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**There's no such thing as a free lunch:
Altruistic parents and the response of household food
expenditures to nutrition program reforms**

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Abstract

Many countries provide extensive in-kind public transfers for specific needs of particular client groups such as the elderly, the disabled, and children. However, this may crowd out private expenditures on the goods in question and, to some extent, undermine the case for not simply giving cash. If the target group belongs to a larger household the mechanism behind this crowding out could be either altruism or agency. This paper is concerned with three nutrition programmes 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 exploit a reform that removed eligibility to the first two programs from *working* poor households. We find significant crowding-out of private food expenditures – a free school lunch reduces food expenditure by around 15% of the purchase price of the lunch, and a free pint of milk reduces milk expenditure by about 80% of the market price. We conclude that this is due to altruism rather than agency problems because milk expenditure crowd-out is similar across milk programs that have different delivery mechanisms.

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1. Introduction

Economists have frequently argued that cash transfers Pareto dominate in-kind transfers. However, this argument is inherently a first-best one and there are several other arguments in favor of in-kind transfers that are valid in a second-best world. For example, in-kind transfers are often used where agency problems may be an issue: this might arise when policy is specifically concerned with the welfare of an individual but a cash transfer cannot be made directly to the intended recipient (see Cox and Jakubson (1995)). A second argument relates to the desire to exploit the stigma associated with visibly being in receipt of some transfer, in order to improve the targeting of such transfers to the most needy. This may be most relevant in circumstances where recorded income is not a good indicator of well-being, for example in an economy with a large underground sector (see Blackorby and Donaldson (1988), and Besley and Coate (1992a,b)). Both of these arguments suggest that an in-kind transfer is not valued as highly as cash by the recipient: in the first case because the agent cannot trade the transfer for cash from which rent could be extracted; and in the second case because the value of the transfer is net of the costs of the stigma¹.

The fact that in-kind transfers are worth more to the poor than to the rich, but worth less than cash, moderates their use for poverty relief. Nonetheless, at the same time as improving the targeting of expenditure to alleviate poverty, in-kind transfers may be able to protect the welfare of children in poor households from adverse shocks associated with variations in parental income. Indeed, this is precisely why many such schemes were introduced. However, if family members are altruistically linked then an in-kind transfer directly to one household member may be offset by some countervailing action by other members. Thus, a major issue for welfare policy is the extent to which public transfers displace private transfers and this depends on the extent of altruism. The “Rotten-kid” phenomenon (see Becker (1976)) applies only if the household is at an interior solution of

¹ See also Balestrino (1999) for an analysis of in-kind transfers when there are other distortionary taxes.

its consumption problem² where the parent is making positive transfers. The Rotten Kid Theorem severely undermines the case for making both cash and in-kind transfers to individuals as opposed to households. One argument for providing in-kind transfers to low income households with children is that this alleviates the effects of poverty on children but does not undermine the work incentives of the parents. But if such transfers can be offset by some corresponding intra-household reallocation then not only is the affect on child welfare undermined but so too is the potential beneficial work incentive effect since (at least some of) the benefit of the transfer intended for the child could be appropriated by the parent.

This paper addresses the issue of the extent to which dependent children and their parents are altruistically linked³, as well as the more conventional issues of the extent to which in-kind transfers crowd out private expenditure and are equivalent to cash (considered, for example, by the US food stamp literature). There has been little research in the UK on this and the few US studies have been directly concerned with these issues are reviewed in Altonji, *et al* (1996), and Currie (1997). The former shows evidence consistent with altruism as a motive for *inter vivos* transfers. The latter shows that a 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. More recently, Bhattacharya, *et al* (2004) has considered the impact of the US school breakfast program and confirms beneficial effects on nutrition, as well as evidence that it promotes good eating habits, better eating of other family members, and has no adverse impact on calorific intake⁴.

² Consumption of the commodity in the absence of the transfer should be greater than the quantity transferred. Other conditions also apply, see Bergstrom (1997).

³ See Altonji *et al* (1995) for evidence of intergenerational altruistic links between parents and adult children, and for a survey of altruism in the context of charitable giving see Rose-Ackerman (1996).

⁴ In contrast, evidence summarised in a special issue of the **American Journal of Clinical Nutrition** (1995), suggests that school nutrition programs had much smaller impacts on nutrition intakes than Currie suggests.

The UK programs of interest here are: Free School Lunches for children from 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 while attending registered childcare institutions regardless of family circumstances. These programs can be informative because of their contrasts: Milk is a good substitute for privately provided alternatives, while school lunches are a poor substitute because of heterogeneous quality. 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. Importantly, two of these programs were reformed in the middle of the observations period: poor households with *in-work* parents lost eligibility to Welfare Milk Tokens and Free School Lunches, whereas previously eligibility was for low income families both in- and out-of-work. Day Care Milk continued to be provided regardless of circumstances.

Studies of the impact of the US food stamp program suggest an increase in food spending despite almost all recipients spending more on food than the value of stamps. Fraker *et al* (1995) finds an increase of 18-28% - perhaps because the stamps will typically be given to the mother. However, this increase is less than the value of the stamps: the marginal propensity to spend on food out of food stamps is in the range 0.20 to 0.45 (see Kuhn *et al* (1996)) which is considerably more than the propensity to spend on food out of marginal cash income according to most estimates of consumer demand. Hoynes and Schanzenbach (2006) also show positive effects of Food Stamps on household food spending⁵ by exploiting the differential introduction of the program across states.

While much of the US food stamp research has been concerned with establishing the value of such transfers to recipient households, we are concerned with the implications of the individualistic nature of transfers to uncover the extent of altruism. It

⁵ In the context of a developing country, see also Del Ninno and Dorosh (2003).

would also be desirable to look directly at child consumption or child outcomes (for example health and test scores⁶), however we examine only the effects of transferring private goods (milk and food) on household expenditures which is a more direct way of testing for altruism.

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 administrate than cash transfers. Moreover, a proportion (the marginal budget share of food) of any cash-out would be allocated to higher food expenditure by the household. More importantly, the question is also 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, allows the parents to alter expenditure patterns. Second, giving milk in day care where the authorities can ensure a child drinks it rather than giving milk to the household where it may be consumed by any household member. We think of differences in the former as revealing altruism and differences in the latter as suggesting agency.

Our analysis is based on pooled cross-section data from the UK Family Expenditure Surveys (FES) 1981-1992⁷. The FES are detailed continuous surveys of household expenditure patterns, demographic characteristics, income sources and transfer receipts. We use 29,222 households containing dependent children to analyze household milk and non-milk food expenditure and its relation to nutrition programs, while controlling for food and milk prices, income and household characteristics.

⁶ See Currie (1997) and references therein for evidence that relates to housing programs and health insurance. See also Browning (1992) who looks at anthropometric effects in developing countries.

⁷ Prior to 1981 free school lunch receipt is not recorded directly, although expenditure on school lunches is recorded. After 1992 information about local taxes (called “rates”) has been removed from the public use data and this undermines our ability to accurately compute welfare entitlements. Importantly, our period of analysis bridges an important reform to nutrition programs.

We exploit a reform⁸ that occurred in 1988 which changed the eligibility conditions for Free School Lunches and Welfare Milk Tokens, but not for Day Care Milk. We use this natural experiment to identify the role of altruism by considering the reformed programs separately, and combine all three programs in a structural model to also test for agency. Furthermore, we use the fact that Free School Lunches are only available during term time and school summer holidays in Scotland are a month earlier than the rest of the UK.

Thus, we pursue a number of identification strategies: difference in differences using grouped data, difference in differences using micro-data, and a structural approach that explicitly models the determinants of program participation. The first strategy assumes that the 1988 reform is a natural experiment, while the second strategy controls for observed differences between the treatment and control groups and the changes in these characteristics over time. As an alternative grouping of micro-data to the second strategy, for Free School Lunches school holidays in Scotland and the rest of the UK are used. The above strategies identify crowd-out. However, testing for agency by comparing responses across reformed programs, and focusing on different delivery mechanisms, might be confounded by other program differences in terms of type of transfer (food as opposed to milk) and target group (younger as opposed to older children). To overcome this, and help in interpreting the results, we estimate a structural model of the determinants of participation in all three nutrition programs and of the budget shares. 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, of course, also just milk that is the ultimate object of the transfer. Differences in the unobservable determinants of both program participation and budget shares are allowed for by adopting restrictive distributional assumptions (multivariate normality). However, this third strategy continues to exploit the reforms for identifying agency from crowd-out effects, and complements this by allowing

⁸ This was known as the “Fowler reform” after Norman Fowler, the Health and Social Security Minister.

the imposition of, and testing of, the theoretical restrictions suggested by the structural specification.

The extent to which the 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. Milk has good market substitutes and Welfare Milk Tokens provide a large proportion of (mean non-eligible household milk) expenditure whereas Day Care Milk provides a small proportion. To anticipate our results, we find that: these milk programs crowd out private milk expenditure by 80% of their value; and Free School Lunches are poor substitutes for products available in the market and we estimate that the private food expenditure crowd out is 15% of their value. We also infer that agency problems are small from our finding that milk transfers have a similar crowd out regardless of delivery mechanism: whether via the child's day-care institution or via welfare-eligible mother. Furthermore, milk transfers appear to have similar crowd-out effects regardless of the size of provision relative to needs.

The plan of the paper is as follows. Section 2 explains briefly the UK welfare system and changes that have occurred over time relevant to nutrition programs. Section 3 describes the stylized facts of the Family Expenditure Data. Section 4 presents, illustrates and discusses estimates of our models for food expenditure and program participation. Section 5 summarizes and concludes.

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

In-kind transfer programs have grown rapidly in the US and Slesnick (1996) shows that they have played a major, but hitherto ignored, role in reducing poverty. In the two decades prior to the mid 1990's there had been a tendency for states to shift support away from cash towards Food Stamps and extensions in Medicaid. Despite the erosion of eligibility to the Food Stamp program (see Kuhn *et al* (1996))⁹ that caused expenditure

⁹ In contrast to the direction of reform in the US, there have been calls for the Free School Lunch program to be extended in the UK. For example, the Social Security Advisory Committee (1994) suggested that Free

and caseload to fall from 1994, since 2000 these have climbed again almost to their 1994 peaks. Currently more than 26 million US households participate in food stamps, receiving an average annual value of over \$1200¹⁰. Compared with the US, in-kind transfers in the UK, with the exception of housing and health-related benefits, are largely nutrition programs for households with children: Free School Lunches, Welfare Milk Tokens and Day Care Milk. In the UK the topic also has renewed relevance because of the launch of a food stamp program called *Healthy Start*, in November 2006¹¹, which will provide vouchers, worth £150 annually, for milk, fruit and vegetables to pregnant teenagers and mothers on welfare with children under age 4.

Several means-tested transfer programs provide benefits for households with sufficiently low income and capital. The main UK cash programs during the 1980's and 1990's were Income Support, Housing Benefit, and Family Credit¹². There are approximately 26 million households in the UK and a large number of households participate in one or more programs¹³ and they are expensive. The corresponding programs in the US are respectively Temporary Assistance for Needy Families, Housing Subsidy, and Earned Income Tax Credit. The two UK cash programs of primary interest here, Income Support and Family Credit, are described in more detail below.

Income Support is a cash transfer which is available to households where income and capital are below a “needs” threshold. Needs are a function of household

School Lunches should be reintroduced for those receiving Family Credit because “more families would move into work” and “there would be a benefit to children in terms of health and nutrition”.

¹⁰ See <http://www.fns.usda.gov/pd/fssummar.htm> for details of the program.

¹¹ See <http://www.healthystart.nhs.uk/>.

¹² 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. 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.

¹³ 2.1 million working age households and 2.7m pensioner households receive Income Support and Pension Credit, 4.0m receive Housing Benefit, and 3.5m couples with children and 2.1m lone parents receive the successor to Family Credit.

demographic characteristics, and entitlement is a proportion of the amount that income falls below these needs. Eligibility is subject to a weekly hours of work maximum above which no household member can work, and there is a small weekly earnings disregard (a ceiling below which household earnings do not affect entitlement to Income Support), making Income Support essentially an out-of-work cash transfer program. It is largely claimed by: the elderly (many of whom receive no pension by virtue of their previous employment) as a supplement to their state-provided pension, the long term unemployed (who have exhausted their eligibility to unemployment insurance benefits), the long-term sick and disabled, and lone parents.

Family Credit is a cash transfer to households with dependent children. Entitlement is a function of the difference between needs and income, subject to a maximum entitlement. Needs are calculated as a function of household demographic characteristics - different to that used for Income Support. Eligibility is subject to a minimum weekly hours of work which at least one household member must satisfy. Approximately half of all Family Credit is paid to lone parents.

The system was reformed in April 1988, but retained a broadly similar structure. The central features of the reform were: synchronizing weekly hours of work limits at 16 (previously there was an eligibility overlap for Income Support and Family Credit in the hours range 20-24); the income definition was now net of income tax and social security (National Insurance) contributions, but there was no common definition of "needs"; and Family Credit became more generous so that eligibility moved higher up the income distribution.

In addition to these cash transfer programs, there are number of in-kind transfers. Eligibilities to Free School Lunches, Welfare Milk Tokens and certain health benefits (free prescription drugs, dental and optical care), are by virtue of receipt of an associated cash transfer. These programs are extensive (caseloads are 1 million children receiving

Free School Lunches¹⁴, 0.2 million pre-school children in households receiving Welfare Milk Tokens, 400 million prescriptions, 10.7 million visits to the dentist, and 3.7 million eye tests in 1997) and expensive (respective annual costs of £150 million, £47 million, £3400 million, £900 million, £55 million). Most UK health care costs, apart from prescription drugs, dental and optical care, are financed through the National Health Service which is a universal program. This is similar to one of largest US in-kind transfer programs – Medicare which is a universal program for the elderly. Finally, Day Care Milk is independent of cash welfare receipt and is simply contingent on attending a registered day-care institution.

Free School Lunches are available each school day to children attending school¹⁵ where a member of the household is receiving either of the cash transfers, Income Support or Family Credit. After April 1988 the children of parents receiving Family Credit were no longer entitled to Free School Lunches. 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.

Official statistics on the number of individuals entitled to Free School Lunches (or any other in-kind transfer) are scanty. In 1984 15.9% of all pupils received Free School Lunches (see Department of Social Security (1995)) and the daily charge for a school lunch was £0.55. In 1992 14% of pupils received Free School Lunches. The same school lunch could be bought by children from families ineligible to the waiver, so we observe

¹⁴ Child Poverty Action Group (2005) estimate that the 2004 figure is 1.4m children.

¹⁵ In the 1906 Education Act, Local Education Authorities were empowered to provide Free School Lunches at their own discretion. In 1921 this was extended to free milk. Orr (1937) documented a link between low-income, malnutrition and under-achievement in schools. In 1947 the School Milk Act ordered the issue of a daily one-third of a pint of milk free to all state school pupils up to age 18. Free school milk was withdrawn from secondary school (ages 12-18) in 1968, and further withdrawn from primary schools in 1971. However, implementation was slow as many Local Education Authorities continued to provide free school milk for some years. In 1969 eligibility to Free School Lunches was explicitly linked to receipt of the Income Support and also to receipt of Family Credit when it was introduced in 1970. Since 1980 Free School Lunches and Welfare Milk Tokens have only been associated with Income Support and Family Credit.

the price. This has been increasing over time relative to the overall retail price index, the food price index and real incomes: the average real price of a school lunch in 1992 was £1.00 compared to £0.55 in 1984. There is very little cross-section variation in price¹⁶.

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 per week on average. This compares with average weekly food expenditure by non-entitled and entitled households with school-aged children of £65.68 and £44.21 respectively in our data.¹⁷

The cash transfer programs were administered by the UK Government Department of Health and Social Security and recipients were informed of the associated in-kind entitlements. However, the Department of Education administered the Free School Lunch program, parents had to make an additional application and this extra administrative hurdle has to be cleared before Free School Lunches could be obtained.

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 liters) of milk at many grocery stores. The extent to which shop-keepers offer an informal cash-out is unknown.¹⁸ 16.6% of

¹⁶ We do observe small variance in weekly expenditure in the data for those who pay for lunches. This is most likely due to variation in school absenteeism across households which we cannot observe in the data.

¹⁷ The US programs which are closest to UK Free School Lunches are the National School Lunch Program and the School Breakfast Program. These are for children from poor households and respectively provide free school lunches for 15 million children (at a 2005 cost of \$7 billion) and a free breakfast for 7 million (at a cost of \$2 billion).

¹⁸ The penalty for exchanging Welfare Milk Tokens for items other than milk is that the shop will no longer be reimbursed for welfare milk tokens. This is an important deterrent to the extent that welfare clients represent a large customer base for many shops.

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 (non-) recipient households with young children of (£4.28) £2.80¹⁹. The real price of milk has been rising over time relative to the overall price index and the food price index²⁰. 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 day care. While, these programs are not as extensive as the US Food Stamp program (where 2005 expenditure exceeded \$28 billion) the results here may be relevant to any program where the transfer is made to one individual (typically the mother) within the household on behalf of other (or all) household members.

3. Family Expenditure Survey Data Description

The Family Expenditure Surveys (FES) are stratified random samples of approximately seven thousand responding households each year²¹; they are conducted continuously over time and collect expenditure information in fine detail, together with information about household composition, characteristics, and levels of income by source. The household food expenditure data is thought to be particularly accurate since it is collected through detailed diary records kept by all spenders²². This is complemented with data on durable goods and on regular bills, such as domestic energy, insurances, etc. which are recorded over three months. Our data contains household level expenditure derived from the individual level weekly diaries completed by all individuals aged over 15. The data that we have access to is aggregated to the household level and averaged

¹⁹ Non-recipient households tend to have fewer children.

²⁰ Although, shortly after this period the demise of the Milk Marketing Board's price fixing agreement resulted in considerable price falls at the major supermarket chains.

²¹ It was merged with the National Food Survey in 2002 and became the Expenditure and Food Survey.

²² See Atkinson and Micklewright (1983) on the reliability of income data in the FES. See Kelmsley *et al* (1980) for details of sampling methods. Tanner (1996) gives checks on the reliability of expenditures data.

over the two diary weeks²³. The Family Expenditure Surveys are the main vehicle 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 entitlements²⁴. 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).

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 ($FC > 0$) are much poorer than the group who received neither ($IS = FC = 0$). For the Income Support group, households became smaller post reform, largely because of the dramatic growth 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. 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. 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 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

²³ Alcohol expenditure counts as non-food expenditure in our analysis.

²⁴ 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).

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

Time period	Variable	Households with children		
		IS>0	FC>0	IS=FC=0
Pre-reform	# adults	2.09 (1.12)	1.95 (0.74)	2.22 (0.65)
	# children 0-4	0.64 (0.77)	0.64 (0.82)	0.53 (0.71)
	# children 5-15	1.26 (1.11)	1.44 (1.17)	1.23 (0.95)
	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
Post-reform	# 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)
	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 Family Credit receipt and IS=FC=0 receipt of neither

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. The reform took place at the beginning of April 1988, one quarter the way through the year, and providing a household received Income Support both pre and post-reform, or Family Credit pre-reform, then it was eligible for the nutrition programs. Neither Figure 1 nor 2 suggests any important time series trends.

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

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

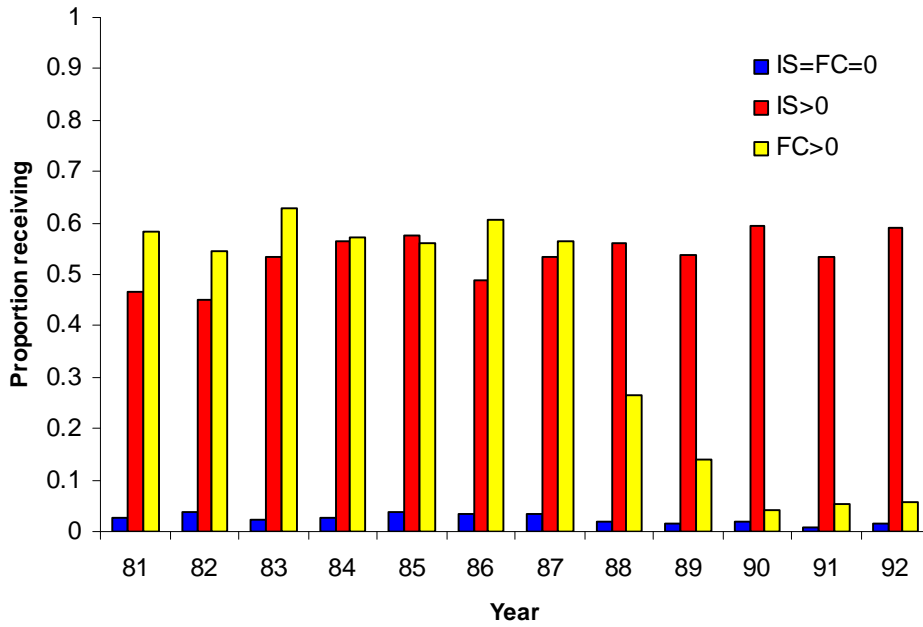
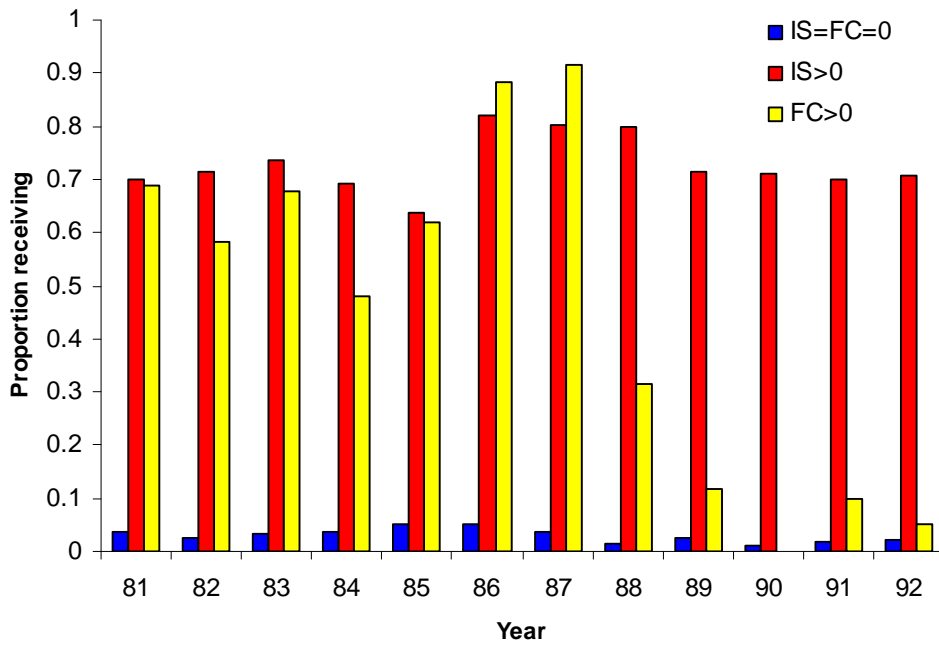


Figure 2 Welfare Milk Token receipt by group and calendar year:
Households with at least one pre-school child



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 were typically made available for 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 are unemployed will have found low paying work and may move from Income Support to Family Credit and still receive nutrition transfers for a period.

Thus, apart from the immediate aftermath of the policy change, the reform seems to have clean effects. 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 explicitly 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*.²⁵

Table 2 shows the levels of expenditure on milk and non-milk food for relevant groups of the population of households with children pre and post reform. Milk spending fell dramatically - by 38% for the IS=FC=0 group reflecting changing tastes and reductions in prices. The fall for the Income Support recipients, who retained their eligibility to Welfare Milk Tokens, was a similar order of magnitude – 32%. In contrast the group that lost their eligibility to Welfare Milk Tokens showed significant rises in milk spending – 69% for those with only pre-school children.

²⁵ Our preferred estimates include data for the whole period 1981-1992. We have also estimated both the difference-in-differences and structural models dropping April 1988 through March 1989 which may be considered a phase-in period for the reform. Difference-in-differences results are slightly higher but lose precision whereas structural budget share estimates are unchanged. In view of this and the short post-reform

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. The decrease in total expenditure for the Income Support recipient group across the reform arises because of the strong increase in the representation of lone parents, who have substantially lower household income, in this category.

Table 3 illustrates the consequences of the April 1988 benefit reform for eligibility to the relevant cash transfer programs. Pre-reform, eligibility to both Income Support and Family Credit provided eligibility to Welfare Milk Tokens for households with young children and Free School Lunches for older children. Post-reform, only Income Support gave eligibility to these nutrition programs. Of households with only children aged 0-4 (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.²⁶

We concentrate on milk and non-milk food spending in our analysis. Milk is all forms of liquid milk, and food is all food including meals consumed away from home. Table 4 summarizes the gross features of nutrition 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 our estimate of 12% of households which corresponds to 14% of school children

observation window, our preferred estimates include data for the whole period *including* April 1988 through March 1989.

²⁶ Eligibility for Welfare Milk Tokens or Free School Lunches requires household *eligibility* to an associated cash transfer and children in the relevant age range. The importance of the distinction between receipt and eligibility groupings is emphasized in the next section.

that receive free school lunches²⁷. Table 4 also highlights similar features for Welfare Milk Tokens and Day Care Milk for households with only pre-school age children. The larger proportion of ineligible participants is likely to be due, in the case of Welfare Milk Tokens, to our inability to identify expectant mothers currently without pre-school aged children, who would be eligible during pregnancy. In the case of Day Care Milk, the survey question routing prevents us from observing ineligible recipients.

Table 5 shows the number of households receiving multiple nutrition transfers according to eligibility. Overall participation by ineligibles (1.7% above the diagonal) is a rather small proportion of the sample, while eligible non-participants are the much larger group below the diagonal (28.5%).

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

Time period	Welfare program Children	IS>0 all	FC>0 0-4 only	FC>0 5-16 only	FC=IS=0 all
pre-reform	Milk	3.92 (3.49)	1.94 (1.98)	3.92 (3.60)	4.97 (3.68)
	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)
post-reform	Milk	2.66 (2.91)	3.27 (2.89)	4.38 (4.20)	3.10 (3.34)
	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.

²⁷ Official figures for 1983 are 13.4% of *families* benefit from Free School Lunches and in 1983 recipient families had 1.92 children compared with 1.60 for non-recipient families, so that the implied proportion of *children* receiving Free School Lunches was 16.1% (Department of Social Security (1995)).

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

Program	Childrens' ages	Pre-reform		Post-reform		Both	
		#	%	#	%	#	%
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.

4. Modeling Household Food and Milk Expenditures

The simplest way to approach the issue of identifying the extent to which expenditure patterns are affected by changes in entitlements is to consider the following straightforward model

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

where s_{ki} is the budget share for household i on good k , \mathbf{T}_i is a vector of participation rates in the three nutrition programmes for household i and \mathbf{X}_i and ε_{ki} are observable and unobservable controls respectively. We are seeking to estimate the vector γ_k , the response of expenditure shares to participation in each programme. Since the \mathbf{T}_i are potentially endogenous we pursue a number of identification strategies. Firstly, we use the 1988 reform as a natural experiment. Observations are grouped according to Family Credit receipt pre- and post-reform, since this determined loss of eligibility to Free School Lunches and Welfare Milk Tokens. Secondly, individual micro-data controls for observed differences between the treatment and control groups and changes in characteristics over time. Endogenous group composition can be allowed for by defining intention to treat as alternatively Family Credit receipt or entitlement. Finally a structural model, which imposes a parametric form for preferences onto equation (1), is estimated which allows theoretical cross-equation restrictions to be imposed and tested. We adopt restrictive distributional assumptions in order to estimate the determinants of program participation

and budget shares. This allows us to exploit the reform, incorporate the distinctions between each program, and include Day Care Milk within a coherent framework, and thereby test the underlying theory.

4.1 *Difference in differences using grouped data*

We grouped the data into cells of monthly averages (prices are observed monthly and we can group the data by interview month since they come from a continuous survey that is in the field throughout the year) and estimated demand share equations for milk and non-milk food which included a before-and-after dummy variable to capture any differences between the pre- and post-reform periods and an interaction between this and the Family Credit recipient proportion. The data was further grouped into those with pre-school children only (for whom the reform removed welfare milk tokens from the Family Credit group), those with school age children (for whom the reform removed Free School Lunches), and those households that contained both age groups (for who the reform removed both Welfare Milk Tokens and Free School Lunches from the Family Credit group).

The share equations are detailed in Table 6 and contain no further covariates and so provide Wald estimates of the effects of the programs. The data clearly shows significant falls in the shares over time. The interaction term is included to capture the effect of *losing* eligibility to the nutrition programs.

We find that, after controlling for the proportion in receipt of Family Credit and Income Support, there is an insignificant fall in the milk share and a significant rise in the food share at the time of the reform, but that the difference between the groups who kept and lost their eligibility to nutrition programs was not significant in either equation. However, the estimates are correctly signed – the loss of Welfare Milk Tokens for those with young children gave rise to a large increase in the milk share and a large fall in the food share; the loss of Free School Lunches for those with older children resulted in a large increase in the food share and a large increase in the milk share.

Table 6 Monthly Mean Food and Milk Share Regression Coefficients (s.e.'s)

	Milk share			Non-milk food share		
	Pre school children only	School age children only	Both	Pre school children only	School age children only	Both
Post-reform	-0.637 (2.590)	-0.821 (0.096)	-0.780 (0.101)	-0.059 (0.040)	-0.146 (0.046)	-0.101 (0.045)
Post-reform *	2.719 (2.590)	2.105 (2.595)	1.387 (1.743)	-1.502 (1.230)	2.418 (1.237)	0.304 (0.771)
FC receipt	-3.968 (1.511)	-3.352 (1.848)	-1.006 (0.459)	0.506 (0.717)	-0.966 (0.881)	-0.387 (0.536)
IS receipt	-1.311 (0.402)	-0.618 (0.453)	-0.459 (0.390)	0.406 (0.190)	-0.032 (0.216)	0.484 (0.173)
R ²	0.543	0.695	0.514	0.116	0.088	0.115

Notes: Milk shares are multiplied by 100 and food shares by 10 for the sake of exposition. Data is weighted by the number of observations in each cell.

It might be tempting to rely on this simple difference in differences methodology as has been done elsewhere²⁸. However, even if we assume that the reform is a clean natural experiment, restrictions are required for the aggregate data to be consistent with consumer theory. In particular, incomes are changing over time, within the treatment and control groups, and only if changes in the *distribution* of income (total expenditure) 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-data²⁹.

4.2 Difference in differences using individual micro-data

We can overcome the aggregation problem by applying the difference in differences method to the micro-data. This has the further advantage that it allows us to control for other observables that vary across time differently for the treatments and

²⁸ See Yelowitz (1995) for an example which uses difference in differences to analyse the effects of a health care reform.

²⁹ See Blundell *et al.* (1993).

controls. The analysis controls for the number and ages of children, income, Family Credit and Income Support receipt/eligibility, and pre- or post-reform observation. Table 6 reports only the coefficient on the interaction between a post-reform dummy variable and the intention to treat dummy of equation (1). 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 the working poor lost eligibility, suggests a number of possible difference-in-differences designs. A natural treatment group throughout are those households who lose eligibility to the nutrition program (i.e. the working poor). Natural candidates for control groups are households always eligible (i.e. the non-working poor), and households never eligible (i.e. the working non-poor). The coefficients of interest from nine alternative definitions of the difference-in-differences for the three budget shares are summarised in Table 7. Grouping is according to cash transfer *receipt*, where the non-working poor receive Income Support, the working poor receive Family Credit, and the working non-poor receive neither.

An important assumption of difference-in-differences is exogenous group composition, whereby individuals must not be able to self-select into treatment status. Cash transfer programme participation is obviously a choice and grouping according to Family Credit receipt status may be problematic. Furthermore, grouping by Family Credit entitlement status post-reform is questionable because households may have altered behaviour in response to the reform which changes entitlement. In order to address this Table 8 groups according to *pre-reform* Family Credit *eligibility* status³⁰. 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 Tables 7 and 8. The effect of losing Free School Lunch eligibility is isolated by sampling households with only school-aged children, presented in the middle three

³⁰ Entitlement to Family Credit is calculated using post-reform household characteristics (pooled cross section data) on the basis of pre-reform Family Credit entitlement rules.

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.

The general pattern of results in Table 7 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 some increase in milk share and a large increase in non-milk food share. To understand the implications of these effects note that, for the average recipient household, Welfare Milk Tokens were exchanged for 9 pints per week with a market price of £3. The average household receiving Free School Lunches had 9.6 per week which were worth £10. Income support recipients are the more natural control group for the treatments of losing nutrition program eligibility since both 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 0.0096 - from about 0.17 to about 0.26. This represents an increase in milk expenditure at the mean of £1.60 and suggests that Welfare Milk Tokens crowded out private milk expenditure by 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 -0.0047 implying a small effect of -£0.80 as some non-milk food spending is switched to milk. For households with only school age children, the loss of Free School Lunch eligibility leads to an increase in non-milk food expenditure of about £3. This implies a non-milk food expenditure crowd-out of less than one third of the Free School Lunch value, although this is not precisely estimated.

The general pattern of results in Table 8 supports the findings in Table 7. Although the estimates are smaller and less precise, they also imply that losing Welfare Milk Token eligibility increases the milk share and leads to some substitution away from non-milk food; while losing Free School Lunch eligibility causes some increase in milk share and a large increase in non-milk food.

For Free School Lunches another difference-in-differences grouping is possible which is not based on the 1988 reform. Free School Lunches are only available during term time, and school summer holidays in Scotland are approximately one month earlier

Table 7 *Intention to Treat effects on budget shares with cash transfer RECEIPT grouping*

Sample households	Treatment ($FC_r > 0$)	Control ($FC_r = 0$)	Milk*100		Non-milk-food*10		All-food*10	
			DD	p-value	DD	p-value	DD	p-value
Children 0-4 only	Lose WMT	Keep WMT ($IS_r > 0$)	0.9599	0.0306	-0.0472	0.0000	0.0488	0.0000
	Lose WMT	Never WMT ($IS_r = 0$)	0.3389	0.1091	-0.0247	0.9143	0.0092	0.0926
	Lose WMT	Either WMT	0.6494	0.0067	-0.0360	0.0000	0.0290	0.0000
Children 5-15 only	Lose FSL	Keep FSL ($IS_r > 0$)	0.2304	0.4597	0.1757	0.2543	0.1987	0.4091
	Lose FSL	Never FSL ($IS_r = 0$)	-0.0562	0.7316	0.2612	0.0013	0.2556	0.0052
	Lose FSL	Either FSL	0.0871	0.7573	0.2185	0.0003	0.2272	0.0024
All	Lose WMT/FSL	Keep WMT/FSL ($IS_r > 0$)	0.4000	0.1317	0.0992	0.3636	0.1392	0.2001
	Lose WMT/FSL	Never WMT/FSL ($IS_r = 0$)	0.1805	0.1957	0.3634	0.0000	0.3815	0.0000
	Lose WMT/FSL	Either WMT/FSL	0.2903	0.0570	0.2313	0.0000	0.2603	0.0000

Note: Cells 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_r is Family Credit receipt and IS_r is income support receipt. Milk and food budget shares are multiplied by respectively 100 and 10 for presentation. The first three substantive 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 8 Intention to Treat effects on budget shares with cash transfer ELIGIBILITY grouping

Sample households	Treatment (FC _e > 0)	Control (FC _e = 0)	Milk*100		Non-milk-food*10		All-food*10	
			DD	p-value	DD	p-value	DD	p-value
Children 0-4 only	Lose WMT	Keep WMT (IS _e >0)	0.1995	0.5851	0.1489	0.3903	0.1689	0.6316
	Lose WMT	Never WMT (IS _e =0)	0.3687	0.1258	-0.4198	0.0002	-0.3829	0.0001
	Lose WMT	Either WMT	0.2841	0.1398	-0.1355	0.0010	-0.1070	0.0005
Children 5-15 only	Lose FSL	Keep FSL (IS _e >0)	0.1611	0.4472	0.0396	0.7088	0.0557	0.6966
	Lose FSL	Never FSL (IS _e =0)	0.0771	0.6193	0.1898	0.0290	0.1975	0.0806
	Lose FSL	Either FSL	0.1191	0.4847	0.1147	0.0299	0.1266	0.0742
All	Lose WMT/FSL	Keep WMT/FSL (IS _e >0)	0.0895	0.6283	0.0563	0.4836	0.0653	0.7093
	Lose WMT/FSL	Never WMT/FSL (IS _e =0)	0.2391	0.0742	0.2661	0.0000	0.2900	0.0000
	Lose WMT/FSL	Either WMT/FSL	0.1643	0.0797	0.1612	0.0000	0.1776	0.0000

Note: Clarifications the same as for Table 6 plus FC_e is Family Credit *eligibility* and IS_e is income support *eligibility*.

than the rest of the UK.³¹ Inspection of the data does indeed confirm that Scotland has different summer school holiday timing. Table 9 presents estimates of this Scotland/non-Scotland school holidays difference-in-differences design. The relevant sample contains households with school aged children with an entitlement to Free School Lunches. If the survey interview takes place during school holidays, Free School Lunches cannot be provided, despite eligibility, and no substitute is offered. These holiday difference-in-differences show average food expenditure share increases throughout: increasing on average by 0.036 according to cash transfer *receipt* grouping and by 0.016 for cash transfer *eligibility* grouping, although the latter are not well determined. Comparable reform-based estimates are in the middle panes of Tables 7 (somewhat smaller) and 8 (about the same) respectively. The significant differences for cash transfer receipt-based groupings are driven by Scotland holidays as treatments and rest of UK as controls rather than vice versa. This could be picking up other distinctive features of summer holiday expenditure in Scotland. Concerns about endogenous group composition suggest that it is most important to reconcile the cash transfer eligibility-based results. Here there are no significant differences and the point estimates are quite close.

Table 9. Effects of free school lunches on non-milk food budget shares by school holidays

Sample			Grouping criteria			
			Cash transfer receipt		Cash transfer eligibility	
	Control	Treatment	DD	p-value	DD	p-value
Free School Lunch eligible	School day	School holiday				
	Scotland	non-Scotland	0.2088	0.0289	0.0705	0.5445
	non-Scotland	Scotland	0.5244	0.0270	0.2588	0.0609
	Scotland/non	non/Scotland	0.3666	0.0268	0.1646	0.3095

Note: The sample includes households with children age 5-15 who are eligible for Free School Lunches. 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).

³¹ 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.

4.3 *Structural demand system with endogenous nutrition program participation*

The importance of nutrition program non-participation was illustrated earlier in Table 4, and this motivates modeling endogeneity of receipt in the budget share equations which are of primary interest. Using the micro-data allowed us to control for *observable* differences across 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 unobserved determinants of program eligibility or participation that are correlated with budget shares. 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. Indeed, it also possible that even the condition that the determinants of eligibility need to be independent of the shares will be violated. This is because, although eligibility is a deterministic function of a set of characteristics, not all of these are observable in our data³², and eligibility is measured with error.

In order to deal with the endogeneity of eligibility or receipt we adopt a more structural approach to the specification of equation (1). Here we impose a structure to the way that the \mathbf{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. We 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 impose the restrictions of consumer theory and test for crowd-out, altruism and agency by incorporating relevant features of all the programs in a coherent demand framework. This demand system with endogenous program participation is modeled using a multivariate generalization of Heckman (1979). Adopting this method has the

³² For example, eligibility for Income Support depends on wealth and child disability also plays a role but neither is observed with precision.

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 reformed.

The FES data has 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 total expenditure are strongly preferred to the original log linear 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 feature of the data but that a quadratic in log total expenditure is a good approximation to non-parametric Engel curves. None of this work allowed for welfare program participation. Thus, here, we assume that the milk and non-milk food budget shares of household i are given by

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

where the subscript k refers to either milk or non-milk food, p_k is the respective real price, y is real total expenditure³³, ε_{ik} is a random disturbance, α_k may be allowed to depend on household demographics, and the vector \mathbf{T}^p contains dummy variables which indicate participation in the transfer programs, p stands for program (i.e. Day Care Milk, Welfare Milk Tokens and Free School Lunches)³⁴. Now consider the control function selectivity adjustment. That is, if T_i^{p*} are latent variables corresponding to observed participation, T_i^p , Z_i^p is a vector of household

³³ Total expenditure here includes housing costs. We control for all of the aspects of the 1988 reforms and make appropriate adjustments to Housing Benefit. Results where total expenditure excludes housing costs are similar.

³⁴ 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. 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.

demographic characteristics which includes transfer entitlements , E_i^p , and the η_i^p are the respective random disturbances then

$$(3) \quad \mathbf{T}_i^p = \mathbf{1} \left(T_i^{p*} = Z_i^p \pi^p + \eta_i^p > 0 \right).$$

A selection issue arises when there is a correlation between unobservables across the program participation and expenditure share equations, i.e. if $\text{cov}(\eta_i^p, \varepsilon_{ik}) \neq 0$.

4.4 Identification of the structural model

The requirements for identifying the demand system in equation (2) are that prices are exogenous and this is usually thought to apply, at least at the micro level. However, identifying the conditional demand system with endogenous conditioning of equations (2) and (3) together requires somewhat more. Assumptions made to identify the model are discussed below. 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 likelihood is a generalization of the multivariate Probit selection model with three correlated endogenous variables (transfer program participation) and two correlated (budget shares) equations of interest:

$$(4) \quad L = \prod \int_{fsl^-}^{fsl^+} \int_{wmt^-}^{wmt^+} \int_{dcm^-}^{dcm^+} \phi_3(\eta^{fsl}, \eta^{dcm}, \eta^{wmt} | \varepsilon^m, \varepsilon^f) \phi_2(\varepsilon^m, \varepsilon^f) d\eta^{fsl} d\eta^{dcm} d\eta^{wmt},$$

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

While it is possible to rely purely on these stochastic assumptions, the context of our problem suggests some exclusion restrictions which may be imposed for stronger (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 that then 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. Against the background of a reform, imperfect indexation and real price changes, additional exclusion restrictions can be considered but are not required for identification.

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, at a given time and place. For a given quality, as income rises from a low level the probability of participation will rise as the desired quality is below the offered quality; but beyond that income level further increases in income lead to a decrease in the participation probability. In the case of Free School Lunches we may capture quality by price relative to the price of (market) food which varies over time³⁵. If the price of school lunches is high relative to the price of food then this is an indication of their higher quality to the extent that the price reflects the costs of raw materials and other inputs³⁶. We use a quadratic in income to capture the inverted “U” shape relationship between the participation probability and income that arises because of the take-it-or-leave-it nature. In addition, a further exclusion restriction is that benefit-year 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 should not affect the budget share beyond the number of in-kind units received. For the budget share, month-of-year dummies capture seasonality and a quadratic time trend is added³⁷.

Finally, it is important to note that it is a maintained assumption that total expenditure is exogenous. It is useful to state why this is assumed and what the

³⁵ 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.

³⁶ 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.

³⁷ Similar results were obtained from including a full set of month of year and calendar year dummies.

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 post-reform rules³⁸, not only those who are in *receipt* of the cash transfer.³⁹ Extending our model to explicitly incorporate participation in the associated cash transfer programs would imply endogenizing income.⁴⁰ The consequence of this extension would be to complicate the model such that further identification assumptions or restrictions would be required. We appeal to intertemporal separability to substantiate our assumption that total expenditure is exogenous and we consider relaxing this to be out of scope for the current paper. It seems unlikely that this is important for the estimates: while the assumption of exogenous total expenditure is rejected by Blundell *et al* (1995) and Browning and Meghir (1991), their results suggest only modest differences in estimates.

4.5 Results and Discussion

Model estimates are presented in Table 10⁴¹. The probability of participating in a nutrition program is an increasing function of the market value of the entitlement and falls with income. These results are consistent with both stigma and transactions

³⁸ This is in contrast to the difference-in-differences analysis in Table 8 where grouping is on the basis of eligibility to the associated cash transfer according to pre-reform rules throughout. Using pre-reform rules in the structural model lowers goodness-of-fit for the relevant program participation equations, reduces precision, but inference is qualitatively unchanged.

³⁹ Official figures for cash transfer take-up are 91.0% for Income Support and 84.0% for Family Credit in 1997. Our calculations suggest that the take-up of Free School Lunches (Welfare Milk Tokens) associated with Income Support was 53.4 (66.5) % and associated with Family Credit was 58.2 (67.5) %.

⁴⁰ Our preferred estimates are presented in Table 5. 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 in support of our simpler specification.

⁴¹ Table 10 presents our preferred specification and this choice needs to be motivated. Including the number of transfers in budget shares and value of entitlement in participation was preferred over other combinations in a likelihood ratio test. Quadratic income terms in the participation equations were insignificant, as were price-income interactions in the milk program participation equations.

cost explanations. We find that the level of entitlement has a positive and significant effect on participation in all cases. Income has a negative effect on milk transfer take-up and the effect on free school lunches is insignificantly positive⁴². 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 is so low that even the poorest households would prefer a higher quality. Finally, the correlation between unobservables that determine participation are not presented in the table, but are statistically significant, which supports our joint modeling of program participation.

There are few estimates for milk elasticities available in the literature but the results here compare well with those from the *National Food Survey* (National Food Survey Committee (1989)) but, unlike those, are well determined.

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 0.2433 representing a real expenditure of £67.11 per week so a fall in the share of 0.0006 represents a reduction in food expenditure of £0.40 per

⁴² The level of entitlement to Free School Lunches is the product of the number of children of school age and the price (times five during term time because there are five school days in a week). Since we already include the number of school aged children our estimates imply that participation does not vary with quality except through its interaction with income.

Table 10. Expenditure Shares and Nutrition Program Participation: ML Estimates

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

lunch (all figures are in 1992 prices). Similarly, the mean milk share of households not receiving Welfare Milk Tokens is 0.0169, which represents an expenditure of £4.25, so reductions in the shares of 0.0011 per pint of nutrition program milk represent reductions in milk expenditures of £0.28.

In Table 12 we present the calculated crowd out of private expenditures averaged over each observation in the dataset. The crowd out for Free School Lunches is 15% of their value, while for milk the figures are both close to 80% of the value. 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 milk effects are quite substantial – a high proportion of the transfer is crowded out by the household making countervailing expenditure changes.

Table 11 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)

Table 12 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)

4. Conclusion

This paper has been concerned with evaluating the impact of nutrition programs for households with children on food expenditure in the UK. 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 significant crowding-out. In the case of Welfare Milk Tokens we expected a high degree of displacement since milk is homogenous and 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. These results do not suggest the presence of agency problems, in 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. 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 potentially important for policy design. They imply that for in-kind transfers to be successful, and limit crowd out of private expenditure, they should be confined to goods where there is no close market substitute. In our analysis we find that the mechanism for this in households with children was parental altruism rather than agency. More generally, the results suggest 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.

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). The finding that agency problems are not large provides some reassurance. However, significant altruism is more

worrying because transfers of the good to one individual in the household may crowd out transfers from other household members.

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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