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# The Impact of Low Income Home Energy Assistance Program (LIHEAP) Participation on Household Energy Insecurity

**Anthony G. Murray and Bradford F. Mills**

Department of Agricultural and Applied Economics,  
Virginia Tech, Blacksburg, Virginia 24061  
amurray@vt.edu, bfmills@vt.edu

*Poster prepared for presentation at the Agricultural & Applied Economics Association's 2012  
AAEA Annual Meeting, Seattle, Washington, August 12-14, 2012*

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## Introduction

- LIHEAP created in 1981 to help both poor households and utility companies.
- LIHEAP helps households with:
  1. Direct monetary payments to utility companies on behalf of households
  2. “Crisis” funds (termination imminent)
  3. Replace broken residential infrastructure
- Which households are eligible:
  - Income at or below 150% of poverty line or below 60% state median income
  - Receive other entitlement benefits like AFDC or SNAP
- LIHEAP is a block grant:
  - States receive specific funding each year
  - Varies by state based on population and climate
  - If funds exhausted eligible households may not receive benefits.

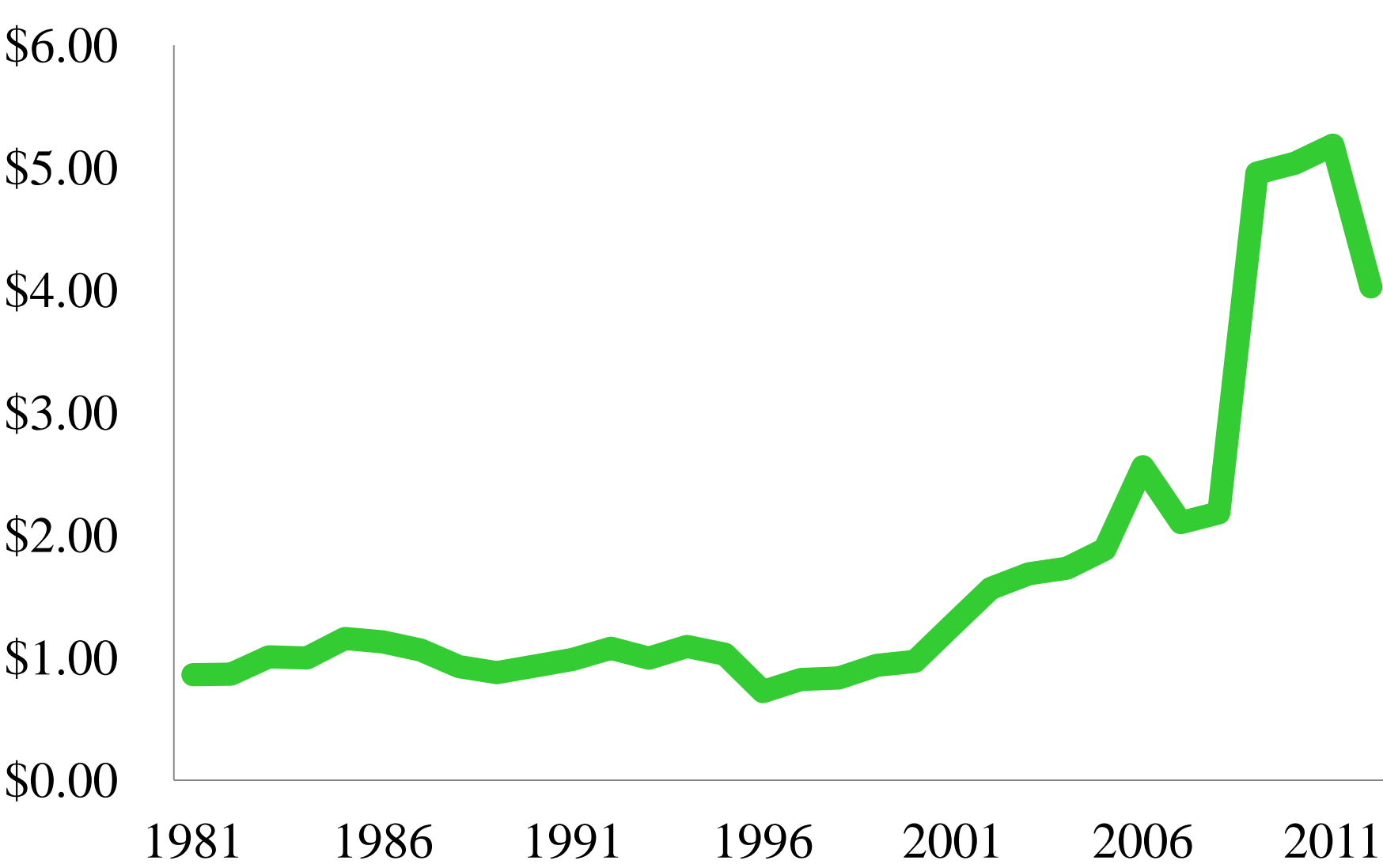


Figure 1. LIHEAP Funding by year (billions, 2005 dollars)

## Research Question

- Does LIHEAP participation make households more energy secure?
- What happens to the number of low-income energy secure households if Congress eliminates LIHEAP?

## Energy Insecure Households

- Index generated similar to the food security index:
  - Continuous, positive, censored household index
  - Based on survey responses to 9 specific questions about energy security in 2005.
  - Roughly 30% of low-income sample can be classified as energy insecure

## Model Specification

- Selection Issue:
    - Households “self-select” into LIHEAP.
    - Ignoring household choice can bias estimation results
    - Household characteristics affecting LIHEAP participation likely influence household energy insecurity levels as well.
- $$A^* = X_1' \alpha_1 + \varepsilon_1 \quad \text{Latent LIHEAP Participation}$$
- $$y^* = \gamma_1 A + X_1' \beta_1 + \varepsilon_2 \quad \text{Latent Household Energy Insecurity}$$

- We cannot observe the latent equations and instead observe  $A$  and  $y$  which indicate
- $$A_i = \begin{cases} 1 & \text{if } A_i^* > 0 \\ 0 & \text{if } A_i^* \leq 0 \end{cases} \quad y_i = \max\{0, y_i^*\}$$
- Use Full Information Maximum Likelihood (FIML) as the most efficient estimation technique to estimate both equations jointly.

$$\begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \end{bmatrix} \sim N \left[ \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{bmatrix} 1 & \rho\sigma_2 \\ \rho\sigma_2 & \sigma_2^2 \end{bmatrix} \right]$$

- Model identified through nonlinearity
  - Pagan and Vella (1989) test fails to reject joint normality assumption.
  - Alternative specifications use exclusion restrictions to test robustness of results

## Results

- Results presented for most general energy insecurity index
  - Consistent across four different energy insecurity indexes.
- Significantly positive error correlation,  $\rho$ , for all energy insecurity indexes

**-All indexes (and all alternative specifications) show that participating in LIHEAP significantly reduces household energy insecurity score!**

## LIHEAP Participation Equation Results

Variable	Estimate	Std. Error	Variable	Estimate	Std. Error
Black head of household	0.078	0.126	Household rents dwelling	0.0237	0.122
Hispanic Head of household	-0.0113	0.148	Household resides in an apartment complex	-0.1574	0.139
Non-White, Non-Black head of household	0.0214	0.141	Household resides in a mobile home	-0.2726	0.17
Number of household members	0.0557	0.038	Total square footage of dwelling	1.65E-05	4.94E-05
Household includes a child less than 6 years old	-0.0419	0.128	Household has air conditioning	0.1765	0.125
House includes an elderly individual greater than 65	0.1735	0.124	Price per kilowatt hour for electricity	-3.5425	2.319
Household has someone at home during the day	-0.0061	0.102	Quality of house dummy variable	0.4003**	0.127
Single-female head of household	0.2645*	0.112	Household resides in a rural environment	-0.3850**	0.136
Single-male head of household	-0.3236*	0.165	Household resides in an urban environment	-0.2169*	0.11
Household Income ( x 1000\$)	-0.0205**	0.008	Annual cooling degree days	-3.18E-05	1.41E-04
Receipt of cash benefits	0.5711**	0.118	Annual heating degree days	1.62E-04*	7.01E-05
Receipt of non-cash benefits	0.8608**	0.117	Regional fixed effects (not shown) [WS Central† & Pacific*]		

## Household Energy Insecurity Equation Results

Variable	Estimate	Std. Error	Variable	Estimate	Std. Error
Household receives LIHEAP benefits	-3.2167**	0.304	Household rents dwelling	0.3357	0.257
Black head of household	0.9159**	0.275	Household resides in an apartment complex	-0.8373*	0.297
Hispanic Head of household	0.0947	0.303	Household resides in a mobile home	-0.1325	0.348
Non-White, Non-Black head of household	-0.281	0.288	Total square footage of dwelling	-3.25E-05	1.04E-04
Number of household members	0.3359**	0.082	Household has air conditioning	0.4111	0.272
Household includes a child less than 6 years old	-0.4580†	0.267	Price per kilowatt hour for electricity	-5.3529	5.054
House includes an elderly individual greater than 65	-0.6070*	0.268	Quality of house dummy variable	1.6380**	0.276
Household has someone at home during the day	-0.1672	0.218	Dwelling built prior to 1970	0.1818	0.165
Single-female head of household	0.6869**	0.24	Household resides in a rural environment	-0.4919†	0.293
Single-male head of household	-0.6249†	0.335	Household resides in an urban environment	-0.3399	0.235
Household Income ( x1000\$)	-0.0518**	0.016	Annual cooling degree days	1.13E-04	2.85E-04
Receipt of cash benefits	1.1586**	0.268	Annual heating degree days	3.26E-04*	1.51E-04
Receipt of non-cash benefits	1.8477**	0.265	Regional FE (significant) [ES Central*, South Atlantic* & Pacific*]		

## Simulations

Policy Scenario	Impact on number of Insecure Households
Eliminate LIHEAP	18% increase
Target most EI households	14% increase
Double funding	10% decrease

## Conclusions

- LIHEAP works! Households that participate have significantly lower household energy insecurity scores.
- Eliminating LIHEAP will have a major impact:
  - Large decrease in the number of energy secure households

## Conclusions (cont.)

- Low quality housing leads to higher LIHEAP participation and higher energy insecurity
  - Tax credits or improved energy efficiency programs potentially beneficial
- More research analyzing federal energy assistance is needed.
  - State level data can improve analysis

## For further information

Please contact [amurray@vt.edu](mailto:amurray@vt.edu) for more information about this project. The full paper with results will be provided upon request as well.