Habits as Adaptations: An Experimental Study

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jointly with
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Introduction

How do people respond to changing incentives?

Puzzling behavior: choice inertia

- inertia in consumption
- brand loyalty
- status quo bias

Habits in macroeconomics

Assuming *preferences for habits*

$$u(c_t - c^{t-1})$$

Justification: Better fit to data (e.g. Constantinides 1990; Fuhrer, 2000)

Problems:

1. No microfoundations
   evidence for inertia $\neq$ evidence for preferences for habits
2. Modeling choice of c^{t-1} not obvious
   - aggregate past consumption, past individual consumption, specific cathegories of goods (Schmitt-Grohé and Uribe, 2007)
3. No comparative statics predictions

This paper: Testing microfoundations of choice inertia

Microfoundations of choice inertia

Habits in psychology:

- *"Automated responses triggered by cues to alleviate cognition costs"* (e.g. Lally et al., 2010)
- Cue = element from history which (empirically) correlates with optimal current choice

Research questions

1. Do habits arise to save on cognition/information costs?
2. How are cues selected?
   - Mechanically?
   - In a predicted way (optimally)?

$\Rightarrow$ a model of costly information acquisition (Steiner, Steward, and Matějka, 2017)

Preview

One binary perception task in each of two periods

Time separable utility

Treatments:

1. Underlying stochastic process and stakes
   $\Rightarrow$ impacts whether habit arises and its strength
2. Information provided to subjects
   $\Rightarrow$ impacts cue selection

Summary:
Habits and cue selection as second-best adaptations

Literature

Theory

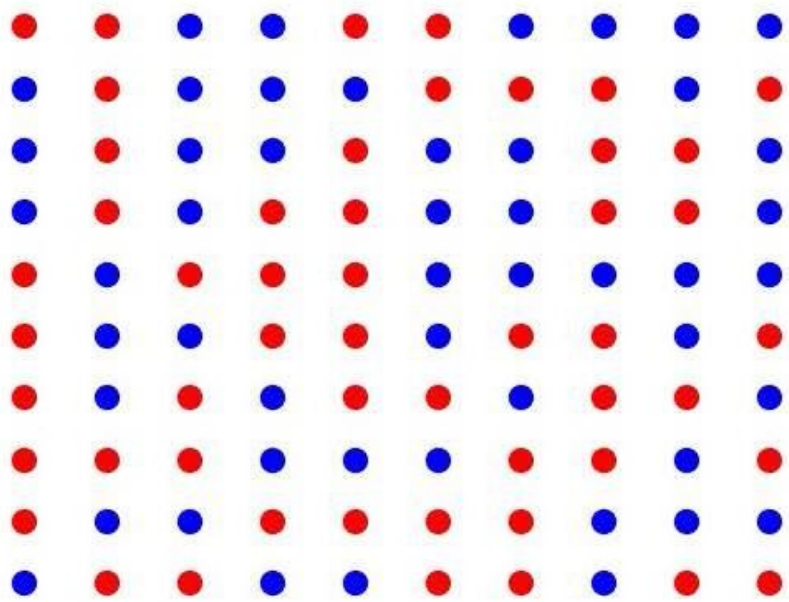
Cue-theory based on psychology: Laibson (2001)
Neuroscience: Camerer, Landry and Webb (2018)
Rational inattention: Steiner, Steward, Matějka (2017)

Experiment

Khaw and Zorilla (2018)

Outline

Caplin and Dean (2014)



- 100 red and blue dots
- Two states: 49 red dots vs. 51 red dots
- Task: determine the predominant color
  - cognitive cost $\Rightarrow$ cost-benefit analysis

Our paper: Two periods

Timing

Two-period task

1. State at $t = 1$ drawn from uniform prior

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2. Subjects make choice at $t = 1$

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5. Subjects make choice at $t = 2$

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6. Correct answers for both periods revealed

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One treatment = 12 iterations of this two-period task

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1. Information feedback: point 3.

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2. Serial correlation (correlated/independent): point 4.

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Treatments vary alongside

1. Information feedback: point 3.
2. Serial correlation (correlated/independent): point 4.
3. Stakes and degree of correlation

Outline

Definitions

Definition: Habit

DM forms a habit if payoff-irrelevant elements of history predict continuation behavior.

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$$\Pr[a_2 = 1 | a_1, \theta_1, \theta_2] \neq \Pr[a_2 = 1 | \theta_2].$$

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Which of $\{a_1, \theta_1\}$?

Definitions

Definition: Cues

$z \in \{a_1, \theta_1\}$ is the cue for the habit if

1. the habit is solely triggered by z and not by both past variables, and
2. z and a_2 are positively 'correlated'.

Definitions

Definition: Cues

$z \in \{a_1, \theta_1\}$ is the cue for the habit if

1. $\Pr[a_2 = 1 | \theta_2, z, w] = \Pr[a_2 = 1 | \theta_2, z]$ and
2. $\Pr[a_2 = 1 | \theta_2, z = 1] > \Pr[a_2 = 1 | \theta_2, z = 0]$

where w is the complementary variable from $\{\theta_1, a_1\}$.

Hypotheses

Based on a theoretical model of rational inattention

- model of costly information acquisition

Specific case of Steiner, Steward, and Matějka (2017)

Augmented for definition of habit, cue selection, and habit strength

Predictions captured in two propositions

Hypotheses

Weak treatments (W)

high stake ($s = \$10$)	*no feedback (N)*	*feedback (F)*
independent (I)	**no** habit	**no** habit
correlation (C) *low ($\gamma = 0.75$)*	**weak** habit cue a_1	**weak** habit cue θ_1

Strong treatments (S)

low stake ($s = \$7$)	*no feedback (N)*	*feedback (F)*
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Correlation $\Rightarrow$ habits as a way to save on costly effort

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Which cue? $\Rightarrow$ depends on its information content

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How strongly? $\Rightarrow$ depends on cost and probability of possible mistakes

Outline

Data: Overview

University of California, Santa Barbara

4 sessions, 76 subjects

- 2 sessions ‘Weak’ treatments, 2 sessions ‘Strong’ treatments

96 decision problems per subject

492 observations per period

$10 show-up fee, $10 vs. $7 incentive

Data: basic statistics

Treatment \Frequency	$a_1 = \theta_1$	$a_2 = \theta_2$	$a_2 = a_1$	$\theta_2 = a_1$
INW	0.84	0.86	0.51	0.50
IFW	0.85	0.85	0.60	0.61
CNW	0.87	0.86	0.78	0.74
CFW	0.89	0.90	0.78	0.77
INS	0.87	0.85	0.51	0.50
IFS	0.82	0.82	0.53	0.55
CNS	0.84	0.85	0.91	0.84
CFS	0.86	0.87	0.75	0.73

Independent (I) vs. Correlated (C)
Feedback (F) vs. No Feedback (N)
Weak (W) vs. Strong (S) habit

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- aggregate accuracy high and homogeneous across treatments and periods
- heterogeneous on the individual level
- hard to extract much more information just by looking at the table

Logit regressions: separately for each treatment

LHS: $a^n_{2,i}$

RHS: $const.$, $a^n_{1,i}$, θ^n_1 , θ^n_2, $session$, $score^n_i$, $score^n_i \theta^n_2$

a_t action at $t = 1, 2$
θ_t state at $t = 1, 2$
$score$ (adjusted) total number of correct answers
$session$ a session dummy

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Interested in how θ_1 and a_1 predict a_2.

Results: habit formation and cue selection

	IFW	INW	CFW	CNW
a_1	-.021 (.036)	.034 (.041)	.017 (.032)	**.191***** **(.051)**
θ_1	.071 (.043)	-.026 (.049)	**.258***** **(.058)**	.002 (.036)
θ_2	**.681***** **(.032)**	**.692***** **(.054)**	**.611***** **(.046)**	**.629***** **(.067)**

	IFS	INS	CFS	CNS
a_1	-.031 (.037)	.037 (.045)	-.033 (.204)	**.511***** **(.110)**
θ_1	.009 (.040)	-.034 (.044)	**.498***** **(.098)**	
θ_2	**.632***** **(.045)**	**.700***** **.036**	**.425***** **(.121)**	**.367***** **.098**

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5. Correlated states and no feedback $\Rightarrow$ habit with cue a_1

Results: habit strength

Pooling data across weak and strong parameters for correlated treatments

- dummy variable $\delta \in \{0, 1\}$

Augmented regression: adding δ and its interaction terms

Estimation of $\Delta(cue) :=$ marginal effect of cue when $\delta = 1$ (S) minus marginal effect of cue when $\delta = 0$ (W)

Findings

1. No feedback treatments: $\Delta(a_1) = 0.314$ with p-value 0.009
2. Feedback treatments: $\Delta(\theta_1) = 0.234$ with p-value 0.06

Conclusion

Laboratory experiment to test habit formation

Findings consistent with the second-best behavior

Complementary question: Internalizing continuation value of information?

- Myopia?