

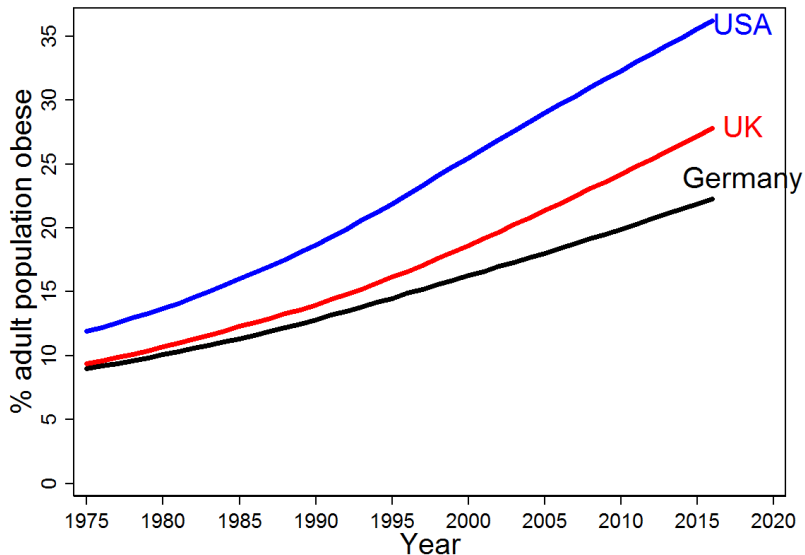
Income, prices, time use and nutrition

Rachel Griffith

ZEW Lectures on Economic Policy

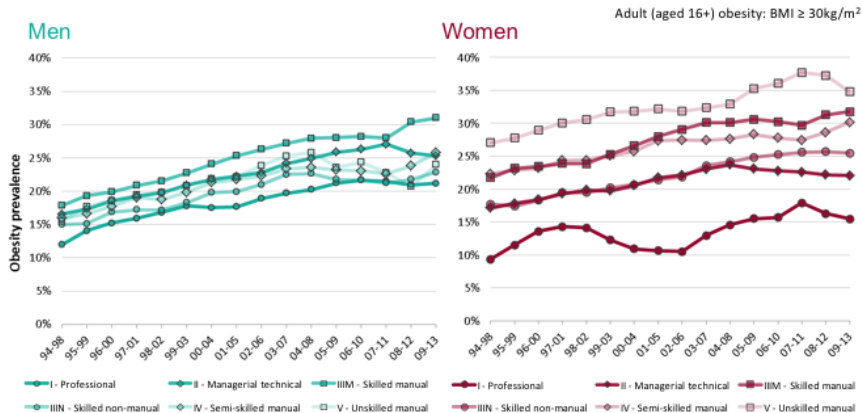
October 2018

Adult obesity has increased

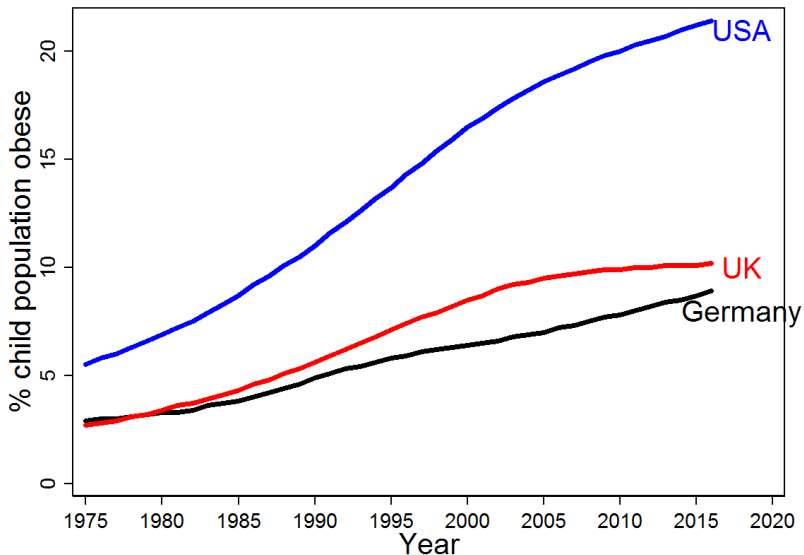


Obesity is more common in poorer households

but has increased across all social classes, UK



Child obesity has increased



Source:WHO

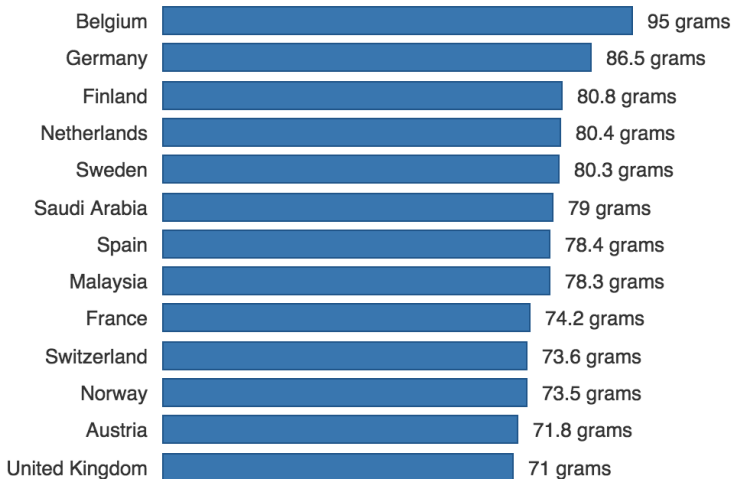
Child obesity is more common in deprived areas, UK



We consume too much fat (recommended max 70g)

Where people eat the most fat

How much fat the average person consumes each day.

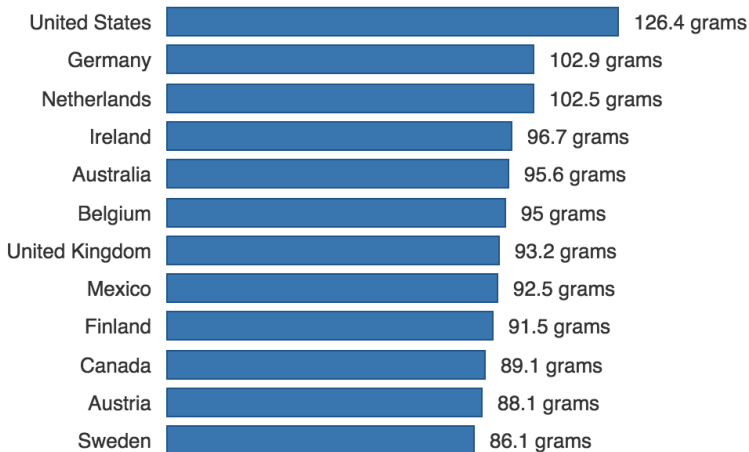


Source: Euromonitor

We consume too much sugar (recommended max 30g)

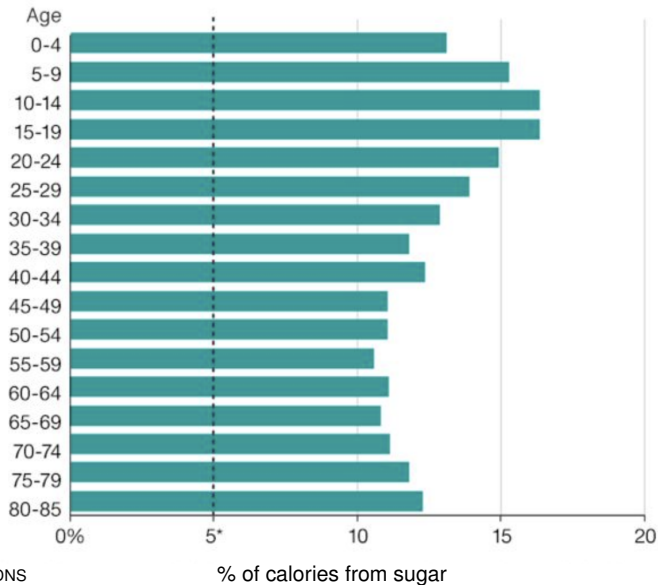
Where people eat the most sugar

How much sugar the average person consumes each day.

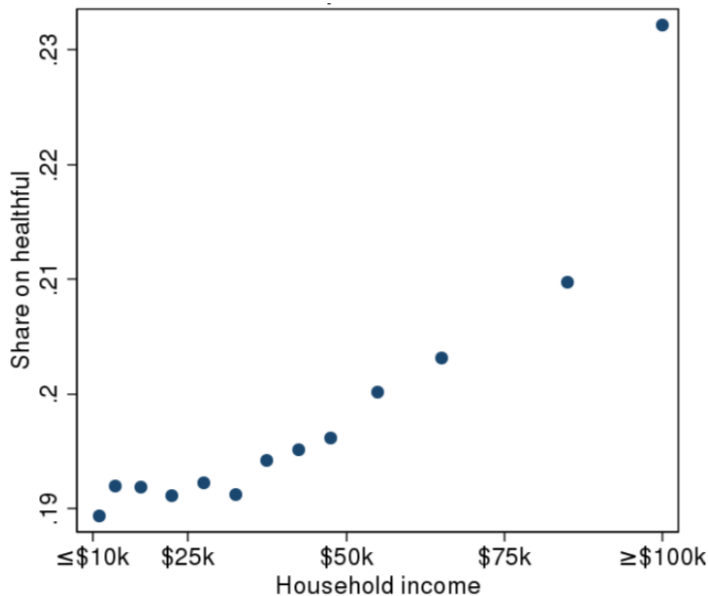


Source: Euromonitor

Children particularly consume a lot of sugar, UK



Lower income households eat less healthy foods, US



Source: Amano (2018)

Consequences of these bad choices: **Externalities**



The economic costs of obesity

Obesity costs
the wider society
£27 billion

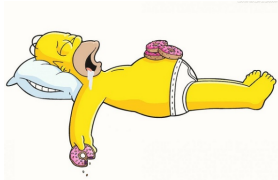
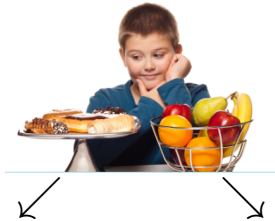


The NHS in England
spent an estimated
£6.1 billion
on overweight and
obesity-related ill-
health in 2014/15

We spend **more** each year
on the treatment of obesity
and diabetes **than** we do on
the **police, fire service and
judicial system combined**



Consequences of these bad choices: **Internalities**



Obesity and poor nutrition have bad consequences

- ▶ Clear evidence that people are making bad food choices
 - ▶ bad in the sense that they leading to poor health, economic and social outcomes
 - ▶ and these bad choices affect that person over their lifetime and potentially impose costs on others that are probably not anticipated at the time of consumption
 - ▶ evidence that this is particularly true for poorer households

Income transfers are effective




- ▶ Cash and conditional cash transfers
 - ▶ in the US: food stamps, the Supplemental Nutrition Assistance Program (SNAP) and the Special Supplemental Nutrition Program for Women, Infants and Children (WIC)
 - ▶ in the UK: Healthy Start Vouchers
- ▶ Evidence that effective at improving outcomes
 - ▶ Currie and Gahvari (2008) “Transfers in cash and in kind: Theory meets the data” *Journal of Economic Literature*
 - ▶ Hoynes, Schanzenbach and Almond (2016) “Long run impacts of childhood access to the safety net” *American Economic Review*
 - ▶ Griffith, von Hinke and Smith (2018) “Getting a healthy start: the effectiveness of targeted benefits for improving dietary choices” *Journal of Health Economics*

Are there other policy options?

- ▶ Are income transfers the only effective policy?
 - ▶ do other policies have the potential to help people make better choices?
- ▶ Current policy attention is focused on
 - ▶ policies that change relative prices (e.g. sugar or soda taxes)
 - ▶ effectiveness will depend on responsiveness of excess consumers; potentially reduce income
 - ▶ policies that restrict advertising of junk foods
 - ▶ depends on how advertising affects demand; potentially increase price competition
 - ▶ “nudge policies”
 - ▶ are aimed at removing temptation, providing cues to make better choices

Policies that aim to change choices

taxes:

Soft drinks levy		
Over 8g sugar per 100ml	Over 5g sugar per 100ml	5g or less sugar per 100ml
24p a litre 	18p a litre 	No levy 
		PA

ban advertising:



remove temptation:



calorie labels:



Does poverty cause poor nutrition?

- ▶ What drives the correlation between low income, poor nutrition and bad outcomes
 - ▶ cognitive overload?
 - ▶ lack of self-control?
 - ▶ time use?
 - ▶ income directly (e.g. cost of food)?
 - ▶ correlated preferences?

Poverty and cognitive overload?

POVERTY AND THE BRAIN



FINDING 1 Human mental bandwidth is finite

THE RULE OF 7

The largest number of discrete pieces of information the average brain can manage is around seven.

CHUNKING

Way to improve memory
Like phone numbers
123-456-7890 =
groups of 3 + 3+ 4 numbers

FINDING 2

Poverty imposes such a massive cognitive load on the poor that they have little bandwidth left over to do many of the things that might lift them out of poverty like:



Going to night school



Searching for a new job



Remembering to pay bills on time

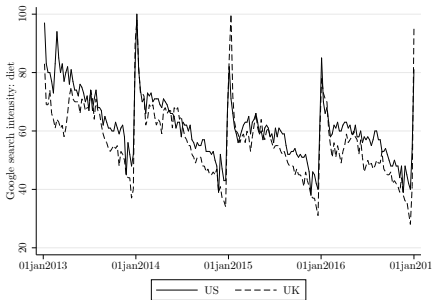
"Poverty is the equivalent of pulling an all-nighter.

Picture yourself after an all-nighter. Being poor is like that every day."

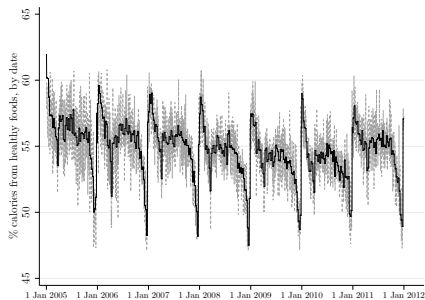
Harvard Economist Sandhil Mullainathan

Lack of self-control?

Google searches for “diet”

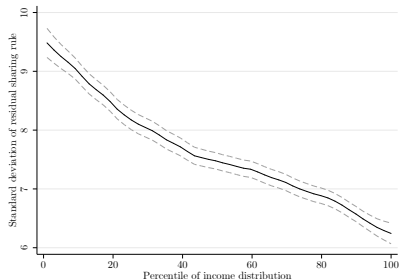


% healthy foods in shopping basket

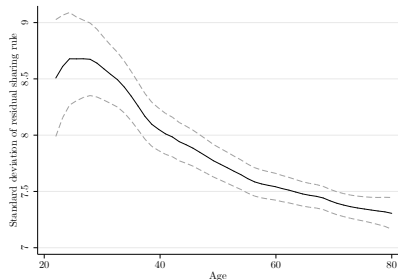


Extent of “self-control problem” is higher for poorer and younger individuals

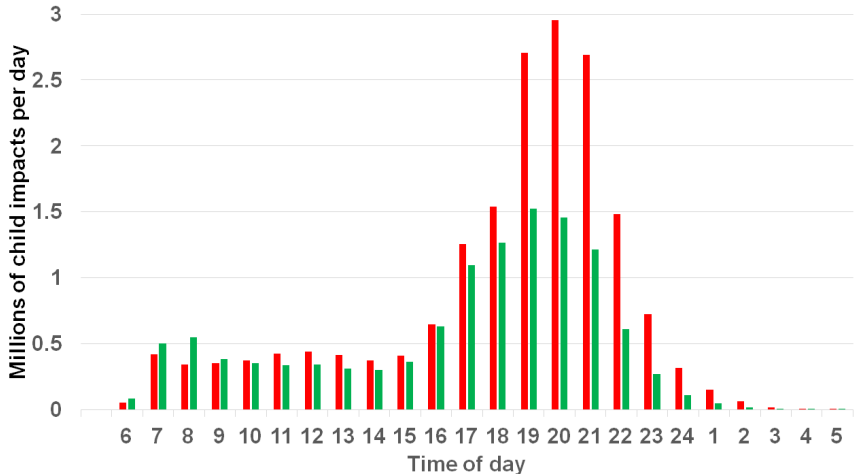
by income



by age



Child advertising viewing: junk foods healthy foods



Source: Griffith, O'Connell, Smith and Stroud (2018)

Well designed policy

- ▶ Well designed policy has the potential to help people make better choices
 - ▶ and reduce externalities and internalities
- ▶ in order to design good policy we need to better understand
 - ▶ why people are making bad choices
 - ▶ how specific policies, or combinations of policies, will affect different people (i.e. will it lead people with the highest externalities or internalities to change their choices)
 - ▶ what other (unintended) effects the policies might have

“Explaining the decline of home-cooked food”

with Thomas Crossley, Michelle Jin and Valérie Lechene

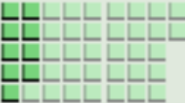
- ▶ The shift away from home-cooked food towards ready-to-eat food has been well publicised
 - ▶ this has been proposed as one of the likely causes of the growth in obesity and decline in the nutritional quality of diets
- ▶ What has driven this shift?
 - ▶ changes in relative prices? have processed foods become cheaper?
 - ▶ there have also been important other changes:
 - ▶ household structures (shift to smaller household size)
 - ▶ time use and labour market behaviour of secondary earners

Food choices, prices, time use and nutrition

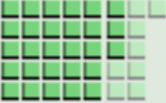
- ▶ We use household level data on food purchases
 - ▶ distinguish the associated cost of preparation time
 - ▶ document the shift from ingredients to pre-prepared foods and the associated changes in prices
- ▶ We model food choices considering
 - ▶ home cooked food requires time
 - ▶ households have heterogenous time costs
 - ▶ households differ in size
 - ▶ potential economies of scale in food production

Dinner for four

(Lighter blocks show value of time required,
using median US wage of **\$16.27/hour**)

Homemade rice and pinto beans  (With time cost of two hours of shopping, travel, prep, and cleanup: **\$41.80**)
\$9.26

Homemade chicken dinner  (With time cost of two hours of shopping, travel, prep, and cleanup: **\$46.32**)
\$13.78

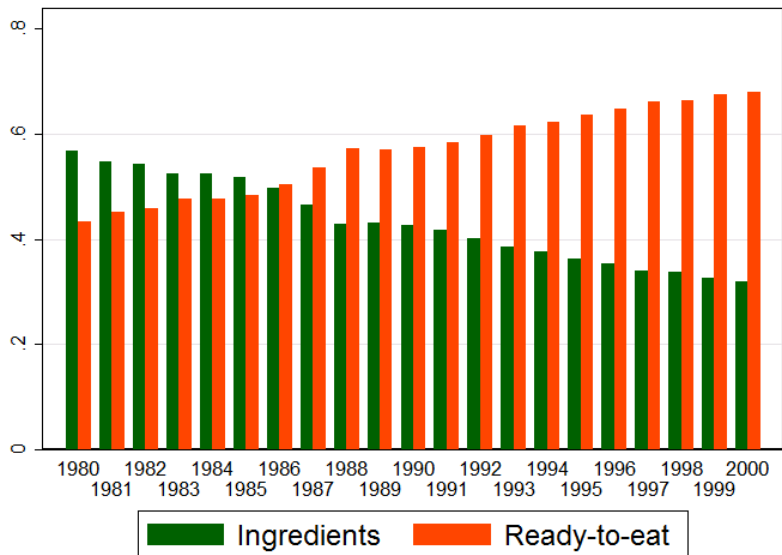
McDonalds  (With time cost of 30 minutes travel: **\$36.03**)
\$27.89

Arby's  (With time cost of 30 minutes travel: **\$42.13**)
\$34.00

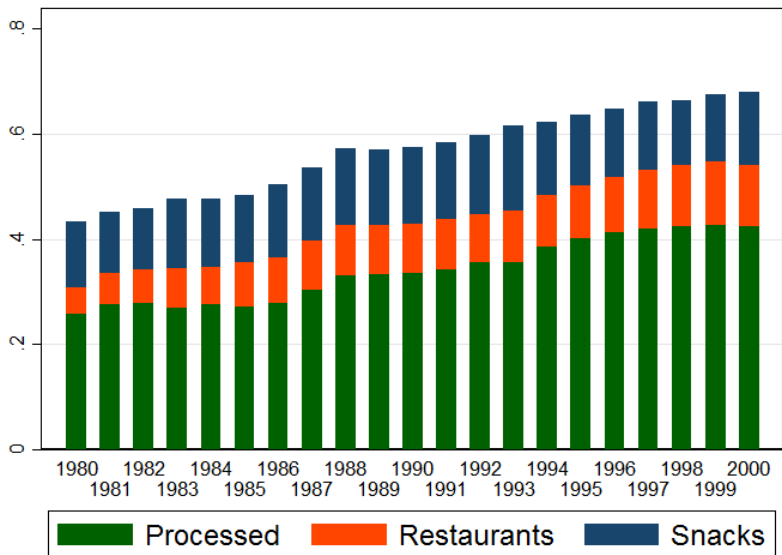
Data - UK Family Expenditure Survey

- ▶ Repeated cross-section 1980-2000
- ▶ 2 adult working age households, any number children (including 0)
- ▶ 200 households per month; about 30,000 observations
- ▶ Detailed information on expenditure and demographics
 - ▶ we map 367 food items to time use
 - ▶ ingredients (need preparation time)
 - ▶ processed food at home
 - ▶ food out in restaurants
 - ▶ food out on-the-go
- ▶ Labour supply: participation and hours worked
- ▶ Market prices from ONS Retail Price Index (RPI)

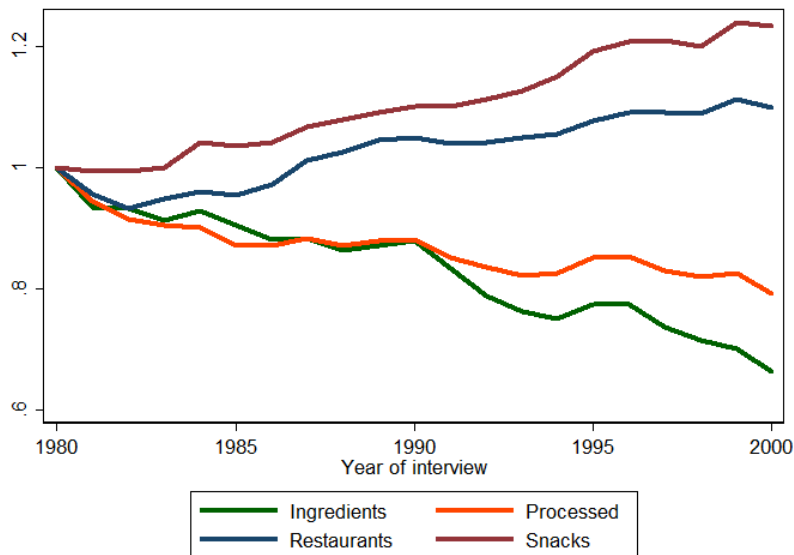
Increase in ready-to-eat food, UK



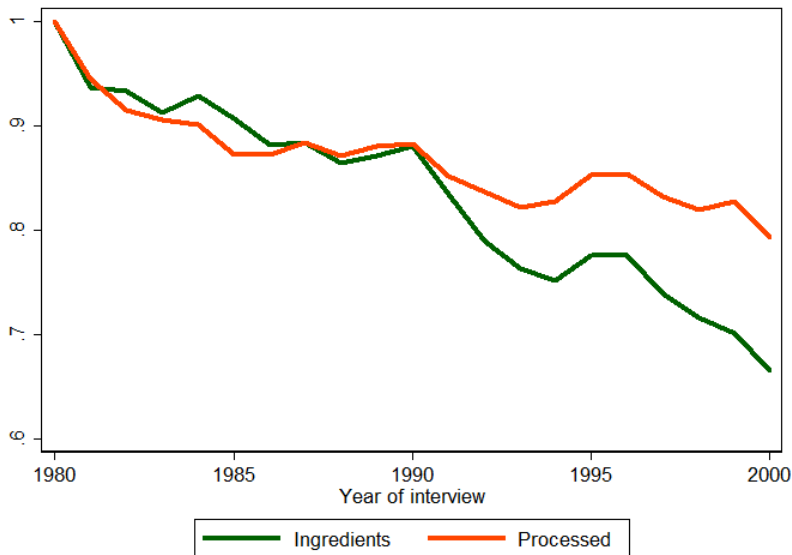
Increase in ready-to-eat food, UK



Prices of ready-to-eat foods and ingredients



Prices of ready-to-eat foods and ingredients

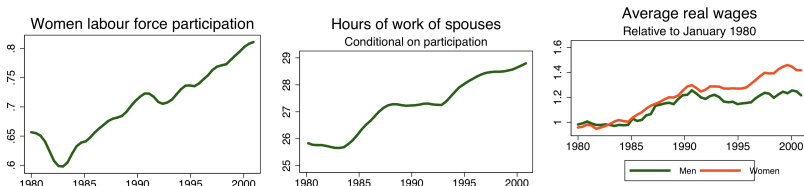


Model

- ▶ Model of food consumption and time use, with home production
 - ▶ cost of home cooked food based on shadow price, incorporating opportunity cost of time and returns to scale to food preparation
- ▶ We are interested in choice between home cooked foods (combine time and ingredients) and ready-to-eat foods (requiring little or no preparation time)
- ▶ The model incorporates trade offs:
 - ▶ on the consumption side: between purchasing ingredients for cooking or purchasing processed foods
 - ▶ on the time use side: between working to earn income, cooking and leisure

Labour market participation of secondary earners

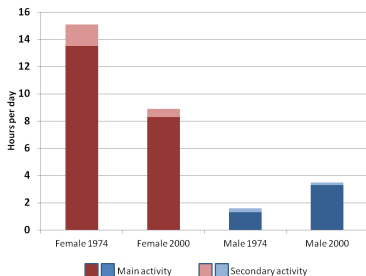
- ▶ We are particularly interested in the impact of increased labour force participation, hours and real wages of secondary earners



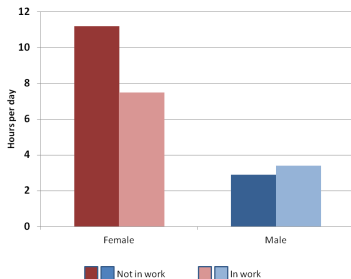
- ▶ this leads to a higher opportunity cost of time for cooking
- ▶ We are also (potentially) interested in effects of reduction in household size
 - ▶ reduced returns to scale

Time spent on food management

1974 and 2000



secondary earner 2000



Source: UK Time Use Survey 2000 and the People's Activities and Use of Time, 1974-1975

Model of work and food demand

- ▶ Household with two adults and any number of children, $n = 2 + K$
- ▶ Utility is derived from
 - ▶ private food goods
 - ▶ r purchased ready to eat
 - ▶ c home produced by combining ingredients i and time t
 - ▶ x : (possibly) public, non-food non-durable good
 - ▶ $\theta \in [0, 1]$: returns to scale to the non-food good
 - ▶ l : leisure
- ▶ Household utility, unitary model with fixed weights

$$\max_{c, r, x, l} : nU \left(\frac{c}{n}, \frac{r}{n}, \frac{x}{n^\theta}, \frac{l}{n} \right)$$

Budget constraint and time constraints

$$\begin{aligned}p_r r + p_i i + p_x x &= y_0 + w_1 \bar{h}_1 + w_2 h_2, \\ T - \bar{h}_1 &= l_1 + t_1 \\ T &= h_2 + t_2 + l_2\end{aligned}$$

- ▶ r : ready to eat food, i : ingredients, x : outside good
- ▶ market price p_r, p_i, p_x
- ▶ y_0 : unearned income, w_j : wage of adults $j = 1, 2$
- ▶ Adult time of $j = 1, 2$ is allocated
 - ▶ h_j : hours of market work, primary earner constrained \bar{h}_1
 - ▶ t_j : time spent cooking
 - ▶ l_j : leisure

Home production of food

$$\frac{c}{n} = \min \left[\frac{i}{n}, \frac{Bt}{n^\gamma} \right]$$

- ▶ c : home cooked food; i : ingredients; complements in home production (Hamermesh, 2008)
- ▶ $t = t_1 + t_2$: time spent cooking; B transforms units
- ▶ $\gamma \in [0, 1]$: returns to scale in cooking
 - ▶ cooking for two takes less than twice the time as for one
- ▶ t_1 and t_2 are perfect substitutes in production
 - ▶ if primary earner cooks less, secondary earner cooks more, works less or has less leisure
 - ▶ so price for time input to cooking is the opportunity cost of the secondary earner, w_2

Model in terms of shadow prices

$$\begin{cases} \max_{c^*, r^*, x^*, l^*} nU(c^*, r^*, x^*, l^*), \\ \text{s.t } p_c^* c^* + p_r^* r^* + p_x^* x^* + p_l^* l^* = \\ \quad \frac{1}{n}(y_0 + w_1 \bar{h}_1 + w_2 T + w_2(T - \bar{h}_1)) \end{cases}$$

where

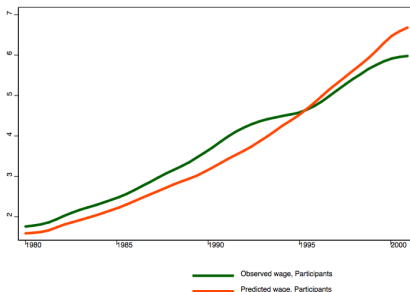
$$p_c^* = p_i + \frac{w_2}{Bn^{1-\gamma}} \quad p_r^* = p_r \quad p_x^* = \frac{p_x}{n^{1-\theta}} \quad p_l^* = w_2$$

$$c^* = \frac{c}{n} \quad r^* = \frac{r}{n} \quad x^* = \frac{x}{n^\theta} \quad l^* = \frac{l}{n}$$

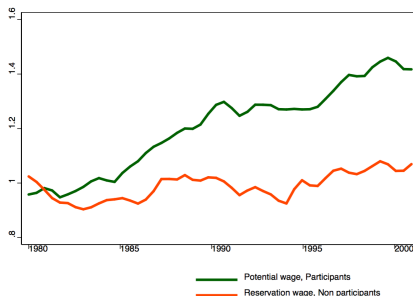
- ▶ Shadow price of home cooked food
 - ▶ increases with higher market wages (w_2) for the secondary earner
 - ▶ potentially decreases with household size (n) if cooking is more efficient in larger households

Potential and reservation wages

- ▶ We estimate an individual wage equation for secondary earners controlling for selection and many individual characteristics
- ▶ We predict a wage and a reservation wage for each individual
 - ▶ for participants the value of time is the potential wage
 - ▶ for non participants it is the reservation wage

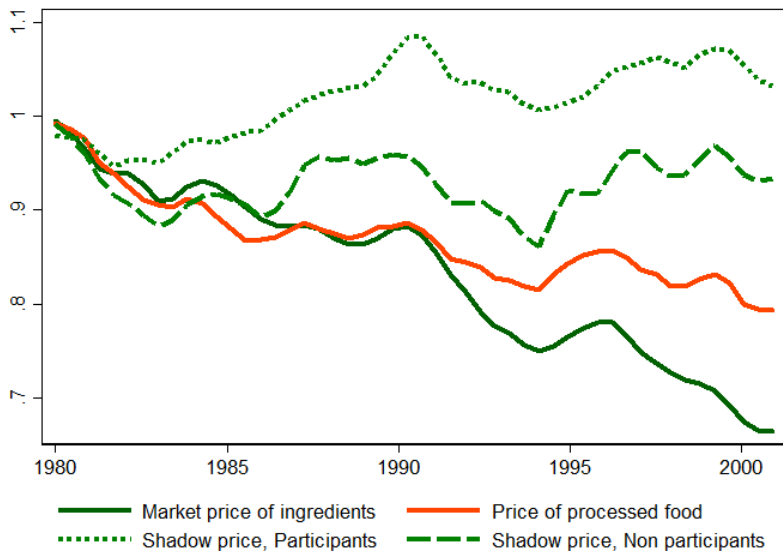


Actual and Predicted Wages



Predicted and Reservation Wages

Shadow price of home cooked food



Implications

- ▶ The market price of ingredients for home cooking has fallen
 - ▶ despite this, demand for processed foods has increased and for ingredients has fallen
- ▶ There have been large increases in labour market participation and wages of secondary earners (primarily women)
 - ▶ the implication of this is a substantial increase in the *shadow price* of ingredients
- ▶ Policy implications
 - ▶ the increase in labour market participation was in part driven by policy, move to in-work benefits
 - ▶ to understand the impact of taxes we need to account for time use
 - ▶ preferences and also perhaps skills in food preparation may also be important (we need to learn more about these)

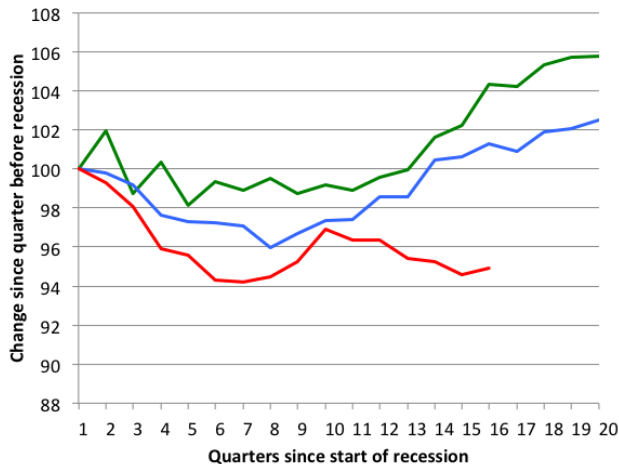
“Shopping around: how households adjusted food spending over the Great Recession”

with Martin O'Connell and Kate Smith

- ▶ Over the Great Recession households experienced adverse shocks to their incomes and large increases in the price of food
 - ▶ unlike previous recessions, expenditure on food failed to keep pace with rising food prices
 - ▶ led some to infer a substantial reduction in the size and nutritional quality of households' food baskets

Fall in non-durable expenditure (UK)

food accounts for most of the difference across recessions



Source: Crossley, Low and O'Dea (2011) "Household consumption through recent recessions" IFS Working Papers , W11/18

Breadline Britain

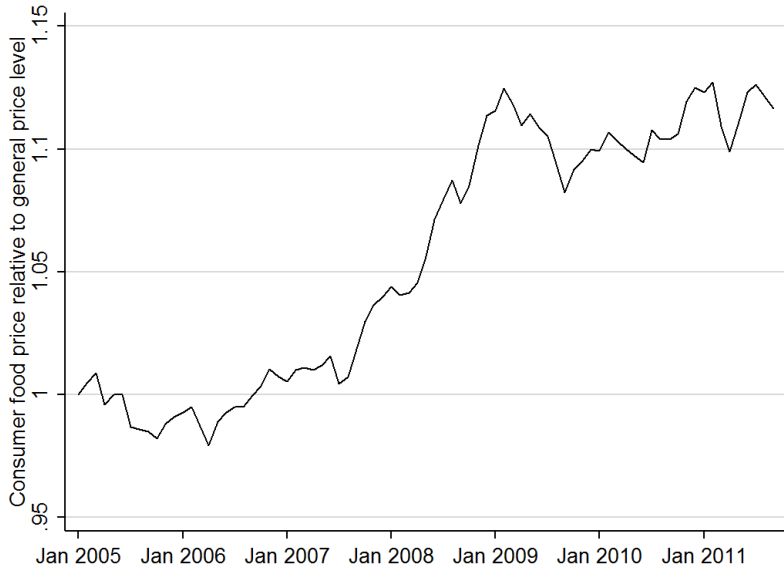


Britain in nutrition recession as food prices rise and incomes shrink

Families filling up on high-fat processed foods as 900,000 fewer in two years manage 'five-a-day' fruit and vegetables

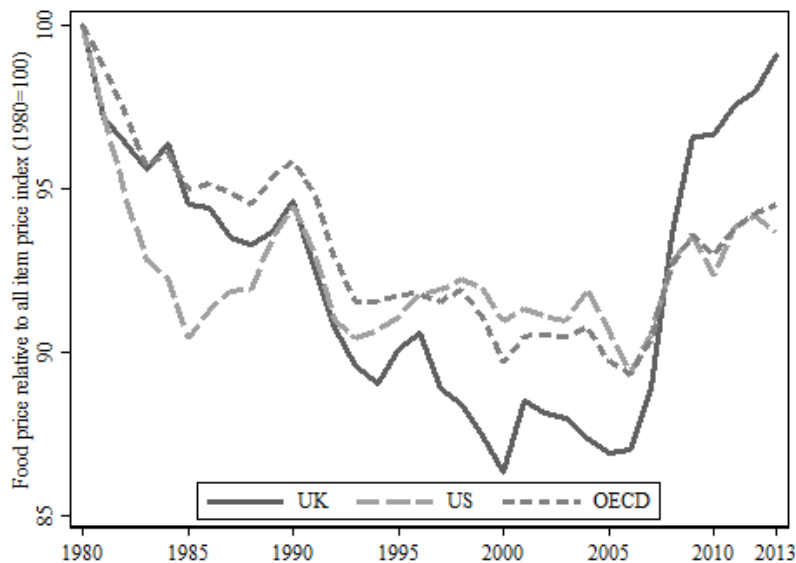
The Guardian

UK consumer price of food, 2005-2011



Source: ONS

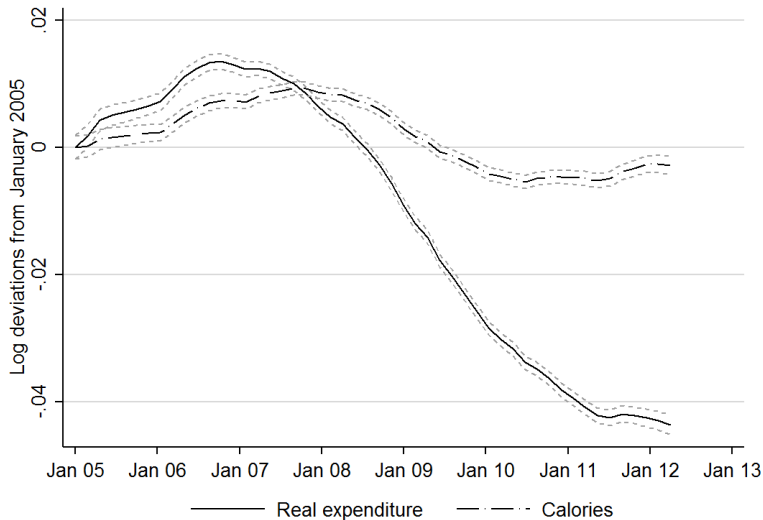
An aside, the real price of food at home, 1980-2013



Source: OECD

Real food expenditure and calories purchased

households substituted to cheaper calories



Source: Kantar

Changes in the Healthy Eating Index (HEI)

- ▶ Substitution to cheaper calories raised concerns about reduced nutrition quality
- ▶ but the nutritional quality of households' shopping baskets **improved** over this period

	Max score	Mean in 2005-2007	Change to 2010-2012	% change to 2010-2012
HEI 2005-2007	100	49.0	0.72	1.5
<i>of which</i>				
“Good” change			1.45	3.0
“Bad” change			-0.72	1.5

- ▶ Good changes: more whole fruit, less sodium, saturated fat, high sugar products
- ▶ Bad changes: less vegetables, less whole grains, less meat

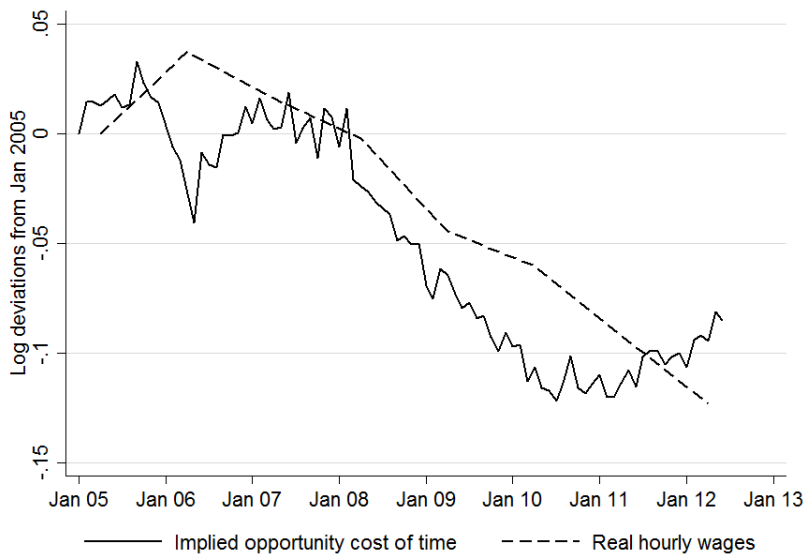
Model

- ▶ Price per calorie, $P = P(e, \mathbf{z}; \phi)$, depends on shopping effort, e
 - ▶ more time shopping results in lower prices, $\partial P / \partial e < 0$, with diminishing returns to effort, $\partial^2 P / \partial e^2 > 0$)
 - ▶ but has an opportunity cost, ω
 - ▶ \mathbf{z} characteristics also affect price
 - ▶ characteristics include: nutrients, branding, time required to prepare
 - ▶ households choose groceries and how much time to allocate to shopping and cooking
 - ▶ spending more time shopping allows households to lower their expenditure on groceries, but they incur a cost of time
- ▶ Similar to Aguiar and Hurst (2007), extended to also consider the choice over the characteristics of their grocery basket

Data

- ▶ Kantar Worldpanel
- ▶ scanner data collected at the household level
- ▶ transaction level, information on all products in the household's shopping basket
- ▶ longitudinal, we observe households on average over 30 months
- ▶ 14,694 households
- ▶ January 2005 – June 2012

Implied opportunity cost of time



Contribution to change in price paid per calorie

	£	% total reduction
Shopping effort:	-1.06	40.8
Savings from discounter	-0.09	3.5
Savings from sales	-0.97	37.6
Nutrient characteristics:	-0.93	35.8
Other characteristics:	-0.60	23.1
Share from generic products	-0.84	32.6
Share of groceries from big pack sizes	0.24	-9.3
Total	-2.59	100.0

Summary

- ▶ Over the Great Recession UK households experience depressed real wages, higher unemployment and higher food prices
 - ▶ expenditure on groceries reduced, unlike in previous recessions
 - ▶ diet quality improved
 - ▶ households changed their shopping behaviour in ways that lowered the average per calorie price of their shopping basket
- ▶ Households were made worse off
 - ▶ but they maintained nutrient characteristics of shopping basket while reducing their real food expenditure
- ▶ Similar results in the US
 - ▶ households spend more time shopping and pay lower prices, Kaplan and Menzio (2014b)), switch to low-price retailers Coibon, Gorodnichenko and Hong, 2014), increase their use of sales, switch to generic products (Nevo and Wong, 2014)

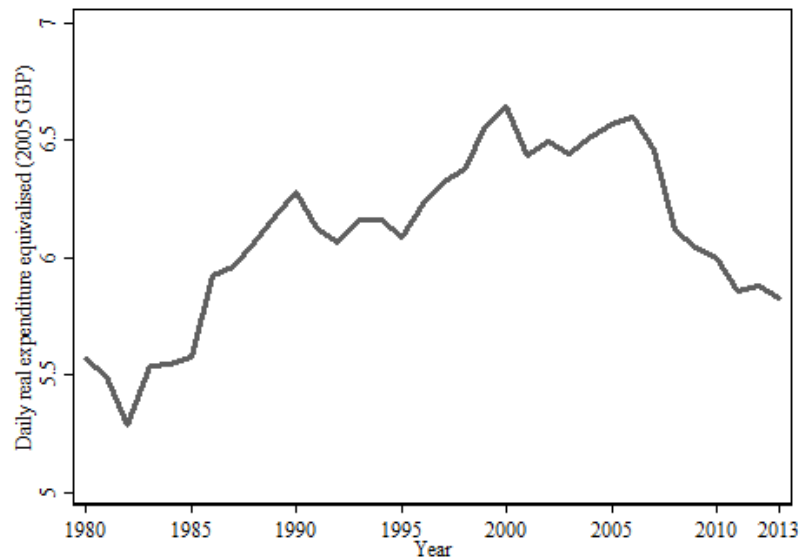
- ▶ It is well known that equating expenditure with consumption can lead to mistaken conclusions about how households are affected by changes in their economic environment
 - ▶ households may increase their time spent searching for lower prices (Stigler, 1961)
 - ▶ or in home production (Becker, 1965) in order to smooth their consumption
- ▶ They may also change the composition of their shopping baskets (i.e. switching from a preferred branded to a cheaper generic product) to maintain the nutritional quality of their food basket

“Gluttony and sloth? Calories, labour market activity and the rise of obesity”

Rachel Griffith, Rodrigo Lluberas and Melanie Luhrmann

- ▶ if we look at the previous few decades, when prices were falling, we see something like the opposite

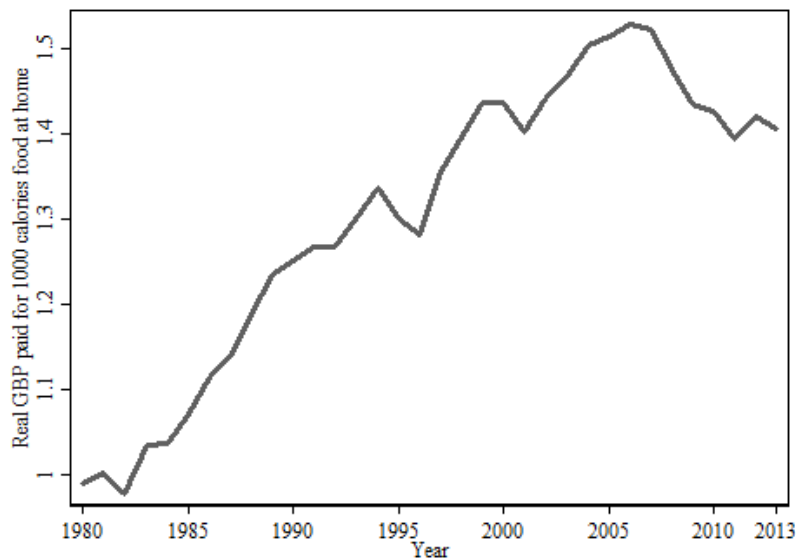
Real expenditure on food and drink, UK



Real expenditure on food and drink, 1980-2013

	Equivalised daily expenditure (2005 £)	% change	
	1980	1980-2007	2007-2013
All food and drink	5.57	15.9	-9.7
<i>of which:</i>			
Food at home	2.83	17.7	-9.9
Eating out, fast food, soft drinks and confectionery	1.44	37.8	-5.9
Alcohol	1.31	-12.2	-15.6

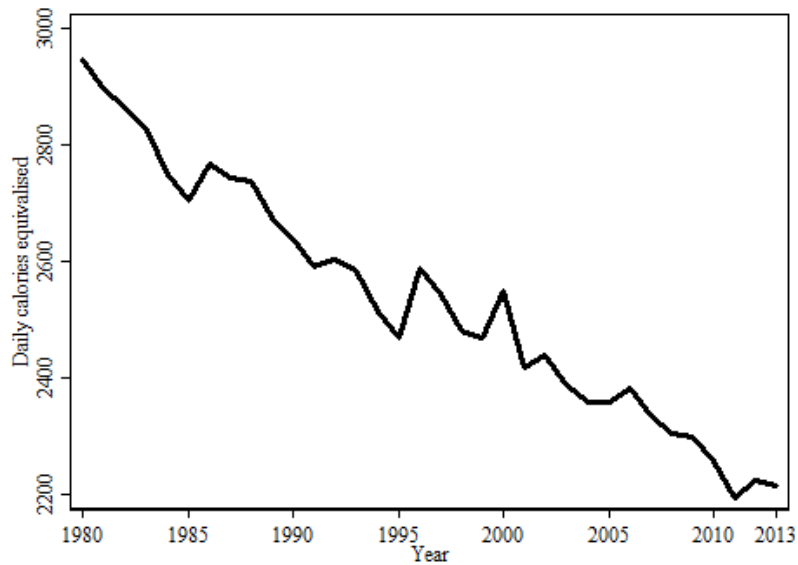
Expenditure per 1000 calories, food at home



Expenditure and calorie shares by food groups

	Food at home	Eating out and fast food	Soft drinks and confectionery	Alcohol
Expenditure shares				
1980	59.6	17.6	5.2	17.6
change 1980-2013	- 2.1	+ 5.4	+ 1.3	- 4.6
Real expenditure per 1000 calories	1.44	4.38	1.99	8.44

Total calories



Summary

- ▶ Calories fell
 - ▶ but the strenuousness of work and daily life fell by more
 - ▶ leading to rise in obesity
- ▶ The relationship between income, work, time use and nutrition
 - ▶ is important for understanding the implications of policy
 - ▶ is still not well understood
 - ▶ increasingly good data
 - ▶ combined with economic theory can help us learn how to design better policy

The effects of junk food advertising

with Pierre Dubois, Martin O'Connell, Kate Smith and Rebekah Stroud

UK policy

- ▶ Restrictions on advertising:
 - ▶ **Current regulation:** In 2007, a ban on TV advertising “unhealthy” food and drinks during children’s programming was introduced
 - ▶ **Under consideration:** Extending this ban to all TV advertising for “unhealthy food” and drink pre watershed
- ▶ In ongoing work we are trying to estimate what would be the effects of extending these advertising restrictions?

Data

We use advertising data from **AC Nielsen**:

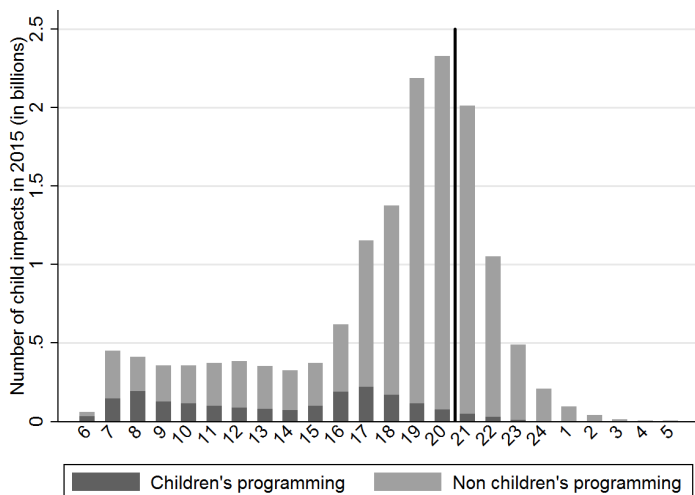
- ▶ detailed information on all TV adverts for food and drink in 2015
- ▶ include brand advertised, time, programmes and channel for each advert, plus number of impacts

We combine with information from the **Kantar World Panel**:

- ▶ household level shopping basket
 - ▶ nutrient information from the back of the pack of each products
 - ▶ we combine nutrients using a single index that is used by regulator – Nutritional Profiling Model (NPM) score
- ▶ media viewing behaviour

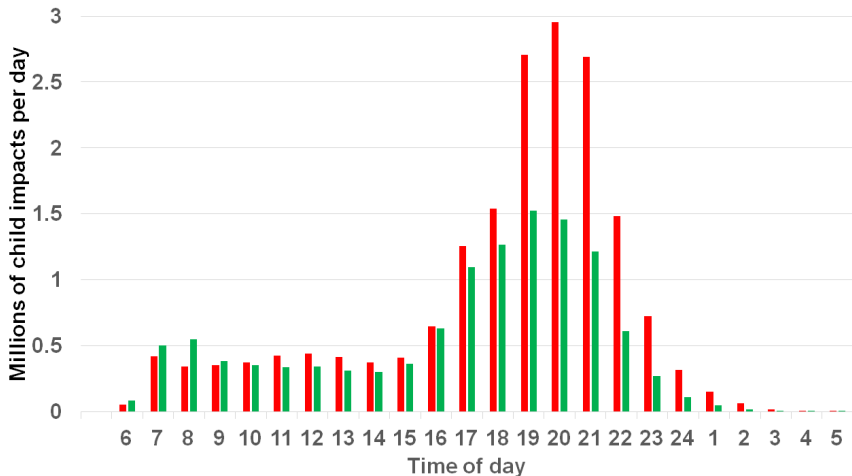
Children see a lot of adverts during “adult” tv

13% of children impacts are during children's programming



Source: Griffith, O'Connell, Smith and Stroud (2018)

Child see a lot of junk foods adverts

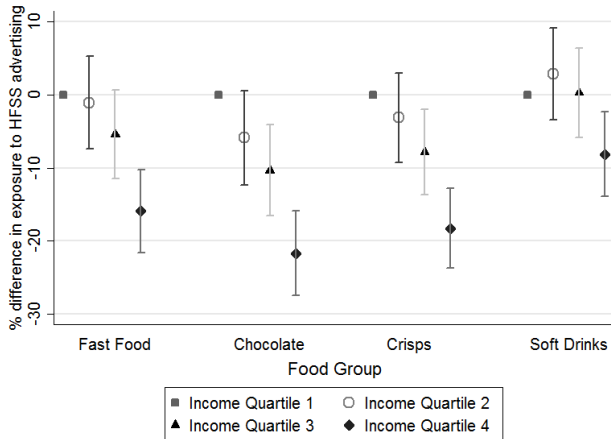


Source: Griffith, O'Connell, Smith and Stroud (2018)

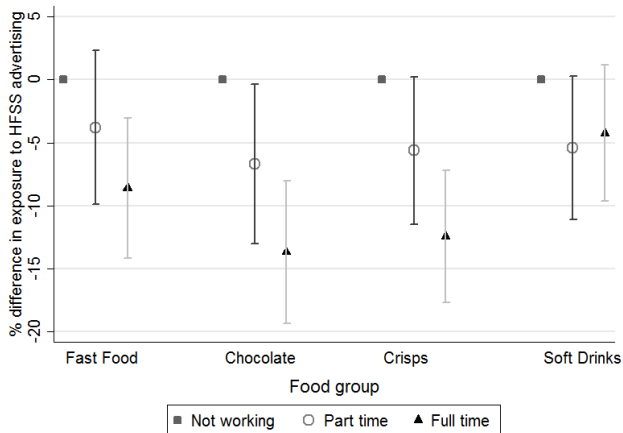
Linking adverts to food choices

- ▶ The Kantar data contains:
 - ▶ TV viewing habits of the main shopper in each household, including details of regularly watched programmes, channels and time slots
 - ▶ information on the demographics of all individuals in the household
 - ▶ details of all food and drink purchases made by each household
- ▶ We have linked information on 6,668 households with children in the Kantar data to the advertising data to construct a measure of the probability that the main shopper in each household was exposed to advertising

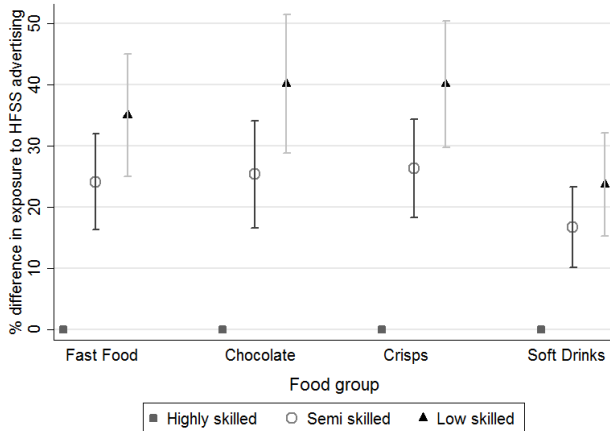
Lower SES households are exposed to more adverts for “unhealthy” foods



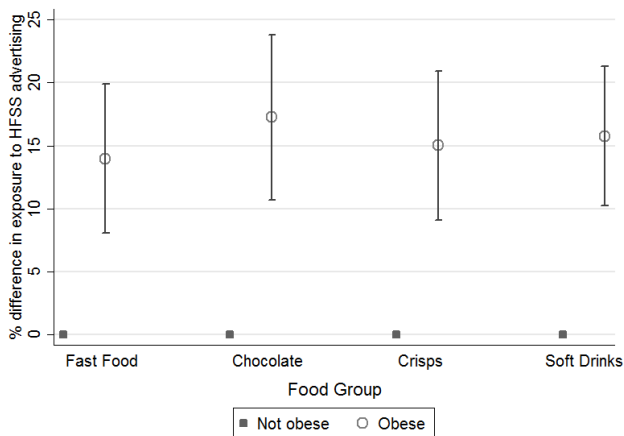
Lower SES households are exposed to more adverts for “unhealthy” foods



Lower SES households are exposed to more adverts for “unhealthy” foods



Households where the main shopper is obese are exposed to more adverts for “unhealthy” foods



“The effects of banning advertising in junk food markets”

with Pierre Dubois and Martin O'Connell

- ▶ Ban on advertising in one junk food market:
 - ▶ leads to substitution to healthier products (higher WTP)
 - ▶ at constant prices, quantity of junk food purchased would decrease
 - ▶ but stronger price competition leads to lower prices and thus only small effect on quantity consumed
 - ▶ profitability in the market is almost unchanged
- ▶ Effect on welfare depends
 - ▶ if advertising is viewed as distorting prices, total welfare would rise
 - ▶ if advertising is viewed as a valued characteristic then welfare would fall

Ongoing work in partnership with UK Department of Health

Changes in exposure \Rightarrow changes in purchases

What effect would a wider ban across all junk food markets have?
model demand incorporating the impact of advertising

Changes in purchases of household \Rightarrow changes in consumption of individuals

Use information from intake surveys and models of intra-household allocation to understand how foods are allocated within the household

Changes in consumption \Rightarrow changes in outcomes

incorporate information from economics, epidemiological and health literatures to better understand how externalities and internalities arise

Policy towards obesity and poor nutrition

- ▶ Clear evidence that people are making bad food choices leading to poor health, economic and social outcomes
 - ▶ these bad choices affect that person over their lifetime and potentially impose costs on others
 - ▶ evidence that particularly true for poorer households
- ▶ Lifting people out of poverty by using cash transfers is effective
- ▶ Are there other policies that can lead to improvements in food choices (that are less expensive?)
 - ▶ policies that change relative prices (e.g. sugar or soda taxes)
 - ▶ policies that restrict advertising of junk foods
 - ▶ “nudge policies”: e.g. remove temptation, calorie labelling

Thank you

Cost minimization problem [▶ Back](#)

$$\begin{aligned} \min_{e, \mathbf{z}, C} \quad & P(e, \mathbf{z}; \phi)C + \omega(e + z'), \\ \text{s.t.} \quad & v(C, \mathbf{z}) = \bar{v} \end{aligned}$$

- ▶ ω : opportunity cost of time
- ▶ \bar{v} : total resources allocated to food consumption
- ▶ The first order condition for shopping effort is:

$$-\frac{\partial P}{\partial e}C = \omega,$$

- ▶ put effort into shopping up to the point where the marginal gain in terms of lower food expenditure equals the opportunity cost of time
- ▶ can be used to recover the household's opportunity cost of time

- The marginal rate of substitution between calories and characteristic k :

$$\frac{\partial v / \partial z_k}{\partial v / \partial C} = \frac{\partial P}{\partial z_k} \frac{C}{P}$$

- how does price per calorie change (within household) through time due both to the household paying lower prices through effort, given basket characteristics, but also due to substitution across the basket's characteristics
- use to study how households adjusted their shopping behaviour in response to deteriorations in the economic environment
 - we analyse changes *within* households over the Great Recession
 - households in the UK experienced reductions in their real incomes, driven by slow nominal wage growth and reductions in asset prices and faced higher food prices

- Negative shocks reduced \bar{v} , households were made worse off
 - but we observe calories and nutritions remained stable
 - how did households achieve this?
- Estimate sensitivity of price paid per calorie to (e, \mathbf{z})

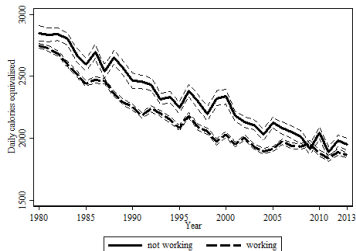
$$\ln P_{ht} = \alpha \ln \mathbf{e}_{ht} + \beta \ln \mathbf{z}_{ht} + \gamma \mathbf{x}_{ht} + \tau_{ht} + \eta_h + \epsilon_{ht}$$

- P_{ht} : price per calorie
- τ_{ht} region-time effects
- η_h household fixed effects
- \mathbf{x}_{ht} time varying household demographics

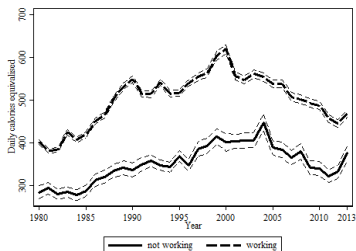
Calories, male by work status

► Females

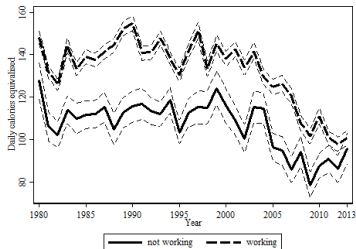
(a) Home



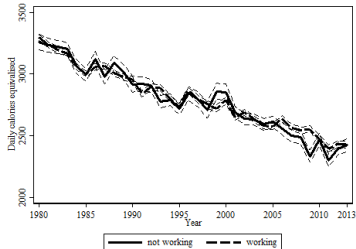
(b) Out, fast food, etc



(c) Alcohol

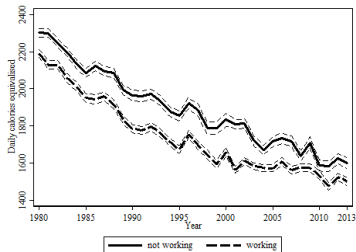


(d) Total

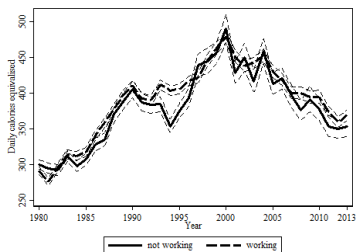


Calories, female by work status [▶ Back](#)

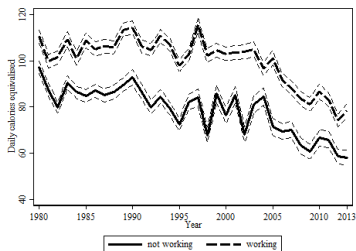
(a) Home



(b) Out, fast food, etc



(c) Alcohol



(d) Total

