



ENERGY

Energy Savings Over a 3-year Opt-in Rewards-based Residential Behavioral Program

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Presented at IEPPEC in Berlin on 9/9/2014

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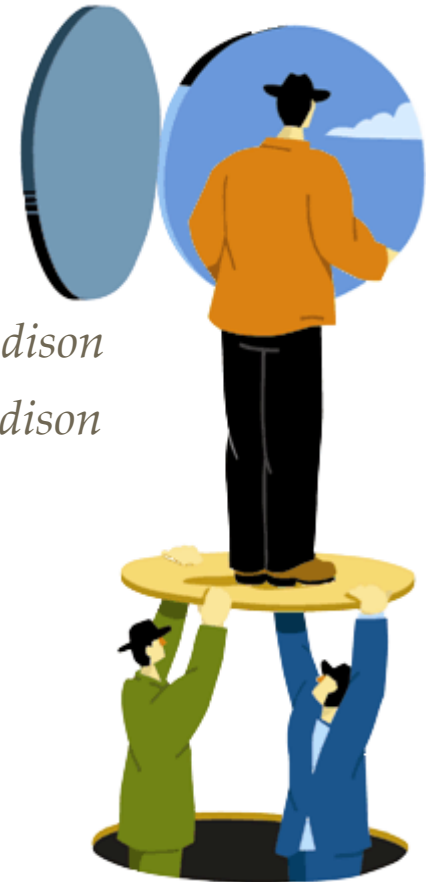


Table of Contents



1 » Introduction

2 » Description of the program and the data

3 » Variation-in-Adoption Method

4 » Matching Methods

5 » Results

6 » Conclusions

Motivation

Star Rating	Condition
★★★★★	Randomized Controlled Trial results in unbiased estimates of savings.
★★★★☆	Regression Discontinuity results in estimates of savings that are likely to be unbiased if done correctly.
★★★☆☆	Variation in Adoption with a Test of Assumptions could result in biased estimates of savings. ⁶⁰
★★★☆☆	Propensity Score Matching could result in biased estimates of savings. ⁶¹
★ Not Advisable ☆	Non-Propensity Score Matching could result in biased estimates of savings.
★ Not Advisable ☆	Pre-Post Comparison could result in very biased estimates of savings.

SLEEAN (2012)

» Is there a better way to choose between methods than an a-priori ranking?

Table of Contents

1 » Introduction



2 » Description of the program and the data

3 » Variation-in-Adoption Method

4 » Matching Methods

5 » Results

6 » Conclusions

Description of the program and the data

The screenshot displays the CUB Energy Saver website. At the top, a navigation bar includes a user profile with 532 Points Balance and \$117 Money Saved, along with links for Settings and Logout. The main header features the CUB Energy Saver logo and a navigation menu with options: Ways to Save (selected), Track Progress, Rewards, Products, and Community. Below the header, the 'Ways to Save' section is active, showing a list of energy-saving actions with their estimated yearly savings. A sidebar on the left provides category filters such as 'Most popular', 'Summer essentials', 'No cost', 'Low cost', 'Home investment', and 'All'. The main content area lists eight actions, each with a small image, a title, a status button (e.g., 'I did it'), and a green box indicating the estimated yearly savings.

Action	Estimated Yearly Savings
Reduce air leakage	\$265
Use a programmable thermostat	\$140
Raise your AC thermostat	\$62
Use a ceiling fan, not the AC	\$65
Use blinds during the summer days	\$24
Clean window AC filters often	\$12
Turn off AC before leaving	\$15

Source: Harding & McNamara (2011)

Description of the program and the data

Tom, here's your electric use update.

Tom, you did not save electricity on your last bill. We determined this by comparing it to your bill from the same period last year. But don't worry, you can save next time by [following through on energy-saving actions](#).



You are using the same or more energy than last year.

Since Joining CUB Energy Saver on 10/25/10:

 **\$ 51** Money Saved  **392** Points Balance

See a few of our most popular ways to save electricity below:



Drying Rack

Use your dryer, a known energy hog, less frequently by using a drying rack or clothesline.

Wash larger loads of dishes

Simply fill your dishwasher before turning it on and start saving money. As always, when you go to the [ways to save page](#), you'll see customized tips and expected results from your actions.

Good job Tom! You are saving energy!

You have saved money on your electric bill compared to the same time last year. You have earned **124 points** this month thanks to your energy efficiency efforts!



You are using less energy than last year.

Since Joining CUB Energy Saver on 10/25/10:

 **\$ 84** Money Saved  **746** Points Balance

See a few of our most popular ways to save electricity below:



Drying Rack

Use your dryer, a known energy hog, less frequently by using a drying rack or clothesline.

Wash larger loads of dishes

Simply fill your dishwasher before turning it on and start saving money. As always, when you go to the [ways to save page](#), you'll see customized tips and expected results from your actions.

Source: Harding & McNamara (2011)

Description of the program and the data

- » 8,140 participants
- » 163,573 potential controls
- » Billing data from January 2008 – August 2013
 - *Average Daily Usage* = $\frac{\text{Billing Usage}}{\text{Billing Days}}$
- » Enrollment date

Table of Contents

1 » Introduction

2 » Description of the program and the data



3 » Variation-in-Adoption Method

4 » Matching Methods

5 » Results

6 » Conclusions

Variation-in-Adoption Method

- » **Requirement:** Rolling Enrollment

- » **How it Works:** Late enrollees are controls for early enrollees

- » **Assumption:** After controlling for customer and monthly fixed effects, energy use and energy savings are not correlated with the timing of program entry

- » **Strengths**
 - No selection bias on decision to enter program

- » **Weaknesses**
 - Could still be selection bias based on timing of enrollment
 - Only uses some of the participants data to estimate savings
 - Difficult to study long-term effects

Quasi-test of VIA assumption: Plot the pre-program treatment effect

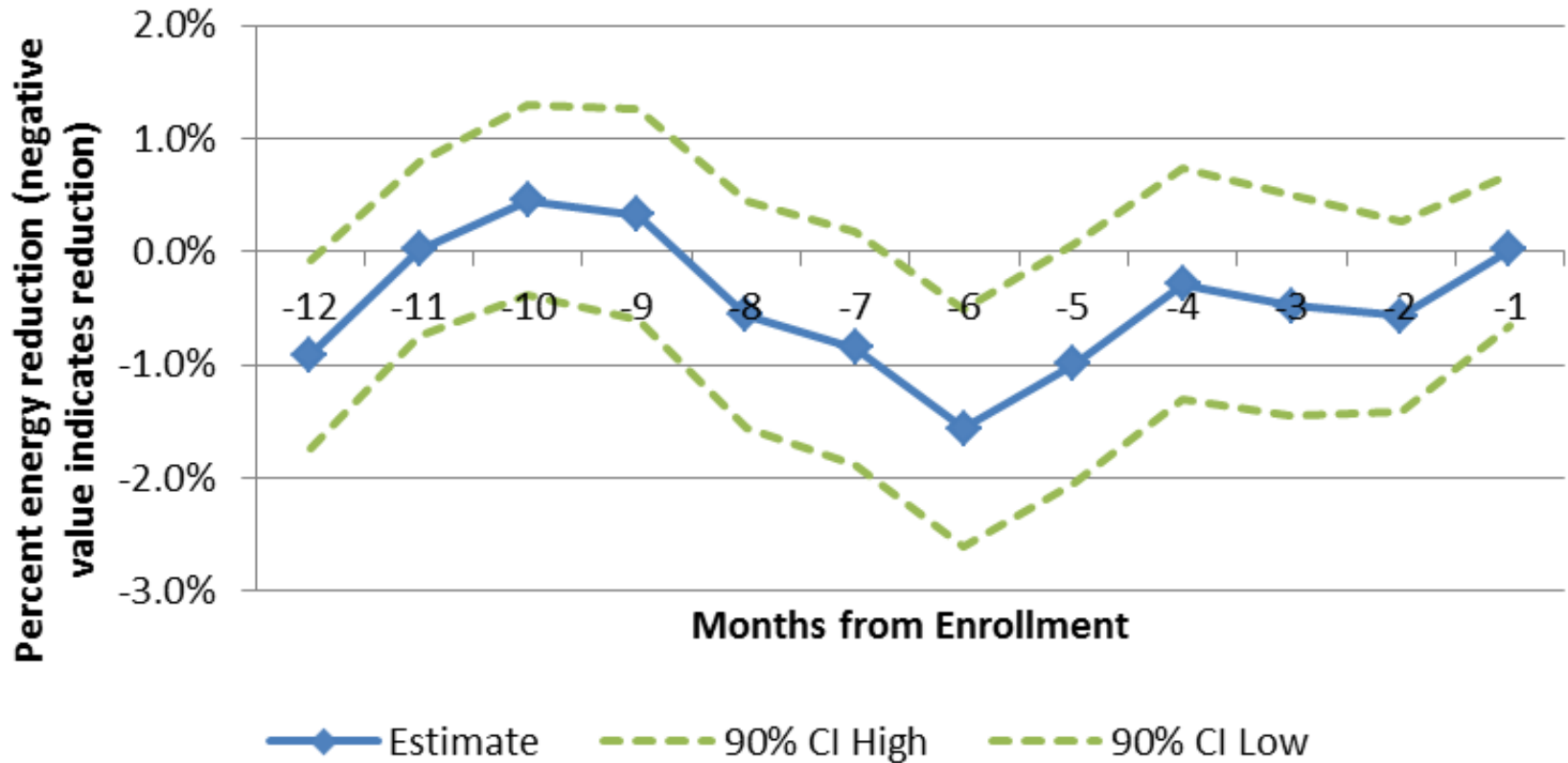


Table of Contents

- 1 » Introduction
- 2 » Description of the program and the data
- 3 » Variation-in-Adoption Method
- 4 » Matching Methods**
- 5 » Results
- 6 » Conclusions

Matching Methods

- » **Requirement:** Data for a large number of households who never entered the program
- » **How it Works:** Select controls from non-participant households via matching
- » **Assumption:** After controlling for customer and monthly fixed effects, energy use in the absence of the program is not correlated with the decision to enroll in the program

- » **Strengths**
 - Utilizes data from all program participants
 - Allows estimation of long-term program effects
- » **Weaknesses**
 - Does not control for selection bias on entering the program

Quasi-test of matching assumption: Difference in pre-program usage during “test period”

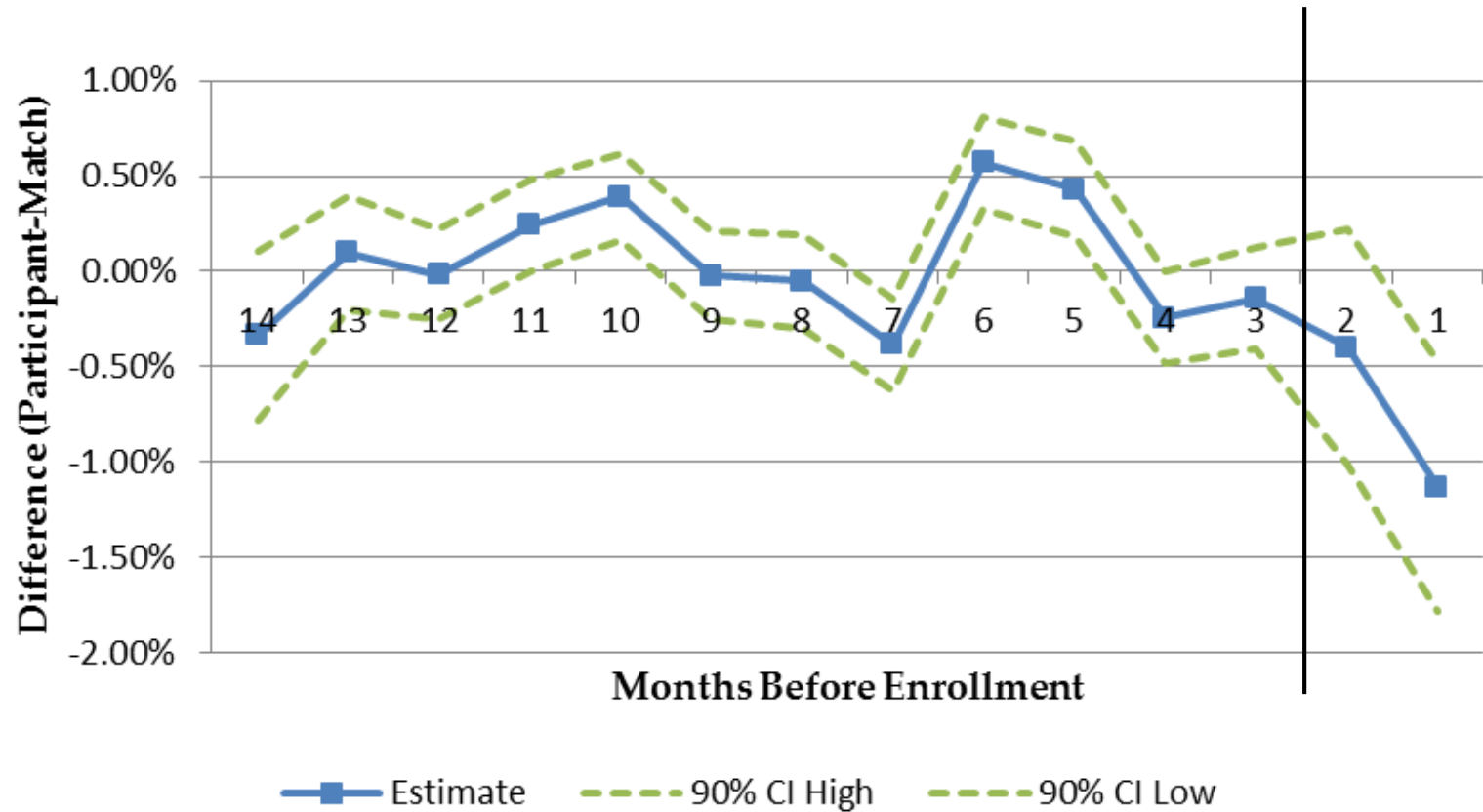


Table of Contents

1 » Introduction

2 » Description of the program and the data

3 » Variation-in-Adoption Method

4 » Matching Methods



5 » Results

6 » Conclusions

Results

Type of Statistic	Method		
	VIA	RPPM	MBC
Number of Participants used in analysis	8,138	6,973	6,973
Average Percent Savings	3.81%	3.86%	3.57%
	<i>0.59%</i>	<i>0.42%</i>	<i>0.21%</i>
Average kWh savings per customer per day	0.985	1.037	0.956
	<i>0.152</i>	<i>0.117</i>	<i>0.056</i>

Table of Contents

- 1 » Introduction
- 2 » Description of the program and the data
- 3 » Variation-in-Adoption Method
- 4 » Matching Methods
- 5 » Results



6 » Conclusions

Conclusions

- » VIA shows no evidence of selection bias, matching is ambiguous
- » Convergent validity
- » Process evaluation desired in future
- » 3.5%-4% savings are good compared similar programs

For quasi-experimental methods, best practice should be to run several different methods with quasi-tests for bias

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What to match on?

1. Often these other variables are not available to the analyst.
2. Past energy use is the best single predictor of current energy. In our dataset, correlation between past and current energy usage is 0.85.
3. Other variables can be included in the regression portion of the matching method.
4. Other variables are unlikely to be statistically significant when past energy use is in the regression equation.
5. Matching on many variables reduces the pool of potential matches.
6. There is only an issue if the difference in other variables is observed *on average* across participants and their matches.