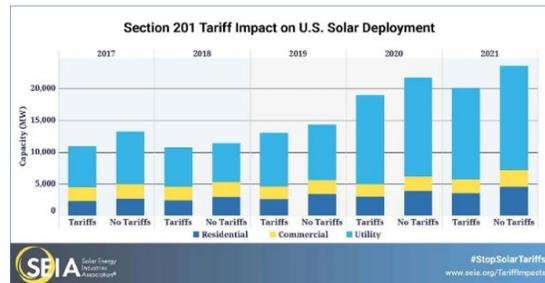


Using experimental methods to examine solar panel adoption using experimental economics

Timothy Tan, Department of Resource Economics, University of Massachusetts Amherst

Brief description of the experiment

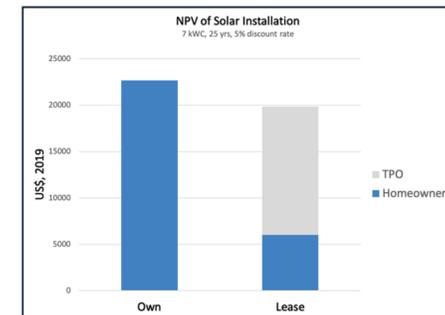


Risk Preferences

The experiment focuses on how risk and time preferences impact household solar adoption in Massachusetts.

- Risk: Policy changes and price fluctuations are the main risk factors impacting adoption decisions.
- Time: The high upfront costs of installation are weighed against the cost reduction benefits that accumulate as the duration of ownership increases showcasing how delayed rewards over time impact adoption decisions.

Time Preferences



Experimental Methodology

The Purpose

The purpose of experimentation in economics is to verify the validity of economic laws.

Design Principles

The main principles for an experimental design are:

1. Simplicity
2. Incentive vs No Incentive
3. Controlled Environment

All economic experiments must adhere to these principles to ensure the accuracy and reliability of the results.

Experimental Design

Types of experimental design:

- Individual experiment: Focuses on the characteristics of the subjects
- Group experiment: Focuses on the social aspect
- Within subject design
- Between subject design
- Cross-over design
- Factorial design

Human Subjects

Types of human subjects available:

- Students
- Nonstudents
- Novices
- Experts

	Advantages	Disadvantages
Students	<ul style="list-style-type: none"> • Access • Convenience • Low Opportunity Cost 	<ul style="list-style-type: none"> • Classroom relationship compromises external validity
Nonstudent	<ul style="list-style-type: none"> • Lower risk of failing external validity 	<ul style="list-style-type: none"> • May lack literacy and sufficient comprehension
Novices	<ul style="list-style-type: none"> • Lower risk of failing external validity 	<ul style="list-style-type: none"> • Lack skills needed for experiment
Experts	<ul style="list-style-type: none"> • Have the skills needed • Costs to meaningful incentives are higher 	<ul style="list-style-type: none"> • Lean towards habitual behavior

Laboratory Facilities

	Advantages	Disadvantages
Manual	<ul style="list-style-type: none"> • Provides flexibility. 	<ul style="list-style-type: none"> • Organizing results for data collection is difficult
Computer	<ul style="list-style-type: none"> • Organizing results for data analysis is easy • Allows for online modes of experimentation 	<ul style="list-style-type: none"> • Commitment of time, space and energy required. • Depends on the funding available to the school.

Conducting the Experiment

A multitude of things need to be considered when executing the experiment...

- Pilot Experiments (done within the university)
- Recruiting subjects
- Reserving lab time and other setup related considerations
- Monitors/Experimenters

- Instructions
- Dealing with queries
- Recording the data
- Debriefing (discussing the results and findings)

Residential household solar adopters



Fig 1. Household solar adoption via roof installation

Test for Time Preferences

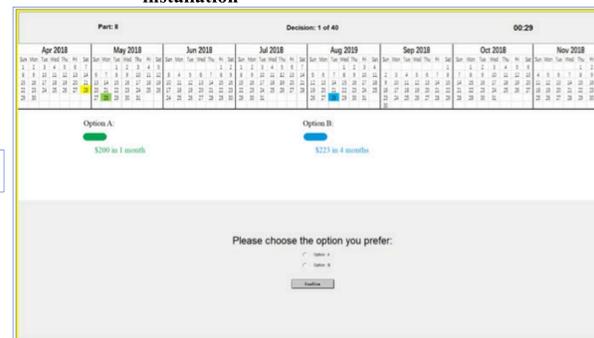


Fig 2. The option given to participants that will reveal their time preferences

Test for Risk Preferences

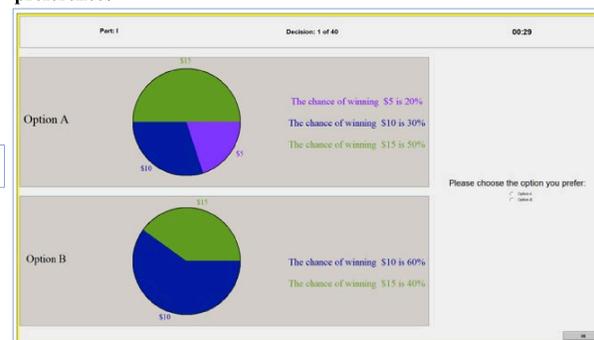


Fig 3. The option given to participants that will reveal their risk preferences

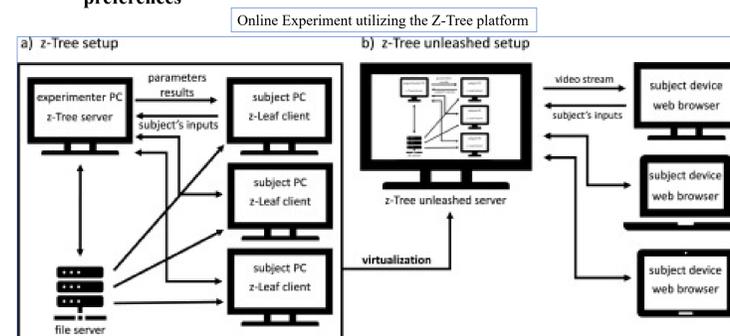


Fig 4. Z-Tree unleashed operates in a closed loop so that privacy and integrity of information is maintained.

Application: Solar Adoption

The Purpose

Using randomized control trials to examine causality that occurs in society.

Design Principles

The experiment incorporates all the key design principles.

Experimental Design

Our experiment has a single treatment. It is not a randomized control experiment. It is an individual experiment.

Human Subjects

In our experiment, the human subjects are made of half solar adopters and half non-solar adopters. The experiment includes 200 subjects, half being comprised of solar adopter and the other half of non-solar adopters. The subjects in our experiment consists of residential households in the state of Massachusetts from various towns. Commercial businesses and other entities are not included.

Laboratory Facilities

Computer mode has been chosen as the mode of choice. The advantages of being a large research university gives us the ability to tap into the funding available to conduct the experiment online using Z-tree unleashed where the experiment happens synchronously in real time. The experiment is conducted using Z-tree where all inputs by participants are logged and stored in FileZilla to maintain privacy while ensuring all inputs came from within the test subject group.

Conducting the Experiment

- Pilot Experiments: executed within the university.
- Recruiting subjects: letters were sent out to randomly selected household addresses out of 2.7 million households, roughly 2,000 – 3,000 letters are sent.
- Reserving lab time: not needed to carry out the experiment as links would be sent to participants online.
- Monitors/Experimenters: recruitment would come from within the university.
- Instructions: instructions would be read out during a zoom session with participants.
- Dealing with queries: queries are dealt with on an individual basis as opposed to a group basis.
- Recording the data: FileZilla is the main means to storing the data.

References:

Friedman, Daniel, and Shyam Sunder. *Experimental Methods: A Primer for Economists*. Cambridge University Press, 1994.
Source 1: <https://www.solarreviews.com/blog/policy-changes-shaping-solar-in-2020>
Source 2: ?

Acknowledgements

I would like to thank CAFE (Center for Agriculture, Food and the Environment) for funding the opportunity for me to engage with this kind of research and Prof. Rong for the advising that was given in regards to my experience as a research assistant in her research project.

