

Online Appendix

Individual Time Preferences and Energy Efficiency

By RICHARD G. NEWELL AND JUHA SIIKAMÄKI*

American Economic Review

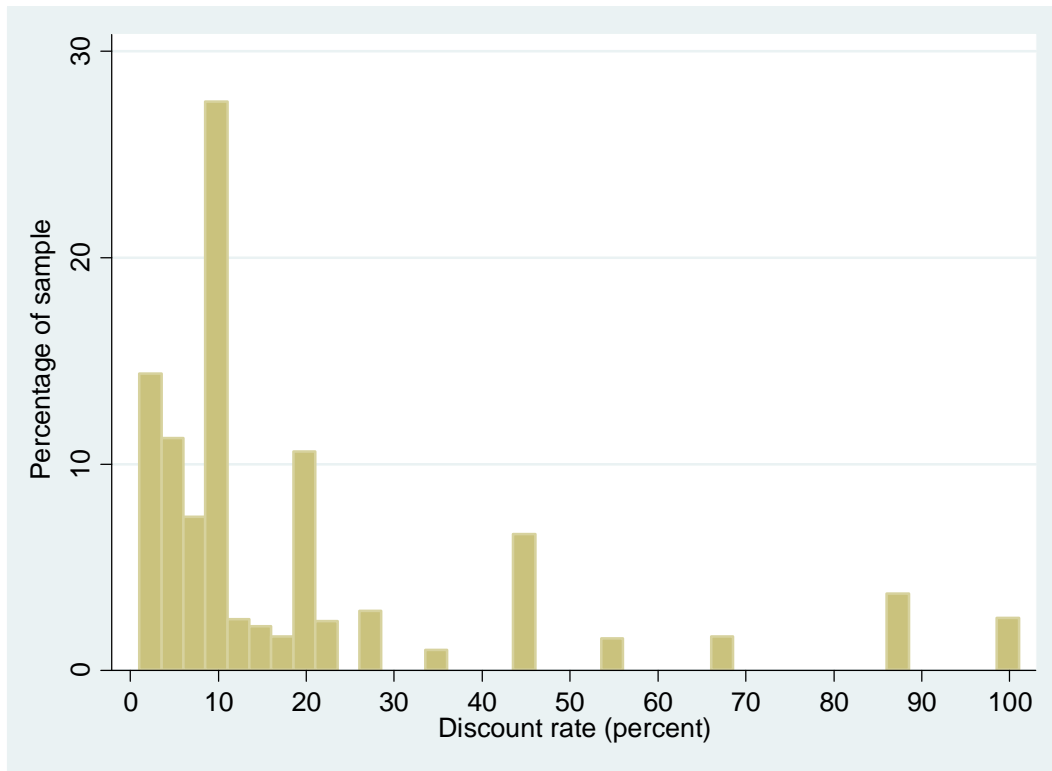


FIGURE A1. THE DISTRIBUTION OF ELICITED INDIVIDUAL DISCOUNT RATES

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.

*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). The research was supported by EPA STAR Grant 83285101.

TABLE A1. SELECT CHARACTERISTICS OF THE SURVEY RESPONDENT, RESPONDENT'S HOUSEHOLDS, AND THE HOUSEHOLD HOME (SUMMARY STATISTICS)

Variable	Description	Mean	St. Dev.	Min	Max
<i>Respondent</i>					
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
<i>Household</i>					
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/ kids 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
<i>Home</i>					
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 A2. 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									0.00	-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	0.01	-0.016	-2.540	0.011	-0.016	-2.83	0.00	-0.016	-2.85	0.00
Age 30-44				-0.351	-2.039	0.041	-0.287	-1.24	0.22	-0.281	-1.216	0.224
Age 45-59				-0.281	-1.453	0.146	-0.271	-1.12	0.26	-0.268	-1.107	0.268
Age 60 or more				-0.333	-1.604	0.109	-0.402	-1.60	0.11	-0.396	-1.584	0.113
High school or less education				-0.136	-1.143	0.253	-0.046	-0.41	0.68	-0.046	-0.410	0.682
White, non-Hispanic				0.009	0.059	0.953	0.031	0.18	0.86	0.035	0.201	0.841
Female				0.003	0.020	0.984	0.020	0.19	0.85	0.015	0.146	0.884
Self-employed				0.142	0.972	0.331	0.152	1.03	0.30	0.156	1.053	0.292
Retired				0.054	0.328	0.743	0.116	0.77	0.44	0.114	0.762	0.446
Disabled				0.239	1.001	0.317	0.265	1.26	0.21	0.268	1.276	0.202
Not working				0.357	1.901	0.057	0.389	1.88	0.06	0.396	1.917	0.055
Kids under 5				0.265	1.404	0.160	0.170	0.80	0.42	0.169	0.805	0.421
Kids 5-17				-0.094	-0.635	0.526	-0.102	-0.64	0.52	-0.104	-0.654	0.513
Home w/ three to four bedrooms				0.033	0.247	0.805	0.090	0.63	0.53	0.092	0.649	0.517
Home w/ five or more bedrooms				0.254	1.461	0.144	0.045	0.21	0.83	0.047	0.221	0.825
Two-person household				-0.007	-0.053	0.957	-0.045	-0.34	0.74	-0.045	-0.331	0.740
Three + persons per household				-0.026	-0.136	0.892	-0.112	-0.57	0.57	-0.109	-0.552	0.581
Likely to move (next five years)				-0.087	-0.495	0.621	-0.115	-0.57	0.57	-0.117	-0.577	0.564
Replaced water heater				-0.115	-0.912	0.362	-0.173	-1.35	0.18	-0.175	-1.361	0.174
Midwest region				-0.055	-0.311	0.756	-0.151	-0.91	0.36	-0.150	-0.910	0.363

Variable	Model 1			Model 2			Model 3			Model 4		
South region				-0.238	-1.369	0.171	-0.309	-1.93	0.05	-0.310	-1.943	0.052
West region				-0.211	-1.261	0.208	-0.311	-1.92	0.06	-0.308	-1.911	0.056
Household income (100,000)				0.003	2.290	0.022	0.003	2.79	0.01	0.003	2.78	0.01
Label attributes												
Operating cost relative to range							0.004	0.22	0.83	0.004	0.21	0.84
EnergyGuide image							-0.017	-1.14	0.25	-0.017	-1.16	0.25
Energy Star logo							0.035	1.74	0.08	0.035	1.75	0.08
Physical energy info							-0.065	-1.78	0.07	-0.065	-1.78	0.08
CO ₂ emissions info							0.041	2.66	0.01	0.041	2.68	0.01
Relative grade info (EU-style)							0.067	3.82	0.00	0.067	3.85	0.00
LL	-4976.1			-4917.5			-4841.6			-4841.2		

Note: See Table A1 for the variable descriptions. The number of observations in the estimation sample equals 879. Note that the econometric analysis in Table A2 differs from Newell and Siikamäki (2014) to match the goals of this paper. First, we estimate WTP for reduced annual energy operating cost, whereas Newell and Siikamäki (2014) estimates WTP for present 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 treatments 3, 8, and 11 in Newell and Siikamäki (2014) as not directly relevant for the estimation of WTP for annual operating cost savings. Constant in this model denotes the coefficient on “any economic information” as a label attribute in Newell and Siikamäki (2014), as all treatments in the analysis include at least some economic information.

TABLE A3. OLS RESULTS TO PREDICT MAXIMUM WTP FOR A \$10 REDUCTION OF ENERGY COSTS (LN(DOLLARS))

Variable	Model 1 (b/se)	Model 2 (b/se)	Model 3 (b/se)	Model 4 (b/se)
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 (b/se)	Model 2 (b/se)	Model 3 (b/se)	Model 4 (b/se)
				.
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

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

TABLE A4. OLS RESULTS TO PREDICT THE PAYBACK TIME (LN(YEARS))

Variable	Model 1 (b/se)	Model 2 (b/se)	Model 3 (b/se)	Model 4 (b/se)
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 (b/se)	Model 2 (b/se)	Model 3 (b/se)	Model 4 (b/se)
				.
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

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

TABLE A5. OLS RESULTS TO PREDICT THE PROBABILITY OF CLAIMING ENERGY EFFICIENCY TAX CREDIT IN THE PAST, RESULTS FROM A LINEAR PROBABILITY MODEL

Variable	Model 1 (b/se)	Model 2 (b/se)	Model 3 (b/se)	Model 4 (b/se)
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

Variable	Model 1 (b/se)	Model 2 (b/se)	Model 3 (b/se)	Model 4 (b/se)
White				.
				.
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

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

TABLE A6. OLS RESULTS TO PREDICT INDIVIDUAL DISCOUNT RATE (ESTIMATED COEFFICIENT ABOVE, STANDARD ERROR BELOW)

	Model 1 (b/se)	Model 2 (b/se)	Model 3 (b/se)	Model 4 (b/se)	Model 5 (b/se)
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

	Model 1 (b/se)	Model 2 (b/se)	Model 3 (b/se)	Model 4 (b/se)	Model 5 (b/se)
Bachelor's degree or higher				-0.132***	-0.142***
				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.)

- | | | |
|--|------------------------------------|--|
| <input type="checkbox"/> In less than a year | <input type="checkbox"/> 3-4 years | <input type="checkbox"/> 7 years or more |
| <input type="checkbox"/> 1 – 1.5 years | <input type="checkbox"/> 4-5 years | <input type="checkbox"/> Don't know |
| <input type="checkbox"/> 1.5 – 2 years | <input type="checkbox"/> 5-6 years | |
| <input type="checkbox"/> 2 – 3 years | <input type="checkbox"/> 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)?

- | | | | |
|-----------------------------------|----------------------------------|------------------------------------|---------------------------------------|
| <input type="checkbox"/> \$1 – 10 | <input type="checkbox"/> \$25-29 | <input type="checkbox"/> \$45 – 49 | <input type="checkbox"/> \$65-69 |
| <input type="checkbox"/> \$10-14 | <input type="checkbox"/> \$30-34 | <input type="checkbox"/> \$50-54 | <input type="checkbox"/> \$70-74 |
| <input type="checkbox"/> \$15-19 | <input type="checkbox"/> \$35-39 | <input type="checkbox"/> \$55-59 | <input type="checkbox"/> \$75-99 |
| <input type="checkbox"/> \$20-24 | <input type="checkbox"/> \$40-44 | <input type="checkbox"/> \$60-64 | <input type="checkbox"/> \$80 or more |
- I would not pay more for lower energy cost, but simply choose a less costly appliance
 Don't know