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There's no such thing as a free lunch:
Evidence of altruism and agency from household expenditure responses to child nutrition programs

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Abstract

Many countries provide transfers for particular client groups such as children and often such transfers are in-kind rather than cash. However, this may, at least partially, crowd out private expenditures on the goods in question because they reduce the incentive for other individuals, like parents, to make altruistic transfers. They are often made to one household member on behalf of another so there may also be agency concerns: the recipient may divert some of the transfer away from the intended beneficiary.

This paper throws light on these issues using three nutrition programs for children in UK households: free lunch at school for children from poor households; free milk to poor households with pre-school children; and free milk at day-care for pre-school children in attendance regardless of parental income.

We provide difference in difference estimates based on a welfare reform and on variation in the timing of school holidays. These estimates are broadly consistent with estimates of a structural model that is identified using the same welfare reform. This gives us confidence in the interpretation of our estimates that the structural model provides but the simple difference-in-difference cannot.

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1. Introduction

In-kind transfers are often regarded as weakly inferior to cash transfers because the cash could always be used to replicate any in-kind transfer of the same value. As a result, in-kind transfer policies are often thought to have paternalistic motivations – for example, to promote good health.[1] A recent example in the UK is "Healthy Start" program which provides vouchers, to certain low income households with children, which can be exchanged for milk, fruit and vegetables. Many such programs exist elsewhere. Such transfer programs are often administratively expensive relative to cash transfer programs. They are often provided through some agent – for example, to a parent on behalf of a child. The agent may be able to divert some of the transfer away from the intended beneficiary. Moreover, children are usually altruistically linked to their parents, and this altruism may lead to internal household redistributions that, to some extent, undo the effects of the external transfers. That is, a parent who feels altruistic towards a child will increase (decrease) internal transfers to the child in the face of smaller (larger) external transfers to the child.[2]

This paper measures the extent to which altruism between parents and their dependent children could undermine the objectives of policy. We also consider to what degree transfers are affected by agency considerations regarding which household member receives a transfer. We do so with the help of changes to three UK

[1] Currie and Gahvari (2008) review the evidence behind alternative arguments for in-kind transfers.

[2] See Bergstrom (1989) for a review of the "rotten kid" theorem that lies behind such behaviour, and see Jacoby (2002) which refers to the absence of altruism as generating a "flypaper" effect because the transfer *sticks* where it lands. Gruber and Hungerman (2007) demonstrates crowding out of chaitable giving by New Deal spending during the Great Depression, while Hungerman (2009) suggests that the degree of crowding out, also in the context of transfer to communities, is affected by diversity.

nutrition programs: Free School Lunches for the children of poor households who attend school; Welfare Milk Tokens which can be exchanged for milk and are available for poor households with pre-school children; and Day Care Milk for pre-school children, regardless of family circumstances, while attending registered childcare institutions. These programs can be informative on these two issues because of their differences. It seems likely that free milk is a good substitute for the privately purchased alternative; while school lunches may be a poor substitute for market food. Moreover, while Welfare Milk Tokens and Day Care Milk both provide milk, they are delivered differently. The former is a transfer to the mother, while the latter is given directly to the child at the institution where we would not expect there to be any agency issue.

Importantly, two of these programs were reformed in 1988: after the reform only poor parents receiving *in-work* welfare benefits were eligible for Welfare Milk Tokens and Free School Lunches, whereas previously eligibility was for low income families who were on *either* in-work *or out-of-work* welfare. Day Care Milk continued to be provided regardless of circumstances.

Evidence that nutrition programs significantly crowd out private food expenditure would provide support to the proponents of cashing-out such transfers since typically in-kind programs are more expensive to administer than cash transfers. The question is of more general interest since altruism undermines the effectiveness of public transfers whether they are cash or in-kind. There are two related questions here. First, providing cash or a good with close market substitutes (like milk) rather than a good with poor market substitutes (like school lunch) may allow the parents to alter market expenditure patterns to divert some of the benefit to others in the household.

Second, there may be different effects from giving milk in day care, where the authorities can ensure a child gets it, rather than giving milk to the household, where it may be consumed by any household member. We think of differences in the former (goods with different substitutabilities) as revealing altruism and differences in the latter (different delivery of the same good) as suggestive of agency.

Our results have general relevance for the design of in-kind transfer programs. Altruism considerations suggest that the closer a transfer is to products available in the market the less effective the transfer will be. Thus, if these considerations are important then we might expect that the recent extension of the welfare milk program in the UK to cover fruit and vegetables will have little of its intended effect on the nutrition standards of children in low income households. Agency considerations may affect how in-kind transfers should be provided, as well as whether they should be.

While much of the US food stamp research[3] has been concerned with establishing the value of such transfers to recipient households or communities, here we are concerned with the implications of the individualistic nature of transfers to uncover the extent of altruism. We know of no work so far that considers the power of agency problems in mitigating in-kind transfer effectiveness more directly, through

[3] In addition to Jacoby (2002), which relates to a nutrition program in the Philippines, there is a variety of US work that bears on the effectiveness of nutrition programs. A number of such papers consider the impact of food stamps on food spending. For example, Hoynes and Schanzenbach (2009), exploit the introduction of the Food Stamp program across US counties in a difference-in-differences design, to show effects on household food spending that exceed the effect that income transfers of the same value would have had. Currie (1997) shows that a US school lunch program is subject to an offsetting nutrition reduction of about 50%, while a school breakfast program is relatively effective with only modest nutritional offsets. Bhattacharya *et al* (2006) noted that the school breakfast program had nutritional benefits for the recipient child, but only modest effects on other household members. Schanzenbach (2009) suggests that school lunches are one cause of obesity but does not consider other household members. Millimet *et al* (2009) confirm that the breakfast program does not increase obesity but that the lunch program does. They also do not consider other household members.

household spending patterns. We examine only the effects of transferring private goods (milk and food) on household expenditures which we think of as a more direct way of testing for altruism. Thus, our work serves as a complement to existing research on the effects of transfers to communities and the effects of transfers on child outcomes (for example health and test scores[4]).

The UK has no food stamps, but does have two programs that provide free milk, which we think of as being close to cash because all households consume milk and milk is the same regardless of whether it is free or purchased. The UK also has a further program that provides Free School Lunches, similar to the US free lunch and breakfast programs. We exploit a reform that occurred in 1988 which changed the eligibility conditions for Free School Lunches and Welfare Milk Tokens, but not for Day Care Milk. Furthermore, we use the fact that Free School Lunches are only available during term time and that school summer holidays in Scotland are a month earlier than the rest in the UK. We combine these features to form natural experiments to identify the role of altruism by considering the reformed programs separately. However, we have no experimental variation in the Day Care Milk program and so we incorporate this, together with the other two programs, by estimating a structural model to also test for agency. This second strategy controls, parametrically, for observed differences between the treatment and control groups and makes assumptions about the distribution of unobservables to facilitate identification. In the structural model we also exploit the welfare reform to provide exogenous variation in

[4] See Currie (1997) and references therein for evidence that relates to in-kind transfers arising from housing programs and health insurance. See also Browning (1992) who looks at anthropometric effects in developing countries.

program eligibility and levels of entitlement. That is, although Day Care Milk was not reformed, it has a target group of children of a similar age to Welfare Milk Tokens and it is just milk that is the ultimate object of each of the transfer programs.

The extent to which a nutrition program is close to cash, in the sense of having close market substitutes, and how large provision is, relative to needs, are both important determinants of the scope for agency. Welfare Milk Tokens and Day Care Milk have good market substitutes, and the tokens provide a large proportion of (mean non-eligible household milk) expenditure whereas Day Care Milk provides only a small proportion.

To anticipate our results, we find that both of the milk programs crowd out private milk expenditure to a similar degree - by about 80% of their value; whereas Free School Lunches, which we think of as poor substitutes for products available in the marketplace, are estimated to crowd out private food expenditure - by only 15% of their value. We infer that agency problems are small from our finding that milk transfers have a similar crowd out regardless of the delivery mechanism: whether via the child's day-care institution or via a welfare-eligible mother. Furthermore, milk transfers appear to have similar crowd-out effects regardless of the size of provision relative to needs. Our results show that altruism is relatively more important than agency in this context.

2. Cash and In-kind Transfer Programs in the UK

In-kind transfers in the UK are largely nutrition programs for households with children: Free School Lunches, Welfare Milk Tokens and Day Care Milk. The

exceptions are the (near-cash) Housing Benefit[5] program and (universal) healthcare provision, In addition to these in-kind transfers, several means-tested cash transfer programs provide benefits for households who have low income and assets.

The main UK cash programs during the 1980's and 1990's were Income Support and Family Credit.[6] Income Support is a cash transfer which is available to households where income is below a "needs" threshold and financial assets are sufficiently low. Needs are a function of household demographic characteristics, and entitlement is the amount that income falls below the needs level. Eligibility is subject to a *maximum* weekly hours of work. Income Support is essentially an out-of-work cash transfer program, similar to AFDC in the US. Family Credit is a cash transfer to low income *working* households with dependent children. Entitlement is a proportion of the difference between needs and income, subject to a maximum entitlement. Needs in the FC program depend on household demographic characteristics (differently from that used for Income Support eligibility), and entitlement is subject to a *minimum* weekly hours of work which at least one household member must satisfy. Family Credit is paid incrementally throughout the year unlike its US equivalent, EITC. Approximately half of all Family Credit is paid to lone parents.

Free School Lunches had been available each school day to children attending school where a member of the household was receiving *either* of the cash transfers,

[5] For most recipients, Housing Benefit is a cash transfer but for a small number living in social housing the payment is retained by the local authority who provides the housing.

[6] Prior to 1988 Family Credit was called Family Income Supplement and Income Support was called Supplementary Benefit. In 1999 Family Credit was replaced by Working Families Tax Credit and in 2003 by Working Tax Credit and Child Tax Credit. Income Support became Job Seeker's Allowance. While there are important administrative differences, the new benefits are essentially more generous versions of their predecessors. We use the terminology Family Credit and Income Support throughout.

Income Support or Family Credit. Welfare milk was provided in the form of vouchers to the parent(s) that could be exchanged for milk at many stores. Finally, Day Care Milk has always been independent of cash welfare receipt, is not means-tested in any way, and is simply contingent on attending a registered day-care institution.

The system was reformed in April 1988, but retained a broadly similar structure. The central features of the reform were: Family Credit became more generous so that eligibility moved higher up the income distribution, but Family Credit ceased to provide eligibility for the two nutrition programs – Free School Lunches and Welfare Milk Tokens. Although Family Credit cash entitlements were increased in 1988, this was not an exact cash-out of the in-kind transfer, since families with children attending school received different increases depending on the age of child. Daycare milk was not affected by the reform.

Free School Lunches and Welfare Milk Tokens are extensive (1997 caseloads were 1.0 million children receiving Free School Lunches, 0.2 million pre-school children in households receiving Welfare Milk Tokens) and expensive (respective annual costs of £150 million and £47 million). In 1984 (1992) 15.9% (14.0%) of all pupils received Free School Lunches (see Department of Social Security (1995)) and the average daily charge for a school lunch was £0.55 (£1.00) in 1992 prices. The same school lunch could be bought by children from families ineligible for the waiver, so we observe the price of a school lunch in our data. There seems to be very little cross-section variation in price. All children have the option of not participating in the lunch provided by the school. Instead they may bring a packed lunch from home (for which no subsidies were available), or they may return home for lunch, or they may go without lunch. Households receiving Free School Lunches in our data received 9.6

lunches per week on average and their average real costs (in 1992) were approximately £1 each. Thus, the market value of the Free School Lunches received by an average recipient household is close to £10 per week, compared to an average weekly food expenditure by entitled (non-entitled) households with school-aged children of £44.21 (£65.68) in our data.

Welfare Milk Tokens were available to households with a child aged 0-4, where one member of the household is receiving Income Support or Family Credit. Again, households receiving Family Credit were no longer entitled to Welfare Milk Tokens after April 1988. Although the transfer is not explicitly for children, the level of entitlement is fixed at one Welfare Milk Token per day for each child aged 0-4 in the household. A token could be exchanged for one pint (0.56 litres) of milk at many grocery stores. 16.6% of households with pre-school aged children received Welfare Milk Tokens in 1987. The market value of the average weekly transfer was £2.98 for 9.0 pints, compared with average weekly milk expenditure of recipient (non-recipient) households with young children of £2.80 (£4.28). The real price of milk has been rising over time relative to the overall price index and the food price index. In 1992 a pint of milk cost £0.33 on average. Day Care Milk is available to all registered childcare facilities and is distributed to all children irrespective of parental income. Children receive 1/3rd of a pint each day they attend.

3. Family Expenditure Survey Data

The Family Expenditure Surveys (FES) are stratified random samples of approximately seven thousand responding households each year. They are conducted continuously over time in Great Britain and collect expenditure information in fine detail, together with information about household characteristics, and income levels

by source. The food expenditure data is thought to be particularly accurate since it is collected through detailed diary records kept by all spenders.[7] The data that we have access to is aggregated to the household level and averaged over the two diary weeks.

The Family Expenditure Surveys have been one of the main vehicles for expenditure, tax and social security policy analysis in the UK (see Johnson, Stark and Webb (1990)) since they contain details of welfare receipts (including in-kind transfers) and tax payments as well as sufficient information to derive reasonably accurate estimates of tax liabilities and welfare entitlements.[8] The data used here is obtained by pooling the 1981 to 1992 surveys to give 29,222 households containing either dependent school-age children or pre-school children or both (excluding multiple-family households). Data prior to 1981 cannot be used because free school lunch receipt was not recorded, and data post 1992 cannot be used because there is no longer sufficient detail to compute welfare entitlements from the data available because of a local taxation reform.[9]

Table 1 shows the characteristics of the households in the data broken down by whether the household was surveyed pre- or post-reform and by cash program receipt. Income Support recipients (denoted IS>0) and Family Credit recipients (denoted FC>0) are much poorer, and much more likely to be lone parent households, than the group who received neither program (denoted IS=FC=0). For the Income Support

[7] See Kelmsley *et al* (1980) for details of sampling methods. See Atkinson and Micklewright (1983) on the reliability of income data in the FES. Tanner (1998) provides checks on the reliability of expenditures data.

[8] We compute entitlements on the basis of recorded incomes, children, etc. using a very detailed routine based on the Institute for Fiscal Studies' TAXBEN program. See Giles and McCrae (1995).

[9] See Appendix for the details of the questions and interview instructions.

group, households became smaller post reform, largely because of the growth in the number of lone parents on out-of-work welfare.

The data shows small numbers who receive but who are not apparently eligible – just 2% of the IS=FC=0 group receive Free School Lunches or Welfare Milk Tokens pre-reform and just 1% post-reform.[10] More serious is that 9% of the Family Credit recipient group post-reform receives Free School Lunches and 4% are in receipt of Welfare Milk Tokens. Post-reform these households should be ineligible and it seems likely that this would have arisen because Family Credit recipients just prior to the reform could continue to receive the associated in-kind transfers for up to 12 months. This is confirmed in Figure 1 which shows the proportions of households with any school age children who are recorded as being in receipt of Free School Lunches. Similarly, Figure 2 shows the proportion of households with a pre-school child who were in receipt of Welfare Milk Tokens. Neither Figure 1 nor Figure 2 suggests any important time series trends.

Pre-reform Family Credit had a run-on period of up to 12 months because of the rule that any changes in household circumstances during the year were ignored. If the change in receipt had been instantaneous following a change in eligibility we would expect the figure for Family Credit recipients in 1988 to be approximately one quarter of the 1987 level (the reform occurred in April 1988). In fact, the proportion is almost one-half in the case of Free School Lunches and just over one-third in the case

[10] One difficulty with the data is that once Family Credit entitlement is established it can then last for up to 6 months (12 months prior to the reform). Indeed, it was the practice of some schools to provide Free School Lunches for a whole school year so that those in receipt of Family Credit or Income Support, at the beginning of the school year, may have still been receiving them more than nine months later, at the end of the year, even though they were no longer eligible on current circumstances.

of Welfare Milk Tokens. This is consistent with there being a substantial lag between implementation of the policy change and actual receipt of the associated cash transfer program – a lag that lasts through to 1989 for cases establishing a claim in the first quarter of 1988. The administrative lags in the welfare system are exacerbated by the delivery mechanisms for Free School Lunches, which were typically awarded for a school term in advance, and for Welfare Milk Tokens, which were typically made available a month in advance. However, after 1989 the proportion of the Family Credit recipients receiving Free School Lunches is reassuringly small. This is small enough to be consistent with Free School Lunch receipt amongst Family Credit recipients arising from previous eligibility to Income Support - because many households who were unemployed will have found low paying work and may move from Income Support to Family Credit and still receive the nutrition transfers for a period. Thus, apart from the immediate aftermath of the policy change, the reform seems to have clean effects.[11]

Table 2 shows the levels of expenditure on milk and non-milk food[12] for relevant groups of the population of households with children pre and post reform. Real milk spending fell dramatically - by 38% for the IS=FC=0 group reflecting changing tastes and falling real prices. The fall for the Income Support recipients, who retained their eligibility to Welfare Milk Tokens, was a similar order of

[11] Indeed, we do not require that there be no measurement error. In the difference-in-difference analysis we are, in any event, estimating an intention-to-treat so the presence of non-compliers are not problematic. And in the case of our structural analysis we are implicitly estimating a local average treatment effect, i.e. the effects of losing nutrition receipt due to the reform, not the effects of losing nutrition receipt *per se*.

[12] Food includes meals consumed away from home and non-alcoholic drinks except milk. Milk is all forms of liquid milk.

magnitude – down 32%. In contrast, the group that *lost* their eligibility to Welfare Milk Tokens (FC>0 and only 0-4 aged children) showed significant *rises* in milk spending – up 69%. Note that households receiving Income Support are on average slightly poorer than households receiving Family Credit, who are on average considerably poorer than those receiving neither. Thus a comparison between the Income Support and Family Credit recipients illuminates the effect of losing Free School Lunches and Welfare Milk Tokens across two groups of low income households.[13]

Table 3 illustrates the consequences of the April 1988 benefit reform for eligibility to the relevant cash transfer programs. Of households with only children aged 0-4 (only 5-15), 2.6% (3.9%) lost their Family Credit-based eligibility to Welfare Milk Tokens (Free School Lunches), and of households with children in both age groups 5.4% lost their Family Credit-based eligibility to both programs.[14]

Figures 3a and 3b show the budget shares of milk and non-milk food, respectively, over time for the three categories of household (IS>0, FC>0, IS=FC=0). The only pronounced trend is the decrease in milk share for the IS=FC=0 group arising from falling real prices and taste changes. This suggests the non-working poor (IS>0) might be a better control group for the working poor (FC>0) because they are less subject to differential trends. Table 4 summarizes the gross features of nutrition

[13] The decrease in total expenditure for the Income Support recipient group across the reform reflects compositional changes: it arises because of the increase in the representation of lone (especially never-married) parents, who have substantially lower household income, in this category.

[14] Eligibility for Welfare Milk Tokens or Free School Lunches requires household *eligibility* to an associated cash transfer, and children in the relevant age ranges. The importance of the distinction between receipt and eligibility groupings is emphasized in the next section.

program eligibility and receipt separately. For Free School Lunches there are just 2.4% of ineligibles that are in receipt (ineligible participants). The overall participation rate for the Free School Lunch program is 58%. Since families in receipt of Free School Lunches contained 1.89 school age children and those families not in receipt of Free School Lunches contained an average of 1.61 children we estimate that 12% of households, corresponding to 14% of school children, receive free school lunches. Table 4 also highlights similar features for Welfare Milk Tokens and Day Care Milk for households with only pre-school age children.[15] Table 5 shows the number of households receiving multiple nutrition transfers according to eligibility. Overall participation by ineligibles (1.7% of observations lie above the diagonal) is a rather small proportion of the sample, while eligible non-participants (non-takeup) are the much larger group below the diagonal (28.5%).

4. Modeling Household Food and Milk Expenditures

Applied demand analysts have come to regard budget shares as the most appropriate way of modelling household spending behaviour (see Pollak and Wales, 1995). Here, we adopt a specification for budget shares that is widely used in applied microeconomic analysis of household spending: one where the budget shares are quadratic in log total expenditure. For the moment, consider the following straightforward model of budget shares

[15] In the case of Day Care Milk, the question routing prevents us from observing ineligible recipients. The larger proportion of ineligible participants in the case of Welfare Milk Tokens is likely to be due to our inability to identify expectant mothers currently without pre-school aged children, who would be eligible during pregnancy.

(1) $$s_{ki} = \mathbf{T}_i \gamma_k + \mathbf{X}_i \beta + \varepsilon_{ki}$$

where s_{ki} is the budget share for household *i* on good *k* = milk, food, the potentially endogenous $\mathbf{T}_i$ indicates participation in the three nutrition programs for household *i*, $\mathbf{X}_i$ are observable controls, and ε_{ki} captures unobservable determinants. We are seeking to estimate the vector γ_k, the response of expenditure shares to participation in each program.

4.1 Difference in differences using individual micro-data

Firstly, we use the 1988 reform as a natural experiment, including individual control variables to capture observed differences between the treatment and control groups and changes in their characteristics over time. The reform only affects Welfare Milk Tokens and Free School Lunches and therefore, in this section, we cannot investigate the effects of Day Care Milk. Thus, we modify (1) such that

(2) $$s_{ik} = \mathbf{T}_i \boldsymbol{\delta}_k + \alpha_k R_i + R_i . \mathbf{T}_i \boldsymbol{\gamma}_k + \mathbf{X}_i \boldsymbol{\beta}_k + \varepsilon_{ik}$$

where R_i=1(0) if *i* is observed post(pre)-reform and is included to capture unobserved differences between pre and post reform expenditure patterns, the **T'**s are included to capture differences in spending patterns between the eligible and ineligibles arising for unobserved reasons, and their interaction captures the effects of the *loss* of eligibility of the programs following the 1988 reform. We include a vector of control variables, **X**, to capture individual specific differences.[16] Applying the difference in differences

[16] While it might be tempting to rely on a simple difference in differences methodology based on data *grouped* by Family Credit eligibility pre and post reform, we are reluctant to do so here. In particular we are concerned that, even if we assume that the reform is a clean natural experiment, restrictions on preferences are required for the aggregate data to be consistent with consumer theory. In particular,

method to the micro-data has the added advantage that it allows us to control for other observables that vary across time differently for the treatments and controls, and we include the number and ages of children, lone parent, income, Family Credit and Income Support eligibility, and pre- or post-reform observation.

The scope of the nutrition programs (milk for households with pre-school children, and food for school-aged children), and the nature of the reform (whereby just the working poor lost eligibility), suggests a number of possible difference-in-differences designs. The natural treatment group throughout are those households who **lost** eligibility to the nutrition program (i.e. the working poor). While it is usual for the control group to be defined as all those not in the treatment group, here we have three candidates for control groups: households who were always eligible (i.e. the non-working poor); households who were never eligible (i.e. the working non-poor); or, as would be more usual, both groups of untreated households.

The difference-in-difference methodology is well known to require that the trends and shocks for treatment and controls are the same. Inspection of Figure 3 suggests that, although there is a strong trend decrease in the shares for both milk and food for the group where FC=IS=0, but the treatment group (FC>0) and what seems like our most credible control group (IS>0) seem to exhibit no strong trend changes.

An important assumption of difference-in-differences is exogenous group composition, whereby individuals must not be able to self-select into treatment status.

incomes are changing over time, within the treatment and control groups, and only if changes in the *distribution* of income (we adopt the usual convention in demand modeling of substituting total expenditure for income) did not affect budget shares can we meaningfully aggregate the data into group means. This condition would imply that preferences are quasi-homothetic, a restriction that is typically rejected in micro-data. See Blundell *et al.* (1993).

Cash transfer program participation is obviously a choice, and grouping according to Family Credit receipt status may be problematic. We could allow for the possibility of endogenous group composition by defining intention to treat using Family Credit *eligibility* rather than receipt. However, grouping by Family Credit eligibility status is also questionable because, *post-reform*, households may have altered behaviour in response to the reform, which would change entitlement. Thus, in Table 6 we group the data so that the **T**'s are defined according to *pre-reform* Family Credit *eligibility* status. That is, entitlement to Family Credit is calculated on the basis of *pre*-reform Family Credit entitlement rules using household observed characteristics, such as income and children. Table 6 reports only the coefficient (denoted γ in the table) on the interaction between a post-reform dummy variable, *R*, and the intention to treat (eligibility) dummy variables, the *T*'s, of equation (2).[17]

It is possible to focus on the effect of losing Welfare Milk Token eligibility by considering households with only pre-school aged children. Estimates for this sample are presented in the upper three rows of Table 6.[18] The effect of losing Free School Lunch eligibility is isolated by just including households with only school-aged children, presented in the middle three rows. The combined effect of losing eligibility to either, or both, nutrition programs uses the full sample and is presented in the last three rows. Each row in each block corresponds to a particular control group (non-

[17] We have also estimated both the difference-in-differences dropping April 1988 through March 1989 which may be considered a phase-in period for the reform. These difference-in-differences results are slightly higher but lose precision. We also estimate a structural model below. Here the structural budget share estimates are unchanged when we drop the phase-in period. In view of this, and the relatively short post-reform observation window, our preferred estimates include data for the phase-in period.

[18] Results that use receipt rather than eligibility are broadly similar to those presented in Table 6 but more precise.

working poor (FC_e=0 and IS_e>0 where *e* indicates eligibility), working non-poor (IS_e=0 and FC_e=0), or both groups together). The general pattern of results in Table 6 implies that losing Welfare Milk Token eligibility increases the milk budget share and causes some substitution away from non-milk food; while losing Free School Lunches causes no significant change in the milk share but a large increase in non-milk food share. To understand the implications of these estimated effects note that, for the average eligible household, Welfare Milk Tokens were exchanged for about 9 pints per week with a market value of approximately £3. The average household receiving Free School Lunches had 9.6 per week which were worth approximately £10. Income Support recipients are the more natural control group for the treatment of losing nutrition program eligibility since both IS and FC groups are relatively poor. The estimates corresponding to this definition of control group suggests that losing Welfare Milk Tokens increased the budget share of milk by 0.96. This represents an increase in milk expenditure, at the mean for these groups, of approximately £1.80 per week and suggests that Welfare Milk Tokens crowded out private milk expenditure by slightly more than half of their value. The loss of Welfare Milk Tokens to households with young children also affects the share of *non-milk* food: but only by -0.47 implying a small effect (of -£0.80) because some non-milk food spending is switched to milk. The final column shows the overall effect on food and milk aggregated together: an increase of approximately £1.

For households with only school age children, the loss of Free School Lunch eligibility leads to an increase in non-milk food share by 2.2%, corresponding to a rise in expenditure of about £5. This implies a non-milk food expenditure crowd-out of approximately half of the Free School Lunch value.

For Free School Lunches (but not Welfare Milk Tokens or Day Care Milk) another difference-in-differences grouping is possible which is *not* based on the 1988 reform. Free School Lunches are only available during school term time, and school summer holidays in Scotland are approximately one month earlier than the rest of the UK.[19] Inspection of the data does indeed confirm that Scotland has different summer school holiday timing.[20]

Table 7 presents estimates of this Scotland vs. England/Wales school holidays difference-in-differences design. The relevant sample contains households with school aged children who have an entitlement to Free School Lunches, or would have, at some time in the school year. If the survey interview takes place during school holidays, Free School Lunches cannot be provided, despite eligibility, and no substitute is available. Again the table just shows the coefficient on the relevant interaction in an equation that controls for time and for region, as well as the same controls as used previously. The first line of the table shows, for example, the effect of comparing spending in Scotland on schooldays with England and Wales during school holidays *at the same time of the year*. These program holiday difference-in-differences, which control for regional and seasonal differences in spending patterns, show that losing Free School Lunches because of school holidays, on average, increases food expenditure share relative to school term time: increasing the share on average by 0.016 although the effect is not well determined. We should think of this

[19] Children in private schools typically have longer summer holidays. We do not have data on who attends private school but, from other sources, we know that they are only 6% of the school population. Households with children in private schools are very unlikely to be eligible for Free School Lunches.

[20] From the pattern of school meals and the survey date observed in the data.

treatment as the effect of *losing* approximately 10 lunches per week worth approximately £10. Thus a change in the share of 1.6% corresponds to an increase in spending on food of approximately £4.70 per week for a typical low income household. So, effectively £1 of Free School Lunches displaces approximately £0.40 of household non-milk food spending – somewhat smaller than the difference-in-difference estimate that exploits the 1988 reform, although this estimate is not statistically significant. Of course, implicit in the school holiday difference-in-differences is the presumption that inter-temporal substitution in food spending is small – in practice there may be changes in the stocks of food in response to the anticipated seasonal loss in Free School Meals that that would suggest that our estimates in Table 7 would be lower bounds to unanticipated permanent losses. It may also true that these estimates are contaminated with a pure holiday effect – that free lunch recipients change their consumption behavior during the holiday period. To investigate this, we compare the change in food spending when holidays occur for free school lunch eligibles with ineligibles. This differences out any pure holiday effect. The result is a 0.016 rise in the share of food for eligibles relative to ineligibles, albeit rather imprecisely estimated, which is exactly the difference we get from our estimate of the effect of losing Free School Lunches because of school holidays. In other words, it seems that holidays do not make a difference, but the loss of a free school lunch does.

4.2 Structural demand system with endogenous nutrition program participation

Our second method relies on the structural form for preferences embodied in equation (1). We also adopt restrictive distributional assumptions in order to estimate the determinants of program participation and budget shares. It is important to note

that this structural model provides estimates of the average treatment effect rather than the intention to treat parameters that the difference-in-differences method provided.

The structural approach still allows us to exploit the reform for identification, but has the important advantage that it allows us to include Day Care Milk within a single coherent framework. Recall that eligibility was unchanged by the reform so we were unable to estimate the effect of such transfers in a difference-in-differences framework. This was an important deficiency because the different delivery mechanisms for milk are potentially informative about agency. It might be argued that daycare milk is synonymous with daycare so that we should not be able to estimate the effect of daycare milk on spending patterns separately from the effect of daycare on spending. In fact, as Table 4 shows, the proportion of eligibles that receive daycare milk is only 19% because much of daycare is unregistered.[21] The identifying assumption that we are making in order to make inferences about agency from the effect of daycare milk compared to welfare milk is that registered and unregistered daycare has the same effects on spending patterns.

The importance of non-participation in nutrition programs was illustrated earlier in Table 4, and this motivates us to consider modeling the endogeneity of program receipt in the budget share equations. Using the micro-data allowed us to control for *observed* differences between individuals within each group. However, the implicit assumption in the previous sub-section is that the treatment is randomly assigned conditional on the observed control variables included. That is, there are no

[21] Only children in registered daycare facilities are eligible for Day Care Milk. Here we treat all children in daycare as potentially eligible because we do not observe whether it is registered or not.

unobserved determinants of program eligibility or participation that are correlated with budget shares. It seems possible that unobserved determinants of participation are likely to affect budget shares – for example, households with members who dislike milk are going to be less likely to participate in the milk programs and will also have a lower milk budget share, conditional on participation.

In order to deal with this potential endogeneity of eligibility we adopt a structural approach to the specification of equation (1). Here we impose an explicit structure to the way that the **X**'s affect the shares, and we also allow for endogenous program participation by assuming that the unobservable determinants of budget shares and participation are jointly normally distributed. However, we can continue to exploit the reform for identification, since nutrition program eligibility is an important determinant of participation, as was shown in Table 4. The structure allows us to test for crowd-out and agency by incorporating the relevant features of all of the programs within a coherent demand framework. This demand system with endogenous program participation is modeled using a multivariate generalization of the Heckman (1979) selection model. Adopting this method has the important advantage that we can incorporate Day Care Milk into the analysis - something that was not possible with difference-in-differences because this program was not subject to the 1988, or any other, reform.

Expenditure patterns in the FES data have been the subject of detailed modeling by Blundell *et al* (1993) and Banks *et al* (1997) which both show that a generalization of the Almost Ideal Demand System, which allows for budget shares to be *quadratic* functions of log total expenditure, are strongly preferred to the original log linear, Almost-Ideal, specification of Deaton and Muellbauer (1980). Moreover,

non-parametric modeling of the nature of Engle curves in this data has been explored in Blundell *et al* (1998) who show that non-(log)-linearity is a strong feature of the data, and that a quadratic in log total expenditure provides a good approximation to non-parametric Engel curves.[22] Such a specification arises from maximizing a utility function, which is of the PIGLOG class (see Deaton and Muellbauer, 1980), subject to a linear budget constraint. Here, we assume that the milk and non-milk food budget shares of household *i* are given by

$$s_{ik} = \alpha_{ik} + \beta_k \ln y_i + \vartheta_k \ln y_i^2 + \sum_j \delta_{kj} \ln p_j + \mathbf{T}_i \boldsymbol{\gamma}_k + \varepsilon_{ik} \quad (3)$$

where the subscript *k* refers to either milk (*m*) or non-milk food (*f*), p_k is the respective real price, *y* is real total expenditure,[23] ε_{ik} is a random disturbance, α_{ik} depend on the household demographics, $\mathbf{X}_i$, and the vector $\mathbf{T}$ contains dummy variables which indicate participation in the transfer programs, *p* (i.e. Day Care Milk (*dcm*), Welfare Milk Tokens (*wmt*), and Free School Lunches (*fsl*)).[24]

Our approach to modeling take-up is atheoretical – we are not concerned about inference in the take-up equations, we are only concerned to get consistent estimates

[22] Blundell *et al* (1998) find that the food Engel curve is close to log linear. Here we disaggregate food into milk and the rest and find that the Engel curve for the rest is also approximately log-linear while the milk share is strongly quadratic.

[23] Total expenditure here includes housing costs. We control for all of the aspects of the 1988 reforms and make appropriate adjustments to Housing Benefit associated with the changes in entitlements for the reformed benefits. Results where total expenditure excludes housing costs are similar.

[24] We do not estimate a more fully disaggregated demand system including a breakdown of other expenditure items such as alcohol, tobacco, services, transport, etc. To the extent that some of these commodity groups are exclusively adult goods (and some even may have negative externalities on child development) we might be able to draw some further informal inferences about child welfare were we to do more disaggregated modelling. However, since our data is silent on child development issues we refrain from further dis-aggregation and confine our attention to agency and altruism effects on food expenditure.

of (3).[25] We assume that, if $T_i^{p^*}$ are latent variables corresponding to observed participation, T_i^p, and $\mathbf{Z}_i^p$ is a vector of household demographic characteristics which includes transfer entitlements, E_i^p, and η_i^p are respective random disturbances then

$$T_i^p = \mathbf{1}\left(T_i^{p^*} = \mathbf{Z}_i^p \pi^p + \eta_i^p > 0\right). \tag{4}$$

The usual requirement for identifying the demand system in equation (3) still applies – that prices are exogenous which is usually thought to apply at the micro level in demand analysis. However, identifying the conditional demand system with endogenous conditioning of equations (3) and (4) together requires somewhat more if a selection issue arises, i.e. if $\text{cov}\left(\eta_i^p, \varepsilon_{ik}\right) \neq 0$. The stochastic specification of the error terms is assumed to be multivariate normal, with an unrestricted variance-covariance matrix. Multivariate normality is assumed on the grounds that it is quite conventional, allows a flexible correlation structure, and leads to a computationally tractable likelihood function. The resulting likelihood is a trivariate Probit selection model with three correlated endogenous variables (participation in each transfer program) and two correlated (budget share) equations:

$$L = \prod \int_{fsl^-}^{fsl^+} \int_{wmt^-}^{wmt^+} \int_{dcm^-}^{dcm^+} \varphi_3\left(\eta^{fsl}, \eta^{dcm}, \eta^{wmt} \mid \varepsilon^m, \varepsilon^f\right) \varphi_2\left(\varepsilon^m, \varepsilon^f\right) d\eta^{fsl} d\eta^{dcm} d\eta^{wmt}, \tag{5}$$

where ϕ_2 and ϕ_3 are the bivariate and tri-variate Normal densities. The limits of integration are given by $+\infty, Z^p \pi^p$ if $T^p = 1$, or $Z^p \pi^p, -\infty$ if $T^p = 0$, and otherwise $+\infty, -\infty$ respectively. Estimation is by Full Information Maximum Likelihood.

[25] See Hernandez and Pudney (2007).

While it is possible to rely purely on these distributional assumptions, the context of our problem suggests some exclusion restrictions may be imposed for non-parametric identification of the model. First and foremost, we exploit changes in the levels of entitlement and eligibility that have occurred over time, through reforms and imperfect indexation over time, which might induce changes in the levels of participation, given household characteristics. The most important of these policy changes was the 1988 reform that removed eligibility to Free School Lunches and Welfare Milk Tokens entirely for the working poor but not for the non-working poor. Embedding a difference-in-differences design into a structural model in this way is essentially a form of grouped instrumental variables. In addition to the reform, imperfect indexation and real price changes, offer additional exclusions that can be thought of as over-identifying restrictions.

A further restriction is suggested by the take-it-or-leave-it nature that nutrition programs typically have. Free School Lunches are available in only one quality, and at a given time and place. The demand for a transfer of this given (usually low) quality is likely to depend on household income since it seems likely that quality is a normal good: for a given quality, as income rises from a low level the probability of participation is likely to rise because the desired quality level is likely to be above the offered quality level; but beyond the income level where desired quality is the same as the offered quality, further increases in income lead to a decrease in the participation probability. That is, the relationship between free school lunch participation and income is likely to be non-monotonic. In the case of Free School Lunches we might

proxy quality by price relative to the price of (market) food which varies over time.[26] If the price of school lunches is high relative to the price of food in general then this is an indication of their higher quality, to the extent that the price reflects the costs of raw materials and other inputs.[27] We use an *interaction* between the quality of the free school lunch (proxied by price) and a quadratic in log income to capture the likely inverted "U" shape relationship between the participation probability and income that arises because of the take-it-or-leave-it nature of the program.[28] Note that our use of the QUAIDS model implies that the shares themselves depend on log price and on a quadratic in log income, but there is no role for an interaction term.

Finally, it is important to note that it is a maintained assumption, as usual in demand analyses, that total expenditure is exogenous. It is useful to state why this is assumed and what the consequences are. Eligibility for Welfare Milk Tokens or Free School Lunches requires both household receipt of an associated cash transfer and children in the relevant age range. For the purposes of our analysis, we assume Welfare Milk Tokens and Free School Lunches are available for those who are *eligible* to the associated cash transfer according to the reigning rules, not only those

[26] The price is the average price observed in the data for those that buy school lunches within each region. In principle this price is fixed nationally although we do find that there is a small cross section variation, especially after the mid 1980's.

[27] Over the time period considered here the real price of school lunches increased by 10%, while the real price of food fell by 13% and the real wages of unskilled workers remained approximately static.

[28] In addition, a further exclusion restriction is that benefit-year (April to March) dummies only enter into the program participation equation. This is in order to capture the effects of other changes in transfer programs, over and above entitlement value – such as administrative procedures. We would argue that these proxies for administrative changes should not affect the budget shares beyond their effect on participation and hence on the number of in-kind units received. For the budget share, month-of-year dummies capture seasonality and a quadratic time trend is added to capture long run changes in spending patterns. Similar results were obtained from including a full set of month of year and calendar year dummies.

who are in *receipt* of the cash transfer. Extending our model to *explicitly* incorporate participation in the associated cash transfer programs would imply endogenizing income.[29] The consequence of this extension would be to complicate the model such that further identification assumptions or restrictions would be required and we consider this to be outside of scope of the present study.[30] Effectively, we are assuming that income matters for total expenditure but the sources of income do not. We assume that a dollar of welfare cash has the same effect, ceteris paribus, on total expenditure as a dollar of earnings or asset income. Thus, our analysis fully incorporates the effects of the cash transfer changes that occurred in 1988.

4.3 Results and Discussion

Table 8 presents our preferred specification and needs some justification. We include the *number* of transfers in the budget shares and the *values* of entitlements in the participation equations since this was preferred over other combinations in a likelihood ratio test. The quadratic income terms in the participation equations were completely insignificant and left the remaining coefficients effectively unchanged so are omitted. We find that the level of entitlement[31] has a significant positive effect on

[29] Our preferred estimates are presented in Table 8. In alternative specifications, the entitlement value of the *cash* transfer was included as an explanatory variable in the associated nutrition program participation equations. The motivation was that a more financially attractive cash benefit may make the whole cash and in-kind transfer bundle more attractive. This would help identification to the extent that cash *entitlement* need not appear in the budget share equations. Coefficients on *cash transfer* entitlement turned out to be insignificant once *nutrition program* entitlement value was included. We take this as evidence supporting our simpler specification.

[30] Moreover, it seems unlikely that this is important for the estimates: although the assumption of exogenous total expenditure is rejected by Blundell *et al* (1993) and Browning and Meghir (1991), their results suggest only modest differences in estimates.

[31] Entitlement level is the product of the number of school age children (multiplied by five during term time, because there are five school days in a school week) and price. Since we already include the number of school age children our estimates imply that participation does not vary with quality except through the income interaction.

participation in all cases. Income has a negative effect on milk transfer take-up and the effect on free school lunches is insignificantly positive. The interaction between income and the real price of school lunches captures the idea that, if quality is a normal good, then at low levels of income an increase in quality will decrease take-up, but at high levels of income an increase in quality will increase take-up. Thus as income rises the interaction with ln*y* should turn from positive to negative and this is reflected in the positive effect on the interaction between the quality and income and the negative effect of the interaction with the *square* of income. In fact our estimates imply that at levels of income in excess of £35 (which is close to the minimum in the data) the negative effect dominates implying that the quality of free school lunches is so low that even the poorest households would prefer a higher quality. Quality issues in milk are unlikely to be important in milk since it is only available in one quality. Not surprisingly, unlike in the free school lunch equation, price-income interactions in the milk program participation equations were insignificant and again their exclusion was unimportant. Finally, the correlations between unobservables that determine participations are not in the table, but are statistically significant, which supports our joint modeling of program participation.

The coefficients on the number of free school lunches and the number of free pints of milk allow us to compute the extent to which these transfers are crowding out private expenditure of households. The mean food share of households not receiving Free School Lunches is 20% representing a real expenditure of £61.71 per week so a fall in the share of 0.006 represents a reduction in food expenditure of £0.19 per lunch (all figures are in 1992 prices), or about one fifth of the market value and somewhat smaller than both of our difference-in-difference estimates that exploited the 1988

reform and school holidays. Similarly, the mean milk share of households not receiving Welfare Milk Tokens is 1.60%, which represents an expenditure of £4.97, so reductions in the shares of 0.011 per pint of nutrition program milk represent reductions in milk expenditures of £0.23 per pint, or about 70% of the market value which is somewhat larger than our difference-in-difference estimates.

The figures in the text above are calculated at the mean of the data. In Table 9 we present the calculated crowd out of private expenditures averaged over each observation in the dataset. Our estimated crowd-out for Free School Lunches is 15% of their value, while for milk the figures are both close to 80% of the value.[32] The cross effects make intuitive sense: one pint equivalent of Welfare Milk Tokens (Day Care Milk) reduces milk expenditure by £0.28 (£0.27) and induces non-milk food expenditure to rise by £0.06 (£0.07), while a Free School Lunch induces milk expenditure to rise by £0.08 and non-milk food expenditure to fall by £0.15. The Free School Lunch effect is small but the welfare and daycare milk effects are quite substantial – a high proportion of the transfer is crowded out by the household making countervailing expenditure changes.

Our estimated elasticities, evaluated at mean income, are presented in Table 10. There are few estimates of milk elasticities available for comparison in the literature but the results here compare closely with those from the British *National Food Survey* (National Food Survey Committee (1989)). But, unlike those, ours are well determined.

Compared to difference-in-differences, the structural estimates reveal greater relative crowd out from welfare milk tokens than free school lunches. In both approaches we use eligibility reforms and regional school holiday variation for identification but assume that eligibility is random conditional on the covariates and that trends are common; while in the structural model we impose economic theory and distributional assumptions but explicitly allow for selection into program participation. We prefer our structural model on three grounds. Firstly: that milk transfer crowd-out is found to be similar for reformed and non-reformed programs, which suggests we are not solely reliant on reform-driven variation for identification. Secondly: both regional vacation timing and the reform to free school lunch eligibility can be incorporated consistently and produce similar estimates. Thirdly: the structural model can identify agency under what seem like quite weak conditions.

There is considerable agreement between the approaches. For example, welfare milk features in both structural and difference in difference models: in the former a token decreases the milk share (whose mean is approximately 1.5%) by 0.1095 (Table 8) so 7 tokens per week for an average of 0.7 young children would reduce the share by about 0.5%; compared to an effect of 0.649% (Table 6, both control groups). Since the take-up rate for milk tokens is in the order of two thirds, a crude correction to make the ITT DD estimate comparable to the structural ATE would bring this 0.649 down to approximately 0.45 – just slightly smaller than the structural estimate. Both models show crowding-out of transfers from the government

[32] We would expect the extent to which milk (tokens or liquid) crowds out spending on milk would be comparable with the effects of Food Stamps in US research. The Hoynes and Schanzenbach (2008) estimate is approximately 80%.

indicative of altruism between parents and their children. The difference in differences suggested crowd-out is only slightly greater for welfare milk tokens than free school lunches, whereas the structural model suggests the difference in the extent of crowding-out between the two programs is somewhat greater. The congruence between structural and reduced form effects gives us confidence in the estimates of agency effects from the structural model. Here we find that the effects of daycare milk are essentially the same as welfare milk suggesting that agency issues are not important.

5. Conclusion

This paper has been concerned with evaluating the impact of nutrition programs for households with children on food expenditure. We have been particularly concerned about the extent to which the aim of these transfers can be undone by countervailing behavior of household members. The results suggest that there is the possibility of significant crowding-out. In the case of Welfare Milk Tokens we expected a high degree of displacement since the level of provision is large relative to typical needs: and we found that approximately three-quarters of the transfer is offset by reductions in milk expenditure. For Day Care Milk we found a similar effect despite the fact that it is less of a substitute for market milk (other household members cannot consume it) and the level of provision is low. The result that milk has essentially the same crowd out of private expenditure, regardless of whether it is given directly to children as Day Care Milk or to the mother as Welfare Milk Tokens, does not suggest the presence of agency problems. Moreover, as might be expected for Free School Lunches, a commodity which may well be a poor substitute for food purchased elsewhere, we found only a relatively small crowd out.

The results are suggestive of strong altruistic connections especially between young children and their parents, which imply that public transfers to the parents have a significantly tempered effect on the children themselves, particularly the young. However, the results are potentially important, and optimistic, for policy design. They imply that in-kind transfers *can* be successful - provided one can limit crowd out of private expenditure by confining such policies to goods where there is no close market substitute. Agency issues in our specific example seem to be relatively unimportant.

While our analysis is confined to in-kind transfers the issues that we address are relevant to other programs for households with children. Many cash transfers are intended to improve the welfare of one type of individual but are paid to another (for example, Child Benefit, a weekly lump sum, is paid to mothers in the UK, and is similar to Child Tax Credits in the US). The finding that agency problems are not large for these in-kind programs provides some reassurance over cash transfer programs.

Finally, while our analysis has uncovered significant altruism but no significant agency effects, we are silent on the well-being of children over and above these effects. It would be useful to know what the impact of programs intended to improve childhood nutrition would be on long term outcomes for children. The effectiveness of such programs depends not only on how the delivery mechanism affects how much nutrition is delivered (which we address here) but also on the effect of a unit of nutrition consumed (which we cannot address with our data). Thus, our analysis is relevant to evaluating the delivery of the treatment, not the treatment itself.

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Table 1 *Descriptive Statistics: Means (standard deviations)*

		Households with children		
Time period	Variable	IS>0	FC>0	IS=FC=0
	Number of adults	2.09 *(1.12)*	1.95 *(0.74)*	2.22 *(0.65)*
	Number of children 0-4	0.64 *(0.77)*	0.64 *(0.82)*	0.53 *(0.71)*
	Number of children 5-15	1.26 *(1.11)*	1.44 *(1.17)*	1.23 *(0.95)*
Pre-reform	Proportion lone parent	0.32	0.26	0.04
	Free School Lunch receipt	0.40	0.47	0.02
	Welfare Milk Token receipt	0.37	0.34	0.02
	Day Care Milk receipt	0.14	0.11	0.07
	# adults	1.75 *(1.00)*	1.92 *(0.80)*	2.15 *(0.63)*
	# children 0-4	0.72 *(0.78)*	0.62 *(0.78)*	0.58 *(0.72)*
	# children 5-15	1.16 *(1.11)*	1.49 *(1.15)*	1.17 *(0.95)*
Post-reform	Proportion lone parent	0.50	0.31	0.05
	Free School Lunch receipt	0.31	0.09	0.01
	Welfare Milk Token receipt	0.41	0.04	0.01
	Day Care Milk receipt	0.11	0.06	0.02

Note: IS>0 denotes Income Support receipt, FC>0 indicates Family Credit receipt and IS=FC=0 receipt of neither.

Table 2 *Expenditure Patterns Pre and Post Reform by Group (£ pw, 1997 prices)*

	Welfare program	IS>0	FC>0	FC>0	FC=IS=0
Time period	Children	all	0-4 only	5-16 only	All
	Milk	3.92 *(3.49)*	1.94 *(1.98)*	3.92 *(3.60)*	4.97 *(3.68)*
pre-reform	non-milk food	45.02 *(26.28)*	41.37 *(21.53)*	54.04 *(26.74)*	61.71 *(28.18)*
	Total	182.05 *(224.62)*	172.98 *(82.29)*	231.48 *(133.89)*	314.96 *(256.82)*
	Milk	2.66 *(2.91)*	3.27 *(2.89)*	4.38 *(4.20)*	3.10 *(3.34)*
post-reform	non-milk food	40.52 *(26.09)*	43.93 *(21.45)*	53.48 *(24.15)*	66.88 *(30.93)*
	Total	164.35 *(124.02)*	194.71 *(83.27)*	209.62 *(79.36)*	361.37 *(242.94)*

Note: Eligibilities in the table are calculated conditional on the cash transfer *receipt*. A similar table where eligibility is conditional on transfer eligibility rather than receipt is available from the authors on request.

Table 3 *Cash Transfer Program Reform and Eligibility*
Number of eligible households (percent of age group)

		Pre-reform		Post-reform		Both	
Program	Childrens' ages	Number	percent	Number	percent	Number	Percent
IS receipt	0-4 only	686	(16.3)	421	(14.7)	1107	(15.6)
	5-15 only	1399	(13.5)	597	(10.8)	1996	(12.6)
	0-4 & 5-15	628	(17.9)	315	(14.7)	943	(16.7)
FC receipt	0-4 only	94	(2.2)	74	(2.6)	168	(2.4)
	5-15 only	249	(2.4)	218	(3.9)	467	(2.9)
	0-4 & 5-15	122	(3.5)	115	(5.4)	237	(4.2)

Note: Eligibilities in the table are calculated conditional on the cash transfer receipt. A similar table where eligibility is conditional on cash transfer eligibility rather than receipt is available from the authors on request.

Table 4 *Program by Program Eligibility and Participation*
Number of households (*row percent)*

Program	Eligible	Not receiving		Receiving		Total
Free School Lunch	No	17426	*(97.4)*	426	*(2.4)*	17888
	Yes	1521	*(41.8)*	2122	*(58.2)*	3643
	Total	18947	*(88.0)*	2584	*(12.0)*	21538
Welfare Milk Tokens	No	10016	*(97.4)*	268	*(2.6)*	10284
	Yes	603	*(24.6)*	1852	*(75.4)*	2455
	Total	10619	*(83.4)*	2120	*(16.6)*	12739
Day Care Milk	No	8140	*(100.0)*	0	*(0.0)*	8140
	Yes	3750	*(81.5)*	849	*(18.5)*	4599
	Total	11890	*(93.3)*	849	*(6.7)*	12739

Notes: UK Family Expenditure Surveys 1982-92. The dataset comprises 29222 households with children from pooled cross-sections. Free school lunch numbers are for households with school-age children 5-15. Welfare milk tokens and daycare milk numbers are for households with children 0-4. Eligibilities in the table are calculated conditional on the cash transfer receipt. A similar table where eligibility is conditional on cash transfer eligibility rather than receipt is available from the authors on request.

Table 5 Multiple Program Eligibility and Participation: households (row percent)

Number of programs entitled to:	Number of programs received								
	0		1		2		3		Total
0	17071	*(97.7)*	391	*(2.2)*	7	*(0.0)*	0	*(0.0)*	17469
1	6731	*(70.1)*	2757	*(28.7)*	100	*(1.0)*	13	*(0.1)*	9601
2	314	*(22.5)*	691	*(49.4)*	393	*(28.1)*	0	*(0.0)*	1398
3	72	*(9.5)*	226	*(30.0)*	300	*(39.8)*	156	*(20.7)*	754
Total	24188	*(82.8)*	4065	*(13.9)*	800	*(2.7)*	169	*(0.6)*	29222

Note: Eligibilities in the table are calculated conditional on the cash transfer receipt. A similar table where eligibility is conditional on cash transfer eligibility rather than receipt is available from the authors on request.

Table 6 Intention to Treat effects on budget shares (%) with cash transfer eligibility grouping

Sample households	Treatment ($FC_e > 0$)	Control ($FC_e = 0$)	Milk		Non-milk-food		All-food	
			γ	p-value	γ	p-value	Γ	p-value
Children 0-4 only	Lose WMT	Keep WMT ($IS_e>0$)	**0.960**	0.031	**-0.472**	0.000	**0.488**	0.000
	Lose WMT	Never WMT ($IS_e=0$)	0.339	0.109	-0.247	0.914	0.092	0.093
	Lose WMT	Either WMT	**0.649**	0.007	**-0.360**	0.000	**0.290**	0.000
Children 5-15 only	Lose FSL	Keep FSL ($IS_e>0$)	0.230	0.460	1.757	0.254	1.987	0.409
	Lose FSL	Never FSL ($IS_e=0$)	-0.056	0.732	**2.612**	0.001	**2.556**	0.005
	Lose FSL	Either FSL	0.087	0.757	**2.185**	0.000	**2.272**	0.002
All	Lose WMT/FSL	Keep WMT/FSL ($IS_e>0$)	0.400	0.132	0.992	0.364	1.392	0.200
	Lose WMT/FSL	Never WMT/FSL ($IS_e=0$)	0.180	0.196	**3.634**	0.000	**3.815**	0.000
	Lose WMT/FSL	Either WMT/FSL	0.290	0.057	**2.313**	0.000	**2.603**	0.000

Note: FC_e is Family Credit *eligibility* and IS_e is income support *eligibility* computed on the basis of pre-reform criteria. DD indicate difference-in-difference estimates and associated p-values from separate budget share regressions on individual data. Controls for log income and its square are included. WMT denotes Welfare Milk Tokens, FSL is Free School Lunches, FC_e is Family Credit receipt and IS_e is income support receipt. The first three rows are estimated on households containing only pre-school children in order to focus on Welfare Milk Tokens. The middle three rows are estimated on households with only school-aged children in order to focus on Free School Lunches. The last three rows are estimates from the full sample of all households with children.

Table 7. *Effects of free school lunches on non-milk food budget shares (%) by school holidays*

Sample	**Control**	**Treatment**	**Cash transfer eligibility**	
	School day in:	School holiday in:	DD	p-value
Free School Lunch eligible	Scotland (Aug)	England/Wales (Aug)	0.00705	0.5445
	England/Wales (July)	Scotland (July)	0.02588	0.0609
	Both (everywhere)	Both (everywhere)	0.01646	0.3095
	FSL Ineligibles:	FSL Eligibles:		
All school aged children	Holiday-term	Holiday-term	0.01662	0.6937

Note: The sample includes households with children age 5-15 who are eligible for Free School Lunches. DD indicate difference-in-difference estimates and associated p-values from separate budget share regressions on individual data. These regressions include month and region effects, as well as household characteristics, and the coefficients above are from the month*region interactions. Family Credit eligibility is calculated on observed characteristics and pre-reform rules. The last row of the table represents both treatment groups together (holidays in any region) and both control groups together (school days in any region).

Table 8. Expenditure Shares and Nutrition Program Participation: ML Estimates

Dependent Variable		**Budget Shares**				**Program Participation**					
Category		**Milk**		**non-milk food**		**free school lunch**		**day care milk**		**welfare milk tokens**	
	Intercept	10.8710	*0.4130*	6.0763	*0.1988*	0.1058	*1.4436*	1.1522	*0.2095*	2.2693	*0.3611*
Program	# free school lunches	0.0309	*0.0025*	-0.0060	*0.0015*						
	# day care milk pints	-0.1055	*0.0246*	0.0026	*0.0014*						
	# welfare milk tokens	-0.1095	*0.0030*	0.0025	*0.0019*						
	Entitlement value					0.5050	*0.1293*	0.2678	*0.0662*	0.2010	*0.0706*
Prices & incomes	Ln $p_{(\text{milk})}$	2.6988	*0.5385*								
	Ln $p_{(\text{non-milk food})}$	1.5095	*0.8147*	0.6300	*0.4475*						
	Ln y	-2.5662	*0.1511*	-0.9637	*0.0690*	0.0890	*0.2668*	-0.2275	*0.0393*	-0.2524	*0.0772*
	$(\text{Ln } y)^2$	0.1207	*0.0145*	0.0007	*0.0064*						
	(Ln y)*lunch price					1.1653	*0.2855*				
	$(\text{Ln } y)^2$*lunch price					-0.1943	*0.0511*				
Demographics	# children 0-4	0.4209	*0.0125*	0.0752	*0.0073*	0.1715	*0.0336*	0.1249	*0.0259*	0.0684	*0.0926*
	# children 5-15	0.3431	*0.0097*	0.2125	*0.0054*	0.1164	*0.0629*	0.0171	*0.0199*	-0.0138	*0.0280*
	# adults	0.3219	*0.0124*	0.2659	*0.0063*	-0.0412	*0.0351*	-0.0122	*0.0425*	-0.1145	*0.0577*
Other controls		**R**,**M**,**t**		**R**,**M**,**t**		**R**,**B**		**R**,**B**		**R**,**B**	

Notes: Conditional (on nutrition program participation) Quadratic Almost Ideal Demand System with homogeneity and symmetry imposed. See main text for tests of these restrictions. Mean log likelihood -3.1221. The budget share dependent variables milk and non-milk food are multiplied by 100 and 10 respectively. Asymptotic standard errors are in *italics*. The reference household type is headed by a lone parent, regardless of employment status. Other controls indicated in the table but not presented are (**B**) dummies for 12 benefit-years, **R** for 10 regions, **M** for 11 months of year. **t** indicates the presence of a quadratic time trend, also parents' marital and employment status interactions are included.

Table 9 *Estimated Crowd Out: Mean (standard deviations)*

Expenditure	**Free school lunch (£1)**	**Welfare Milk (£0.33)**	**Day-care milk (£0.33)**
Milk	0.0786 (*0.0153*)	-0.2785 (*0.0543*)	-0.2684 (*0.0523*)
Food	-0.1526 (*0.0298*)	0.0636 (*0.0124*)	0.0661 (*0.0129*)
Other goods	0.0740 (*0.0144*)	0.2149 (*0.0419*)	0.2022 (*0.0394*)

Table 10 *Estimated Elasticities: Mean (standard deviation)*

	Milk		**Food**	
Milk Price	-0.1008	*(0.0021)*	0.0901	*(0.0031)*
Food Price	0.0901	*(0.0031)*	-0.7355	*(0.0146)*
Income	0.1162	*(0.0225)*	0.1789	*(0.0197)*

Appendix

Q = question; I = instruction to interviewer.

Q99: Have (any of) you (or your children under 16) had any free welfare milk during the past seven days ending yesterday?

I99: Welfare milk is available for:
i. Expectant mothers and all children under school age in families in receipt of supplementary benefit, housing benefit supplement, family income supplement or in special need because of low income.
ii. An expectant mother who already has two children under school age, regardless of family income.
iii. All but the first two children under school age in families with three or more children under school age, regardless of family income.
iv. Handicapped children aged 5 to 16 who are not attending an educational establishment.

Q100: Has (have any of) your child(ren) under 16 had any free school milk during the past seven days ending yesterday?
I100: Free school milk is supplied to children up to approximately their seventh birthday at registered day nurseries, playgroups and state primary school or approved child minder. The amount is one third of a pint per day. For children with particular health problems, milk may be supplied up to their sixteenth birthday or the allowance may be more than one third of a pint.

Q101: Has (have any of) your child(ren) at state school(s) had any school meals during the past 7 days ending yesterday?
I101: Free school meals are supplied to children whose parents are on a low income. The conditions governing school meals vary from local authority to local authority.

Figure 1 *Free School Lunch receipt by group and calendar year: Households with at least one school age child*

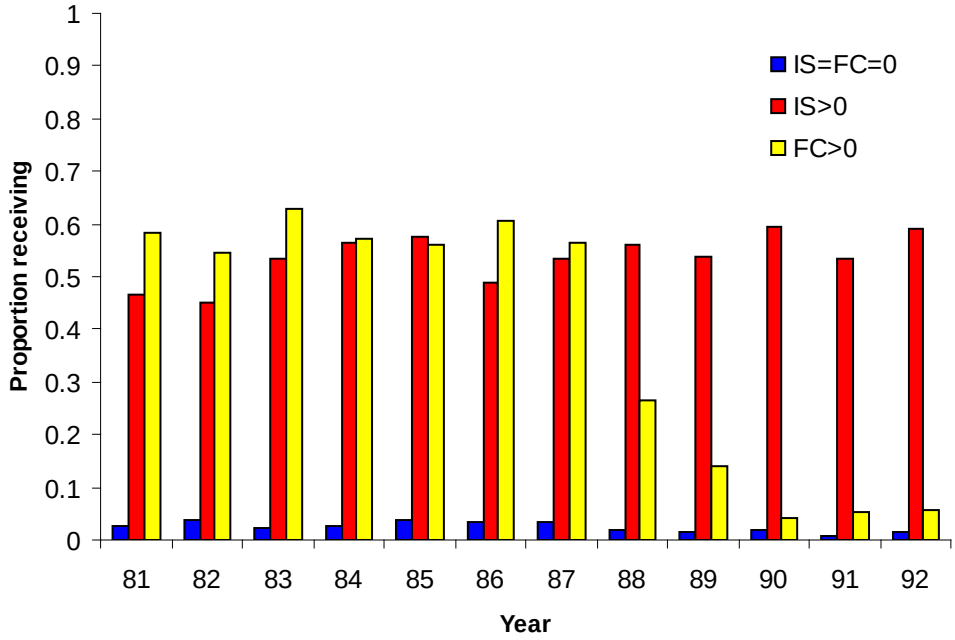

Figure 2 *Welfare Milk Token receipt by group and calendar year: Households with at least one pre-school child*

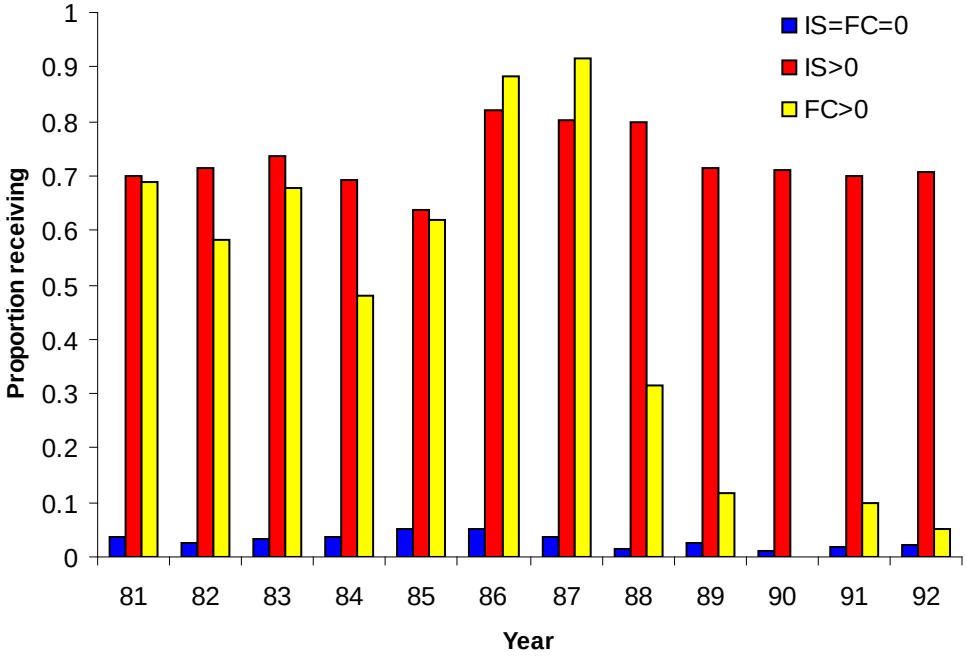

Figure 3a Milk Budget Share by group and calendar year

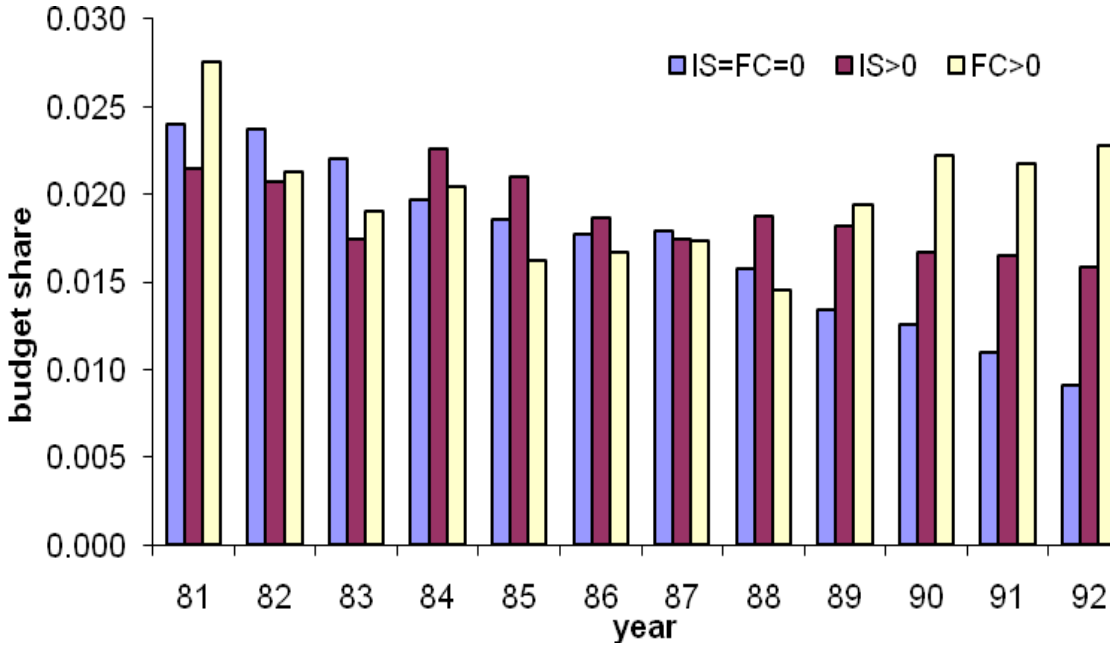

Figure 3b Food Budget Share by group and calendar year