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Gluttony and Sloth:
long-run changes in bodyweight,
diet and labour market activity

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Motivation

- Obesity is a major public policy issue
  - abnormal or excessive fat accumulation that may impair health

- According to the World Health Orgnization (WHO)
  - worldwide obesity has more than doubled since 1980
  - 39% of adults overweight in 2014
  - 13% obese
  - most of the world's population live in countries where overweight and obesity kills more people than underweight
  - 42 million children under the age of 5 were overweight or obese in 2013

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Motivation

- Obesity results from a caloric imbalance
  - more calories from food and drink consumption
  - than burned in physical activity

- The media, policy makers and much of the academic literature has emphasised increased gluttony as the main cause of rising obesity
  - Surprisingly, when we look at data from official government household surveys we find that calories have *fallen*
  - raises the question: why have we seen such rapid rises in weight?
  - is it due to changes in physical activity and time use?
    - particularly labour market activities

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Obesity in 2010
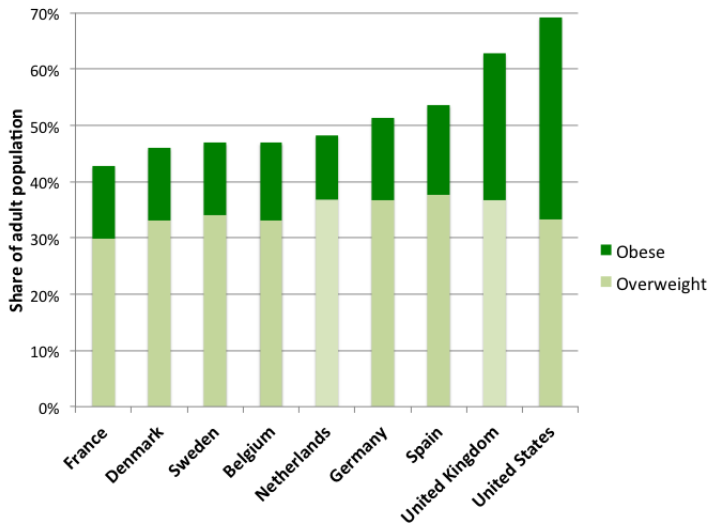
The media focus on gluttony

- for example, this photo was in *The Guardian* last week alongside an article "WHO report: 74% of men and 64% of women in UK to be overweight by 2030"

Policy focus on gluttony

- McKinsey report and WHO document a large range of policies that have been implemented to target obesity
- Of the 74 policies that McKinsey document
  - 45 were focused on food behaviours (e.g. labelling, taxes)
  - 11 focused on exercise (e.g. cycling infrastructure, subsidised gym membership)
  - 13 targeted both - the balance between food and exercise (e.g. education, health councelling)
  - 5 others (e.g. surgery)

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Academic literature focus on gluttony

- The economics and medical literatures have emphasised increased food consumption as the main cause
  - Cutler, Glaeser and Shapiro (2003) "Why Have Americans Become More Obese?" *Journal of Economic Perspectives*
  - Bleich, Clutler, Murray and Adams (2008) "Why is the developed world so obese?" *Annual Review of Public Health*
  - Brunello, Michaud and de Aldeano (2009) "The rise of obesity in europe: an economic perspective" *Economic Policy*

  - plus many others

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What evidence for gluttony?

- The literature showing a rise in calories is mainly based on "food availability" data
- Household level survey data show a different picture
- UK
  - Griffith, Lluberas and Luhrmann (2015) "Long-run changes in food purchasing and calories in the UK"
  - decline in calories, changes in physical exercise

- USA
  - Ladabaum et al (2014) "Obesity, abdominal obesity, physical activity, and caloric inake in us adults: 1988-2010" *The American Journal of Medicine*
  - no change in calories, changes in physical exercise

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What evidence for gluttony?

- Griffith, Lluberas and Luhrmann (2015) combine information on calories purchased and expenditure from UK household expenditure survey data

  - repeated cross-section, representative sample
  - diary of purchases over a one or two week period
  - record expenditure and quantities for approx. 200 food items
  - calorie information matched in by government agency

  - 1980-2000: National Food Survey (NFS) and Family Expenditure Survey (FES)
  - 2001-2008: Expenditure and Food Survey (EFS)
  - 2008-2010: Living Costs and Food Survey (LCFS)

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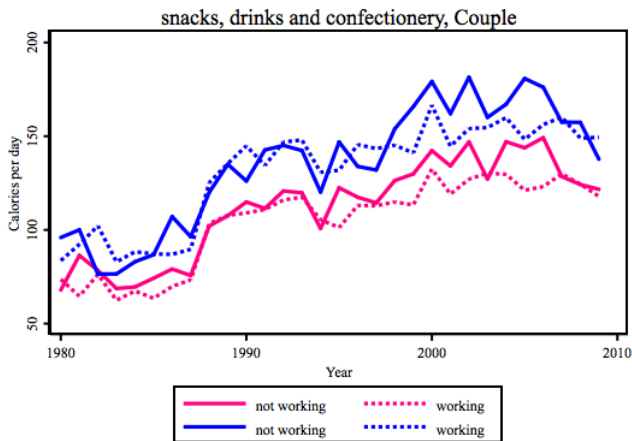Fiscal Studies

What evidence for gluttony?

- Calorie data not collected for some food categories prior to 2001
    - we impute using information on expenditure, demographics and price of calories

- Data are at household level, we want individual level
    - household size and composition has changed, decline in household calories could be driven by this
    - we estimate sharing rule, similar to Chesher (1998)

- We use data on adults 25-79

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What evidence for gluttony?

- When we put all the data together what we see is that
  - purchase of calories in snacks, drinks and confectionery increases
  - purchase of calories in food out at restaurants, take away meals and alcohol increases
    - the increase is much bigger for working people
  - purchases of calories in meals at home *decreases*
    - particularly for working people
    - people who work substitute market goods for home production
    - expenditure on food at home remains fairly constant
    - people switch to more expensive calories
  - the overall effect is a reduction in total calories
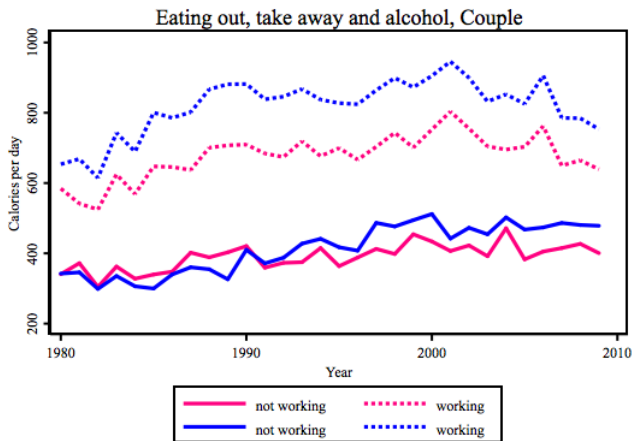
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Calories from snacks, drinks and confectionery

- couples - trend similar across household types
- +75 calories per person per day from lowest to highest point, average around 2 calories per person day over 30 year period

snacks, drinks and confectionery, Couple

Legend:
- not working (pink solid)
- working (pink dotted)
- not working (blue solid)
- working (blue dotted)

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Calories from eating out, take aways and alcohol

- couples - trend differs across household types
- +200 calories per person per day from lowest to highest point, average around 5 calories per person day over 30 year period

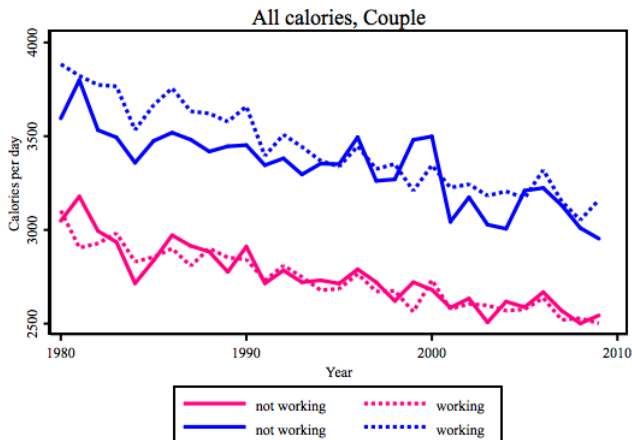Eating out, take away and alcohol, Couple

Calories from food at home

- couples - trend similar across household types
- -500 calories per person per day from lowest to highest point, average around -25 calories per person day over 30 year period
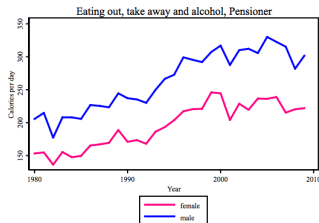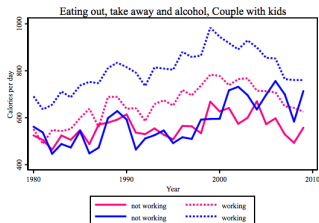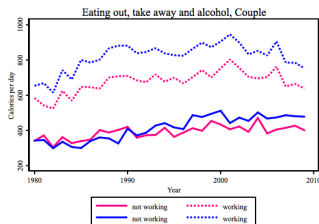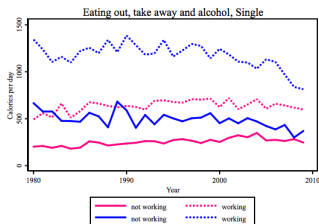

Food at home, Couple
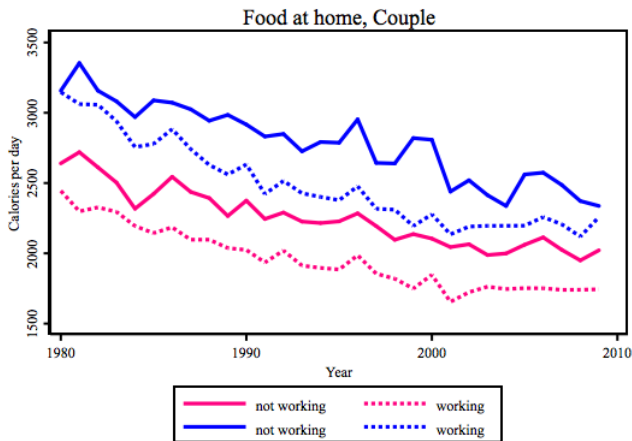
Total calories

- couples - trend similar across household types
- the overall effect is a reduction in total calories
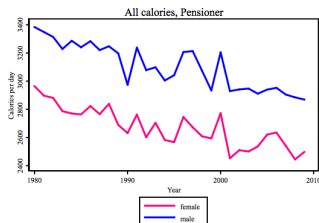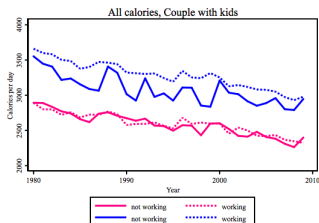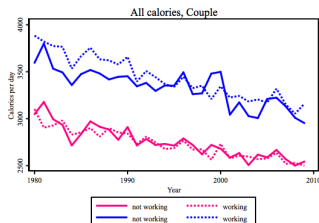

All calories, Couple

Calories from eating out, take aways and alcohol

- variation across household types and whether working

Calories from all food

- much less variation in total calories
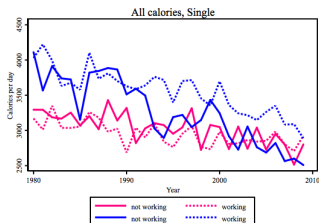
What is the magnitude of these changes in calories?

- snacks, drinks and confectionery
  - around 2 calories per person per day
  - around 0.1 kg per year, all else equal

- eating out, take aways and alcohol
  - across all people around 5 calories per person per day
  - around 0.25 kg per year, all else equal

- food at home
  - across all people around -25 calories per person per day
  - around -1.1 kg per year, all else equal

- total calories
  - across all people around -18 calories per person per day
  - around -0.75 kg per year, all else equal

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Gluttony? What do the calories data show?

- There is an increase in
  - snacks, drinks and confectionery
  - food out, particularly for workers

- This is more than offset by a decrease in calories from foods at home
- Calories for consumption at home decline
  - because households switch to more expensive calories
  - around 10% of the decline in calories is due to reduction in the calorie density within food categories
  - the rest of the decline is due to shifts across food categories, away from sugary products like jam and honey, and fats, like butter, towards fruit and vegetables, fish and cereals

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This is a puzzle

- What is driving weight gain?
- weight gain comes from imbalance between calories eaten and calories burned in physical activities
- there are many relevant activities to consider
- one important one is work
- important because
  - it takes up a lot of most people's time
  - there have been big changes in participation and the strenuousness of work
  - there are important complementarities between work and food purchasing behaviour

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Changes in food consumption are correlated with labour market activity

Sloth? Changes in labour markets

- Males
  - occupation changes have resulted in a shift towards less strenuous jobs
  - older cohorts retired early and now work shorter hours

- Females
  - more likely to be in the labour market
  - more likely to be working longer hours
  - occupation changes have resulted in a shift towards less strenuous jobs, though less so than for males
  - spend less time on housework (which is more strenuous than work)

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Sloth? Strenuousness of activities

- To measure the strenuousness of activities we use "metabolic equivalents of tasks" (METs)

  - METs are an estimate of the metabolic rate while doing an activity relative to the metabolic rate while resting
  - lying or sitting quietly has a MET of 1
  - riding in a car has a MET of 1.3
  - riding a bike to work has a MET of 4
    - requires 4 times the energy expenditure at rest
  - housework has a MET of between 2.5-6.5
  - carrying a bag of groceries up a flight of stairs has a MET of 5
  - running a 5-minute mile has a MET of 19

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Sloth? Strenuousness of occupations

- We create a consistent coding for 374 occupations from 1980-2009 using the Labour Force Survey (LFS) for England
- We map these occupations to METs published in Tudor-Lock et al (2011)
  - a sedentary job that involved sitting at a desk all day, such as a computer programmer, has a MET of 1.5
  - an active job, such as a janitor, has a MET of 4.5
- The average male working a 40 hour week in a strenuous job would burn around 85kg in energy per year, the average female around 70kg
  - moving from a strenuous to a moderately active job would reduce this by 25kg for males (to 60kg per year) and 20kg for females (to 50kg)
  - moving to a sedentary job reduces it by another 25kg for men (to 30kg) and by another 20kg for females (to 30kg)

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Sloth? other activities

- To burn an equivalent amount of energy in exercise, the average person would have to jog for
  - 8.6 hours a week (low activity job)
  - 14.3 hours a week (medium activity job)
  - 20 hours a week (high activity job)

- Other uses of time
  - Housework also important
    - it is strenuous
    - the amount of time on housework has declined
    - housework has become less strenuous
  - Less strenuous forms of travel
  - More TV viewing and other sedentary activities

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Sloth? Strenuousness of occupations, males

- for males there is a shift away from more strenuous occupations towards less strenuous occupations

Occupation	% male workforce		**change**
	1981	2008	**1981-2008**
Sedentary	32.4	45.2	**12.8**
(manager, clerical, professional)			
Moderate	32.6	31.9	**-0.7**
(technical, sales, services)			
Active	34.8	22.9	**-11.9**
(operatives, crafts)			

Source: Labour Force Survey (LFS)

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Sloth? Strenuousness of occupations, females

- females shift away from more strenuous occupations towards the middle group of occupations by strenuousness

Occupation	% female workforce		change
	1981	2008	**1981-2008**
Sedentary	44.6	40.2	-**4.4**
(manager, clerical, professional)			
Moderate	34.4	50.8	**16.4**
(technical, sales, services)			
Active	20.9	9.0	-**11.9**
(operatives, crafts)			

Source: Labour Force Survey (LFS)

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Sloth? increase in BMI by occupation change

- panel data from British Household Panel Survey (BHPS)
- change in BMI by change in strenuousness of occupation
- individuals changing occupation and moving to less strenuous occupations gain more weight

Change in strenuousness of occupation	change in BMI 1984–1991	
	female	male
more sedentary	1.92	1.32
no change	1.40	1.11
more active	1.42	1.21
move out of work	1.23	0.53

Source: BHPS

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Model of food choice

- To better understand the joint decisions that household are taking over food and work it is useful to specify a structural model that we can take to data

- Crossley, Griffith, Jin and Lechene (2015) "What's for dinner? A structural model of food consumption and time use"

  - develop a model of household choice over time allocation and consumption, incorporating the trade offs between:
  - home-cooked food and purchased prepared meals
  - working to earn income and leisure time and cooking time

- Shadow price of home cooked food incorporates opportunity cost of time and returns to scale in food preparation

- Estimate the model on UK data and examine the economic causes of the shift away from home cooked food

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Model

- Households derive utility from consuming different types of food, an outside good and leisure

  - The household maximizes

  $$U(f, c, x, l_1 + l_2)$$

  f; home cooked food, c prepared foods, x outside good, and l_a is leisure of adult a

- Food is either produced by combining ingredients and time or purchased ready to eat.

  - Home-made food f is produced by combining ingredients i and time $t_1 + t_2$

  $$f = \min[i, F(t_1 + t_2, 2 + K)],$$

  - Time and ingredients are complements, Hamermesh 2008

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Model

- In addition to the usual budget constraint, household faces a time constraint. They allocate time between work, home production of food and leisure

  - Time constraint: $h_a + t_a + l_a = 70$ per week for $a = 1, 2$, where t_a is the amount of cooking time by adult a, h_a is working hours

- Primary earner hours of work taken as given. Hours of secondary earner is a choice variable
- We assume food production technology

$$F = (t_1 + t_2)\chi(2 + K)^{1-\gamma}$$

where χ is a scaling factor converting time into units of food, and γ reflects the returns to scale in cooking.

  - $\gamma = 1$ means cooking a meal for two people will take doubled the time of cooking a meal for one person, i.e. no returns to scale. $\gamma = 0$ complete returns to scale: cooking a meal for any number of people takes the same amount of time.

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Model

- The model yields

  - a set of (Marshallian) demands for different types of food,
    outside good, and leisure c, i, x, L
    as functions of full income Y and shadow prices
    $(p_c^*, p_i^*, p_x^*, w^*)$ and household demographics

  - full income: $Y = y_0 + w_1 \overline{h}_1 + w_2(T - \overline{h}_1) + w_2 T$

- $p_i^* = p_i + \frac{w_2}{\chi(A+K)^{1-\gamma}}$; the shadow price of home cooked food
  depends on market prices, wages and household size

- Home cooked food is more expensive for smaller households
  and households with higher market wages

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Empirical Strategy

- We estimate the structural model including the demand system for 5 goods

  - ingredients for home cooked food (including time)
  - ready prepared processed foods
  - food out
  - non-food
  - leisure

- work participation decision

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Counterfactual analysis

- We use the estimates to consider how the pattern of food consumption would have differed under counterfactual trends of prices and wages
- relative market prices of food hadn't changed
- labour market opportunities (for second earners) hadn't changed

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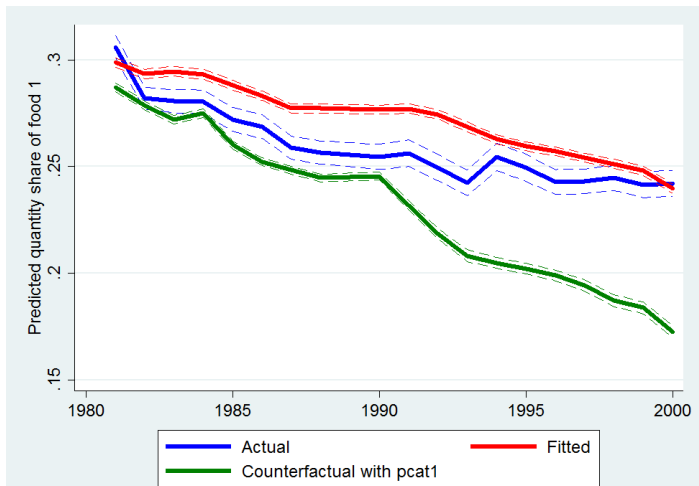Fiscal Studies
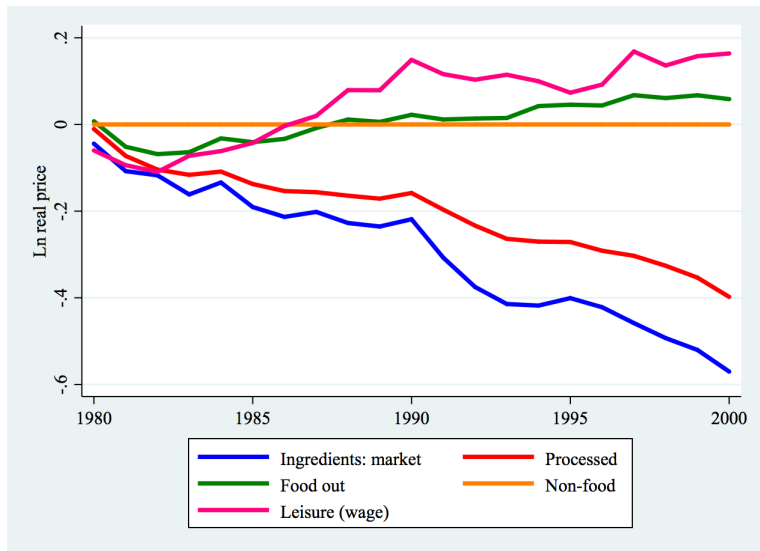
Market prices

Market prices and shadow price of home cooked food

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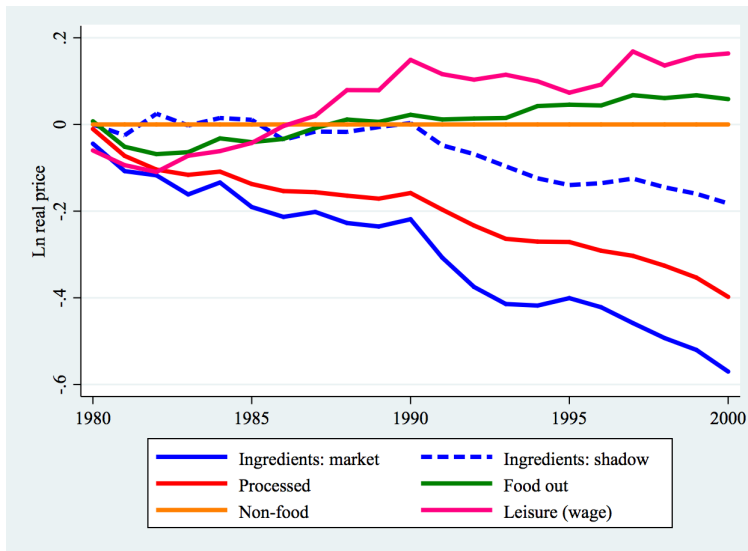
Counterfactuals

- if prices hadn't changed then households would cook *less* food at home, food out would be relatively more attractive because relative price wouldn't have increased

Counterfactuals

- if wage opportunities for secondary earners hadn't increased then households would cook *more* food at home, shadow price of home cooked foods would not have risen
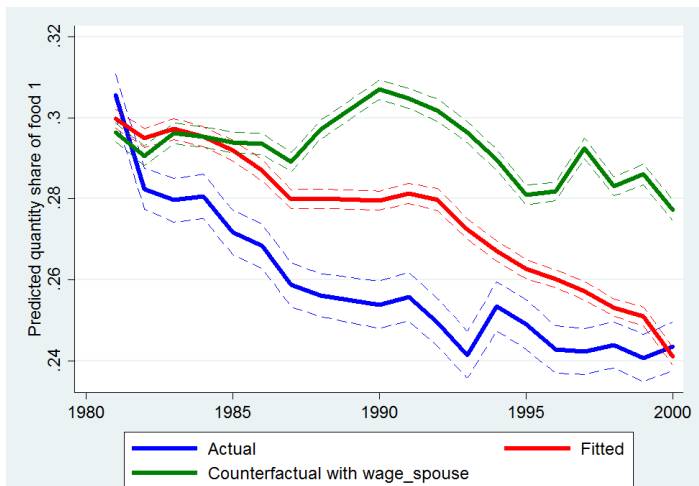
Summary

- In a model where households optimize over consumption and time use the true cost of ingredients (which require cooking) depends on the cost of time

- The shift away from home-cooked food and towards prepared food can be attributed to the real fall in the shadow price of prepared food, which offset the real fall in the market price of ingredients

- Had real wages been constant (rather than increasing), home cooked food as a share of all food would have remained fairly constant rather than falling

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Summary and conclusions

- Obesity is the result of an imbalance in calories
- The media, policy makers and much of the academic literature has emphasised increased gluttony as the main cause of rising obesity
  - people are consuming more calories than they are burning in activity
  - but does not seem to be due to increased gluttony

- changes in occupations, and other uses of time, have reduced the strenuousness of daily life and changed household consumption patterns
- we need to understand better the interactions between food demand, labour market activities and other uses of time

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