Research Methods for the Built-Environment: Analysis of Actual Behaviour

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Social science methods

- Social science tries to explain empirical phenomenon.
- Primarily it does this by looking at actual (historical) data. So called 'natural' experiments.
- The best natural experiments are those where a major change happens, but other things remain the same and where there are as many comparable units of analysis as possible.
- We are fundamentally concerned with actual human behaviour individually or collectively (most economics is behavioural economics).
- Regression analysis is our main approach.

Figure 6.14 Segmented strategy for encouraging pro-environmental behaviours
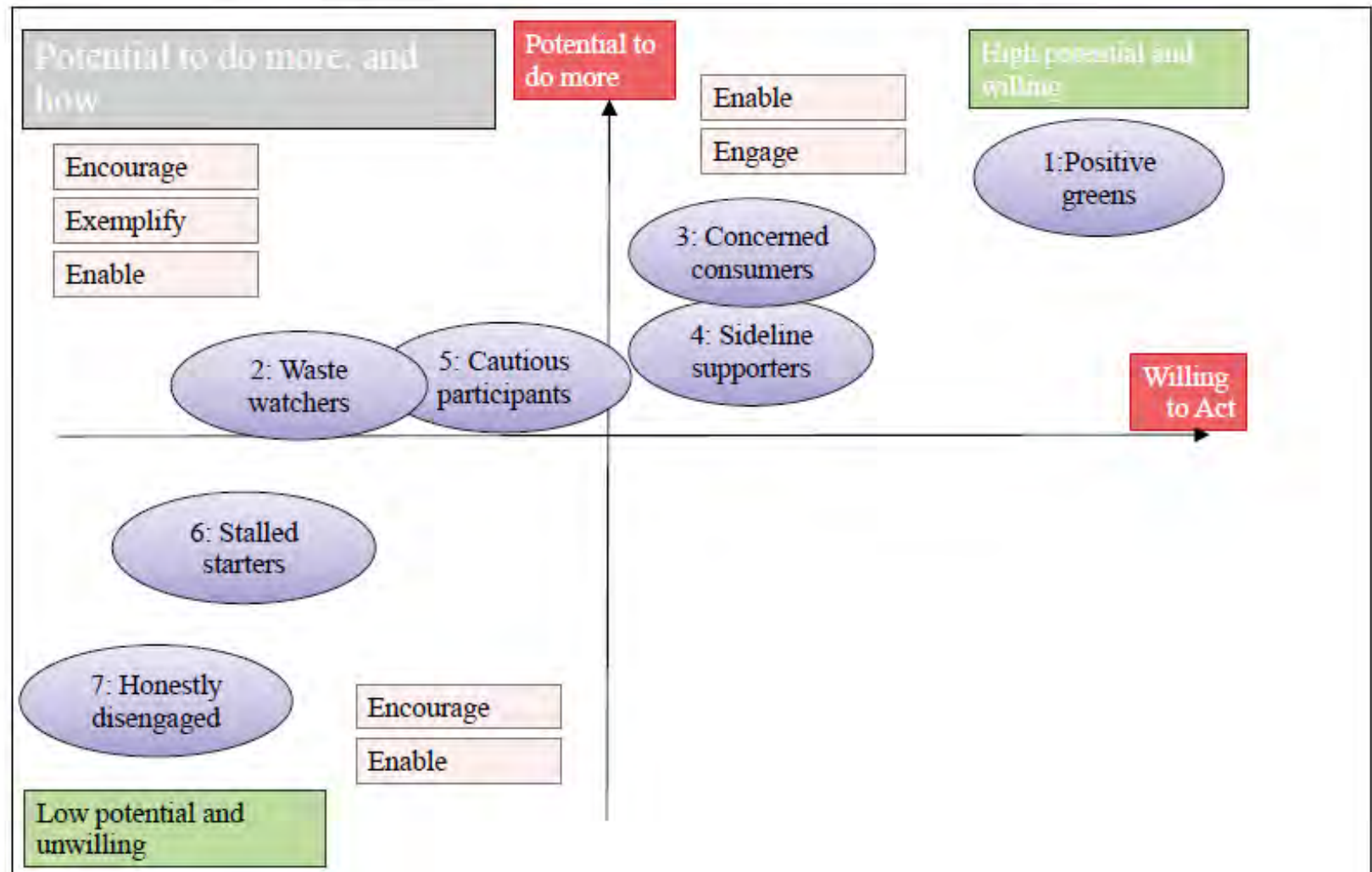
Source: CCC First Report, 2008, p.228.
Need to harness market to engage consumers.

Two approaches to behaviour

- Role of social capital in behaviour of companies
  - We look at the UK high street retail sector's climate strategies.

- Behavioural economics of individuals
  - We look at household electricity use data from semi-smart meters.

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Social Capital - Key concepts

- Climate strategies
  - actions to reduce carbon footprint
  - part of corporate responsibility

- Partnership and social capital
  - "features of social organisation, such as trust, norms and networks, that can improve the efficiency of society by facilitating coordinated actions" (Putnam, 1993, p. 167)
  - "interpersonal networks" (Dasgupta, 2005)

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Sainsbury and Forum for the Future

- £30,000 per year donation for minimum 3 years
- Strategic sustainability services
- Commitment at senior management level
- Involvement with Masters course for sustainable development

Alliance Boots and Business in the Community

- £12,175 membership contribution annually
- Dedicated relationship manager – practical advice
- Environment leadership team
- CEO involvement

Company data: 60 UK retailers

- Value Added Scoreboard 2008
- Wide definition of retail that includes:
  - Food retailers and wholesalers
  - Drug retailers
  - General retailers
- Considerable share of:
  - Sector value added (25%)
  - Sector employees (34%)
  - Sector CO_2 emissions

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Best practice index

Category	Indicator	Max. Score	Category total
Measurement	Scope 1 emissions	2	
	Scope 2 emissions	2	
	Scope 3 emissions	2	
	External verification	2	
	Relative measures	2	(10)
Target setting	Longer-term plans/targets	2	
	Integrated into business strategy	2	
	Lighting	2	
	HVAC and/or refrigeration	2	
	Distribution network	2	(10)
Target impacts	Achievement of CO_2 targets from previous year	2	
	CO_2 reduction targets	2	
	CO_2 reduction reporting	2	(6)
Implementation/ engagement programmes	Employees Suppliers Customers	2 2 2	(6)
	TOTAL	30	

Partnership scoring system

Indicator	Maximum score
Membership/Donation/Payment for services	1
Involvement in projects/advice services specific to the company	1
Involvement in projects/issues beyond company-specific	1
Board-level engagement (e.g. required CEO/board involvement as part of partnership model or emphasis on CEO/board involvement by the company)	1
Longer-term engagement, i.e. beyond 1 year; not annually renewed	1
TOTAL	5

Going back to an earlier example…

Sainsbury and Forum for the Future

- £30,000 per year donation for minimum 3 years
- Strategic sustainability services
- Commitment at senior management level
- Involvement with Masters course for sustainable development

Partnership score:

- – Donation (+1)
- – Longer-term (+1)
- – Company-specific (+1)
- – Board-level/senior involvement (+1)
- – Beyond company-specific (+1)

Total: 5

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Company scores

	Measure-ment (10)	Target setting (10)	Target impacts (6)	Implement-ation (6)	Total (32)
John Lewis	7	10	5	6	28
Tesco	9	9	5	5	28
Sainsbury	6	7	6	3	22
Halfords	2	8	5	4	19
NEXT	6	3	3	1	13
Carpetright	0	5	1	3	9
Somerfield	0	5	3	0	8
Aldi	0	3	0	0	3
House of Fraser	0	0	0	1	1
Lloyd's Pharmacy	0	0	0	0	0

Top 10 companies....

	Best practice score	Partnership score
Marks & Spencer	29	31
John Lewis	28	23
Tesco	28	28
Cooperative Group	25	24
Kingfisher	24	21
Debenhams	23	6
WH Smith	23	8
Sainsbury	22	15
Home Retail	21	9
N Brown	21	3

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Partnership: depth and diversity

	Total partnership score	Depth	Diversity
Asda	15	2.1	3
Debenhams	6	2.0	2
Game	2	2.0	1
Greggs	3	3.0	1
Halfords	4	2.0	1
HMV	1	1.0	1
John Lewis	23	2.3	4
Kingfisher	21	2.1	3
M&S	31	2.2	3
WH Smith	8	2.0	3
Average		1.0	1.1

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Overall trends

In order of best practice score

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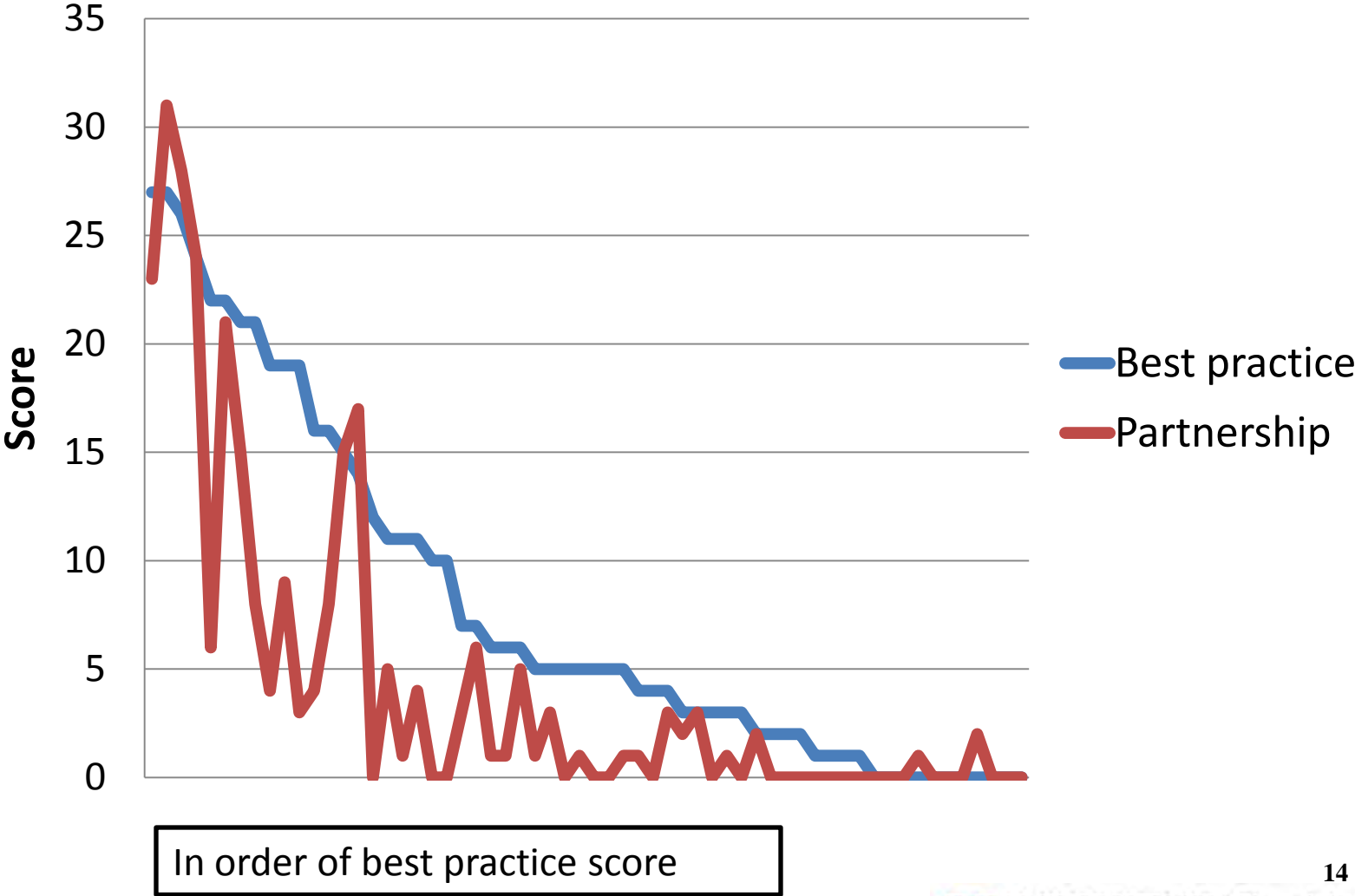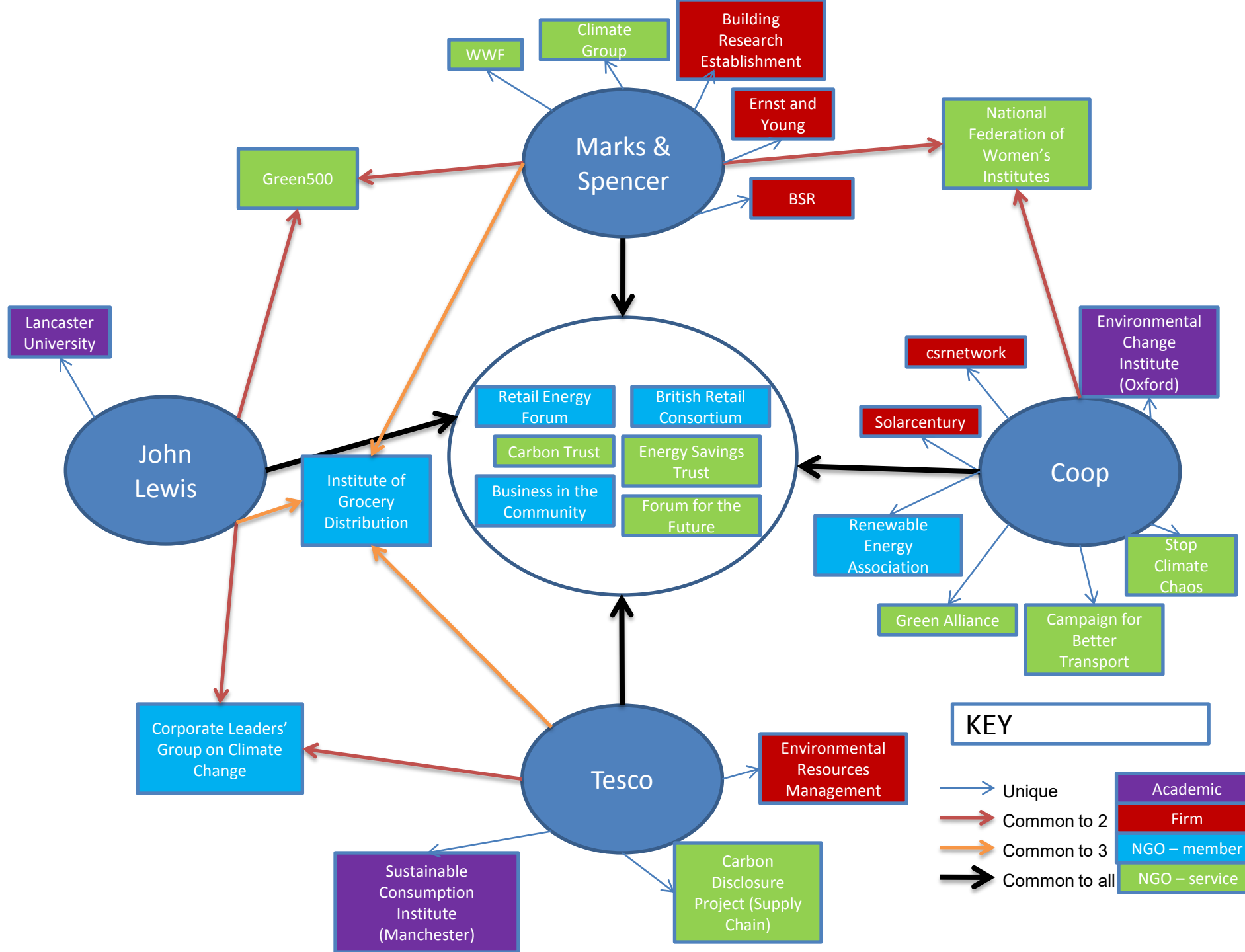
Regression Analysis

- Best practice in climate strategies
  - Company size (+); listing (+)
  - Engaged and diverse partnering (+)
  - Partner types: academic
- Partnership
  - Company size appears to dominate
  - Listing (+); sub-sector (insignificant)

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Behavioural Economics: Conventional Theory

- We wanted to analyse how to encourage people to reduce energy consumption, via the way their Pre-payment meter (PPM) works.

- An intuitive way to think about people's top-up behaviour theoretically is in terms of an application of the Baumol Tobin model.

- It suggests that people balance:

  – Benefits: People put money on their meter to avoid having to purchase top-up every time they need electricity.

  – Cost: Forgone interest (as they could keep their money on a savings account).

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PPM is experiencing a revival in NI...

- We are working with NIE Energy

- To date more than 30% of all households in NI used the new PPM system (ca 240,000)

- New connections are continuing at a rate of 2,000 a month.

- Still PPM customers are not a rep. sample of the population.

Probability of Having a PPM

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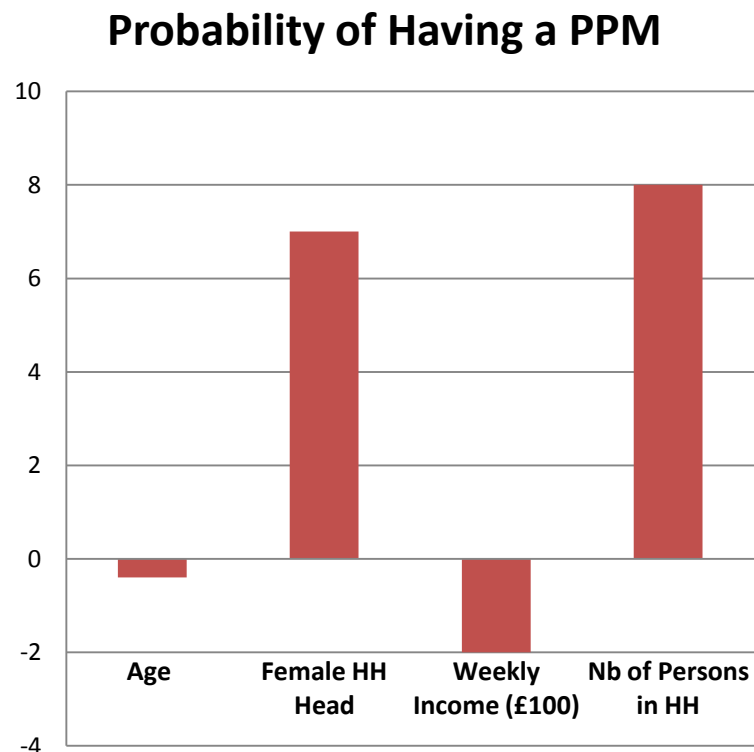
Theory: Customers do cost-benefit analysis

- Formally, customers minimise:

$$(Y/2N)i + FN$$

  where:

  Y = Annual expenditure

  N = Number of top-ups per year

  F = Cost per top-up trip

  i = interest rate

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Theory: Customers do cost-benefit analysis

- Formally, customers minimise:

$$(Y/2N)i + FN$$

which gives:

$$N^* = \sqrt{\frac{Y}{2F}}$$

and:

$$\text{Average Top-up Amount}^* = \sqrt{\frac{YF}{2i}}$$

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In reality: Customers choose small top-ups

- Plugging in values for a typical PPM customer our model suggests 2.3 top-ups per year - worth £230 each.

- In reality customers top-up their meters ca 50 times a year - with £13 per top-up.

Distribution of Mean Top-Up Amounts
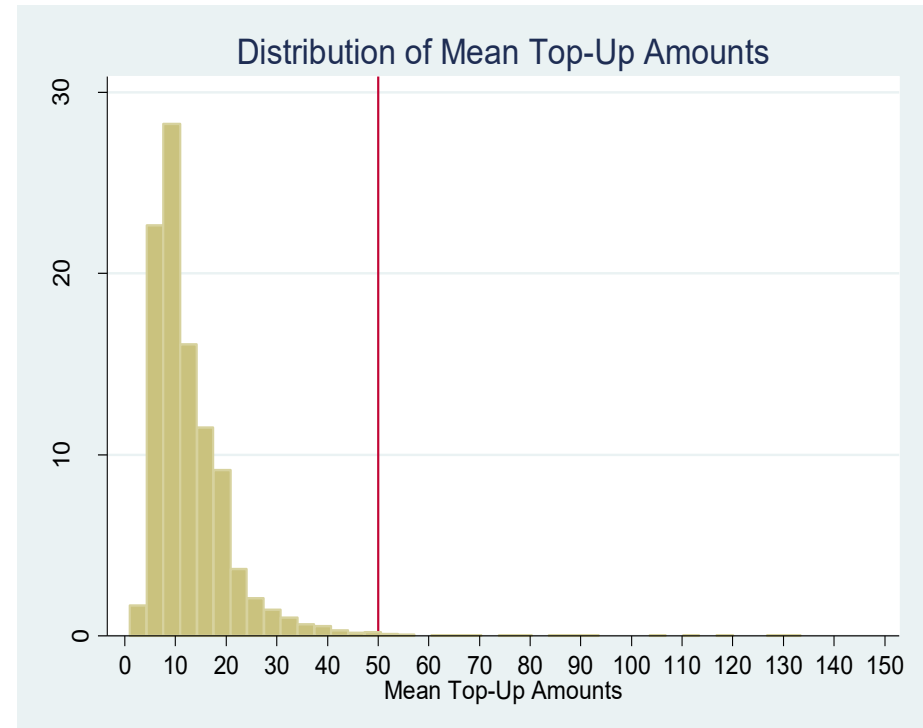
...and do not increase top-ups when tariff increases

- Our model suggests that a customer responds to a change in tariff by changing N* *and* Average Top-up Amount*.

- In reality customers only increase the number of top-ups (N*) when the tariff increases.

Response to Change in Tariff

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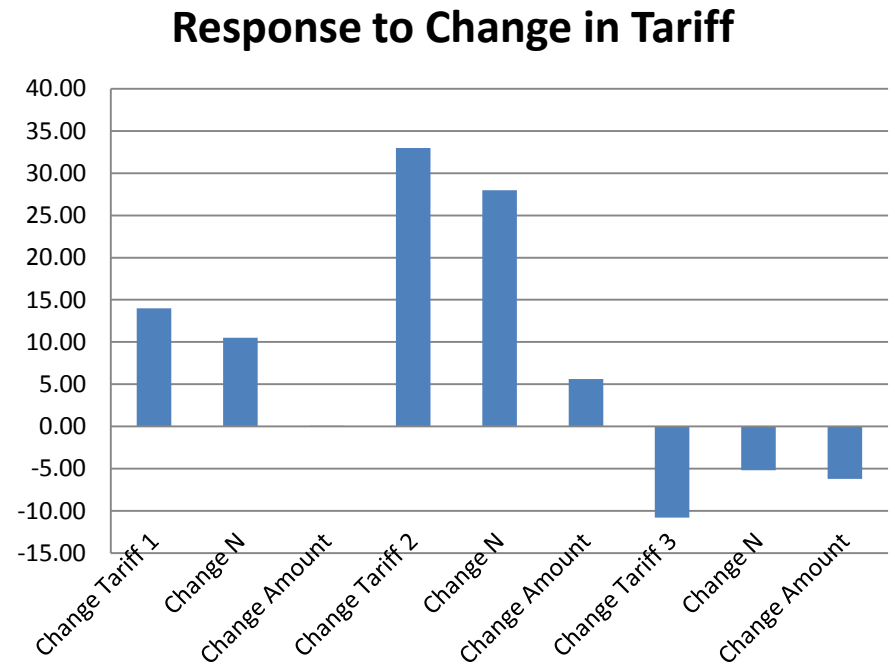
There are various possible explanations...
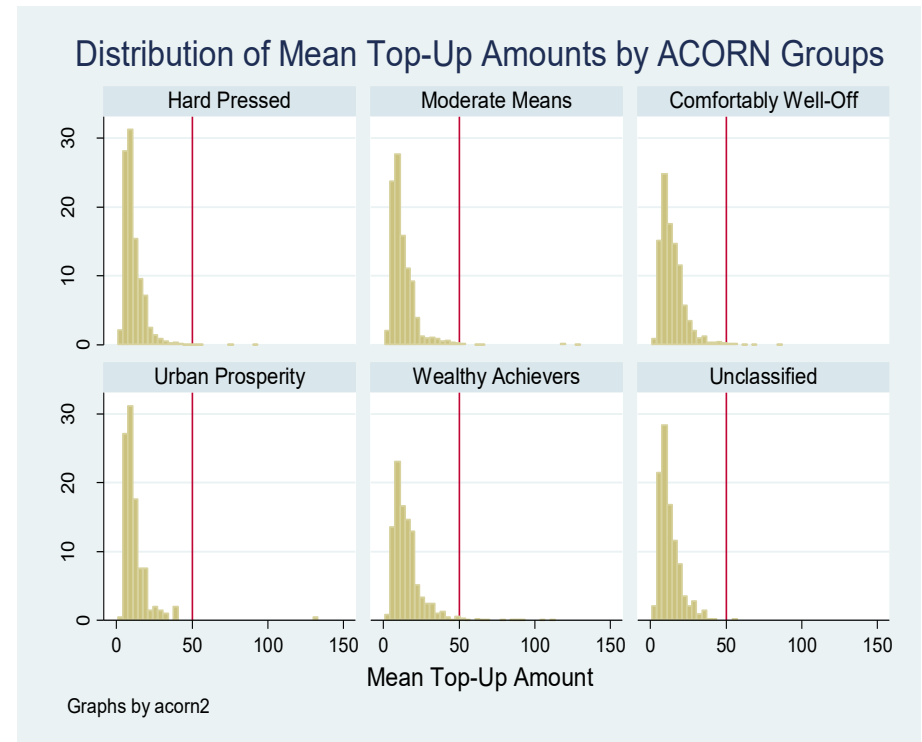
- Changing the parameters of the model
  - does not work
- Liquidity Constraints
- Expectations
- Loss Aversion
- Commitment Device

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Liquidity constraints are not full story...

- Liquidity constraints are likely to be important.

- However, they do not explain why also people in the highest ACORN groups
  - Top-up small amounts only;
  - Adjust to changes in tariff by changing only their top-up frequency.

Distribution of Mean Top-Up Amounts by ACORN Groups

Graphs by acorn2

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Other explanations not convincing either...

- Expectations:
  - We do not find evidence for people hording before increases in tariffs; or speculating on falling tariffs.

- Loss Aversion:
  - The new technology decreases the possibilities in which customers can lose money (eg by providing re-prints of voucher codes).

- Commitment Device:
  - The small top-up amounts could be part of a rule-based commitment device. This cannot explain, however, how people adjust to changes in tariffs.

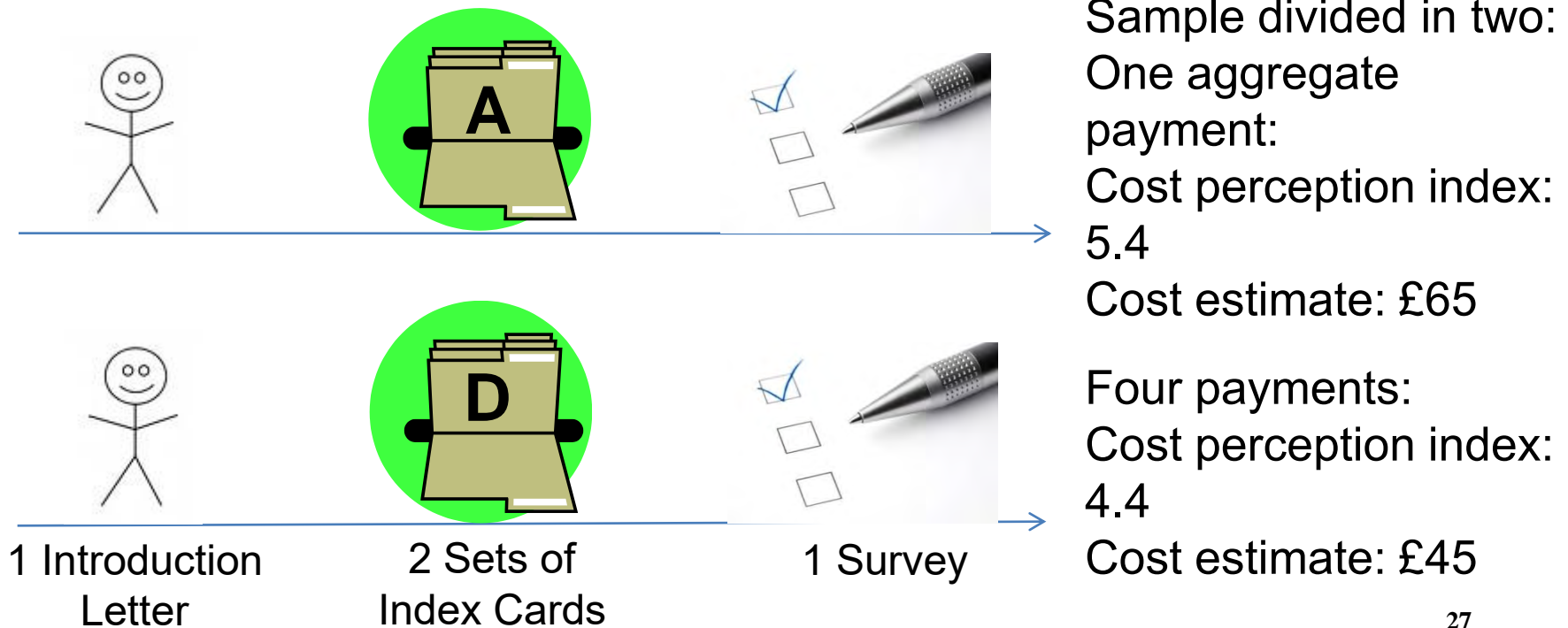UNIVERSITY OF CAMBRIDGE | Electricity Policy Research Group

Do perceptions matter?

- One way of explaining our two anomalies is by arguing that people perceive small top-ups differently from large ones.

- Intuitively, spending 10 times £10 may feel less than spending £100.

- There exists a large body of related literature. (Finkelstein, 2009; Gourville, 1998; Morvitz et al, 1998)

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… Yes, in an experiment…

- We asked 41 students to make a series of mock payments…

Sample divided in two:
One aggregate payment:
Cost perception index: 5.4
Cost estimate: £65

Four payments:
Cost perception index: 4.4
Cost estimate: £45

| 1 Introduction Letter | 2 Sets of Index Cards | 1 Survey |

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We find similar evidence....

- A preliminary regression analysis of actual top up data suggests a statistically significant decrease in consumption - after an increase in minimum top-up amount of: 7% (when on line top up minimum increased from £2 to £15).

- Now proceed to field trial with NIE Energy...

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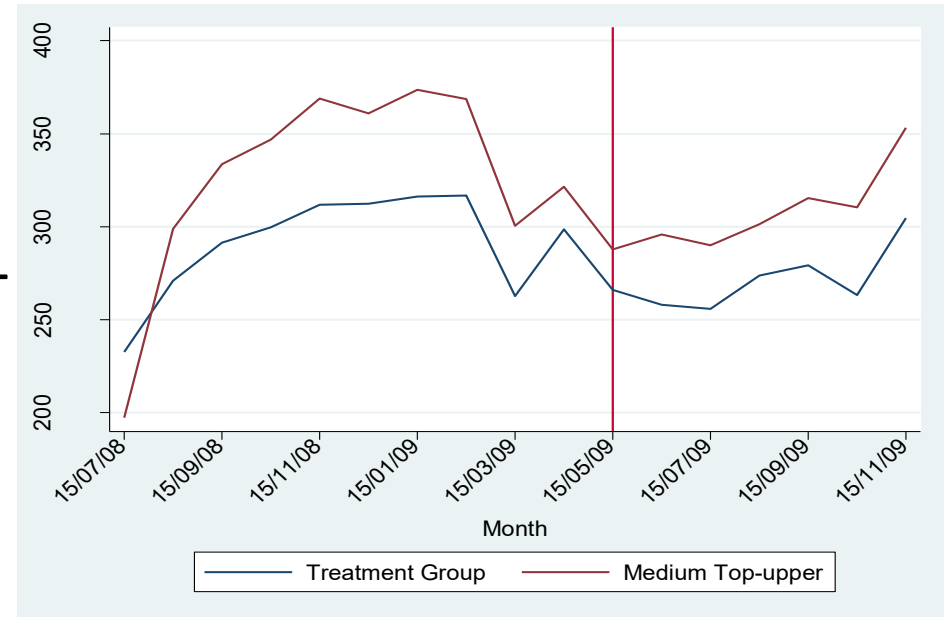
Conclusions

- Social science focuses (by implication) on deviations from design ratings.
- There is a significant divergence between rational human behaviour and what people actually do!
- There is a wide variation of performance of firms in reality, with only some firms being best practice (also true of countries etc…)
- Empirical social science addresses these differences.
- If there wasn't there would be no social science!!!

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Some References

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