

Back to Basics: A Price Response Approach to Estimating Lighting Freeridership

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Agenda

- Evaluation Context
- Program Description
- Upstream Net-to-Gross (NTG) Approaches
- Our Approach
- Results
- Lessons Learned
- Conclusions

Evaluation Context

- Efficiency Maine Trust (EMT)
Residential Lighting Program (RLP)
 - Contracted with Cadmus in September 2011
 - Impact & Process Evaluation of FY2011
 - Final Report: September 2012
- Freeridership analysis (impact evaluation)

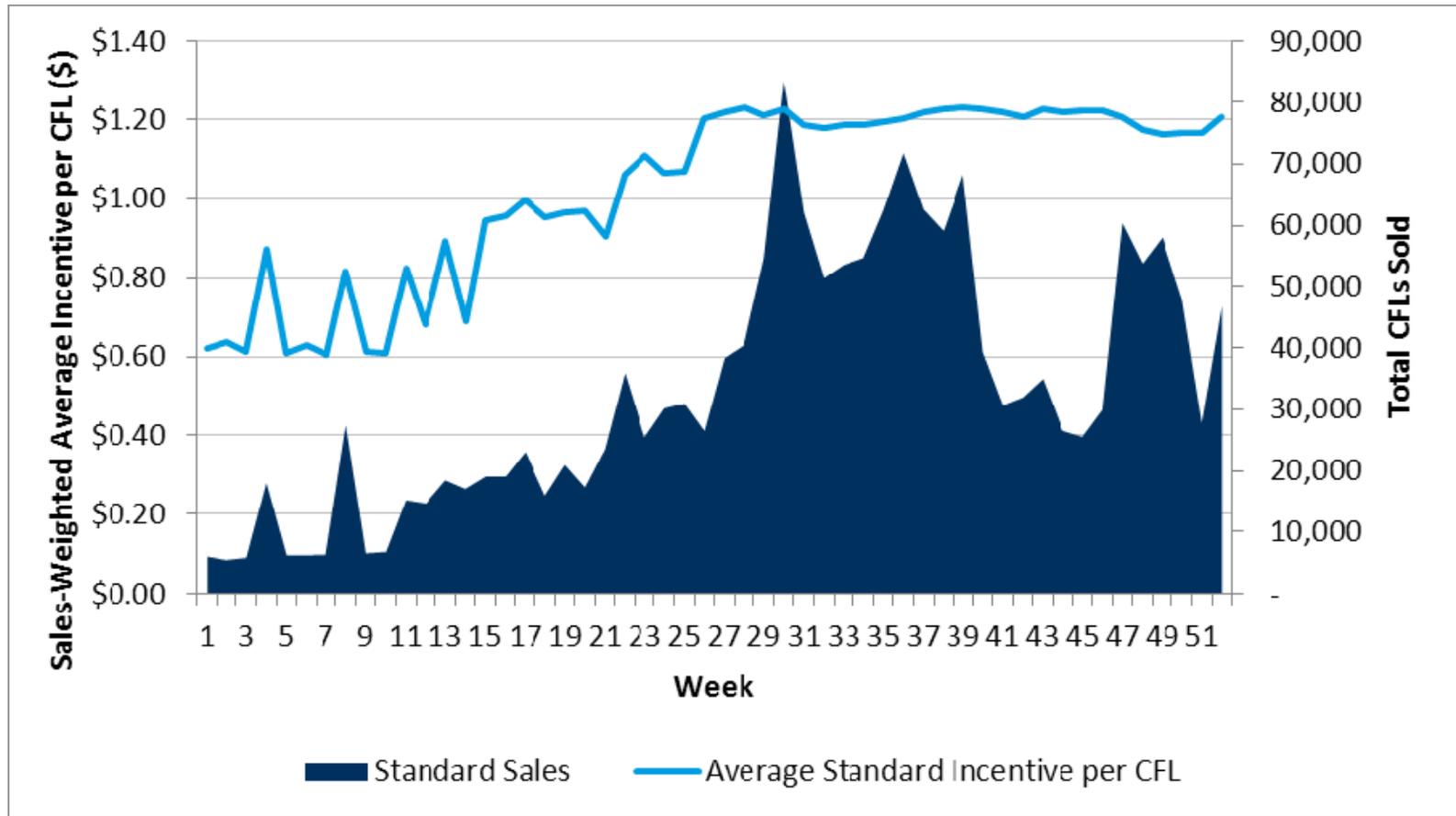
RLP Program Description

- **Provides financial incentives** to encourage sale, purchase, and use of CFLs by Maine consumers
- **Primarily a markdown program**
 - Markdowns: 90% of program budget
 - In-store coupons (some smaller stores)
 - Pilot CFL giveaway with Appliance Rebate program
 - Contracts with implementer to administer the program
- **Active field staff** presence at retail stores:
 - Verify markdowns
 - Restock coupons
 - Educate retail staff and consumers

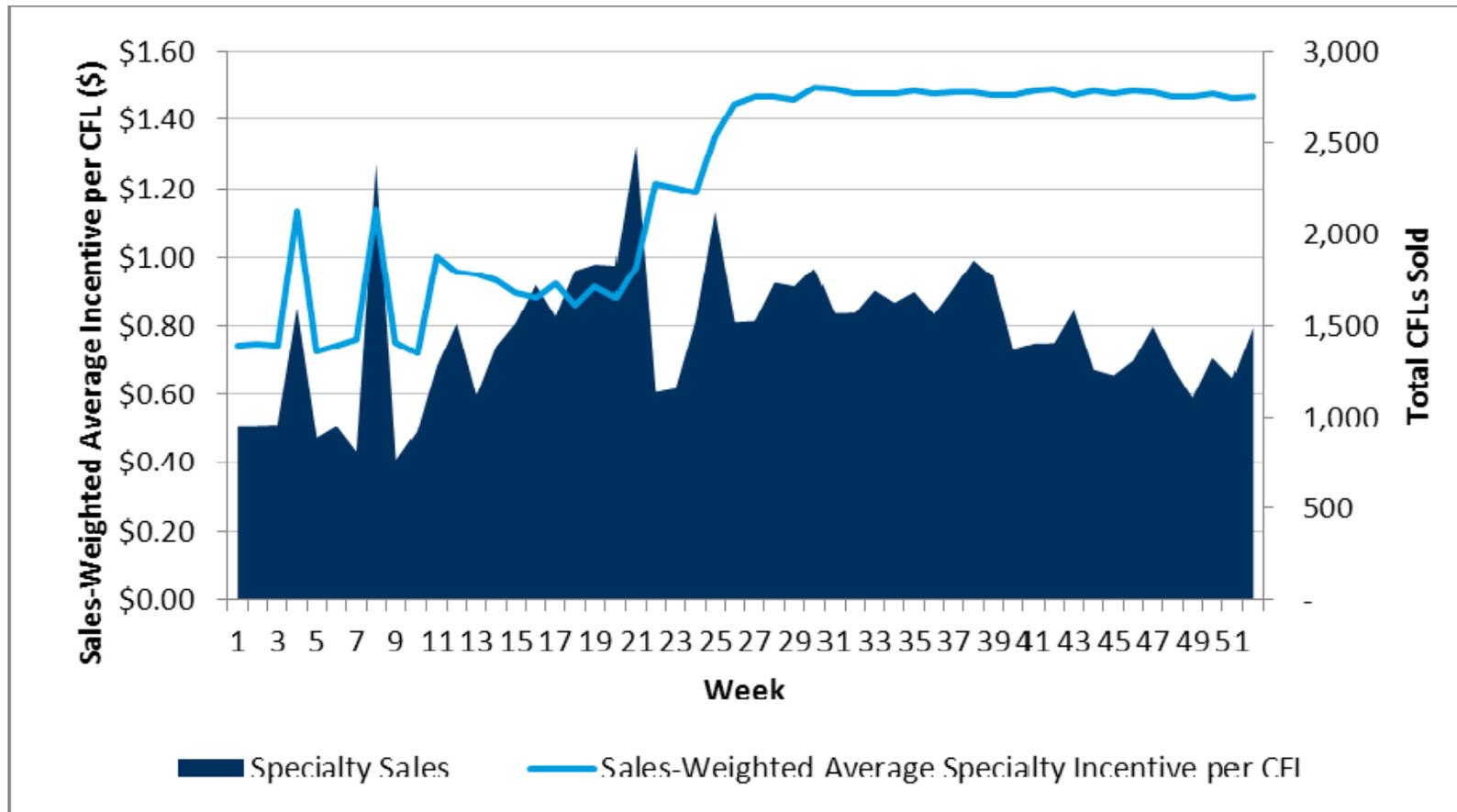
RLP Program Implementation

- **Significant shift in 2011:**
 - Re-purposed \$500,000 from TV advertising to increase markdowns
 - Discrete, substantial change in price of program CFLs
 - Typical markdown: \$1.25 per CFL
- **Results:**
 - Program CFL initial cost in line with (lower than) incandescent bulbs
 - Retailers motivated to invest in off-shelf merchandising (floor and end cap displays, larger signs)

Program Standard CFL Sales



Program Specialty CFL Sales



Upstream Program Design

- Price signal is main lever
- Demand is elastic (responds to price)
- Market share or econometric methods are preferred NTG approaches, however:
 - Not been used much in the past
 - At times, data inadequate data to quantify elasticity (price response)

Source: Cook, G. (2008). *Attribution Methodology Wars: Self-Report Versus Statistical number Crunching- Which Should Win?* ACEEE Summer Study.

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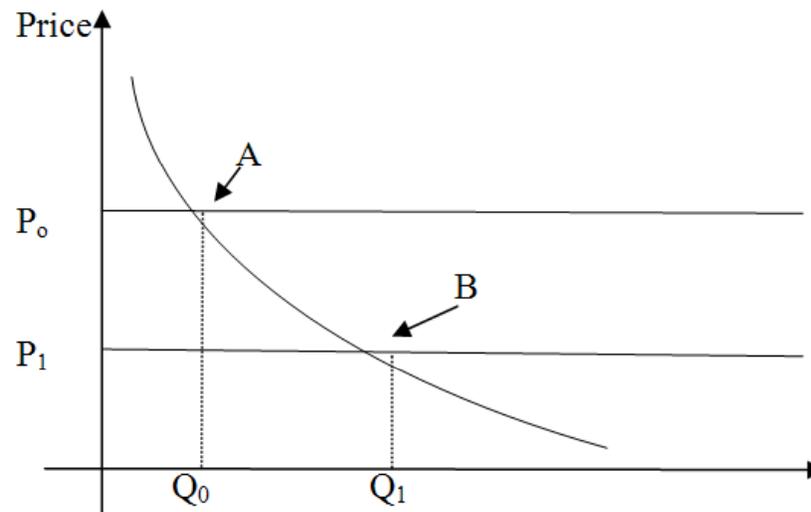
Overview of NTG Approaches

Approach	Pros	Cons
Self-Report	<ul style="list-style-type: none"> • Simple • Less expensive • Takes into account complexities of program-participant interaction. • Can use multiple data sources (i.e., vendor interviews). 	<ul style="list-style-type: none"> • Biases: non-response bias, recall, potential specification bias (scoring freeridership values) • Can underestimate spillover • Sampling can be difficult
Market Share	<ul style="list-style-type: none"> • Addresses trends in entire market • Useful if participation not well defined 	<ul style="list-style-type: none"> • Difficult to obtain data
Econometric	<ul style="list-style-type: none"> • Provides quantitative estimates of magnitude of net impacts • Based on measured data • Tests for bias and precision can be included 	<ul style="list-style-type: none"> • Sample often not randomly determined • Potential for omitted variable bias • Heterogeneity in customer base • Difficult to obtain data • Often omits trade ally effects (spillover)

Source: Cook, G. (2008). *Attribution Methodology Wars: Self-Report Versus Statistical number Crunching- Which Should Win?* ACEEE Summer Study.

Price Elasticity Approach: Theory

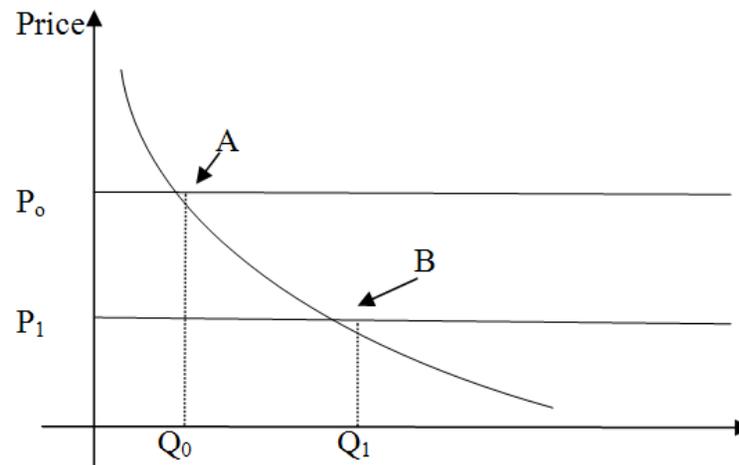
- Consider a downward sloping demand curve:



- Assuming elastic demand (as shown), shifting price P_0 to P_1 should shift Q_0 to Q_1

Price Elasticity Approach: Theory

- If P_0 is the initial bulb price and P_1 is the price of the program bulb (with markdown), then Q_0 is freeridership (would have purchased at P_0)



- We have P_0 , P_1 , and Q_1
- If we know the slope of demand curve, we can predict Q_0

$$\text{Net of freeridership sales} = \frac{\text{Gross Sales} - \text{Net Sales}}{\text{Gross Sales}} = \frac{Q_1 - Q_0}{Q_1}$$

Estimating Price Elasticity: Theory

- Given variation in the markdown over time, and hence price, we can estimate the price elasticity
 - This variation across time and space (different bulbs) gives variation necessary to econometrically fit demand curve (observations of price-quantity pairs)
- Prices often changed en masse with negotiation of MOUs
 - Acts as a natural experiment
- Required data:
 - Program and non-program price
 - Variation in price (markdown) over time
 - Data on external factors that affect price (e.g., specialty/standard, wattage, manufacturer, retailer)

Estimating Price Elasticity: Model

- Use regression models to estimate slope of demand curve (elasticity)
- Typical equation:

$$\ln(\text{sales}) = \beta_0 + \beta_1 \ln(\text{price}) + \sum \beta_\gamma \text{Fixed Effects}_\gamma + \sum \beta_\delta \text{Time Effects}_\delta$$

- Use regression results to predict sales if price at the original retail level

Benefits of Our Approach

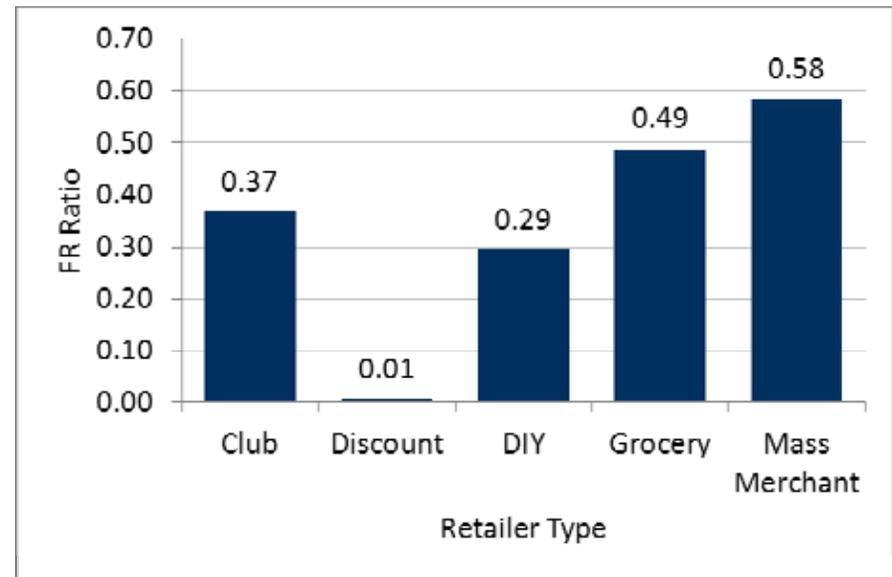
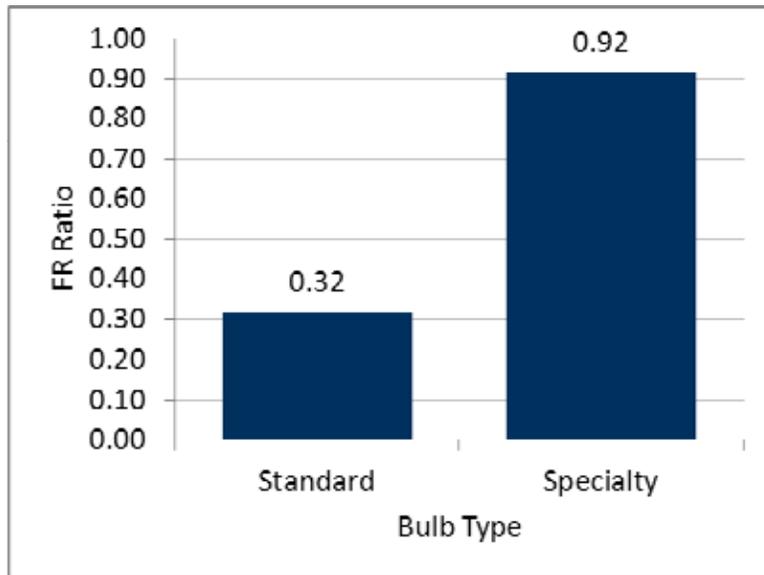
- Built on strong theoretical foundation
 - Basic price theory
- Produces stable, reliable estimates
 - Data driven
 - Little chance for measurement error
 - Removes subjectivity (i.e. what customer thinks would have done at different price or without program)
 - Can provide statistically valid results
- Based on actual purchasing behavior
- Assumptions clearly presented
- Able to explicitly quantify factors affecting freeridership

Limitations

- **Assumptions**
 - Price elasticity same for customers who purchase program and non-program bulbs
 - Prices remain constant over study period for competing goods (incandescents)
 - Elasticity is constant over the price range (no non-linearities)
- **Cannot capture**
 - Non-like spillover (showerheads, aerators, etc.)
- **Difficult to capture**
 - Like spillover (need, at minimum, understanding of price trends for non-participating retailers/bulbs)
 - Impact of marketing (need detailed data)
- **Potential for error in model specification**
 - Bias from unobserved variables

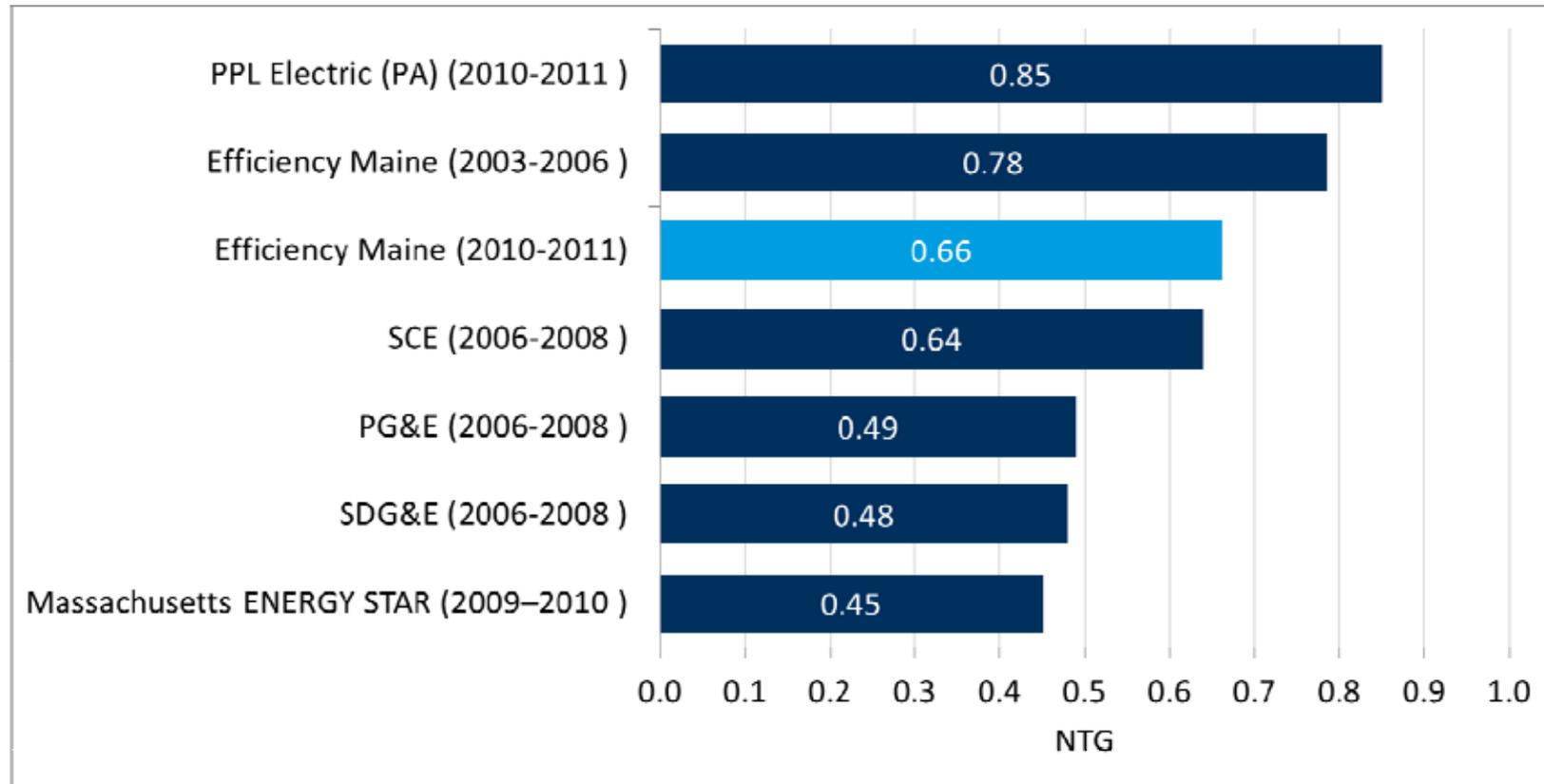
RLP Results

- Program Overall Freeridership: 0.34



- Program Overall NTG: 0.66

Results in Context



- Implementing contractor noted that freeridership similar to their internal analysis

Looking Forward

- Approach presents a good opportunity for cost-effective, stable freeridership results
 - May be extended to spillover, using supplementary data from nonparts & manufacturers
- Data driven methods more viable as point-of-purchase (POP) data more available
 - Cadmus implementing similar NTG approach in evaluations for several utilities

Lessons Learned: Keys to Success

- Understand program implementation and operation well; ensures model well-specified
 - For example, needed to know the program included in-store promotions and when those promotions occurred so model can account for their effect
- Understand the data
 - QA/QC critical
- Strong communication between evaluation team and program implementation team
 - Evaluator needs access to data experts to resolve questions and understand any issues/limits of data

Lessons Learned: Challenges

- Getting buy-in from non-technical stakeholders
 - Comfort with data driven approach, but “econometrics” is a black box, which leads to questions, such as:
 - Why should I believe that? How can I know if they did it correctly?
 - Can be hard to explain intricacies in “plain English”
 - Self-report/survey methods easier for non-technical audience to understand

Conclusions

- Process went well overall
- Econometric methods not easily understood or explained. Initial reactions:
 - “I need to understand the underlying methodology to remove doubts about the results.”
 - “I just don’t know how [they] did it. It may have been wonderful, but I have no way to know.”
- Ability for evaluator to work directly with implementing contractor was important

Questions?

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