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Are the Non-Monetary Costs of Energy Efficiency Investments Large? Understanding Low Take-up of a Free Energy Efficiency Program[†]

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This paper finds striking evidence that individuals and households bypass opportunities to improve energy efficiency that require zero out-of-pocket expenditures and are widely believed to be privately beneficial. We report results from a large-scale randomized controlled trial that significantly reduced barriers to participation in the Federal Weatherization Assistance Program (WAP). This program, the largest residential energy efficiency program in the country, aims to reduce the energy burden of low-income Americans by installing energy efficiency measures in their homes. Since the program's inception in 1976, more than 7 million households have received weatherization assistance.

Related work (Fowlie, Greenstone, and Wolfram 2015) finds that participation in this program significantly reduces energy consumption—and associated energy expenditures—among participating households.[1] These sizeable private benefits notwithstanding, a very small fraction of income-eligible families apply for weatherization assistance. An even smaller fraction of eligible households actually receive it. The low participation rates raise questions about what other factors—beyond monetary costs and energy savings—drive adoption decisions.

The experiment was conducted with a sample of more than 30,000 households in Michigan who were presumptively eligible for WAP. The treatment group was educated about WAP and offered extensive personal assistance with completing the application. After a massive effort to reduce barriers to participation, application rates and program participation remained low. Overall, the evidence is consistent with high non-monetary costs associated with WAP participation and the adoption of more involved energy efficiency improvements.

I. The Weatherization Assistance Program

The Weatherization Assistance Program provides free energy efficiency improvements to low-income households. Federal support for this program increased significantly under the American Reinvestment and Recovery Act (ARRA). Our study was conducted in Michigan during the ARRA-funded period.

Participating households receive a free energy audit and a home retrofit that typically includes some combination of insulation, window replacements, furnace replacement, and infiltration reduction. The average value of the efficiency retrofits provided to participating households in our study approximately $5,000 per home.

Although households incur no direct monetary costs to participate, the process of applying for weatherization is onerous and time intensive, at least partially to prevent fraud. Applicants must submit extensive paperwork documenting

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[1] Our estimates of the net present value of energy savings (valued using retail energy prices) range from $1,500 to over $3,600, depending on assumptions about the lifespan of the investment and the relevant discount rate. These savings appear to be substantially smaller than the costs of the energy efficiency investments (Fowlie, Greenstone, and Wolfram 2015).

their eligibility, including utility bills, earnings documentation, social security numbers and deeds to the home. Eligible applicants are then prioritized following guidelines that recommend ranking applicants highly if the household includes the elderly, persons with disabilities, or families with children, or where the occupants typically face a high energy burden (energy as a share of income) or have high residential energy use (see 10 CFR 440.16(b) (1–5)).[2]

II. Research Design

The study was conducted in southeast Michigan. To select the study sample, we first identified census blocks that had high rates of home ownership, high rates of natural gas heating, and household incomes that would qualify for weatherization assistance. We also screened out any households that had already received weatherization assistance in recent years as this would render them ineligible for future participation. From this group we drew a sample of over 30,000 households. Approximately one-quarter of these were randomly assigned to an encouragement "treatment." The remaining "control" households were free to apply for WAP but were not contacted or assisted in any way by our team.[3]

We worked closely with a well-respected organization that specializes in designing communications strategies and managing outreach campaigns to develop a persuasive recruit and assist strategy. The encouragement phase of our efforts began in March 2011. Our field staff, many of whom were trusted individuals hired from the communities where the experiment was conducted, made almost 7,000 initial, in-person house visits. These ground operations were complemented with 23,500 targeted robocalls and over 15,000 door hangers and mailed post cards to raise awareness of both the weatherization program and our encouragement campaign. When this information campaign was complete, all households in the encouraged group had received some form of communication, with most contacted several times. Our team was able to speak in person with almost two-thirds of the treated households (the remaining households could not be found at home during canvas operations or did not answer the door).

Following this initial encouragement phase, the field operations transitioned to an enrollment phase. Over the course of approximately 9,000 personal phone calls and 2,700 home visits, the staff helped individuals complete and deliver paperwork to the implementing agencies. In total, the encouragement and enrollment efforts cost approximately $450,000, which amounts to $50 per targeted household and over $1,000 per weatherized household.[4]

III. Empirical Findings

Figure 1 provides a graphical summary of how our randomized encouragement intervention affected program participation.

The figure highlights the low levels of participation in both the control and treatment groups. Even after the extensive efforts to encourage participation, only 15 percent of the households in the treated group, less than one-quarter of those to whom our team spoke, submitted an application and fewer than 6 percent of them actually received a weatherization.

However, the intervention had a significant impact on both the application and weatherization rates of the treatment group relative to the control group. In the control group, only 2 percent of the households applied to the program compared to 15 percent in the encouraged group. The rate at which households received a weatherization retrofit increased from less than 1 percent in the control group to almost 6 percent in our encouraged group. Notably, the weatherization rate conditional on submitting an application does not vary significantly across the control and treatment groups.

Our intervention eliminated some—but by no means all—of the time and effort required to participate in the program. Households in the treatment group had to actively decide to participate, engage with our staff, meet with contractors,

[2] Code of Federal Regulations http://www.law.cornell.edu/cfr/text/10/440.16.

[3] See Fowlie, Greenstone,and Wolfram (2015) for further details on the experimental design.

[4] To put these numbers into perspective, the cost per weatherized household is lower than customer acquisition costs reported by solar providers who are similarly offering households the opportunity to lower future energy expenditures (although targeting households in a different demographic and requiring an upfront investment) (see Seel, Barbose, and Wiser 2014).

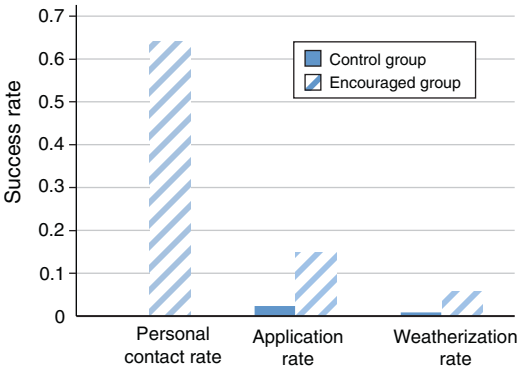

FIGURE 1. APPLICATION AND WEATHERIZATION RATES ACROSS GROUPS

Notes: This figure summarizes the rate at which households were contacted in person by our team, applied for weatherization assistance, and successfully received weatherization assistance, respectively.

endure the hassle of having a construction team working in their home, etc. One interpretation of our findings is that these remaining costs exceeded the expected benefits from weatherization for a majority of households.

We cannot identify the specific households that participated in the program due to our encouragement intervention. However, a comparison of observable characteristics across households that received a weatherization retrofit in the control group and households receiving a retrofit in the encouraged group reveals what types of households were moved to participate by our encouragement.

Table 1 makes this comparison using data on household demographics, energy consumption, housing characteristics, and projected savings. The demographics and housing characteristics are collected by the local community action agency, which is responsible for screening applicants and implementing the home retrofits. These implementing agencies also conduct an energy audit at each home that files an eligible WAP application before it is weatherized to determine which measures are projected to reduce expected energy expenditures by more than their costs. We collected energy consumption data from the local utility. See Fowlie, Greenstone, and Wolfram (2015) for more details.

The first two columns report the average values and standard deviations (in parentheses)

TABLE 1—DIFFERENCES IN SAMPLE MEANS BETWEEN GROUPS OF WEATHERIZED HOUSEHOLDS

	Experimental control (1)	Experimental encouraged (2)	(2)–(1) (3)
Household demographics			
Household income ($)	17,048 (8,840)	19,783 (12,172)	2,735** (1,016)
Household size (number of people)	1.99 (1.30)	2.37 (1.60)	0.38** (0.14)
Children (share of hh)	0.19 (0.40)	0.27 (0.44)	0.07* (0.04)
Elderly (share of hh)	0.28 (0.45)	0.38 (0.49)	0.11** (0.04)
Reported disability (share of hh)	0.04 (0.21)	0.04 (0.19)	−0.01 (0.02)
Monthly energy consumption, dwelling characteristics			
Winter gas (MMBtu)	10.42 (3.93)	9.80 (3.47)	−0.62* (0.32)
Electricity (MMBtu)	2.02 (0.95)	2.21 (1.07)	0.19** (0.09)
Age of home (yrs)	62.87 (18.80)	58.92 (20.73)	−3.94** (1.94)
Floor area (sq. ft.)	1,759.62 (596.33)	1,733.61 (594.10)	−26.01 (57.33)
Retrofit costs and projected savings			
Reported cost (total)	5,287.18 (2,912.26)	4,620.07 (2,619.31)	−667.11** (283.75)
Proj. savings (MMBtu)	63.71 (44.11)	55.36 (41.83)	−8.35** (4.10)
Projected savings: investment ratio	2.07 (1.28)	1.81 (1.04)	−0.26** (0.11)
Households	178	435	

Notes: Columns numbered 1 and 2 report average values and standard deviations (in parentheses). Column 3 reports differences in means (standard errors are in parentheses).
***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

for the control and encouraged participants, respectively. The third column reports the difference in group means.

Table 1 suggests that a reduction in the information and process costs borne by the potential beneficiaries induces households with higher incomes to participate. Encouraged households are also larger on average, more likely to have children in the home, and more likely to report an elderly resident as compared to weatherized households in the control group. Although the floor area of weatherized homes does not vary across groups, homes are somewhat newer in the

encouraged group. Households in the encouraged group had slightly lower levels of winter gas consumption and slightly higher levels of electricity consumption historically. Efficiency audits conducted at all participating households prior to weatherization projected relatively lower savings, lower weatherization costs, and lower projected savings to investment ratios among encouraged participants.

This heterogeneity in households' responses to a reduction in process and information costs has implications for program targeting. A growing literature explores the extent to which "ordeal mechanisms" result in improved targeting of program resources (Alatas et al. 2012). By contrast, Allcott, Knittel, and Taubinsky (2015) document that energy efficiency programs that are not means tested are likely taken up by households who are less likely to experience market failures, such as poor information.

In this setting, onerous application procedures could be advantageous if they serve to discourage households with less to gain from a weatherization retrofit. Along some dimensions, the results are consistent with this interpretation as we observe households with higher projected net savings and lower incomes in the control group of participants. However, groups targeted by the WAP program include the elderly, disabled, and households with children. Among these groups, we find a reduction in process costs can increase participation.

IV. Discussion

There is a large and persistent difference between the levels of investment in energy efficiency that appear to be privately beneficial and the investments that private individuals actually pursue (Allcott and Greenstone 2012). The economics literature has identified several possible explanations for this apparent gap. This study sheds light on the role that information and transaction costs can play in determining household-level decisions to pursue residential energy efficiency improvements.

This study documents that households take-up an energy efficiency retrofit with zero out of pocket costs and roughly $5,000 of improvements to their homes at a very low rate. Further, the take-up is only modestly increased by extraordinary efforts to inform households—via multiple channels—about the sizeable benefits and zero monetary costs. These findings are consistent with high non-monetary costs associated with WAP participation and/or energy efficiency investments, at least for the population we studied. High non-monetary costs associated with these investments would suggest the energy efficiency gap in the residential sector is narrower than it appears.

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