JPMorgan Chase & Co.

Feeling the Heat: How Households Manage High Air Conditioning Bills

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As the climate becomes hotter, the choice between air conditioning and other spending becomes harder

- Climate change is increasing the number of extremely hot days, with significant consequences for health, economic output, and daily welfare.
- Surveys report many low-income households already struggling to balance electricity bills and necessities like food (EIA, RECS 2015).
- With limited budgets, low-income households must choose between more A/C and more food, housing, etc.
- **How do households make this choice? What does this mean for equitable climate policy?**
- We can use JPMC Institute data to answer these questions.
  - We directly observe electricity bill payments, other spending, and income levels.
  - We match customer location to daily temperature records to see how household behavior changes as temperatures change.

INSTITUTE DATA

THE JPMORGAN CHASE INSTITUTE LEVERAGES DE-IDENTIFIED DATA FROM:

- $3.7+ TRILLION BALANCE SHEET
- 7.3+ MILLION SMALL BUSINESSES
- 209+ MILLION RETAIL CUSTOMERS
- 300+ THOUSAND INSTITUTIONAL INVESTORS

INDIVIDUAL TRANSACTIONS
Information on amount, day and time, zip code, channel, and counterparty characteristics (2007 – one month prior to present)

ACCOUNT LEVEL INFORMATION
Accounts held, activity frequency, and monthly balances (including deposit accounts, savings accounts, money market, credit card, mortgage and home equity loans, and auto loans)

DEMOGRAPHIC CHARACTERISTICS
On an entirely deidentified sample: gender, banded age, and geography

INSTITUTIONAL INVESTORS
All types of institutional investors across all asset classes and regions globally

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Low-income households deal with high A/C bills primarily by reducing A/C use, not other spending

Main Finding

Low-income households are much more likely to cut A/C use than other spending. However, the expected mortality risk likely exceeds the financial savings from lower A/C use.

Detailed Findings

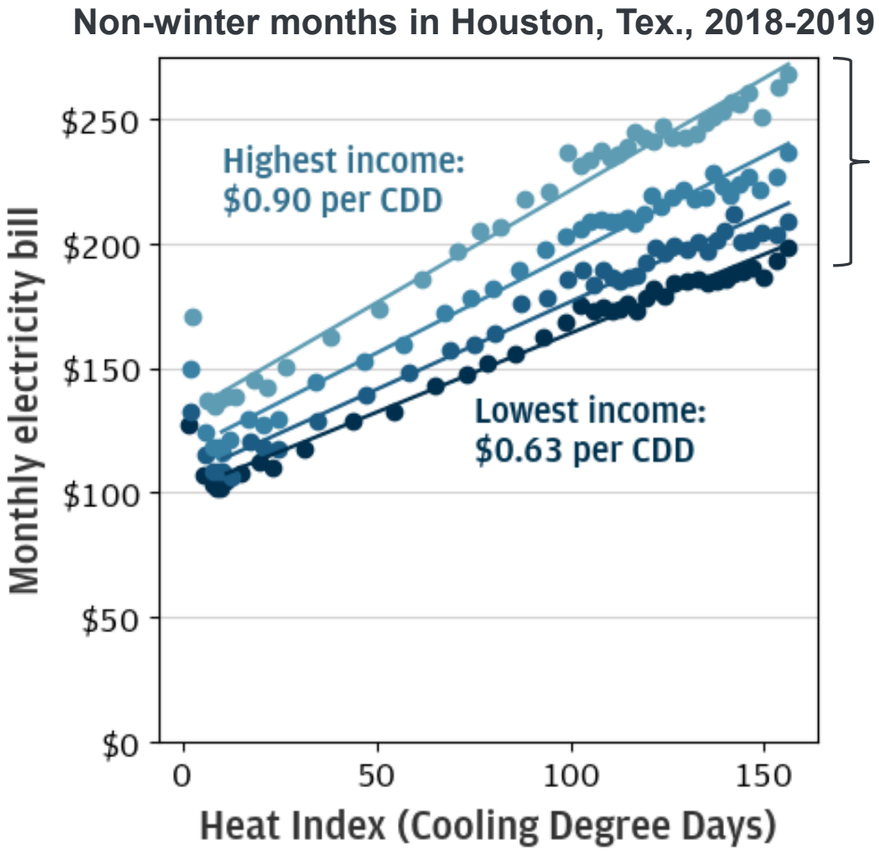
1. Low-income households cool their homes significantly less, spending about 40% less on electricity on hot days than high-income households. This is net of differences in housing characteristics.
2. Very high electricity bills may cause households to delay and/or reduce some non-A/C spending, but the magnitude of these adjustments is small for most households.
3. The cost of increased mortality risk from decreased A/C use is 2-3 times higher than the money saved by reduced cooling.

Policy Implications

- The main source of welfare inequality from increased heat due to climate change may be physical rather than directly financial.
- Policies to reduce this inequality must account for how readily households reduce A/C use to maintain their other spending.
- Closing the cooling gap will require changing the cost of A/C use relative to other spending; transfers or lump-sum payments may be less effective.
  - For example, flexibility in bill payment can prevent service shutoffs in emergencies, but it may not increase A/C use beyond current levels.

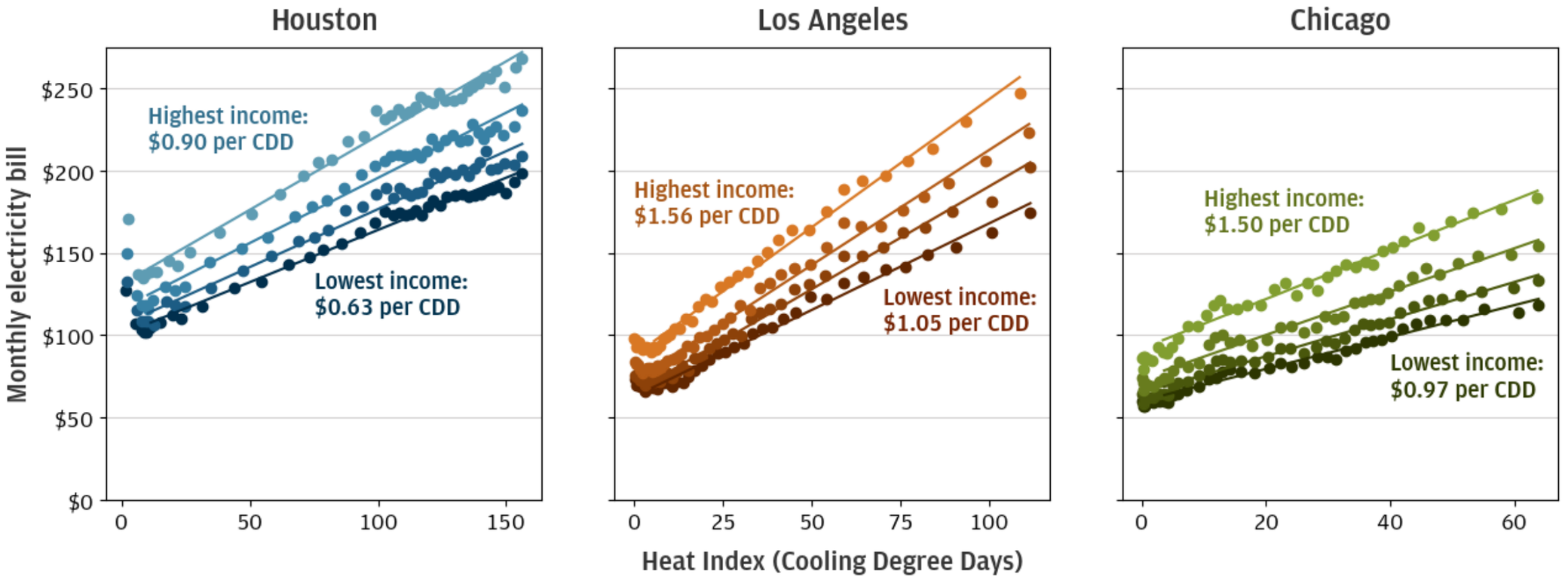
Low-income households cool their homes significantly less, are ~40% less responsive to temperature

- In relatively hotter months, all households increase their electricity use (and electricity bills) to cool their homes.
- However, low-income households increase their electricity usage much less than high-income households.
- Electricity use could differ across low- and high-income houses for numerous reasons.
  - Looking specifically at the relationship between heat and electricity bill eliminates baseline differences in electricity use (e.g., 2nd freezers).
  - Using data on differing house sizes, we can better equate electricity use with A/C use and comfort (larger houses cost more to cool). Results on later slide.
  - Analyzing multiple cities separately (Houston, Los Angeles, Chicago) ensures that different A/C technologies or adaptation practices are not driving our result.



As temperature increases, low-income households do not cool their houses as much, even after adjusting for differences in house size

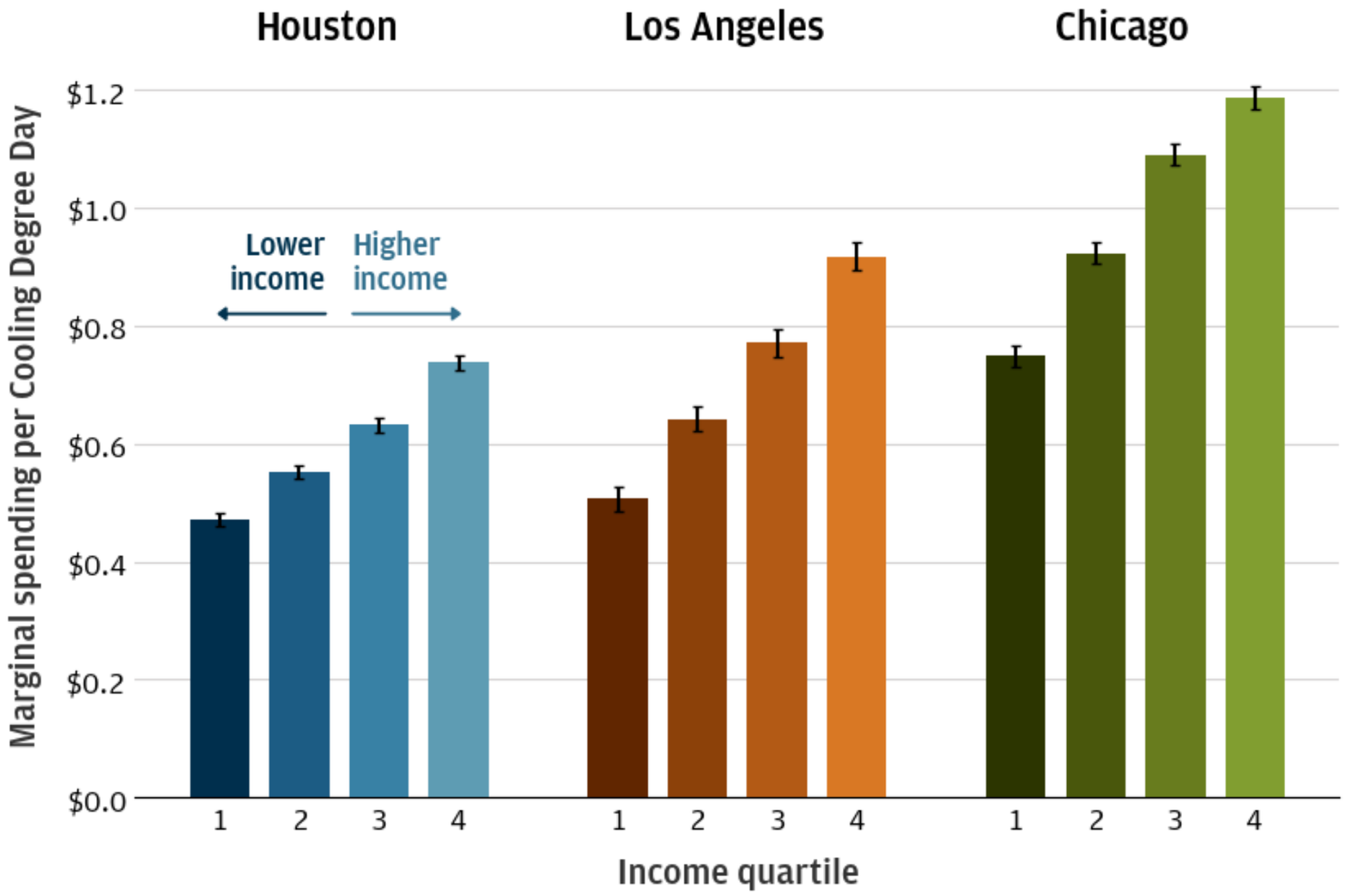
Differences in cooling by income exist in all cities in our sample, with disparate climates and housing stocks



Note: Each point denotes the average electricity bill within a Cooling Degree Day (CDD) bin in the given within-city income quartile. We use CDDs to measure the total deviation from 25°C within a billing cycle: a day with an average temperature of 26 °C is one CDD, and two such days constitute two CDDs, while a day with an average temperature of 27 °C also constitutes two CDDs. We calculate 50 quantile bins of the total number of CDDs in a 30-day billing cycle corresponding to the bill payment. Each bin is represented by its average CDD. The best-fit line is estimated using OLS regression. Sample is restricted to summer months (May to October).

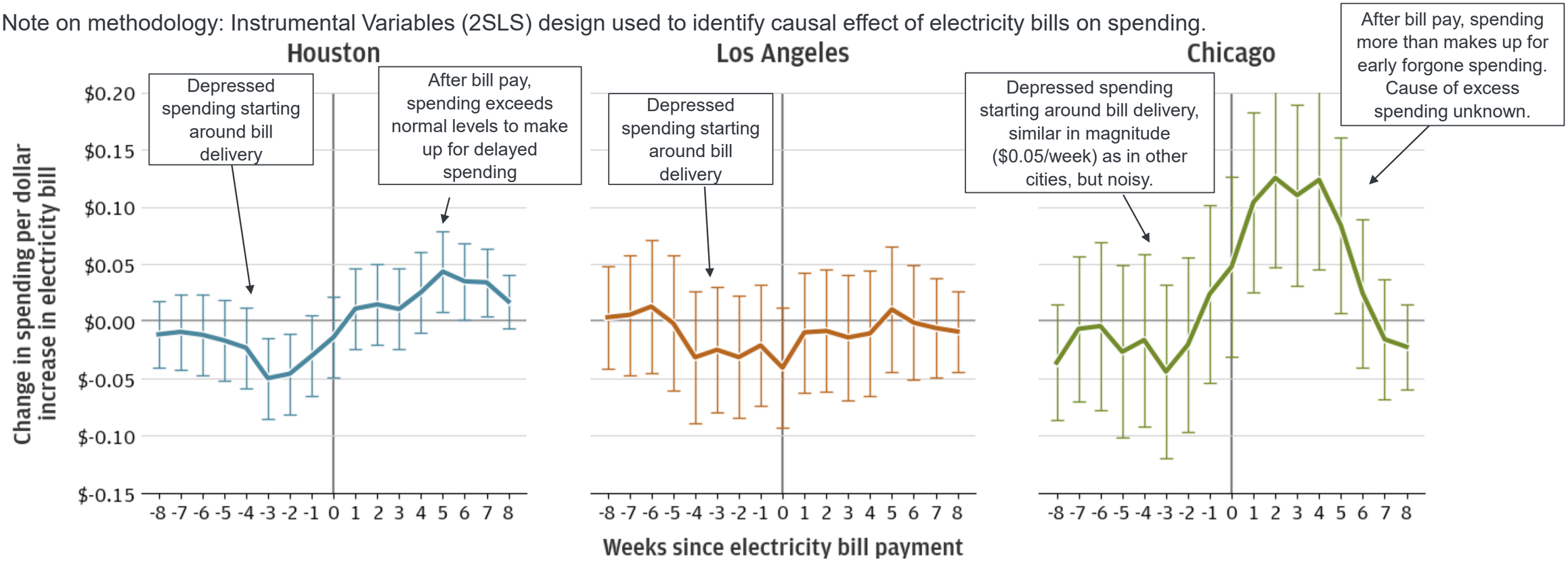
Source: JPMorgan Chase Institute

The cooling/income relationship exists even after explicitly controlling for home characteristics



Some evidence that discretionary spending is suppressed by higher bills

- Higher bills could cause households to pull back on discretionary spending.
- Households may also delay spending (spending below baseline before bill pay and then above baseline spending afterward).
- Taken at face value, households in Houston delay about $0.20 of spending per $1 of electricity bill.
- Driver of different responses unclear, though Houston has significantly higher temperatures and electricity bills than the other cities while Chicago has significantly lower summer temperatures and more severe winters.
- Note on methodology: Instrumental Variables (2SLS) design used to identify causal effect of electricity bills on spending.



Expected cost from increased mortality risk alone outweighs the benefit of lower A/C use

Benefits of reduced A/C use

- Low-income households cool 35-40% less intensively than high-income households
- High-income spend $8-$12 per 95 F day (net of house size).
  - Poor insulation increases energy expenses by 18% for low-income households (Fowlie et al. 2018)
- **Benefit of less A/C use: $2.70-$4.40 per hot day**
  - Some of which is used on additional discretionary spending

Cost of reduced A/C use due to mortality risk

- Full A/C use reduces mortality by 75% (A/C impact from Barreca et al. 2016)
- A 95 F day increases mortality by 0.94 deaths per 100,000 (Deschenes & Greenstone 2011)
- Value of statistical life = $9.4 million (EPA VSL inflated to 2019)
- **Cost of less A/C use: $7-8 per hot day**
  - Increased heat exposure also shown to impact sub-lethal health outcomes, as well as labor productivity, educational outcomes, etc.

Policies to reduce inequal exposure to high heat must account underuse of A/C by low-income households to be efficient

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Technical background

- Decision to fund marginal cooling vs. marginal consumption depends on the marginal costs and benefits of cooling relative to consumption.
- Thus, any policy that only affects the household's budget constraints (income effects) will not significantly change the mix of cooling vs consumption.
- For example, suppose household usually spends $500 per summer on cooling.
  - Scenario 1: The household is enrolled in a program that pays for their first $400 of cooling. For each additional $1, the household still must choose between A/C and other spending.
  - Scenario 2: The household is enrolled in a program that pays for their first $600 of cooling. The household will almost certainly increase their cooling, because there is no trade-off below $600.