2014

Municipal Recycling In Waterville: A Choice Experiment

Katharine V. Eddy
Colby College, kveddy@colby.edu

Alec A. Finigan
Colby College, afinigan@colby.edu

Follow this and additional works at: http://digitalcommons.colby.edu/jerec

Part of the Economics Commons, and the Natural Resource Economics Commons

Recommended Citation

Municipal Recycling In Waterville: A Choice Experiment

Abstract

The city of Waterville, Maine has experienced many struggles with establishing an economically and socially beneficial method for collecting recyclables from residents. In 2006, the town made the choice to terminate its curbside recycling pickup and open the Skills facility, where residents were able to transport there recyclables and dispose of them at the facility. This proved to also not be economically beneficial and the town ended this option for residents in 2012. The motivation behind establishing a new recycling program in Waterville is making Waterville more environmentally friendly, the creation of jobs for residents in the trash collecting business, moral obligation, and interest in public priorities. This paper aims to assess what the potential opportunities are for reinstating a curbside pickup recycling program in the town of Waterville. Through use of a choice experiment the aim is to quantify the utility Waterville residents put on a curbside-recycling program. The survey was conducted as a door-to-door survey by students in EC231-Enviorenmental and Natural Resource Economics. We find that respondents are willing to pay more for curbside pick-up than drop-recycling and the there is no significant difference between the WTP for sorted and unsorted recycling. We also find that households that currently recycle, that have a higher income and that are more educated are willing to pay more for recycling.

1. Background

Waterville, Maine continually experienced issues with its municipal recycling programs in recent history. Six years ago, Waterville had a curbside recycling program. Residents, however, did not provide enough volume of recyclables to sustain the program. The cost of the program far outweighed the revenues produced by the recyclables. When this program was terminated, the town of Waterville signed a contract with Skills Recycling. From 2007-2013, the town paid Skills Recycling, a private recycling company, $12,500 per year to take paper, plastic, cans, and glass and residents could drop off their recyclables at the this local facility. The lack of recycling volume Skills received from Waterville residents resulted in total losses exceeding $400,000 for the company. In July 2013, Skills Recycling stopped accepting commonly recycled items such as paper, plastic, cans, and glass and now only recycles computers and other electronics. Their business model includes a website where these used discarded electronics can be purchased for a small fraction of what they would cost new.

At the time Skills Recycling stopped accepting commonly recycled items, the town began a new contract with Shredding on Site, which agreed to accept recyclables from Waterville community members. This contract includes the option for either party, the town or Shredding on Site, to terminate the contract if beneficial or necessary. There is minimal difference between using Shredding on Site and Skills, and the two sites are less than a mile apart. This new policy has allowed the town of Waterville to maintain a place for community members to drop off their recyclables; however, it has not adjusted in any way to address the issue that caused Skills Recycling to terminate its contract. This means that the program with Shredding on Site is in jeopardy of termination if the volume of recyclables does not allow them to operate in the black. Town officials in Waterville consider the ability to recycle a priority as the motion to develop a new recycling program at Shredding on Site passed 6-0. However, the lack of volume received by Skills Recycling suggests community members are not willing to make the effort to drop off their recyclables. This summer, city councilors approved a committee to examine Waterville's solid waste and recycling practices and suggest changes. This committee was scheduled to make a proposal with regards to curbside recycling and a pay-per-bag system by January 1, 2013, however the deadline has been extended undeterminably. The committee is currently working on gathering bids from various companies for the outsourcing of curbside recycling. They are weighing whether a pay-per-bag

garbage system will be a strong incentive for people to consistently recycle. In addition, they are determining whether a sort or no-sort recycling system would be a more viable option. Specifically, which is monetarily sustainable while still beneficial to the environment. The status quo could stand; however, options are being explored.

Complicating matters is the contract between the city of Waterville and PERC an incineration company fifty miles south of Waterville. In 2000, Waterville entered into a contract in which this city is obligated to send at least 7,000 tons of waste to the PERC facility to be burned to produce energy. Since the recession, Waterville has consistently failed to meet this 7,000 ton requirement and has been sending around 4,000 tons annually. The contract requires the city to pay a fine for the tonnage not met. Implementing a recycling program would reduce the collection of non-recyclable waste to be sent to this company, and would be a capital burden on the city. Additionally, there has been a struggle to find an outsourcing company that is willing to only collect curbside recycling and not trash. Trash collection is currently run by Waterville's Public Works and provides many jobs to town employees. While the town doesn't have the capabilities to conduct trash removal itself it is also an issue if they were to outsource and lose local town employment opportunities. This red tape complicates the issue of city recycling further.

Comparing neighboring municipalities to Waterville provides knowledge on how similar towns manage their waste removal. Waterville has contracts with Oakland and Winslow for disposal of residential household waste. All three municipalities deliver their waste in packer trucks to the PERC incinerator in Orrington. The transfer station loads about 10,000 tons a year in trailers for disposal at PERC. Winslow has weekly curbside garbage removal and provides 24/7 sorted recycling drop off at the local library. Oakland residents do not have curbside pickup for either garbage or recycling but do have access to the transfer center on Old Town Farm Road where they can drop off their trash. Fairfield employs a "Pay-per-Bag" trash system. Residents can purchase trash stickers for $1.50 per thirty pound bag at the Town Office. After the stickers are purchased, they must drop the garbage at Pine Tree Waste located on Airport Road in Waterville. Residents can also elect to hire a private trash hauler. Even in Waterville's neighboring towns the trash disposal and recycling systems vary, but what seems the most successful are those programs with the built in incentive to recycle.

The goal of this project is to determine Waterville household preferences towards different municipal recycling programs and discover their willingness to pay for recycling and garbage removal. While the community members have

elected officials who view recycling as a priority, it is not entirely clear that individuals in the community are willing to take the time and effort to sort and drop off their recyclables. The failure of the Skills Recycling program highlights this issue the city is facing, because of this we want to look at a more efficient recycling program. City officials have been debating whether this program would be viable. For the long run, a curbside recycling program would be advantageous because the amount of solid waste would be drastically reduced, however, the environment is not the solitary consideration for the decision. By developing a choice experiment we hope to quantify the value the town of Waterville places on a curbside pickup program for recyclables and discover household willingness to pay.

2. Motivations

Recycling has become increasingly difficult for Waterville residents over the past decade. After eliminating the curbside pick-up program in 2006 and no longer offering recycling drop-off at the SKILLS facility since May of 2013, Waterville residents now must drop-off their recycling at the Shredding on Site (SOS) location in town. We believe that many people in Waterville have a desire to recycle but they do not want to put in the effort of bringing their recyclables to a facility and sorting them. We want to investigate public preference for implementing a curbside recycling program and investigate what residents would be willing to pay for a curbside pickup program. We hope that our results will influence policy makers in the future and improve the state of recycling in Waterville.

Municipal recycling is a particularly relevant issue given the increased awareness about global climate change. As students living Waterville, we have noticed the lack of convenient recycling options and have been made aware of the city's recycling challenges. We want to understand local perspectives and preferences. Through the last ten years, the town has participated in various recycling programs that have all been unsuccessful; programs are continually being altered and re-established every few years. An economically efficient recycling program would make Waterville more environmentally friendly and could potentially create jobs in the waste disposal industry. This project has been designed to gather insight into resident's preferences regarding recycling and how income affects such preferences.

3. Lit Review

Hua Liu's paper "Recycling Economy and Sustainable Development" is an economic history analysis that determines ways in which sustainable development can be brought about by a recycling economy. Sustainable development is defined as a growth process, which meets the needs of the present without jeopardizing the welfare of future generations. Historically, human societies have experienced three main economic eras: the primitive economy, the agricultural economy and the industrial economy.

The economic growth of nations requires more capital-intensive methods of production. Processes of industrialization, combined with a wave of economic globalization, have been putting significant pressure on the environment in general, and ecological services in particular. In fact, the internationalization of production widens the spread of pollution. As economic globalization increases, the level of global pollution rises as well because evolving economies require more energy, more transport, and more exploitation of raw materials. As wealth and income increase, the demand for manufactured equipment grows as well. Consequently, a series of problems arose, such as the energy crisis, environmental pollution, and ecological damage.

Hua Liu argues that a recycling economy is the best way to achieve sustainable development only if it follows a "Reduce, Reuse, Recycle" code of conduct for socio-economic activities. The 3R principle is based on bionomics laws. A traditional economy changes resources into waste to achieve growth where a recycling economy provides added value to used goods to promote economic growth. It serves the dual purpose of waste utilization and environmental protection. "A recycle economy," Liu says, "is the embodiment of sustainable economic development". This research paper confirms our motivation for finding an appropriate solution promoting environmentally friendly practices coherent with residents' preferences.

Thomas Kinnaman and Don Fullerton's paper "Garbage and Recycling in Communities with Curbside Recycling and Unit-Based Pricing" estimates the impact of a user fee and curbside recycling program on recycling and garbage volume. They found that without correction of endogenous policy, the price per unit of garbage collection has a negative effect on garbage volume and a positive cross-price effect on recycling. The model then adjusts for the endogeneity in local government decisions and finds that the positive effect of the garbage price on the recycling quantity would not apply to other communities looking to implement a pricing program. Our research design should shed light on whether or not this effect applies to Waterville, ME.

Tracy Boyer, an assistant professor in the Department of Agricultural Economics at Oklahoma State University, published an applicable paper in relation to this choice experiment. "Talking Trash: Valuing Household Preferences for Garbage and Recycling Services Bundles Using a Discrete Choice Experiment" analyzes household preferences for municipal waste services in Stillwater, Oklahoma. The motivation behind the study came from the fact that many smaller municipalities are looking for new ways to operate their recycling systems due to increasing costs for gate fees and worker salaries. Many towns are attempting to develop new methods that will reduce costs, such as mechanized pay-as-you throw container garbage collection, as well as, changes to the services they currently provide, such as recycling collection. By conducting a discrete choice experiment, Boyer was able to examine the variety of services that a town or city could provide for waste collection, while considering limited budgets and considerable vocal opposition from some residents.

Residents of the town of Stillwater were asked to complete four choice sets, each of which contained three scenarios for a garbage collection package, with the third scenario represented maintaining the status quo. The status quo consisted of garbage being picked up curbside two times each week and recyclables collected at four central locations within the town. The study also included yard waste pickup, which was collected on a weekly basis for a cost of $13 per month. The attributes that the choice experiment looked at were garbage schedule, recycling schedule and collection location, yard waste schedule and collection location, the option for a per bag fee for additional garbage pickup, and a standard monthly fee for the garbage collection package. The results from the study showed that women, current recyclers, and households with higher income are more willing to pay for recycling services. One noticeable point from this experiment that we can apply to our own is that Boyer noticed that residents did not value more service for garbage pickup. The study showed that eliminating one day of garbage pickup could help cover some of the costs for curbside recyclables pickup. In conclusion, the study showed that residents were willing to pay $1.98 per household per month for the addition of curbside recycling pickup. We believe that our study will have very similar results to that of this paper.

Bohm, Folz, Kinnaman, and Pdolsky's 2010 paper "The Costs of Municipal Waster and Recycling Programs" estimates the cost functions for both municipal solid waste collection and disposal and curbside recycling programs. The results showed that marginal and average costs of recycling systems exceed those of waste collection and disposal. The data for the study also includes economic

factor costs and program attributes including sorted versus unsorted recycled materials, public versus private firms handling the business, and frequency of collection. This paper provides a solid foundation of specific results, which we can cross-reference with the results of our survey.

Additionally, Katia Karousaki and Ekin Birol's 2008 paper "Investigating household preferences for kerbside recycling services in London: A choice experiment approach" published in the Journal of Environmental Management looks to examine determinants of household recycling behavior and estimate which recycling service attributes are valued most highly by the public. They used a stated preference survey and a choice experiment to value services by using the attributes: number of dry materials, collection of compost, textile collection, and frequency of collection. They surveyed 188 households in the London area using a stratified sampling approach. The authors collected data on the social and economic characteristics of respondents and current recycling behavior. The survey also aimed to investigate which policy instruments were more acceptable by the public to encourage recycling: charging for garbage or deposit refund. It was found that there was strong favor towards deposit refund. Additionally, respondents preferred a program that collected more frequently and collected a greater number of materials at the lowest possible cost. The author's derived a willingness to pay welfare measure for changes in curbside recycling. Growing off Karousaki and Birol's paper we would like to virtually model their experiment with our own attributes and distribute the survey to households in Waterville in order to understand household preferences in the local community.

4. Methods

Using and expanding on existing literature regarding municipal recycling and the use of choice experiments, we designed a discrete choice experiment to be given to a random sample of Waterville residents. We used experimental design theory to construct profiles of the various programs in terms of its attributes and levels. Profiles are assembled in choice sets and survey respondents are then asked to state a preference for each occasion. There were four survey versions, each consisting of six choice questions and thirteen demographic questions. The attributes of the survey included: type of program, frequency of pick-up and distance to drop-off center, and added payment for recycling. The type of program had three different levels, curbside pick-up of trash and recycling (unsorted), curbside pick-up of trash and recycling (sorted),

and curbside pick-up of trash and drop-off of recycling (unsorted).   The frequency and distance levels included, recycling picked up every week, recycling picked up every two weeks, recycling drop off center less than 10 miles away, and recycling drop off center between 10 and 20 miles away. Finally, the cost attribute had six levels: 0, 2, 4, 6, 8, and 10 dollars. The demographic questions covered: current recycling behavior, understanding thoughts and relationship to environment, education level, employment, zip code, number of dependent children, gender, age, income level, and climate change opinions. Figure 1 displays the survey attributes and levels used in the survey.

Figure 1:

Attribute	Description	Levels
Type of program	Curbside pickup service for recyclable and trash (sorted vs. unsorted), or a drop off location for recyclables with curbside trash.	Curbside pick-up of Trash and recycling (unsorted) Curbside pick-up of Trash and recycling (sorted) Curbside pick-up of Trash and drop off of recycling (unsorted) Status Quo Weekly curb side pick up trash
Frequency and Distance	How recycling is handled	Recycling picked up every week 🕐🕐 Recycling picked up every two weeks 🕐 Recycling drop off center is less than 10 miles away Recycling drop off center is between 10 to 20 miles away
Added Payment for recycling $	The added cost household will be paying per month for the recycling services provided by the city. Paying for recycling is a change from the status quo.	$0 $2 $4 $6 $8 $10

A number of unique set of choice questions can be developed from these attributes and levels. Using an orthogonal technique, 24 pair-wise comparisons

of the given services were produced. These 24 sets were then divided into four, producing the four versions of the survey. Each of the 24 sets included two recycling service profiles and a third profile which provided the status quo option. Figure 2 is an example of one choice set used in the surveys.

Figure 2:

Attributes	Alternative 1	Alternative 2	Status Quo
Type of program Curbside pickup service for recyclable and trash (sorted vs. unsorted), or a drop off location for recyclables with curbside trash.	**Curbside pick-up of Trash and drop off of recycling (unsorted)**	**Curbside pick-up of Trash and drop off of recycling (unsorted)**	**Weekly Garbage Removal Only**
Frequency and Distance How recycling is handled	**Recycling drop off center is less than 10 miles away**	**Recycling drop off center is between 10 to 20 miles away**	**Shredding on Site Recycling Center**
Added Payment for recycling The added cost household will be paying per month for the recycling services provided by the city. Paying for recycling is a change from the status quo. $	**$4** $ $	**$10** $ $ $ $ $	**No Cost to Household**
Please tick/mark (√) only one	☐ A	☐ B	☐ C

The surveys were implemented in April 2014 using a stratified sampling approach to break up Waterville and randomly sample various neighborhoods. Students from Colby College economics classes went door-to-door conducting face-to-face surveys of head of households 18 years or older. The response rate

was not recorded, but the final data set consists of 201 useable surveys, resulting in 4101 total observations.

5. Data Preparation

Table 1:

Summary Statistics	
Average income	$55,947
Average education level	3.277
Average number of dependent children	0.8565
Average age	30.26
Percentage female	47.3%
Households that Recycle	67.4%
Observations	2667

In addition to our 24 choice experiment questions, we asked respondents to answer 13 demographic questions on social and economic characteristics. The descriptive statistics are listed above in Table 1. On average, the respondents' mean income was $55,947, which is significantly greater than the average income of a Waterville resident, which is $32,922. This may be attributed to a certain demographic of people being more willing to participate in the survey, or could also occur from people being dishonest in reporting their income. Our question about respondent education had 5 levels as seen in the demographic questions. The mean value was 3.277, which means the average respondent completed somewhere between an associate's degree and a bachelor's degree. 85.9% of Waterville residents have a high school degree or higher while 24.3% of residents have earned a bachelor's degree or higher. Survey respondents average 0.8565 children under the age of 18 living in the household. The average age of respondents was 30 years, which is similar to the median age of Waterville residents, which is 36.8 years. About 47% of respondents were female, which is about equal to Waterville residents as a

whole with 46.8% being female. Finally, 67.4% of respondents said they currently recycle in some form.

Prior to analysis, we coded the choice experiment data and entered them according to the levels of the attributes. We used a mixed multinomial logit model and performed a willingness to pay (WTP) measure for the list of attributes. An explanation of the mixed multinomial logit model is provided below, taken from *Derivations of Models to Estimate Discrete Choice Data* by Sahan T. M. Dissanayake

6. Estimation : The Mixed Multinomial Logit Model

The standard multinomial logit model assumes that the respondents are homogeneous with regard to their preferences (the βs are identical for all respondents). This strong assumption is no typically valid and recent literature has started using the mixed multinomial logit model (MMNL)[1] as one of the standard methods to analyze discrete choice data. The MMNL incorporates heterogeneity of preferences (Hensher and Greene. 2003, Carlsson, et al. 2003). The following is a summary of the derivation of the MMNL estimator and the calculation of the WTP.

Assuming a linear utility, the utility gained by person *q* from alternative *i* in choice situation *t* is given by

$$_\mathrm{T}U_{qit} = \alpha_{qi} + \beta_q X_{qit} + \varepsilon_{qit} \qquad (1)$$

where X_{qit} is a vector of non-stochastic explanatory variables. The parameter α_{qi} represents an intrinsic preference for the alternative (also called the alternative specific constant). Following standard practice for logit models we assume that ε_{qit} is independently and identically distributed extreme value type I. We assume the density of β_q is given by $f(\beta \,|\, \Omega)$ where the true parameter of the distribution is given by Ω. The conditional choice probability of alternative *i* for individual *q* in choice situation *t* is logit[2] and given by

---

[1]This approach is also referred to as the mixed logit, hybrid logit, random parameter logit, and random coefficient logit model.

[2] The remaining error term is iid extreme value.

$$L_q(\beta_q) = \prod_t \frac{\exp(\alpha_{qi} + \beta_q X_{qitq})}{\sum_{j \in J} \exp(\alpha_{qj} + \beta_q X_{qjt})} . \qquad (2)$$

The unconditional choice probability for individual *q* is given by

$$P_q(\Omega) = \int L_q(\beta) f(\beta | \Omega) d\beta . \qquad (3)$$

The above form allows for the utility coefficients to vary among individuals while remaining constant among the choice situations for each individual (Hensher, et al. 2005, Carlsson, et al. 2003, Train. 2003). There is no closed form for the above integral; therefore P_q needs to be simulated. The unconditional choice probability can be simulated by drawing R random drawings of β, β_r, from $f(\beta | \Omega)$ [3] and then averaging the results to get

$$\tilde{P}_q(\Omega) = \frac{1}{R} \sum_{r \in R} L_q(\beta_r) . \qquad (4)$$

In the choice experiment questions, option A and option B are both restoration options that can be viewed as being closer substitutes with each other than with option C, the status quo option (Haaijer, *et al.* 2001; Blaeij et al. 2007). One method to incorporate this difference in substitution between options is to use an econometric specification for the mixed multinomial logit model that contains an alternative specific constant (ASC) that differentiates between the status quo option and choices that represent deviations from the status quo. This can be achieved by using a constant that is equal to one for alternative A or alternative B.

The coefficient estimates for the mixed multinomial logit model cannot be interpreted directly. Therefore, we calculate average marginal WTA for a change in each attribute *i* by dividing the coefficient estimate for each attribute with the coefficient estimate for the payment term, as given in (9). (Dissanayake)

---

[3]Typically $f(\beta | \Omega)$ is assumed to be either normal or log-normal but it needs to be noted

that the results are sensitive to the choice of the distribution.

7. Results

The results revealed that the values for recycling drop-off, curbside pick-up, and distance are all significant at the 5% level of significance. On average, residents are willing to pay $6.40 for recycling drop-off and $7.05 for curbside pick-up. The WTP estimate for drop-off has a standard deviation of 0.751 and the WTP estimate for curbside pick-up has a standard deviation of 0.964. Therefore, we cannot say that the WTP estimate for curbside pick-up is significantly greater than the estimate for drop-off recycling. The distance attribute produced a WTP estimate of –$2.81 with a standard deviation of 0.426. This means that residents are willing to pay $2.81 less for recycling drop-off for each additional mile they live from the drop-off center. This value was statistically significant at the 5% level of significance. While the estimates for recycling drop-off and curbside pick-up are similar, the negative estimate for distance shows that people would only be willing to pay for recycling drop-off if the facility was located in close proximity to their home.

The remaining two attributes are sorted curbside recycling and frequency of pick-up. Neither of these variables are statistically significant at the 95% confidence level. Therefore, the results seem to show that residents do not have strong preferences for these two attributes.

a. Results 1

Table 2:

WTP	
	(1)
	Choice
Recycling Drop-off	6.395***
	(0.751)
Curbside Pick-up	7.048***
	(0.964)
Sorted	0.0636
	(0.417)
Frequency	-0.148
	(0.413)
Distance	-2.806***
	(0.426)
Observations	4101

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

b. Results 2

After running the overall mixlogit regression we also ran a mixlogit using subsamples to analyze demographic effects on willingness to pay. The results are displayed in the following tables.

Table 3:

WTP Current Household Recycling Practice		
	(1)	(1)
	Y	N
Recycling drop-off	9.945***	3.021***
	(1.343)	(0.911)
Curbside pick-up	9.646***	4.393***
	(1.536)	(0.943)
Sorted	0.369	-0.0426
	(0.635)	(0.494)
Frequency	-0.631	-0.0729
	(0.675)	(0.425)
Distance	-3.681***	-2.305***
	(0.709)	(0.645)
Observations	2694	1299

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4:

Income		
	(1)	(1)
	>50,000	<50,000
Recycling Drop-off	9.414***	5.120***
	(1.743)	(0.991)
Curbside Pick-up	10.77***	3.592**
	(1.890)	(1.146)
Sorted	1.375	-0.856
	(0.772)	(0.579)
Frequency	-0.0839	-0.432
	(0.674)	(0.513)
Distance	-4.105***	-2.577***
	(1.027)	(0.623)
Observations	2130	1971

Standard errors in parentheses $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5:

	(1) Low EDU	(1) High EDU
Education		
Recycling Drop-off	2.956***	9.126***
	(0.879)	(1.330)
Curbside Pick-up	2.926***	11.49***
	(0.802)	(1.630)
Sorted	0.322	0.174
	(0.447)	(0.723)
Frequency	-0.432	0.107
	(0.486)	(0.685)
Distance	-1.203**	-4.051***
	(0.461)	(0.741)
Observations	1434	2667

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The results are consistent with previous literature. Households that already practice recycling are willing to pay over $5 more for curbside pickup than households that do not currently recycle. They are also willing to pay more for every other option and still there is no significant preference on sorted or frequency. Income also produced the same results. Households in the higher income bracket are significantly more willing to pay for curbside-pickup, almost $7 more a month. Education also seems to have a relatively large effect on willingness to pay. Household members with more than an associates degree are more willing to pay for curbside-pickup by over $8 a month. Additionally, further data revealed that women are more willing to pay for recycling than men.

8. Conclusion

This study used a choice experiment to evaluate the extent to which Waterville residents would be willing to pay for curbside recycling services. Also, this paper looks at what other preferences residents have in terms of drop-off recycling, distance from the drop-off facility, frequency of pick-up, and whether or not you have to sort your recyclables for curbside pick-up. We saw that the WTP estimates for recycling drop-off and curbside pick-up were not statistically different, however after observing a statistically significant negative value for the distance attribute, it became clear that residents are willing to pay more for curbside pick-up, unless the drop-off center is in close proximity to their house.

The WTP estimates for sorted curbside pick-up and frequency of pick-up were not statistically significant at the 95% confidence interval. This means that Waterville residents do not have a strong preference for either of these two attributes. Therefore, as a recommendation to policy makers, the ideal scenario would be to implement a curbside pick-up recycling program with pick-up occurring every other week. If the town implements a program with curbside pickup, and requires payment, the appropriate price point would be around $7 a month. We believe implementing a curbside recycling program would not only be a positive environmental move for the town but economically makes sense, as there is an evident willingness to pay for such services. Further research on the topic could reveal more cost-effective methods for curbside collection as well as possible economic incentives for residents. Income and education have a substantial effect on household willingness to pay for waste removal services. Perhaps taking a deeper dive into analyzing Waterville demographics could be a further way to aid policy makers in deciding the best option for the city.

Upon reflection we should have included a demographic question asking how exactly each household recycles. There could be households that take bottles in for redemption and thus recycle, however, these households may not recycle non-returnables. We may have been able to reveal more information if we had identified these two groups separately. Also, we determined that our average WTP estimate for curbside recycling pick-up was $7. However, the average income for our sample was significantly higher than the average income for Waterville residents, $55,947 and $32,922 respectively. Therefore, our estimate may be greater than the true value. Further research with a larger sample size identifying at an income level more similar to the average for Waterville residents may provide a more accurate estimate.

9. *Acknowledgements*

10. Works Cited

"A Loss in Profits Has Waterville Recycling Center Shifting Gears." *Morning Sentinel*. N.p., 25 Apr. 2006. Web. 06 Nov. 2013.

Bornstein, David. "The Recycling Reflex." *The New York Times - The Opinion Pages*. N.p., 25 July 2012. Web. 06 Nov. 2013.

Boyer, Tracy. "Talking Trash: Valuing Household Preferences for Garbage and Recycling Services Bundles Using a Discrete Choice Experiment." *American Agricultural Economics Association Annual Meeting* (2006): n. pag. Print.

Creason, Jared, and Michael J. Podolsky. "Economic Impacts of Municipal Recycling."*The* Review of Regional Studies 31.2 (2001): 149-64. Web. 6 Nov. 2013.

Kinnaman, Thomas C., and Don Fullerton. "Garbage and Recycling in Communities with Curbside Recycling and Unit-Based Pricing." *NBER. National Bureau of Economic Research*, Apr. 1997. Web. 10 Dec. 2013.

Liu, Hua. "Recycling Economy and Sustainable Development." *Journal of Sustainable Development* 2.1 (2009): n. pag. Print.

Park, Seejeen. "Analyzing Effective Municipal Solid Waste Recycling Programs: The Case of County-level MSW Recycling Performance in Florida, USA." *Sage Journals*. Sage, 8 July 2013. Web. 10 Dec. 2013.

Dissanayake, Sahan. "Derivations of Models to Estimate Discrete Choice Data."