Do Smart Technologies Deliver?
Smart Thermostats and Energy Conservation
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1. Motivation: Big Costs & Bold Claims
- Residential energy use has significant private and social costs
  - Private: ~$2,000 in energy bills per household per year (EIA, 2019)
  - Social: ~20% of all US carbon pollution (EIA, 2019b)
- Largest share (~40%) of residential energy goes to heating & cooling (EIA, 2019a)
- Smart thermostat claim: ↑ efficiency ⇒ ↓ energy use w/out ↓ consumer utility
  - Based on engineering or correlation studies, not from “the field”
- Policy implications: ENERGY STAR & Smart Grid Investment Grant (SGIG) programs

2. Abstract: Smart Thermostat Field Experiment
- Goal: Test the hypothesis that smart thermostats reduce energy consumption

3. Experimental Design
3.1 Sample Randomization & Spatial Balance
- N = 1,385
- Control: 694
- Treatment: 691
- Failed Install: 64
- Decline: 129
- Install: 498

3.2 Descriptive Evidence
- Central CA - Treatment
- Central CA - Control
- Northern CA - Treatment
- Northern CA - Control

3.3 Empirical Model: DDIV
- Second-stage equation
  \[ e_{it}^j = \alpha_i^j + \beta_i^j P_i + \gamma_s P_{it} + \delta_j + \epsilon_{it} \]
  \( e_{it}^j \): energy use of type j in (electricity, natural gas)
  \( \alpha_i^j \): an indicator for installation of a smart thermostat in home i
  \( \beta_i^j \): an indicator for post-assessment status in time period t
  \( \gamma_s \): an indicator for household i's treatment status in our experiment

4. Results: Null & Robust

5. Potential Mechanisms: Descriptive Evidence
- Do users program thermostats? ✓
- Program for energy savings? ✓

References