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Consumer Preferences of Solar Systems in Boston and Atlanta: A Choice Experiment

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Honors Thesis

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Abstract

Creating a cleaner energy grid has become a hot topic over the past 20 years, as the effects of fossil fuels on our planet has become clearer. The solar market in the US has exploded over the past 10 years, with an average annual growth rate of about 42% (*Solar Industry Research Data*, 2020). Choice experiments are often conducted to better understand consumers preferences towards products or characteristics of products. In this study, data of a choice experiment in a survey of residents in Boston and Atlanta regarding preferences for attributes of household solar energy collecting system are analyzed. The results of data analysis give us a better understanding as to what consumers in Boston and Atlanta value in a solar photovoltaic or hot water system, and to estimate what they are willing to pay (WTP) for these systems, and upgrades in attributes/features of these systems.

Introduction

According to a Pew Research Center (2019) study, about 77% of US adults believe that renewable energies like wind, solar and hydrogen technologies should be prioritized in the United States energy supply versus expanding fossil fuels. Over the past decade the renewable energy market, specifically the solar photovoltaic (PV), has seen tremendous growth, and solar panels are increasingly being installed in homes across the US. 19.2 GWdc of additional Solar pv capacity was installed by the end of 2020, compared to just 245 installed capacity (MWdc) ten years ago (SEIA 2020). On the other hand, Solar Hot Water (SHW) has significantly less buzz around it but could equally help transform the US energy system. According to EIA (2018), in 2015 water heating was responsible for 19% of the energy use in the average US home. The popularity of these systems varies as individual states are adopting solar at different rates. Georgia and Massachusetts rank similar in the national ranking by SEIA in 2020, but the Massachusetts solar installation among residential homes far out numbers Georgia (SEIA 2020).

Massachusetts also has more residential incentives for installing solar systems compared to Georgia (DSIRE 2020), which could potentially be the driver behind this difference. A choice experiment conducted in these two cities could give more specific empirical insight into which characteristics, and features of an energy system that are important to Georgia and Massachusetts consumers. The results of this CE can also be used to calculate the WTP for these various features. These results could be used to give more information to policy makers and researchers as to what consumers value in their energy system, more specifically consumers in the greater Boston and Atlanta areas. This could also provide for more targeted incentives and research, to promote installing green energy systems.

Literature Review

According to (*Solar Industry Research Data*, 2020), the cost of a solar PV system to power the average residency has dropped from $40,000 to $20,000, and this is before Federal and State incentive policies. The average price of a solar hot water system is about $9,000 according to Energy Sage, (2020) and about $6,300 after the Federal Residential Renewable Energy Tax Credit. However, the Federal Residential Renewable Energy Tax Credit, is set to be reduced from 26% of the installation cost to 22% in 2021, and then expire at the beginning of 2022 (*DSIRE*, 2020). After the federal tax credit expires, the burden of incentivizing homeowners to install solar systems will be almost entirely be left up to the individual states. Natural gas is competing with solar PV for the top new capacity installed every year, and according to (*Solar Industry Research Data*, 2020), they are currently tied at 37%. The current information available on SHW systems is slim when compared to Solar PV. SEIA, which is the source of a lot of the information on the Solar market, has not updated their public information on SHW since 2010. The latest readily available information on SHW systems comes from a

2020 report from Renewables Now (REN21), a global organization focused on producing information on renewable energy solutions. According to a report by REN21 (2020), the US is 2nd in SHW heating capacity and is 5th in Net capacity additions. A study by Hang et al. (2012) mentions how SHW systems are the most common application of solar energy in the world, but this may have changed with a decrease in natural gas and an increase in Solar PV. REN21 (2020) found that the U.S. SHW capacity decreased in 2019 by 4%. There are various types of policies that state and local governments put into place that try to reduce the upfront cost of installing solar systems and create a positive return on investment (M. Lee et al., 2018; Matisoff & Johnson, 2017). Lee et al. (2018) divided solar incentives up into two broad categories of tax incentives and cash incentives. Tax incentives are in the form of tax credits or exemptions on sales tax or property tax. Lee et al. (2018) further broke down the cash incentives into capacity-based incentives and performance-based incentives. Depending on the capacity of the solar system installed in your home, you can receive a rebate from the state or local utility. Capacity for solar PV and SHW systems are measured differently but typically the bigger the system a person has installed, the larger their rebate is from the utility (*DSIRE*, 2017). The energy produced by the solar PV system installed can also qualify homeowners for direct payments from the utility company in the form of RECs (renewable energy credits) or net metering policies (M. Lee et al., 2018; Matisoff & Johnson, 2017).

As mentioned previously, the literature on solar water heating systems is sparse when compared to solar PV, however there is some literature that looks at the reasons people may choose to adopt SWHs and how government incentives could affect this. A recent study by Sanguinetti et al. (2021) conducted in California sought to understand why residents have not adopted SHWs, despite having the optimal climate for it. The authors sought to understand the consumers experience and barriers at five different stages of technological adoption, knowledge persuasion, decision, implementation, and confirmations, which were developed by Rogers (2003). The survey was conducted on 227 single-family households that have SHWs in California, and they found that most of the respondents were persuaded to adopt a SHWs because of cost savings and environmental benefits. They also found that 47% respondents installed the system because there was a rebate available. The most common concerns among their sample was the high upfront cost of installing the system, ROI, and how well the system would perform. Higgins et al. (2014) created a model to estimate the adoption of different green systems across 2.7 million households in New South Wales, Australia. These households grouped together based upon individual characteristics, like income, home ownership, housing type, and number of bedrooms. They found that the adoption rates for different water heating systems depend largely on the upfront costs and annual cost. The authors also found that Households that adopted SHWs were in the upper income groups and found that increasing the rebate amount for these systems made adoption more common among lower income groups. Mills & Schleich (2009) look at a sample of German households to determine how geographic, residential, and household characteristics may change the likelihood that a household adopts solar water heating. The authors found that the amount of sun radiation and if the house was recently built can make a household more likely to have solar hot water installed. However, the authors found that the yearly saving for adopting a solar hot water system was low, but this article is 12 years old.

Similar to SHWs, Previous Studies looking at how solar PV incentives effect consumer behavior have focused on comparing how effective these policies are at lowering the upfront costs, increasing profitability, and how this translates to an actual increase in installations.

Matisoff & Johnson, (2017) developed a system to standardize the most common incentive types into a $/Watt scale for all 50 states and compared this to the amount of new installations every year from 2002-2012. They found that the value of incentives didn't always translate to more installations, however they found that programs that cut the upfront cost were the most effective. Bauner & Crago (2015) considered the long-term uncertainty associated with investing in a solar PV system, and how consumers may value waiting to install. They found in 2015 that the net present value (NPV) must be 60% greater than the upfront costs for a person to invest. Another study, by Lee et al. (2018), factored in the level of solar radiation and the cost of electricity in each 50 states when analyzing how incentives effect the viability of residential solar as an investment. This study by M. Lee et al. (2018) combined the effect of solar radiation, cost of electricity, and incentives to show that Atlanta was just shy of harboring profitable solar investments due to the absence of a tax exemption, but Boston was easily able to show a profitable investment due to the cost of electricity paired with state solar incentives.

There is also literature on how various non-monetary incentives could affect solar PV installations, like neighbor's choice, environmental benefit, housing, and whether the system is shared or not. Reeves et al. (2017) found that when a micro solar market has reached a mature level of installations, the importance of neighbors to provide information is more important than in a growing market. Bollinger & Gillingham (2012) found similar results with peer affects and information transfer. Bollinger & Gillingham (2012) looked at the peer effects associated with solar installations in California. They found that additional solar PV installations in a zip code, increases the probability that more installations will occur in that zip code. The strength of the effect of peers on solar installations was more apparent in zip codes with people who lived in big houses and had a commute (Bollinger & Gillingham, 2012). Best et al. (2019) found that respondents who rented or were in apartments were less likely to install solar panels, but respondents that lived in houses had a positive relationship between the number of bedrooms and likeliness of installing solar panels. A study done by Pless et al. (2020) compared what kind of information consumers were looking for when debating opting into a shared Solar PV system, or install their own system. The authors found that consumers looking into a shared system valued information about the physical components and modifications needed for their home, versus the consumers that wanted to install their own solar PV system searched for information about specific savings and ROI. Best et al. (2019) also found that respondents in Australia who participate in a green energy pricing program were more likely to have solar panels installed. The authors used this enrollment in green energy programs to gauge whether a respondent valued environmental benefits. Bollinger & Gillingham (2012) used hybrid car adoption as gauge for environmental preferences, and found that areas with higher hybrid car adoption, also had higher Solar PV installations.

The conditional logit model originally developed by McFadden (1973) that is used for choice experiments (CE's) is popular in environmental preference literature. However, the literature and research done in the intersection of Solar and CE's is slim. Several choice experiments have been done on other environmental energy choice studies, like the study by Nie et al. (2018), which focused on consumers preferences in Shanghai for electric vehicles (EV). The authors used a multinomial logit model to analyze how respondents valued different characteristics of EVs. The authors also probed their respondents on key demographic questions, like whether the respondent was likely to purchase an EV in the future and compared the results for different groups. Bae & Rishi (2018) conducted a choice experiment with a conditional logit model to uncover the preferences of South Koreans when it comes to green energy pricing programs. According to the authors, South Korea currently has an RPS, but no green pricing program. The Green energy pricing programs Bae & Rishi tested for were optional, and the citizens would choose to opt in at a premium. The respondents had two green energy programs they could select or neither. The characteristics of each program was energy source, share of green electricity to total electricity production, premium electricity tariff, distance from residence to green electricity power plant, number of new jobs, and type of incentives. There are many research papers done on various topics associated with solar, but very few have conducted a choice experiment regarding solar energy systems. Most of the relevant literature I did find, was conducted in countries outside of the US. Ntanos et al. (2018) conducted a choice experiment in Greece on a sample of about 400 respondents and was the only CE study I found that specifically asked about SHW systems. Out of the 9 attributes included in the choice experiment, only 5 were statistically significant. The significant attributes were Perceived benefits, subsidies, motivation by socio-political framework, perceived disadvantages of renewable energy systems, and institutional promotion barriers. One of the questions asked was whether the respondents had a renewable energy system, and the authors found that the most common system among their sample was SWH, with 95% of the respondents who had a system, had SWH. H.-J. Lee et al. (2018) looked at how consumers in South Korea value various attributes of small-scale Solar PV energy systems. The authors conducted a choice experiment and calculated the marginal willingness to pay (MWTP) of respondents for installation location, installation scale, operation, electricity use, and price. H.-J. Lee et al., (2018) showed that respondents in South Korea had the highest MWTP for Solar PV systems that were installed on the residence, operated by a corporation, and were not shared. The authors also calculated the RI (relative importance) of each characteristic to the respondent making that choice, and monthly electricity bills was found to be the most relatively important characteristic. Another CE study in South Korea was conducted by Yang et al. (2017) on 1000 respondents using in-person interviews. The focus of this research was on South Koreans preferences to the environmental effects of large-scale solar PV plants. The environmental effects of different large scale solar PV plants that Yang et al. (2017) used in their CE were habitat loss, Landscape destruction, Hazardous materials, light pollution, and price. The Authors results showed that respondents cared the most about an increase in light pollution, and least worried about landscape destruction from an installed Solar PV plant. One of the few CE's using data from the US, specifically New Mexico, was done by Mamkhezri et al. (2020). However, this study did not investigate consumer preference for different characteristics of a residential installation, but consumer preferences for RPS, and what percentage of this should come from rooftop solar energy. The MWTP of respondents for an increase in RPS in the study done by Mamkhezri et al. (2020) shows the rural and urban residents have different preferences for rooftop solar and an increase in RPS. This research paper fills a big gap in the literature of choice experiments conducted on US respondents regarding their preferences towards specific characteristics of installing solar PV systems.

Solar Incentives

As mentioned earlier, there is a significant difference in the quantity and quality of solar system incentives in Georgia and Massachusetts (DSIRE, 2021a). All this information is summarized in Table 1. Both states let residents connect their solar PV systems to the grid and offer easements which allows residents with solar systems to negotiate to keep air space clear around their system. Since 2011, the MA state government has offered a rebate for installing SHWs in residential homes. The rebate is calculated by multiplying the number of installed collectors by 100, and the solar rating. This rebate is capped at $4,500 or 40% of total installed costs, which ever is the lower number. There is also the Solar Massachusetts Renewable Target (SMART) Program that provides residents with a solar PV system, that is under 5MW of capacity, money for energy surpluses that their solar system produces that is sent back to the grid. The SMART program, net metering, and SRECs policies are ways that residents can earn money from performance of their solar PV system. Net metering is one of the few Solar incentives that Georgia offers. MA also offers a 100% property tax exemption for 20 years, and a 15%- or $1000-income tax credit to qualified solar PV and HW systems. NREL (2021) provides geospatial data which shows the average amount of solar radiation the US gets, and an areas viability for Solar systems. One of the tools on the NREL website is called, "PVWatts Calculator." Typing in Atlanta for the PVWatts calculator estimates the energy and savings that would be produced from a system of your specification. For these examples I used the default values for the solar system. The results showed that Atlanta yields an annual average of 5.26 kWh/square meter a day of solar radiation, and 5718 kwh of AC energy per year. For Boston, the average annual solar radiation was 4.72 kWh/square meter a day, and an estimate of 5213 kWh of AC energy produced by the system per year. While this shows that Atlanta has more solar radiation than Boston, Boston had slightly more yearly savings ($778 vs $668) due to the higher cost of electricity (NREL, 2021).

Table 1.

State	**MA**		**GA**
System Type	**Solar PV**	**Solar HW**	
Tax Credits	Income		NA
Tax Exemptions	Sales & Property		NA
Net Metering	Residents with 2 MW or less solar system		Up to 10 kW for the first 5000 customers or 32 MW of capacity
Renewable Portfolio Standards	1600 MW of PV required by 2020		NA
Cost of electricity	18.5 cents/kWh		9.62 cents/kWh
Other	Solar loan program, SMART program	Rebate per collector based on rating	NA

Research Question(s) and Prediction(s)

The focus of this research paper will be investigating the views and preference of Boston and Atlanta consumers for different characteristics of solar energy systems. The specific characteristics that are being compared are: system type, whether the system is shared, upfront cost, environmental benefit, neighbor's choice, and yearly saving per year. The specific research questions that will be tested are:

- What characteristics of residential Solar PV/HW systems are important to consumers in the greater Boston and Atlanta areas?
- Do consumers in the Boston and Atlanta areas prefer Solar PV over Solar HW or vice versa?
- What is the willingness to pay (WTP) and marginal willingness to pay (MWTP) of the respondents in the greater Boston and Atlanta area for features and attributes of solar systems?

I expect that there will be a difference between the Boston and Atlanta residents when it comes to their views and preferences towards all these characteristics. This would also mean that there is a difference in their MWTP, and WTP for these characteristics. I also predict that the most important characteristics for Boston and Atlanta residents, in general, for their energy system will be cost related. This would specifically be the upfront cost and yearly savings per year. I would also predict that Solar PV would be more popular among respondents from both areas when compared to SHW. Also, referring to the various literature (Bollinger & Gillingham, 2012; H.-J. Lee et al., 2018; Mamkhezri et al., 2020), I expect there to be a positive MWTP for neighbors choice, systems that aren't shared, and systems that save the consumer money on their electricity bill.

Data & Methodology

The data employed in this study were collected via an online survey of Boston and Atlanta residents, conducted in 2017, regarding household preferences for alternative household waste water collection systems and solar energy harvesting systems . Lu et al. (2019) analyze the data from the part of the survey on preferences for different household water collection systems, while I analyze the data from the section on solar systems. This data has not been used in another study and was collected using a platform called "Amazon Mechanical Turk." The specific survey administered was a discrete choice experiment, with 12 questions that contained 2 different solar systems. After 4 months of data collection, the sample size was a total of 1299 respondents, with 697 respondents from Metro Atlanta, and 602 respondents from the Greater Boston Area (Lu et al., 2019). This survey was conducted to try and uncover how the residents of these areas view alternative energy and water solutions, with Lu et al. (2019) focusing the alternative water aspect of the survey data. For my research, I will be focusing on the data that was collected from the energy questions that probed respondents on their preferences when it comes to solar PV and SHW systems. The questions asked respondents to pick between 2 energy choices or neither. The respondent compares the factors that are displayed for two of the options. The factors that differentiated the energy options were, system type, whether the system would be shared, upfront cost, environmental benefits, neighbor's choice, and the amount of money saved per year (Lu et al., 2019). The specific format of the data is laid out in Table 2.

Table 2

Attribute	Levels (coding)
Solar PV	0: No system 1: Solar PV system
Solar HW	0: No system 1: Solar HW system
Own	1: owned by individual; 0: community owned
Upfront Cost	3: $3000; 6: $6000; 9: $9000; 12: $12000
Environmental benefits	0: no benefit; 1/3: insignificant; 2/3: moderate; 1: significant
Neighbors have system	0: no installation; 0.5: some installation; 1: most installed
Yearly Savings	0.48: $480; 0.96: $960; 1.44: $1440

The format of this survey is called a, "choice experiment," which tries to assign values to characteristics of a good. Because there are 3 options (choice 1, choice 2, or neither) for the respondent to choose from, and six characteristics for each choice, a specialized econometric model must be used to properly analyze the results of the choice experiment. The most popular econometric model employed to analyze the responses to a choice experiment is the conditional logit model (McFadden, 1973).

The conditional logit model uses a random utility model to estimate the utility that a consumer gets from picking a choice out of a group of choices (Holmes et al., 2017). The expected utility from picking a choice is modeled using the characteristics of that choice and the monetary value (Holmes et al., 2017). As the consumers expected utility from picking that choice increases relatively to other choices, the probability that the consumer will pick that choice over the alternatives increases (Holmes et al., 2017). In this case, the utility of picking one of the two solar systems or none changes depends on the system type, whether the system would be shared, upfront cost, environmental benefits, neighbor's choice, and the amount of money saved per year. Running a conditional logit model will give insight as to how these characteristics affect a respondents' expected utility empirically. Specifically, I will be analyzing this data in R using the statistical package, "Survival." In this package there is a function to estimate conditional logit models developed by Terry Therneau, PH.D. of the Mayo Clinic. This package was originally developed for survival analysis but will also work for this choice experiment. When contacting Doctor Therneau, he conveyed that the method of maximum likelihood estimation did not matter. The exact specification of the model is (Rodríguez, 2020):

$$\eta_{ij} = \boldsymbol{z}_j'\boldsymbol{\gamma}.$$

This the model that McFadden (1973) developed, Where η is the expected utility from the attributes Z, for choice γ. This means that each choice has attributes that influence the expected utility of the respondent for picking that choice.

The conditional logit model also provides the necessary data to calculate MWTP (marginal willingness to pay) for the respondents for each attribute of the choices (Holmes et al., 2017). This is the ratio of the attribute coefficient to the negative price coefficient (Holmes et al., 2017). This is useful because it allows us to assign a monetary value to consumers preferences to different characteristics. The makes it easier to infer the relationship between the intendent variables and selecting a choice. To calculate the WTP and MWTP in R a package, by Hideo Aizaki called, "support.CEs," automatically calculates the WTP from the conditional logit model. These values will also be adjusted for median household income in both Atlanta, and Boston, for a more accurate comparison of the values. The combination of the random utility model and the conditional logit model provides the methodological framework to develop empirical evidence from the data on GA and MA consumers and show how they value various characteristics of their energy systems.

Results

After running the conditional logit model in R, every choice characteristic was found to be statistically significant in both Boston and Atlanta, except for the, "own" variable. Because the nature of this model, the estimate coefficients can't be interpreted as marginal effects on the respondent's utility, but instead the sign, and the relative magnitude of the coefficient can be interpreted. The only negative coefficient was cost, which means that this was the only variable that decreased the respondent's probability of choosing a system This was expected, as the previous literature has found that upfront cost is the biggest barrier for people to install a solar system, and that programs that cut upfront cost are the most effective increasing installations (Sanguinetti et al., 2021),(Matisoff & Johnson, 2017), (Bauner & Crago, 2015). The positive coefficient for system type, neighbor's installation, environment, and save suggests that these characteristics will increase the probability that someone will install a solar system in either Boston or Atlanta. The difference in the relative magnitude of the system attributes, for both Boston and Atlanta, show that the environmental benefit of the system is more important than the neighbor effect, and yearly savings. The overall results show that Both Atlanta and Boston respondents are generally indifferent between Solar system type, and the systems impact on environment is relatively more important when deciding between systems than neighbors having a system installed, or yearly savings. The difference in the magnitude of the coefficients between Boston and Atlanta respondents is minimal, but there are slight differences for neighbor, environment, cost, and even the system type. The magnitude difference of neighbor suggests that Atlanta respondents are relatively more likely to adopt a solar system if their neighbors have one. The difference in coefficient magnitude of environment suggests that the environmental impact of the solar system has a relatively stronger impact on Atlanta respondents when compared to Boston respondents. The cost coefficient for Boston respondents suggests that upfront cost has less impact on the decision choice for Boston respondents when relatively compared to Atlanta respondents. For the most part, the Atlanta respondents were indifferent between the solar system types, but Boston respondents had a slightly higher preference for SHW systems.

Table

	Atlanta	***Boston***
	Dependent variable:	*Dependent variable:*
	selected	selected
Solar PV	1.013***	1.062***
	(0.070)	(0.075)
Solar HW	1.008***	1.121***
	(0.070)	(0.075)
Own	0.006	-0.044
	(0.036)	(0.038)
Neighbor	0.528***	0.453***
	(0.042)	(0.045)
Cost	-0.212***	-0.192***
	(0.006)	(0.006)
Environment	1.025***	0.941***
	(0.050)	(0.052)
Save	0.542***	0.591***
	(0.043)	(0.046)
Observations	25,092	21,672
R^2	0.111	0.114
Max. Possible R^2	0.688	0.688
Log Likelihood	-13,129.220	-11,297.030
Wald Test	2,633.710*** (df = 6)	2,352.750*** (df = 6)
LR Test	2,942.719*** (df = 6)	2,627.023*** (df = 6)
Score (Logrank) Test	2,953.420*** (df = 6)	2,637.068*** (df = 6)
Note:	$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$	

For more specific and quantitative results I will now discuss the WTP, and MWTP results from the model in Tables 4 and 5. This section discusses the nominal WTP and MWTP, before adjusting for the median household income in Table 4. The variable that indicates if household will be owned by the respondent or the community if left out because it was insignificant. The results below in Table 4 show that there is a significant difference in the WTP, and MWTP for Boston and Atlanta residents for solar systems, and yearly savings. The nominal results suggest that Boston residents are willing to pay more for a Solar PV and SHW systems and an increase in yearly savings, than Atlanta Residents. This has interesting policy implications, as Atlanta residents may need more incentives to purchase a solar system compared to Boston residents. Specifically, Atlanta residents are willing to pay about $4,700 for a solar system, while Boston residents are willing to pay $5,500 for solar PV, and $5,800 for SHW. The difference in nominal MWTP for yearly savings show that Boston residents are willing to pay $3,000 more for a system with increased yearly savings, and Atlanta residents willing to pay $2,500. For an increase in environmental benefits, both Boston and Atlanta residents are willing to pay about $4,900. The MWTP for neighbors having a system installed is about $2,500 for Atlanta, and $2,350 for Boston. Overall, the nominal MWTP, and WTP results show that Atlanta residents are willing to pay less money for a solar system when compared to Boston residents. Boston residents are generally willing to pay more for an increase in all attributes when compared to Atlanta Residents, except for neighbors that have a system installed already.

However, after adjusting the WTP and MWTP for median household income (MHI) a nearly opposite story can be told. Data USA, (2018), a free platform for US data developed by the Deloitte MIT Collective Learning Group, and Datawheel, is the source of the median household income for both Atlanta and Georgia for the year 2018. The median household income for Boston is $71,834, and $65,345 for Atlanta. Because the MWTP and WTP is in thousands of dollars, these values are divided by 1000 before deflating the MWTP and WTP values. The results in Table 4 show that residents in Atlanta have a high WTP for all features and increase in attributes compared to Boston respondents. This is especially present for system type and environment benefits. The real WTP for a solar PV system in Atlanta is $7,295, and $7,259 for solar HW. This is about a $650 difference in the WTP for a solar system between Atlanta and Boston residents. The difference in MWTP for environmental benefits was similar, with Atlanta residents willing to pay about $670 more for an increase in environmental benefits compared to Boston residents. There was a smaller difference in the WTP for neighbor, and MWTP for additional savings, but Atlanta residents are willing to pay $350 if their neighbors have solar systems, and for additional yearly savings on their solar system. The difference between WTP for a solar HW system and a solar PV system is basically zero for both Boston and Atlanta residents, suggesting that residents are not willing to pay more for one system over the other. Again, the results show that the environmental attribute is the most important for both Boston and Atlanta residents, when compared to the yearly savings and the neighbor effect.

Table 4

	Atlanta			**Boston**		
Attribute	MWTP	2.5%	97.5%	MWTP[1]	2.5%	97.5%
Solar PV	**4.7672***	4.1876	5.3814	**5.5361**	4.8356	6.2599
Solar HW	**4.7433**	4.1593	5.3547	**5.8480**	5.1479	6.5590
Neighbor	**2.4870**	2.0970	2.8670	**2.3620**	1.9217	2.8163
Environment	**4.8251**	4.3548	5.3070	**4.9093**	4.3589	5.4988
Save	**2.5527**	2.1225	3.0015	**3.0844**	2.5648	3.6234

*The measurement unit is $1,000.

Table 5

	Atlanta	**Boston**
Attribute	**MHI Adjusted MWTP**	**MHI Adjusted MWTP**
Solar PV	7.2955*	6.6364
Solar HW	7.2589	6.6032
Neighbor	3.8059	3.4621
Environment	7.3841	6.7170
Save	3.9065	3.5536

*The measurement unit is $1,000.

Conclusion

While the renewable energies, specifically the solar market, are a hot topic in the US, there have been very few choice experiments done in the US on residents preferences to systems, and their attributes. The results of the choice experiment on solar systems between Atlanta and Boston Residents are mixed, depending on if you analyze the nominal or real values for the results of the choice experiment. A completely different story will be told if you deflate the WTP and MWTP values for Boston and Atlanta Residents. While the coefficients are not directly interpretable, they can provide insight into the relative importance of each attribute to Boston and Atlanta residents. All the coefficients were positive except for cost, which was expected, and tells us that solar systems, neighbors choice, environmental benefits, and yearly savings all make someone from Boston or Atlanta more likely to adopt a solar system, with the amount of environmental benefits a system yields being the most important in both cities. While initially it seemed that Boston Residents were willing to pay more for a solar system, additional environmental benefits, and additional yearly savings, after deflating the WTP and MWTP by median household income in each city, the opposite was shown to be true. Atlanta residents have a higher WTP to both types of solar systems, neighbor's choice, environmental benefits, and yearly savings. This has interesting policy implications as Massachusetts, and Georgia are rank similarly in solar markets (8th and 9th respectively) by SEIA, (2021), but the overwhelming majority of Georgia's solar installations are by Utilities. If Georgia implemented just a fraction of the solar incentives that Massachusetts has in place, it could change the dynamic of the entire solar market in Georgia.

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