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Bill Salience, Bill Design, and their Impacts on Residential Energy Consumption

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RESEARCH OBJECTIVES

TRC sought to **understand bill salience** in Southern California Edison (SCE) territory.

Average Impacts	Does a measurable bill salience effect exist for SCE customers?
Distribution of Impacts	Are there customer groups that exhibit greater or lesser impacts on energy use following a bill? Are there external factors that drive the impacts?
Bill Element Drivers	What elements of the bill itself are particularly salient? Are there elements of a bill that may increase or inhibit impacts on energy use?

METHODOLOGY

Billing Analysis

Using meter data and metadata, TRC analyzed the variation in energy usage following the receipt of a bill relative to energy use preceding the bill.

User Experience Tests

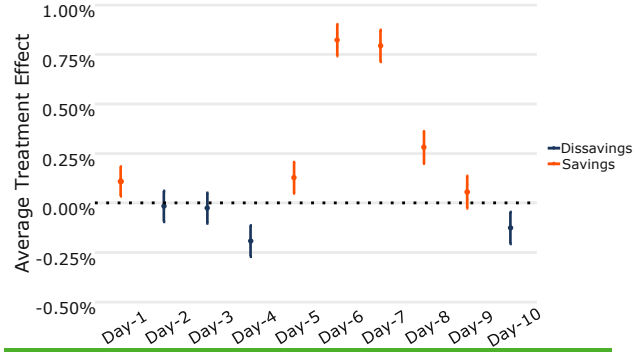
TRC conducted walkthroughs of the bill with customers to understand customer behaviors and reasons for bill salience.

Limitations: The user experience tests were only done with customers who receive paper bills. Therefore, these results may differ for those who receive online bills.

FINDINGS

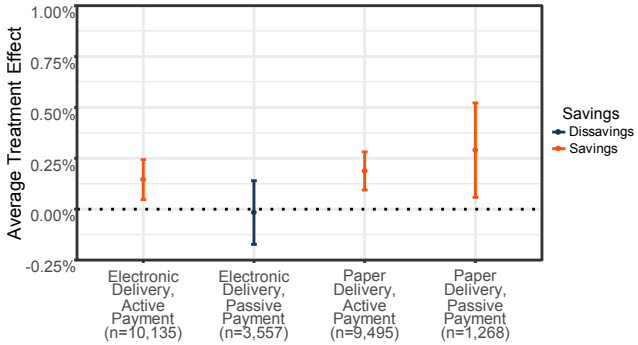
Positive Bill Salience Effects

TRC found an average positive bill salience impact of **approximately 0.18% in the 10 days after the statement is created**, meaning there is a significant decrease in energy usage following the creation of a bill statement.



Effect of Delivery and Payment Type

A two-by-two classification of bill delivery (paper vs. electronic) and payment method (active vs. passive) reveals **salience effects for all combinations except accounts with both electronic delivery and passive payment**.



The user experience tests found that passive payment customers may be less likely to consciously think about their bill amount.

Income Related Differences

Although there is uncertainty around income estimates, on average, **lower income accounts show higher salience effects** than higher income accounts.

Confusion Impacts on Bill Salience

More than half (n=11, 57%) of user experience respondents **found one or more parts of their SCE bill confusing** or difficult to understand.

"I don't understand what any of this [new charges section] means. I know that at one point I got a credit back - but didn't really understand why." – *User Experience Respondent*

Customers also mentioned skipping over bill sections they found confusing. This tendency could **lead to a decrease in overall comprehension of their energy usage** – and, by extension, an inability to take effective action to reduce their energy use in response to a bill.

Perceived Impact on Bills

47% of respondents felt **that they didn't have any power to impact the amount they owe** on their bill.

Impact on Bill Salience

When customers perceive that they have little control over their energy use, they may be less motivated to explore bill information about their energy use or to make changes as a result of receiving their bill.

Executive Summary

In order to provide insight into potential bill salience effects— that is, changes in energy usage caused by the receipt of a bill— for Southern California Edison (SCE) residential customers, TRC undertook a two-part research effort. First, we performed a quantitative analysis of advance metering infrastructure (AMI) meter data and metadata for a sample of customer accounts using statistical techniques to examine reductions in energy use following the receipt of a bill. Following the quantitative analysis, we conducted a set of customer user experience interviews to provide greater insight into the human drivers of reduced consumption attributable to receiving a bill.

Our findings are consistent with previous research that found that there is an average decrease in a customer's usage after they received a utility bill. Our quantitative evaluation found that on average, there is a positive bill salience effect of approximately 0.18% during the 10 days following a bill date, peaking on the 6th and 7th day after a statement is created with reductions of roughly 0.06% across all customers across the month. Further, we found this salience effect to be present specifically for delivery type and payment channel combinations that require higher levels of engagement with a bill (e.g., paper bill delivery or an active payment channel), whereas there was no significant effect for those who use both automatic payment and receive an electronic bill. Though this estimate is very small — particularly compared to the 1-1.5% savings from HER programs — these savings are extremely broad-based and the variability implies that there may be opportunities for increasing this response for some groups.

Our models also found that income plays an important role with bill salience, with lower income levels exhibiting higher salience effects, on average. Additionally, when segmenting several of the variables in the metadata by income, our team repeatedly found instances where lower income levels exhibited higher salience effects within the subsegment.

Following the quantitative analysis, TRC conducted user experience interviews with 19 residential SCE customers who received a paper bill and paid either actively or passively, including 4 CARE participants, to better understand how customers interact with their bill and identify elements of the bill and process that have implications for bill salience effects.

The interviews revealed a number of factors that could dampen the potential for customers to respond effectively to information contained in their bill. Over half found one or more parts of their SCE bill to be confusing or difficult to understand, many conceded to only paying close attention to their bill if the amount owed was unexpectedly high, and several customers felt they had little control over their bill amount and energy use. Moreover, some respondents felt they were already doing all they could to save energy. At the same time, interview respondents also provided some insight into how bill salience effects can unfold at the individual household level. Four respondents recalled instances where a high bill spurred them to discuss reducing their energy use with their households, and some relied on habit-based energy-saving strategies such as unplugging items, being mindful of peak times, or using less air conditioning that could all be heightened by or reinstated after receiving a bill.

This report highlights the research objectives and methodology for each phase of the research, documents research limitations, and provides detailed findings from both phases of this research effort.

1 Introduction

1.1 Purpose

This report details the methodology and findings from two complementary phases of research undertaken to help Southern California Edison (SCE) understand bill salience for its residential energy customers: a quantitative analysis using statistical techniques to detect bill salience effects across customers, and a set of user experience interviews to provide greater insight into the human drivers of reduced consumption attributable to receiving a bill.

This research set out to answer key questions related to bill salience effects, or changes in energy usage following the receipt of a bill, including whether a measurable bill salience effect exists for SCE customers and, if so, how large it is, how long it lasts, and for whom. The incorporation of qualitative user experience interviews also allowed TRC to delve further into residential customers' bill-related practices to provide insight into what elements of the bill may be particularly instrumental in any potential bill salience effects.

Taken together, the findings from both arms of this research effort allow us to better understand what elements of a utility bill are salient and which groups of customers experience different effects, shedding light on areas of opportunity to increase energy savings.

1.2 Previous Research

The most relevant research regarding bill salience effects comes from Gilbert and Zivin (2014).[1] The authors found that there was an average decrease in customers' usage after they received a utility bill. That study, however, is limited by the inability to analyze the data by whether bills were sent by mail or email, or if customers paid through an automatic bill pay channel or another method. Arguably, when studying bill salience, these details about the bill must be known in order to go beyond the average impacts and understand how responses may differ based on these factors.

This is highlighted by the finding in a study by Sexton (2015) that automatic bill payment (ABP) increased residential electricity consumption by 4% for a publicly owned electric utility.[2] The importance of payment channel is also highlighted in DNV GL's research for the California Public Utility Commission (CPUC) on PG&E residential customers in which they found that customers who enrolled in ABP or Budget Billing (BB) programs have higher energy usage than other customers.[3,4] That study, however, noted this increase in energy usage was mitigated for customers enrolled in Home Energy Report (HER) programs. Home Energy Report programs

[1] Gilbert, B., & Zivin, J. G. (2014). Dynamic salience with intermittent billing: Evidence from smart electricity meters. *Journal of Economic Behavior & Organization, 107,* 176-190.
[2] Sexton, S. (2015). Automatic bill payment and salience effects: Evidence from electricity consumption. *Review of Economics and Statistics, 97*(2), 229-241.
[3] DNV GL (2017). Auto Bill Pay and Budget Billing Impact Evaluation - Residential, California Public Utilities Commission. www.calmac.org. CALMAC ID: CPU0163.01
[4] Getachew, L., Agnew, K., Sadhasivan, G. (2018). Auto Bill Pay and Budget Billing Impact Evaluation - Residential Gas.

provide customers with information about energy usage (price and quantity); therefore, the provision of this information seems to be important.

The importance of information for moderating potential salience effects is supported by a randomized control trial studied by Jessoe and Rapson (2014) that mixed increases in prices during an event period with information provided by an in-home display (IHD).[5] The authors of that study were interested in understanding the price elasticity of electricity consumers and asked if the lack of complete information made consumers appear inelastic to price or if consumers actually were price inelastic. They found that relative to the control, residential electricity customers who were exposed to information feedback via their IHDs during an increased pricing event exhibited an 8-22% decrease in energy usage in that event period, whereas households who only experienced the price increase reduced demand by 0-7% during pricing events (households in both treatment groups were informed of upcoming price increases via email, voicemail, or text message). Thus, with real-time information, households became more elastic to price. Furthermore, they found that the treatment effects spilled over into non-event hours and days as customers formed conservation habits.[6]

Timing of the bill has also been investigated as an important factor in energy demand. Households in Germany receive their energy bills just once a year, in contrast to monthly billing in the United States. A recent study by Singhal (2020) found that German households used less energy for heating annually if their bill preceded the winter heating season as compared to households that were billed during off-winter months.[7]

The above evidence suggests that timing, program enrollment, payment channel, and information feedback are important considerations for bill salience research.

1.3 Key Findings

1.3.1 Quantitative Impact Analysis

- Positive Salience Effects
  - On average, our models indicate that there is a positive salience effect of approximately 0.18% during the 10 days after a billing statement is created.
  - These savings primarily occur on the 6th and 7th days after a statement is created.
- Engagement with Delivery and Payment are Key
  - Our models indicate that accounts which receive an electronic bill and use a passive form of payment (e.g., auto-pay) have approximately no salience effect.
  - Accounts which receive a paper bill and/or use an active form of payment have a positive salience effect.
- Income-Related Differences
  - On average, accounts with lower incomes have higher salience effects.

[5] Jessoe, K., & Rapson, D. (2014). Knowledge is (less) power: Experimental evidence from residential energy use. *American Economic Review, 104*(4), 1417-38.
[6] Ibid.
[7] Singhal, P. (2020). Inform Me When It Matters: Cost Salience, Energy Consumption, and Efficiency Investments.

  - Several programs, payment information, and demographic variables show higher salience effects for lower income groups.
- Home Energy Reports
  - Our models indicate that Home Energy Report recipients exhibit less bill salience than accounts which do not receive reports. This may be because of a *report* salience effect, rather than a bill salience effect for these customers.

1.3.2 User Experience Interviews

- Impact of Confusion on Bill Salience
  - More than half (n=11, 57%) of respondents found one or more parts of their SCE bill to be confusing or difficult to understand.
  - Customers described skipping over sections of the bill they found confusing, including key sections that could help them better understand their energy use and how to reduce it.
- Impact of Expectations on Bill Salience
  - Many respondents have expectations around their bill amount and note they are only likely to pay close attention to their bill when the amount due is not in line with these expectations.
  - This suggests that, for customers with a set expectation of how much they will owe, a bill will likely have a greater salience effect when it is considered “abnormally high.”
- Some Customers Feel They Lack Power Over Bill Amounts
  - Many customers we spoke to have the perception that they have little-to-no control over their bill, their energy use, and what SCE charges them.
  - This perceived lack of agency likely reduces bill salience and disincentivizes them to change their behavior, even if they receive a bill that they perceive to be too high.
- Managing Energy Use
  - Many respondents (37%) felt they were already taking actions to save energy at home but had simply exhausted their opportunities to reduce energy consumption.
  - Customers described a variety of strategies for managing their energy use, from longer-term investments such as purchasing energy-efficient appliances to more habit-based strategies like turning off lights when not in use.
  - Those who have invested in longer-term strategies may be less likely to change their behavior to impact their bill, whereas those with more habit-based strategies to reduce their energy use may be prompted to reinstate their habits after receiving a bill.

2 Methodology

2.1 Quantitative Impact Analysis

2.1.1 Overall Approach

Through the use of analytical approaches using advance metering infrastructure (AMI) data and SCE's customer data, we were able to identify whether a decrease in energy use is occurring following bill receipt, for how long and for whom, and under what conditions. The overall approach we used was to analyze the variation in energy usage following the receipt of a bill relative to energy use preceding the bill to understand the nature of any energy reduction and how it varies across customers.

This analysis used statistical techniques to detect whether customers' energy consumption after receiving a bill was lower than it was before receiving the bill, controlling for other key drivers of consumption, such as temperature. Using AMI data, TRC estimated these energy usage changes using a within-subject modeling approach to provide estimates for each unique account and bill combination. After joining a series of metadata for each account, the research team identified key variables correlated with these estimates across all customers using machine learning techniques. Then, TRC performed an impact segmentation analysis to understand the differences between these groups of customers and quantify bill salience estimates within various subgroups.

2.1.2 Detailed Methodology

Data Received and Data Cleaning

TRC received AMI data and metadata for a sample of customer accounts. The metadata included demographic information, bill payment and delivery characteristics, program participation, and hourly weather data. The availability of these data allowed the research team to investigate bill salience effects based on several different account characteristics. Table 2-1 outlines the steps taken during data cleaning and the number of observations and accounts remaining after each step. Less than 1% of accounts were dropped during data cleaning and preparation.

Table 2-1. Data Cleaning

Step	Observations Remaining	Accounts Remaining
Step 1: Load the raw AMI data	385,915,958	22,000
Step 2: Remove exact duplicates	385,913,171	22,000
Step 3: Average multiple hourly reads for each account	385,894,100	22,000
Step 4: Subset to pre and post periods	211,667,886	21,991
Step 5: Remove overlapping bill-account events	207,484,032	21,988
Step 6: Remove accounts with over 50% of reads equal to zero	206,856,352	21,883
Step 7: Remove outlier accounts	206,758,695	21,872
Step 8: Remove outlier observations	206,748,446	21,872
Step 9: Subset to account-days with at least 23 hours in a day	206,678,406	21,872
Step 10: Subset to account-events with 7 pre-period days and at least 1 post-period day	204,802,551	21,872
Step 11: Aggregate data to daily level	8,534,646	21,872
Step 12: Join metadata and remove customers missing weather information	8,534,245	21,871

Modeling

The modeling portion of the analysis involved two main components, identifying key variables and estimating salience impacts.

Identifying Key Variables

TRC estimated bill salience impacts for each unique account and bill combination, controlling for weather using a within-subject modeling approach. Then, the research team used machine learning techniques to identify which variables in the metadata showed a high correlation with these estimates. The process involved using auto machine learning techniques to construct several models to fit the data and selecting the top-performing model based on root mean square error (RMSE). TRC experimented with auto machine learning on the regular dataset as well as one-hot encoded[8] variables to see how the results varied by data preparation. The top performing model was a stacked ensemble model composed of several underlying models. These models suggested that salience impacts are correlated with month, year, income, bill delivery type, and various payment information associated with the account. The research team

[8] One-hot encoding is a way of representing mutually exclusive categorical variables in numeric form.

investigated these variables, along with several other variables of interest to identify the bill salience impacts within each segment.

Estimating Impacts

TRC estimated overall percent savings, percent savings by "post day",[9] and percent savings by hour of the day during the 10 days following the statement. Looking at these three different categorizations of savings allowed us to understand better when and if there is a bill salience effect. Equation 2-1 presents a representative regression equation for the overall percent savings specification. We include account-level fixed effects to control for unobserved factors that do not vary over time, such as demographic characteristics of customers. The function asinh refers to the inverse hyperbolic sine (hyperbolic arcsine). This transformation, much like the logarithmic transformation, allows us to estimate percentage changes of the marginal impacts, but unlike a logarithmic transformation, asinh is defined at zero, allowing us to include observations with zero cooling degree days or heating degree days. We clustered the standard errors at the account level to allow for arbitrary correlation between observations for the same account.

Equation 2-1. Overall Percent Savings

$$\begin{aligned}\text{asinh}\,(kWh)_{it} = \beta_1 Post_{it} + \beta_2 \text{asinh}\,(CDH)_{it} + \beta_3 \text{asinh}\,(HDH)_{it} + \beta_4\,\text{asinh}(CDH^2)_{it} \\ + \beta_5 \text{asinh}\,(HDH^2)_{it} + \beta_6 \text{asinh}\,(CDH * HDH)_{it} + \alpha_t + \gamma_i + \epsilon_{it}\end{aligned}$$

Where:

kWh_{it}	is the average kWh consumption by account *i* on day *t*;
$Post_{it}$	is a binary variable taking the value of 0 during the 7 days prior to a bill statement being created and 1 during the 10 days following creation of the statement for account *i* at time *t*;
CDH_{it}	is the number of cooling degree hours for account *i* at time *t*;
HDH_{it}	is the number of heating degree hours for account *i* at time *t*;
β_k	are regression slope coefficients;
α_j, *and* γ_i	are year-month and account fixed effects; and
ϵ_{it}	is an idiosyncratic error term.

The research team analyzed bill salience impacts by customer segment using three models. The various model specifications allowed us to estimate overall, day-specific, and income-specific impacts. The three models provide a percent savings average treatment effect (ATE) associated with each customer segment, controlling for weather, account fixed effects, and time fixed effects. These findings are discussed in the Detailed Findings section of this report.

[9] "Post day" refers to the ordered count of days after the bill statement date. That is, on the day after the statement date post day = 1, the day after that post day = 2, etc.

2.2 User Experience Interviews

2.2.1 Overall Approach

Following the quantitative analysis, TRC undertook a series of user experience interviews to understand how SCE residential customers interact with their energy bill. The primary objectives for this phase of the research were to:

- Understand the overall salience of bills for customers.
- Understand customer behaviors upon receiving a bill.
- Identify opportunities for improving the SCE bill pay experience.

User experience interviews aim to test the "effectiveness, efficiency and satisfaction with which specified users achieve specified goals in particular environments."[10] This research approach is intended to extract insights from customers on their behaviors, motivations, habits, and concerns related to a specific product or deliverable. In many cases, the researcher aims to replicate the experience of using that product or deliverable without research intervention to discover the user's genuine experience with the product. User experience interviews therefore gain deeper insights about a product or deliverable than a survey alone.

In this case, the research team employed user experience interviews to understand how residential customers who receive a paper bill in the mail from SCE interact with the information on their energy bill. These user experience interviews included a walkthrough of a paper bill with these customers, allowing the customers to directly reflect on their experience receiving a bill while viewing the document. This allows for a replication of the experience of receiving their bill in a research environment.

2.2.2 Detailed Methodology

Sample Overview

The research team interviewed 19 residential SCE customers for this user experience interview effort, with a target of 21 completes. We targeted three strata with a target of seven completes per strata, using the data set of customers from the quantitative portion of this research. For user experience interviews, the data received from each interview is richer than a survey. Therefore, the data received from the interviews often reaches saturation around seven completes.

Originally, a fourth strata was included in the sample targets, which was a group that participated in the California Alternative Rates (CARE) program, but paid passively. This group was ultimately dropped from the recruitment effort, as we had conducted outreach by phone and email at least four times per customer with no completes. Additionally, this group is much smaller than the other groups in the sample, consisting of only 1.5% of the customer accounts in the original customer data set given by SCE. Further details about the sample are outlined in the table below:

[10] International Organization for Standardization, 1998. ISO9241 Ergonomic, Part 11: Guidance on Usability. Geneva, Switzerland.

Table 2-2. Interview Sample

Stratum	Bill Delivery	Payment	CARE Participation Status	Target n	Respondent n
1	Paper	Active	Participant	7	4
2	Paper	Active	Non-participant	7	7
3	Paper	Passive	Non-participant	7	8

In Table 2-2:

- **Bill delivery** refers to the mode by which customers receive their SCE energy bill. Our team uses the customer's most recent mode of bill delivery in our sample to determine this.
- **Payment** refers to whether the customer pays their monthly bill manually either online, by check, or by phone (i.e., "active") or whether they have an automatic payment plan in place, usually directly tied to their bank account to be pulled on a certain date (i.e., "passive").
- **CARE participation** status refers to whether the customers is enrolled in California Alternate Rates for Energy (CARE).
- **n** refers to the number of interviews we completed within each group.

Research Limitations

During this research effort, TRC encountered several barriers to the methods and sample that will impact the research results. We have outlined each limitation below with an estimation of its impact on the research results.

Bill Delivery Method

We opted to focus on customers with paper bill delivery for the purposes of this usability testing effort; however, many SCE customers pay their energy bill via online bill delivery. We opted to focus on customers with paper bill delivery for a two primary reasons:

1. Our earlier Bill Salience research indicated a high salience effect among customers that use paper bill delivery.
2. To conduct usability tests with customers using online bill delivery, the research team would have needed access to a dummy *My SCE* account with a representative bill or would have needed to ask customers to share their account via screen share in order to actively review a bill with the interviewee. The first option was deemed too much of an administrative burden; the second option came with privacy concerns.

While the scope of this current usability testing effort delivers findings on customers who interact with their SCE bill via paper bill delivery, it may be in SCE's interest to pursue a second usability testing effort in the future to explore the salience of customers that utilize online bill payment.

Service Type and Bill Design

We stratified our sample by payment type and CARE participation status and used an example bill with a Domestic (non-TOU) bill design in our UX testing. We did not stratify our sample

based on service type. Based on responses from interviewees, it is likely that some had TOU service, and thus receive bills with TOU bill designs. Thus, the bill design used as an example in their interviews would differ from the bill they receive. The discussion with the interviewees was specifically about their bill, with the sample bill as a guide, so we do have some information based on TOU accounts. Specific TOU-related investigations could be an area for future research.

Sample Quality

The sample quality associated with the user experience effort proved to be a challenge. Of the overall sample,11% had invalid emails and of those contacted by phone 12% had wrong or disconnected phone numbers. This was a particular challenge for the CARE active strata, who had the smallest sample (309) and the largest proportion of invalid phone numbers or emails.

Point-of-Contact

The research team observed that, while the point-of-contact associated with an SCE account tended to be the male of the household, we commonly heard in recruiting calls that SCE's contact person was not the billpayer in their household.[11]

Solar Customers

Of the respondents we interviewed, more than half (57%) had solar panels installed on their home. While solar has become more popular within Southern California – and it is likely popularity will continue to rise – this breakdown is not representative of Southern California Edison's population. The distribution of solar customers within the sample is detailed in Table 2-3.

Table 2-3. Number and Percent of Respondents with Solar Panels

	N of Solar Customers	Percent of Respondents
Overall	**11**	**57%**
Non-CARE, Passive Payment	5	62%
Non-CARE, Active Payment	5	71%
CARE Participant, Active Payment	1	25%

The research team does not have a researched explanation for why these customers were more likely to respond to recruitment and complete the user experience interviews. Our theory is that individuals who are apt to get solar have more of an interest in their energy experience and thus may be more willing to take part in an interview about their experience with their bill. In 2019-20, TRC conducted exploratory Grid Edge Research with customers across the United States who had recently installed solar panels to reduce their dependency on the electric grid. All the respondents in this interview effort cited a keen interest in the customer-utility

[11] This tracks with national trends; a 2019 Doxo study (https://www.doxo.com/insights/doxo-launches-doxoinsights/) analyzed aggregate payment statistics from 50,000 billers and 2.5 million users, and found that women are, on average, 12% more likely to pay household bills than men.

relationship; they noted that they had always carefully monitored their usage and spending trends and were eager to provide feedback on their experience as a utility customer. It is possible that the same disposition applies to this research sample – one where *residential customers who closely monitor their utility-customer experience are more likely to get solar panels and are also more likely to agree to participate in research efforts related to their energy experience.*

English as an Additional Language

In the recruiting process, we encountered some customers who spoke Spanish. Given that Hispanic customers make up an estimated 46% of the SCE customer base, our team would recommend embedding an interviewer with fluency in Spanish for any subsequent user experience interview efforts.[12] While some Hispanic or other native Spanish speaking customers were able to be interviewed for this research, those who did not feel comfortable with their English fluency to complete the interview were unable to participate.[13]

[12] https://newsroom.edison.com/stories/celebrating-hispanic-heritage
[13] These individuals self-selected out of the research. None were turned away by the interviewer due to a language barrier.

3 Detailed Findings: Quantitative Impact Analysis

3.1 Analysis Findings

3.1.1 Overview

This section describes the results of the impact segmentation analysis. Table 3-1 provides summary statistics for key groups. The number of accounts reflects the total number of accounts that exist in that group for at least one bill, so the sum will be greater than the total number of accounts as many accounts exist in more than category in our sample.

Table 3-1. Summary Statistics for Key Groups

Delivery	Payment	Average Usage (kWh/day)	Usage Standard Deviation	Number of Accounts	Number of Bills
Electronic Delivery	All	22.2	18.1	13,055	249,059
Paper Delivery	All	20.3	17.5	10,616	194,386
Unknown	All	20.6	19.5	9,409	60,496
All	Active Payment	21.9	18.1	18,205	312,203
All	Passive Payment	19.6	15.7	4,633	88,776
All	Unknown	21.0	19.7	17,332	102,962
Electronic Delivery	Active Payment	22.7	18.4	10,135	152,313
Electronic Delivery	Passive Payment	20.2	15.9	3,557	66,095
Electronic Delivery	Unknown	24.4	20.4	7,787	30,651
Paper Delivery	Active Payment	20.6	17.3	9,495	144,460
Paper Delivery	Passive Payment	17.9	14.9	1,268	22,681
Paper Delivery	Unknown	21.3	20.0	6,621	27,245

Delivery	Payment	Average Usage (kWh/day)	Usage Standard Deviation	Number of Accounts	Number of Bills
Unknown	Active Payment	26.3	20.6	2,490	15,430
Unknown	Unknown	18.6	18.7	9,154	45,066
All	All	21.3	18.1	21,871	503,941

Table 3-2 provides summary statistics by income group. Note that the Very Low income group is the bottom 10%, the Low income group is above that up to 40%, and each successive group is an additional 20% of the distribution.

Table 3-2. Summary Statistics by Income Quantile

Income Category	Average Usage (kWh/day)	Usage Standard Deviation	Number of Accounts	Number of Bills
Very Low	18.5	17.7	2,081	48,125
Low	20.1	17.0	6,487	149,878
Medium	20.5	16.5	4,236	97,736
High	21.7	17.4	4,360	100,735
Very High	24.9	20.8	4,350	99,816
Unknown	22.0	22.6	357	7,651

The figures in this section display percent savings Average Treatment Effect (ATE) point estimates along with their 90% confidence interval using cluster-robust standard errors at the account level. A positive ATE indicates our models shows a decrease in energy usage following the creation of a bill statement. The confidence intervals show the uncertainty level around the point estimate, attributable to uncontrolled variation in the data or small sample sizes. As with the table above, the “n” value shown next to each segment displays the total number of accounts which represent the particular subgroup at least once in the data, so the sum will be greater than the total number of accounts.

Overall, our models found that on average there is a positive bill salience impact of approximately 0.18% in the 10 days after the statement is created. The savings vary by post day, as shown in Figure 3-1. Average Percent Savings by Post Day, with the highest savings occurring on the 6th and 7th day after a statement is created. These savings primarily occur

overnight, as shown in Figure 3-2 below. The pattern of daily savings is surprisingly consistent across groups of customers with differences in magnitudes and slight differences in overall shape, but no major deviation from the overall pattern between customer groups. This is surprising given that the amount of time it takes for a bill to reach customers likely varies between electronic and paper delivery mechanisms.

Figure 3-1. Average Percent Savings by Post Day

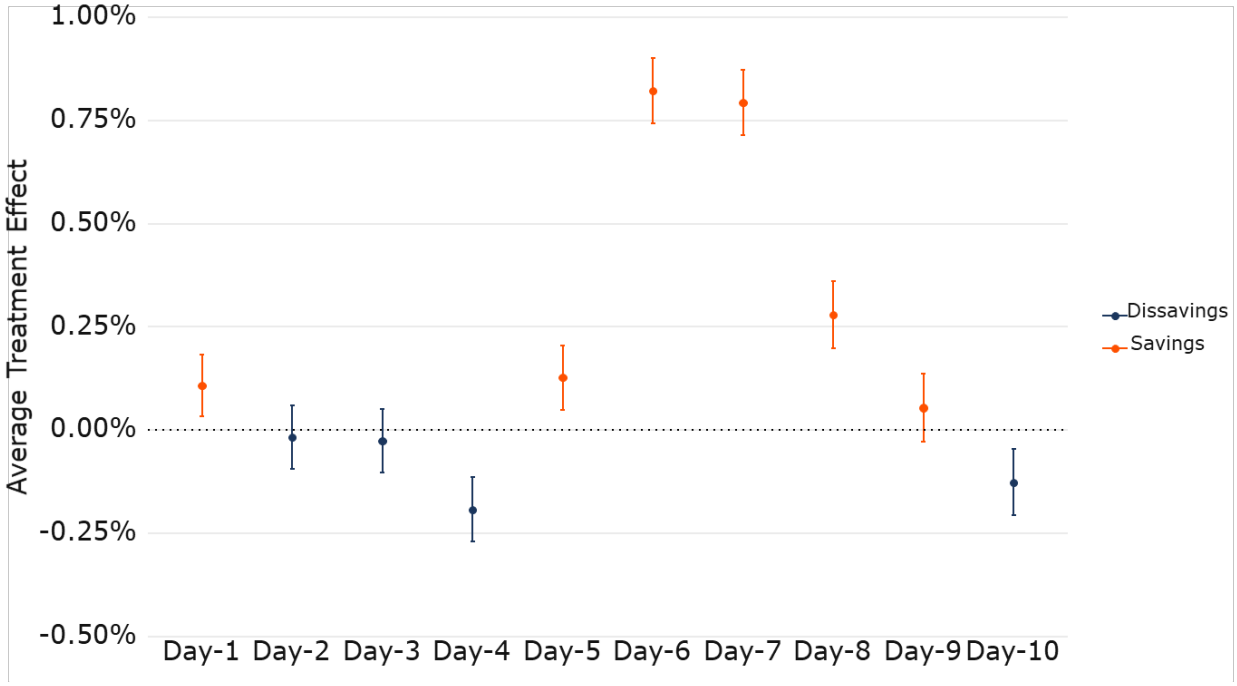
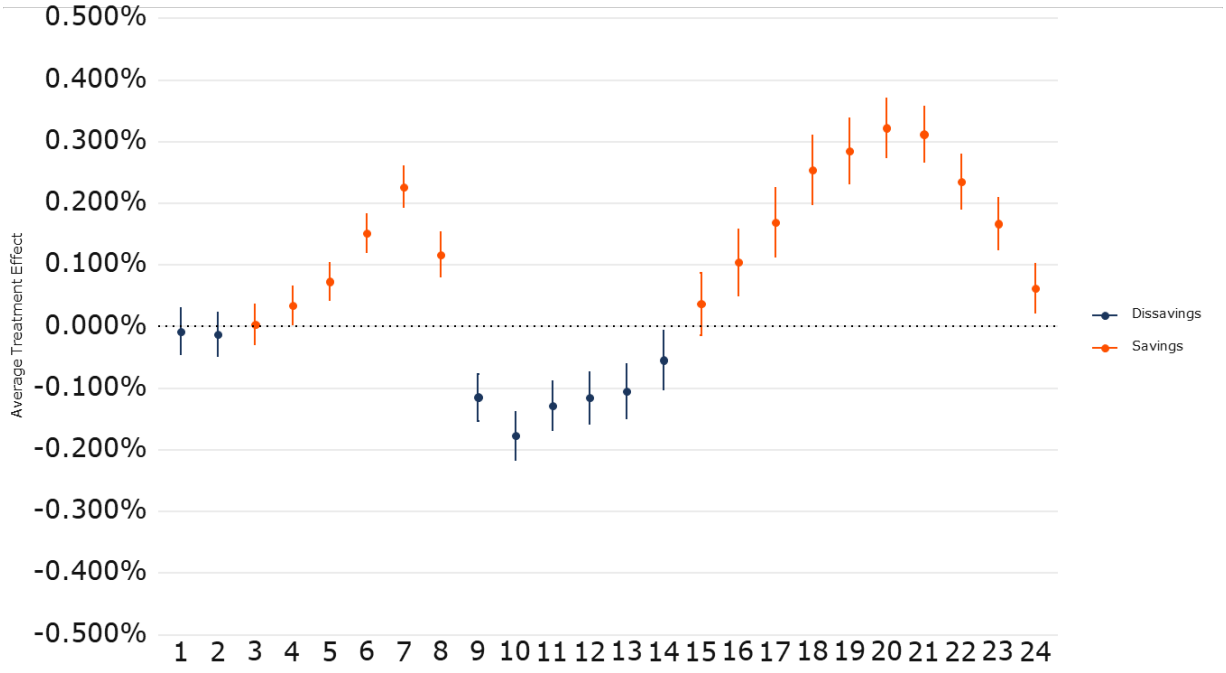


Figure 3-2. Average Percent Savings by Hour

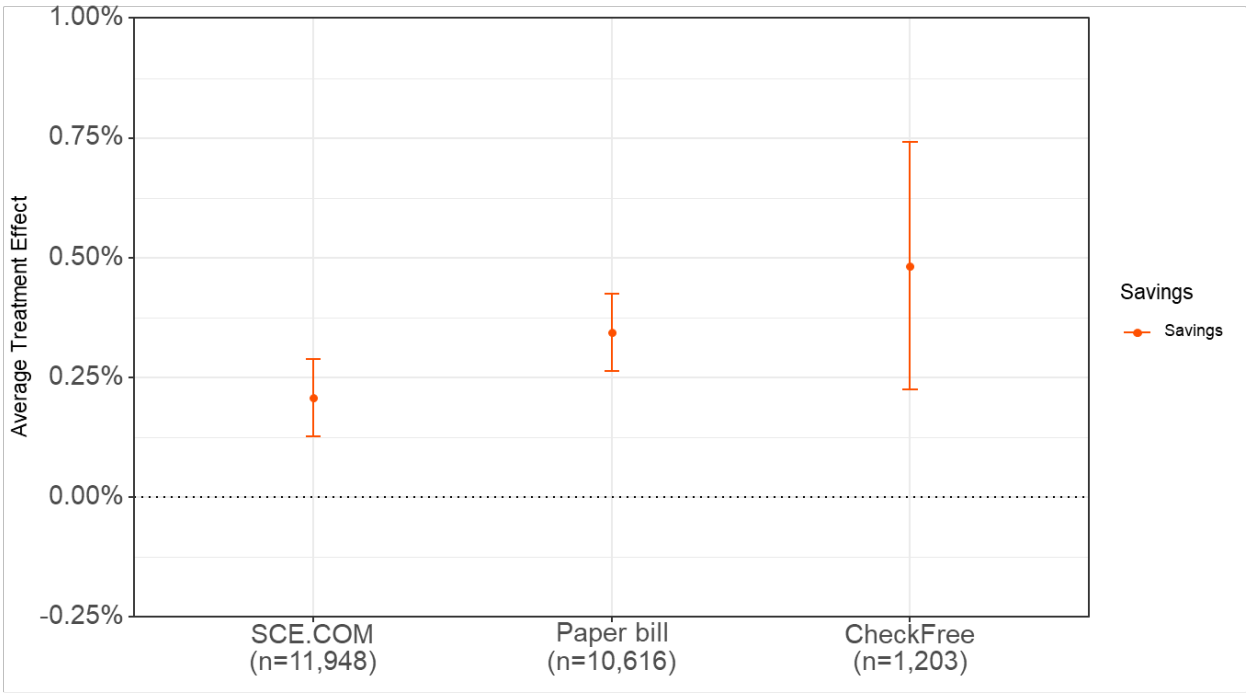


Given the non-linear relationship between energy usage and bill amount, there is not a direct comparison readily available for the reduction in the bill amount. This reduction over the 10 days after the bill date is equivalent to a roughly 0.06% average monthly electricity use reduction. Based on the average consumption we observe in our sample, this amounts to about 4.7 kWh per year on average. Given that electricity use reduction affects the peak marginal rate at which electricity is billed, the average bill impact would likely be more than 0.06%.

3.1.2 Bill Delivery Type

The data in our analysis contain three primary bill delivery types: CheckFree, Paper bill, and SCE.com. CheckFree bills and SCE.com bills are electronic forms of delivery whereas paper bills are mailed to customers. TRC explored how salience impacts varied between these three delivery types, which is shown in Figure 3-3.

Figure 3-3. Overall Percent Savings by Bill Delivery Type



All three delivery types have positive point estimates, meaning on average, there is a reduction in energy usage after the statement is created for each of these channels. None of the point estimates appear to be statistically significantly different from one another. When broken out by post day, the positive salience effect for paper bills appears on 9 of the 10 days after the statement is created, whereas bills delivered through SCE.com have a positive salience effect for roughly half of the days. Figure 3-4 shows the differences broken out by post day for all three delivery channels.

Figure 3-4. Post Day Percent Savings by Bill Delivery Type

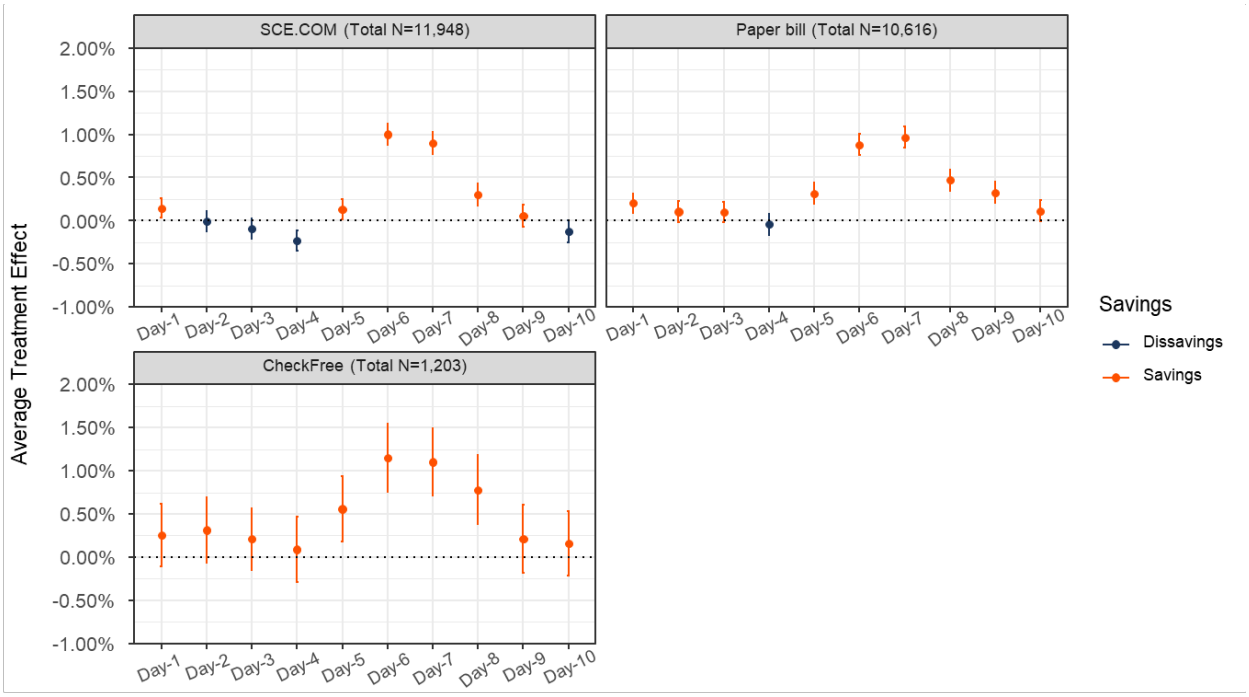
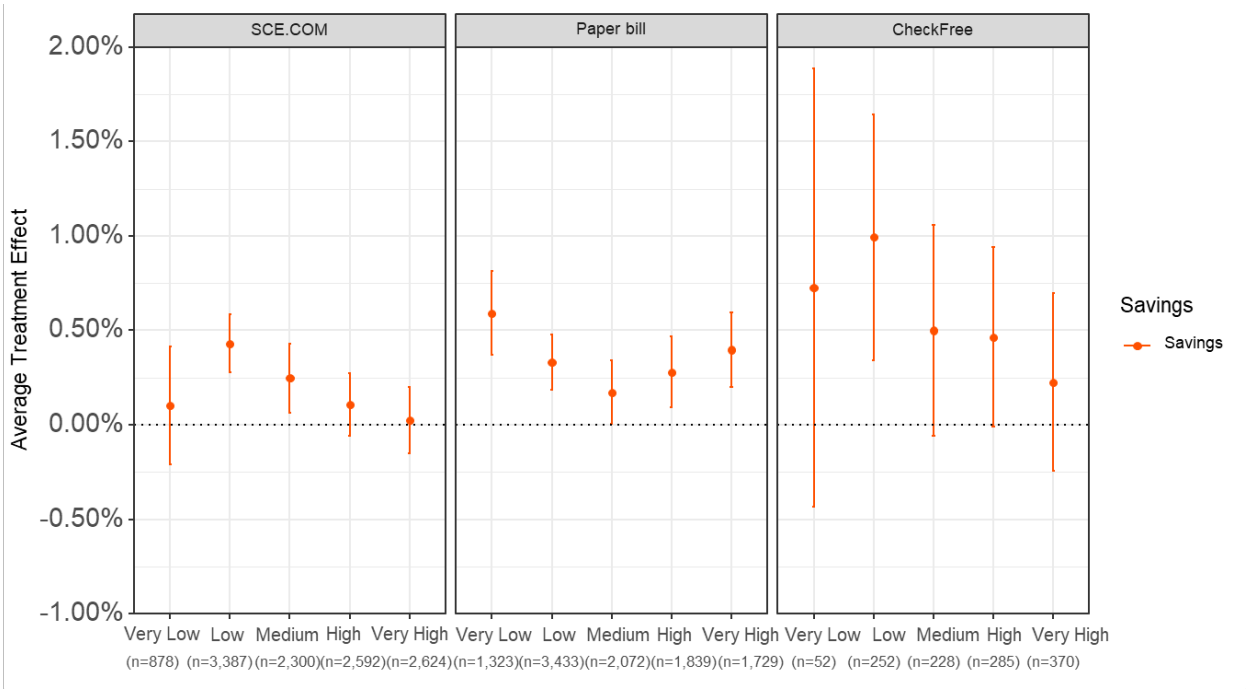


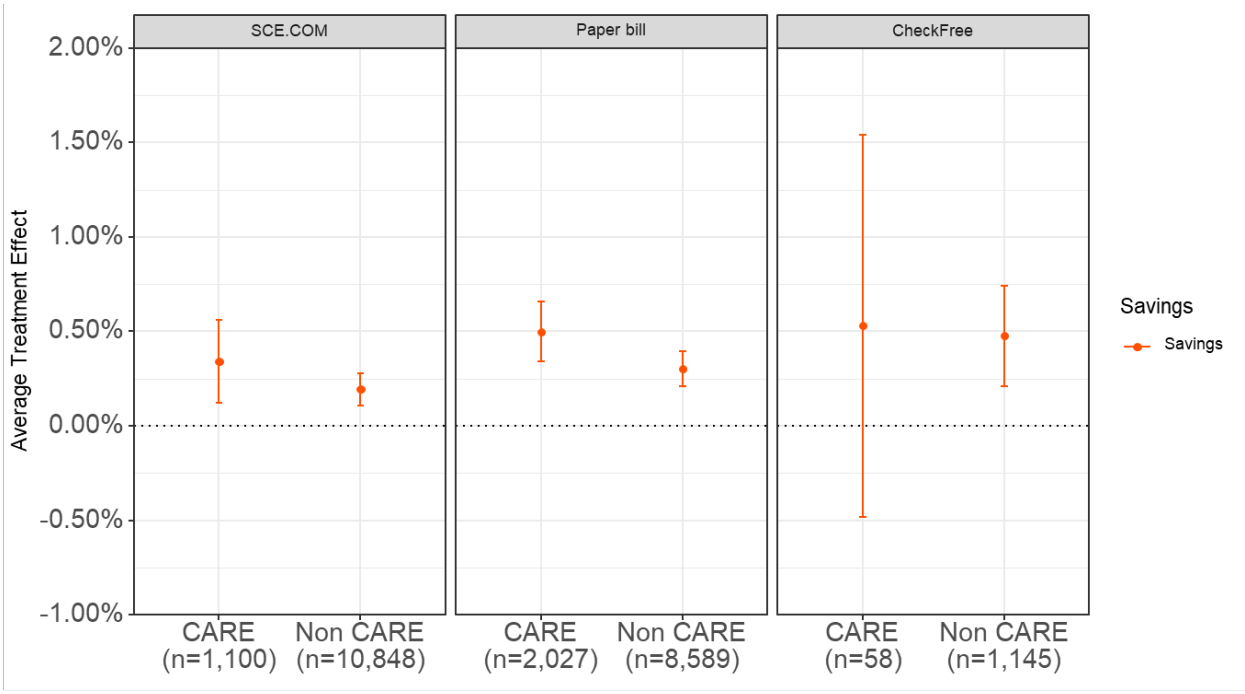
Figure 3-5 shows the breakout of impacts by income level. The salience effect for each of these channels show that lower incomes generally have higher point estimates, suggesting income is an important variable for understanding bill salience.

Figure 3-5. Overall Percent Savings by Bill Delivery Type and Income Level



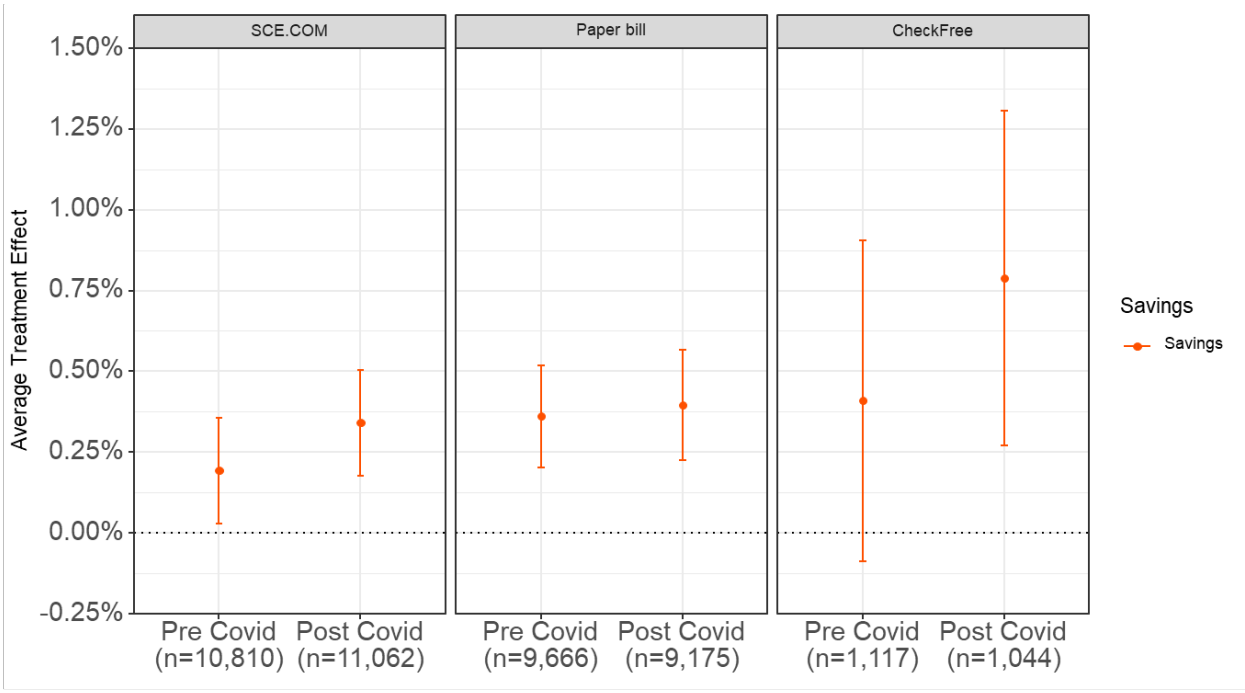
TRC investigated delivery channel differences broken out by CARE program participation to understand if CARE customers produce different effects than Non-CARE customers. Our models suggest that CARE participants have slightly higher estimates than Non-CARE participants in each of the delivery channels; however, the results are not statistically different from one another as shown in Figure 3-6.

Figure 3-6. Overall Percent Savings by Bill Delivery Type and CARE Participation



Lastly, the research team examined differences in salience impacts by delivery type before the COVID-19 pandemic, versus after the pandemic began. The results from our models suggest that on average, the salience effect of each channel is slightly larger after the start of the COVID-19 pandemic; however, these differences are not statistically significant, as shown in Figure 3-7. Our approach to defining Pre Covid versus Post Covid is discussion in section 3.1.6.

Figure 3-7. Overall Percent Savings by Pre- and Post-COVID



Overall, the results from the impact segmentation on bill delivery type suggest each channel has a positive salience effect. The savings for paper bills appear to be slightly higher than bills through SCE.com, although this difference is not statistically significant. Intuitively this seems plausible – a paper bill shows up in the mailbox, providing a signal to the customer that a payment is due. Further, the paper bill appears to have several days of savings. An illustrative example may be a customer opens the bill and leaves it on the counter, serving as a signal for several days. Alternatively, a digital bill appears to have a slightly lower salience effect – the bill may not be accessed or simply may be lost in the mix of other digital information, thus lowering the overall point estimate.

3.1.3 Bill Payment Channel

SCE offers a variety of payment channels for which customers may pay the balance on their bill. TRC estimated impacts by payment channel for channels with a sufficient number of accounts in the data to explore these differences. Figure 3-8 and Figure 3-9 below show the estimates for each channel overall as well as the estimates broken out by post day.

Figure 3-8. Overall Percent Savings by Payment Channel

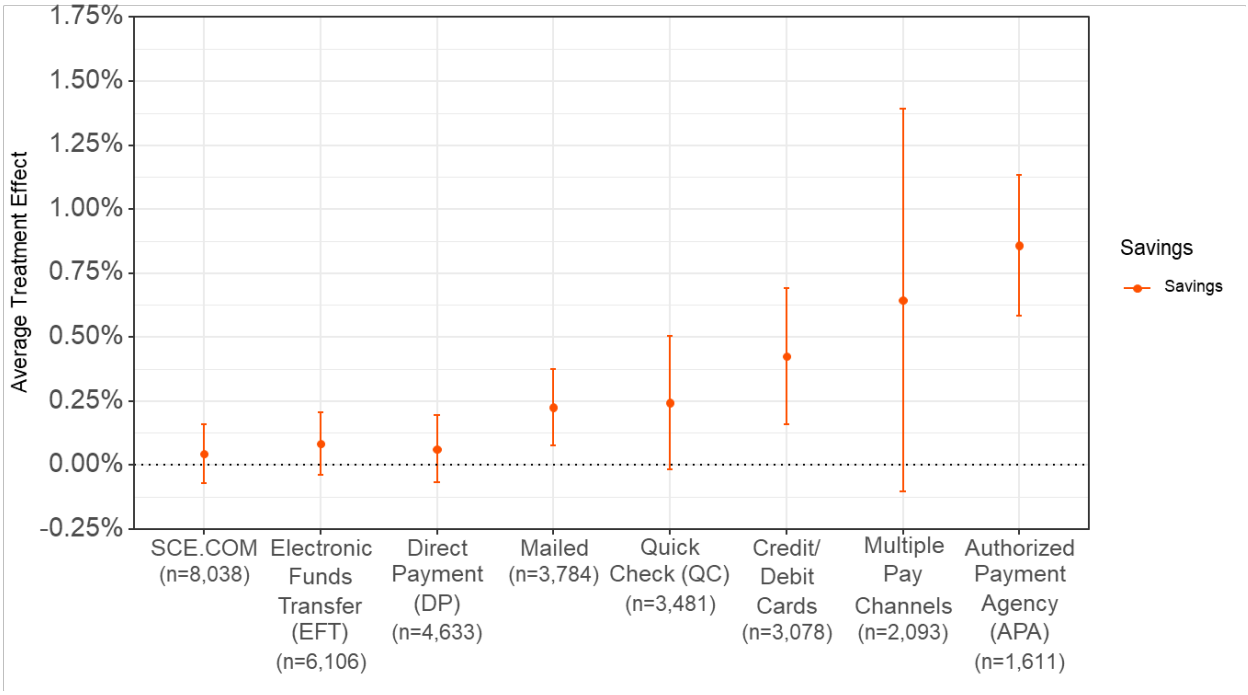
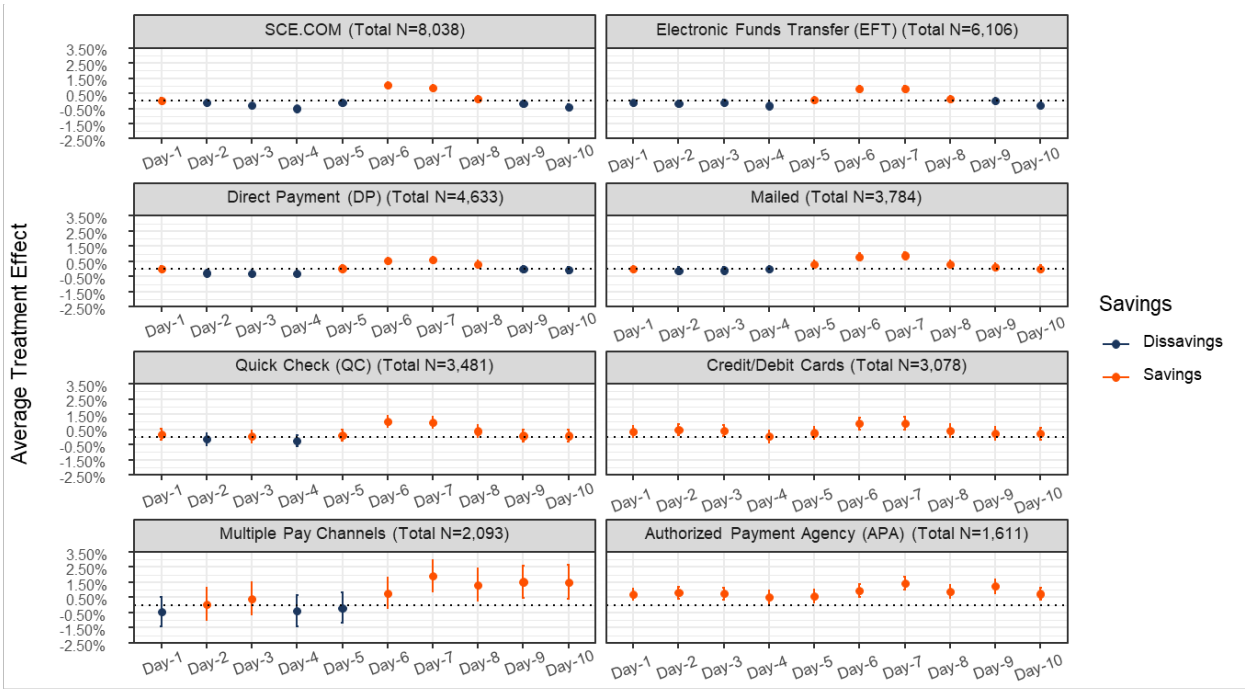


Figure 3-9. Post Day Percent Savings by Payment Channel



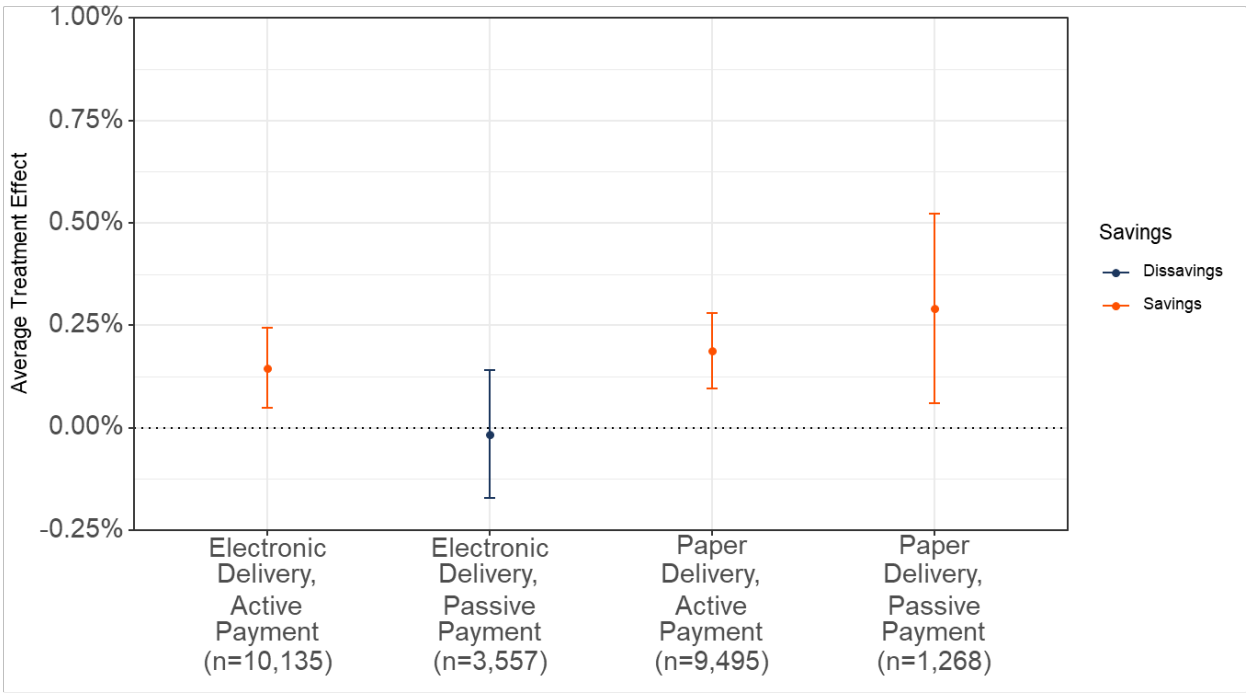
The models identified small, positive salience effects for Authorized Payment Agencies, Credit/Debit Cards, and Mailed payment channels. Further, payments through Authorized Payment Agencies and Credit/Debit Cards appear to have positive impacts for several days after the statement is created. The other channels appear to have approximately no salience effect. The research team did not identify any substantial differences within each payment channel broken out by income.

Some of these payment channels require an active form of payment, meaning the customer must actively take action each billing period to pay their bill (e.g., mailing a check). Other payment channels allow a passive form of payment, allowing the customer to utilize automatic payment options online. An active channel such as Mailed, shows positive impacts in our model. This seems plausible – the customer must actively take time to pay their bill, thus increasing the salience of the bill. A passive channel such as Direct Payment (a common autopay method), shows approximately zero salience impact in our model, suggesting that lower levels of engagement with the bill may lead to less salience. This hypothesis in investigated further below.

3.1.4 Bill Delivery and Payment

Understanding bill delivery type and bill payment type differences are only one piece to the puzzle. It's plausible that the salience effect is correlated with both of these channels. To investigate this hypothesis, TRC classified bill delivery types and payment types into broader groups. We classified bill delivery types into either paper or electronic delivery and classified payment channels into either active or passive payments. Our model results from this two-by-two classification are shown in Figure 3-10 below.

Figure 3-10. Overall Percent Savings by Delivery and Payment



Our two-by-two classification and modeling approach showed that bills with an electronic delivery and a passive form of payment have approximately no salience effect whereas all other classifications show positive effects. This suggests that customers who either receive a physical (paper) bill or actively have to make a payment for their bill, have higher salience effects. The research team did not identify any substantial differences by post day or income level.

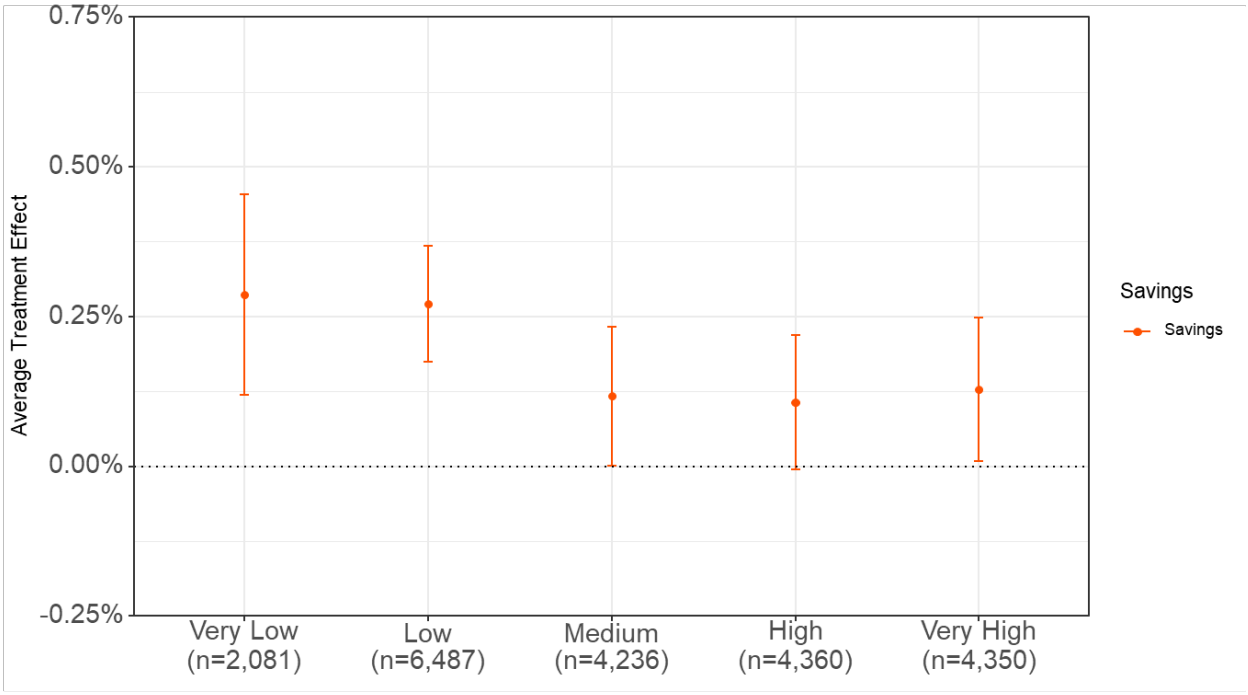
3.1.5 Income-Related Findings

TRC assigned accounts into income quantiles[14] based on each customer's discrete income level and the number of persons living in their household. The research team investigated the relationship between income and bill salience across a number of programs, demographics, and payment information. The results of the impact segmentation on income and our income-related findings are described below.

Income

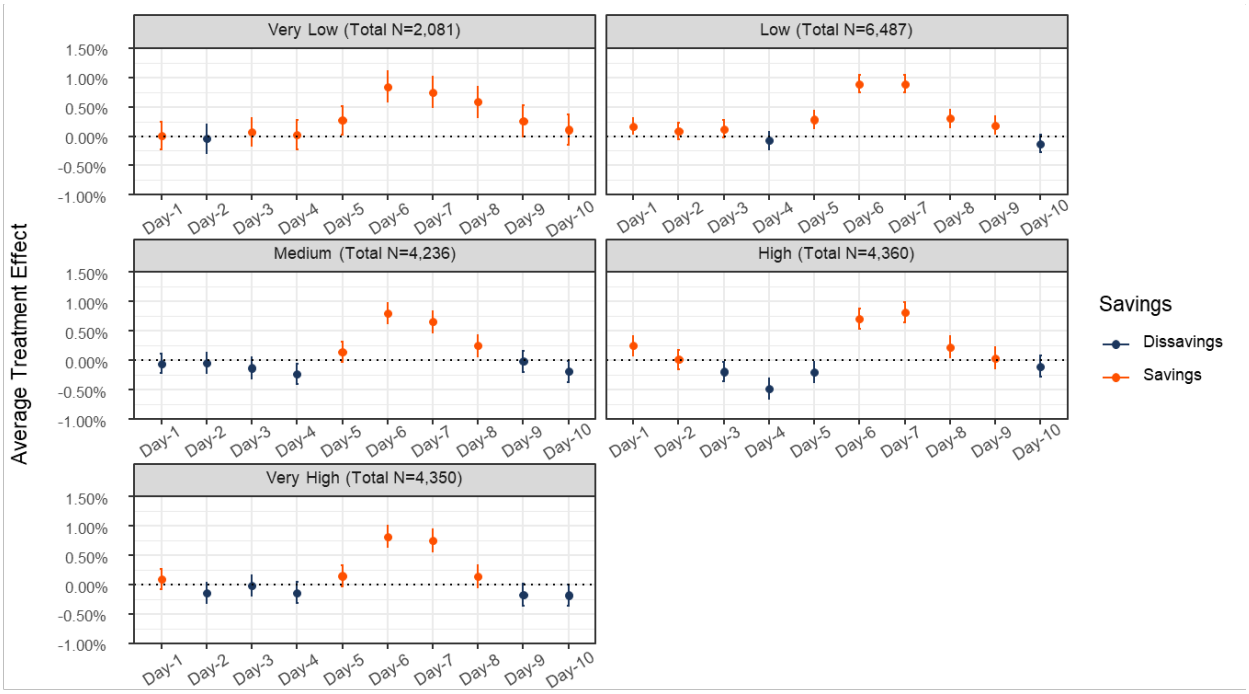
TRC modeled the relationship between income and bill salience and, on average, found that as income increases, bill salience impacts decrease. Figure 3-11 shows the point estimates broken out by income level. Although there is large uncertainty around each estimate, the lower income accounts show the highest salience effects. Notably, even though low-income customers consume less energy on average than high-income customers (as shown in Table 3-2), low-income customers have larger absolute bill salience impacts because their proportional savings are so much larger. Further, the lower income accounts exhibit savings on up to 9 of the 10 post period days, as shown in Figure 3-12.

Figure 3-11. Overall Percent Savings by Income Level



[14] We grouped this into the lowest decile, and then up to the 40%, 60%, 80%, 100% percentiles.

Figure 3-12. Post Day Percent Savings by Income Level



Shut-off Moratorium

The research team analyzed the relationship between being under a shut-off moratorium and bill salience. Although the moratorium is not a proxy for income, we expect accounts that are having a challenging time making ends meet are more likely to be a part of the moratorium. The results in Figure 3-13 suggest that accounts under the moratorium have a higher salience effect than those not under moratorium. Further, on average, accounts under a moratorium exhibit positive savings on all 10 of the post period days after the statement is created, as shown in Figure 3-14.

Figure 3-13. Overall Percent Savings by Moratorium

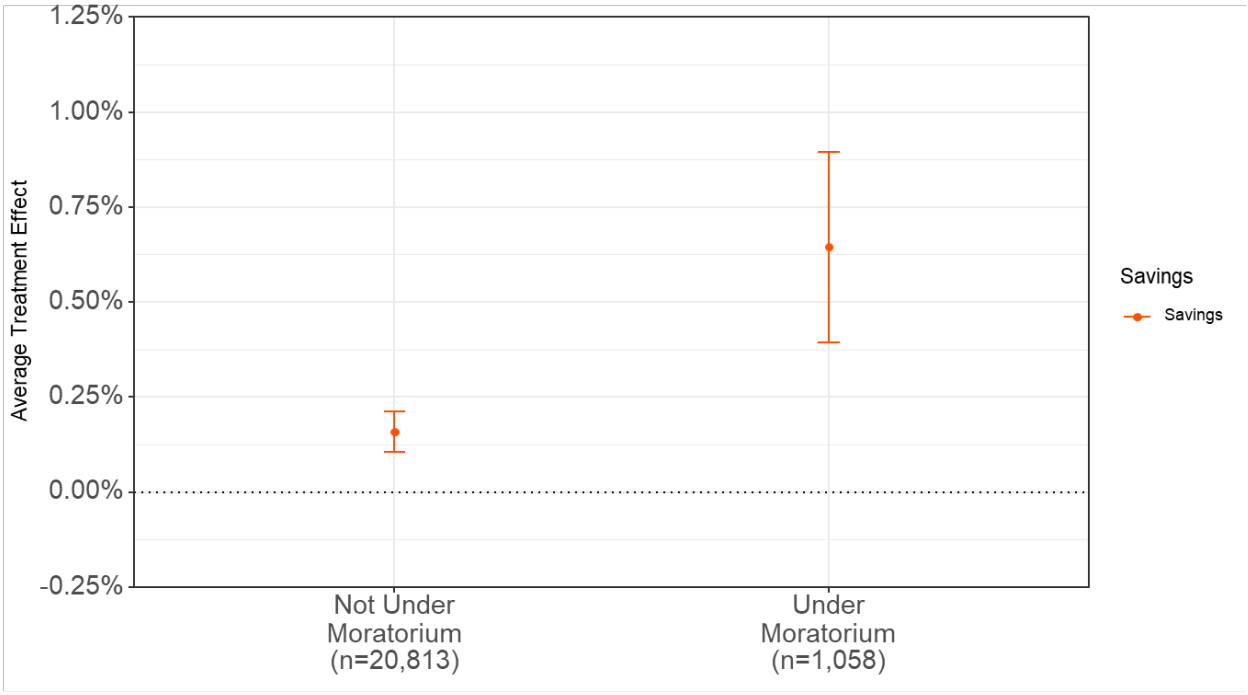
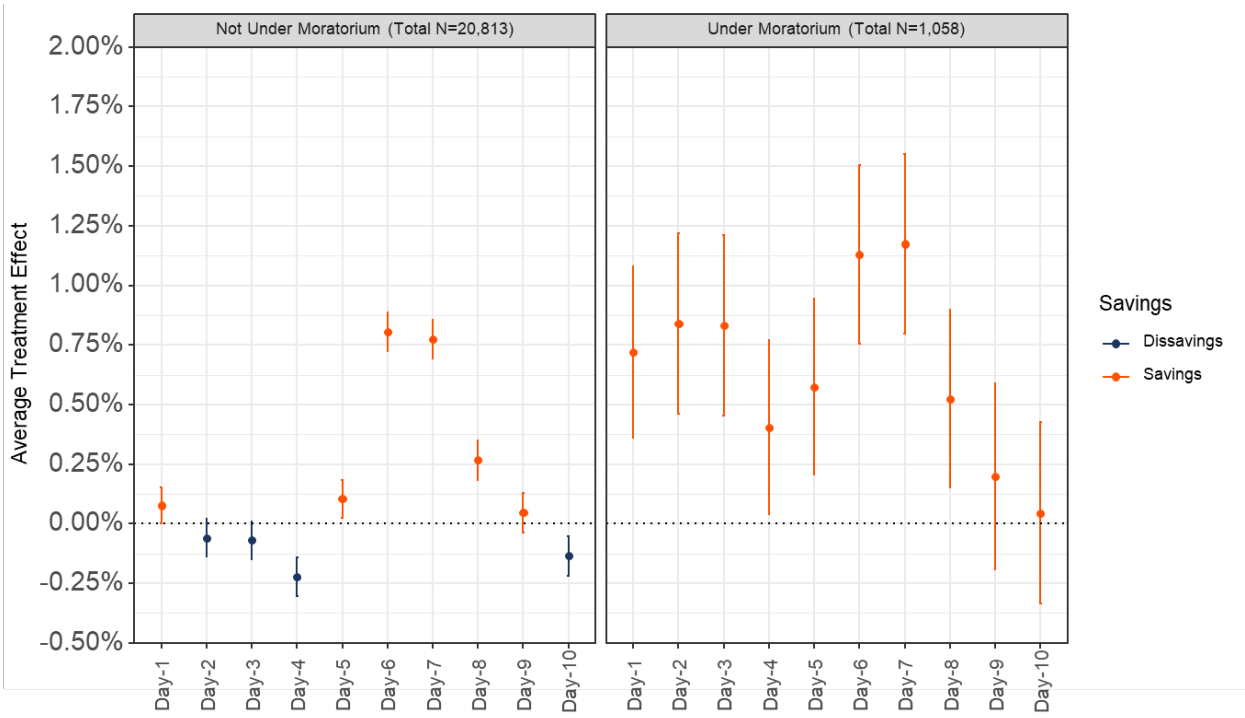


Figure 3-14. Post Day Percent Savings by Moratorium



Non-Payment

Utilizing payment information for each account, we flagged unique bill and account combinations for which no payment occurred. Although having no payment for a bill is not synonymous with having a low income, it may signal a similar underlying characteristic of a customer. Using this payment information, our team analyzed non-payment information in three ways:

1. No Payment for the Unique Bill and Account Event
   a. At the bill level, the data suggest a bill with no payment generally has a higher salience impact than that of a bill paid on time; however, the uncertainty around these estimates does not signal a statistically significant difference, as shown in Figure 3-15. (Note that the n value refers to the number of customers represented at least once in each group and so sums to more than the total number of customers in the sample.) When broken out by post day, events with no payment showed positive impacts on 9 out of the 10 days after the statement is created, as shown in Figure 3-16.

Figure 3-15. Overall Percent Savings by No Payment Bills

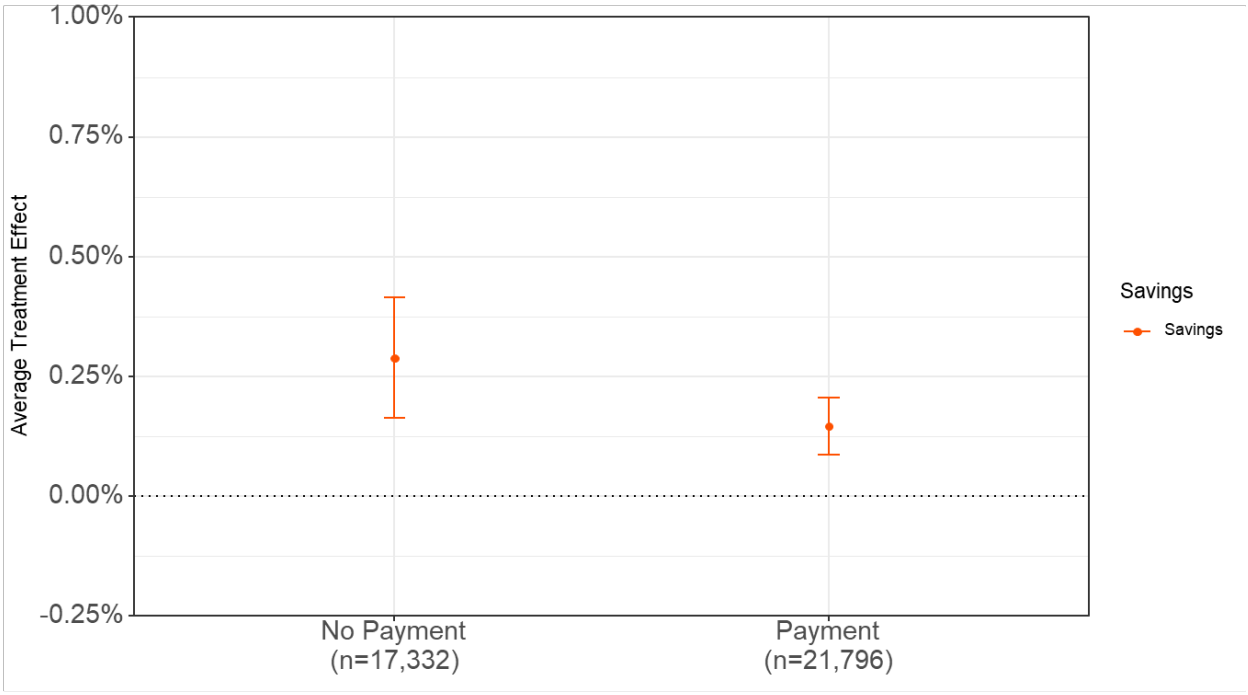
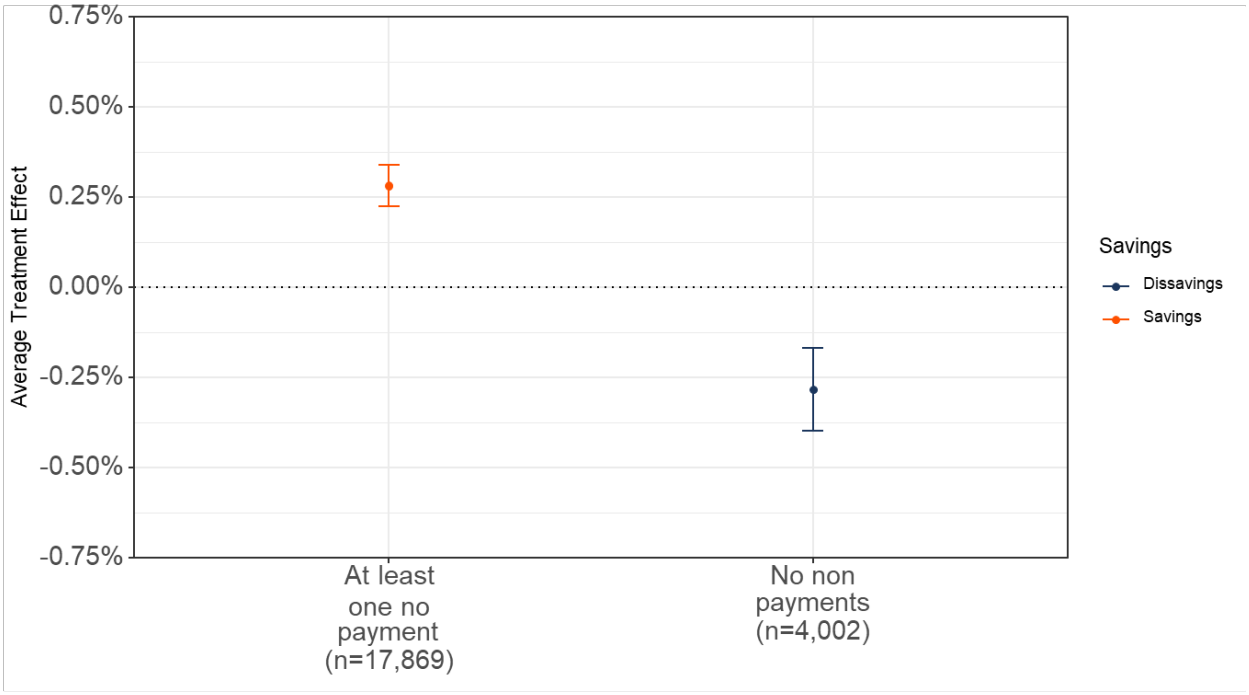


Figure 3-16. Post Day Percent Savings by No Payment Bills

2. Accounts With at Least One Non-Payment Occurrence

a. Accounts with at least one non-payment occurrence exhibited positive salience effects, whereas accounts which always paid exhibited slightly negative effects as shown in Figure 3-17; however, the vast majority of accounts in our data showed at least one non-payment occurrence. Therefore, this relationship may be picking up characteristics of our sample of accounts, rather than the effect of having at least one no payment occurrence.

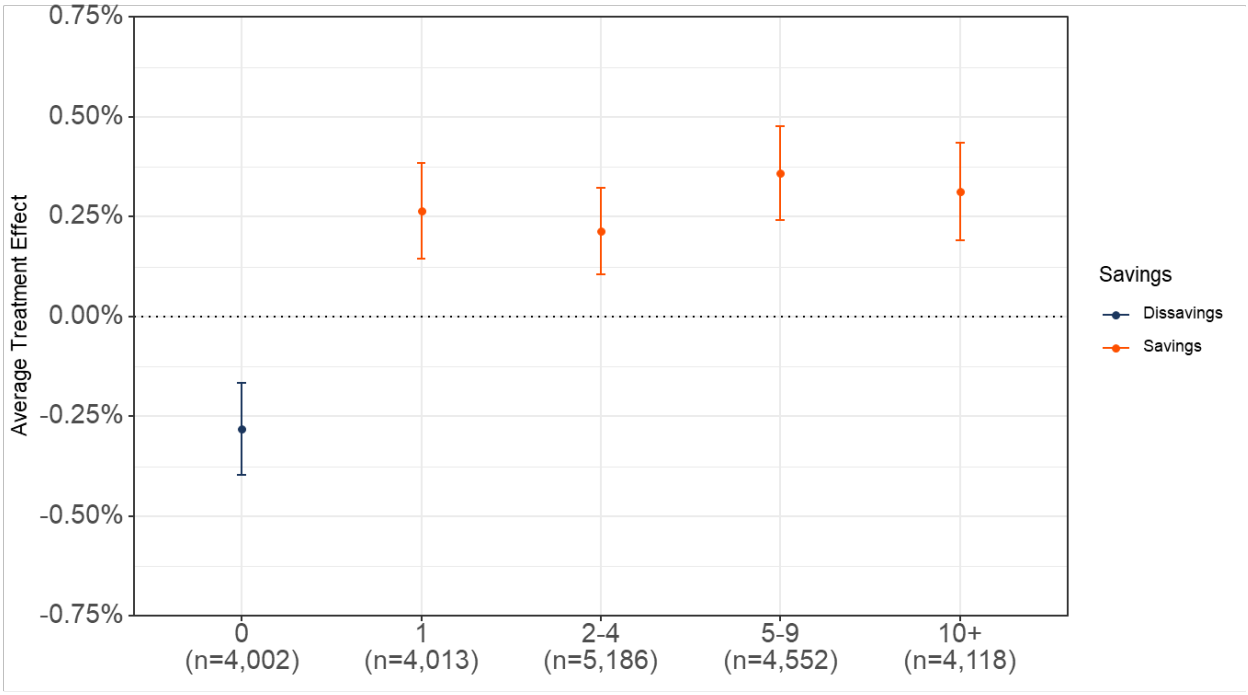
Figure 3-17. Overall Percent Savings by No Payment Accounts



3. The Number of Non-Payment Occurrences

a. Accounts were classified into one of five categories: Zero Non-Payments, 1 Non-Payment, 2-4 Non-Payments, 5-9 Non-Payments, or 10+ Non-Payments. The results suggest that there is no clear salience difference between the groups which exhibit at least one non-payment occurrence, as shown in Figure 3-18. In other words, as the number of non-payment occurrences increases, the salience effect remains relatively constant.

Figure 3-18. Overall Percent Savings by Number of No Payment Occurrences

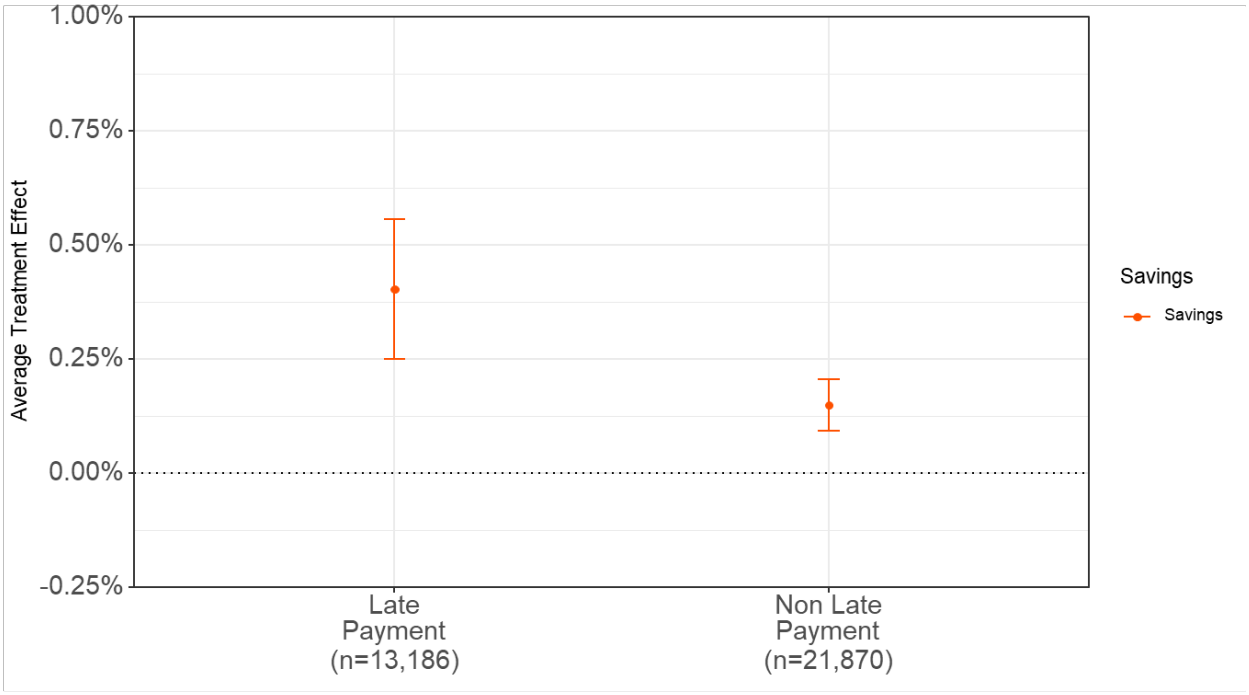


Late Payment

The payment information for each account contains indicators for when an account has a late payment. Although there are several reasons why an account may have a late payment, this field may help better-understand salience for those with lower income and/or financial difficulty. Using late payment information, our team analyzed three cases:

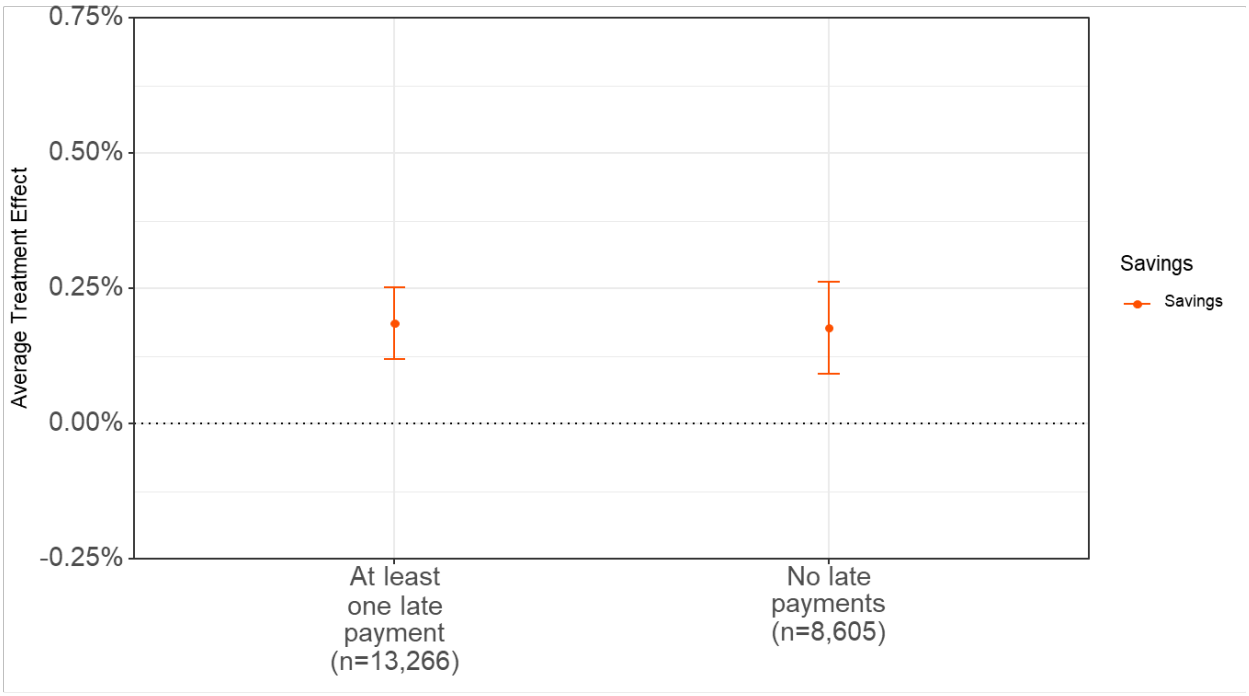
4. Late Payment for the Unique Bill and Account Event
    a. At the bill level, the data suggest a bill with a late payment has a slightly larger salience effect than that of a bill without a late payment; however, these estimates have high levels of uncertainty due to variation in the data, as shown in Figure 3-19. (Note that the n value refers to the number of customers represented at least once in each group and so sums to more than the total number of customers in the sample.) It is plausible that a customer may be late because they simply forgot to make a payment or due to financial burdens. These two cases may have different average impacts on bill salience, and the average treatment effect will reflect the average impact across them within the sample.

Figure 3-19. Overall Percent Savings by Late Payment Bills



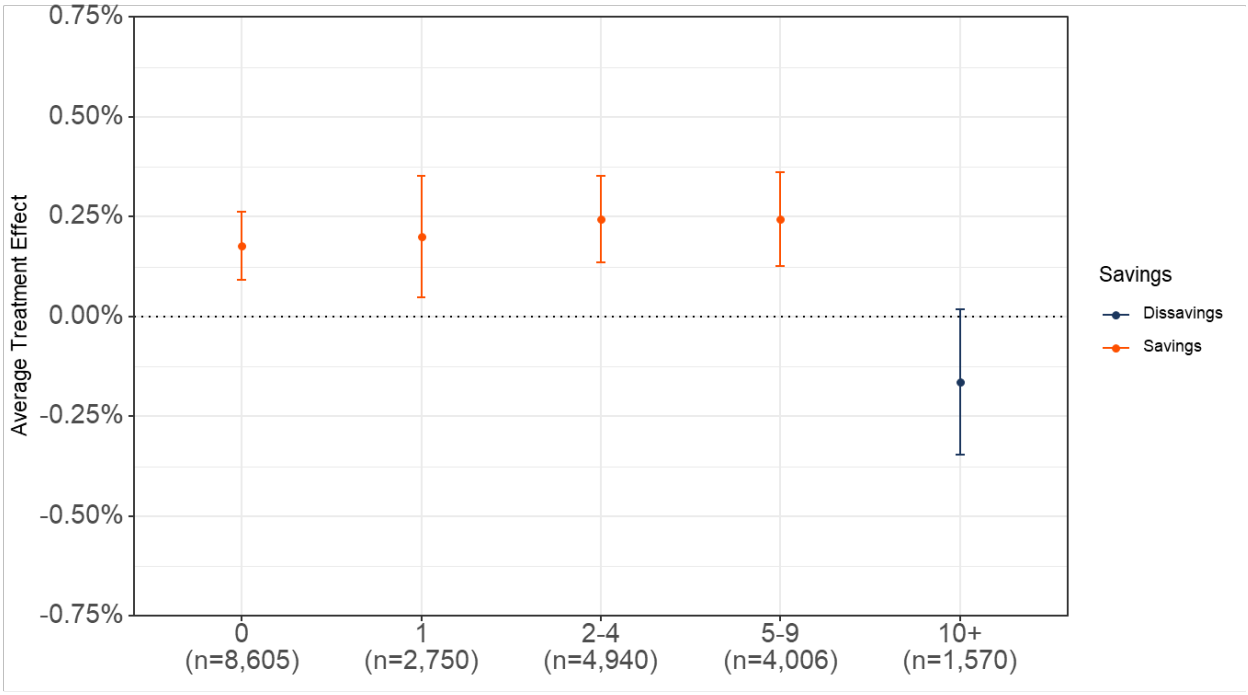
5. Accounts With at Least One Late Payment Occurrence
   a. Accounts with at least one late payment occurrence exhibited approximately the same levels of bill salience as those which never had a late payment, as shown in Figure 3-20.

Figure 3-20. Overall Percent Savings by Late Payment Accounts



6. The Number of Late Payment Occurrences
   a. Accounts were classified into one of five categories: No Late Payments, 1 Late Payment, 2-4 Late Payments, 5-9 Late Payments, or 10+ Late Payments. The group of accounts with 10 or more late payment occurrences showed a negative salience impact, statistically insignificant from zero. All other late payment groups exhibited a similar level of positive bill salience, as shown in Figure 3-21. This suggests accounts with 10 or more late payments are different than those with fewer late payments. An account with several late payments may not have the latitude to reduce their consumption after seeing the bill.

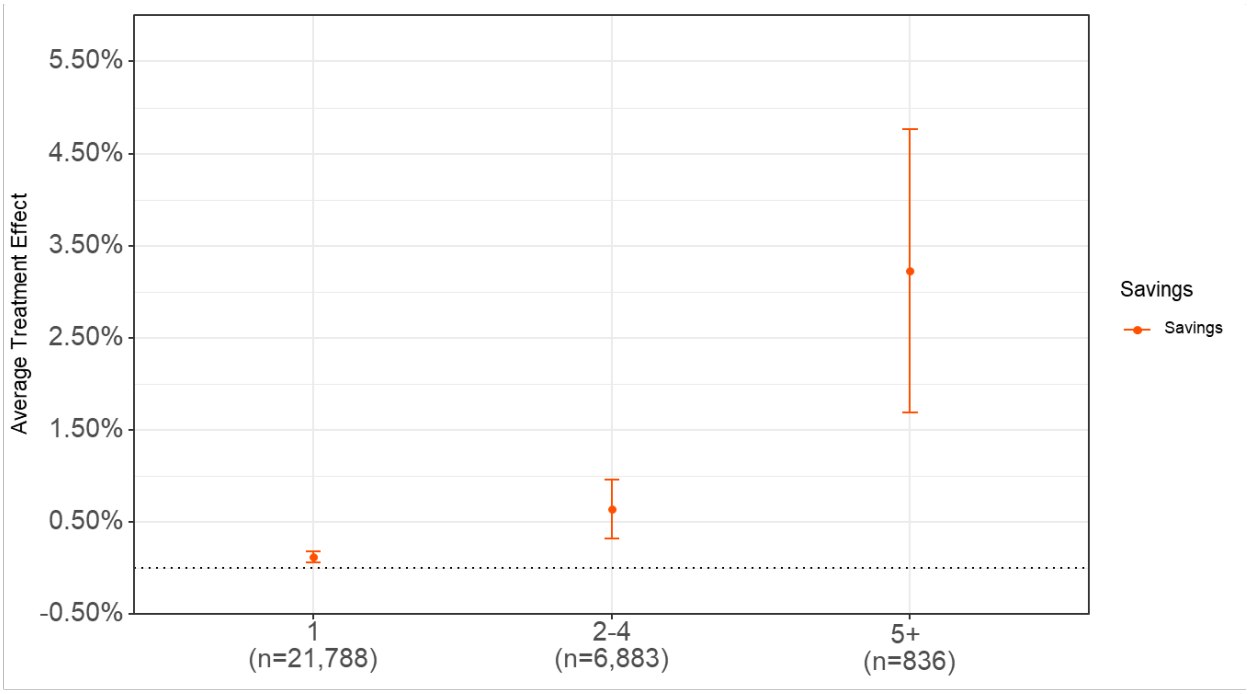
Figure 3-21. Overall Percent Savings by Number of Late Payment Occurrences



Number of Payments

The metadata included a field signaling the number of payments made for each bill for several accounts in the data. For accounts with this information, the research team analyzed the salience impacts by number of payments: 1 Payment, 2-4 Payments, or 5+ Payments. The models show that as the number of payments for a bill increases, so does the salience, as shown in Figure 3-22. (Note that the n value refers to the number of customers represented at least once in each group and so sums to more than the total number of customers in the sample.) This suggests that accounts making more payments may have higher levels of engagement with their utility bill and thus, higher average impacts.

Figure 3-22. Overall Percent Savings by Number of Payments



Other Income-Related Findings

The research team investigated salience effects and differences by income for several programs, demographics, and account characteristics. Although the differences were not statistically significant by income level, the frequent occurrence of low-income customers exhibiting higher point estimates was a recurring theme. Table 3-3 highlights both overall and income-related findings for segments where the variable suggested income-related differences.

Table 3-3. Overall and Income-Related Findings

Segment	Finding
Time of Use Rate (TOU)	Non-TOU accounts show slightly higher salience effects than TOU accounts. Both TOU and non-TOU accounts with low income have higher point estimates relative to other income levels.
Budget Assistance Program (BUDG)	Non-BUDG accounts show slightly higher salience than BUDG accounts. Both BUDG and non-BUDG accounts with low income have higher point estimates relative to other income levels.
Dwelling Type	There were no clear differences between single family and multifamily households except that single family accounts with low income have higher point estimates relative to other income levels.
Household Size	There were no clear differences between households of different sizes except that households with 1 person living in the home exhibited a linear relationship with income (as income increases, impact estimates decrease).

Owner vs Renter	There were no clear differences between homeowners and renters except that homeowners with low income have higher point estimates relative to other income levels.
Home Square Footage	There were no clear differences between homes of different square footage levels except that homes in the .60 to .80 quantile of the data show a linear relationship with income (as income increases, impact estimates decrease).
Marital Status	There were no clear differences between single vs married accounts except that single accounts with low income have higher point estimates relative to other income levels.
Children	There were no clear differences between accounts with children vs accounts without children. Both types of customers showed low income customers with higher point estimates relative to other income levels in their respective group.
Bill Type	There were no clear differences between bill types except that accounts with lower income levels have higher point estimates relative to other income levels.

Income-Related Findings – Takeaways

There are several variables where we see a recurring theme of higher point estimates for those of lower income levels relative to the rest of the segment. Although the confidence intervals are large, suggesting high levels of uncertainty around the exact point estimate, the theme persists throughout the analysis. This suggests that accounts with lower income have a higher salience relationship with their bill than accounts of other income levels.

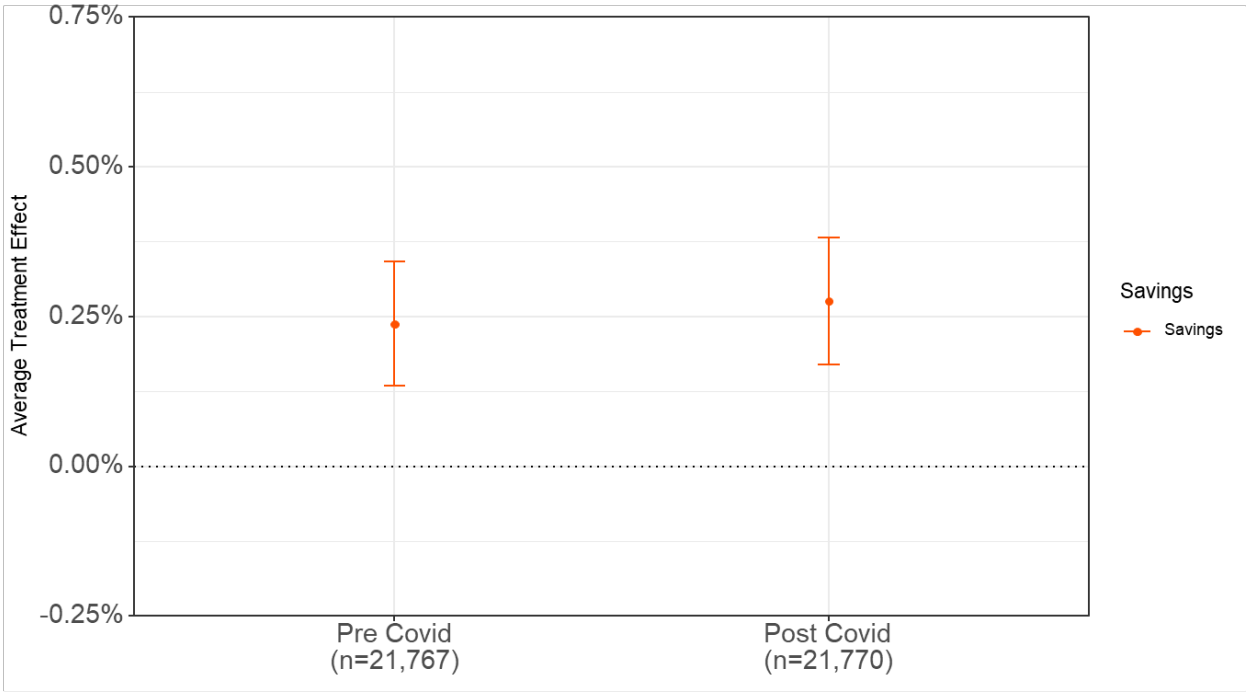
3.1.6 Other Notable Findings

Three other segments exhibited notable findings from the impact segmentation analysis: Pre vs Post COVID, Net Energy Metering accounts, and Home Energy Report accounts. This section highlights the findings for these three segments.

Pre vs Post COVID

The AMI data received for the analysis spanned from mid-2018 through August 2020. In order to investigate how bill salience changed during the COVID-19 pandemic, TRC defined a “Post COVID” period as March 2020 through August 2020 and a “Pre COVID” period as March 2019 through August 2019. The team modeled the average differences between these two periods to see how impacts change during these two partial-years. The results shown in Figure 3-23 found approximately equal impacts between the two periods, suggesting that the COVID pandemic did not have an overall effect on bill salience.

Figure 3-23. Overall Percent Savings by COVID Period



Net Energy Metering

The metadata allowed the team to analyze differences between accounts with Net Energy Metering (NEM) vs other accounts. The results from our models indicate that NEM accounts exhibit higher impacts than other accounts, shown in Figure 3-24. Further, these impacts are shown in

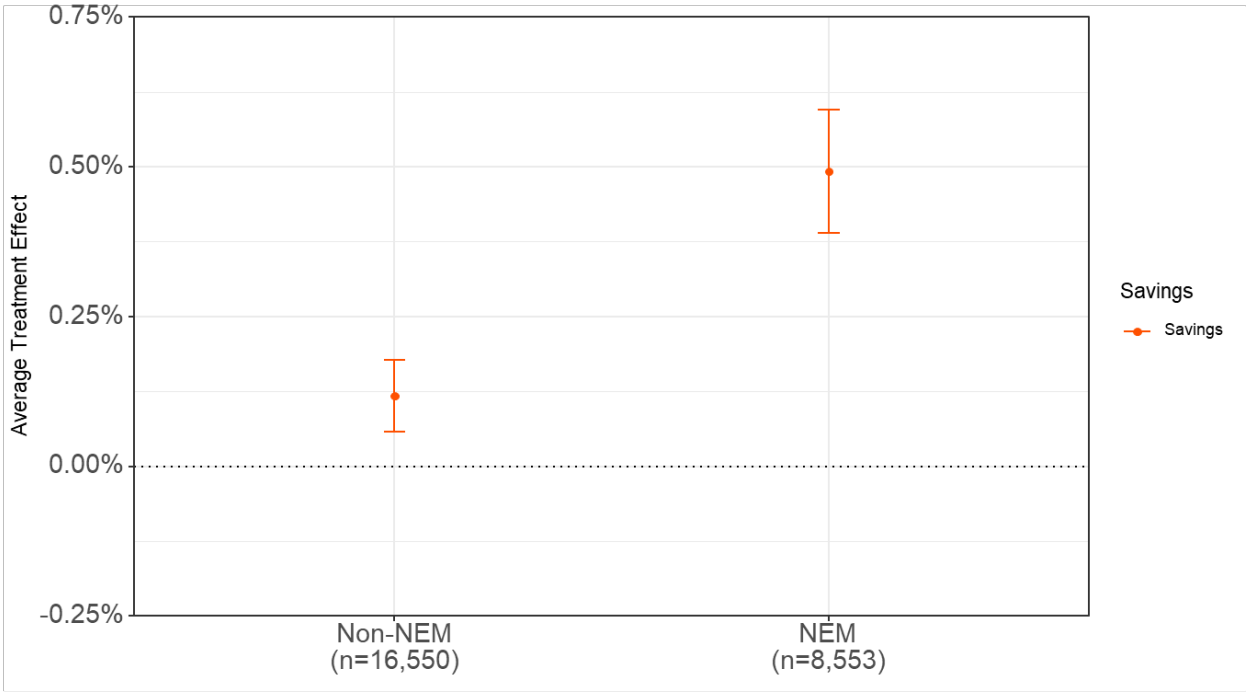


Figure 3-25 broken down by each of the 10 days after the statement is created. When broken out by income, NEM accounts all exhibit roughly the same impacts; however, non-NEM accounts with lower income levels exhibit higher salience than other income levels, as seen in Figure 3-26.

Figure 3-24. Overall Percent Savings by NEM

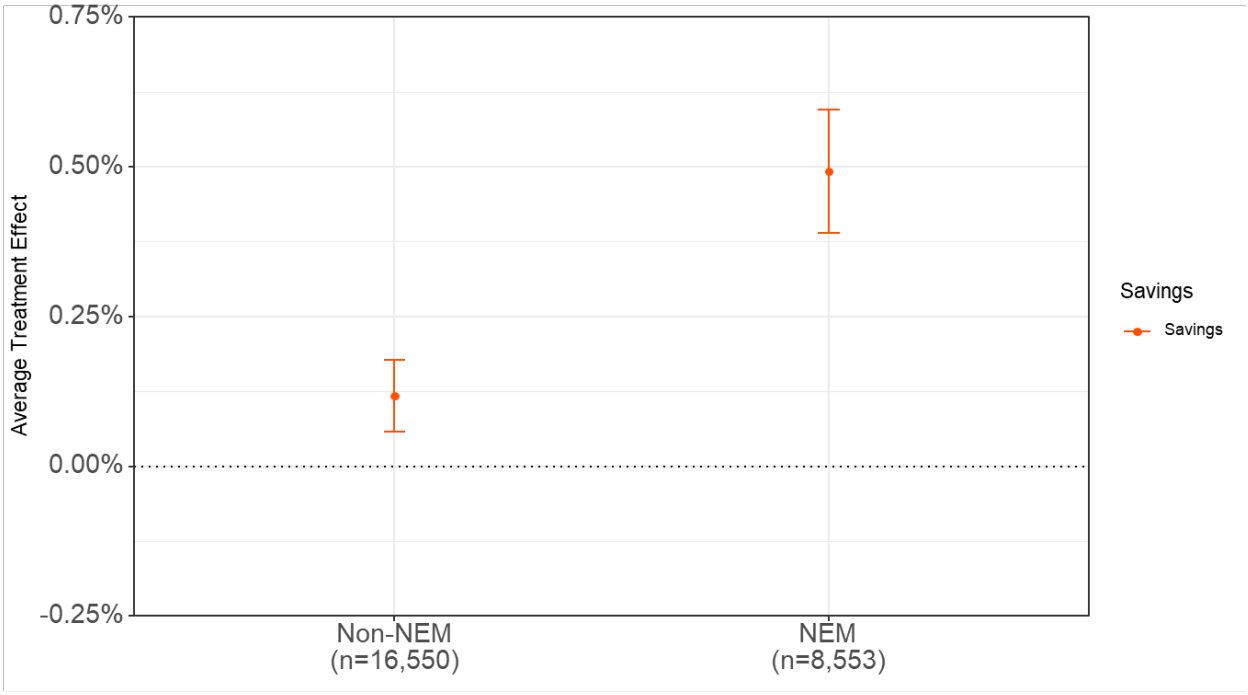


Figure 3-25. Post Day Percent Savings by NEM

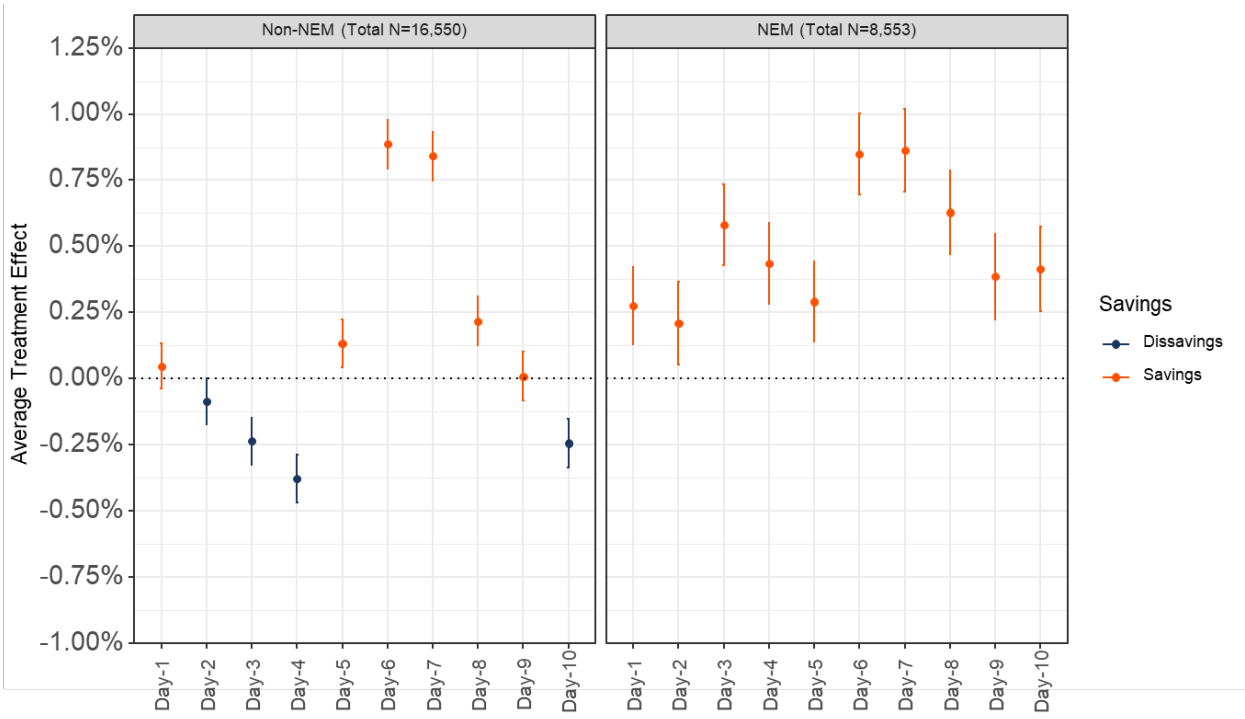
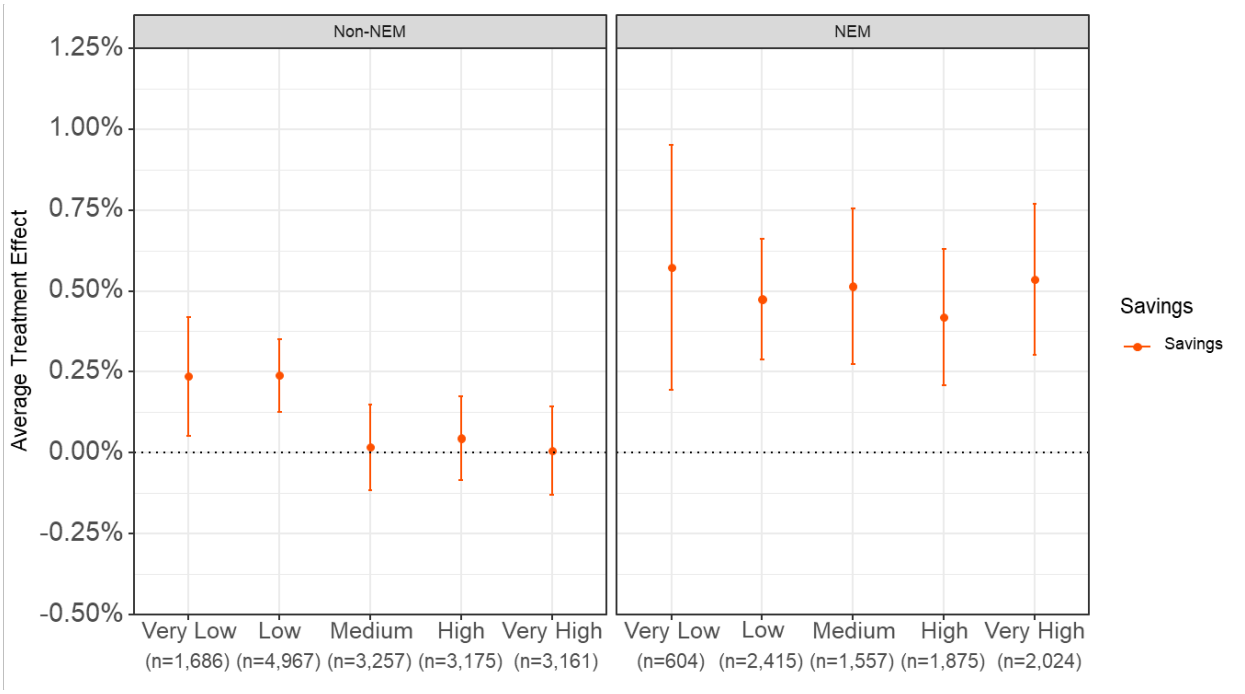


Figure 3-26. Overall Percent Savings by NEM and Income Level

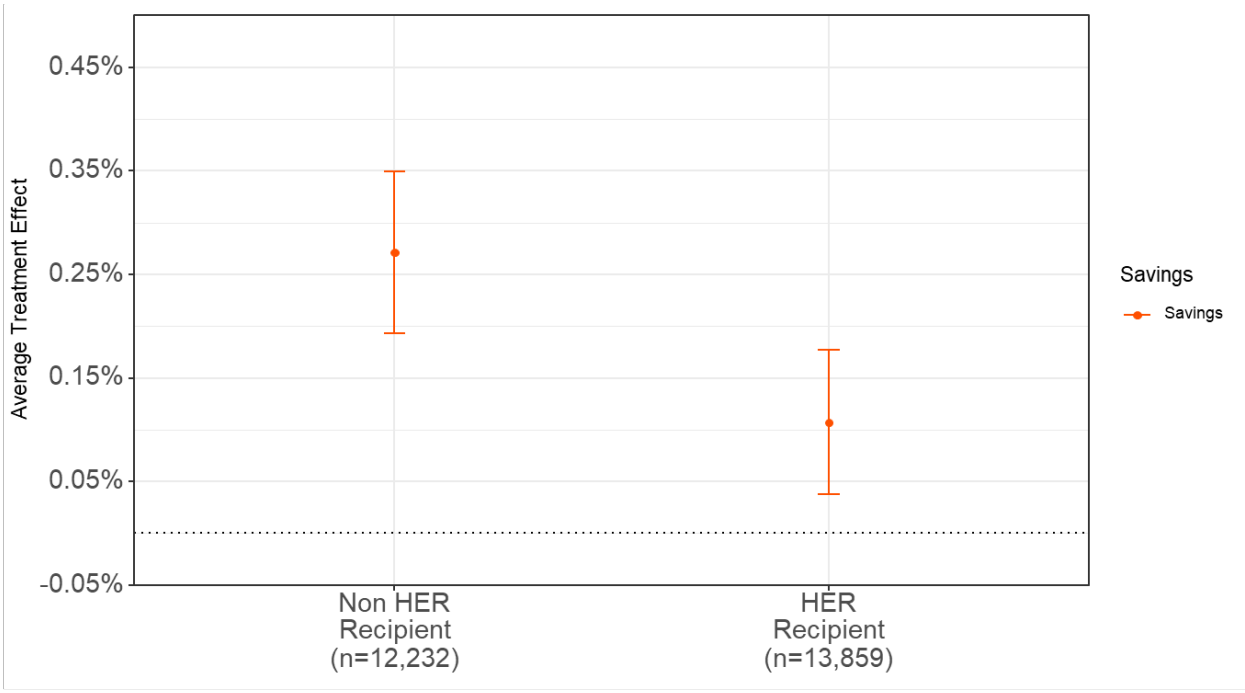


Home Energy Reports

The research team received information from Oracle detailing Home Energy Report (HER) program participation for accounts. Using these data, we examined salience differences by:

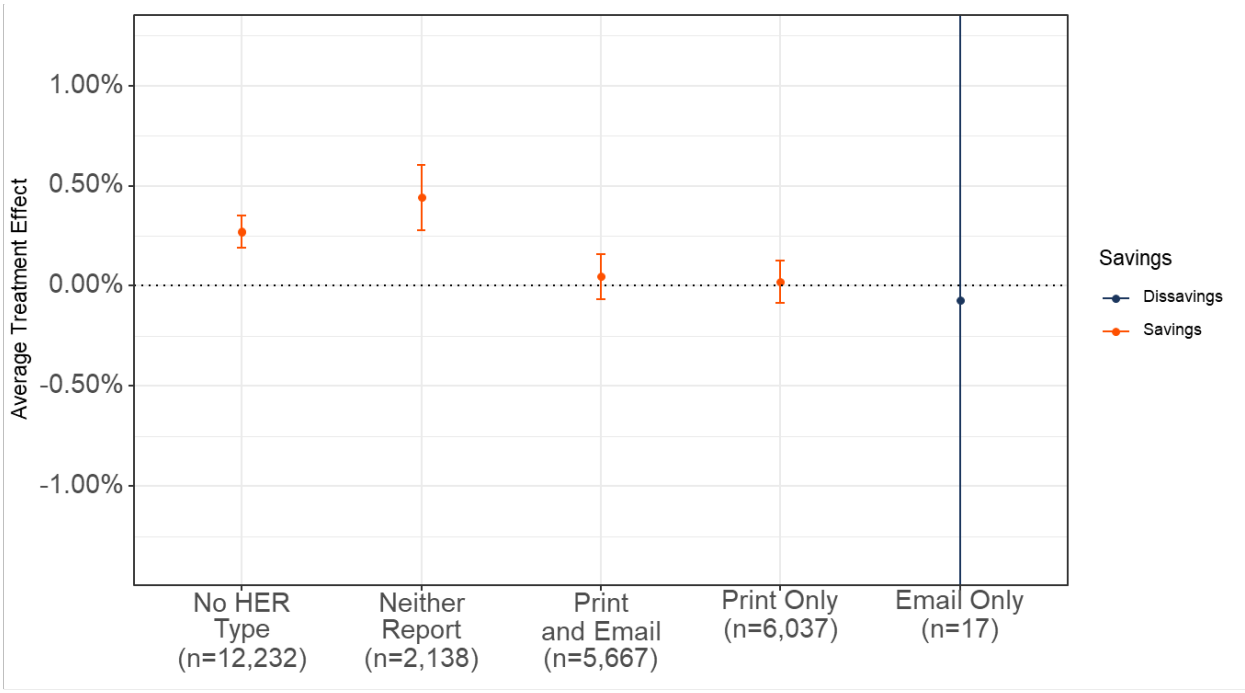
1. HER Enrollment
    a. Using HER enrollment start dates, the team estimated impacts for bill-account combinations which received HERs vs those which did not. The results show that accounts which receive a HER appear to have slightly lower salience effects than those which did not receive a report, as shown in Figure 3-27.

Figure 3-27. Overall Percent Savings by HER Enrollment



2. HER Type
   a. The Oracle data identified the type of report each HER participant received: Print Only, Email Only, Print and Email, or Neither Report. It is unclear what type of information is received for customers who did not receive either report, so TRC classified them as their own group. We classified non-HER participants as receiving No HER Type. The results from our models show that customers receiving Neither Report or No HER Type have higher impacts than the other three groups, shown in Figure 3-28. The HER accounts receiving some form of report exhibit approximately no bill salience effect in our data.

Figure 3-28. Overall Percent Savings by HER Type



Other Notable Findings – Takeaways

Although our data did not identify a clear salience difference pre vs post COVID, we are limited by partial year data. Further research could be conducted to analyze if salience changes between the two periods by looking at a longer timeframe or various subsegments.

Our Net Energy Metering results suggest that NEM accounts have higher levels of salience than other accounts; however, this could be correlation not causation. For example, a NEM customer is likely highly engaged with energy compared to the general population. It may be that this undefined characteristic of NEM accounts is the driver of the higher levels of bill salience, rather than simply being a NEM account. It is important to keep this in mind when interpreting results from these models.

Our estimates suggest that HER accounts exhibit less bill salience than non-HER accounts. It seems plausible that accounts which receive HERs use the report as their signal for energy usage rather than their utility bill. We do not know when the accounts receive HERs each month, but if the report comes at a different time than the billing statement is created, we may see salience effects around the time the HER is received rather than a salience effect when the statement is created.

3.1.7 Remaining Segments

TRC examined bill salience effects for the remainder of the variables provided by SCE. Table 3-4 summarizes the findings for the remaining segments.

Table 3-4. Other Segment Findings

Segment	Finding
California Alternate Rates for Energy (CARE)	CARE accounts may have slightly higher salience than non-CARE accounts but large uncertainty.
Family Electric Rate Assistance (FERA)	Too few FERA accounts and, as a result, too much uncertainty to draw a conclusion.
Smart Energy Program (SEP)	Too much uncertainty on the SEP estimate to draw a conclusion.
Payment Extension in Past Year (EXT)	Too much uncertainty on the EXT estimate to draw a conclusion.
Level Pay Plan (LPP)	Too much uncertainty on the LPP estimate to draw a conclusion.
Payment Arrangement in Past Year (ARA)	ARA accounts may have slightly higher salience than non-ARA accounts but large uncertainty.
Summer Discount Plan (SDP)	SDP accounts may have higher salience than non-SDP accounts. Savings for SDP accounts happen on several days after the statement is created.
Age	No clear salience differences between age groups.
Home Year	No clear salience differences between home year groups.
Climate Zone	Climate zones 14 and 15 (in the desert) may have slightly higher salience than other climate zones but large uncertainty.
Year-Month	No clear seasonality differences apart from the weather-driven effects controlled for in the model.

Several of these segments have large uncertainty around the point estimates, leading to the inability to draw conclusions from the impact segmentation. Further investigation on additional data may reveal more salience differences between groups or narrow the confidence intervals and reinforce these findings.

3.2 Limitations

As with any evaluation, there are several limitations from our research which should be kept in mind.

Correlation vs Causation

Our models compare a particular subgroups' consumption in the week before a bill date to their consumption in the ten days after a bill date controlling for several variables, such as temperature; however, the results do not distinguish between correlation and causation. For instance, our Net Energy Metering results suggest that NEM accounts have higher levels of

salience than other accounts; however, a NEM customer is likely highly engaged with energy compared to the general population. It may be that this undefined characteristic of NEM accounts is the driver of the higher levels of bill salience, rather than simply being a NEM account. It is important to keep this in mind when interpreting results from these models.

Uncertainty

Several of the variables have small sample sizes and therefore, too much uncertainty in the estimates from our models to draw conclusions. Other variables have a larger sample size, but the group of accounts exhibit varying behavior leading to high levels of uncertainty. Both cases limit the ability to draw conclusions from our impact segmentation.

Static vs Dynamic Indicators

Some of the fields provided were dynamic, meaning we are able to understand which bill is associated with the indicator. For example, the Net Energy Metering flag was provided along with a start date. Using these data, we are able to properly assign unique bill and account combinations into pre vs post Net Energy Metering. Other fields provided were static, meaning we received one indicator representing the classification for the customer. Fields with a static assignment may confound the bill salience effect by including bills unassociated with the subgroup.

COVID

Our research took place during the middle of the COVID-19 pandemic. Therefore, we only have AMI data through August 2020. The impact segmentation comparing pre vs post COVID periods is limited by partial-year data and may not fully reflect the effect of the pandemic on bill salience.

Data Accuracy

The estimates from our models are bound to the quality of the data received. Some fields are unknown, missing, or have accuracy concerns limiting our ability to confidently analyze the impact.

4 Detailed Findings: User Experience Interviews

4.1 Overview

This section details key findings the research team extracted from the user experience interview effort. Detailed findings are organized by theme.

4.2 Bill Pay Habits

The bill-pay habits of the respondents varied slightly by strata. Those who paid by **passive payment** (auto-pay) — usually through a direct connection to their bank account — all paid on the due date, as the payment was pre-scheduled to pull on the date the bill was due. This means that these customers do not consciously have to think about when to pay their bill or the bill amount, unless they are interested in looking at the contents of their bill.

Active payment customers typically paid online though the website, though a few reported they previously paid over the phone or through check. These customers were less likely to wait until the due date to pay the bill, and instead pay it immediately or according to a household bill pay schedule (either bi-weekly or monthly). Two respondents reported that they intentionally determined their bill pay schedule based on their paycheck payment schedule. Of these customers, one participated in the CARE program and one did not. The details of the payment schedule can be found in Table 4-1.

Table 4-1. Bill Payment Schedule

	Overall	Non-CARE, Passive Payment	Non-CARE, Active Payment	CARE Participant, Active Payment
Due Date	11	8	2	1
Later date	2	0	1	1
Immediately	4	0	3	1
Based on pay cycle	2	0	1	1

4.2.1 How Bill Pay Habits Impact Bill Salience

Active payment customers, by necessity of their payment type, need to think about the amount they owe, how to pay their bill, and when to pay it. Therefore, these customers' energy usage may be more salient to them than customers whose bills are automatically drawn from their account, as similar results were found in Sexton (2015) that automatic bill pay increased usage by 4%.[15] In order to pay their bill, active payment customers need to open their bill and, at minimum, read the amount they owe. This gives them an opportunity to reflect on the amount of energy they use – and how that impacts their bill amount. This may be especially true for

[15] Sexton, S. (2015). Automatic bill payment and salience effects: Evidence from electricity consumption. *Review of Economics and Statistics, 97*(2), 229-241.

customers (i.e., low-income customers) who have financial constraints; their ability to pay their bill depends greatly on the amount of energy they use.

4.3 Customers are Confused by Bill Content, but Satisfied

More than half (n=11, 57%) of respondents found one or more parts of their SCE bill to be confusing or difficult to understand. Some customers dialed in on specific sections of the bill, while others cited overarching sources of confusion with the information presented on the bill. While few customers made a direct connection between confusion over the bill and the bill being less salient during their interviews, customers did mention skipping over sections they found confusing. Customers skipping over vital information that could help them to better understand their energy use could lead to a decrease in overall comprehension of their energy usage. If customers do not understand their energy usage, they will not have the information or tools they need to understand how to reduce it.

4.3.1 Details of New Charges Section

The *Details of New Charges* section (located on page 2 of the bill) was a pain point for 32% of respondents overall and 54% of those that had confusion with their bill. For these respondents, a chain of emotions appeared to follow when we focused on this section of the bill – first confusion, then either acceptance or frustration. These respondents found the language and presentation of the information to be unclear, noting:

- "Explanation of delivery changes… **doesn't make any sense to me**."
- "**I don't understand what any of this means**. I know that at one point I got a credit back – but didn't really understand why."
- "Delivery charges. There's an awful lot of charges, **and I don't understand what any of them mean**."
- "I've never read [this section]. **Still doesn't make any sense** now that I'm reading it, and I never question it."

While some customers appeared to be comfortable *not* fully understanding the content of the *Details of New Charges* section, others felt frustrated by the lack of clarity and/or frustrated about having the charges applied to their account.

4.3.2 Vocabulary Used in Bill

Others (26% of respondents) had issues with the specific vocabulary used in the bill and noted that specific terms did not make sense to them. When probed, these respondents felt that the information was communicated to them in a way they could not understand. A few key terms were called out specifically:

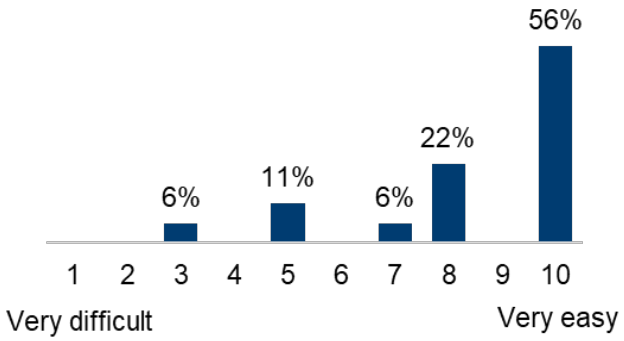
- "I have no idea what these **public purpose funds** are. Maybe [they] promote education? This doesn't make sense to me."
- "I don't know what this **DWR bond** charge is? How am I supposed to know what that is?"
- "I understand there is a **tier** system, but I don't understand what they mean. How do they calculate these?"

When discussing terms that felt confusing, respondents typically appeared to be frustrated. While some understood that this could be language the utility was required to include, others seemed to feel like the terminology was intentionally opaque. They wanted **more clarity and easy-to-understand terminology** to better understand the information presented in their bill.

4.3.3 Ease of Bill-Pay Rating

Interestingly, respondents had favorable responses when we asked them to rate their billing process. Respondents rated the difficulty of the billing process an average of 8.4 out of 10 (where 1 is "very difficult" and 10 is "very easy"), as shown in Figure 4-1. This signals that, while the majority of respondents found one or more parts of the bill to be confusing, the majority of respondents also thought the billing process overall was very easy to navigate.

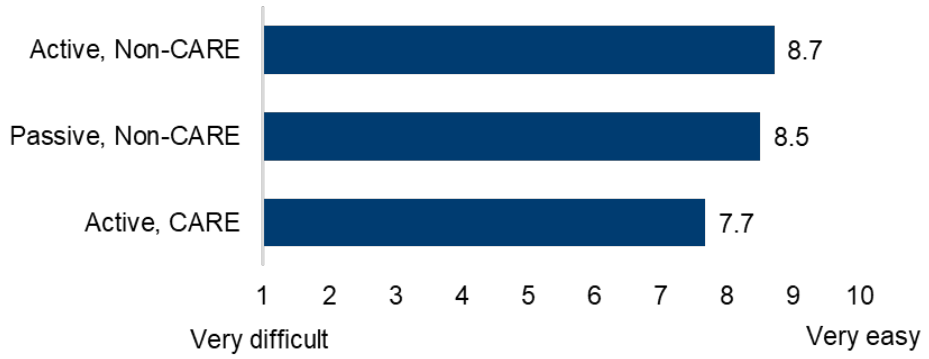
Figure 4-1: Difficulty of the Billing Process



Additionally, while all customers were fairly satisfied with the perceived ease of the billing process, those who were participants in the CARE program were slightly less likely to rate the ease of the process favorably.[16] There was a negligible difference between the customers that were not CARE program participants but had either active or passive forms of payment. These differences in ease of bill payment ratings can be seen in Figure 4-2. Of the three strata, CARE active payment customers found the bill pay experience to be the most difficult; they may experience financial constrains that make the "difficult" part of the bill pay process their ability to pay the bill.

[16] Due to small sample sizes, these differences are not statistically significant.

Figure 4-2. Ease of Bill Payment by Strata



4.3.4 How Confusion about Bill Impacts Bill Salience

The disconnect between the perceived ease of the bill pay process and confusion about the bill could indicate that respondents do not typically pay careful attention to their bill when they receive it. If this is the case, customers may simply not read their bill carefully enough to internalize the areas that are confusing. As mentioned above, by skipping over "confusing" sections of the bill, customers may miss out on key information that could help them better understand their energy use – and, by extension, not take action to reduce their energy use.

4.4 Customers Have Expectations of the Bill Amount

Respondents' previous usage patterns shape how they interact with their bill. The respondents we interviewed had years of history as SCE customers – on average, respondents had been an SCE customer for 26 years.

4.4.1 Established Customer Habits Shape Bill Pay Actions

Out of 19 respondents, 10 (52.6%) reported that when they open and pay their bill, they have expectations around how much they would owe and how much energy they would use. Several of these customers referred to their bill pay activity, either implicitly or explicitly, as a routine. These respondents have well-established patterns that correlate with their bill pay actions and are **likely to only pay close attention when something is not in line with their expectations**. Respondents noted:

- "I wouldn't look at the third page unless it was really high – I never read the delivery charges. Just **looked at tiers – since that is the usage I have control over**."
- "As long as the bill **appears reasonable**, I just pay."
- "If the bill is under a certain amount, I don't pay attention to the bill. **If it's over, I will look at the details**."
- "I see if everything is in my ballpark and meets my expectations. **I want to make sure there are no outliers**. If everything looks normal, I don't investigate."

More than half (52.6%) of respondents reported having established expectations about the information they would find on their bill each month – and noted they would not scrutinize the bill unless the amount owed was unexpected. This applied to both for the amount due and for the bill format. They noted:

- "I've been an **SCE customer for decades**, so I know what to look for."
- "I'm very familiar with the bill, as I have been **getting it for 40 years**."

There appeared to be a correlation between a customers' length of time as an SCE customer and the scrutiny with which they reviewed their bill. While these respondents expressed high familiarity with the bill, they did not appear to read it closely – instead, they would scan it to make sure nothing looked irregular, then make their payment.

4.4.2 How Expectations About Bill Impact Bill Salience

For the respondents that reported not looking into their bill unless it was outside their expectations, the bill will likely have a greater salience effect when it is considered "abnormally high". What is considered to be "normal" for a bill will depend on a customer's energy use, their income, their usage of solar panels, and the seasons. Additionally, what is considered a deviation from "normal" will also depend on these factors. For one individual, an increase in their expected amount of $10 could be considered substantial, while for another they may not notice a bill fluctuation of $50 or more. The quantitative analysis did not find differences in the bill salience effect depending on season; this may indicate that customers have adjusted their expectations significantly based on seasonal variation in the bill amount.

In the quantitative analysis we found that bills were more likely to be salient for customers that were CARE program participants. This may be in part due to the fact that their expectations for the bill amount are lower and their threshold for a deviation from normal is lower, due to income constraints. While the CARE program does help assist low-income customers afford their bills, two out of the four customers we interviewed mentioned still being afraid of opening their bill at times due to trepidation about the amount they would owe.

4.5 Customers Feel They Lack Power Over What They Owe

Nine out of nineteen respondents (47%) felt that they didn't have any power to impact the amount they owe on their bill. People reported feeling this way due to four key reasons:

- **Limited energy-saving actions in their control:** 37% of respondents felt they were doing as much as much as they could do to reduce their energy use already.
- **Reality of seasonal changes**: 31% of respondents felt that seasonal changes – and related energy needs associated with hotter or cooler months – were an unavoidable reality.
- **Lack of trust in bill information**: 32% of respondents felt that SCE had set charges in place, and they – as the customer – did not have any power to impact the amount they owed.

- **Scrutiny from solar customers**: 21% of respondents had installed solar panels recently and felt like the information they received from their solar panel provider did not match the information they received from SCE.

4.5.1 Customers' Perceived Limited Control Over the Bill

Many respondents (37%) felt they were **already taking action to save energy at home** but had simply exhausted their opportunities to reduce energy consumption. When we discussed this with respondents, they appeared to feel resigned that they were doing the best they could but were not seeing measurable differences on their energy bill. Respondents noted:

- "I already **know how to reduce my energy use**. And I'm doing it."
- "I feel like I'm **doing what I can**."
- "I took advantage of SCE's assessment program to do upgrades, and we always turn the lights off and are careful about A/C and temperature in the house... but we're **sick of our bills going up**."

Similarly, other customers (16%) felt that overall, they had limited control over the amount they owed SCE each month, no matter how many actions they took to reduce energy consumption.

- "The bill **is what it is**."
- "I look at the detail on the charges, for the charges that you can't change **– there is nothing you can do.** I'm not going to call and ask about it because it is the way it is"
- "I'm always in Tier 2. I **don't know how to get down** low enough to get out of it."

These customers have the perception that they have little-to-no control over their bill, their energy use, and what SCE charges them. This likely disincentivizes them to change their behavior, even if they receive a bill that they perceive to be too high. We heard that the bill "is what it is" directly from three respondents – and this sentiment was reflected among other respondents. These respondents likely have little motivation to explore the bill or their energy use and are unlikely to change their energy use as a result of receiving their bill.

4.5.2 Reality of Seasonal Changes

Several respondents (31%) felt that **seasonal changes dictated the peaks and valleys** in their bill amounts. They felt their bill would inevitably go up during hotter months – when they would use more air conditioning – and go down in cooler months. Respondents noted:

- "It [the bill amount] just feels like a **reflection of how hot it is** – lower in the winter and more in the summer – not much you can do."
- "Sometimes the tier I'm in feels **outside my control, especially during warm months** when I have to turn the A/C on a lot."

When we asked one respondent whether seeing their usage prompted them to think about reducing their energy use, they noted: "Not really – it is what it is. I mean you are going to turn your lights on; you are going to use your washing machine; you are going to use the air conditioning."

For customers in Southern California, the summer is usually the period of highest energy usage, resulting in the highest bills of the year. Respondents appeared to feel that, compared to the amount they paid in the summer when they are using their A/C, the bills in the cooler months are low enough not to cause concern. For these customers that feel that their energy use mostly depends on seasonality, it could be helpful to acknowledge this natural fluctuation in energy use and identify and communicate tips to reduce their energy use year-round.

4.5.3 Lack of Trust Over Bill Information

Of those interviewed, 32% of respondents cited **lack of trust in SCE** about the information presented on their bill. Some respondents felt there were hidden charges embedded on their bill, while others felt the charge amounts were variable and unexpected. Respondents noted:

- "They raise the rates so much; there's a lot of hidden stuff here that isn't clear."
- "You never know what you are going to get."
- "I am not a conspiracy theorist but if you ask me if I feel confident all the time about that [tier charges] – no, I don't."

The customers that do not trust the data on their bill may be less likely to act upon the information presented on it. For example, if they were to see usage that is considered "high," they may not feel motivated to attempt to lower their usage.

This lack of trust also seemed to be linked directly to the tier system; several customers did not understand how and when they fall into different tiers of energy usage. The bill amount seemed to be the highest motivating factor for customers to investigate their energy usage and change their behavior – and the amount the customer is billed directly correlates to the customers' tier. Therefore, if a customer does not trust or understand the tier system of billing, a high bill may still not motivate them to change their energy use, as they think they lack control over which tier they fall into no matter their energy use.

4.5.4 Scrutiny from Solar Customers

Four respondents (21%) had installed solar panels in the past few years. They noted that the usage **amounts reported by their solar company did not match with SCE usage amounts**, and they were suspicious of this:

- "What SCE says I'm using and what I think I'm using do not always line up. But what are you going to do? Just pay the bill."
- "My solar app doesn't match up with billing from SCE."
- "I create energy but don't get credited for all of it."

This is an interesting puzzle for SCE: while a significant amount of solar customers' usage is likely linked to their solar and not SCE, if they distrust the bill information presented on their SCE bill, they will be unlikely to act on it. For instance, if a solar customer is using more than they are producing and needs to use energy produced by SCE, they may be more surprised by the amount charged, but more distrustful of the amount that SCE claims that they used.

4.6 Customers Respond to Visual Cues

As we walked through the bill with respondents, we noted that they liked visual depictions and elements that drew their eyes. Customer most frequently (n=11) mentioned liking the usage bar graph on the top of page 3; when we asked respondents what information was helpful to understand their bill, eleven of respondents dialed in on this section. Four customers mentioned that their eyes were drawn to font that was large and/or bolded, which they thought was helpful to help them find important information.

- *When asked what on the first page they noticed first:* "Routing outage. Stuff at the **top and in bold**."
- "My main takeaway is the amount I have to pay. It is in **bold letters and stands out a little bit** – catches the eye."

Customers also seemed to interpret the usage bar graph better than other depictions of the usage information.

- "I **like the graph** to quickly see my usage information."
- "**Nice bar chart** – I can recognize if I'm using it too much and correct it."
- "I find the **graph interesting**. I like to compare the average electricity usage."
- "I always look at the amount due, then past and current usage. I **like to look at the graphs on the second page**, then look at the tier usage."

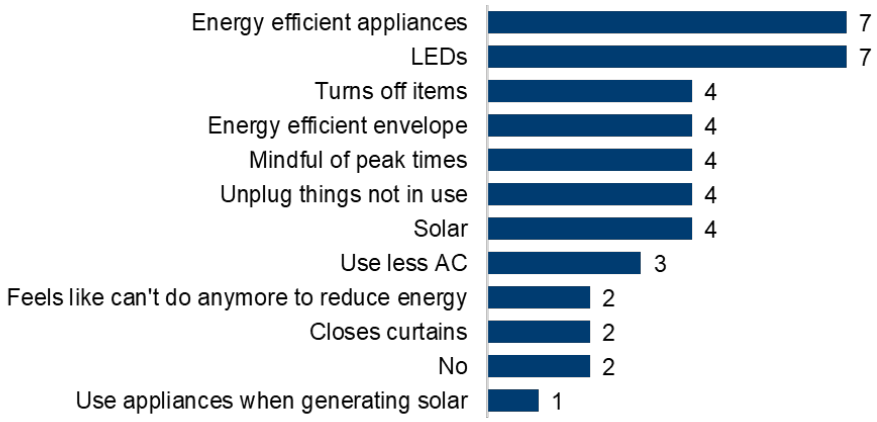
4.6.1 How Visual Cues Impact Bill Salience

When customer's eyes are drawn to parts of their bill – by color, visuals, or bold text – this information will stand out in their mind as important. It will also help key information stand out as a signpost, making it easier for them to focus on as they analyze their bill each month. Respondents responded positively to the bold, large text highlighting the amount they owed. SCE may want to consider using visual cues to highlight other important information, which may increase the salience of this information.

4.7 Customers Employ Strategies to Manage Energy Use

Customers mentioned using several strategies to manage their energy use. When asked, most mentioned that they tried to purchase energy-efficient appliances, install LEDs, and turn off equipment when not in use. Full details of the strategies used to reduce energy use can be seen in Figure 4-3.

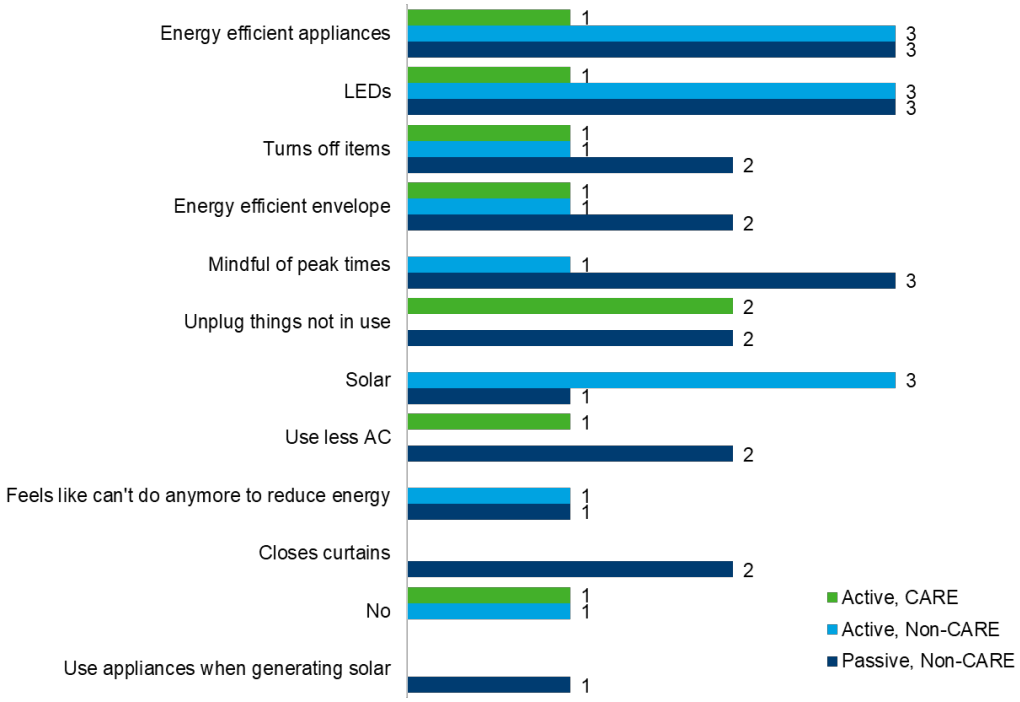
Figure 4-3. Strategies to Reduce Energy Use



Those who participated in the CARE program were less likely to mention purchasing appliances, replacing LEDs, and being mindful of peak timing.

Conversely, they were more likely to mention unplugging equipment when not in use, turning off equipment, and using less air conditioning. This may show that those who are on the CARE program still think about their energy use frequently, but their strategies to lower their energy use are more habit-based — such as turning off the lights — rather than purchasing more energy-efficient products. Details on these differences between strata are detailed in Figure 4-4.

Figure 4-4. Distribution of Strategies to Reduce Energy Use Between Strata



4.7.1 How Customers Managing Energy Use Impacts Bill Salience

How customers manage their energy use may impact the salience of a bill. For instance, if customers have invested in longer-term strategies, such as buying energy-efficient products or installing solar panels, they may not think about needing to change their behavior to impact their bill. For those that have more habit-based strategies to reduce their energy use, such as unplugging items, being mindful of peak times, or using less AC, a high bill may prompt them to reinstate their habits.

Four respondents mentioned that, when a high bill comes, they will talk to those in their household about their energy use and remind them of energy-saving habits. This seemed to be especially true for those who had children; two respondents mentioned that their children needed reminders of energy-saving habits, and that high bills would prompt these reminders. These two customers discussed their habits of discussing energy use with their children:

- "If the bill is really high, that is the **time to have a family conversation**, you know. A conversation with the kids on turning up the A/C and turning off the lights."
- *After receiving a high bill: "*Yeah, **we talk about it and I get upset about it but**, then in the following two days they [the children] do it [use the A/C all day] all over again."

For customers who do not report having manual or habit-based strategies to manage their energy use, it may help to make these manual strategies more top of mind, such as a simple reminder that while having energy efficient appliances is helpful, other more manual strategies are still important to reduce their energy use.

5 Synthesis and Conclusion

This study has built upon and expanded upon the existing research about bill salience impacts. The two primary contributions are using customer information to understand how average bill salience impacts vary between customer groups, and to investigate through user experience interviews how customers perceive their bills. This section synthesizes the results from the quantitative and qualitative research efforts that make up this study.

Our quantitative evaluation found that, on average, there is a positive bill salience effect of approximately 0.18% across the 10-day period after a bill date. This average effect peaks in general on the 6th and 7th day after a statement is created with reductions near 0.8%. These findings support existing research by Gilbert and Zivin (2014) which found that there is an average decrease in a customer's usage after they received a utility bill.[17] The availability of customer metadata allowed our research team to investigate these bill salience effects further based on various characteristics.

Previous research by Sexton (2015) found that automatic bill payment increased residential electricity consumption by 4% for a publicly owned electric utility.[18] Our analysis of payment channels found that on average, the common auto-pay option for SCE customers (Direct Payment) had a positive salience effect, but not statistically significantly different from zero. Although our results do not align nominally, we found that other payment channels which require active forms of payment generally had higher salience effects. Our team was able to analyze this relationship further by examining bill delivery type and payment channel combinations. We found that when these channels involve higher levels of engagement (e.g., paper bill delivery or active payment channel), these effects are higher than passive channels that require little or no engagement. Conceptually, the story drives the same point – less engagement with a utility bill may lead to lower salience effects.

The qualitative user experience interviews conducted by our team provided further insight into how residential customers engage with their utility bill, with many implications for salience effects. All interview respondents received a paper bill but differed in whether they paid using active or passive payment methods. Even among this group of customers who have relatively higher engagement by virtue of their bill delivery method, engagement with their bill tended to be minimal, and the interviews revealed aspects of their experience that likely lead to lower salience.

While the quantitative analysis found the strongest salience effect on the 6th and 7th days after a billing statement was created, interview respondents notably described bill paying routines that likely lead to variations in both *when* and *how frequently* a salience effect occurs. Those with a passive payment method set up need only engage with the bill once, when originally opening or reviewing it, if they engage with it at all. Those who paid actively, however, varied in whether they opened their bill and set up payment at the same time, or came back to it to set up payment later in the billing cycle. This suggests that, for some customers, a salience effect

[17] Gilbert, B., & Zivin, J. G. (2014). Dynamic salience with intermittent billing: Evidence from smart electricity meters. *Journal of Economic Behavior & Organization*, *107*, 176-190.
[18] Sexton, S. (2015). Automatic bill payment and salience effects: Evidence from electricity consumption. *Review of Economics and Statistics*, *97*(2), 229-241.

could occur on more than one occasion. Although the customer data cannot speak to this specific circumstance, we did observe a higher average salience impact for accounts that made multiple payments on a single bill. While likely correlated with disposable income, this situation is another where a customer would engage with their bill multiple times.

In addition to providing insight into respondents' bill paying routines, the interviews shed light on residential customers' expectations and attention in interacting with their bill. One of the most striking findings from the qualitative phase of the research is the relative prominence of the bill amount relative to other bill content in terms of respondents' attention—several respondents admitted that the amount owed and the due date are often the only elements of the bill they noticed. Most have learned over time what "normal" variation they can expect and are motivated to give other components of the bill more scrutiny only when those expectations are violated and a bill is higher than anticipated. This suggests that the bill amount is frequently the only salient information for many customers. These expectations vary with seasons, so that respondents expect high bills in the summer. This may explain why we did not observe significant seasonal variation in bill salience impacts in the quantitative analysis. When the bill amount is seen as unremarkable, it may also be less likely to generate any sort of response in terms of energy use. That said, several participants recalled months where they have been surprised by their bill amount, despite being aware of typical use patterns and seasonal variation in their usage.

When respondents *do* look more closely at other parts of their bill, rather than gleaning a better comprehension of their usage and rates, over half (57%) encounter information and terminology that they don't understand, leading to confusion and, at times, frustration and distrust. The one exception to this pattern was the chart that shows customers' daily average usage over time, which respondents tended to readily comprehend (or at least perceive that they understood). Conversely, the *Details of your new charges* section was widely seen as the most confusing part of the entire bill. Crucially, this is also the part of the bill that has the most relevant information for customers when it comes to understanding why they owe the amount that they do. While there were sources of confusion, respondents for the most part rated the entire process from receiving their energy bill to making a payment as fairly easy. But this may be because individual customers have grown accustomed to skipping over the parts of their bill that they don't understand.

Some interview respondents seemed to feel a lack of agency regarding their energy bill. As one put it succinctly, **"it is what it is."** Several talked about feeling powerless to impact the amount they owed, either because they didn't fully understand what they were being charged for, didn't trust the charges were an accurate reflection of their usage (this was particularly true of respondents with solar panels), or didn't think there was anything else they could be doing to use less energy. Even long-time customers who felt they knew what to look for on their bill didn't necessarily feel in control or that they would know if they were being mischarged. These beliefs may inhibit customers' ability to use the information provided to effectively manage their energy use and lower their bill in the future.

However, this perceived lack of control did not mean that respondents were dismissive of energy efficiency measures or pessimistic about their efficacy. Rather, many had already taken actions or attested to adopting habits to cut back their energy use to the extent where they didn't know what more they could do to reduce their use any further. They reported a variety of longer-

term measures that require costs upfront, like buying LEDs, upgrading to energy efficient appliances, or better insulating a home, as well as habitual measures like closing curtains or shifting the time of day they do laundry. Any of the measures that persist through time, such as equipment changes, would not affect the estimated bill salience impact because they affect both the pre-bill and post-bill period identically. It is possible that those who primarily employ more habitual actions, e.g., becoming more vigilant about turning lights off, may change their behaviors more after receiving a bill than those who have made longer-term investments.

Although several of the perceptions and beliefs related to the bill process described above may reduce the likelihood that customers are highly motivated to reduce their energy use after receiving a bill, it is clear from the quantitative analysis that such a reduction is taking place. While many respondents did not make an explicit connection between receiving a bill and changes in their energy use, four respondents did note that getting an unexpectedly high bill had led them to have discussions in their household about conserving energy. It is also possible that bill salience effects operate partially unconsciously, meaning customers may not have full insight into the impact engaging with their bill has on their energy-related behaviors.

It is also noteworthy that our quantitative models found that income plays an important role in bill salience, with lower income levels exhibiting higher salience effects, on average. Further, when segmenting several of the variables in the metadata by income, our team repeatedly found instances where lower income levels exhibited higher salience effects within the subsegment. While some households may have the latitude to pay their bill no matter the amount, for a household with less disposable income, a bill may be a much more powerful cue to curb energy use. Two interview respondents shared their experiences of feeling scared to open their bill or being stressed over seeing a large bill. Moreover, respondents who were participants in the CARE program were slightly less likely to rate the ease of the bill process favorably, possibly because of difficulty related to their ability to pay, and were more likely to mention using habit-based reduction strategies.

One final area where the qualitative interviews can help explain findings from the quantitative analysis relates to Net Energy Metering (NEM) accounts, which generate some of their own electricity. NEM accounts exhibited higher bill salience effects than other accounts. We also saw that customers with solar panels participated in interviews at a higher rate than anticipated based on their proportion of the customer base. Additionally, all six of the solar customers interviewed reported not fully trusting the information in their energy bill. In concert, this suggests a higher level of engagement with their energy experience among solar customers.

Taken together, the two phases of bill salience research provide insight into the varying bill salience impacts across several customer types, payment information, demographics, and other characteristics, and improve our understanding of how customers perceive the information on their bill, what information is salient to their decisions around energy consumption, and the types of behavior that may result from this information.