# Handwashing and Habit Formation: A Test of Rational Addiction

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# Handwashing with soap

- High rates of child stunting and mortality worldwide due to bacterial and viral transmission
  - Diarrhea, ARI
  - 2 million child deaths yearly (WHO 2013)
- Handwashing with soap
  - "the most effective vaccine against childhood infections" (World Bank 2005)
- But handwashing rates abysmally low (3-35%) worldwide, especially during critical times. Why?

# Why don't people wash their hands?

1. Scarcity of information
   - Information interventions have not worked. (WSP 2015, Galiani et al. 2015)
   - People believe washing is important. ▸ study context
2. Scarcity of resources
   - Resource interventions, including our own, have not worked. (WSP 2013, Ejemot et al. 2015, SHDS 2015)
   - People have soap and water. ▸ study context
3. No health returns in high-disease environments
   - Not true in our setting: handwashing reduces acute respiratory infection and loose stool incidence ▸ results
   - translates into significant improvements in weight and height ▸ results

People still don't wash. ▸ study context

# Key features of handwashing with soap

1. Preventive activity.
   - Returns are not salient.
2. Not a social norm.
   - No persistent social costs to shirking.
3. Repetitive activity.
   - Repeated engagement is costly...unless it becomes a habit.

▸ study context

These features apply to many important health activities: water treatment, latrine use, clean cookstove use, etc.

# Conceptual framework: habits and rational addiction

Becker and Murphy (1988): A Theory of Rational Addiction

1. Habit formation: intertemporal complementarities in the utility from consumption
2. **Rational** habit formation: Agents are aware of complementarities, so changes in future consumption affect current consumption

▸ the model

# What we do in practice

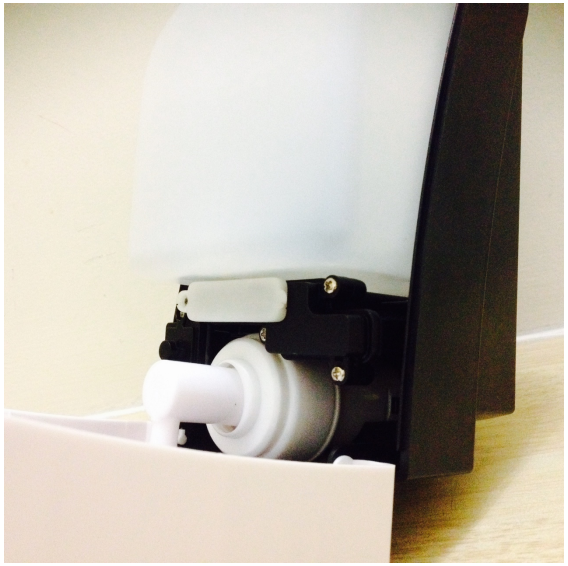
We implement an RCT among 2900 rural households with young children in West Bengal.

1. Our experimental design randomizes:
   - whether agents *receive* monetary incentives, social incentives, only a soap dispenser, or no intervention for daily handwashing

     $\Rightarrow$ habit formation
   - whether agents *anticipate* monetary incentives, social incentives, or neither

     $\Rightarrow$ rational habit formation
2. We observe:
   - precise measure of handwashing behavior before, during, and after withdrawal of the interventions
   - willingness-to-pay for soap
   - child health: diarrhea, ARI, weight, height

# Measurement technology: from the Media Lab

# Measurement technology: to the field

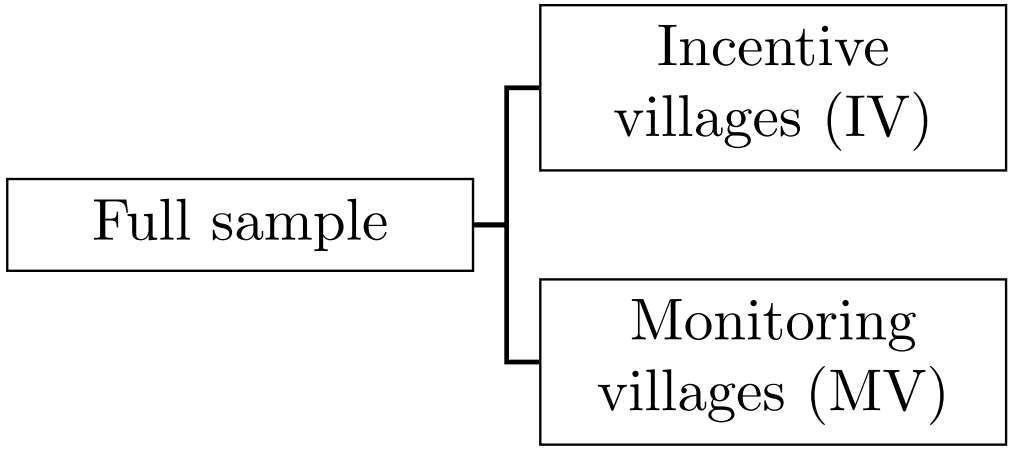
# Handwashing outcome measure

Primary outcome: binary measure of dispenser use during the family's self-reported evening mealtime.

Maximize $\sigma$ by making handwashing amenable to habituation:

$\Rightarrow$ **habit loop:** trigger, routine, feedback (Neal et al. 2015)

# Experimental design




Households are visited once every two weeks.

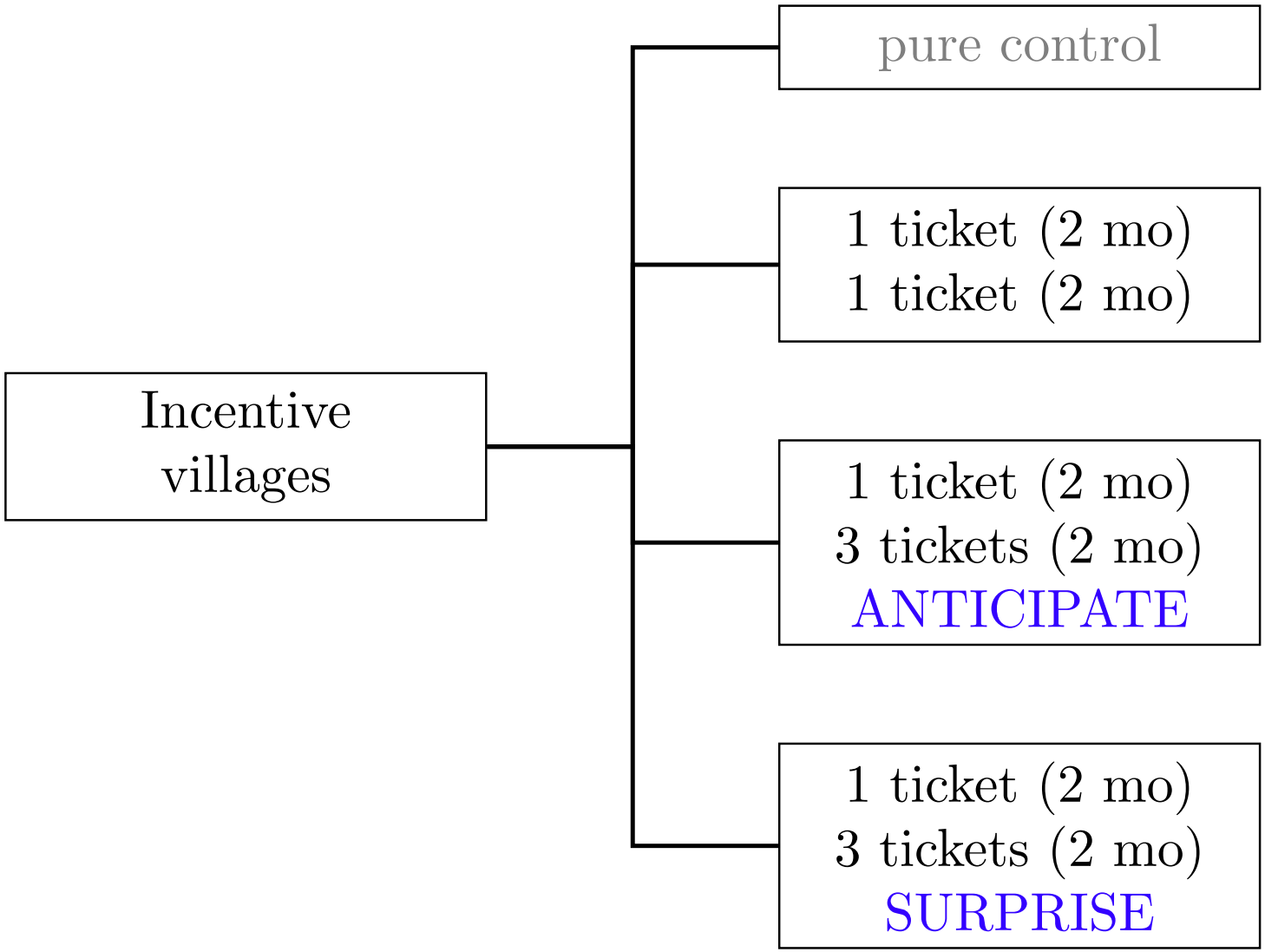
# Incentives intervention

Incentivized households receive:

1. calendar
2. dispenser to keep
3. soap for one year
4. tracking of behavior on calendar
5. tickets (one or three) per night dispenser active
   - redeemed for child and household prizes (on day of receipt or later)
   - 1 ticket = Rs. 3 = USD 0.05

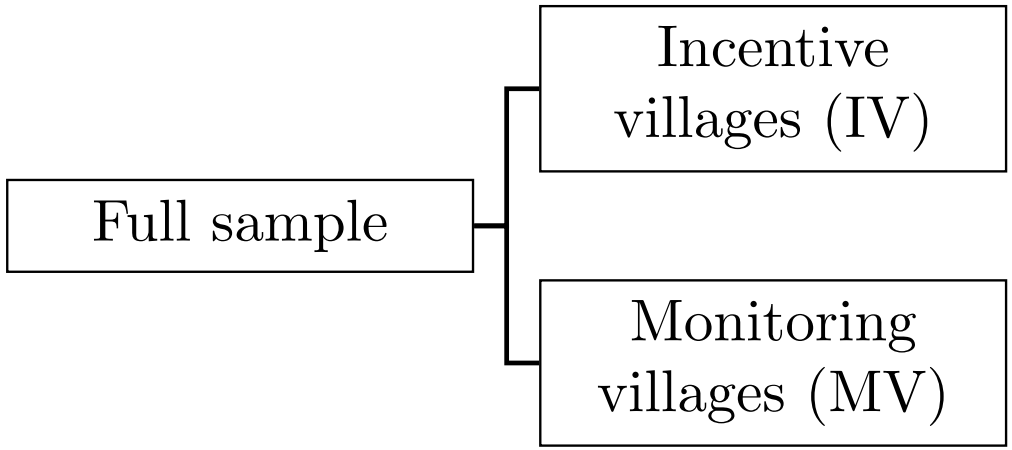
**Note:** tracking measured and incentives earned daily, but recorded and received every two weeks

# Incentives



# Parallel monitoring experiment

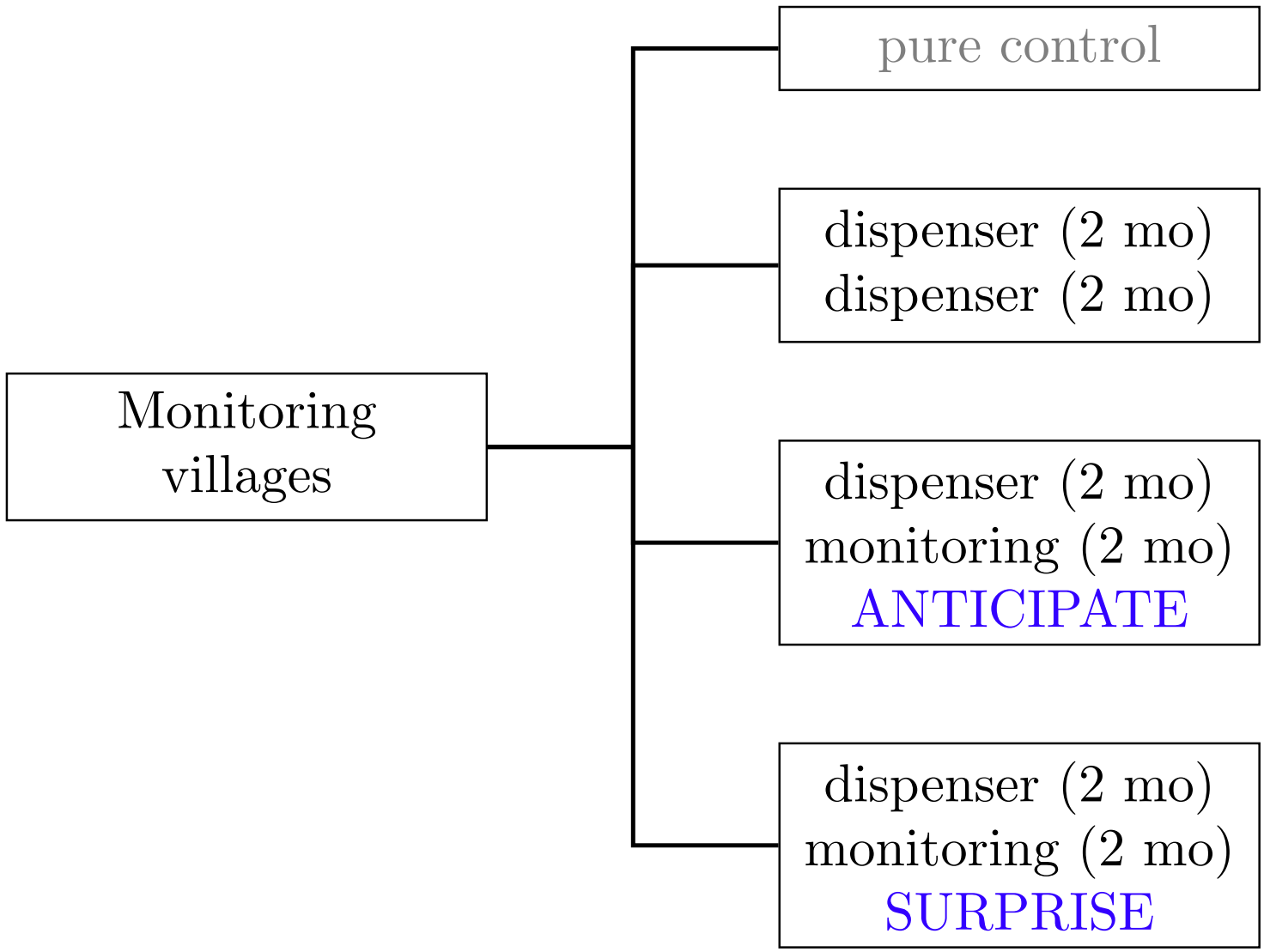
Disentangling incentives from feedback alone:



# Monitoring intervention

| Household Receives | Incentive | Monitoring |
|---|---|---|
| calendar | × | × |
| dispenser to keep | × | × |
| soap for one year | × | × |
| feedback on calendar | × | × |
| tickets | × | |

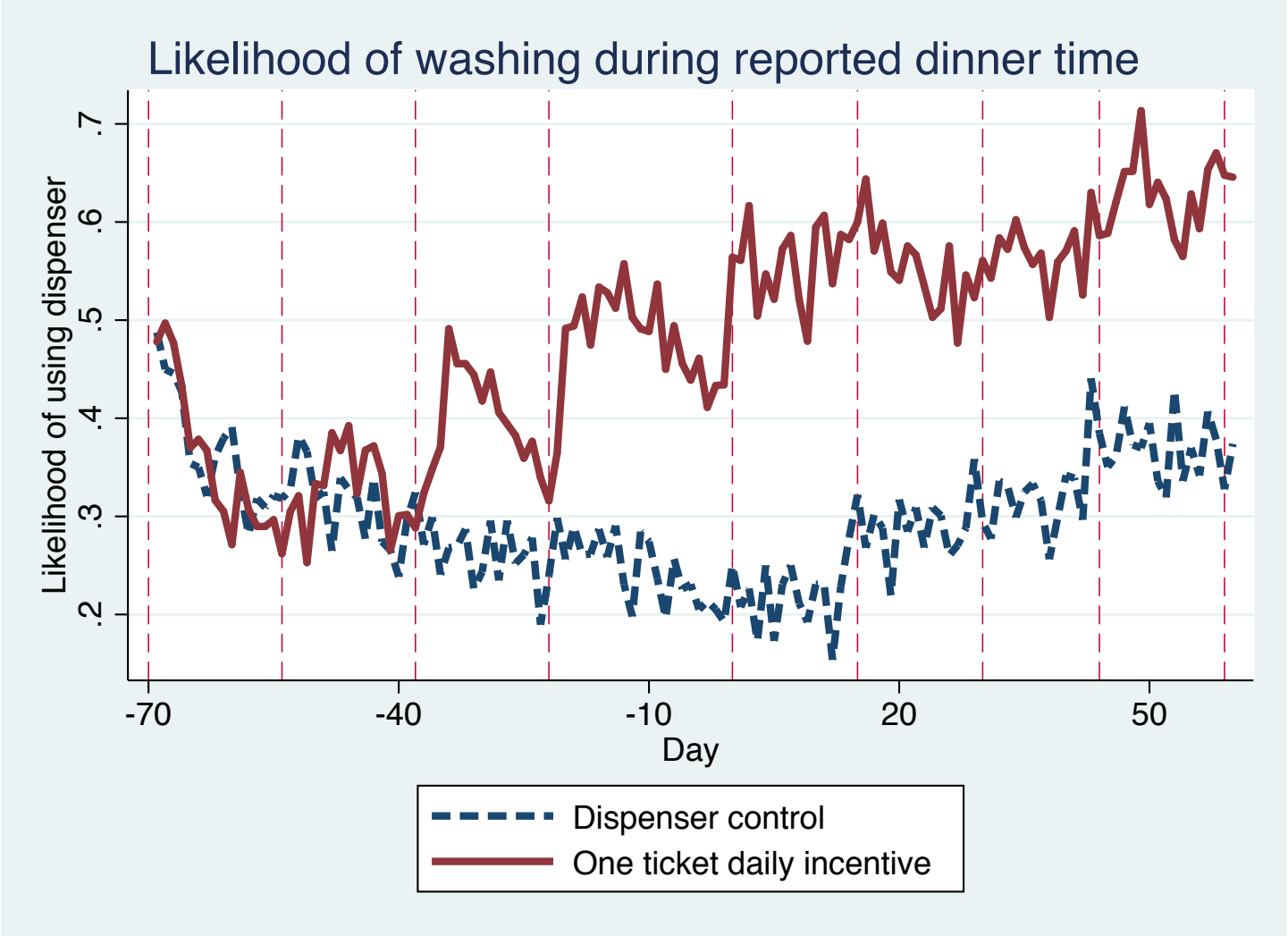
# Monitoring



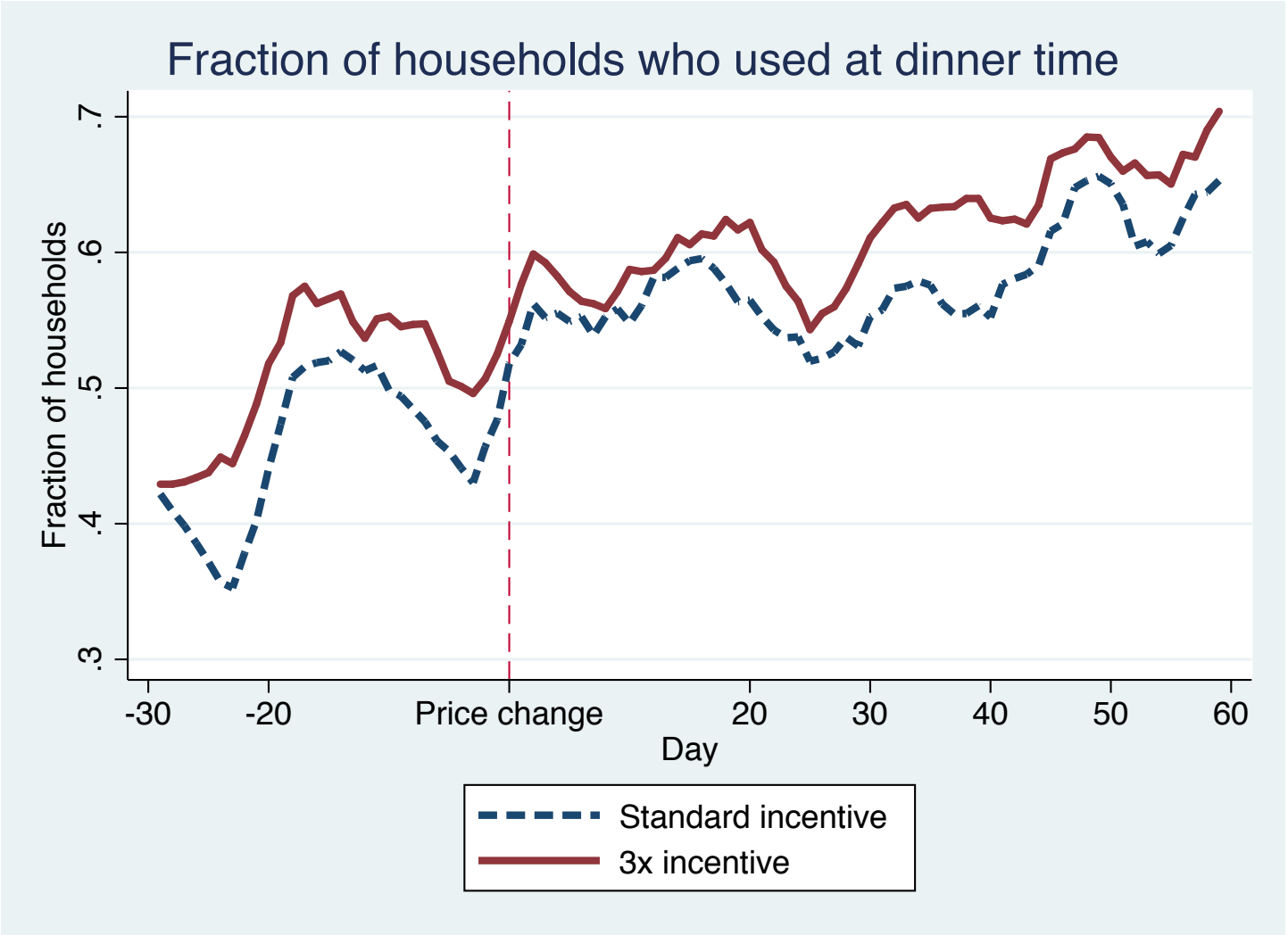
# Roadmap

# Contemporaneous effects

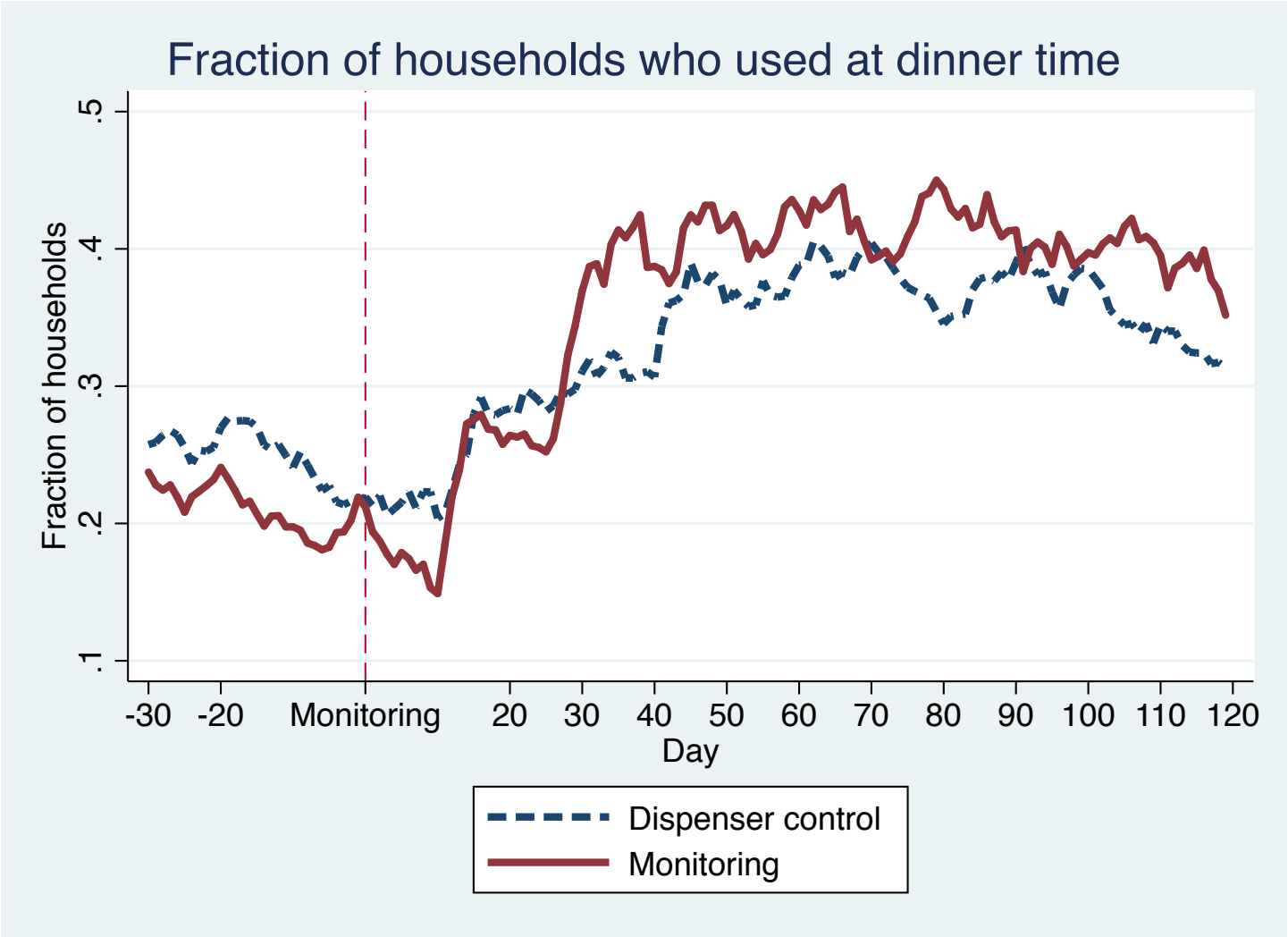
# **Contemporaneous effects**: receiving any tickets increases handwashing at dinnertime



# **Contemporaneous effects**: tripling tickets has little effect on handwashing

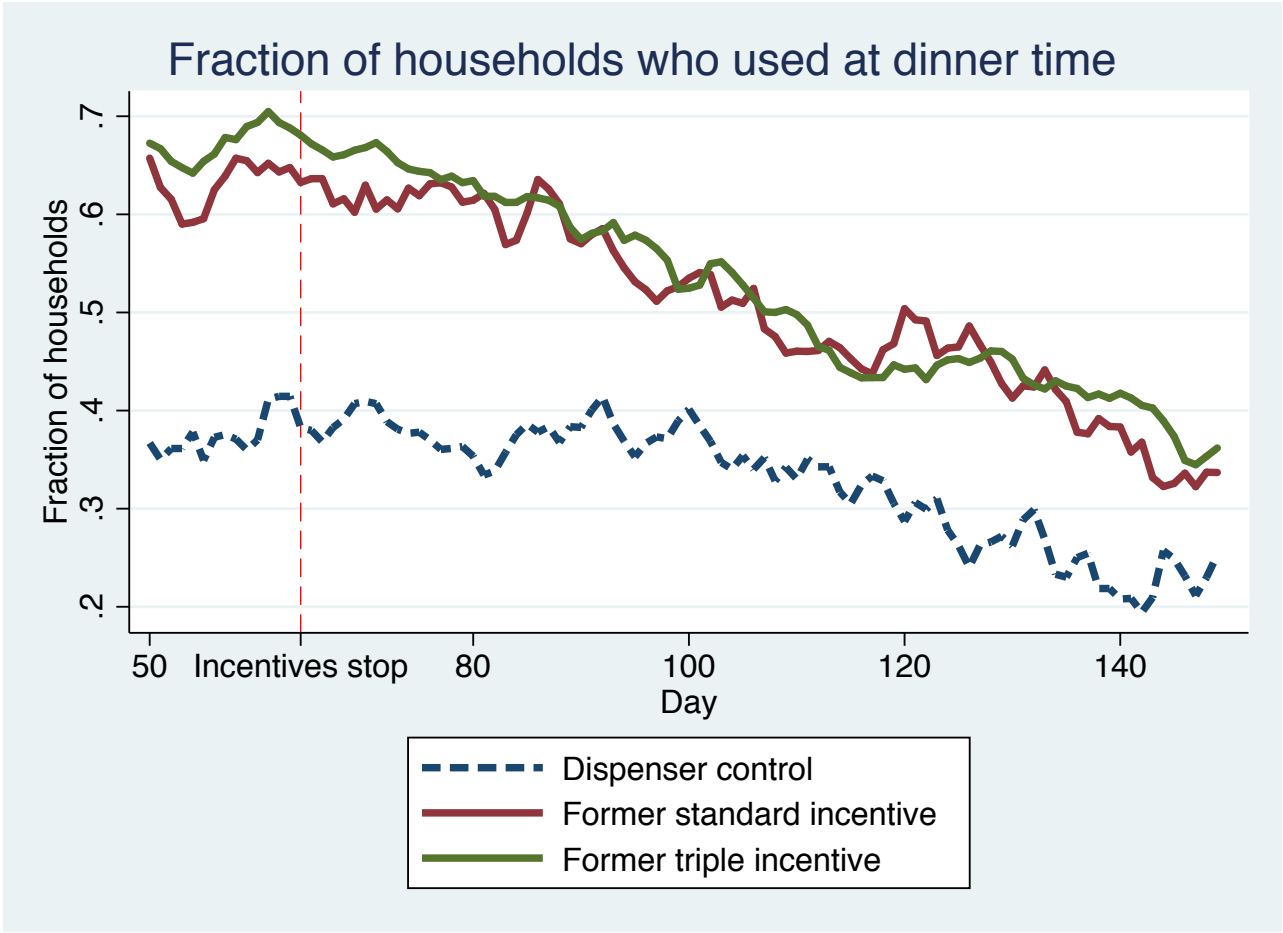


# **Contemporaneous effects**: monitoring increases handwashing

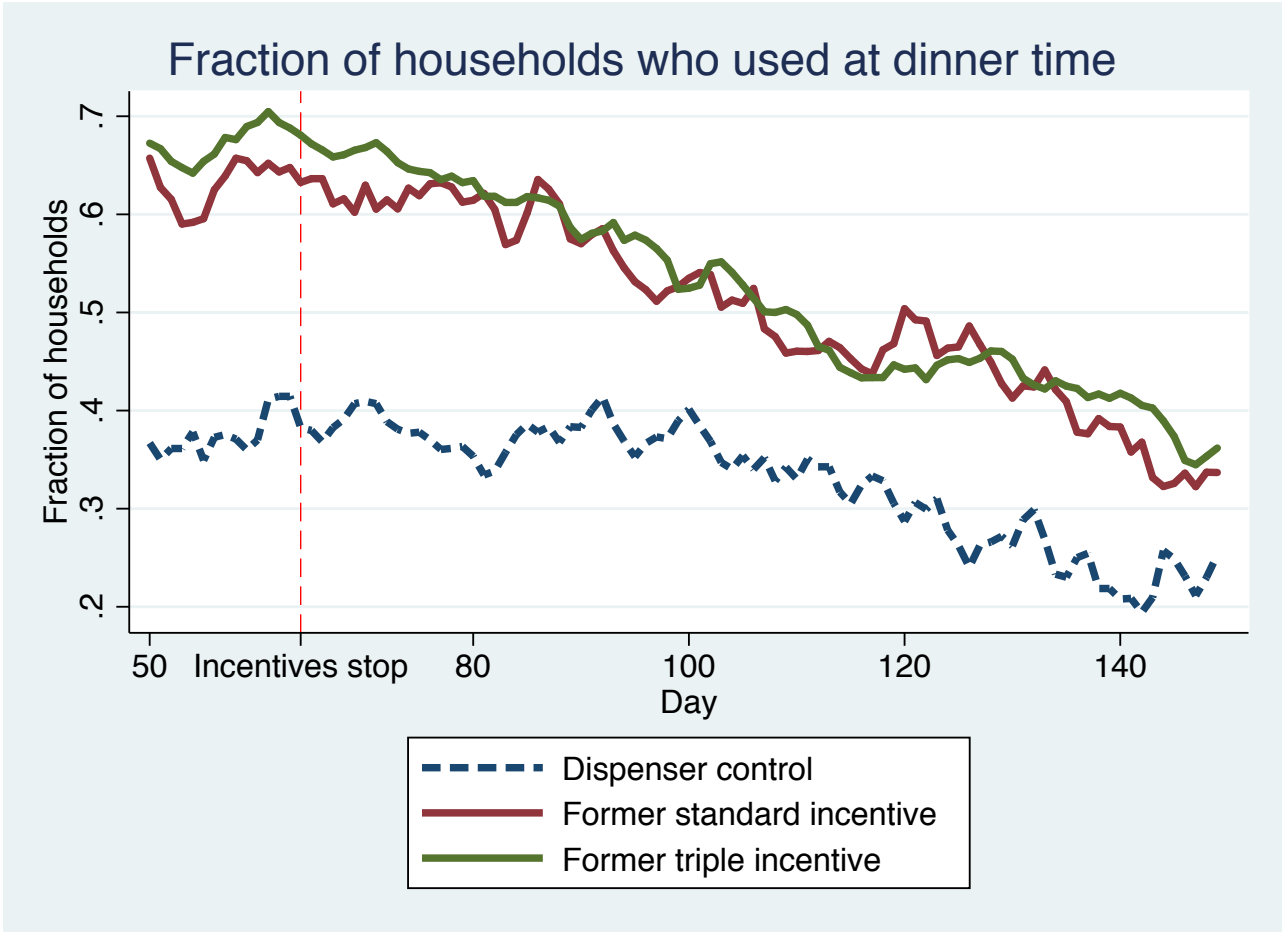


# Persistence effects

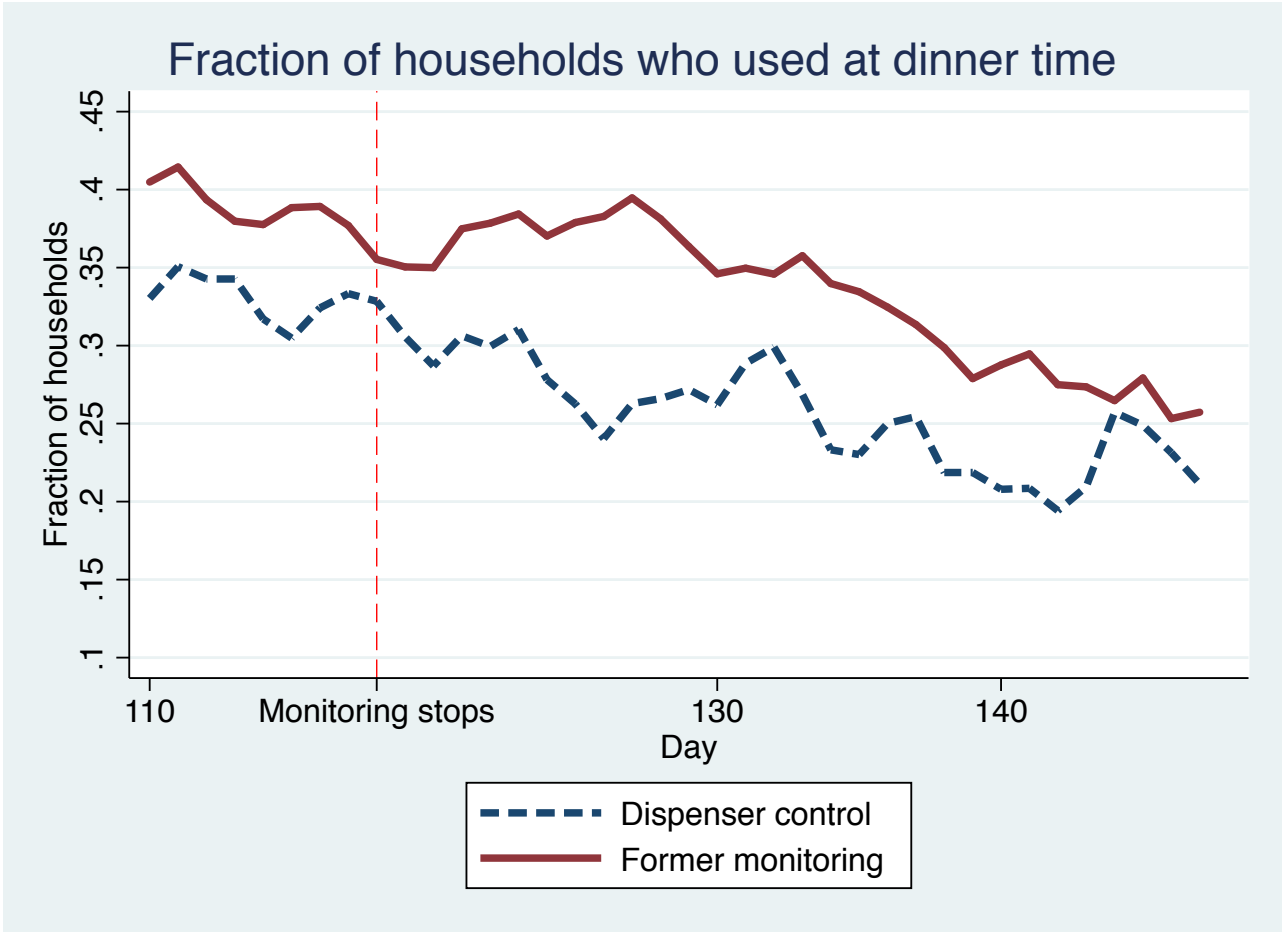
# **Habit formation**: previously receiving incentives makes you wash more on extensive margin



# **Habit formation**: previously receiving triple vs. single tickets does not persist

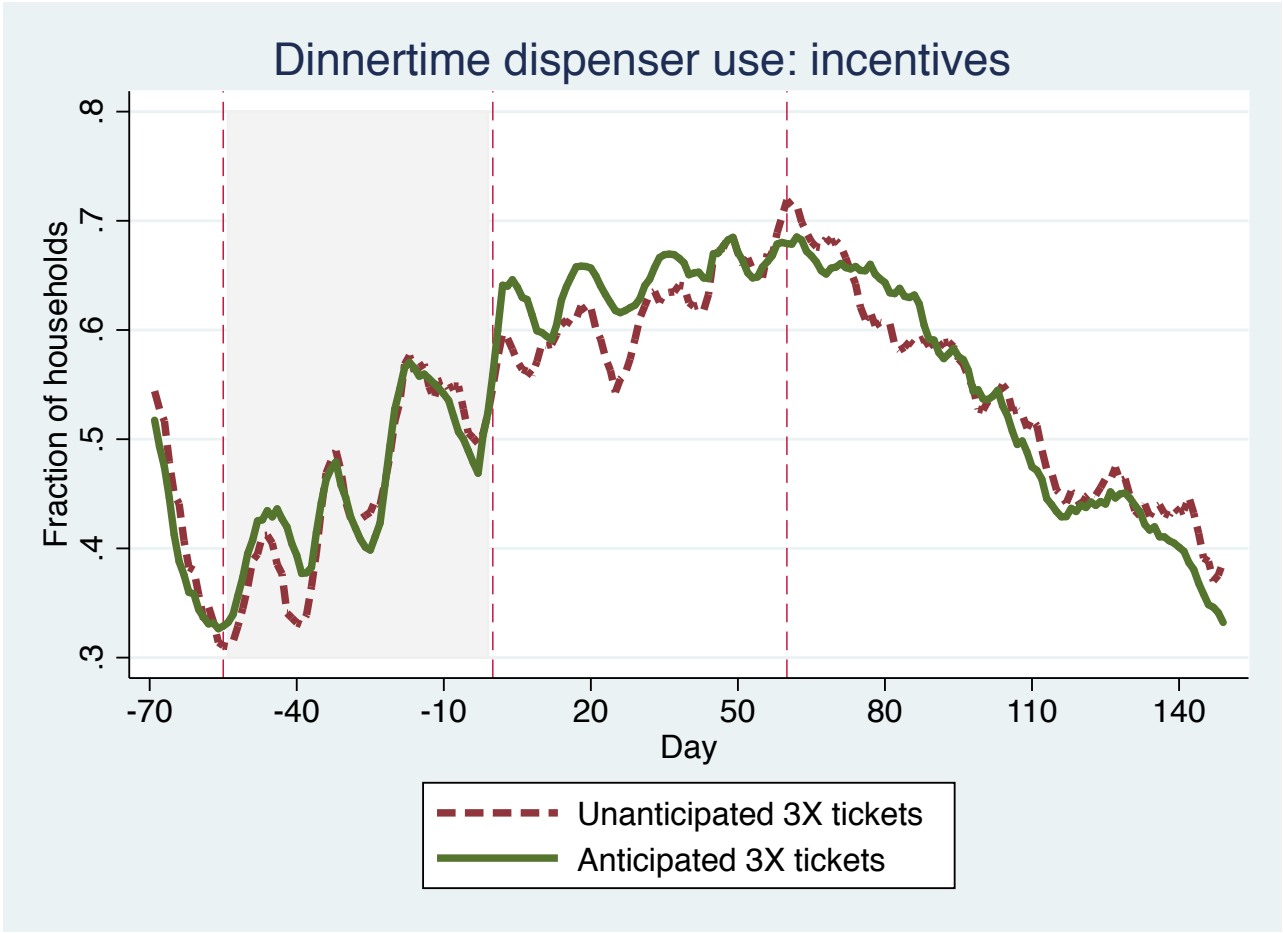


# **Habit formation**: previously being monitored makes you wash more

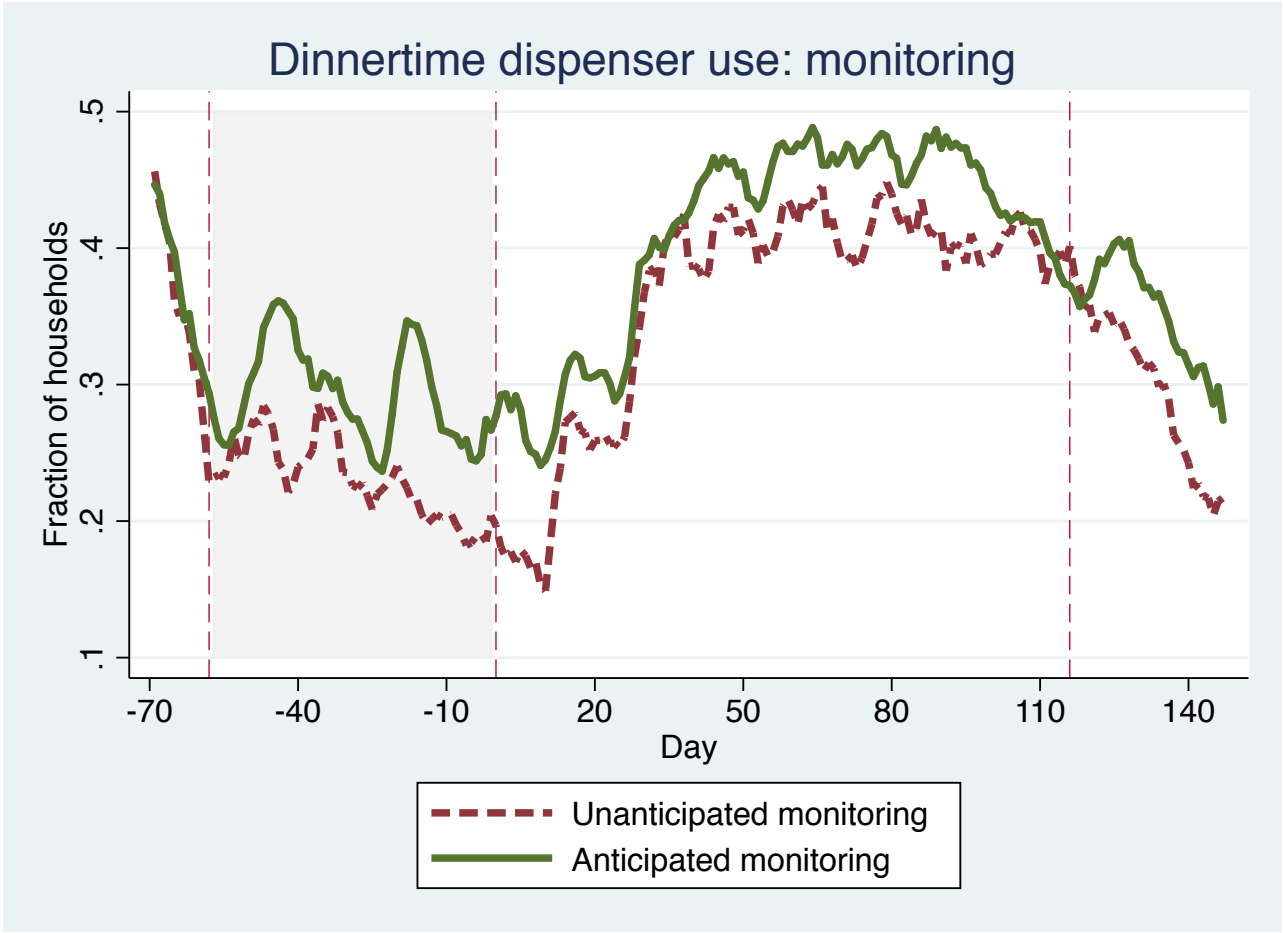


# Rational habit formation effects

# **Rational habit formation**: no evidence in households anticipating triple tickets



# **Rational habit formation**: strong evidence in households anticipating being monitored



# Child health effects

# Handwashing decreases loose stool and ARI incidence

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Any loose stool | Total days of loose stool | Any ARI symptoms | Total days of ARI |
| Received dispenser | -0.0315*** | -0.0817*** | -0.0393** | -0.204** |
| | [0.00975] | [0.0236] | [0.0154] | [0.0884] |
| Mean of pure control | 0.100 | 0.209 | 0.270 | 1.247 |
| | [0.00572] | [0.0151] | [0.00886] | [0.0504] |
| Observations | 3,820 | 3,830 | 3,830 | 3,830 |

*Notes:* Observations are at the child level. "Received dispenser" is any household that received a dispenser, pooled over treatment arms. p-values adjusted for multiple hypothesis testing using Anderson (2008). *** p<0.01, ** p<0.05, * p<0.1.

▸ disaggregated by age ▸ disaggregated by treatment arm
▸ Back

# Handwashing improves child anthropometric outcomes

| | (1) | (2) | (3) |
|---|---|---|---|
| VARIABLES | Weight for age z-score | Height for age z-score | Mid-arm circ. for age z-score |
| Received dispenser | 0.135* | 0.227* | 0.0752* |
| | [0.0640] | [0.0902] | [0.0518] |
| Mean of pure control | -2.167 | -1.866 | -1.365 |
| | [0.0459] | [0.0666] | [0.0432] |
| Observations | 863 | 862 | 858 |

*Notes:* Observations are at the child level. "Received dispenser" is any household that received a dispenser, pooled over treatment arms. p-values adjusted for multiple hypothesis testing using Anderson (2008). *** p<0.01, ** p<0.05, * p<0.1.

Back

# To summarize:

1. Handwashing alone has **substantial impacts on child health**
2. Financial incentives and monitoring without incentives increases handwashing
3. **Handwashing is habitual**: effects persist after incentives or monitoring are removed

   $\Rightarrow$ optimal scheme: frontload incentives
4. **Agents are rational habit formers**: anticipation of a rise in the future likelihood of handwashing increases current handwashing

   $\Rightarrow$ optimal scheme: delay and announce incentives

# A model of habit formation for good behaviors

Discrete time model with periods $1, ..., T$.

Agent chooses to:

- wash hands: $w_t = 1$
- not wash: $w_t = 0$

Habit stock of activity:

- $k_t = \gamma k_{t-1} + w_{t-1}, \gamma \in [0, 1)$
  where $\gamma$ is the level of decay

# A model of habit formation for good behaviors

Define the agent's instantaneous utility from washing in period t as

$$u_t(w_t, k_t) = \begin{cases} \alpha - [x_t - \sigma k_t] & \text{if } w_t = 1 \\ 0 & \text{if } w_t = 0 \end{cases} \quad (1)$$

where

- $\alpha$ is the health benefit from washing
- $x_t$ is the cost of washing (in time, effort, attention)
- $\sigma$ is ease in washing due to habituation

Behavior is **habit forming**: $\frac{\partial u_t}{\partial k_t} > 0 \Rightarrow \sigma > 0$

# Levers to increase handwashing

We want to maximize the net instantaneous utility of handwashing:

$$\begin{aligned} u_t(k) &= u_t(1,k) - u_t(0,k) \\ &= \alpha - x_t + \sigma k_t \end{aligned} \tag{2}$$

When consumption stock is zero, we can only shift:

- $x_t$: subsidize cost of washing

Once $k_t$ is positive, $\sigma$ kicks in $\Rightarrow$ subsidy can be temporary.

# Testable predictions

$$u_t(k) = \alpha - \underbrace{x_t}_{\textit{incentives}} + \sigma k_t$$

▸ Incentive breakdown

1. **Incentives:** $\frac{\partial u_t}{\partial x_t} \leq 0$. Reducing the cost of handwashing (by increasing the value of handwashing) raises handwashing rates.
2. **Habit formation:** $\frac{\partial u_t}{\partial k_t} \geq 0$. A rise in past handwashing rates increases current handwashing rates.

# Testable predictions

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# Rational habit formation

In a world where agents are forward looking, their long run utility is:

$$U_t(k_t) = \max_{w_t} \begin{cases} [\alpha - x_t + \sigma k_t] + \delta U_{t+1}(\gamma k_t + 1) & \text{if } w_t = 1 \\ \delta U_{t+1}(\gamma k_t) & \text{if } w_t = 0 \end{cases}$$

Additional testable prediction:

**Rational habit formation:** $\frac{\partial^2 U_t}{\partial k_{t+1}} \geq 0$. An anticipated [and actual] rise in future handwashing rates is associated with an increase in current handwashing rates.

Consistency check:

**Health:** $\alpha \geq 0$. Handwashing generates positive health internalities.

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