SIMONS, ANDREW [S6-P-24]

The effects of fuel-efficient cookstoves on fuel use, particulate matter, and cooking practices: Results from a randomized trial in rural Uganda

Co-authors: Theresa Beltramo, Impact Carbon, San Francisco, CA; Garrick Blalock, Cornell University; David I. Levine, University of California, Berkeley

Traditional biomass cookstoves cause substantial environmental degradation, contribute to global climate change, worsen poverty, and cause an estimated four million deaths a year. Fuel-efficient cookstoves, depending on quality and construction, have the potential to reduce all of these problems. Because of these benefits, fuel-efficient cookstoves have a long history within the development community. While there have been some successes, most regions continue to adopt efficient stoves at "puzzlingly low" rates (Mobarak et al. 2012).

Study Design

We tracked stove usage before and after the purchase of fuel-efficient stoves (Envirofit G-3300) in 165 households across fourteen rural parishes in Southwestern Uganda. Households that agreed to purchase the new stove were randomly assigned into two groups: early buyers, late buyers. We asked both groups to install stove use monitors (SUMs) that read temperatures on their traditional and Envirofit stoves. After giving consent, three stone fires were fitted with SUMs immediately. Two weeks later the early buyers group received their first Envirofit stove. Five weeks later the late buyers received their first Envirofit stove. Six weeks after late buyers received their Envirofits, both groups were surprised with a second Envirofit stove. Because common cooking practices require simultaneous cooking pots (e.g., rice and beans, matooke with sauce), we gave a second Envirofit to permit normal cooking using only fuel-efficient stoves. We performed a series of kitchen performance tests (KPTs) (Bailis, Smith, and Edwards 2007) in each household across the different waves of fuel-efficient stove introduction. These recorded the quantity of firewood consumed, the levels of air pollution (particulate matter sized 2.5 micrometers (PM2.5)), and a detailed food diary).

Analysis

We used a machine-learning algorithm to predict hours cooked throughout the dataset of approximately 1.7 million temperature readings we recovered. This process, detailed in Simons et al. (2014), allowed us to unobtrusively and inexpensively track stove usage on a larger sample and for a longer continuous time than almost any past study. We analyze several outcomes: · Stove usage (hours cooked/day, meals and people cooked for per day) · Wood usage (kg/day) · Household air pollution (PM2.5 concentrations)

For each outcome we run a regression:

$$Yipt = \alpha ip + b1 * midlinet + b2* endlinet + \beta 1 (Ti *midlinet) + \beta 2 (Ti *endlinet) + \epsilon ipt$$

where Yipt are the outcomes listed above for household i for parish p in study wave t (baseline, midline or endline), αip are fixed effects for each household, baselinet andmidlinet are dummies for study wave, and Ti is a dummy equal to one if in the early treatment group. ϵip is a residual that may be clustered by parish * study-wave but is assumed to be i.i.d. within a parish and study-wave. The coefficients of interest are β1 (the effect of being in the treatment group during the midline) and β2 (the effect of being in the early group during the endline).