Parental investment in child nutrition

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- Child nutrition of concern, rise in obesity and other indicators that health may have declined in recent years
- Nutrition in early life is linked to later life outcomes
- Increase in processed foods thought to be a possible contributing factor
- We are interested in understanding the factors that have contributed to the increase in purchases of processed foods

Three stylised facts that motivate this project

- Increase in share of processed foods over ingredients
- Increase in female labour supply
- Reduction in household size
- (reduction in relative price of processed foods)



Motivation



- Model of household choice over time allocation and consumption
 - incorporates the trade offs between cooking and purchasing pre-prepared meals, working to earn income and spending leisure time with children

• Empirically estimate model using data from the UK, learn about

- elasticities of demand for home-cooked food to market prices and shadow prices of time and ingredients, which are functions of wages and household size
- what is relative importance of factors leading to decline in home-cooked food
- counterfactually, how would policies (wage subsidies, taxes on prepared food, policies to encourage stability of cohabitation) affect
 - composition of food consumed
 - child outcomes

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- Household contain adults and children
- Households derive utility from consuming food, an outside good and leisure
- Food consumption enters adult and child utility differently
- Adults allocate time between work, home production and time with children (leisure)
- Food can be produced either by purchasing it ready made, or by purchasing ingredients and spending time in home production
- AIDS style demand system for the share of full income allocated to different types of foods as a function of shadow prices of prepared foods, ingredients and leisure

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$$\max \lambda u\left(\frac{f}{A+K}, \frac{x}{(A+K)^{\theta}}\right) + (1-\lambda)h\left(\frac{g}{A+K}, \frac{AI}{K}\right)$$

- u() : adult material wellbeing
- h() : child wellbeing
- A : number of adults
- K : number of kids
- λ : welfare weight that household places on adult material wellbeing
- f : adult food aggregate
- g: kids food aggregate
- x : outside good shared between household members
- $0 < \theta < 1$: measures the publicness of the outside good
- I: time spent with children per adult

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$$\frac{f}{A+K} = f\left(\frac{r}{A+K}, \frac{c}{A+K}\right), \ \frac{g}{A+K} = g\left(\frac{r}{A+K}, \frac{c}{A+K}\right)$$

• two types of food (in application seven types)

- c : pre-prepared foods, e.g., ready meals, takeaways
- r : food produced at home using ingredients i, and time

$$\frac{r}{A+K} = \min\left[\frac{At}{(A+K)^{\gamma}}, \frac{i}{A+K}\right]$$

- *t* : time per adult spent on food preparation
- $0 < \gamma < 1$: possible returns to scale in food production
- implies that $At = \frac{i}{(A+K)^{1-\gamma}}$ and r = i

$$\frac{y_0 + wA(T - I - t)}{A + K} = p_c \frac{c}{A + K} + p_i \frac{i}{A + K} + p_x \frac{x}{A + K}$$

- y_0 : unearned income
- w:wage
- A : number of adults
- K : number of kids
- T : hours available in the day
- I: time spent with children per adult
- t: time per adult spent on food preparation

 p_c , p_i , p_x market prices for pre-prepared food, ingredients and outside good

Model

Putting together:

$$max \lambda u(f(c^*, i^*), x^*) + (1 - \lambda)h(g(c^*, i^*), I^*)$$

s.t.
$$y_0^* + wT^* = p_x^* x^* + w^* l^* + p_i^* i^* + p_c c^*$$

where

$$c^* = \frac{c}{A+K} \qquad i^* = \frac{i}{A+K}$$

$$l^* = \frac{Al}{K} \qquad x^* = \frac{x}{(A+K)^{\theta}}$$

$$y_0^* = \frac{y_0}{A+K} \qquad T^* = \frac{AT}{A+K}$$

and shadow prices are:

$$p_c^* = p_c \qquad p_i^* = p_i + \frac{w}{(A+K)^{1-\gamma}}$$
$$p_x^* = \frac{p_x}{(A+K)^{1-\theta}} \qquad w^* = \frac{wK}{A+K}$$

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- Solution is set of (marshallian) demands for *c**, *i**, *x**, *l**
- which are functions of full income $Y^* = y_0^* + wT^*$ and shadow prices (p_c^* , p_i^* , p_x^* , w^*)
- which imply relationships between observed market expenditures, and market prices and household demographics



Model - functional form assumptions

- Assume welfare weight (λ) constant
- Almost Ideal Demand System (AIDS)
- Yields four shares (*c**, *i**, *l**, *x**)
- (at the moment) we model only demand for food that is purchased ready to eat (c*)
- We estimate a set of equations for various pre-prepared food types of the form

$$s_{c*} = \frac{p_c c^*}{Y^*} = \alpha_c + \delta_{cc} \ln p_c^* + \delta_{ci} \ln p_i^* + \delta_{cw} \ln w^* + \delta_{cx} \ln p_x^* + \beta_c \ln(\frac{Y^*}{P})$$



FES/EFS

- repeated cross-section 1975-2009
- we use only household with kids, where head of household 25-64
- approx. 200 households per month
- detailed information on expenditure on different types of food and outside good, household composition, demographic information and incomes

$$s_{j*} = rac{p_j q_j}{Y^*}$$

- expenditure share of food type j in full income
- we observe households' weekly expenditure on different types of food in cash terms
- we estimate Y*, full income

Food types

Category	Description (FES/EFS categories)
1. Ingredients for cooking	Meat, eggs, fish, vegetables, butter, margarine, pasta, rice, legumes, oil, flour
 Ingredients (also ready to eat) 	Bread, cheese, cold and cooked meats cream, milk, yoghurt, fruit, juice, prepared fish
3. Drinks	Carbonated drinks, coffee, tea, hot choc, fruit juice, squash, bottled water
4. Ready meals	Ready meals, packaged and canned foods, breakfast cereals, pickles, sauces, soup, baby food
5. Takeaway (eaten at home)	Take-away meals, sandwiches
6. Meals out	Meals out, inc hot, cold and canteen, some snacks eaten out, workplace meals
7. Sweets and snacks	Confectionary, ice cream, biscuits, cakes
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$$Y^* = (y_0 + wAT) = p_x^* x^* + p_i^* i^* + p_c c^* + w^* l^*$$

- Can we measure directly?
- we observe "net unearned income in the household" in the EFS
 - but it is often negative, and we have no saving or borrowing in this model
- we observe hourly wages for people in work
 - but not for people out of work
- we measure full income as total weekly expenditure on all items (food plus x) plus the imputed cost of time with children (I)

Full income - valuing time with children (I)

- cost of I is wage times free hours
- assume each adult has 10 hours 5 days a week for work and leisure

$$Y^* = \sum_{j=1}^{7} p_j q_j + p_x x + w_h (10 * 5 - h_h) + w_s (10 * 5 - h_s)$$

- *w_h* is the actual hourly wage of the head of household, or if a wage is not reported (e.g. if the head is unemployed) we impute it
- *h_h* is weekly working hours of head
- *w_s* is the actual hourly wage of the spouse (if there is one) or if not reported it is imputed
- h_s is weekly working hours of the spouse

- We estimate a wage equation using people observed in work (without controlling for selection at this point)
- estimated at the individual level relating log hourly wage to individual's characteristics
 - sex, age, age squared, marital status dummies, occupation dummies including one for occupation missing one), household type dummies, *K*, age of youngest kid, net household unearned income y₀, spouse characteristics and year dummies
- run separately for
 - head of house in couple
 - single parent
 - spouse

See Tables 1-3

Components of food price indices

Category	Description (RPI categories)
 Ingredients for cooking 	beef, lamb, pork, bacon, poultry, oth_meat, fish,
	butter, oil_fats, eggs, pots, oth_vegs
2 Ingradianta	broad abaaaa fruit milkarad milkfroa
2. Ingredients	beef lamb perk bacon poultry oth most fich
(also ready to eat)	beer, ramb, pork, bacon, pounty, our_meat, iisn
3. Drinks	softdrin, tea, coffee
0.20	
4. Ready meals	oth_food, cereals
5. Takeaway (eaten at home)	takeaway
6. Meals out	canteen, restaur
7 Sweets and spacks	hisquite sug pros swo choo
1. Sweets and shacks	Discuits, sug_pres, swe_choc

- Stone price index including
- price of foods as above
- price of outside good x includes all other items in the RPI that are not food
 - Alcohol Tobacco Housing Fuel, Lighting, Household goods, Household services, Clothes, Shoes, Chemical goods, Personal Services, Motoring, Fares, Audio Visual, Books Newspapers, Leisure services
- wages

$$\ln(\widehat{p}_i + \frac{\widehat{w}}{(A+K)^{1-\gamma}})$$

•
$$\widehat{p}_i = \frac{p_i}{p_x}, \ \widehat{w}_i = \frac{w}{p_x}$$

- depends on γ , returns to scale parameter, we grid search over it
- wage is wage of spouse if there is one
- if not is wage of head of house
- idea is that this is the wage of the second earner, i.e. the person within the household who is most likely to do the cooking

Share of full income on food and other goods



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Share of full income on main food groups



Share of full income on different types of food



Market price of different types of food



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Shadow price of ingredients



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Market price of ingredients and ready meals and shadow price of ingredients



(IFS)

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Declining household size



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Increasing working hours of spouses



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$$s_{j*} = \frac{p_j q_j}{Y^*} = \alpha_j + \sum_{m=2}^7 \delta_{jm} \ln \hat{p}_m + \delta_{j1} \ln(\hat{p}_1 + \frac{b\hat{w}}{(A+K)^{1-\gamma}}) \\ + \delta_{jw} (\ln \hat{w} + \ln K) + \pi_j \ln(A+K) + \beta_j (\ln \frac{Y^*}{P})$$

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Share on ready meals (own price is lpT4), Table 4

	(1)	(2)	(3)	(4)	(5)	(6)
Definition of ingredients	T1+2	T1	T1+2	T1	T1+2	T1
VARIABLES	g=0.1	g=0.1	g=0.5	g=0.5	g=0.9	g=0.9
In hu AIC	0.0000***		0.0055***		0.0045***	
IDIWAK	(0.0062		0.0055		0.0045	
InT1 wAK	(0.0004)	0.0053***	(0.0004)	0 0048***	(0.0004)	0 0040***
· · · · - · · · · · · · · · · · · · · ·		(0.0004)		(0.0004)		(0.0003)
lpT2		0.0141***		0.0139***		0.0135***
		(0.0016)		(0.0016)		(0.0016)
lpT3	0.0006	0.0011	0.0006	0.0010	0.0006	0.0010
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
lpT4	-0.0061***	-0.0124***	-0.0056***	-0.0118***	-0.0050***	-0.0109***
	(0.0013)	(0.0015)	(0.0013)	(0.0014)	(0.0013)	(0.0014)
lp15	0.0202***	0.0131***	0.0204***	0.0133***	0.0207***	0.0135***
In TC	(0.0030)	(0.0031)	(0.0030)	(0.0031)	(0.0030)	(0.0031)
ip i o	0.0044	0.0145	0.0036	0.0136	0.0027	(0.0022)
InT7	-0.0072***	-0.0133***	-0.0070***	-0.0129***	-0.0066***	-0.0124***
ip i /	(0.0012)	(0.0014)	(0.0012)	(0.0013)	(0.0012)	(0.0013)
lwlK	-0.0024***	-0.0023***	-0.0024***	-0.0023***	-0.0023***	-0.0022***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
IAK	0.0141***	0.0139***	0.0142***	0.0140***	0.0141***	0.0140***
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0004)	(0.0004)
IrY	-0.0116***	-0.0116***	-0.0116***	-0.0116***	-0.0115***	-0.0115***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Observations	76,266	76,266	76,266	76,266	76,266	76,266
Robust standard errors in parentheses						
*** p<0.01, ** p<0.05, * p<0.1						

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Food type	Median income
Food type	elasticity ($\gamma = 0.5$)
Drink	0.33
Meals out	1.12
Ready meals	0.28
Snacks	0.29
Takeaway	0.73

Notes: Numbers reported are median of elasticities across all households.

	Drink	Meal	Ready	Snacks	Take
		out	means		away
Drinks	-0.29	-1.24	0.33	-2.01	1.19
Meals out	-0.24	-0.24	-0.48	-0.86	1.14
Ready meals	0.05	0.24	-1.34	-0.42	1.28
Snacks	0.18	0.51	0.30	-0.21	-1.05
Take away	0.55	3.35	-1.11	-0.67	-1.65

Notes: $\gamma = 0.5$. Numbers reported are median of elasticities across all households. Element (i, j) gives the change in share of food type *i* with respect to the price of food type *j*.

	Shadow p ingred	Shadow p leisure
Drinks	0.53	-0.17
Meals out	1.17	-0.62
Ready meals	0.35	-0.14
Snacks	0.19	-0.10
Take away	0.11	-0.29

Notes: $\gamma = 0.5$. Numbers reported are median of elasticities across all households. Element (i, j) gives the change in share of food type *i* with respect to the price of food type *j*.

- Preliminary results
 - work to do on the data
 - work to do on estimation
- More flexibility in functional form
- Counterfactual simulations