Government intervention in food markets when firms react

Rachel Griffith

Institute for Fiscal Studies and University of Manchester

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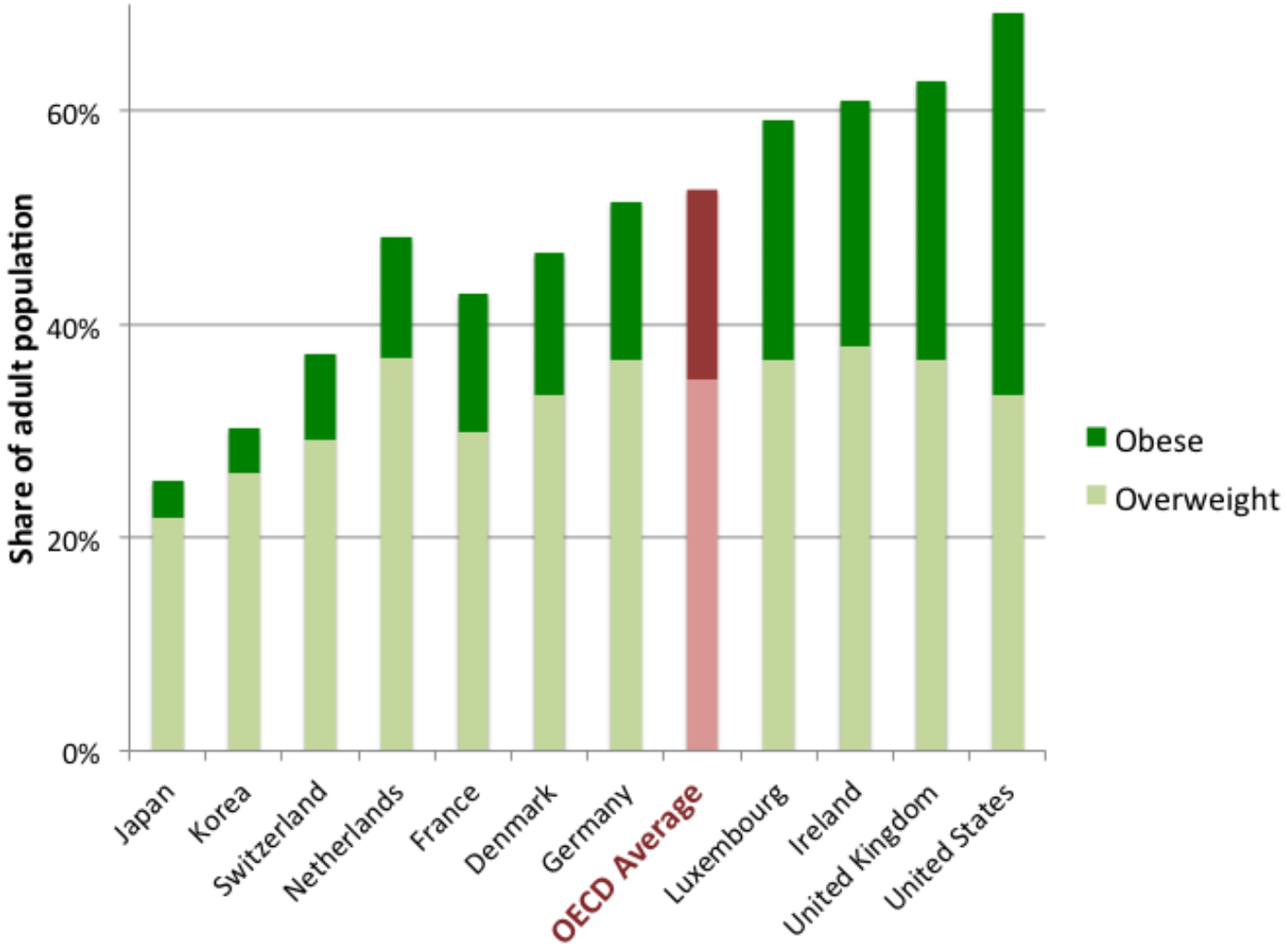
Outline

- Motivation
  - increase in weight and obesity
  - rise in other diet-related disease
- What role for government interventions?
  - externalities
  - information failures, self-control problems
- Evaluating (possible) policy responses
  - ex post and **ex ante**
  - consumer response **and firm response**
- Example: restrictions to junk food advertising
- Summary and avenues for further research

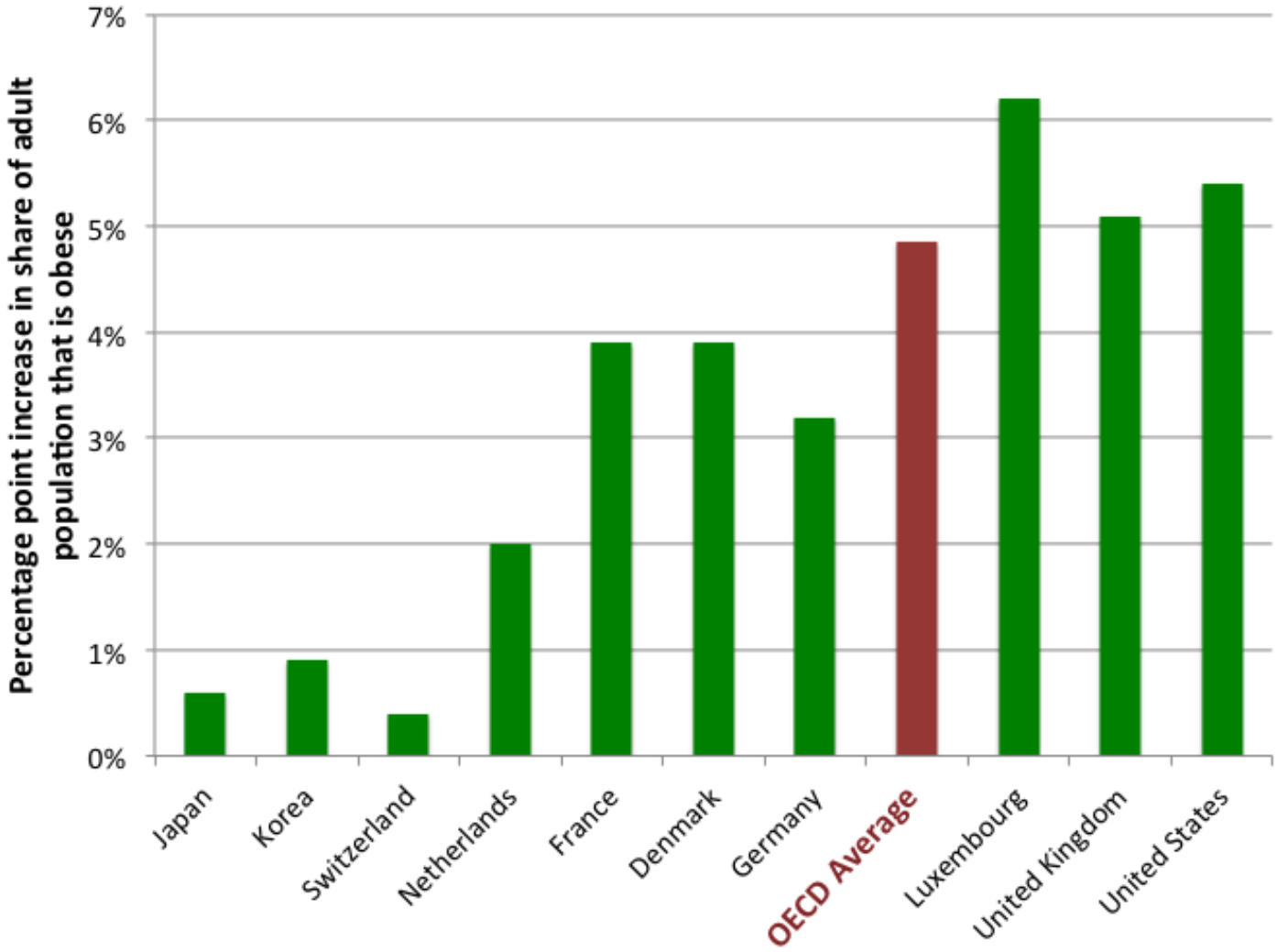
Motivation

- Latest figures suggest high levels of obesity and overweight adults, particularly in US, UK and Ireland



Motivation

- Share of adults that were obese rose by 5 percentage points from 2000-2010 in US and UK (figures not available for Ireland)



Motivation

- Childhood obesity more difficult to measure, figures taken from various (inconsistent) studies
- England
  - 4-5 year olds: 9.3% obese, 13% overweight
  - 10-11 year olds: 18.9% obese, 14.4% overweight
  - 2-15 year olds: 28% obese or overweight
- Ireland
  - *"currently there are no agreed criteria or standards for assessing Irish children for obesity some studies are indicating that the numbers of children who are significantly overweight have trebled over the past decade"* (Irish Department of Health)
  - 9 year olds: 7% obese, 20% overweight (Growing Up In Ireland)
- US
  - 6-11 year olds: 18% obese, up from 7% in 1980
  - 12-19 year olds: 21% obese, up from 5% in 1980

Motivation

- Excess weight leads to health problems
  - increased risk of cardiovascular disease, hypertension, diabetes, joint problems, certain cancers, depression

Relative risk factors for obese people

Disease	Men	Women
Type II diabetes	5.2	12.7
Hypertension	2.6	4.2
Heart attack	1.5	3.2
Colon cancer	3.0	2.7
Angina	1.8	1.8

Source: National Audit Office. Figures for England

Motivation

- Not only obesity, also rise in other diet-related disease
  - excessive salt
    - can lead to increase in hypertension
  - excessive saturated fat
    - can lead to high cholesterol and increase risk of heart attack, stroke, narrowed arteries
  - excessive sugar
    - can lead to diabetes and impaired immune system
  - low fruit and vegetable intake
    - accounts for about 20% of cardiovascular disease worldwide
  - low consumption of wholegrains
    - contain folic acid, B vitamins and fibre which are important protectors against heart disease
- Obesity and poor nutrition in children
  - can lead to longer term health and developmental problems
  - and feed through into poor social and economic outcomes

What role for government?

- Well functioning market yields efficient allocation of goods
  - if individuals are fully informed and rational
  - if firms are price takers, so prices reflect costs
- Why might food markets fail?
  - are individuals fully informed about the characteristics and consequences of food consumption?
  - are individuals "rational" when making food choices?
  - are firms price takers?
  - do prices reflect costs?
  - are there
    - externalities from consumption
    - information or cognitive failings
    - combined with market power by firms

What role for government?

Externalities

- If consumption imposes costs on others
  - an individual has no incentive to take these costs into account
  - leads to excessive consumption from a social perspective
- What externalities are there from food consumption?
  - costs of healthcare (or insurance)
    - hospital admissions with a primary diagnosis of obesity in England tripled from 2007 to 2011 from 3,860 to 11,570
  - lost economic output due to sickness absence and lower productivity
- BUT need to be careful, are these all externalities?
  - what are incremental costs of treating obesity
  - some costs fall on the individual (eg through lower wages)

What role for government?

Externalities on your future self

- Consumers might not be fully forward looking
  - in which case the externality is on the person's "future self"
  - children the most compelling case

- Information failings
  - people may be capable of processing information, but lack the necessary information to make informed choices
    or
  - people may be cognitively unable or unwilling to process it, even if all the information is there

  - The policy response to these will differ

What role for government?

Information failings

- Consumers may be badly informed about:
  - their own nutritional needs
  - the nutritional characteristics of a specific food product
  - costs associated with the consumption of certain foods (particularly when uncertain and are borne in the future)
- Example
  - 48% respondents thought they did not need to worry about their saturated fat intake if they exercised regularly, were not overweight or ate lots of fruit and vegetables (FSA, 2009)
  - this view is incorrect - excessive consumption of saturated fat can have negative health consequences for anyone

What role for government?

Competing and confusing information

- Firm advertising might conflict with government advice
- Profit-making firms incentives not necessarily aligned with consumers interests
    - if consumers lack information, are cognitively constrained, or have other "behavioural biases"
    - information provision by firms may be misleading, or play on individual's "behavioural biases"
        - e.g. a firm may highlight one characteristic more than others, for example, that its product is low in fat while failing to tell customers that it is high in sugar
    - firms might also intentionally obfuscate

What are the policy options?

- Directly provide information through schools, government advertising, labelling, etc.
- Provide education to help individuals process information
- Alter incentives and choice sets through changing relative prices or incomes
    - Fiscal measures
    - Regulation
    - Cash transfers
- "Nudge" policies
    - alter the "choice architecture", the way choices are presented to individuals and the context in which they are made

Policy analysis and evaluation

- Need clarity about aims of policy intervention
  - simply aim to achieve a reduction of unhealthy behaviours?
  - which market failures are we trying to correct?
  - an increase in welfare?
- Evaluation of the effect of policies
  - ex post versus ex ante policy analysis
  - many policies have not been implemented, or only in limited form
  - where they have it has not usually been in a good "experimental" set up
- Important to consider what new market **equilibrium** will be after policy intervention
  - consumer responses
  - firm responses (e.g. changing price of goods, product offering, or way products are advertised)

Example: Ban on advertising junk foods

- The food industry is heavily regulated e.g. for health and safety reasons; recent moves to extend to health related regulation
  - ban junk food in schools
  - voluntary regulation to reduce salt through reformulation
- One proposal is to restrict advertising of "junk foods"
- We carry out an **ex ante** evaluation of the likely impact of such a policy in the crisps market

"The Effects on Demand, Supply and Welfare of Banning Junk Food Advertising: Structural Estimation on a Junk Food Market"
joint work with Pierre Dubois and Martin O'Connell

Ban on advertising junk foods

Objectives

- What are the equilibrium and welfare consequences of an advertising ban?
- Advertising bans aim to lower consumption, but it isn't obvious what will be the effect on quantity:
  - depends on how advertising affects demand, whether it is expansionary or contractionary
  - and depends on strategic response of firms
- Impact of advertising ban on consumer welfare will depend on whether advertising is:
  - informative about product existence or characteristics
  - a product characteristic that is valued by consumer
  - persuasive and distorts consumer decision-making

Ban on advertising junk foods

Effects of advertising on quantity

- if advertising is predatory
  - adverts steal market share of other firms; firms over-invest in advertising and want to commit to not advertise; banning advertising increases profits, little impact on total quantity
- if advertising is cooperative
  - adverts increase market demand; firms face free-riding problem, under-invest in advertising relative to profit-maximising amount; banning advertising would decrease demand
- advertising only one of strategic variables available to firms
  - ban may lead firms to respond by changing other strategic variables (e.g. may increase price competition)
- advertising can be a barrier to entry
  - ban could lead to industry expansion

Ban on advertising junk foods

Consumer welfare

- The impact on consumer welfare also depends
- If advertising is viewed as a characteristic of the product, then welfare considerations are 'standard'
- However, if advertising is persuasive, and distorts consumers decision making, then defining the impact of a ban on welfare is more complicated
  - if advertising leads consumers to make *"choices ... predicated on improperly processed information, welfare evaluations should be guided by choices made under other conditions"* Bernheim and Rangel (2009)
  - we use this idea and evaluate welfare under "non-distorted" preferences (those with no advertising)

Ban on advertising junk foods

Consumer choice model

- We need to allow advertising to effect demand flexibly
  (so allow us to potentially pick up expansion or contraction and to allow advertising to inform or distort consumers)
  - we estimate a random coefficients discrete choice model
  - payoff to consumer from choosing a product is:

$$\bar{v}_{ijt} = \alpha_i\left(\mathbf{a_{jt}}, p_{jt}\right) + \psi_i\left(\mathbf{a_{jt}}, x_j\right) + \gamma_i(\mathbf{a_t}) + \eta_i(\mathbf{z}_j, \xi_j) + \epsilon_{ijt}$$

  payoff from choosing outside good is:

$$\bar{v}_{i0t} = \eta_{i0} + \epsilon_{i0t}$$

  where:
  - p_{jt}: price; j indexes products, t time
  - x_j: nutrient characteristics
  - $\mathbf{a_{jt}}$: advertising stock; $\mathbf{a_t} = (\mathbf{a_{1t}}, ..., \mathbf{a_{Jt}})$
  - z_j: other observed product characteristics
  - ξ_j: an unobserved product characteristic

Ban on advertising junk foods

Supply model

- Multi-product firms
- Compete by simultaneously setting prices and advertising expenditures to maximize their profits
- Firms' problem is dynamic because
  - advertising today affects future demand and hence payoffs
  - however, we can use just the firm's pricing first-order condition to recover (constant) marginal costs
  - which is all we need (in addition to demand estimates) to consider counterfactual of a ban on advertising

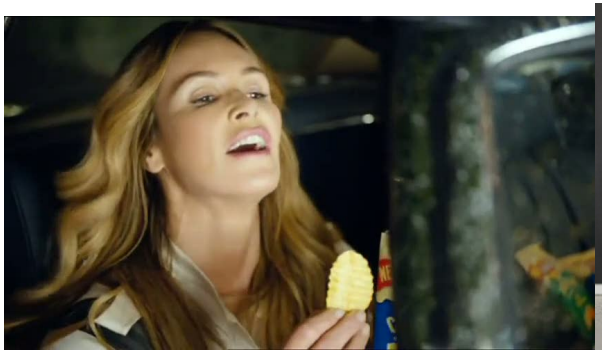
Ban on advertising crisps

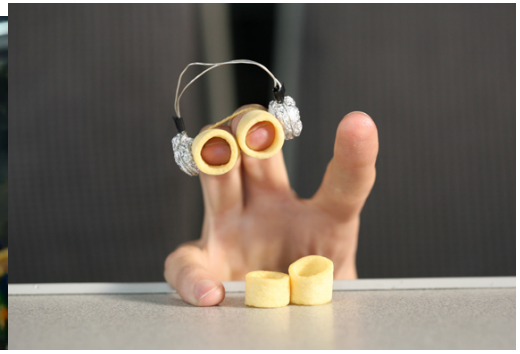
Data

- We consider the UK crisps market
- Consumer purchase choices from market research data
  - Kanter/TNS Worldpanel, June 2009 - October 2010
  - all snacks brought into home (161,513 transactions) AND all snacks bought for consumption outside the home (99,636 transactions)
  - product characteristics (including nutrients)
  - household demographics
- Advertising expenditure by brand and month from 2001-2010

Ban on advertising crisps

Is advertising of crisps a valued characteristic or persuasive?





Ban on advertising crisps

Nutrient data

- current UK regulation bans advertising of products with a score of 4 or higher during children's TV programming

Brand	Nutrient score	Energy (kj per 100g)	Saturated fat (g per 100g)	Sodium (g per 100g)
Pringles	16	2160	6.31	0.62
Walkers Reg	10	2164	2.56	0.59
Walkers Sens	11	2023	2.16	0.71
Walkers Dor	12	2095	2.86	0.66
Walkers Oth	15	2020	2.50	0.82
KP	18	2158	5.87	0.85
GW	16	2101	4.01	0.92
Asda	15	2125	4.13	0.75
Tesco	15	2145	4.65	0.77
Other	12	2084	3.84	0.70

Ban on advertising crisps

Empirical demand specification

- Estimate flexible demand system to potentially allow for
  - advertising to be predatory
  - advertising to be cooperative
  - advertising to be informative
  - advertising to be valued as a characteristic
  - advertising to be distortionary
- Include price, advertising, interactions, higher order terms, interactions with observed demographics, random coefficients

Ban on advertising crisps

Estimates of willingness to pay for one point reduction in nutrient score

- coefficient estimates allow us to show that advertising reduces consumers' willingness to pay for healthier products

Food on-the-go market	Level of advertising:		
	Zero	Medium	High
Willingness to pay (pence)	2.31	1.19	0.06
	[2.04, 2.59]	[1.02, 1.33]	[-0.10, 0.52]
% of mean price	4.6%	2.3%	0.1%
	[4.02, 5.09]	[2.01, 2.62]	[-0.19, 1.02]

Numbers are median WTP in pence; [] are 95% confidence interval.

Ban on advertising crisps

Counterfactual policy analysis

- Estimate demand model
- Use estimated coefficients in combination with supply model to recover marginal costs
- Use these structural parameters to simulate counterfactual situations, e.g. one in which advertising is banned
    - first assume no firm pricing response
    - compare to equilibirum where we allow firms to reoptimise prices
        - we find that firms lower price, banning advertising leads to tougher price competition
        - this partly mitigates the impact of the ban

Ban on advertising crisps

Aggregate effect

	Pre ban	Post ban	
		No firm response	With firm response
Quantity (mKg)	30.01	23.37	28.37
	[29.46, 30.38]	[22.15, 24.52]	[26.84, 29.59]
% change		-22.1%	-5.5%
		[-25.86, -18.10]	[-9.96, -1.00]
Profits (£m)	88.17	75.37	75.12
	[83.74, 91.76]	[70.05, 79.56]	[69.98, 78.99]
% change		-14.5%	-14.8%
		[-18.71, -9.99]	[-18.67, -10.75]

[] are 95% confidence interval.

Ban on advertising crisps

Mean effect on households/individuals

	Food at home	Food on-the-go
Pre ban		
Quantity (Kg per year)	7.21	0.52
	[7.07, 7.31]	[0.50, 0.52]
Mean nutrient score	13.83	12.52
	[13.81, 13.86]	[12.48, 12.55]
Post ban: with firm response		
% change in quantity	-5.2%	-6.6%
	[-9.94, -0.70]	[-12.89, -0.91]
% change in nutrient score	-4.7%	-2.7%
	[-5.18, -4.08]	[-3.46, -1.89]

Ban on advertising crisps

Consumer welfare

- What are the welfare effects of banning advertising?
- Two perspectives
  1. Advertising is a characteristic that consumers value
     - if advertising is a characteristic, the payoff function represents the consumer's (indirect) utility function and the consumer makes decisions to maximise utility
     - the welfare consequences of banning adverting will consist of a welfare loss from the loss of the characteristic and a welfare gain through increased price competition
  2. Advertising distorts decision making but doesn't enter consumer utility
     - if advertising is distorting, then consumer's (indirect) utility should be evaluated in the absence of advertising and the consumer makes decisions that maximise their expected payoff, which differs from their "true" utility
     - the welfare consequences of banning adverting will consist of a welfare gain from the removal of the distortion and a welfare gain through increased price competition

Ban on advertising crisps

Welfare effects

- the welfare effects of the ban depend crucially on the view one takes on whether advertising is a characteristic that consumers value, or distorts decision making

	Characteristic	Distorting
Characteristics effect (£m)	-48.00	
	[-54.14, -41.21]	
Choice distortion effect (£m)		33.21
		[31.77, 36.37]
Price competition effect (£m)	14.22	14.22
	[12.00, 16.45]	[12.00, 16.45]
Total comp variation ($m)	*-33.78*	*47.43*
	[-40.21, -26.62]	[45.31, 51.41]
Change in profits ($m)	*-13.05*	*-13.05*
	[-16.50, -9.30]	[-16.50, -9.30]
Change in welfare (£m)	**-46.83**	**34.38**
	[-56.84, -36.31]	[31.45, 38.96]

Summary

- Policy concern
  - public health concern about obesity and diet
- Economic rationale for intervention
  - there may be externalities, but probably small
  - consumers possibly lack information, and more importantly the ability/willingness to process it or act on it
  - and firms might act to exploit this
- Policy options
  - need to think clearly about aims of government intervention in order to effectively target policy
  - as well as considering consumer responses, it is important to consider the likely supply-side responses of firms
  - and to consider impact on total welfare, not only on the object of public health concern

Summary

- When evaluating policy we need to consider how firms will respond, i.e. what new market equilibrium will be after policy intervention
    - firms may respond to policies in ways that make the policy less effective, e.g. by changing price of goods, product offering, or way products are advertised, or potentially more effective
    - structural estimation has an important role to play in allowing us to do this
- In the example of banning advertising in crisps market:
    - the ban lead to a reduction in quantity purchased
    - but the increased competition in prices, lowered price which expanded the market, meant that the effect was much lower than if only the direct effect of the advertising ban was considered

Further research

Evaluation of other policies: information campaigns

- Information campaigns directly target lack of information
- However, difficult to design and implement
  - general message ineffective, tailored messages expensive
  - complex message (e.g. "don't drink drive" is a simple message, "eat a healthy diet" is a complicated message)
- Need to account for potential supply-side responses, shifts in the demand curve will change optimal price for firm
  - example the '5-a-day' campaign - "eat more fruit and veg"
  - do the following thought experiment
    - assume 50% of consumers already well informed, 50% not
    - assume campaign made consumers less price sensitive (because it increased their willingness to pay for fruit and veg)
    - if monopoly (or oligopoly) supplier this would lead firms to increase price, the informed consumers would now face a higher price, and so reduce fruit consumption (because their willingness to pay has not shifted)

Further research

Evaluation of other policies: taxes

- Increase the price of unhealthy food so consumers substitute towards healthier alternatives
  - e.g. a "sugar tax", "fat tax" or "soda tax"
- Effectiveness of the policy depends on:
  - how consumers respond to price changes
  - how firms change prices in response to the tax
  - the two are linked through the shape of the demand curve
- With linear demand curve :
  - and *perfect competition* a tax is entirely passed through
  - and *monopoly* the price increase is less than the tax
- More generally the price increase could be **less than, equal to or greater than the tax imposed**, depending on the demand curve and market structure

Further research

Evaluation of other policies: nudge policies

- "Standard economic" interventions work through changing incentives by changing relative prices or incomes
- Nudge policies aim to "alter choice architecture" or exploit consumer biases in decision making
    - growing influence at the heart of government (Behavioural Insights Team, Obama's Nudge Unit)
    - labeling effects, default options, mental accounts, ...
- Called "nudge" or "libertarian paternalism"
- Recent emphasis comes from "behavioural economics", but
    - lacks formalism
    - economists have for a long time considered deviations from the "standard" model, for example, incomplete information

Further research

Evaluation of other policies: cash transfers

- Households with higher income have better diets
  - would giving poor households money improve their diets?
  - i.e. does income have a causal effect on the quality of diet?
- In kind or conditional cash transfers give money tied to expenditure on a specific item
  - Childcare vouchers
  - US food stamps
  - Healthy Start Vouchers
- Often combined with a "nudge" (e.g. labeling effect)
  - can we distinguish the standard economic effects from the nudge?

Further research

What are the causes of weight gain? gluttony or sloth

$$W_t = W_{t-1} + \overbrace{\text{calories in}_t}^{\textit{gluttony}} - \overbrace{\text{calories out}_t}^{\textit{sloth}} - BMR$$

where

- W is weight
- calories in: calories eaten in food
- calories out: calories expended in work, travel, leisure and other activities
- BMR: Basal Metabolic Rate or the number of calories needed to keep the body alive

- the composition of calories - sugar, fat, alcohol - might also play a role

Further research

Sloth

- Large changes in time use
  - work and travel account for a lot of energy expended
  - also housework for women
- Big shift from manual to non-manual work
  - in 1975 about 50% non-manual and 50% manual
  - by 2009 80% non-manual and 20% manual
  - non-manual work uses a lot fewer calories
- More car use, less public transport, walking, cycling
- How important is reduced activity, e.g. changes in labour market behaviour, in accounting for rising obesity?