INDIVIDUAL TIME PREFERENCES AND ENERGY EFFICIENCY

By RICHARD G. NEWELL AND JUHA SIIKAMÄKI*

*Newell: Duke University, Box 90467 Durham, NC 27708 (e-mail: richard.newell@duke.edu). Siikamäki: Resources for the Future, 1616 P St. NW, Washington DC 20036 (email:juha@rff.org).
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A large literature examines energy-efficiency investments by consumers and firms, particularly evaluation of the extent of and explanations for an "energy efficiency (EE) gap" (Gerarden, Newell, and Stavins 2015). But prior studies have not considered the role of individual discount rates in such decisions. Instead, most assessments assume a certain discount rate against which the rationality of observed choices is gauged (Allcott and Wozny 2014), or alternatively, estimate aggregate discount rates that best match observed EE decisions, conditional on an assumed decision model (Hausman 1979).

The absence of evidence on the role of individual discount rates is surprising because the profitability of EE investments depends fundamentally on the rate at which individuals discount future energy savings relative to the required upfront investment. The potential importance of individual discount rates is further heightened by findings in experimental studies that elicited time preferences exhibit considerable heterogeneity (Frederick, Loewenstein, and O'donoghue 2002).

This paper broadly examines the role of individual discount rates in EE decisions. Our earlier findings on information provision (Newell and Siikamäki 2014, hereafter NS) indicate that the efficacy of alternative labels in guiding cost-efficient decisions depends critically on the discount rate used for analysis. Here we closely examine individual discount rates as a determinant of the value households place on future energy savings.

Our results demonstrate that individual discount rates exhibit considerable heterogeneity and systematically influence household willingness to pay (WTP) for EE, as measured through product choices, required payback periods, and EE tax credit claims. The relationship is statistically significant, empirically robust, and not confounded by the characteristics of the homeowner, household, and their home. We also examine the determinants of individual discount rates to better understand what drives their substantial heterogeneity: education, household size, race, credit score, and to some extent income, are important factors. Overall, our findings imply that individual discount rates are critical to understanding EE investments, the "EE gap," and to guiding policy on EE.

I. Household Survey

We draw evidence from extensive survey results from 1,217 random single family U.S. home owners (see NS for details).[1] A key part of the survey included choice experiments to estimate WTP for EE. Using a computerized survey instrument, each study participant faced several decisions involving choosing the preferred product from three different appliance options. The specific choice problem was a water heater purchase, which provides a range of distinct advantages.

We administered 12 randomized label treatments that altered the type of available EE information. The choice experiments examined a large number of alternative product models across the respondents and labeling treatments so that elicited data enables estimation of the implicit tradeoff between the purchase cost and annual energy operating cost of the appliance.

The survey elicited individual discount rates using a method common to experimental economics (Williams and Koller 1999). Moreover, it collected rich data on the characteristics and life situation of the homeowner, household, and their home.

II. Labels, WTP for EE, and Discounting

The experiment setting and econometric approach enables disentangling the relative importance of different types of information on labels in guiding EE behavior, and distinguishing it from intertemporal behavior.

Using choice data in combination with the random utility and multinomial logit models, NS directly estimate WTP for reductions in the present value of operating costs (PVOC) so that one can readily examine whether households under- or overvalue energy savings. For cost-minimizing energy decisions a household should be willing to pay one dollar more in purchase cost for each dollar of reduced PVOC. NS models WTP for reduced PVOC as a function of information treatments to directly estimate how much the labeling attributes contribute to the valuation of PVOC.

NS find that the information content and label style strongly influence the valuation of EE and that a lack of relevant information leads to significant undervaluation of EE.[2]

The degree to which the current U.S. EnergyGuide label guided cost-efficient decisions depends importantly on the discount rate assumed appropriate for the analysis. Using individual discount rates elicited in the

[1] We fielded the survey using a random sample from the probability-based GfK panel, which is designed to be representative of the U.S. The GfK panel is widely used for research in many fields.
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[2] Providing simple information on the economic value of saving energy was the most important element guiding more cost-efficient investments in EE, with information on physical energy use and carbon emissions having additional but lesser importance.

survey, NS find the current EnergyGuide label came very close to guiding cost-efficient decisions, on average. However, using a uniform five percent discount rate—typical of government regulatory analysis, but much lower than the average individual elicited rate—the EnergyGuide label led to choices resulting in a one-third undervaluation of EE. These results reinforce the importance of intertemporal choice and discounting both for understanding individual behavior and for guiding policy decisions.

III. Time Preferences and EE Choices

Individual Time Preferences

We elicited individual discount rates using an experiment where the respondent chose between a $1,000 payment available in one month and a higher payment available in 12 months.[3] The elicited discount rates indicate considerable heterogeneity (Fig S1), and are generally consistent with other similar experimental evidence (see NS for a more detailed review). The mean rate was 19 percent, the median was 11 percent, and the standard deviation was 23 percent. The distribution has a concentration at relatively low discount rates (≤10 percent) and is skewed right with a few observations at high rates (≥40 percent). An advantage of our sample is that it is more representative of the population than is typical of the time preference elicitation literature; this breadth also allows for exploration of the effect of demographic variables (see section IV).

WTP for EE Investments

Next, we examine individual time preferences as a determinant of households' WTP for annual energy savings, using data from the appliance choice experiments described earlier. Our empirical model follows the random utility model with a linear additive structure written to directly estimate WTP for annual operating cost (OC):

$$(1)\ U_{ij} = \lambda_i(p_{ij} + \gamma_i OC_{ij}) + \varepsilon_{ij},$$

where U_{ij} denotes the utility that person i derives from alternative j, λ_i is the marginal utility of income estimated on p_{ij}, the price of alternative j, and ε_{ij} is a random variate distributed iid. The term γ_i is the WTP for annual operating cost. We enter OC as a negative to estimate WTP for energy savings and then re-parameterize γ_i as follows:

$$(2)\ \gamma_i = \hat{\gamma}\exp(\beta R_i + \phi X_i),$$

[3] Using a method based on Williams and Koller (1999), we administered a series of questions where each respondent who chose the near term payment ($1,000) continued through new choices with a larger 12-month payment, until the respondent switched from choosing the near term payment to the 12–month payment.

where R_i is the individual specific discount rate for person i and X_i is a vector of variables which denote the characteristics and situation of the homeowner, household, and their home. X_i also includes as controls seven binary indicators of the information treatment person i received. The specification allows direct estimation of the effect of individual time preferences on WTP for EE, controlling for other possible determinants.[4]

We estimate several empirical specifications ranging from a simple model that includes only the purchase and operating cost of choice alternatives (Model 1), to gradually more flexible and comprehensive specifications that incorporate the characteristics of the homeowner, household, and their home (Model 2), and information treatments (Model 3). Finally, we add a random element to the purchase cost parameter to model heterogeneity remaining after inclusion of observed heterogeneity (Model 4).

The estimation results indicate a robust and statistically significant relationship between individual discount rates and WTP for EE (Table 1, column 1; details in Table S2). Different model specifications estimate the coefficient *ß* at almost exactly the same magnitude, indicating that WTP for annual operating cost savings declines by about 1.6 percent for each percentage point increase in the individual's discount rate. This is intuitive: for individuals with higher discount rates the value of reduced future operating costs is lower, as is their WTP for EE.

[Insert Table 1 Here]

The robustness of the estimation results suggests individual discount rate heterogeneity is not adequately controlled for through the characteristics of the homeowner, household, and their home.[5] Regardless, including data on those variables barely alters the coefficient on individual discount rates.

The survey also asked respondents directly to state their maximum WTP for a $10 reduction in annual energy costs (see supporting information). OLS estimation results show a robust, statistically significant association between the individual discount rate and WTP for EE (both in logs). The coefficient on the individual discount rate (Table 1, column 2; details in Table S3), indicates that the elasticity of WTP with respect to the discount rate is about -0.08 to -0.10. This result is consistent qualitatively

[4] We also control for the non-monetary attributes of the choice alternatives but exclude them in Equation (1) for brevity.

[5] We consider an extensive set of over 20 variables to denote such conditions (Table S1), including data on the age, education, ethnic background, gender, and employment status of the head of household; number of children; household size, income, and likelihood of moving; number of bedrooms; whether the home has a new water heater; and U.S. geographic location (East, Midwest, South, West).

with the findings based on the more detailed choice experiment (Equations 1 and 2).

Payback Period Required for EE Investments

The survey also directly asked respondents their "payback" preferences—how quickly a more EE water heater should recover its additional purchase price through energy savings to remain attractive (see supporting material). Again, OLS estimation results show a consistent and statistically significant association between the individual discount rate and payback years (both in logs). The coefficient on the individual discount rate (Table 1, column 3; details in Table S4) indicates that the elasticity of payback period with respect to the discount rate is roughly -0.05 to -0.08. Again, the finding is consistent with expectations: the greater the discount rate, the shorter the time horizon required for the investment to break even.

Tax Credits for EE Investments

Federal tax credits to promote household investments in EE were in place 2006–2011. These credits were popular, with 23 percent of single family homeowners in our sample taking advantage of the credits. We examine the factors determining who claimed EE tax credits, with particular interest in whether individual discount rates are associated with tax credit claims.[6] The estimation results indicate that the likelihood of claiming a tax credit is systematically associated with lower individual discount rates, higher household income, and a lower likelihood of moving (Table 1, column 4; details in Table S5). The likelihood of claiming the tax credit increases as the individual discount rate decreases. This is as expected because WTP for EE is higher for households with relatively low discount rates (see results above), so they are higher on the demand curve for EE investments.

IV. Influence of Individual Characteristics on their Time Preferences

Next, we examine the determinants of individual discount rates using observable characteristics of the head of household, the household, and their home as predictors in a wide array of regression specifications.[7]

One of the most consistent results (Table S6) is that education matters greatly in the context of individual discount rates. Controlling for other factors, individuals with some college education have discount rates 8-9 percentage points lower, and those with at

[6] We examine this relationship using a simple linear probability model, which includes the individual discount rate as a predictor along with several other potentially relevant drivers of the tax credit choice, including income, likelihood the household will move in the next five years, and various homeowner attributes.

[7] Other studies have also found that education and income have a negative effect on discount rates (Anderson et al. 2006).

least a bachelor's degree 13-14 percentage points lower, than those with no college (whose mean rate was 24 percent). This result is consistent across models with a wide range of continuous and categorical controls for income and even credit score.

Other consistent determinants of discount rates include household size and race. Larger households and black, non-Hispanic respondents had relatively high discount rates, even after controlling for income, education, and a wide range of other characteristics.

Income has a distinct association with individual discount rates, although this relationship is not always statistically significant. Setting statistical significance aside, we have examined many specifications with categorical dummies for fine-grained income categories. The magnitude of those estimates consistently suggests that higher incomes tend to be associated with lower discount rates. The results also suggest that the discount rates may spike at very low incomes, below $10,000 annually.

Finally, we find that lower credit scores are associated with significantly higher individual discount rates, consistent with the financial interest rates the individual likely faces.

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TABLE 1— ESTIMATED COEFFICIENT ON INDIVIDUAL DISCOUNT RATE WHEN PREDICTING PREFERENCES FOR EE

	WTP for annual energy savings [a]	WTP for $10 reduction in operating cost [b]	Payback Time [c]	Federal EE Tax Credit [d]
Model 1 (most restricted model) [e]	-0.017***	-0.100***	-0.076***	-0.028*
Model 2 (more flexible than Model 1)	-0.016**	-0.100***	-0.075***	-0.024*
Model 3 (more flexible than Model 2)	-0.016***	-0.080**	-0.061***	-0.019
Model 4 (most flexible model)	-0.016***	-0.079**	-0.046*	-0.017

Notes: See Newell and Siikamäki (2014) for the description of the survey experiments.

Source: Author calculations.

[a] Estimated using an exponential specification (see Equation 2). See Table S2 for other results.

[b] OLS to predict the maximum amount (dollars in logs) the respondent is WTP for every $10 reduction in the annual energy cost of a water heater. See Table S3 for other results.

[c] OLS to predict the length of time (years in logs) the respondent listed when asked how quickly a more energy-efficient water heater alternative should recover its additional purchase cost through energy savings. See Table S4 for other results.

[d] A linear probability model to predict the likelihood the household claimed the federal EE tax credit. See Table S5 for other results.

[e] Model specifications vary by model type and dependent variable. See the supporting material for the specification of different models.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

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Supporting Information

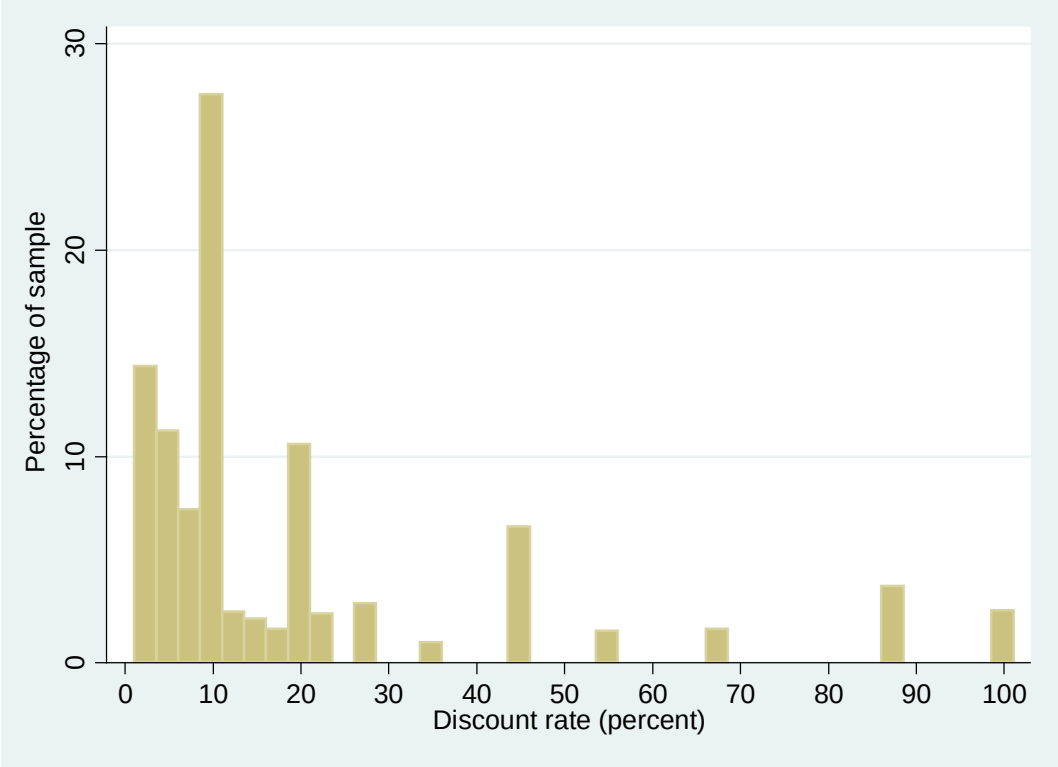

FIGURE S1. THE DISTRIBUTION OF ELICITED INDIVIDUAL DISCOUNT RATES

Note: Median, mean, and standard deviation of the discount rate equals 11.0%, 19.3%, and 22.8%, respectively. See Newell and Siikamäki (2014) for the elicitation method.

TABLE S1. SELECT CHARACTERISTICS OF THE SURVEY RESPONDENT, RESPONDENT'S HOUSEHOLDS, AND THE HOUSEHOLD HOME (SUMMARY STATISTICS)

Variable	Description	Mean	St. Dev.	Min	Max
Respondent					
Age under 30*	Age under 30 years	0.059	0.236	0	1
Age 30-44	Age 30-44 years	0.205	0.404	0	1
Age 45-59	Age 45-59 years	0.329	0.470	0	1
Age 60 or more	Age 60 years or more	0.407	0.492	0	1
High school or less	Highest educational attainment	0.353	0.478	0	1
Some college or more*	Highest educational attainment	0.647	0.478	0	1
White, non-Hispanic	Ethnic background	0.833	0.373	0	1
Other ethnicity*	Ethnic background	0.167	0.373	0	1
Female	Gender	0.464	0.499	0	1
Male*	Gender	0.536	0.499	0	1
Paid employee*	Employment status	0.473	0.499	0	1
Self-employed	Employment status	0.087	0.282	0	1
Retired	Employment status	0.276	0.447	0	1
Disabled	Employment status	0.060	0.238	0	1
Not working	Employment status	0.046	0.209	0	1
Household					
No kids under 17*	Household with no kids under 17 years old	0.720	0.449	0	1
Kids under 5	Household w/ kids under 5 years old	0.113	0.317	0	1
Kids 5-17	Household w/ kinds 5-17 years old	0.226	0.419	0	1
One person*	One person household	0.204	0.403	0	1
Two persons	Two person household	0.420	0.494	0	1
Three or more persons	Three or more person household	0.376	0.485	0	1
Likely to move	Household likely to move to a new home within 5 years (min 75% chance)	0.081	0.273	0	1
Income under $30K	Household income under $30K	0.165	0.371	0	1
Income $30-$59K	Household income $30K-$59K	0.346	0.476	0	1
Income $60-$90K	Household income $60K-$89K	0.225	0.418	0	1
Income over $90K	Household income over $90K	0.257	0.437	0	1
Income ($100K)	Household income	65.216	40.55	2.5	>200
Home					
1-2 BR*	Home with 1-2 bedrooms	0.198	0.399	0	1
3-4 BR	Home with 3-4 bedrooms	0.734	0.442	0	1
5 or more BR	Home with 5 or more bedrooms	0.068	0.251	0	1
Replaced water heater	Water heater replaced in last 5 years	0.224	0.417	0	1
Northeast*	U.S. regional location	0.175	0.380	0	1
Midwest region	U.S. regional location	0.254	0.436	0	1
South region	U.S. regional location	0.367	0.482	0	1
West region	U.S. regional location	0.204	0.403	0	1

Note: The number of observations is 1,181. The asterisk (*) denotes the baseline (excluded category) required for identification for binary variables.

TABLE S2. MULTINOMIAL LOGIT ESTIMATION RESULTS TO PREDICT THE PROBABILITY OF WATER HEATER CHOICE (SEE EQ 1 AND 2)

Variable	Model 1			Model 2			Model 3			Model 4		
	Est.	t-val.	p-val.	Est.	t-val.	p-val.	Est.	t-val.	p-val.	Est.	t-val.	p-val.
Purchase Cost - mean	-0.199	-19.81	0.00	-0.205	-20.41	0.00	-0.212	-21.05	0.00	-0.218	-15.06	0.00
Purchase Cost - standard deviation							0.010	0.00	0.00	-0.053	0.04	-1.29
WTP for Annual Operating Cost Savings (Eq. 2)												
Constant	0.080	10.96	0.00	0.100	3.54	0.00	0.087	2.74	0.01	0.086	2.78	0.01
Discount rate	-0.017	-2.80	0.00	-0.016	2.29	0.02	-0.016	2.79	0.01	-0.016	2.78	0.01
Age 30-44	0.000	-6.91	0.00	-0.351	-7.04	0.00	-0.287	-7.60	0.00	-0.281	-7.59	0.00
Age 45-59	0.000			-0.281	-2.04	0.04	-0.271	-1.24	0.22	-0.268	-1.22	0.22
Age 60 or more	0.000			-0.333	-1.45	0.15	-0.402	-1.12	0.26	-0.396	-1.11	0.27
High school or less education	0.000			-0.136	-1.60	0.11	-0.046	-1.60	0.11	-0.046	-1.58	0.11
White, non-Hispanic	0.000			0.009	-1.14	0.25	0.031	-0.41	0.68	0.035	-0.41	0.68
Female	0.000			0.003	0.06	0.95	0.020	0.18	0.86	0.015	0.20	0.84
Self-employed	0.000			0.142	0.02	0.98	0.152	0.19	0.85	0.156	0.15	0.88
Retired	0.000			0.054	0.97	0.33	0.116	1.03	0.30	0.114	1.05	0.29
Disabled	0.000			0.239	0.33	0.74	0.265	0.77	0.44	0.268	0.76	0.45
Not working	0.000			0.357	1.00	0.32	0.389	1.26	0.21	0.396	1.28	0.20
Kids under 5	0.000			0.265	1.90	0.06	0.170	1.88	0.06	0.169	1.92	0.06
Kids 5-17	0.000			-0.094	1.40	0.16	-0.102	0.80	0.42	-0.104	0.81	0.42
Home w/ three to four bedrooms	0.000			0.033	-0.64	0.53	0.090	-0.64	0.52	0.092	-0.65	0.51
Home w/ five or more bedrooms	0.000			0.254	0.25	0.81	0.045	0.63	0.53	0.047	0.65	0.52
Two-person household	0.000			-0.007	1.46	0.14	-0.045	0.21	0.83	-0.045	0.22	0.83
Three + persons per household	0.000			-0.026	-0.05	0.96	-0.112	-0.34	0.74	-0.109	-0.33	0.74
Likely to move (next five years)	0.000			-0.087	-0.14	0.89	-0.115	-0.57	0.57	-0.117	-0.55	0.58
Replaced water heater	0.000			-0.115	-0.50	0.62	-0.173	-0.57	0.57	-0.175	-0.58	0.56
Midwest region	0.000			-0.055	-0.91	0.36	-0.151	-1.35	0.18	-0.150	-1.36	0.17
South region	0.000			-0.238	-0.31	0.76	-0.309	-0.91	0.36	-0.310	-0.91	0.36

Variable	Model 1			Model 2			Model 3			Model 4		
West region	0.000			-0.211	-1.37	0.17	-0.311	-1.93	0.05	-0.308	-1.94	0.05
Household income under $30K	0.000			0.000	-1.26	0.21	0.000	-1.92	0.06	0.000	-1.91	0.06
Household income $30-$59K	0.000			0.000			0.000			0.000		
Household income $60-$90K	0.000			0.000			0.000			0.000		
Household income over $90K	0.000			0.000			0.000			0.000		
Household income (100,000)	0.000			0.003			0.003			0.003		
Label attributes												
Any economic information	0.000	-2.80	0.01	0.000	-2.54	0.01	0.000	-2.83	0.00	0.000	-2.85	0.00
Operating cost relative to range	0.000			0.000			0.004			0.004		
EnergyGuide image	0.000			0.000			-0.017	0.22	0.83	-0.017	0.21	0.84
Energy Star logo	0.000			0.000			0.035	-1.14	0.25	0.035	-1.16	0.25
Physical energy info	0.000			0.000			-0.065	1.74	0.08	-0.065	1.75	0.08
CO_2 emissions info	0.000			0.000			0.041	-1.78	0.07	0.041	-1.78	0.08
Relative grade info (EU-style)	0.000			0.000			0.067	2.66	0.01	0.067	2.68	0.01
LL	-4976.1			-4917.5			-4841.6			-4841.2		

Note: See Table S1 for the variable descriptions. The number of observations in the estimation sample equals 879. Note that the econometric analysis in Table S2 differs from Newell and Siikamäki (2014) to help better address the specific goals in this paper. First, we estimate WTP for reduced annual energy operating cost, whereas Newell and Siikamäki (2014) estimates WTP for sent value operating cost. Second, we estimate heterogeneity associated with the characteristics of the respondent, household, and their home directly as a determinant of WTP for annual operating cost savings, whereas Newell and Siikamäki (2014) considers those variables as determinants of heterogeneous marginal utility of income (interact them with purchase price). Third, here we exclude from the estimation dataset information treatments 3, 8, and 11 in Newell and Siikamäki (2014) as not directly relevant for the estimation of WTP for annual operating cost savings.

TABLE S3. OLS RESULTS TO PREDICT MAXIMUM WTP FOR A $10 REDUCTION OF ENERGY COSTS (LN(DOLLARS))

Variable	Model 1	Model 2	Model 3	Model 4
Ln(discount rate)	-0.100***	-0.100***	-0.080**	-0.079**
	0.028	0.028	0.029	0.029
Ln(income)		0.001	0	0.001
		0.001	0.001	0.001
Excellent credit score (726 and above)			.	.
			.	.
Good credit score (700-725)			-0.203*	-0.178*
			0.083	0.082
Medium credit score (626-699)			-0.320*	-0.282*
			0.127	0.127
Low credit score (551-625)			-0.074	-0.078
			0.167	0.166
Very low credit score (under 550)			-0.326	-0.255
			0.207	0.206
Do not know credit score			-0.09	-0.131
			0.079	0.078
Ln (probability to move w/n next 5 years)				-0.081*
				0.035
Age 18-29				.
				.
Age 30-44				0.196
				0.13
Age 45-59				0.294*
				0.132
Age 60 or more				0.342*
				0.141
No high school				.
				.
High school				0.26
				0.138
Some college				0.285*
				0.137
Bachelor degree or greater				0.16
				0.139
White				.

Variable	Model 1	Model 2	Model 3	Model 4
				.
Black, non-Hispanic				0.039
				0.131
Other, non-Hispanic				-0.391*
				0.153
Hispanic				0.321**
				0.113
Mixed race, non-Hispanic				-0.278
				0.197
Gender (male)				-0.124*
				0.06
Married				-0.087
				0.076
Divorced				-0.09
				0.102
Working				0.023
				0.1
Retired				0.109
				0.119
Looking for work				-0.243
				0.15
Kids under 5 years old				0.086
				0.102
Kids 6-17 years old				-0.176*
				0.08
Constant	3.213***	3.165***	3.320***	2.901***
	-0.073	-0.089	-0.104	0.236
R^2	0.015	0.016	0.03	0.105
BIC	2017.8	2023.6	2045.3	2104.4
AIC	2008.4	2009.5	2007.7	1977.6
N	810	810	810	809

TABLE S4. OLS RESULTS TO PREDICT THE PAYBACK TIME (LN(YEARS))

Variable	Model 1	Model 2	Model 3	Model 4
Ln(discount rate)	-0.076***	-0.075***	-0.061***	-0.046*
	0.018	0.018	0.018	0.018
Ln(income)		0.002***	0.001*	0.001
		0	0	0.001
Excellent credit score (726 and above)			.	.
			.	.
Good credit score (700-725)			-0.168**	-0.145**
			0.054	0.053
Medium credit score (626-699)			-0.215**	-0.161*
			0.081	0.081
Low credit score (551-625)			-0.063	0.004
			0.105	0.104
Very low credit score (under 550)			-0.532***	-0.477***
			0.138	0.138
Do not know credit score			-0.093	-0.067
			0.049	0.049
Ln (probability to move w/n next 5 years)				-0.009
				0.022
Age 18-29				.
				.
Age 30-44				0.107
				0.085
Age 45-59				0.109
				0.085
Age 60 or more				0.214*
				0.093
No high school				.
				.
High school				0.218*
				0.091
Some college				0.272**
				0.091
Bachelor degree or greater				0.371***
				0.093
White				.
				.

Variable	Model 1	Model 2	Model 3	Model 4
Black, non-Hispanic				0.111
				-0.075
Other, non-Hispanic				0.041
				0.105
Hispanic				-0.099
				0.072
Mixed race, non-Hispanic				0.058
				0.131
Gender (male)				-0.182***
				0.038
Married				-0.122*
				0.049
Divorced				-0.068
				0.066
Working				0.024
				0.061
Retired				0.099
				0.077
Looking for work				-0.02
				0.092
Kids under 5 years old				0.138*
				0.064
Kids 6-17 years old				0.078
				0.05
Constant	0.885***	0.773***	0.914***	0.833***
	-0.045	-0.054	-0.066	0.154
R^2	0.017	0.029	0.052	0.113
BIC	1980.9	1975.1	1984.3	2041.4
AIC	1971	1960.2	1944.6	1907.6
N	1055	1055	1055	1052

TABLE S5. OLS RESULTS TO PREDICT THE PROBABILITY OF CLAIMING ENERGY EFFICIENCY TAX CREDIT IN THE PAST, RESULTS FROM A LINEAR PROBABILITY MODEL

Variable	Model 1	Model 2	Model 3	Model 4
Ln(discount rate)	-0.028*	-0.024*	-0.019	-0.017
	0.011	0.011	0.011	0.011
Ln(income)		0.099***	0.082***	0.043*
		0.016	0.017	0.021
Excellent credit score (726 and above)			.	.
			.	.
Good credit score (700-725)			-0.016	-0.003
			0.034	0.035
Medium credit score (626-699)			-0.037	-0.027
			0.049	0.05
Low credit score (551-625)			-0.171**	-0.169*
			0.066	0.066
Very low credit score (under 550)			-0.163	-0.122
			0.085	0.086
Do not know credit score			-0.083**	-0.085**
			0.031	0.031
Ln (probability to move w/n next 5 years)				-0.030*
				0.014
Age 18-29				.
				.
Age 30-44				0.025
				0.054
Age 45-59				0.02
				0.054
Age 60 or more				0.035
				0.059
No high school				.
				.
High school				0.068
				0.053
Some college				0.051
				0.054
Bachelor degree or greater				0.114*
				0.056
White				.

Variable	Model 1	Model 2	Model 3	Model 4
				.
Black, non-Hispanic				-0.038
				0.048
Other, non-Hispanic				-0.066
				0.068
Hispanic				0.032
				0.046
Mixed race, non-Hispanic				-0.035
				0.081
Gender (male)				0.024
				0.024
Married				0.074*
				0.031
Divorced				-0.018
				0.042
Working				0.018
				0.04
Retired				0.06
				0.049
Looking for work				0.014
				0.058
Kids under 5 years old				0.041
				0.043
Kids 6-17 years old				0.101**
				0.033
Constant	0.166***	-0.216**	-0.102	-0.225*
	-0.027	-0.068	-0.077	0.113
R^2	0.005	0.035	0.046	0.076
BIC	1337.3	1308.1	1329.1	1424.9
AIC	1327.1	1292.8	1288.4	1287.3
N	1208	1208	1208	1205

TABLE S6. OLS RESULTS TO PREDICT INDIVIDUAL DISCOUNT RATE (ESTIMATED COEFFICIENT ABOVE, STANDARD ERROR BELOW)

	Model 1	Model 2	Model 3	Model 4	Model 5
Household income (ln)	-0.035***				
	0.009				
Household income $10K-19K		-0.068	-0.068	-0.044	-0.041
		0.050	0.050	0.050	0.05
Household income $20K-34K		-0.075	-0.071	-0.054	-0.053
		0.046	0.046	0.047	0.047
Household income $35K-49K		-0.092*	-0.083	-0.071	-0.074
		0.046	0.046	0.046	0.046
Household income $50K-74K		-0.095*	-0.086	-0.065	-0.067
		0.045	0.045	0.046	0.046
Household income $75K-99K		-0.109*	-0.094*	-0.065	-0.071
		0.046	0.046	0.048	0.047
Household income $100K-149K		-0.151**	-0.131**	-0.099*	-0.107*
		0.047	0.047	0.050	0.049
Household income $150K +		-0.112*	-0.091	-0.055	-0.066
		0.052	0.053	0.055	0.055
Excellent credit score (726 +					
Good credit score (700-725)			0.018	0.006	
			0.019	0.019	
Medium credit score (626-699)			0.086**	0.070*	
			0.028	0.028	
Low credit score (551-625)			0.109**	0.067	
			0.037	0.037	
Very low credit score (under 550)			0.122*	0.090	
			0.052	0.051	
Do not know credit score			0.035*	0.031	
			0.017	0.017	
Age 30-44				-0.012	-0.01
				0.030	0.03
Age 45-59				-0.007	-0.008
				0.029	0.029
Age 60 or more				0.006	0.003
				0.032	0.032
High school				-0.051	-0.057*
				0.029	0.029
Some college				-0.082**	-0.091**
				0.030	0.03
Bachelor's degree or higher				-0.132***	-0.142***

	Model 1	Model 2	Model 3	Model 4	Model 5
				0.030	0.03
Black, non-Hispanic				0.063*	0.073**
				0.027	0.027
Other, non-Hispanic				0.034	0.031
				0.039	0.039
Hispanic				-0.028	-0.023
				0.031	0.031
Mixed race, non-Hispanic				0.029	0.027
				0.048	0.048
Gender (male)				0.017	0.016
				0.014	0.014
Married				0.010	0.005
				0.019	0.019
Divorced				0.046	0.043
				0.024	0.024
Working				0.036	0.031
				0.023	0.023
Retired				-0.037	-0.044
				0.028	0.028
Looking for work				0.004	0.001
				0.034	0.034
Kids under 5 years old				0.029	0.028
				0.026	0.026
Kids 6-17 years old				-0.007	-0.005
				0.021	0.021
Household size				0.017*	0.017*
				0.007	0.007
Constant	0.334***	0.293***	0.260***	0.237***	0.273***
	-0.038	-0.043	-0.044	0.064	0.063
R^2	0.011	0.013	0.030	0.084	0.075
BIC	-76.20	-36.40	-21.70	44.10	21.0
AIC	-86.40	-77.10	-88.00	-119.00	-116.6
N	1208	1208	1208	1208	1208

*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

Survey questions and response alternatives used to directly elicit data on payback time and WTP for energy efficiency. This section was placed after the choice experiments in the survey instrument. We use the midpoint of the categorical responses to create a continuous variable for estimation.

Paying for Energy Savings

Energy efficient water heaters use less energy to operate. They typically are relatively more costly at the time of purchase, but help reduce household's long-run energy bill. Whether choosing an energy-efficient water heater makes sense depends on the household, how costly the water heater is, and how large energy savings it can provide over time. People also have different views regarding how quickly their spending on energy-efficiency improvements should pay back in reduced energy bill. Many factors, such as life situation, income, and personal preference and judgment, influence such views, and rightfully so.

11. Consider purchasing a water heater. In your situation and view, how quickly should a more energy-efficient alternative recover its additional purchase expense in energy savings? (Check the longest amount of time it can take to recover the additional purchase price for you to still be happy with purchasing an energy efficient model.)

☐ In less than a year	☐ 3-4 years	☐ 7 years or more
☐ 1 – 1.5 years	☐ 4-5 years	☐ Don't know
☐ 1.5 – 2 years	☐ 5-6 years	
☐ 2 – 3 years	☐ 6-7 years	

12. For every $10 reduction in the annual energy cost of a water heater, how much greater purchase price would you be willing to pay for the model (at the most)?

☐ $1 – 10	☐ $25-29	☐ $45 – 49	☐ $65-69
☐ $10-14	☐ $30-34	☐ $50-54	☐ $70-74
☐ $15-19	☐ $35-39	☐ $55-59	☐ $75-99
☐ $20-24	☐ $40-44	☐ $60-64	☐ $80 or more

☐ I would not pay more for lower energy cost, but simply choose a less costly appliance

☐ Don't know