difference analysis, comparing the difference between distorted eligible and ineligible households with the difference between infra-marginal eligible and ineligible households, shows no significant differences for any household characteristics.[12] As shown in Figure 1, the groups also exhibit similar pre-reform trends. Our identifying assumption is that, absent the reform, spending among distorted and infra-marginal eligible households would have evolved in the same way as spending among the same groups defined over ineligible households. Figure 1 shows trends in pre-reform spending to be similar across distorted and infra-marginal households among both eligible and ineligible groups.

One final point we take from Table 2 is that it is very infrequent for households to purchase the recommended five portions of fruit and vegetables a day, this happens in only between 0% and 6% of household-months, indicating there is sufficient scope for *all* households to increase their spending on fruit and vegetables. Over the period both before and after the introduction of Health Start Vouchers there was a widespread 5-a-day campaign in the UK, which would be likely to offset any perception among households already spending at the level of the Vouchers that they were consuming the optimally healthy level of fruit and vegetables.

Finally, exploiting the rich Kantar data, we are able to directly investigate attitudes, preferences and household decision making in relation to spending. We focus on a comparison between distorted and infra-marginal households. This allows us to address directly a possible concern that there may be differences in behavioural biases between the two groups that may lead to differences in how they respond to nudges. Table 3 presents the proportion of households who agree with a number of statements about their attitudes, preferences and behaviours. We order these by the *p*-value indicating whether the proportion agreeing with each statement is significantly different across the two groups (distorted and infra-marginal). We expect the two groups to be very similar, as they are both drawn from a group of low-income households on benefits with children, and the evidence supports this. There is no evidence that one group exhibits systematically greater behavioural bias than the other.

4. Empirical strategy and main results

Our main interest in this paper is in disentangling whether the response to Healthy Start Vouchers is driven by a change in economic incentives, or whether the prescriptive labelling of the income (the "nudge") also played a role. Our identification strategy is a triple differences approach. Comparing

[12] Including characteristics not shown here, such as marital status, social class, and the region where the household lives (available upon request).

the change in spending before and after the introduction of the scheme across eligible and ineligible households would allow us to identify the overall effect of the policy; we specifically identify the mechanism through which the policy affected spending by additionally comparing responses across distorted and infra-marginal households. Our analysis is based on a sample of households who are all on benefits, and observed both before and after the reform.

Motivated by the discussion in section 2, our formal test of the mechanisms is based on comparing marginal propensities to consume out of income and vouchers. However, we start with a simpler "treatment effect" specification that tests for differences in the overall effect of the reform across distorted and infra-marginal households:

$$ln(FV_{ht}) = \beta_0 + \beta_1 Post_t + (\beta_2 + \beta_3 Post_t)E_{ht}^D + (\beta_4 + \beta_5 Post_t)E_{ht}^{IM} + \delta \mathbf{X}_{ht} + \phi_h + \tau_t + e_{ht} \quad (1)$$

where $ln(FV_{ht})$ is the logarithm of expenditure on fruit and vegetables for household h in month t. $Post_t$ is a binary indicator for months after November 2006, when the scheme was introduced. E_{ht} is a binary indicator for whether the household is eligible for Healthy Start Vouchers, based on the age of children in the household. Interacting $Post_t$ and E_{ht} captures the overall effect of the reform. We allow this to vary by whether households are distorted (D) or infra-marginal (IM), denoted by the superscript; we also report the pooled estimate. The vector $\mathbf{X}_{ht}$ includes other time-varying household-level covariates, including a full set of fixed effects for the number of children and number of adults in the family to control for varying food needs across households (Currie, 2003). We also control flexibly for the age of the youngest and the oldest child (in months). Household fixed effects ϕ_h control for time invariant differences in preferences across households, and year and month effects, τ_t, pick up common annual and seasonal fluctuations in spending. e_{ht} is an idiosyncratic error, clustered by household. The coefficients β_3 and β_5 are our parameters of interest, capturing the effect of the reform for distorted and infra-marginal households respectively.

The results are presented in Table 4. Column (1) reports the coefficient from the pooled specification, showing that the reform led to a significant and sizeable 15.5% increase in spending on fruit and vegetables among eligible households compared to the ineligible control group. Column (4) shows that there was a corresponding increase in the *quantity* of fruit and vegetables purchased, equivalent to 1.84kg per month or over two-thirds of a portion per household per day. Columns (2) and (5) show that the aggregate effects on spending and quantity purchased were driven entirely by distorted households who increased their spending by 23.2% (equivalent to more than one portion per household per day), while there was no (statistically significant) increase in spending among infra-marginal households. The difference between the coefficients for distorted and infra-marginal households is statistically significant (*p<0.001*).

Our formal test of economic incentives versus nudge follows Moffitt (1989) and Hoynes and Schanzenbach (2009). Specifically, we test for equality of responses to vouchers and cash income separately for distorted and infra-marginal households, using the following specification:

$$ln(FV_{ht}) = \alpha + \beta_1 Post_t + (\beta_2 + \beta_3 Post_t)E_{ht}^{D} Value_{ht} + (\beta_4 + \beta_5 Post_t)E_{ht}^{IM} Value_{ht} + \theta^{D} E_{ht}^{D} Y_{ht} + \theta^{IM} E_{ht}^{IM} Y_{ht} + \delta \mathbf{X}_{ht} + \phi_h + \tau_t + e_{ht} \quad (2)$$

where $Value_{ht}$ denotes the value of the Healthy Start Vouchers (in £) that the family is eligible for, which we interact with indicators for distorted (D) and infra-marginal (IM) households, denoted by the superscript, and with a post-reform indicator. We also allow spending to depend on income (Y_{ht}), measured in £s and proxied by total spending on fast moving consumer goods. The marginal propensity to consume fruit and vegetables out of cash is the derivative of $ln(FV_{ht})$ with respect to Y_{ht}. We allow this to differ across distorted and infra-marginal households, and present a number of sensitivity checks allowing more flexibility in the way that Y_{ht} enters in the robustness analysis below.

Since we proxy income by total grocery spending, it includes the value of the vouchers. The parameters β_3 and β_5 therefore capture the difference in the MPC out of vouchers compared to cash for distorted and infra-marginal households respectively. We expect $\beta_3 > 0$, since both the economic incentives and the nudge would cause distorted households to spend more out of vouchers than they would out of cash: i.e. $MPC_{HSV} > MPC_{cash}$. Among infra-marginal households, the economic incentive effects would cause them to spend the vouchers in the same way as cash, i.e. $MPC_{HSV} = MPC_{cash}$, implying $\beta_5 = 0$, while the nudge would cause them to spend the vouchers differently, i.e. $MPC_{HSV} > MPC_{cash}$, implying $\beta_5 > 0$.

The results are presented in Table 4, column (3). The parameter β_3 is positive and statistically significant implying that, for distorted households, there is an additional increase in fruit and vegetable expenditures of 0.7% per £1 of vouchers (compared to £1 cash income). By contrast, β_5 is not significantly different from zero, implying that infra-marginal households treat the vouchers in the same way as cash. The *p*-value shows that the effects for distorted and infra-marginal households are significantly different (*p=0.024*).

The results for the quantity consumed (in kg) are presented in columns (4) to (6), the magnitude of which is consistent with the results on expenditures. With an average spending on fruit and vegetables for eligible distorted households of £15.45 per month (see Table 2), the increase in fruit and vegetable spending of 0.7% per £1 of vouchers is equivalent to approximately £0.11 per £1. On average, families purchase around 1kg of fruit and vegetables per £1 (see Table 2 and Table B3),

suggesting that the increase in the quantity of fruit and vegetables purchased per £1 of voucher is approximately 100g; similar to our estimate in column (6).

These results are in line with economic incentive effects and are not consistent with there being any nudge effect, since we strongly expect both distorted and infra-marginal households to respond positively to the nudge. In the next section we confirm the robustness of these findings.

5. Robustness

In this section we carry out a number of robustness checks. These address the common trends assumption underlying the triple differences strategy, the functional form specification, the definition of distorted and infra-marginal households, the sample of households used and the definition of benefit receipt. We start by examining a number of placebo tests, looking at cases where we do not expect to find any effect of the scheme (a pseudo reform and estimates of the effect of the reform on fruit juice and frozen fruit and vegetables which were not covered by the vouchers). We then test and discuss the robustness of our main result to alternative specifications.

5.1 Placebo tests

We test the robustness of our common trends assumption through a number of placebo tests. A particular concern might be whether our results are driven by mean reversion, since we define distorted and infra-marginal households by their pre-reform levels of spending. We already deal with this in a number of ways. First, we select only households that are observed for at least four months prior to the reform. Second, our triple differences strategy would imply that mean reversion would apply differentially across eligible and ineligible households. Here, we run additional tests. First, we look at a pseudo reform introduced in November 2005 (one year prior to the true start of the scheme) and restrict the data to December 2004 to November 2006. We define distorted and infra-marginal households in the same way as before, but based on their spending prior to November 2005. Columns (1) and (2) of Table 5 show that neither distorted nor infra-marginal households respond to this pseudo reform, suggesting that trends were similar before hand. Although there is a negative MPC out of vouchers for distorted households (column (2)), we do not see this for the overall effect shown in column (1).

Second, we analyse the effects of the Healthy Start Scheme on similar foods that were not allowed to be purchased with the vouchers. Columns (4) to (6) of Table 5 present the effects on spending on fruit juice and on frozen fruit and vegetables respectively, showing no significant responses among either distorted or infra-marginal households.

5.2 Functional form

We test our functional form specification using the same sample and variables of interest as above. Estimation of the marginal propensity to consume out of cash depends on how income is included in the regression. Although both distorted and infra-marginal groups are low-income households on benefits, Table 2 shows that the level of spending among the infra-marginal group is higher than among the distorted group. Our main specification controls linearly for income, but we test the robustness to alternative specifications.

Column (1) in Table 6 replicates our main result (column (3) in Table 4) for comparison. Column (2) includes a separate quadratic polynomial in income for distorted and infra-marginal households. Column (3) uses total *food* spending as the proxy for income, and column (4) instruments this with total spending on fast-moving consumer goods. Column (5) constrains the marginal propensity to consume out of income to be the same across distorted and infra-marginal households. Finally, column (6) allows the effects of time-varying covariates (number of adults and children in the household, and a quadratic polynomial in age of the youngest and oldest child) to change after the introduction of the scheme. The results are robust across the different specifications.

5.3 Distorted/ infra-marginal households

Our main specification splits the sample according to whether households spent less than £12.86 a month *per child* at any time prior to the introduction of the policy (distorted households) and those who never spent less than £12.86 a month per child (infra-marginal households). As a robustness check, we define distorted (infra-marginal) households as those who (never) spent less than £12.86 *per voucher*. The results are presented in column (1) of Table 7, showing similar results to those above.

One possible interpretation of the nudge might be that the value of the Vouchers provides a benchmark level of spending on fruit and vegetables – which would then differentially affect spending among distorted and infra-marginal households. We believe we can rule out that the reasons that infra-marginal households do not respond is because they already purchase very high levels of fruit and vegetables. The WHO recommends individuals to consume at least five portions of fruit and vegetables a day and there was a widespread 5-a-day campaign in the UK from 2004. Table 2 shows that the vast majority of households (including infra-marginals) buy fewer than this. In additional robustness analysis (not shown here), we drop households who, at any point, purchase five or more daily portions of fruit and vegetables per person. Although the estimate for distorted households remains unchanged, the estimate for infra-marginal households becomes negative. The

direction of this change is inconsistent with an explanation that the vouchers create a norm, since the largest reduction would be exactly among the group who consume the most fruit and vegetables to start with. We also think it is unlikely that households would have seen the vouchers as a signal to reduce their spending on fruit and vegetables, since the widespread 5-a-day campaign would have made it clear that households should have been consuming considerably above their current level.[13]

5.4 Loose fruit and vegetables

As discussed in Section 3, approximately 20% of our sample do not scan items without a barcode, such as loose fruit and vegetables, meat and fish purchased over the counter. We re-run our analyses using the sample of households that do scan loose items. This is presented in column (2) of Table 7, showing very similar estimates to those obtained in the full sample.

5.5 Estimating the 'true' value of the vouchers

Due to the pre-existing Welfare Food Scheme that provided households with milk tokens, the net value of Healthy Start Vouchers is less than a situation without the pre-existing scheme. This implies that our estimates of the MPC out of vouchers are likely to *underestimate* the true response. We argue that households consume milk in relatively fixed quantities, depending on the household size. Assuming that milk is separable from other food spending, conditional on household size, we can therefore approximate the value of the voucher for fruit and vegetables *net* of what households spend on milk, more precisely estimating the marginal propensity to consume fruit and vegetables out of vouchers. We do this by subtracting households' milk spending from the total value of the vouchers they are eligible for, and comparing the MPC out of vouchers to that out of income using this new definition.

Column (3) in Table 7 presents the results, showing larger estimates than those above: distorted households additionally increase their fruit and vegetable expenditures by 1.1% per £ of vouchers (compared to a £ of cash income). Consistent with the above, we find that infra-marginal households do not respond differently to vouchers compared to cash.

5.6 Benefit recipients

Finally, we explore the robustness of our analysis to different ways of defining benefit receipt. Our main specification uses hours worked, and includes only households *always* on benefits. First, we

[13] The '5-a-day' campaign does not count potatoes as a vegetable, whereas the Healthy Start Scheme allows households to spend their vouchers on plain fresh potatoes. Our results (available upon request) show that the increase in spending is driven by an increase in spending on vegetables more generally, rather than simply by an increase in spending on potatoes.

explore whether our results are robust to the use of a different sample, also including households whose benefit status changes over time. Column (4) still restricts the sample to benefit recipients, but also includes households who may have changed benefit status over time. Second, we specify an alternative definition of benefit receipt. Although our definition of benefit receipt based on hours worked does a good job at capturing households who are truly on benefits, we omit some household who are on benefits. To consider whether this is important we also use a wider set of characteristics available in both the Kantar data and in the Expenditure and Food Survey (EFS) to predict benefit receipt in the EFS (see Appendix B, and Table B2). We apply the estimated coefficients from the EFS to the Kantar data to create a predicted probability of benefit receipt. We define households as being on benefits when their predicted probability exceeds 0.7.

This approach also does a good job at capturing those who truly receive benefits: the EFS data shows that, among those defined as being on benefits (i.e. having a probability of benefit receipt that exceeds 0.7), 92% actually receive benefits (not shown here, but available upon request). Using this different sample of benefit recipients, we estimate the effect of the Healthy Start Scheme on fruit and vegetable consumption. The results are presented in column (5) of Table 7. Finally, column (6) uses the full sample of households with children aged 0-8, specifying the probability of benefit receipt, as predicted from the EFS estimates, as weights in the analysis (Arellano and Meghir (1992)).

Our results are robust to these alternative specifications. We therefore believe that our results provide strong evidence that the effects of the reform operated through distorted households, not infra-marginal households, consistent with the underlying economic incentives in the policy and not with any nudge.

6. Summary and discussion

Our analysis of the Healthy Start Scheme makes two substantive contributions to the ongoing debate about how to bring about improvements in dietary choices. First, we identify that targeted benefits are effective in increasing purchases of fruit and vegetables. Second, we present plausible evidence that the scheme worked through economic incentives rather than through a "nudge". We discuss each of these findings in turn.

Our estimates indicate that the Healthy Start Scheme has increased spending on fruit and vegetables by around 1.8 kg per household per month, equivalent to two-thirds of a portion per household per day. Among distorted households the increase has been more than one portion per day. Given low levels of spending prior to the reform, the scheme has made a sizeable contribution to households moving closer to five a day, although it has not been enough to ensure that all households receiving

the Vouchers meet that target.

Our estimate of the effect of the reform is an intention to treat effect, since we look at eligible and ineligible households, rather than actual voucher recipients. The advantage of this approach is that eligibility is solely determined by the (exogenous) age of children in the household, implying that our estimate is not upwardly biased by households selecting into the scheme. If anything, we are likely to underestimate the true effect of the scheme, since (i) the net value of the voucher is less than what we observe due to the pre-existing Welfare Food Scheme, (ii) approximately 80% of eligible households receive the vouchers, and (iii) we estimate that approximately 8% of the group we define as being "on benefits" may not truly receive benefits.

Our finding of no response to the nudge aspects of the Scheme is relevant to the increasing interest in this type of behavioural policy. One of the potential attractions of nudge to policymakers in this case is that, if it worked, it could have broadened the policy's effects and achieved the desired outcomes more cheaply than the standard economic incentive effects of targeted benefits. In the absence of any nudge, the value of the vouchers given to infra-marginal households may be seen by some as a deadweight cost, since it does very little towards the goal of improving dietary choices - a significant cost given that around one-third of all households are infra-marginal in our analysis.

The question remains as to why there was no nudge effect in this situation. A number of small-scale studies have demonstrated positive impacts from nudges (primarily via the positioning of healthy options in menus and/or canteens). Compared to these interventions, however, labelling benefits is attractive as it is scalable and easy (and cheap) for a government to implement on a national scale. Two studies have shown that labelling can have real effects on behaviour in different circumstances - in relation to education in developing countries (Benhassine et al, 2013) and spending on heating by UK pensioners (Beatty et al, 2012). Our study suggests there may be limits to its effectiveness. One possibility is that dietary preferences are deeply ingrained and simply hard to shift. However, our results indicate that more work is needed to understand when and why this kind of labelling can change dietary choices. Until then, economic incentives are likely to provide policy-makers with a more proven and powerful tool for encouraging healthy eating; the focus should be on how to design the most cost-effective standard economic incentives to encourage healthy eating, as well as in how to design effective nudge policies.

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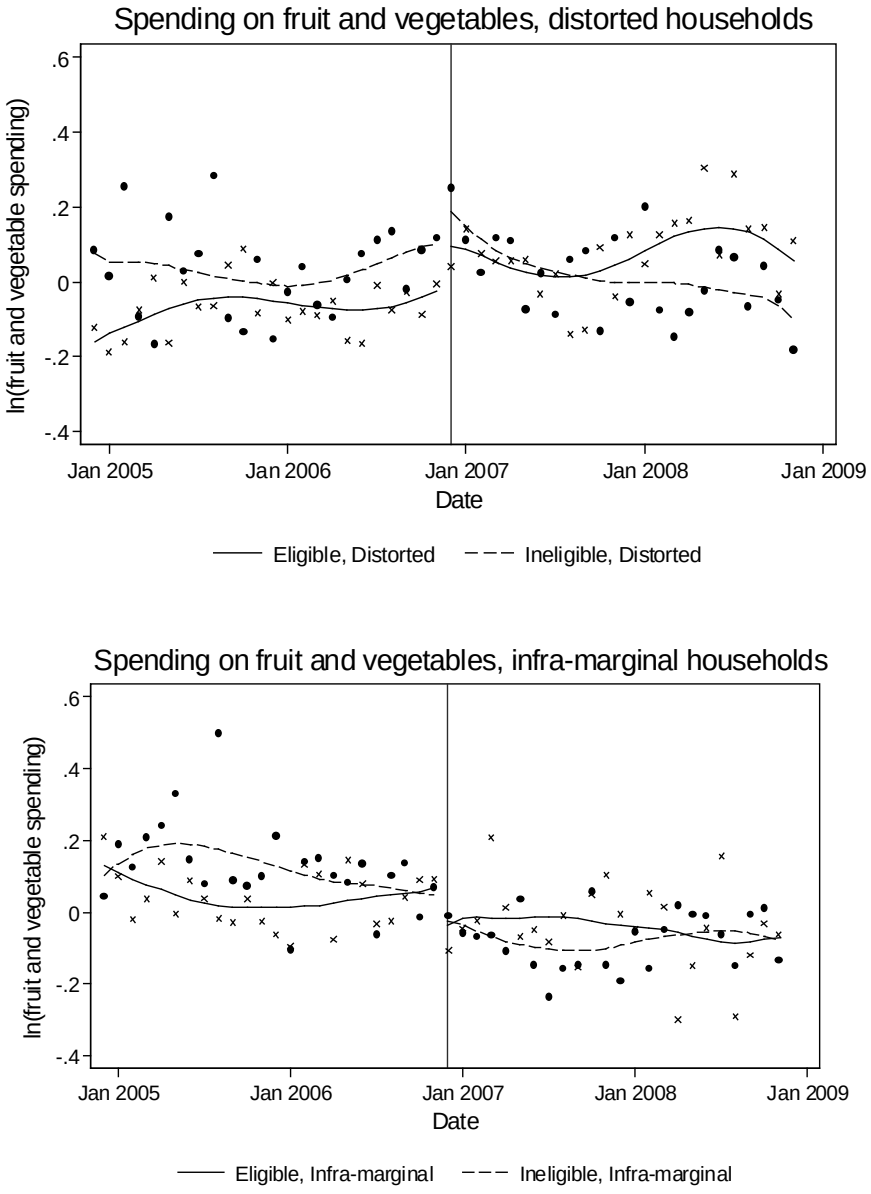
Figure 1: Expenditures on fruit and vegetables among distorted and infra-marginal, eligible and ineligible households



Note: Each symbol represents mean spending on fruit and vegetables in that year-month across households, conditional on household mean levels. The lines are added for ease of legibility, obtained from locally weighted regressions. The vertical line indicates when the scheme was introduced. Eligible households, indicated by x *and the solid line, are those with children aged 0-3 or where the woman is at least 3 months pregnant; ineligible households, indicated by solid dots and dashed line, are those with children aged 4-8, and those where the woman is not yet pregnant, but will become pregnant (and therefore eligible) during our observation period. Households who prior to the reform spent less than £12.86 per child on milk, fruit and vegetables are defined as distorted; those never spending less than £12.86 per child are defined as infra-marginal. We observe 1591 and 683 household-months for distorted and infra-marginal eligible households respectively; and 1428 and 804 household-months for distorted and infra-marginal ineligible households.*

Figure 2: Effect of targeted benefits

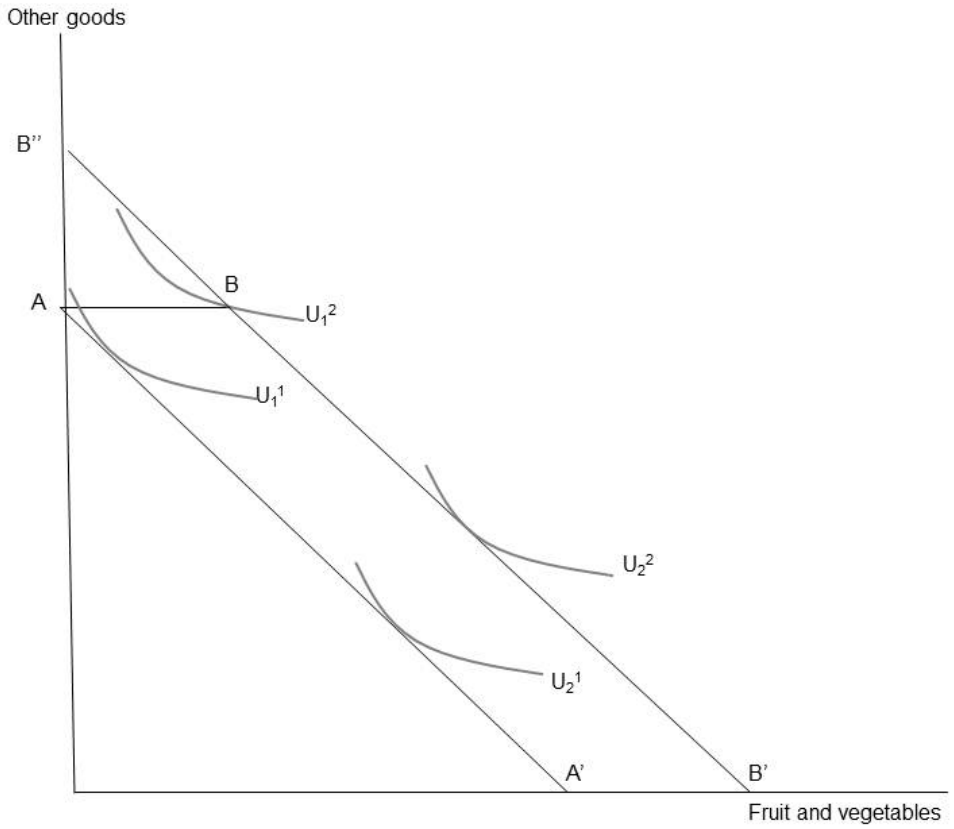


Table 1: Comparison of the Welfare Food Scheme and the Healthy Start Scheme

	Welfare Food Scheme	Healthy Start Scheme
Families on benefits receive:	One voucher per family with children aged ≤ 4	One voucher per pregnant woman, one voucher per child aged ≤ 3 (two vouchers per infant aged 0-1)
The value per voucher:	Approximately £2.80 *	£2.80 from 27 November 2006 £3.00 from 6 April 2008
Vouchers can be spent on:	7 pints of cows' milk (or 900g of formula for infants aged 0-1)	Milk, plain fresh fruit and vegetables

Notes: Both schemes apply to households who receive Income Support, Income-based Jobseeker's Allowance, or Child Tax Credit with an income below a certain year-specific threshold (£13,230 in 2003/04, £13,480 in 2004/05, £13,910 in 2005/06, £14,155 in 2006/07, £14,495 in 2007/08, £15,575 in 2008/09).
** The value of a voucher during the Welfare Food Scheme depends on the price of milk, as each voucher was exchangeable for 7 pints of cow's milk. In 2006, the price of a pint of cow's milk was approximately 40p, so 7 pints is equal to approximately £2.80.*

Table 2: Means and standard deviations of the Kantar data, by eligibility

	(1) Eligible		(2) Ineligible		(3)	(4)
	Mean	SD	Mean	SD	Diff	p-value
Distorted						
Total spending (£): fruit & vegetables	15.45	(9.7)	13.20	(10.2)	2.25	<0.01
Total quantity (kg): fruit & vegetables	15.84	(9.1)	12.99	(9.0)	2.85	<0.01
Portions of fruit and vegetables per person/day	1.67	(0.9)	1.56	(1.0)	0.11	<0.01
Proportion purchasing ≥5 portions per person/day	0.01	(0.1)	0.00	(0.1)	0.00	0.32
Total spending: all foods	180.86	(65.3)	171.47	(67.6)	9.38	<0.01
Total spending: fast moving consumer goods	39.55	(22.3)	35.19	(21.8)	4.36	<0.01
Household size	4.07	(0.9)	3.56	(1.0)	0.51	<0.01
≥3 months pregnant	0.09	(0.2)	-	-	-	N/A
No. of 0 year olds	0.20	(0.4)	-	-	-	N/A
No. of 1-3 year olds	0.93	(0.5)	-	-	-	N/A
No. of 4 year olds	0.15	(0.3)	0.29	(0.4)	-0.14	<0.01
No. of 5-18 year olds	1.11	(1.0)	1.69	(0.9)	-0.58	<0.01
No. of adults	1.91	(0.5)	1.69	(0.6)	0.22	<0.01
Number of household-month observations	1591		1428			
Infra-marginal						
Total spending: fruit & vegetables	26.63	(12.2)	22.56	(12.3)	4.07	<0.01
Total quantity (kg): fruit & vegetables	23.23	(9.5)	20.57	(10.1)	2.66	<0.01
Portions of fruit and vegetables per person/day	2.69	(1.2)	2.73	(1.5)	-0.04	0.57
Proportion purchasing ≥5 portions per person/day	0.03	(0.2)	0.06	(0.2)	-0.03	<0.01
Total spending: all foods	210.71	(62.3)	203.93	(71.4)	6.78	0.05
Total spending: fast moving consumer goods	51.27	(30.2)	42.72	(24.9)	8.55	<0.01
Household size	3.68	(0.9)	3.28	(1.0)	0.40	<0.01
≥3 months pregnant	0.14	(0.3)	-	-	-	N/A
No. of 0 year olds	0.24	(0.4)	-	-	-	N/A
No. of 1-3 year olds	0.80	(0.5)	-	-	-	N/A
No. of 4 year olds	0.08	(0.2)	0.25	(0.4)	-0.17	<0.01
No. of 5-18 year olds	0.61	(0.8)	1.32	(0.9)	-0.71	<0.01
No. of adults	2.02	(0.6)	1.84	(0.6)	0.19	<0.01
Number of household-month observations	683		804			

Note: Eligible households are those ≥3 months pregnant, or with a child aged 0-3; Ineligible households are those with children aged 4-8, or not yet pregnant. Households who (at any point prior to the reform) spent less than £12.86 per child on milk, fruit and vegetables are defined as distorted; those never spending less than £12.86 per child are defined as infra-marginal. A portion of fruit and vegetables is defined as 80g. Other covariates, including marital status, social class, and the region where the household lives are not significantly different across distorted and infra-marginal consumers (not shown here, but available upon request).

Table 3: Differences in behavioural characteristics of distorted versus infra-marginal households

	Distorted		Infra-marginal		
	Mean	Std. dev.	Mean	Std. dev.	p-value
I Often Buy Foods Because I've Seen Them Advertised	0.533	(0.500)	0.414	(0.495)	0.061
I Regularly Buy National Lottery Tickets	0.194	(0.397)	0.293	(0.457)	0.075
I Decide Which Brands To Buy Before I Go Shopping	0.230	(0.422)	0.333	(0.474)	0.077
I Make Sure I Eat Well-Balanced Meals	0.315	(0.466)	0.424	(0.497)	0.079
Once I Find A Brand I Like I Tend To Stick To It	0.673	(0.471)	0.566	(0.498)	0.086
I Like To Spend As Little Time As Possible Food Shopping	0.212	(0.410)	0.141	(0.350)	0.138
I Tend To Consider Various Brands On The Shelf Before Making My Choice	0.594	(0.493)	0.515	(0.502)	0.215
I Often Buy Things Just Because I See Them On The Shelf	0.648	(0.479)	0.586	(0.495)	0.315
I Like To Enjoy Life And Don't Worry About The Future	0.545	(0.499)	0.606	(0.491)	0.336
I'm Prepared To Pay More For Products That Make Life Easier	0.176	(0.382)	0.222	(0.418)	0.368
I try to lead a healthy lifestyle	0.448	(0.499)	0.505	(0.503)	0.376
I Try To Buy a Healthy Range Of Foods These Days	0.370	(0.484)	0.424	(0.497)	0.384
I Like To Plan For The Future	0.255	(0.437)	0.303	(0.462)	0.401
I Tend To Eat When I Am Bored	0.394	(0.490)	0.354	(0.480)	0.512
I Spend More Money In The Supermarket Than I Intend To	0.255	(0.437)	0.222	(0.418)	0.550
I Make A Shopping List Before I Go Out And Stick To It	0.182	(0.387)	0.212	(0.411)	0.554
I Use Money Off Coupons Whenever I Get The Chance	0.442	(0.498)	0.414	(0.495)	0.654
I Always Compare Prices Between Different Brands Before Choosing	0.473	(0.501)	0.444	(0.499)	0.657
I Work To A Strict Budget When I'm Buying Groceries	0.533	(0.500)	0.505	(0.503)	0.658
I Tend To Spend Money Without Thinking	0.224	(0.418)	0.232	(0.424)	0.880
When My Favourite Brands Go On Offer I Stock Up On Them	0.339	(0.475)	0.333	(0.474)	0.920
Number of households	165		99		

Note: The response to each statement is 1 "agree strongly", 2 "agree", 3 "neither", 4 "disagree", or 5 "disagree strongly". The table shows the means and standard deviations of the proportion of households in the sample that agree or strongly agree, distinguishing between distorted and infra-marginal households. Households who (at any point prior to the reform) spent less than £12.86 per child on milk, fruit and vegetables are defined as distorted; those never spending less than £12.86 per child are defined as infra-marginal. The p-value comes from a t-test that the mean for distorted equals the mean for infra-marginal household. We do not observe these behavioural characteristics for 2 households in our sample.

Table 4: The effect of Healthy Start Vouchers

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	ln(fruit and vegetable expenditure)			fruit and vegetable quantity (in kg)		
$E_{ht} \times Post_{ht}$	0.155***			1.838***		
	(0.047)			(0.690)		
$E_{ht}^{D} \times Post_{ht}$: Distorted		0.232***			2.629***	
		(0.050)			(0.715)	
$E_{ht}^{IM} \times Post_{ht}$: Infra-marginal		-0.025			-0.050	
		(0.065)			(1.090)	
E_{ht}	-0.126**			-1.952***		
	(0.055)			(0.739)		
E_{ht}^{D}: Distorted		-0.207***			-2.982***	
		(0.068)			(0.854)	
E_{ht}^{IM}: Infra-marginal		0.040			0.149	
		(0.069)			(0.973)	
$Value_{ht}$ (£) $\times Post_{ht} \times E_{ht}^{D}$ (β_3): Distorted			0.007***			0.093***
			(0.002)			(0.030)
$Value_{ht}$ (£) $\times Post_{ht} \times E_{ht}^{IM}$ (β_5): Infra-marginal			0.001			0.029
			(0.002)			(0.044)
$E_{ht}^{D} Y_{ht}$:Total grocery spending, Distorted			0.004***			0.051***
			(0.000)			(0.003)
$E_{ht}^{IM} Y_{ht}$: Total grocery spending, Infra-marginal			0.003***			0.046***
			(0.000)			(0.007)
p-value: $E_{ht}^{D} \times Post_{ht} = E_{ht}^{IM} \times Post_{ht}$		<0.001			0.015	
p-value: $\beta_3 = \beta_5$			0.024			0.176

*Notes: Sample includes 4506 observations on 266 households between December 2004 - November 2008. All columns include household, month and year fixed effects, age and age squared of youngest and oldest child (in months), dummies for whether household includes: 2 adults, 3+ adults, 1 child, 2 children, 3 children, 4+ children, and a dummy indicating whether the household did not buy any fruit and vegetables that month. E_{ht} equals 1 for households with a child aged 0-3 or where the woman is ≥3 months pregnant. $Post_{ht}$ equals 1 for the period December 2006 onwards. "D" indicates distorted households, "IM" indicates infra-marginal households. Total grocery spending is spending on food and fast moving consumer goods. Robust standard errors in parentheses, clustered by household. * p<0.10, ** p<0.05, *** p<0.01.*

Table 5: The effect of Healthy Start Vouchers: robustness I

	(1)	(2)	(3)	(4)	(5)	(6)
	Placebo: Dec04 – Nov06		*Full sample*: Dec04 – Nov08		*Full sample*: Dec04 – Nov08	
Dependent variable:	ln(fruit and vegetable expenditure)		ln(fruit juice expenditure)		ln(frozen fruit and vegetable expenditure)	
$E_{ht}^{D} \times Post_{ht}$: Distorted	-0.037		0.126		0.179	
	(0.087)		(0.253)		(0.287)	
$E_{ht}^{IM} \times Post_{ht}$: Infra-marginal	-0.065		0.051		-0.117	
	(0.091)		(0.376)		(0.467)	
E_{ht}^{D}: Distorted	-0.243**		-0.263		-0.164	
	(0.115)		(0.268)		(0.404)	
E_{ht}^{IM}: Infra-marginal	0.022		-0.224		-0.878*	
	(0.091)		(0.275)		(0.491)	
$Value_{ht}$ (£) $\times Post_{ht} \times E_{ht}^{D}$ (β_3): Distorted		-0.009**		-0.002		-0.008
		(0.004)		(0.013)		(0.014)
$Value_{ht}$ (£) $\times Post_{ht} \times E_{ht}^{IM}$ (β_5): Infra-marginal		-0.004		-0.007		-0.009
		(0.005)		(0.019)		(0.031)
$E_{ht}^{D} Y_{ht}$:Total grocery spending, Distorted		0.005***		0.007***		0.019***
		(0.000)		(0.001)		(0.001)
$E_{ht}^{IM} Y_{ht}$: Total grocery spending, Infra-marginal		0.002***		0.006***		0.018***
		(0.000)		(0.001)		(0.002)
p-value: $E_{ht}^{D} \times Post_{ht} = E_{ht}^{IM} \times Post_{ht}$	0.693		0.851		0.572	
p-value: $\beta_3 = \beta_5$		0.153		0.803		0.968
No. of households	224	224	266	266	266	266
No. of household-months	2232	2232	4506	4506	4506	4506

*Notes: All columns include household, month and year fixed effects, age and age squared of youngest and oldest child (in months), dummies for whether household includes: 2 adults, 3+ adults, 1 child, 2 children, 3 children, 4+ children, and a dummy indicating whether the household did not buy any fruit and vegetables that month. E_{ht} equals 1 for households with a child aged 0-3 or where the woman is ≥3 months pregnant. $Post_{ht}$ equals 1 for the period December 2006 onwards. "D" indicates distorted households, "IM" indicates infra-marginal households. Total grocery spending is spending on food and fast moving consumer goods. Robust standard errors in parentheses, clustered by household. * p<0.10, ** p<0.05, *** p<0.01. The placebo test in columns (1) and (2) defines the introduction of the scheme as November 2005.*

Table 6: The effect of Healthy Start Vouchers: robustness II

	(1)	(2)	(3)	(4)	(5)	(6)
	Main specification	Quadratic in spending	Using food spending	Instrumenting food spending	MPC_{cash} same for D&IM	Include $Post_{ht} \times \mathbf{X}_{ht}$
Dependent variable: ln(fruit and vegetable expenditure)						
$Value_{ht}$ (£) $\times Post_{ht} \times E_{ht}^{D}$ (β_3): Distorted	0.007***	0.007***	0.007***	0.007***	0.008***	0.005*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
$Value_{ht}$ (£) $\times Post_{ht} \times E_{ht}^{IM}$ (β_5): Infra-marginal	0.001	0.002	0.001	0.001	0.000	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
$E_{ht}^{D} Y_{ht}$:Total grocery spending, Distorted	0.004***	0.009***				0.004***
	(0.000)	(0.001)				(0.000)
$E_{ht}^{D} Y_{ht}^{2}$:Total grocery spending, Distorted		-0.000***				
		(0.000)				
$E_{ht}^{IM} Y_{ht}$:Total grocery spending, infra-marginal	0.003***	0.008***				0.003***
	(0.000)	(0.001)				(0.000)
$E_{ht}^{IM} Y_{ht}^{2}$:Total grocery spending, infra-marginal		-0.000***				
		(0.000)				
Y_{ht}: Total grocery spending					0.004***	
					(0.000)	
$E_{ht}^{D} Y_{ht}$:Total grocery spending, Distorted			0.006***	0.005***		
			(0.000)	(0.001)		
$E_{ht}^{IM} Y_{ht}$: Total grocery spending, Infra-marginal			0.004***	0.004***		
			(0.000)	(0.001)		
Kleibergen-Paap rk *F*-statistic				45.07		
p-value: $\beta_3 = \beta_5$	0.024	0.040	0.053	0.029	0.011	0.012

*Notes: Sample includes 4506 observations on 266 households between Dec '04 - Nov '08. All columns include household, month and year fixed effects, age and age squared of youngest and oldest child (in months), dummies for whether household includes: 2 adults, 3+ adults, 1 child, 2 children, 3 children, 4+ children, and a dummy indicating whether the household did not buy any fruit and vegetables that month. E_{ht} equals 1 for households with a child aged 0-3 or where the woman is ≥3 months pregnant. $Post_{ht}$ equals 1 for the period December 2006 onwards. "D" indicates distorted households, "IM" indicates infra-marginal households. Total grocery spending is spending on food and fast moving consumer goods. Robust standard errors in parentheses, clustered by household. * p<0.10, ** p<0.05, *** p<0.01. Column 1 and 2 control for a first and second order polynomial in total spending. Column 3 controls for total food spending, and column 4 instruments this with total spending on fast moving consumer goods. The Kleibergen-Paap rk F-statistic shows the strength of the first stage. Column 5 constrains the MPC out of income to be the same across distorted and infra-marginal households. Column 6 allows the effects of the time-*

varying covariates to change after the introduction of the scheme.

Table 7: The effect of Healthy Start Vouchers: robustness III

	(1)	(2)	(3)	(4)	(5)	(6)
	Alternative definition of D and IM	Drop hhs not recording loose F&V	$Value_{ht}$ minus milk spending	Include those on benefits at any point	Benefits defined as Pr(ben)>0.7	Benefit probability used as weights
Dependent variable: ln(fruit and vegetable expenditure)						
$Value_{ht}$ (£) × $Post_{ht}$ × E_{ht}^{D} (β_3): Distorted	0.007***	0.008***	0.011***	0.005***	0.006**	0.006***
	(0.002)	(0.003)	(0.003)	(0.02)	(0.002)	(0.002)
$Value_{ht}$ (£) × $Post_{ht}$ × E_{ht}^{IM} (β_5): Infra-marginal	-0.001	0.002	0.002	-0.000	-0.000	-0.001
	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)
$E_{ht}^{D}Y_{ht}$:Total grocery spending, Distorted	0.004***	0.004***	0.004***	0.004***	0.004***	0.004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$E_{ht}^{IM}Y_{ht}$: Total grocery spending, Infra-marginal	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
p-value: $\beta_3 = \beta_5$	0.010	0.055	0.037	0.028	0.064	0.001
No. of households	266	210	266	413	225	1521
No. of household-months	4506	3825	4506	5644	3836	26133

*Notes: F&V denotes fruit and vegetables. All columns include household, month and year fixed effects, age and age squared of youngest and oldest child (in months), dummies for 2 adults, 3+ adults, 1 child, 2 children, 3 children, 4+ children, and a dummy indicating whether the household did not buy any fruit and vegetables that month. $Post_{ht}$ equals 1 for the period December 2006 onwards. "D" indicates distorted households, i.e. those that spent less than £12.86 per child on milk, fruit and vegetables (at any point prior to treatment); "IM" indicates that infra-marginal households, i.e. those never spending less than £12.86 per child prior to treatment. Total grocery spending is spending on foods and fast moving consumer goods (goods purchased in supermarkets). Column 1 defines distorted households as those who, prior to the introduction of the scheme, spent less than £12.86 per voucher (rather than per child); infra-marginal households are those who never spent less than £12.86 per voucher. Column 2 drops households that do not record purchases of loose fruit and vegetables. Column 3 defines the value of the voucher as the value minus spending on milk. Column 4 also includes households whose benefit status changes over time. Column 5 uses households with a predicted probability of receiving benefits (using the EFS) over 0.7. Column 6 uses these predicted probabilities as weights. Robust standard errors in parentheses, clustered by household. * p<0.10, ** p<0.05, *** p<0.01.*

Appendix A: The Welfare Food Scheme and the Healthy Start Scheme

Welfare Food Scheme

Concerns about access to nutritional foods during wartime rationing led to the introduction of the Welfare Food Scheme (WFS) in 1940 (Department of Health, 2002). The scheme provided free access to milk and vitamins for low-income pregnant women and low-income households with children under five. Households that received certain social security benefits were automatically sent tokens that could be exchanged for seven pints of liquid milk a week, or 900g of infant formula. These benefits included Income Support, Income-based Jobseeker's Allowance, or Child Tax Credit with a family income less than a year-specific threshold (e.g. £13,480 in the tax year 2004/05; see also Table 1). The scheme changed little over the first 60 years, but was substantially reformed in 2006, when it was replaced by the Healthy Start Scheme.

Healthy Start Scheme

The Healthy Start Scheme replaced the Welfare Food Scheme on 27 November 2006 after being piloted in Devon and Cornwall from November 2005. The scheme was explicitly intended to promote healthy lifestyles by changing diets. Households are sent vouchers that can be spent on plain fresh fruit and vegetables, cow's milk, or infant formula. Vouchers cannot be spent on fruit and vegetables that have any other ingredient added, such as potato salad, or seasoned vegetables. From 2011, they could additionally be spent on frozen fruit and vegetables; we do not consider that here.

On introduction of the Healthy Start Scheme in November 2006, the monetary value of a voucher was £2.80 (this gradually increased over time; see Table 1). Similar to the Welfare Food Scheme, the receipt of certain benefits determines whether the family receives Healthy Start Vouchers, including Income Support, Income-based Jobseekers' Allowance, and Child Tax Credit with a family income less than a year-specific threshold.[14]

Take-up and use of Healthy Start Vouchers is high. An estimated 79-80% of all eligible households receive the vouchers, of which 90% are used (Department of Health, 2009). Many retailers accept Healthy Start Vouchers, including supermarkets, corner shops, milkmen, chemists, market stalls and greengrocers. Households can find information about which retailers accept vouchers on the Healthy Start website, or by calling their helpline.

All applications to the Healthy Start Scheme have to be countersigned by a health visitor or midwife, who is also expected to provide information and advice on breastfeeding and healthy eating. Eligible households are sent four vouchers per 4-week period per child (eight vouchers for children aged

[14] From October 2008, the benefits also include Income-related Employment and Support Allowance. We do not consider that here, as our sample ends in November 2008.

between 0 and 1). Vouchers are only valid for this four week period, after which they can no longer be used.

To date, there have not been any large-scale evaluations of the Healthy Start Scheme, though there are three small (qualitative) studies. One focuses on the views and experiences of parents, professionals and small retailers (Lucas et al., 2013), whilst the others examine whether it affected food consumption. They find an increase in reported fruit and vegetable consumption (Hills et al., 2006) and intakes of energy, calcium, folate, iron and vitamin C (Ford et al., 2009), but sample sizes are small (n = 58 and 336 respectively).

Milk spending

We argue that households consume milk in relatively fixed quantities, depending on household size. Figure A1 below shows the distributions of monthly spending on milk and on fruit and vegetables, conditional on the number of adults, the number and ages of children, year, month and household fixed effects. This shows that the distribution of monthly milk expenditures is very concentrated, and much more concentrated than monthly spending on fruit and vegetables, with no large differences between eligible, ineligible, distorted, or infra-marginal households. Analyses (not shown here, but available from the authors upon request) show that the standard deviation of milk spending is significantly smaller than the standard deviation of spending on fruit and vegetables.

We also confirm findings from the UK Committee on Medical Aspects of Food and Nutrition Policy (Department of Health, 2002), showing that the vast majority of households did not consume the amount of milk they could purchase with the tokens under the Welfare Food Scheme. Our findings suggest 85% of households in our sample belong to this group, with little difference between eligible, ineligible, distorted and infra-marginal households. Finally, examining the effect of the introduction of the Healthy Start Scheme on milk spending shows no significant effects, with all estimates close to zero.

The reform of the scheme

Estimating the effect of the introduction of Healthy Start Vouchers is complicated by the pre-existing Welfare Food Scheme. We assume that consumers maximise their utility, which is a function of their spending on milk (x_1), fruit and vegetables (x_2) and other food (x_3): $U = U(x_1, x_2, x_3)$. This is subject to a budget constraint, given by

$$m + b = y = x_1 p_1 + x_2 p_2 + x_3 p_3,$$

where m denotes (other) income and b denotes income from benefits.

We assume milk is purchased in fixed quantities, depending on household size, the number and age of children: $x_1 = \bar{x}_1 = x_1(N_{ads},\ N_{kids}\ , Age_{kids})$. In other words, the quantity purchased does not depend on price or household income. This is consistent with the fact that the distribution of milk spending (conditional on household characteristics) is very concentrated, as shown above. If benefit income is paid in cash, households purchase a fixed quantity of milk and then allocate their remaining budget between fruit and vegetables and other food: $x_n^* = x_n(\ p_2,\ p_3, y - p_1\bar{x}_1)$, with *n = 2, 3* and where the superscript * indicates the optimal spending.

Under the Welfare Food Scheme, households receive welfare tokens of value b that can only be spent on milk. For the majority of households, the report by the UK Committee on Medical Aspects of Food and Nutrition Policy indicates that that $b < \bar{x}_1 p_1$ (Department of Health, 2002). In other words, households are "distorted", they but are assumed not to locate at the kink because the amount of milk that can be purchased with the tokens is greater than the maximum they want to purchase. Because of the distortion, spending on fruit and vegetables and other food for household receiving welfare tokens is given by $\hat{x}_n = \hat{x}_n(\ p_2,\ p_3, y - b) \leq x_n^*$, with *n = 2, 3*.

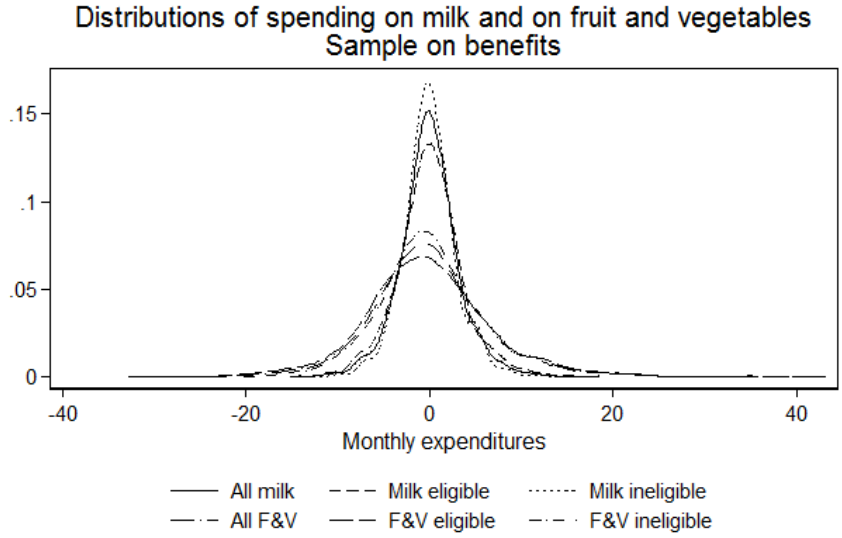
In November 2006, welfare tokens are replaced with Healthy Start Vouchers, which are of roughly equivalent monetary value. However, the new vouchers can be spent on milk, fruit and vegetables: $b = \ \bar{x}_1 p_1 + x_2 p_2$. The effect of introducing the vouchers is similar to the case with no welfare tokens (as shown in Figure 2), but the value of the extra benefit is lower: $b' = \ b - \bar{x}_1 p_1$.

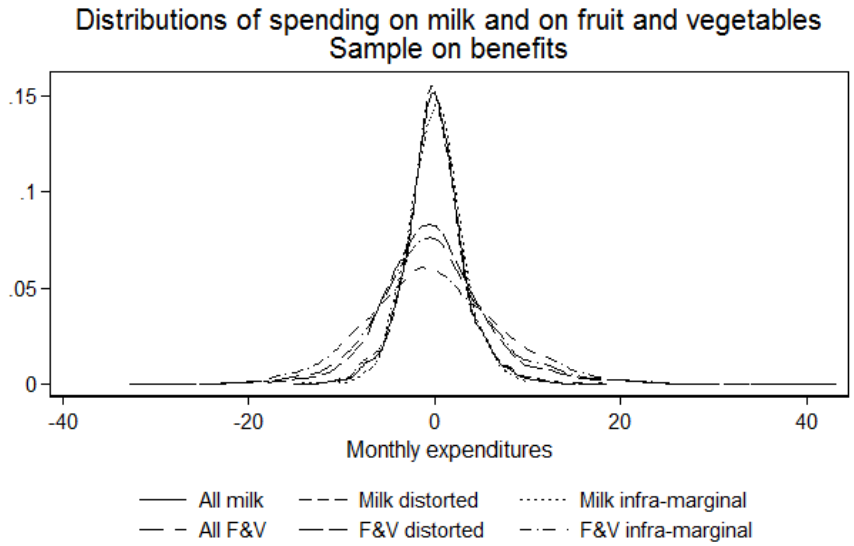
We can distinguish between two groups. First, those who are infra-marginal under Healthy Start Vouchers: $b \leq \bar{x}_1 p_1 + x_2^* p_2$, and who therefore choose optimal spending $\bar{x}_1, x_2^*, x_3^*$. Following introduction of Healthy Start Vouchers, there is no change in spending on milk, while spending on fruit and vegetables and other food increase in line with b' (from $\hat{x}_n$ to x_n^*) due to an income effect.

Second, those who are distorted under Healthy Start Vouchers spend $\bar{x}_1 p_1$ on milk, $\check{x}_2 p_2 = (b - \bar{x}_1 p_1) \geq x_2^* p_2$ on fruit and vegetables and $\check{x}_3 = \check{x}_3(\bar{x}_1, \check{x}_2,\ p_3, m) < x_3^*$ on other food. This predicts that the increase in spending on fruit and vegetables is greater among distorted than among infra-marginal consumers (from $\hat{x}_2$ to $\check{x}_2$), whilst the increase in spending on other foods is less among distorted than infra-marginal consumers (from $\hat{x}_3$ to $\check{x}_3$).

Before the introduction of the reform, we observe $\bar{x}_1 p_1 + \hat{x}_2 p_2$. Using the cut-off b will therefore cause some distorted consumers to be included in the infra-marginal group, leading to an over-estimate of any change in fruit and vegetable spending for the infra-marginal group.

Figure A1: Conditional distributions of monthly expenditures on milk and on fruit and vegetables





Note: Expenditure is conditional on the number of adults, the number and ages of children in the household, year, month and household fixed effects.

Appendix B: Identifying households on benefits in the Kantar data

We define a household as being "on benefits" if the head (and the main shopper in couples) are not in work, unemployed, in education, or work less than 8 hours a week. To assess how well this simple rule does in predicting which households are on benefits, we look at data from the Expenditure and Food Survey (EFS; a repeated cross-sectional study of households in the UK), which contains both hours worked and actual benefits receipt. Using this definition, we find that 17.8% of all households with a child aged 0-8, or where the woman is pregnant in the EFS are on benefits, compared to 20.7% in a similar sample in the Kantar data. In addition, we compare our definition of being on benefits (based on hours worked) in the EFS to the share of these households that are truly on benefits. Table B1 shows that we do well in capturing households that are truly on benefits. The rows show the work status of the head of household, recoded to the categories observed in the Kantar data; the columns show the hours worked by the spouse (or that there is no spouse present in the household).

The shaded area indicates the sample used in our analysis: those we predict to be on benefits using hours worked. We show the number of households observed in each cell, the number who is in on benefits, and the probability that households in each cell are on benefits. For example, the upper left hand cell shows that of single parent households where the parent is not in work, 95% of households in the EFS are in receipt of benefits. Similarly, of households where the head works between 1-8 hours and there is no spouse 90.3% are on benefits. Overall, among those households in the EFS that we predict to be on benefits based on the hours worked, 91.7% actually received benefits.

In our robustness analyses, we also use households that we predict to *not* be on benefits as an addition control group. These are defined as households where the head (or the main shopper if in couples) works 30 or more hours per week. Table B1 shows that, among households where the head and spouse work 30 or more hours per week, 97.7% do not receive benefits, suggesting that the majority of households captured using our definition of benefit receipt are identified correctly.

We examine the robustness of our findings to an alternative definition of benefit receipt, where rather than using hours worked, we predict the probability of receiving benefits as a function of covariates in the EFS. Table B2 shows the marginal effects of a probit regression using the EFS. This suggests that we predict benefit receipt well: a simple probit using the cross-sectional EFS provides a pseudo R^2 of 0.54.

Figure B1 compares the distribution of the predicted probability of being on benefits in the Kantar data (predicted using the estimates from the EFS) with that from the EFS data. This shows that they

line up well: the majority of individuals are predicted not to be on benefits, with the largest densities for probabilities of benefit receipt less than 0.4. The density increases again for probabilities above around 0.7. In our robustness analysis, we use Pr(benefits)>0.7 as the cut-point to define a household as being on benefits, though the results are robust to using different cut-points ranging from 0.6 to 0.9. Comparing this predicted benefit receipt (based on Pr(benefits)>0.7) to the actual benefit receipt in the EFS, we find that, among those we define as being on benefits, 92% receives benefits.

Figure B1: The densities of Pr(on benefits) from the EFS and Kantar data

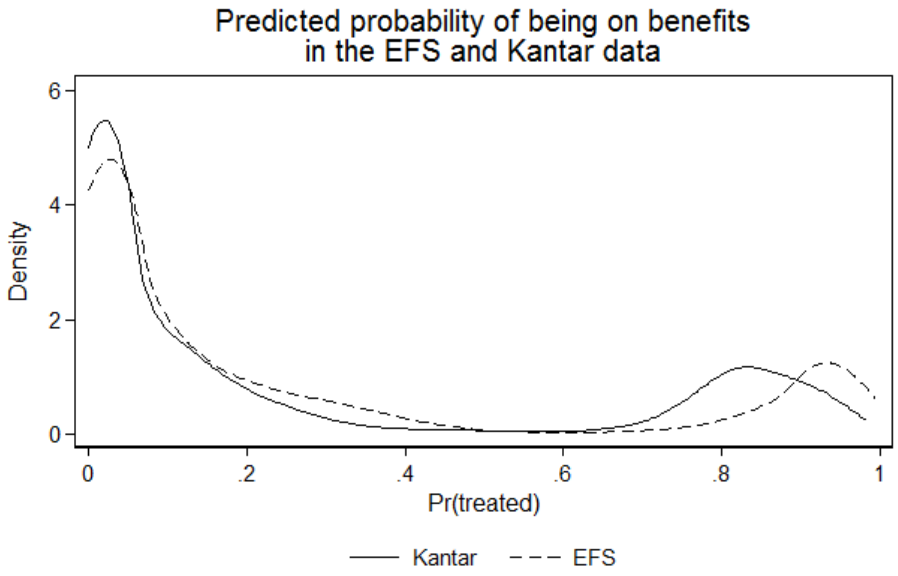


Table B1: Number and percent of households on benefits by demographic status in the EFS

Head:		Spouse: no spouse	not in work	1-8 hours	8-30 hours	30+ hours	Total
not in work	*N* in group	804	326	2	48	149	1,329
	N on benefits	764	284	1	25	33	1,107
	% on benefits	95.0%	87.1%	50.0%	52.1%	22.1%	83.3%
1-8 hours	*N* in group	31	6	0	2	7	46
	N on benefits	28	2	0	0	2	32
	% on benefits	90.3%	33.3%	-	0%	28.6%	69.6%
8-30 hours	*N* in group	313	109	5	43	181	651
	N on benefits	50	33	1	11	9	104
	% on benefits	16.0%	30.3%	20.0%	25.6%	5.0%	16.0%
30+ hours	*N* in group	250	1,242	106	1,540	1,160	4,298
	N on benefits	15	151	10	93	15	284
	% on benefits	6.0%	12.2%	9.4%	6.0%	1.3%	6.6%
Total	*N* in group	1,398	1,683	113	1,633	1,497	6,324
	N on benefits	857	470	12	129	59	1,527
	% on benefits	61.3%	27.3%	10.6%	7.9%	3.9%	24.1%

*Note: For each demographic group, the table provides the total number of households in that group, the number of households in that group who receive benefits, and the percent of households on benefits (i.e. (N on benefits/N in group)*100). The shaded area is the main sample definition used in the Kantar data. Calculations from the Expenditure and Food Survey.*

Table B2: Determinants of benefit receipt: marginal effects from a probit regression using the EFS

	Pr(on benefits)	
2 adults	-0.082	(0.057)
3 adults	-0.076***	(0.024)
Pregnancy	-0.035**	(0.016)
No. aged 0	0.004	(0.018)
No. aged 1	0.011	(0.017)
No. aged 2	0.020	(0.019)
No. aged 3	0.017	(0.017)
No. aged 4	0.018	(0.018)
No. aged 5	0.016	(0.017)
No. aged 6	0.014	(0.018)
No. aged 7	0.024	(0.018)
No. aged 8	0.003	(0.017)
No. aged 9	-0.023	(0.020)
No. aged 10	0.021	(0.020)
No. aged 11	0.025	(0.021)
No. aged 12	0.034	(0.028)
No. aged 13	0.007	(0.024)
No. aged 14	-0.028	(0.024)
No. aged 15	0.006	(0.029)
No. aged 16	0.040	(0.028)
No. aged 17	0.019	(0.036)
No. aged 18	0.082**	(0.041)
Household size squared	-0.001	(0.002)
Married	-0.032	(0.051)
Widowed/divorced/separated	-0.029*	(0.016)
Non-manual social class	0.234***	(0.054)
Manual social class	0.464***	(0.056)
Semi-skilled social class	0.387***	(0.068)
Unskilled social class	0.383***	(0.085)
Unemployed	0.572***	(0.075)
Head works less than 8 hours per week	-0.021	(0.044)
Head works between 8 and 30 hours per week	-0.127***	(0.010)
Head works 30 or more hours per week	-0.368***	(0.046)
Shopper works less than 8 hours per week	0.007	(0.029)
Shopper works between 8 and 30 hours per week	-0.095***	(0.010)
Shopper works 30 or more hours per week	-0.181***	(0.010)
Household owns 1 TV	0.106	(0.064)
Household owns 2 TVs	0.072	(0.054)
Household owns 3 TVs	0.083	(0.058)
Household owns 4 TVs	0.082	(0.060)
Household owns 2 cars	0.006	(0.013)
Household owns 3 cars	0.053**	(0.025)
Household owns a PC	0.010	(0.015)
Household owns a freezer	-0.007	(0.044)
Household owns a drier	0.006	(0.011)
Household has internet	-0.043***	(0.017)
Household owns a microwave	0.009	(0.022)
Household owns a dishwasher	-0.034***	(0.011)
Pseudo R^2	0.54	
Observations	6891	

*Notes: Regression uses data from the Expenditure and Food Survey (EFS) from 2004-2008, and includes 6,891 observations. Year and region dummies included. Standard errors in parentheses, * p < 0.10, ** p < 0.05, *** p < 0.01*

Table B3: Means and standard deviations of the Kantar data, full sample by eligibility

	(1) Full sample		(2) Eligible		(3) Ineligible	
	Mean	SD	Mean	SD	Mean	SD
Full sample						
Total spending (£): fruit & vegetables	17.70	(11.8)	18.81	(11.7)	16.57	(11.9)
Total quantity (kg): fruit & vegetables	16.90	(10.1)	18.06	(9.8)	15.72	(10.1)
Portions of fruit and vegetables per person/day	1.98	(1.2)	1.98	(1.1)	1.98	(1.3)
Proportion purchasing ≥5 portions per person/day	0.02	(0.1)	0.01	(0.1)	0.03	(0.2)
Total spending: all foods	186.5	(68.4)	189.8	(65.9)	183.2	(70.7)
Total spending: fast moving consumer goods	40.5	(24.5)	43.1	(25.5)	37.9	(23.2)
Household size	3.71	(1.0)	3.94	(0.9)	3.45	(1.0)
≥3 months pregnant	0.06	(0.2)	0.11	(0.3)	-	-
No. of 0 year olds	0.11	(0.3)	0.21	(0.4)	-	-
No. of 1-3 year olds	0.46	(0.6)	0.89	(0.5)	-	-
No. of 4 year olds	0.20	(0.4)	0.12	(0.3)	0.27	(0.4)
No. of 5-18 year olds	1.23	(1.0)	0.94	(1.0)	1.55	(0.9)
No. of adults	1.85	(0.6)	1.95	(0.5)	1.75	(0.6)
Number of household-month observations	4506		2274		2232	

Note: Eligible households are those ≥3 months pregnant, or with a child aged 0-3; Ineligible households are those with children aged 4-8, or not yet pregnant. Households who (at any point prior to the reform) spent less than £12.86 per child on milk, fruit and vegetables are defined as distorted; those never spending less than £12.86 per child are defined as infra-marginal. A portion of fruit and vegetables is defined as 80g. Other covariates, including marital status, social class, and the region where the household lives are not significantly different across distorted and infra-marginal consumers (not shown here, but available upon request).