Valuing Urban Beaches: Distribution of Benefits across Race and Income[1]

Claire M. Munaretto
Amy W. Ando

Department of Agricultural and Consumer Economics[2]
University of Illinois Urbana-Champaign

Abstract

Much research has estimated the recreational values of natural areas, but that research has largely neglected the values of natural areas in urban environments, and has focused on generating total or median household values rather than exploring how benefits are distributed among racial, ethnic, and socio-economic sub-groups of society. This paper fills those gaps by estimating the value of public beaches in the third largest city in the U.S., Chicago, and how the distribution of that value is affected by income, race, access to transportation, and age. We analyze data from a travel cost survey of over 750 diverse households in the greater Chicago area. Results indicate that willingness to pay (WTP) for these urban beaches is especially high among African-Americans in the community, and that WTP first increases but then declines with increasing income. We find that the average resident would be willing to pay about $385-$815 for a year's beach season, and that the total net value of the beach system ($ 2.12-$4.75 billion) is orders of magnitude more than the cost of maintaining the system. And while other research makes clear that the costs of environmental degradation often fall disproportionately on low-income and minority communities, in this case at least the benefits of this public environmental good accrue disproportionately to them as well.

JEL Codes: Q26, Q51, Q57

Keywords: Environmental justice, recreational value, travel cost model

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[1] We thank Brenna Ellison, Erica Myers, Hope Michelson, and attendees of the UIUC pERE seminar and the W3133 Multi-State Hatch Workshop for helpful comments and suggestions. This work is based in part on research funded by the W3133 Multi-state Hatch Grant, USDA-NIFA grant #230830.
[2] Claire.Munaretto@gmail.com; amyando@illinois.edu

I. Introduction

Scholars of environmental justice have studied patterns of inequity in the health risks of hazardous pollution borne by minority and low income neighborhoods, but the environmental justice literature lacks extensive research on the distribution of benefits of outdoor natural amenities (Mohai, Pellow, & Roberts, 2009; U.S. EPA, 2014; Williams, 1999; Bowen, 2002; Mohai & Saha, 2006). Many papers have estimated the recreational benefits of natural areas, but few focus on natural amenities in urban areas that have diverse populations. To fill both those gaps, this paper estimates the value of the beaches in the city of Chicago, and how that value is distributed among racial/ethnic and income groups. This paper answers several questions. Are urban beaches an inferior good? What is the value of the Chicago beaches? Do willingness to pay (WTP) and consumer surplus (CS) for urban beaches vary across racial/ethnic and income groups? These questions dig into the literature which has found low income/minority people having relatively limited neighborhood park accessibility and substitutes (Abercrombie et al., 2008; Garcia et al., 2016), and thus explores a new strand of environmental justice research. We find that average WTP for the 2016 summer beach season in Chicago is quite high, ranging from about $500-$1,000 per person, and that consumer surplus (CS) for Chicago's beaches is actually highest for low-income and minority households.

A few previous papers have estimated the values of urban beaches. Lew and Larson (2005) do a travel cost survey to estimate the value of recreation at San Diego County's 31 heavily used beaches. Using a random utility model (RUM) model, the survey estimated the median value of a beach day to be $30.29. The study's extensive questioning of amenities identified those influencing beach use, and found that longer beaches, free parking, and lifeguards increase the likelihood of visits. Interestingly, water quality was the highest reported factor explicitly affecting beach experience, but this was not significant in the revealed survey results, perhaps because some respondents never go in the water and others (surfers) will use the water regardless of quality.

In Australia's first beach valuation using the travel cost method (TCM), the setting is an urban beach on the Sunshine Coast that is open year round and visited by residents and visitors from the Brisbane area. Blackwell (2007) runs three regressions for robustness: OLS, truncated Poisson, and truncated negative binomial and uses the truncated negative binomial, due to support in the literature and having the highest log likelihood. The annualized CS per person given by the truncated negative binomial was $17.41/person/year for residents and $107.75 for visitors (Blackwell, 2007).

To our knowledge, only one study has been conducted on freshwater beaches: a TCM of two beaches on Lake Erie in the summer of 1997 (Sohngen et al., 1998). At the beaches of Maumee Bay State Park and Headlands State Park in Ohio on Lake Erie, an on-site survey was conducted with response rates of 52% (n=345) for Headlands and 62% (n=230) for Maumee Bay. Results of the study estimated the value of a beach day of $25 and $15 for Maumee Bay and Headlands respectively.

The National Ocean Economics Program has a bibliography database on their website of which papers valuing oceanic beaches in the United States are listed prior to 2008. These values range from $0.07-$120.74 for residents and tourists all over the country using varying methods. A less extensive list can be seen in Appendix A; that table reviews features and results of several TCM studies of beaches and other water activities to place this current paper in the TCM literature.

Few studies have explored variation in travel demand by ethnicity. Bowker & Leeworthy (1998) estimate trip demand using the TCM. Their study of recreation in the Florida Keys finds a significant difference in CS and price elasticity between white/Caucasian and Hispanic users. CS for whites was estimated at $757, while Hispanic users had an estimated $121 CS. This study was one of the first to look into how recreation demand differs by ethnic group. Policy implications include equity issues in pricing such as entrance fees (Bowker & Leeworthy, 1998).

While few papers in the environmental economics literature examine recreation demand across race/ethnicity, the topic is well studied in the urban geography and leisure literatures. Availability and access to quality urban recreation continues to be an issue for low-income and minority groups. Garcia et al. (2016) discusses how Latino neighborhoods have limited park availability in Los Angeles, and More & Stevens (2000) found that user fees exclude low-income peoples from recreation. Wolch, Wilson, Fehrenbach (2005) conclude that low-income and minority dominated neighborhoods have less access to parks than white/Caucasian neighborhoods. Sister, Wolch, & Wilson (2009) discover that minorities and low-income groups were more likely to live close to highly congested parks. Park quality has a tendency to correlate with income and racial/ethnic diversity as Engelberg et al. (2016) found in Baltimore. McKenzie et al. (2013) also find that quality of community center facilities/amenities is positively correlated to neighborhood income. Furthermore, Alesina et al. (1999) ascertain that shares of spending on public goods are inversely related to ethnic populations in cities. On the other hand, there is inconsistency in the literature as Abercrombie et al. (2008) do not find the hypothesized inaccessibility to recreation by low-income and high-minority neighborhoods in Maryland. These case studies support a national issue of overall reduced quality of recreation for urban ethnic populations.

In this paper, we study the city of Chicago as a case study of how race, ethnicity, and income affect demand for urban beaches. Chicago continues to be an extremely segregated city by race and income. From race riots in the 1960s to present day protests regarding police shootings, the city has experienced, and continues to experience, racial tensions. The extent of race and income segregation can be seen in Figures 1 and 2.

In Chicago, significant proportions of the population are living in poverty, and 10% of the city's population lives in deep poverty, defined as income less than half of the federal poverty line. For an individual, the poverty threshold for 2016 was $11,511 and for a family of four was $24,339. These proportions can range between 40 to 60 percent of residents living below the poverty level in the South and West sides, areas of Chicago that are predominately African American (U.S. Census Bureau, 2016; Emmanuel, 2015; Dodge, 2014).

Studies of Chicago have been designed to improve understanding of the metropolitan area's income and racial disparities. Zou (2014) serves as an example of analyzing racial, ethnic, and socioeconomic inequality spatially. The study finds that higher priced mortgages occur at a higher rate where African-Americans, Hispanics, and lower income peoples reside. These areas are predominantly located in the south-side of Chicago and Cook County, the county in which Chicago resides. The strong geographic concentration of higher-priced mortgages can be considered a form of "reverse redlining" (Zou, 2014). Redlining is intentionally withholding funds from areas on the basis of racial and ethnic makeup, historically from when lending institutions would draw red lines around those neighborhoods on a map. Reverse redlining occurs when similar targets of redlining are subjected to predatory lenders via these subprime mortgages (Hinnant-Bernard & Crull, 2004). Chicago's beaches, while never formerly segregated in the early twentieth century, had invisible lines separating white/Caucasian and black/African American beach-goers (Encyclopedia of Chicago, 2005). This supports the inherent segregation of race/ethnicity and income in the Chicago area.

Studies have also tried to understand racial and ethnic influence on outdoor recreation participation rates in Chicago (Carr & Williams, 1993; West, 1989; Hutchison, 1987). The sociology literature, when comparing whites/Caucasians, blacks/African Americans, and Latinos/Hispanics, produce varying results (Hutchison, 1987). The use of outdoor recreation by different ethnic and racial groups can be highly dependent on the proximity to urban areas. One paper examines how barriers to access and use of regional parks affect use by minorities. This study also examines whether marginality and interracial relations play a role in restricting access to regional parks by lack of access to automobile transportation in Detroit (West, 1989). Carr & Williams (1993) focus on ethnicity's role in recreation behavior and inform and improve the management of outdoor recreation. Field observations of different ethnic groups were conducted in thirteen of Chicago's neighborhoods and parks during the summers of 1981 and 1982. Three of the parks studied were lakefront parks and are adjacent to Montrose Beach, North Avenue Beach, and 31st Street Beach (Lawerence Park, Diversey Park, and Burnham Park in the study respectively). Lawerence Park (Montrose) was reported to having a mixed neighborhood population and a mixed user population. Diversey Park (North Avenue) reported having both white/Caucasian neighborhood and user populations, and Burnham Park (31st Street) reported having both black/African American neighborhood and user populations. The study's results yielded that Caucasians were observed doing individual activities opposed to Hispanics, where family activities dominated and overall had used parks more intensively than whites/Caucasians and blacks/African Americans. Hutchison posits that differences in typically white/Caucasian and black/African American recreation activity may be more strongly related to social class than racial differences. Policy implications for Chicago parks are predominantly to provide facilities that would most likely to be best used by the corresponding neighborhood populations. The study also found that parks surrounded by primarily black/African American populations were underutilized and called on community managers to determine the causes of under-use (Hutchison, 1987).

The study done by Gobster (2002), intercept surveyed 898 users of Chicago's Lincoln Park, which abuts North Avenue Beach. These users were broken down by ethnicity with 217 black/African American, 210 Hispanic/Latino, 182 Asian, and 289 white/Caucasian. The study revealed that park users share overall interests and concerns for the parks, but differ in park use and sentiments of racial discrimination. Policy implications out of this study are primarily park access and use. Lincoln Park defies norms in that minority groups are willing to travel longer distances to use the park whereas the whites surveyed came from the surrounding neighborhoods. The combination of family groups and longer distances to the park can restrict transportation options, yet a significant proportion of Latinos used mass transit. This observation called for more travel routes and the possible expansion of mass transit.

This paper estimates the value of the Chicago beaches via the TCM, a demand based model for nonmarket valuation, used frequently to value recreational uses of environmental goods (Parsons, 2003). We identify how the number of trips people take to the Chicago beaches varies with factors such as travel cost (which depends heavily on distance from the beaches), reliable access to a vehicle, race/ethnicity, income, age, gender, and the ability to swim. Controlling for all these correlated factors allows us separately to identify the roles that race and income play in the value people place on Chicago's 26 beaches, which are shown in Figure 3.

II. Methods

2.1 Travel Cost Methodology

Non-market valuation techniques are employed in recreational studies with three basic approaches: TCMs of demand for single sites, TCMs of choices among multiple sites (random utility models), and stated preference methods (contingent valuation models). The TCM values recreation benefits of individuals by their recreational behaviors, or revealed preference. This paper treats the Chicago beaches as a single site, and single-site models acts like a conventional demand function with quantity demanded being the number of trips and price being the cost of accessing the site. Single-site models work best for estimating the total use and value of a site. Price variation comes from different people living at different distances from the site with low price equating to short distances from the site. Theory tells us that the demand function slopes down as the number of trips decrease with increased distance to the site.

The number of trips, or trip count, to the Chicago beaches, tc_i, is the quantity demanded, and is a function of the travel cost of the trip, p_i, and the individual's characteristics, z_i, giving the demand function (Parson, 2003):

$$(1)\ tc_i = f(p_i, z_i).$$

As the above demand function is given, the individual's CS for a single trip for an individual is:

$$(2)\ CS_i = \int_{p_i^0}^{p_i^{choke}} f(p_i, z_i)\, dp_i,$$

where p_i^0 is the individual's trip cost and p_i^{choke} is the individual's choke price. The choke price is the price at which an individual's number of trips becomes zero. These concepts are illustrated in Figure 4. In Figure 4, the area marked as CS is the individual's total consumer surplus for trips to the Chicago beaches throughout the 2016 summer season. The area labeled as “Travel Cost” is equal to the amount an individual paid to travel to the site. The sum of those two values gives the total WTP for trips for an individual. For an extensive overview of the TCM, see Parsons (2003).

2.2 Survey

2.2.1 Survey Methodology Literature

Travel cost surveys are conducted either by on-site or off-site sampling. An example of off-site sampling would be to mail a survey to a random sample for the survey participants to mail back. On-site sampling would be intercept sampling at the site and completion of some type of survey or mail the survey in once completed. A benefit of on-site sampling is that the population of those with some demand for the amenity is targeted; off-site sampling requires a much larger sample in order to have sufficient power to identify the parameters of the demand function. On the other hand, on-site sampling systematically excludes people with little or no demand for the amenity, and randomization of the sample is extremely difficult. Ways to randomize on-site sampling include randomly selecting week and weekend days throughout the season and interviewing every tenth person. To correct for selection bias in on-site sampling, an empirical analysis must be truncated so observations less than one are not observable and corrections can be made for the endogenous stratification. While the limitations of on-site sampling can be overcome, we use off-site sampling because it provides information needed to estimate the intercept and avoids selection bias. This can be costly as more surveys are needed to reach a large enough portion of site users (Parsons, 2003); we use an internet survey approach to collect sufficient data.

2.2.2 Survey Design and Data Collection

Our survey was administered online via Qualtrics to circumvent the sample selection problem that on-site sampling exhibits. In order to avoid poor recall in the survey participants, the online survey was released shortly after the official close of Chicago's beach season, Labor Day 2016. In an effort to maintain participant focus, the survey was designed to take the average participant only five to ten minutes to complete.

Before the data were collected, we carried out pre-tests of the survey to confirm logic flow and to ensure that respondents understood the purpose of and questions within the survey. Following IRB review, two soft launches were conducted to refine the survey and ensure quality responses. Two "check" questions were included to verify that respondents were actually reading the questions and answering to the best of their abilities.

The survey begins with background information on the Chicago beaches, states that the beach season is Memorial Day through Labor Day (May, 27 – September 5 in 2016), and includes a map of where the beaches are along the lakefront. It is then followed by eligibility screening questions to ensure that respondents are adults and living in the Chicagoland area. The next question, asking the respondent's racial/ethnic identity, is also in the screening questions as Qualtrics, the survey administrator, used it to ensure that the survey had enough respondents who were black/African American and Hispanic/Latino for tests of differences between groups to have sufficient power. We deliberately over-sampled those groups by eight and three percent, respectively.

The third section of the survey asks about the respondent's beach use during the 2016 summer beach season. One questions asks if they visited any of the public beaches that summer. If they respond yes, they continue to answer more questions about which beaches, how many times they visited those beaches, which was the most recent trip, and specific questions about the most recent trip. If the respondent reported no beach visits, they by-passed the follow-up section and moved on to section four.

Section four, the qualitative portion of the survey, asked if certain factors, such as water quality and beach cleanliness, played an important role in the decision to go to any Chicago beach. Section five, the last section, gathers demographic characteristics to be used as controls. These factors are necessary to this survey as our study tries to understand who benefits the most from the public good that is the Chicago beaches.

We surveyed 783 individuals living in the Chicagoland area. Three individuals reported in the comment portion that they purposely lied on the question asking for annual household income. Two individuals reported to living out of state despite reporting an Illinois zip code. Ten respondents reported visiting the Chicago beaches more times than there were days in the beach season and were determined to be outliers. These fifteen respondents were removed from the data set leaving 768 total respondents used in this study.

2.3 Conceptual Model and Data Analysis

In order to estimate an individual's WTP for the Chicago beaches, the survey data are applied to the TCM shown in equations 1 and 2. The variables included in the individual's characteristics, z_i, are the annual household income category, race/ethnicity, gender, age, and the ability to swim.

The TCM can be estimated with several econometric tools; in this paper, we use the zero-inflated negative binomial (ZINB) regression to model the sample data to give predicted trips and derive individual CS and WTP. The ZINB regression is ideal for modeling count data with excessive zeros and overdispersed count outcome variables. The difference between the zero-inflated poisson (ZIP) and the ZINB is that the negative binomial distribution in the ZINB allows for overdispersion of the non-zero count values (Zuur et al., 2009).

The ZINB is a two-part model that tries to capture the decision to be a participant, binary process, and then from that, if a participant, what is the demand for trips, count process. The non-participants, or zeros, are divided into permanent and temporal non-participants, with the permanent non-participants never visiting the site, no matter the price, and temporal non-participants face a price above their choke price. The zero-inflated model determines a zero in both the binary, the permanent non-participants, and the count process, the temporal non-participants (Martinez-Cruz, 2016).

The expected number of trips for an individual is given as:

(3) $E[tc_i] = P(I_i = 0) * 0 + P(I_i = 1) * E[tc_i|I_i = 1]$,

where the trip count for person $i = tc_i$ and I_i=1 if tc_i>0; 0 otherwise. ZINB model estimates CS for each individual as:

(4) $CS_i = -P(I_i = 1)E[tc_i]/\beta_{tc}$,

with β_{tc} representing the estimated coefficient for the travel cost.

2.3.1 The Opportunity Value of Travel Time (VTT)

The calculation of the price variable or the travel cost of the trip, p_i, is still a matter of debate in the literature. Many recreation valuation papers solely use the time spent traveling to the recreation site as the cost and, if there is one, the site's entrance fee. In an urban setting, the travel cost tends to be minimal and an entrance fee is unlikely in the case of public goods such as parks, beaches, and river walks. One of the first papers to estimate on-site costs for beach visits was Bell & Leeworthy (1990), but they exclusively valued on-site costs for tourists, not including residents due to inherently different recreation making decisions for short distances.

The cost of the visit contains two values: the cost of travel round trip and the cost of the traveler's time. The cost of travel is fairly straight-forward and non-disputed in the literature. The debate and lack of cohesiveness in the literature comes to the valuation of time. Some papers do not assign any value to time spent traveling to and from the site (Bell & Leeworthy, 1990). Some assign the wage rate (Loomis, 2011), some assign a fraction of the wage rate (Cesario, 1976; Sohngen, 1998; Blackwell, 2007), some create a labor supply model to assign the non-work travel value (Lew & Larson, 2005; Feather & Shaw, 1999), and some assign value to the time spent on the site as well (Loomis, 2011).

Cesario (1976) determined that the literature, subject to discretion, valued non-work travel time between 25% and 50% of the wage rate. Sohngen (1998) uses the estimate of 30%, based on Cesario, of the individuals wage rate because it would reduce the effect of higher hourly wages due to the survey asking for household income opposed to hourly wage. In the Australian example, Blackwell (2007) uses 40% of the reported wage rate to estimate an individual's time cost. The reason given for this is that it is a contested decision in the travel cost literature and similar studies have used 40% as a value of the opportunity cost of time (Blackwell, 2007). Lew & Larson (2005) use a labor supply model based on Feather & Shaw (1999). The model is broken into four categories of workers: workers with flexible schedules, non-workers, overemployed, and underemployed. For flexible workers, time cost is their wage, unemployed and overemployed have a time cost greater than their wage, and underemployed have a time cost less than their wage (Lew & Larson, 2005). Fezzi, Bateman & Ferrini (2014) estimate a value of travel time (VTT) specific for recreation trips via driving choices between open access and toll roads. They find that 3/4 of the wage rate is roughly the average VTT for recreation trips and conclude that the typical assumption of 1/3 of the wage rate is downward biased.

For this paper we use both a third of the wage rate and three-quarters of the wage rate to value the traveler's time in accessing the nearest Chicago beach. A third of the wage rate tends to be the most used in the travel cost literature. Three-quarters of the wage rate will also be used to give an upper bound to the VTT.

2.3.2 Calculating Travel Time Costs

In order to have consistency in calculating travel costs for all respondents, regardless of whether he/she actually visited a beach, we calculated round trip travel distance from the individual's zip code centroids to the nearest beach using R's ggmap package (Kahle & Wickham, 2016). In the survey, respondents indicated if they had reliable access to a car or personal vehicle. If he/she indicated yes, then we multiplied the estimated driving time and distance from the home zip code centroid to the nearest beach by two to give a round-trip travel time. If he/she answered no, then we multiplied the estimated travel time via public transportation by two.

We based calculation of the estimated wage rate on the respondent's reported annual household income. We took the average point of the income range, then divided it by the reported number of wage earners per household and by 2000 (representing the number of hours worked annually given 40 hour work weeks and 50 weeks worked per year). For example if a respondent reported an annual household income of $50,000-$74,999 and two income earners in the household, the hourly wage rate would be $62,500/(2*2000) = $15.63. We then multiplied the estimated hourly wage rate by a third and by three-quarters to give the shadow values of leisure time (SVLT) to be used in the regressions.

Calculating the actual cost of travel, we multiplied the round-trip travel distance for those with reliable access to a car or personal vehicle by the AAA 2016's estimated gas cost per mile: 9.28 cents (AAA). For those that reported not having access to a car or personal vehicle, we estimated their travel cost using round-trip fare for public transportation costs (specifically, a round-trip ticket on the "L"). A one-way trip costs $2.25; thus the round trip value used is $4.50 (RTA, 2016).

The SVLT and the actual cost of travel were summed for each individual to give our price per trip, p_i. Similar methods are used in the literature (e.g. Sohngen et al., 1998; Parsons, Massey, & Tomasi, 1999; Bin et al. 2005; Blackwell, 2007; Amoako-Tuffour & Martinez-Espinerira, 2008; Loomis, 2011; Amoako-Tuffour & Martinez-Espinerira, 2012; Fezzi, Bateman, Ferrini, 2014).

2.4 Hypotheses

Evaluating the distribution of benefits from environmental goods across race and income in regards to access and use is fairly new to the applied economics literature. However, the urban geography and leisure literatures document the benefits and values of parks as well as across different sub-populations (Sister, Wolch, & Wilson, 2009; Wolch, Wilson, Fehrenbach, 2005; Comber, Brunsdon, Green, 2008; Engelberg et al., 2016; More & Stevens, 2000; Garcia et al., 2016; Gobster, 2002; Hutchison, 1987; West, 1989). From this literature, the following hypotheses are derived for the effects of the factors in equation (1).

We hypothesize that minority and low-income people will use the public beaches more on average than whites/Caucasians. This hypothesis comes from the thought process that the nearest beaches North of Chicago, five public beaches operated by the City of Evanston, charges a daily admission fee (City of Evanston, 2016). The literature supports that user fees exclude low-income peoples from recreation (More & Stevens, 2000). Additionally, the literature suggests that minority communities have relatively limited park availability and that, likely correlated with park availability, minority and low-income groups in general were likely to live close to congested parks (Garcia et al., 2016; Sister, Wolch, & Wilson, 2009). See Table 1 for a summary of hypotheses.

III. Results

3.1 Summary Statistics

The total number of useable responses came to 768 after filtering for 15 incomplete or illogical responses. The population of users to be analyzed are residents, 18 years and older, of the Chicago Metropolitan Area within the state of Illinois. The sampling area was chosen in order to view distance variation in the sample, but avoids people in Indiana and Wisconsin that have Indiana Dunes State Park and Whitefish Dunes State Park closer than Chicago Beaches. Within the survey region, there are 339 zip codes from nine counties and 228 of the 339 zip codes are represented in the sample.

According to the US Census Bureau, in 2014, the total population in the Chicago-Naperville-Elgin Metropolitan Statistical Area within the state of Illinois was just over 8.6 million people. The breakdown by race/ethnicity is 53% white alone, 22% Hispanic/Latino, 17% black/African American alone, 6.4% Asian alone, 10.7% Other. These values exceed one as Hispanic/Latino is an ethnicity, not a race. The breakdown by location comes to 60% living in Cook County, the county in which the city of Chicago resides, 11% in DuPage County, the closest county to the west of Cook County, and the remaining 29% from the surrounding counties. To ensure that our sample approximated these breakdowns and had sufficiently large numbers of minority respondents to obtain robust results regarding the impact of race on beach demand, we asked Qualtrics to sample such that 25% of respondents were black/African Americans and 25% were Hispanic/Latinos. We also specified that 60% should be from Cook County, 10% from DuPage County, and 30% from the surrounding counties (U.S. Census Bureau. "QuickFacts." 2014).

Summary statistics of the sample can be seen in Table 2. When asked if he/she visited a Chicago beach at least once in the 2016 summer beach season, 53% of respondents answered that they had. The variation in trip count ranges from 0 to 97 times in the 101 day beach season. On average, the sample visited Chicago beaches seven times throughout the season, with a median of one. The sample had an average round trip travel cost for a single visit of $14.61, median of $11.25, when using a third of the wage rate and $27.41, median of $20.41, when using 75% of the wage rate. A distribution of annual household income can be seen in Figure 5 to reinforce the sample's diversity.

The distribution of trips to the beach can be seen in Figure 6 as a histogram. Mean attendance varies by race/ethnicity and annual household income bin. As shown in Table 3, Caucasians visit the beach, on average, 2.98 times throughout the beach season. By comparison, black/African Americans visit the beaches 11.03 times, Hispanic/Latinos visit the beaches 7.97 times, and Asians visit the beach 9.27 times on average. When looking at average visits by household income category, households that earn between $25,000 and $49,999 annually visit the beaches the most at just over ten times throughout the summer. Households that earn over $150,000 annually visit the beach the least, at under three times throughout the summer.

3.2 Regression Results

The results of the ZINB regression, run in Stata 12, are in Table 4. Explanatory variables used in both the logit and negative binomial portions of the regression are travel cost, race/ethnicity, household income bin, age, gender, and ability to swim. We find that travel cost, income of over $150,000, the inability to swim, and black/African American are statistically significant in both parts of the regression. The literature supports use of all variables in both the logit and full model portions of the regression (Yau et al., 2003; Moghimbeigi et al., 2008; Zuur et al., 2009; Czajkowski et al., 2015).

The results of the logit, labeled "Inflate" in Table 4 as it determines the probability that someone would not visit a Chicago beach, show that an increase in travel cost, age, and the inability to swim increase the probability of not visiting the Chicago beaches. Categories that decrease the probability of not visiting the Chicago beaches are household incomes of $50,000-$74,999 and $150,000+, and minority status. Specifically, whites/Caucasians are 3.9 to 13.5 times more likely to never go to a Chicago beach than a minority person, all else equal.

The results in the column labeled "Trip Count" in Table 4 gives the response variable predicted by the full model. Interpreting the results of the regression that used a third of the wage rate for the SVLT for the Travel Cost, if a respondent were to increase his/her travel cost by $1, the expected number of trips would decrease by exp(-0.016) = 0.984 while holding all else equal. Thus, the higher the cost of travel, the fewer predicted trips will occur. For a black/African American person, the expected number of trips to the beach is exp(0.534) = 1.706 times the expected number of trips for a white/Caucasian person holding all else equal. For someone that cannot swim, the expected number of trips to the beach is exp(-0.32)=0.73 times the expected number of trips of someone who can swim all else equal. Annual household income, while only the wealthiest bracket is statistically significantly less than the omitted (lowest income category), influences predicted trips. Predicted trips increase from the omitted category to the next ($25,000-49,999) and then decrease with each subsequent category. This is visualized in Figure 7. Please note that the different values used for travel cost, a third of the wage rate and three-quarters of the wage rate do not have much effect on the regression results except for the travel cost losing its significance in the logit portion of the model.

We tested the hypothesis that the ZINB is the best model to fit the sample data. The Likelihood Ratio Chi-Square test ensures that one of the coefficients is nonzero, which is validated by the small p-value from the Likelihood Ratio test. The Vuong test compares the ZINB to the negative binomial model. The z-value is significant here, meaning the ZINB is a better fit than the negative binomial model. The ZIP test compares the ZINB model to the zero-inflated poisson model. The likelihood ratio test for alpha=0 is also significant showing that the ZINB is preferred to the zero-inflated poisson model.

Table 3 shows the mean predicted trips for both regressions next to the sample means for different racial/ethnic and income categories. The predicted trips are very similar to one another. Additionally, they both closely follow the trends of the sample means by group. Table 5 shows the predicted trips for the regression using a third of the wage rate in more detail. The table shows the predicted number of trips to the Chicago beaches for the 2016 summer season by specific racial/ethnic and income groups. It is further broken down by the ability to swim, inability to swim, and not considering the ability to swim. This is visualized in Figure 8. The key message of this table is that low-income minority groups are more likely to visit the Chicago beaches and to go more often than whites/Caucasians. This is consistent with our hypotheses.

Summary statistics for estimated CS, WTP, travel cost, and number of trips are in Table 6. As one would expect, the values of CS and WTP obtained from the regression using 75% of the wage rate are a little over twice the values obtained from the regression using a third of the wage rate. Moving to Table 7, the CS varies greatly by race/ethnicity and income bracket. CS peaks for those in the $25,000-$49,999 income bracket at $617 and $1343 for the regressions using a third of the wage rate and three-quarters of the wage rate respectively. CS is minimal for those in the $150,000+ income bracket at $208 and $450. These values reflect the high use by those in the $25,000-$49,999 income bracket and low use by those in the $150,000+ income bracket. Across racial/ethnic groups, whites/Caucasians have the lowest CS for the Chicago beaches, reflecting the ethnic group's low use, at $200 and $432 for the regressions using a third of the wage rate and three-quarters of the wage rate respectively. Non-white/Caucasian groups have relatively similar CS for the Chicago beaches ranging from $435-$658 and $946-$1432 for the regressions using a third of the wage rate and three-quarters of the wage rate respectively.

WTP for the Chicago beaches, while still varied, are not as drastically varied for the income brackets because WTP is the CS plus the actual travel cost of the entire beach season. The actual cost of the entire beach season is the number of trips to the beach multiplied by the expected round-trip cost of a single trip to the beach. As wealthier income brackets took few trips to the beach, their travel cost is less than that of middle income brackets, who visited the beaches more, on average. Despite the decrease in variation, the wealthiest households are only willing to pay $272 - $583, almost half the average WTP for everyone, $492 - $1,049. For racial/ethnic groups, WTP difference between whites/Caucasians and minorities is more drastic. We find that whites/Caucasians are willing to pay a third of what blacks/African Americans are willing to pay for a beach season in Chicago, all else equal, and half of the average WTP for everyone.

These findings are consistent with those of Bowker & Leeworthy (1998) whose study of recreation in the Florida Keys found a significant difference in CS between white/Caucasian and Hispanic users. While the full model does not indicate that Hispanic/Latino people use the Chicago beaches statistically significantly more, the logit portion of the model is statistically significant for the three minority groups in predicting of being less likely to be a non-zero user of the beaches than whites/Caucasians. That the wealthiest households are only willing to pay half of the average indicates that the Chicago beaches must be an inferior good over most of the range of income, as quantity demanded declines with income.

3.3 Total Value of Chicago's Beaches

In order to answer the question, "What is the value of the Chicago beaches?" we roughly extrapolated the sample results to each zip code in the Chicago Metropolitan Area in the state of Illinois. The 2015 American Community Survey reported that a few zip codes had fewer than ten households in the zip code. These zip codes were dropped from the extrapolation, leaving 334 remaining zip codes. Equation (5) below shows how the net value (CS) of the Chicago beaches can be calculated:

(5) $CS_{Total} = \sum_{j=1}^{J}(\overline{WTP_j} - TC_j)N_j$,

where j represents the zip code, and $N$is the number of adults. Equation (6) below describes the calculation of the average WTP for an individual zip code. Average WTP per adult in a zip code is calculated as the sum of the WTP for each individual race/ethnicity, r, multiplied by the number of people of each race/ethnicity in each zip code, and then divided by the total number of people in the zip code.

$$(6)\ \overline{WTP_j} = \frac{\sum_{r=1}^{R}(WTP_r \times N_{rj})}{N_j}$$

To calculate the final extrapolated results, shown in Table 8, we used data from the American Community Survey (ACS) for 2015, specifically: median household income; percent of households that are white/Caucasian, black/African American, Hispanic/Latino, Asian, and "Other"; and the number of people in the zip code over the age of 18. Median household income was categorized in the same manner used in the regressions of Table 4.

In order to estimate average WTP per person in every zip code of the Chicago area (even those that were not represented in our survey sample) the estimates of WTP by race/ethnicity reported in Table 7 were used with ACS data on the zip code's racial/ethnic makeup in the calculation described by Equation 6. Total WTP in the area is then found by multiplying each zip code's population by the average WTP of a person in that zip code; the result is a value of an estimated total WTP for the entire Chicago metropolitan area ranging from $2.7-5.7 billion (Table 8).

We estimated total visits during the season by applying the ZINB's regression results in Table 4 to zip code characteristics to find the expected number of trips for a representative person in each zip code, multiplying those numbers by the numbers of people in each zip code, and adding up the resulting expected numbers of trips. Data included median household income, majority race/ethnicity of a neighborhood, percent female, ability to swim, and median age. Determining the majority race/ethnicity of a neighborhood was done following Moore & Diez Roux (2006). The ability to swim was the only variable at the zip code level that could not be taken from census data. Rather, the variable was interpolated from the Chicago beach survey results using inverse distance weighted (IDW) in ArcMap 10.3 for the zip codes that were not sampled. The final calculation in Table 8 estimated 56.8 – 59.4 million total visits occurred during the 2016 beach season.

The travel cost calculations used the same driving time and distance to the nearest beach explained in the regression results section. The wage rate was estimated using the percent of households reported in the ACS as married to identify two wage earners in a household; other households were assumed to have a single wage earner. The mean estimated number of income earners by zip code is 1.75 and extremely close to the mean number of income earners in the sample, which was 1.76. Round trip travel costs using one third of the wage rate are an average of $14.61 round trip across the zip codes; using three-quarters of the wage rate, that number becomes $24.95. Both are within 10% of the travel costs estimated for the sample data. CS for a representative person in a zipcode is the WTP minus the travel cost experienced by that representative household, the latter given by roundtrip travel cost multiplied by the number of trips taken by a representative person in that zipcode.

Total CS in a zip code is found by multiplying the CS for a representative household in that zip code by the number of adults living in the zip code. An estimated 6,581,355 million adults live in these zip codes of the Chicago Metropolitan Area; we calculate a total CS of $2.12-4.75 billion in 2016. The net value only captures the value above the travel cost. Total estimated values of gas costs and travel time ranges from $558-948 million annually.

The Chicago Park District estimated over 6.5 million visits to the Chicago beaches throughout the 2016 beach season (B. Daley, personal communication, March 3, 2017). This number is informed by the Chicago Park District's lifeguards who conduct counts of beach visitors twice a day (B. Daley, personal communication, April 29, 2016). The large difference in total estimated trips (roughly 50 million visits) likely comes from underestimation on the side of the Chicago Park District. For example, the Chicago Park District does not appear to capture large events that draw mass amounts of visitors in their estimation. North Avenue Beach's visitation estimate by the Chicago Park District was about 650,000 for the month of August. This number misses the estimated two million people that attend the annual Air and Water Show at North Avenue Beach every August (CBS Chicago). In addition, the count estimate comes from lifeguards counting the population on the beaches only twice a day (B. Daley, personal communication, March 3, 2017). This number misses beach users who have short visits that do not overlap with count times. Lew & Larson (2005) do not attempt to generate aggregate trip estimates in this way due to the challenges inherent in such an exercise.

IV. Conclusions

This study was designed to improve understanding of how the benefits of urban environmental goods varies among racial and income groups, and to estimate the total value of something like beaches in an urban area. We tested the effects of race/ethnicity, income levels, estimated travel cost, age, gender, and the ability to swim on individuals' use of Chicago beaches in the 2016 summer beach season. Results of the study can be used by policymakers in deciding what resources to devote to this particular recreational resource, and in understanding how the benefits of their programs accrue to low-income and minority groups in the city.

We find that the people living in the Chicago Metropolitan Statistical area within the state of Illinois value (gross) the Chicago's beaches on average of $500-$1,000 annually per person and in total, have an annual net value of $2.12-4.75 billion. Across individuals, this value varies with income, race/ethnicity, the ability to swim, age, and travel cost. The value of the Chicago beaches decreases across most of the income range, so they are what economists call an inferior good. An individual whose annual household income is over $150,000 has a net value for the beaches of $200-$450 whereas an individual whose annual household income is $25,000-$49,999 has a net value of $615-$1,350 annually. Regarding disparity of net value across race, whites/Caucasians value the beaches from $200-$430 each year, while blacks/African Americans value the beaches from $660-$1,430 – more than three times as much.

In comparing these results to the literature, the unit of comparison is the value of a beach day. In this term, Chicago beaches are valued at $38-$92 of consumer surplus per trip, or the average annual consumer surplus divided by the predicted trips. At first glance, this study's estimates can seem out of place, but the estimate in Bell & Leeworthy (1990) or $34 for daily consumer surplus has the same buying power as $63 in 2017 dollars. Sohngen (1998) found annual values for two state park beaches to sum to $9.6 million, $14.3 million in 2017 dollars. An urban recreation study found Portland's Forest Park to derive annual consumer surplus of $31 million each year (Mitchell-Nelson & Schaffer, 2015). By comparison, Portland's Metro population is a fifth of Chicago's. Regarding spending, the Chicago Park District's entire budget for 2016 was $458.1 million and spent roughly $3.5 million on seasonal lifeguards alone (Chicago Park District, 2017). These numbers make clear that the beaches of Chicago have high value relative to the cost of maintaining them, and that the results of this case study may be relevant to discussions of other large, diverse urban centers with public recreation sites.

Through our regression analyses we were able to measure factors that affect the number of times individuals visit the Chicago beaches. We found that consumer surplus is highest for low income and racial/ethnic minority groups and for people who can swim. The findings of this paper address a new branch of environmental justice research that explores how the benefits of investments in public natural amenities are divided among racial and income groups. While research on pollution often finds that the damages of pollution are borne disproportionately by disadvantaged groups, this study finds that lower-income and minority individuals have disproportionately high use of and value from the public good that is the Chicago beaches. Future research would do well to explore whether that pattern holds for other kinds of natural amenities.

V. References

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Table 1: Hypothesized effects of Chicago beach use

Factor	Hypothesized Sign	Actual
Minority	+	+
Lowest income	Omitted	Omitted
Low-middle income	+	+
Higher Income	-	-
Age	-	-
Unable to swim	-	-

Table 2a: Summary Statistics [a]

Variable	Mean	SD	Min	Max
Trip Count	7.03	13.45	0	97
Travel Cost - 1/3 wage rate	14.61	12.89	0.30	83.85
Travel Cost - 75% wage rate	27.41	26.57	0.57	183.04
Household Income				
$25,000-49,999	0.23	0.42	0	1
$50,000-74,999	0.19	0.39	0	1
$75,000-99,999	0.17	0.38	0	1
$100,000-149,999	0.15	0.36	0	1
$150,000+	0.12	0.32	0	1
Race/Ethnicity				
Black/African American	0.25	0.43	0	1
Hispanic/Latino	0.25	0.44	0	1
Other	0.06	0.24	0	1
Asian	0.07	0.26	0	1
Cannot Swim	0.23	0.42	0	1
Age	45.22	15.67	18	80
Female	0.62	0.48	0	1

[a] N = 768

Table 2b: Comparing Sample and Population Statistics

	Sample	Population
Household Annual Income		
$0-24,999	13.8%	24.2%
$25,000-49,999	22.8%	20.5%
$50,000-74,999	19.1%	17.2%
$75,000-99,999	17.1%	12.8%
$100,000-149,999	15.4%	15.3%
$150,000+	11.8%	14.3%
Race/Ethnicity		
White alone	35.7%	53.0%
Black/African American	25.3%	17.1%
Hispanic/Latino	25.4%	21.9%
Other	6.4%	6.4%
Asian	7.2%	10.7%
Age	45.2	38.5
Female	62.4%	51.1%

Table 3: Trip counts by race and income

	Sample Mean	Predicted Trips – 33%	Predicted Trips – 75%
N	768	768	768
Race/Ethnicity			
Caucasian	2.98	3.25	3.24
Black/A. Amer.	11.03	10.72	10.74
Hispanic/Latino	7.97	7.82	7.84
Other	7.69	7.09	7.09
Asian	9.27	8.26	8.29
Total	7.03	6.90	6.91
Household Income			
$0-24,999	8.53	8.24	8.25
$25,000-49,999	10.15	10.05	10.07
$50,000-74,999	6.89	6.91	6.90
$75,000-99,999	6.48	6.29	6.30
$100,000-$149,999	5.16	4.42	4.45
$150,000+	2.75	3.38	3.37
Total	7.03	6.90	6.91

Table 4: ZINB regression estimates

	Using 1/3 of the wage rate [a]		Using 75% of the wage rate [b]	
	Trip Count	Inflate	Trip Count	Inflate
Travel cost	-0.016***	0.022*	-0.007***	0.009
	(0.005)	(0.012)	(0.003)	(0.006)
Household Income				
$25,000-49,000	0.243	-0.449	0.247	-0.444
	(0.209)	(0.429)	(0.209)	(0.433)
$50,000-74,999	-0.123	-1.277***	-0.119	-1.263**
	(0.224)	(0.497)	(0.225)	(0.499)
$75,000-99,999	-0.077	-0.582	-0.069	-0.565
	(0.224)	(0.480)	(0.225)	(0.485)
$100,000 -	-0.206	-0.504	-0.195	-0.479
$149,999	(0.239)	(0.501)	(0.240)	(0.507)
$150,000+	-0.602**	-1.493**	-0.158*	-1.441*
	(0.305)	(0.753)	(0.310)	(0.753)
Race/Ethnicity				
Black/African	0.535***	-1.513***	0.561***	-1.560***
American	(0.198)	(0.423)	(0.310)	(0.422)
Hispanic/Latino	0.114	-1.349***	0.135	-1.388***
	(0.193)	(0.441)	(0.193)	(0.445)
Other	0.314	0.033	0.330	0.023
	(0.292)	(0.528)	(0.293)	(0.529)
Asian	0.207	-2.600**	0.233	-2.560**
	(0.245)	(1.289)	(0.245)	(1.234)
Cannot swim	-0.321*	1.554***	-0.319*	1.553***
	(0.169)	(0.363)	(0.170)	(0.363)
Age	-0.003	0.055***	-0.003	0.056***
	(0.005)	(0.012)	(0.005)	(0.012)
Female	0.053	0.448	0.053	0.471
	(0.131)	(0.315)	(0.131)	(0.318)
Constant	2.414***	-3.004***	2.359***	-2.984***
	(0.345)	(0.887)	(0.345)	(0.901)

[a] N = 768. Standard errors in parentheses. * = 10% significance, **=5% significance, ***=1% significance. $\chi^2 = 62.71$; Pr > $\chi^2 = 0.0000$. Vuong test of zinb vs. standard negative binomial: z = 5.50 Pr>z = 0.0000. ZIP test: Likelihood-ratio test of alpha=0: chibar2(01) = 3936.08 Pr>=chibar2 = 0.0000.

[b] N = 768. Standard errors are in parentheses. * = 10% significance, **=5% significance, ***=1% significance. $\chi^2 = 62.21$; Pr > $\chi^2 = 0.0000$. Vuong test of zinb vs. standard negative binomial: z = 5.47 Pr>z = 0.0000. ZIP test: Likelihood-ratio test of alpha=0: chibar2(01) = 3957.29 Pr>=chibar2 = 0.0000.

Table 5: Average predicted number of trips to the beach by annual household income, race/ethnicity, and the ability to swim – using 33% of the wage rate for travel cost

			Can Swim		
Household Income	Caucasian	A. Amer.	Hispanic	Other	Asian
$0-24,999	2.86	12.38	8.18	6.70	9.62
$25,000-$49,999	4.50	16.90	11.06	9.91	12.53
$50,000-$74,999	4.21	12.68	8.19	8.29	8.89
$75,000-$99,999	3.45	12.47	8.14	7.47	9.14
$100,000-$149,999	2.94	10.86	7.10	6.43	8.01
$150,000+	2.77	7.95	5.13	5.31	5.52
			Cannot Swim		
Household Income	Caucasian	A. Amer.	Hispanic	Other	Asian
$0-24,999	0.67	5.15	4.22	2.67	5.34
$25,000-$49,999	1.21	7.92	6.24	4.26	7.35
$50,000-$74,999	1.44	7.10	5.23	4.11	5.59
$75,000-$99,999	0.96	6.04	4.70	3.29	5.44
$100,000-$149,999	0.80	5.16	4.05	2.79	4.73
$150,000+	1.01	4.62	3.35	2.73	3.52
			All		
Household Income	Caucasian	A. Amer.	Hispanic	Other	Asian
$0-24,999	2.63	9.47	7.21	6.12	8.68
$25,000-$49,999	4.16	13.29	9.87	9.11	11.40
$50,000-$74,999	3.93	10.44	7.46	7.70	8.17
$75,000-$99,999	3.20	9.88	7.29	6.87	8.33
$100,000-$149,999	2.72	8.57	6.35	5.91	7.30
$150,000+	2.59	6.61	4.69	4.94	5.08

Table 6: Summarizing regression results – value estimations for the 2016 beach season [a]

	Variable	Mean	SD	Min	Max
	WTP	492.48	291.32	20.37	1444.41
	CS	423.71	276.04	9.59	1370.83
33%	Travel Cost	68.76	51.79	1.89	323.87
	Predicted Trips	6.90	4.50	0.16	22.33
	Travel Cost - 1 trip	14.61	12.89	0.30	83.85
	WTP	1048.50	621.16	43.12	3067.11
	CS	921.67	595.61	22.68	2922.18
75%	Travel Cost	126.84	99.53	2.92	643.22
	Predicted Trips	6.91	4.47	0.17	21.91
	Travel Cost - 1 trip	27.41	26.57	0.57	183.04

[a] N = 768

Table 7: Consumer surplus and willingness-to-pay estimates across race and income

	CS		WTP		Travel Cost	
Household Income	33%	75%	33%	75%	33%	75%
$0-24,999	$ 506	$ 1,100	$ 549	$ 1,164	$ 43	$ 64
$25,000-$49,999	$ 617	$ 1,343	$ 695	$ 1,480	$ 78	$ 136
$50,000-$74,999	$ 424	$ 921	$ 499	$ 1,059	$ 75	$ 138
$75,000-$99,999	$ 386	$ 840	$ 458	$ 977	$ 72	$ 137
$100,000-	$ 271	$ 592	$ 341	$ 730	$ 70	$ 138
$150,000+	$ 208	$ 450	$ 272	$ 583	$ 64	$ 133
Total	$ 424	$ 922	$ 492	$ 1,049	$ 69	$ 127

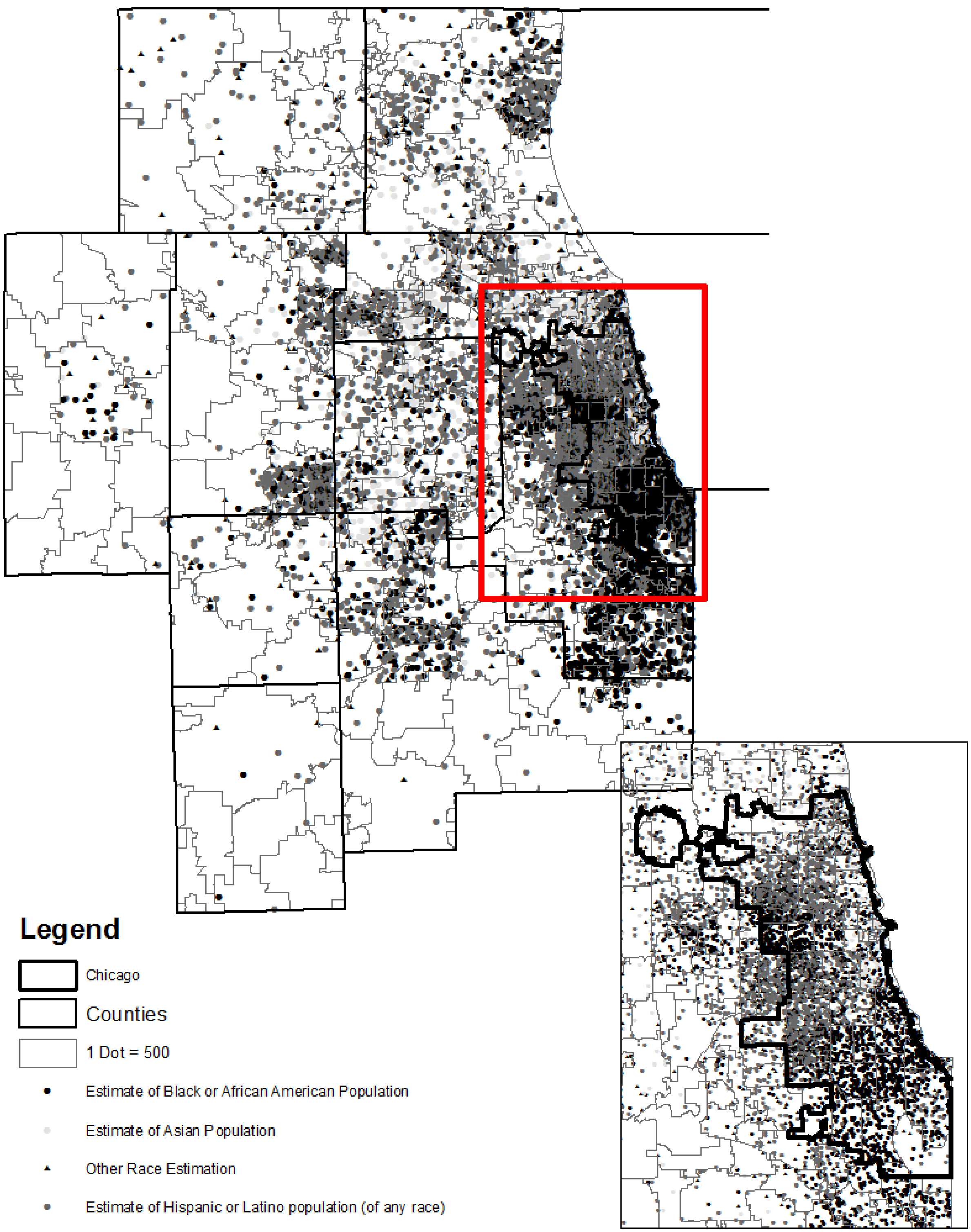
	CS		WTP		Travel Cost	
Race/Ethnicity	33%	75%	33%	75%	33%	75%
White/Caucasian	$ 200	$ 432	$ 251	$ 528	$ 52	$ 96
Black/African A.	$ 658	$ 1,432	$ 736	$ 1,574	$ 78	$ 142
Hispanic/Latino	$ 480	$ 1,046	$ 552	$ 1,178	$ 72	$ 131
Other	$ 435	$ 946	$ 520	$ 1,103	$ 84	$ 157
Asian	$ 507	$ 1,106	$ 604	$ 1,290	$ 97	$ 184
Total	$ 424	$ 922	$ 492	$ 1,049	$ 69	$ 127

Table 8: Results of extrapolation [a]

Variable	Using 1/3 of the wage rate	Using 3/4 of the wage rate
Population over 18 (millions)	6.519	6.519
Estimated total WTP ($1M)	$ 2,680	$ 5,700
Estimated total trips (millions)	59.4	56.8
Estimated total travel cost ($1M)	$ 558	$ 948
Estimated total CS ($1M)	$ 2,120	$4,750

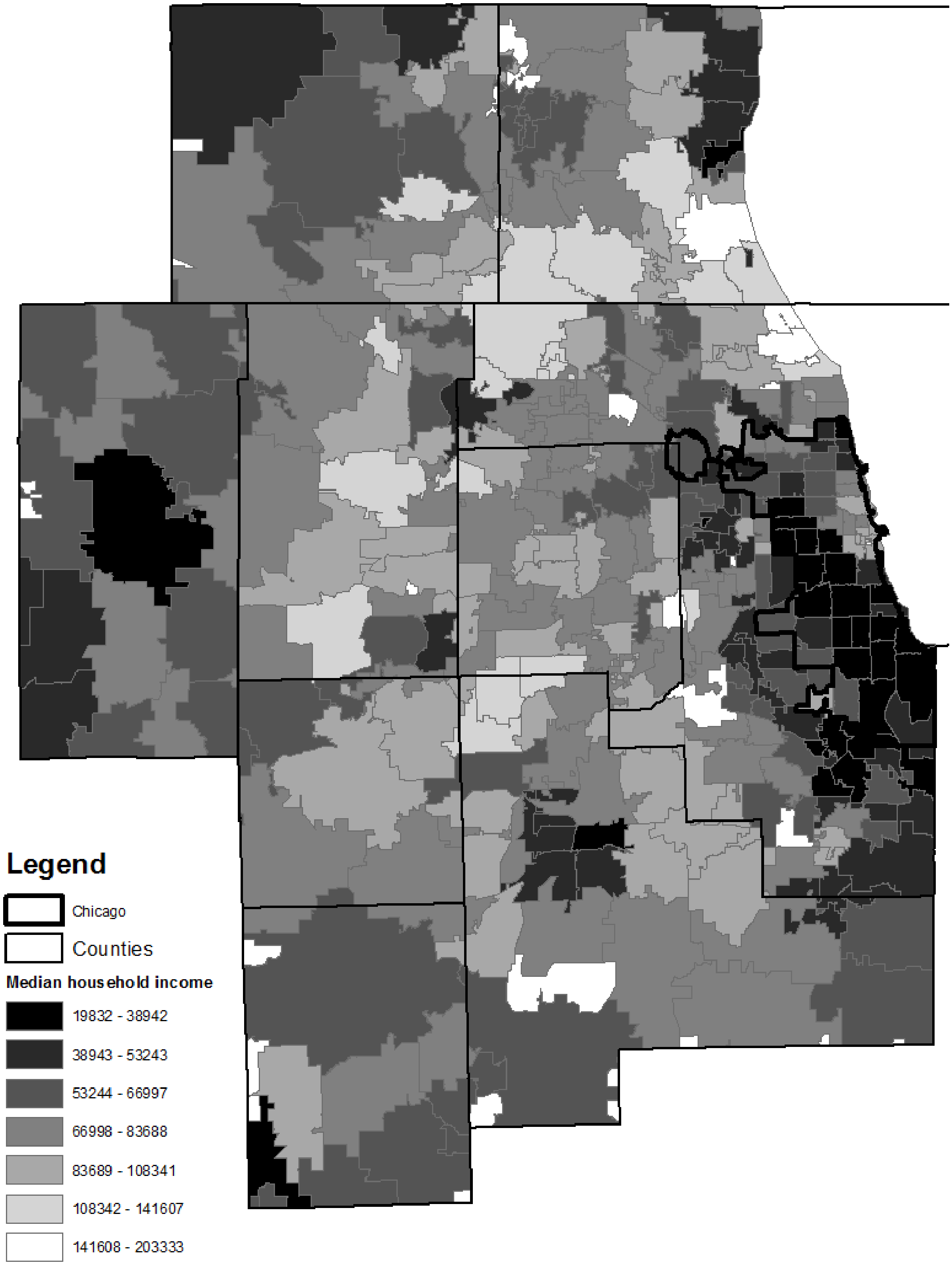
Note: This table gives the totals over all of the 308 usable zip codes in the Chicago metropolitan area.

Figure 1: Spatial concentrations of minority populations



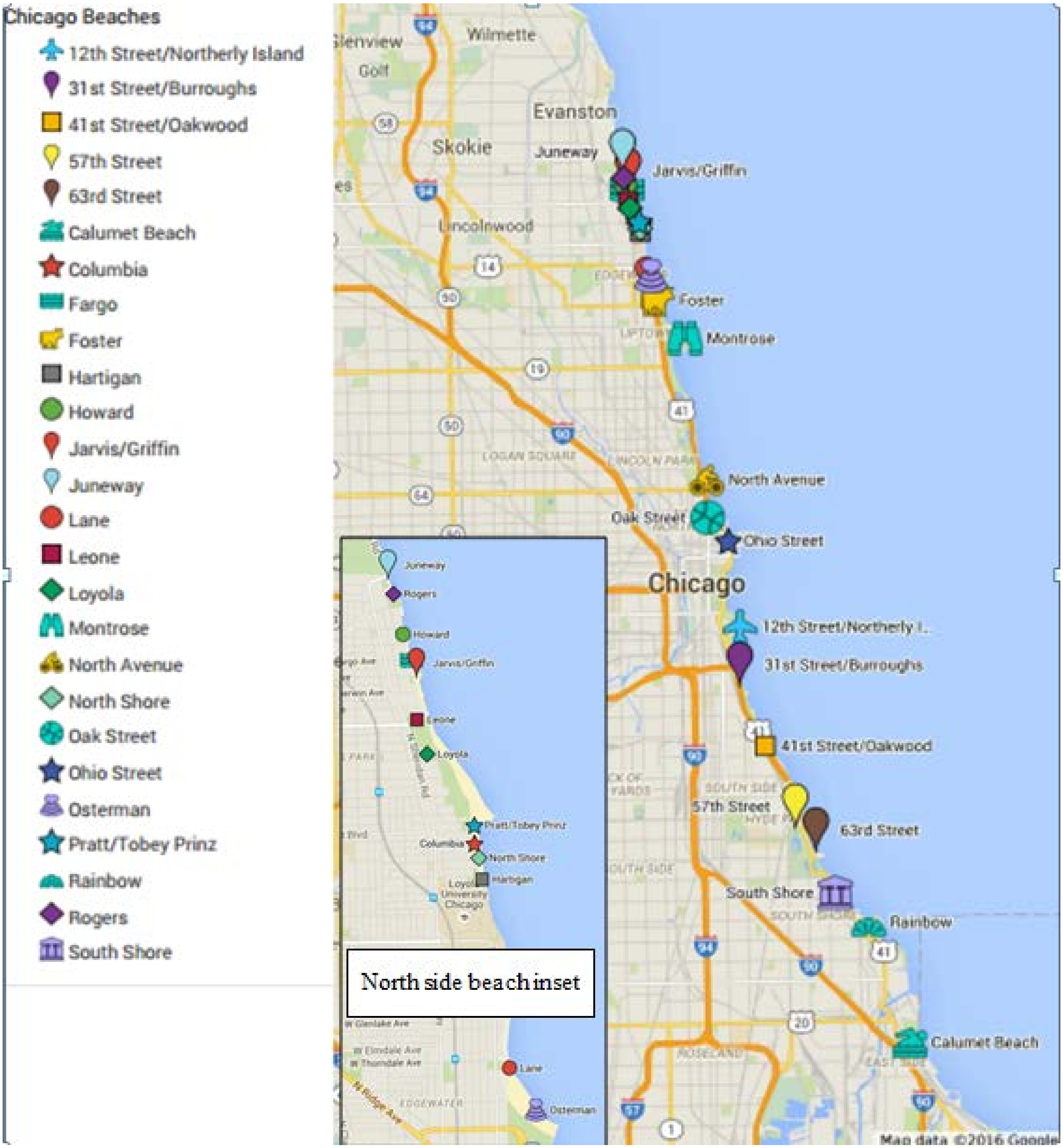
Note: Constructed in ArcMap using 2015 census data

Figure 2: Spatial distribution of median household income by zip code



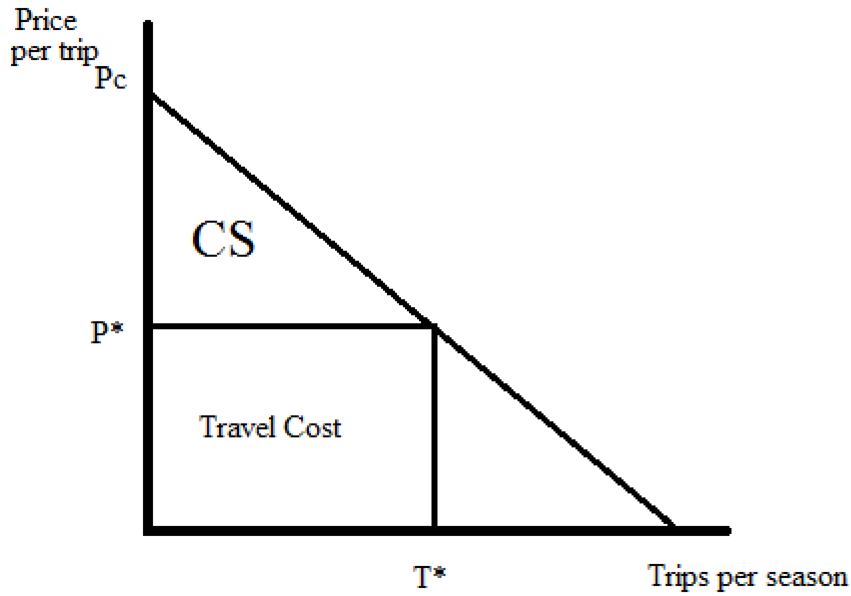
Note: Constructed in ArcMap using 2015 census data

Figure 3: Map of Chicago's 26 public beaches



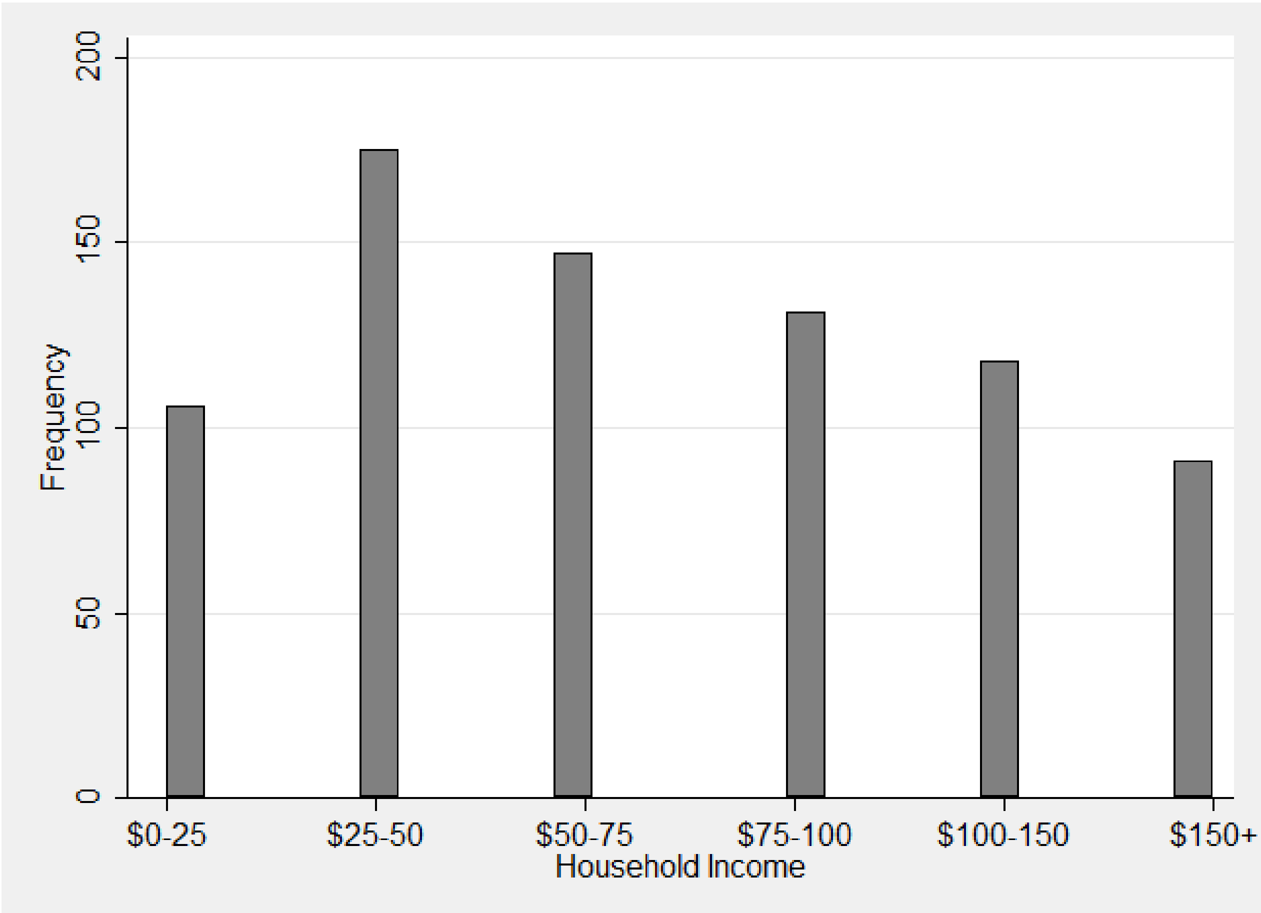
Note: Constructed in Google Maps

Figure 4: Demand function for trips to the beach



Note: WTP = CS + Travel Cost; P_c is the choke price

Figure 5: Panel Characteristics



Note: Annual Household Income is given in thousands

Figure 6: Histogram of trip count

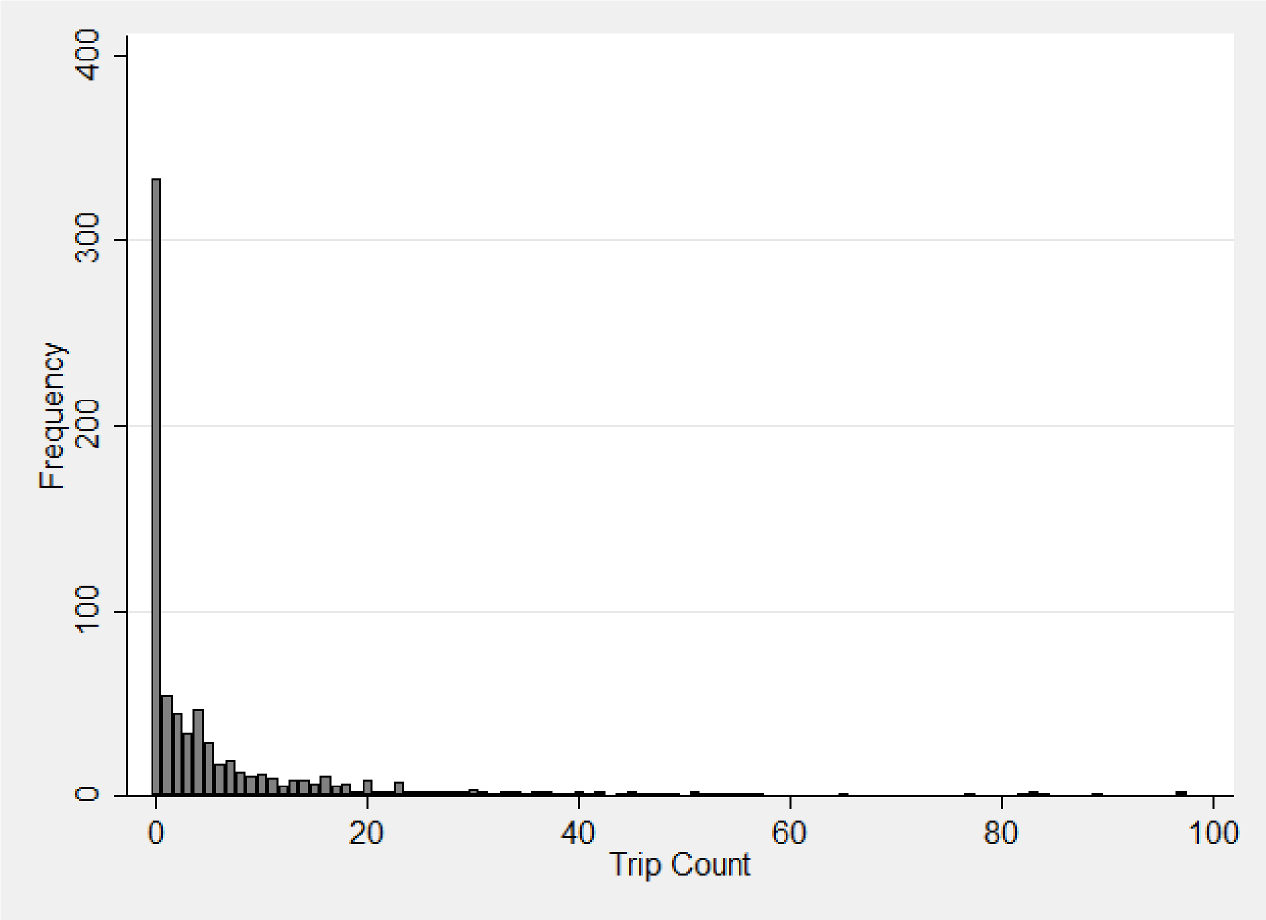
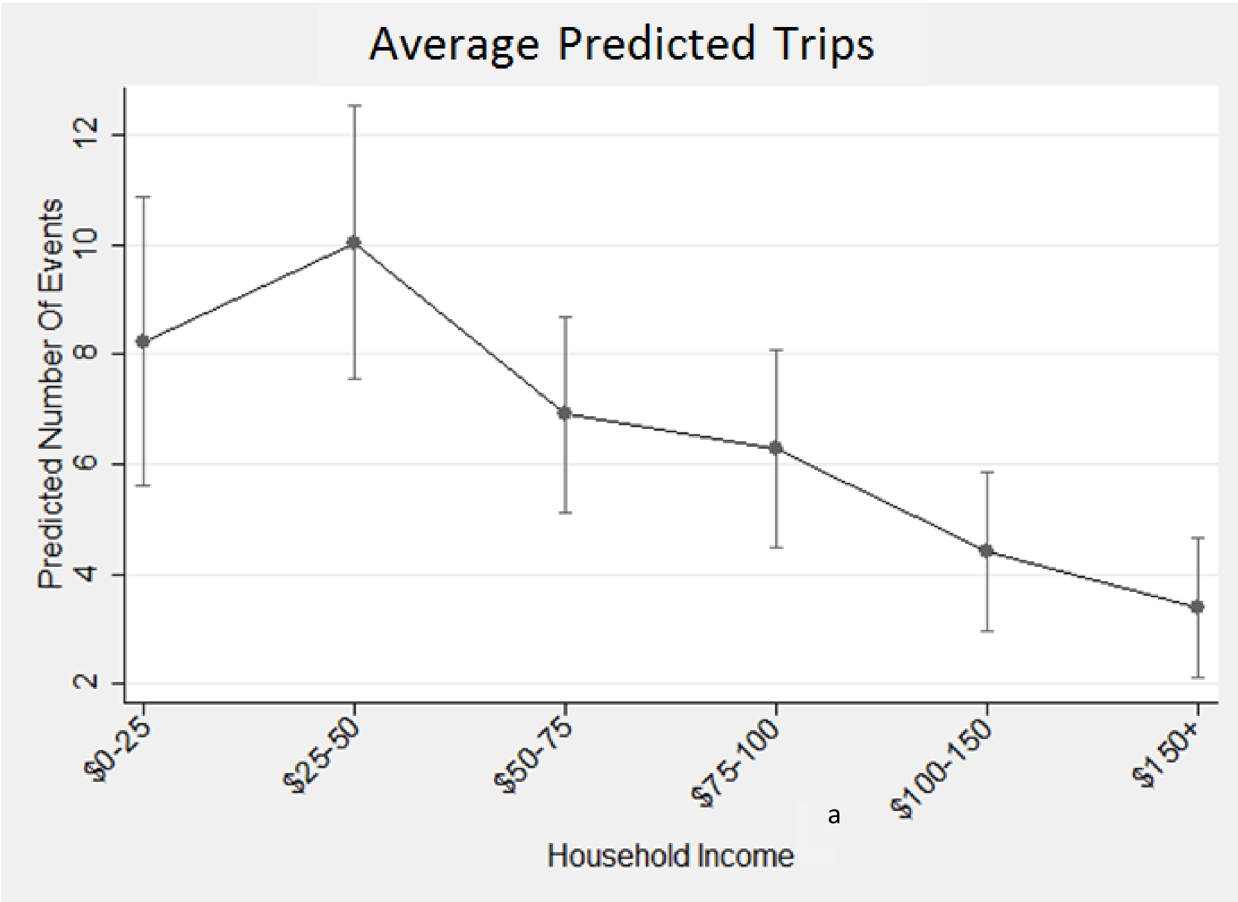


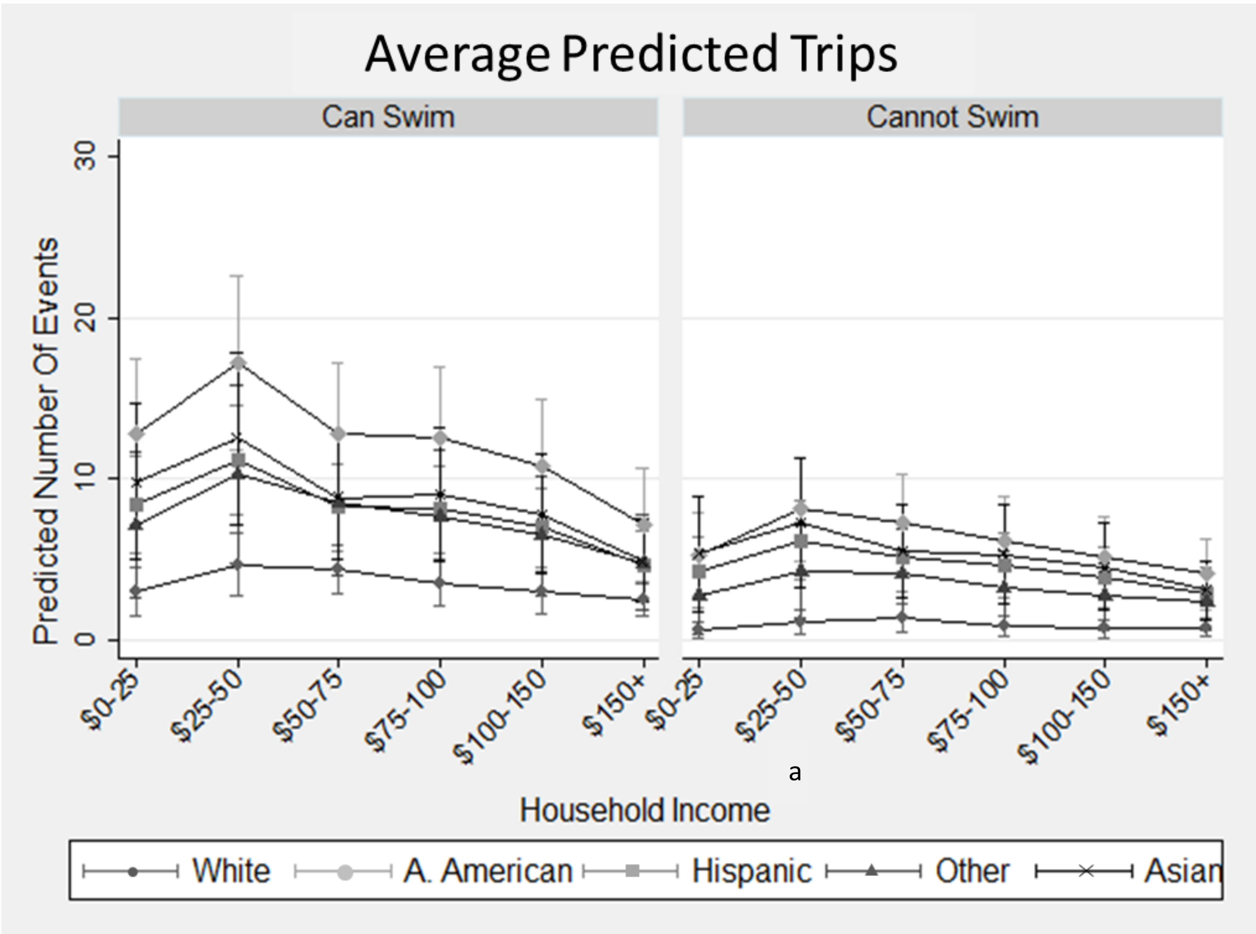
Figure 7: Predicted number of beach visits by annual household income bracket



[a] Annual Household Income is given in thousands

Note: This figure used a third of the wage rate for the travel cost variable

Figure 8: Predicted number of beach visits, comparing people of different races/ethnicities given different household annual incomes and the ability to swim



[a] Annual Household Income is given in thousands

Note: Graph made in Stata using the marginsplot command which visualizes the margins from the regression. The regression used for this plot was the regression using a third of the wage rate to estimate travel cost.

APPENDIX A: Water activity value estimates

Paper	Value of a beach day	How was the survey conducted?	Sample size	Avg Trips per year	Users	Location
Bell & Leeworthy, 1990	Daily CS: $34	off-site, but does not consider non-beach-visitors	826	NA	Visitors	Florida
Sohngen et al., 1998	CS: $25 & $15 Price: $10 & $11	On-site	230 & 345	6 & 7	Visitors	Ohio
Feather & Shaw, 1999*	$6.23 (travel cost only), $14.17 with shadow wage as OPC of time	Off-site (telephone)	447 (RUM) & 864 (labor model) & 599 (hedonic model)	10.8	Residents (within 100 miles)	water activities; IN, NA, PA, WA
Parsons, Massey, & Tomasi, 1999	NA - calculated loss due to beach closure	Off-site (mail)	400/565 took day trips	4.1	Delaware residents	62 beaches in Northeast U.S.
Shaw, Fadali & Lupi, 2003*	$2.63-$7.95	on-site & off (random digit dial phone survey)	113 (on) & 364 (off - phone)	14.1 (on) & 6.2 (off)	Residents - 21 counties	Sierra Nevada waters
Loomis, 2003*	$24[a] & $9.60[b] & $9.67 (off-site)	On-site & Off-site (mail)	172 (on) & 488 (off)	28 (on) & 9.6 (off)	Residents	River in Wyoming

Bin et al. 2005	$11-$80 (day trips) & $11-$41 (overnight)	on-site	130 day; 274 overnight	2.06 day trips & 1.37 overnight	hh within 1,000 miles (avg:419m)	North Carolina
Lew & Larson, 2005	Mean value: $28.27	Off-site (phone-mail-phone)	494	18	Residents	California
Lew & Larson, 2008	$21-$23: daily access to beach	Off-site (phone-mail-phone)	494	18	Residents	California
Blackwell, 2007	A$12.99 (all), A$2.39 (residents)	On-site	250	48	Visitors & Residents	Australia
Amoako-Tuffour & Martinez-Espinerira, 2008*	$668-$1596 per person-trip	on-site	787	0.678-0.88	Visitors	Canada
Loomis, 2011 *	$43.65	Off-site (mail)	256	23	Residents	Wyoming
Amoako-Tuffour & Martinez-Espinerira, 2012*	$403.11-$1760.56 per person-trip	on-site	854	NA	Visitors	Canada
Larson & Lew, 2014*	~33% (fixed), ~47% (random) of wage rate	NA	NA	NA	Vistors	SE Alaska
Fezzi, Bateman, Ferrini, 2014	8.35€/h-9.35€/h ~75% of wage rate	On-site	457 (155 1-day)	NA	Residents	Italy
Munaretto & Ando, 2017	$61.38 & $133.38	Off-site (on-line survey)	768	7	Residents	Chicago

* denotes not a beach

[a] On-site sampling not corrected for truncation

[b] On-site sampling corrected

APPENDIX B: Determining Neighborhood Classification

Determining a race/ethnic majority neighborhood was taken from Moore & Diez Roux (2006) who used the rule of thumb that if a neighborhood was home to greater than or equal to 60% of a particular race/ethnicity, it is considered "predominantly" a certain race/ethnicity. This standard determines the breakdown of racial/ethnic zip codes to be 67.3% white/Caucasian, 8.6% black/African American, 1.9% Hispanic/Latino, and 22.2% Other. No zip codes were predominantly Asian and the zip codes without a 60% majority were classified as Other.

The ability to swim was the only variable at the zip code level that could not be taken from census data. Rather, the variable was interpolated from the Chicago beach survey results using inverse distance weighted (IDW) in ArcMap 10.3 for the zip codes that were not sampled. "IDW interpolation determines cell values using a linearly weighted combination of a set of sample points. The weight is a function of inverse distance … This method assumes that the variable being mapped decreases in influence with distance from its sampled location (ArcMap 10.3, 2016)." The five nearest neighbors were used to inform missing swim abilities. This strategy left sixteen zip codes without values as they are on the fringe of the Chicago Metropolitan area. This drops the usable zip codes from 324 to 308. Please note that the Chicago beach survey sampled 768 valid respondents from 228 of now 308 usable zip codes.

Once all the zip codes have the appropriate characteristics via U.S. Census data, or Chicago beach survey in the case of ability to swim, the ZINB results, when applied to the zip codes, demonstrate the Chicago beaches are an inferior good. In comparison to the survey results and regression results, as shown in Table 3, the averages are relatively similar, but the racial/ethnic and income distributions are off, stemming from the underrepresented minority zip codes and higher ability to swim than sampled, 23% cannot swim according to the sample and 20% cannot as a result of the interpolation to the zip codes.