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Is Outdoor Recreation Recession-proof? An Empirical Investigation on Iowan's Lake Recreation Behavior During 2009 Recession.

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Abstract

The US economy was hit hard by a recession during 2008–2009, which is considered the longest and most severe economic crisis since the end of Great Depression. The recession affected individual economic well-being through unemployment, stock market crashes, and falling real estate prices, all of which generated low consumer confidence. While much is known about the effect of recessions on macro-level variables, much less is known about how the effects of recession alter household-level consumption behavior. Specifically, during periods of high unemployment, many households will experience lower income, which results in lower spending on normal goods. However, with changes in employment status, members of some households will also experience a lower opportunity cost of time, and may therefore undertake more household activities that are time intensive. To study effects of this type requires detailed household-level data both before and after a recessionary event. In this paper, we utilize a panel data set that is uniquely suited to studying the effects of recession on micro decision making in the context of household recreational choices. Specifically, utilizing a panel from the “Iowa Lakes Project” comprised of both pre-recession and post-recession data on household employment status, usage of recreational sites, and a suite of socioeconomic variables, this paper investigates how employment status changes during the recession impact lake-based recreation demand.

1. Introduction

Nature based outdoor activities are very popular among people in the United States. Around 113 million people, almost half of the country's population, participated in some form of outdoor activities in 2009 [Outdoor foundation (2010)]. How does an individual's recreation behavior change in the event of an economic shock such as recession? Outdoor foundation statistics show that although the total participation in outdoor recreation increases slightly in the recession year 2009 compared to 2008, nearly 42% of the respondents believe that the 2009 recession affected their outdoor recreation participation to some extent. When recession hits the economy, a previously fulltime employed individual might turn into unemployed, or get few hours for paid-works, or forced to retirement. Retirement in the face of recession is more likely for relatively aged employee. When individuals' employment status is affected during recession, they usually cut expenditure on non-essentials such as traveling, recreation, eating and dining out, participation in sports, and equipment purchases etc.

Iowans are not exception in participating in outdoor recreation activities. Lake recreation activities are very popular among Iowans. Almost sixty percent of Iowans participated in some form of lake based recreation activities in 2009, and the participants take around fifteen single day lake trips on average [Iowa Lake Survey 2009 report (2011)]. The high participation rate among Iowans in lake based recreation activities implies the huge values that Iowans assign to non-market nature based public resources such as lake and parks.

Being an agricultural state, although Iowa did not experience a hard hit by recession of 2008 like many other US states, the unemployment rate in Iowa in 2008-2009 was still significantly high compared to the neighboring years. According to the estimates of Bureau of Labor Statistics (BLS), the unemployment rate in the state rose from 3.7% in 2006 to 6.3% in 2010.¹ The objective of this study is to rigorously investigate if there is any impact of employment change during recession starting in year 2008 on Iowans' outdoor recreation behavior i.e., more specifically Iowans' trip taking behavior to 132 local lakes. The lake survey data collected by Iowa State University offers us an opportunity to conduct the analysis.

¹ The estimates of unemployment statistics for Iowa are available at <http://data.bls.gov/pdq/SurveyOutputServlet>.

Quasi-experimental studies for impact analysis have recently been very popular in economic literature. However, such causality analysis relating a recessionary shock and recreation behavior is almost missing in the literature. One contribution of this study would be to fill this gap. The 2009 great recession resembles a natural and exogenous event, and provides a scope to introduce such impact analysis study in recreation demand literature. To our knowledge this is the first study investigating the effects of recession on micro decision making in the context of household recreational choices.

Recession might affect an individual's recreation demand through several opposing paths. Even if employment status remains unchanged during a recession, an individual might demand less recreation due to uncertainty and therefore increase precautionary savings. Two important components playing a critical role in determining recreation behavior are income and opportunity cost of time. Both of these components might be affected for an individual experiencing employment shock during recession. When recession hits the economy, an individual previously employed full time may get fewer paid work hours, or be forced into retirement, resulting in a fall in income, but offering more time for leisure and recreation. Change in employment status during recession, therefore, might influence one's outdoor recreation demand through two opposing effects: substitution effect from cheaper time, and income effect from a fall in income. Again, the unemployment during recession and resulting income loss, or foresight for that, might lead an individual to revise plans for exotic vacations and trips, which might induce an increase in demand for local, cheap recreation activities. For example, if an Iowan was initially opted to go to Hawaii for vacation in the year 2009, s/he might revise the plan in the face of a recession and, instead might take some day or overnight recreation trips in local sites.

The Outdoor Foundation's aggregate statistics reveal that total participation in outdoor recreation increased slightly in the recession year 2009 compared to that of 2008, but nearly 42% of the respondents believed that the 2009 recession affected their outdoor recreation participation to some extent. In contrast, the consumer-expenditure survey statistics show that expenditures on pleasure and non-business travelling declined during the recession year of 2008–2009 (Bureau of Labor Statistics 2012). The literature investigating the relationship between recession and recreation demand is limited. Poudyal, Paudel, and Tarrant (2013) used monthly time-series park visitation data and obtained negative association between national park visitation demand and

recession. Utilizing two intercept surveys conducted in 2006 and 2009 on Quandary Peak, a very popular hiking place in southeast Denver, Loomis and Keske (2012) did not find any significant impact of recession on total number of visits, travel expenditure, and willingness to pay for visits. However, in their paper, respondent groups studied before and after recession are different. Again, it is not clear whether the survey respondents experienced any employment or wealth shock during the recessionary period. Our study would differ in various aspects including the focus and methodology.

This paper explores if change in employment status during 2009 recession affected Iowans' lake recreation behavior. Iowa Lakes Project survey data provides us an opportunity to observe individual recreation demand behavior (both participation and number of trips) and employment status both before and during recession. The "Iowa Lakes Project" administered a random population survey, and collected a rich set of information on Iowan's lake visitation patterns at 132 lakes in Iowa as well as demographics including employment status. The survey has been administered five times in total, including once each in 2005 and 2009. The 2005 and 2009 surveys together provide us a panel of 2,773 individuals whom we observed both before and during the recession. We have exploited this panel to investigate how the individuals who move from full-time employment status in 2005 to part-time employment, unemployment, or retirement status in 2009, demand outdoor lake recreation both at the extensive and intensive margins. In our setting, the treatment group individuals are those who experience employment shock during the recession year 2009. Assignment to this treatment group is non-random due to both observable and unobservable factors, which is also known as selection problem. Propensity score matching (PSM) method (Rosenbaum and Rubin 1983), is one technique which is commonly used to overcome such selection problem. Therefore, following non-experimental treatment literature, we have applied PSM method to conduct our empirical analysis.

Insensitivity of recreation demand to recession imply stable economic benefits from nature based economic activities, which bears implications for long run policy making and investment on nature based public amenities. Our findings would inform the policy-makers for public investment in Iowa lakes. For example, if demands for recreation in lakes are found stable and unaffected by natural shocks such as recession, it would imply that recreation based rural non-farm economic activities as well as employment in those sectors are recession proof.

The remaining of the paper is organized in the following manner. Section 2 first presents a brief overview of a baseline recreation demand model and then make a review of literature on role of time and its value in determining one's demand for outdoor recreation. This section also discusses other similar areas relevant to our research question. Section 3 outlines a theoretical model to develop the intuition on possible impacts of recession on recreation demand. Section 4 describes how our research problem fits into the propensity score matching framework. Section 5 analyzes the data we use for this analysis. Section 6 reports and discusses our findings and results. Finally, section 7 draws some concluding remarks.

2. Background and Literature Review

Two important components playing critical role in determining recreation behavior are income and opportunity cost of time. Like any other economic good, income determines an individual's purchasing power of recreation services. If recreation service is a normal economic good, we expect the impact of a rising income on recreation to be positive, and vice versa for it being inferior good. Time spent for recreation services has various components: travel time and time spent on site. Opportunity cost of time is the alternative best use value of time spent for recreation services. There is a tradeoff between time usage for paid work and time spent for recreation services. If someone takes recreation services instead of working, s/he is actually sacrificing the money income by not working during the time spent for recreation services and, therefore, opportunity cost of time spent in recreation services would be higher, the higher the individual's wage is. Following discussion on a baseline recreation model would formally present this tradeoff.

The baseline recreation demand model, as described by Phaneuf and Requate (2012), emanates from an individual's optimization between consumption of non-recreation necessities, and recreation goods and services. The individual is naturally endowed with T units of time, out of which she works for H hours in the market for a wage of w -per-hour, and allocates the remaining time $T-H$ between recreation(R) and leisure(l) in an optimal way so that her utility from consumption of R , l , and the *numeraire* good(z) is maximized. For simplicity, we are assuming that the hours of work, H , is determined outside the model independently of choices of R , l , and, z . Formally, the individual wants to maximize the utility function $U(z, R, l; q)$, where q is representing the taste parameters, subject to two separate constraints

- i) Money income constraint: $wH = cR + z$ where c is the \$ cost of a trip, and
- ii) Time resource constraint: $= H + l + t * R$, where time remaining after work hours, $T - H$, is used for leisure and recreation, and t is the time cost for consumption of each unit of R .

Individual solves the following 2-constraints utility maximization problem

$$\max_{z,R,L,\mu,\lambda} U(z, R, l; q) + \lambda(wH - cR - z) + \mu(T - H - l - tR)$$

First order conditions are as follows

$$R: \quad U_R = \lambda c + \mu t \quad (1)$$

$$Z: \quad U_Z = \lambda \quad (2)$$

$$L: \quad U_L = \mu \quad (3)$$

$$\lambda: \quad wH = cR + z \quad (4)$$

$$\mu: \quad T = H + l + tR \quad (5)$$

Equation 2 and 3 above imply that $\frac{U_L}{U_Z} = \frac{\mu}{\lambda} = \phi$, which is shadow value of time, i.e., money value of one unit of time. Utilizing this again to manipulate equation 1 and 2 offers

$$\frac{U_R}{U_Z} = c + \frac{\mu}{\lambda} t = c + \phi t$$

, which actually shows that for the optimizing individual, in the equilibrium, marginal monetary benefit from of 1 unit of recreation trip $\left(\frac{U_R}{U_Z} = \frac{\delta z}{\delta R}\right)$ must equates the marginal cost $(c + \phi t)$ of the trip. So, the recreation price consists of an explicit part, c , and an implicit part, ϕt . Solving the above first order conditions with specific functional form for utility would give us demand equation for each of $z^*(c, t, w, H, T, q)$ $R^*(c, t, w, H, T, q)$ $l^*(c, t, w, H, T, q)$ and, $\phi^*(c, t, w, H, T, q)$.

Using Becker's (1965) full income notion, and assuming individual can freely choose work hours H , the above two constraints could be reduced into one single constraint by solving the time resource constraint for H and substituting it into the money income constraint. An individual facing the constraint $wT = z + cR + wl + wtR$, then solves the following single constraint utility maximization problem

$$\max_{z,R,L,\lambda} U(z, R, l; q) + \lambda(Y - z - (wt + c)R - wl),$$

where Y represents the full income wT . The price of recreation here, is $c + wt$, which is different from $(c + \phi t)$, the price we derived in the two constraint problem. If shadow value of time is equal to the individual's market wage rate, the recreation prices in both cases are the same.

The baseline model above demonstrates that income is an explicit component in recreation demand function. Similar to any other economic goods' demand model, the recreation demand studies usually incorporate income measures to explain recreation behavior. The role of income on consumption of recreation trips differs compared to other economic goods and commodities. In their survey, Phaneuf and Smith (2004) presented income elasticity estimates from several recreation demand studies lying in the range from 0.17 for beach recreation to 2.45 for hiking or wilderness. For most of the cases, they observe elasticity estimates lie below one. However, although recreation studies often found significant coefficient for income variable, it says little about marginal impact from income change. For upward changes in income individuals might switch from cheaper local lake, or park visit to completely different types of luxurious or exotic recreation.

The purpose of the above discussion on role of income and time in recreation demand literature is to motivate the possible pathways through which recession might influence recreation demand behavior. In face of a recession, both of these components might be affected. If the recession hits the recreationist directly through a reduction in working hours, or job loss, the individual would naturally experience a fall in money income but have more available time for leisure and recreation. It implies that the opportunity cost of time to be spent for recreation (ϕ , in our baseline model) would decrease as well. However, an opposing effect would come into the scenario through the decrease in working hours and, resulting fall in income. These two opposing effects are comparable to substitution and income effect resulting from a price change

for an economic commodity. Whether the time effect dominates the income effect would determine the overall effect of recession on one's recreation demand behavior.

Again, the unemployment (or, fall in working hours) during recession and resulting income loss might lead an individual to demand more of cheap, local recreation activities. In modeling recreation demand, the choice set often includes an element "stay-at-home" option[Egan, Herriges and Kling, 2009]. This "stay-at-home" option captures everything outside the model including options for other recreation activities such as exotic vacation, or an international trip. If a recreationist has plan for such trips but experiences fall in income due to a recession, s/he is less likely to make those expensive tours. In such cases, the "stay-at-home" becomes less appealing compared to other elements in the choice set, and might induce an increase in demand for local recreation activities.

Studies that investigate the impact of an exogenous shock such as a recession on recreation behavior, either empirically or theoretically, is generally missing. Loomis and Keske is one exception as we introduced at the beginning. Their study relies on two intercept surveys conducted in 2006 and 2009 on one single location-Quandary Peak, a very popular hiking place in Southeast Denver, Colorado. They did not notice any significant difference in hikers' income between the two periods, which might be explaining to some extent why the average number of visits, visitation expenditure, and willingness to pay did not change across periods. Although the authors recognize that apart from income shocks there might be uncertainties due to crash in housing market and stock market, however, it is not clear whether the survey respondents experience any employment shock during the recessionary period. If not, the individual would not face the tradeoff between time resources and income in choosing recreation demand. Utilizing longitudinal recreation data would help to figure out correctly if recession affected individual takes more recreation trip during recession.

In contrast to recreation demand literature, various applied microeconomic fields generate number of interesting studies investigating individual's distinct economic behavior during recession. Health economics literature demonstrates a negative association between business cycle and mortality, child health care, food-at-home, vegetables and fruits intake [Christopher Ruhm (2000, 2005), Dave and Kelly (2010)]. Many of these studies focus on economic goods which incorporate both monetary price and time cost components and, thus resemble recreation demand in the context of recession.

Exploring US unemployment and mortality data for several periods, Ruhm shows that mortality is cyclical, as 8 of the 10 major causes responsible for 75% of the US yearly death actually decline during recession. Several arguments work behind these apparently paradoxical impacts of recession. Decreased work hours during contraction improve health status from reduced work stress, reduced work related injuries and accident. Another argument relies on the change in value of time during contraction. During the recession, leisure becomes relatively abundant, and the price of leisure declines accordingly. In response to the fall in opportunity cost of time, the recession affected individuals might spend more time for health improving physical activities and exercises, spending time with families and friends, self-care, and food at home. Using Behavioral Risk Factor Surveillance Survey (BRFSS) data, Ruhm (2005) found countercyclical relationship for physical activities. Using the same survey data, Dave and Kelly found that rising probability of employment is associated with reduced likelihood of eating fruits and vegetables and increased chance of eating unhealthy snacks. Since economic contraction might cause a shift in both of income and time constraint, the choice of both food at home as well as healthy food becomes cheaper.

Time intensive activities, for example, child health care might also exhibit a pro-cyclical pattern [Chay and Greenstone (2003) Dehejia and Lleras-Muney (2004)]. A depressed wage during economic downturn reduces the cost of involvement in taking various caregiving activities such as more preventive health visits, breastfeeding, cooking healthy meals, or improving general cleanliness. However, during contraction income also falls, which might affect parents' ability to purchase nutritious food or health augmenting inputs. It seems that two opposing effects work simultaneously: substitution effect from cheaper time, and income effect from fall in income. In the developed countries the substitution effect dominates to result in improved child health during recession while in the developing countries, income effects usually dominate and cause infant mortality rate to rise [Baird, Friedman, and Schady (2011)].²

² Miller and Urndinola (2007) is one exception for developing countries, which finds that Colombian coffee growers experience reduced child mortality in the face of exogenous shock in income through fall in price of coffee.

3. Theoretical Motivation

In this section, we would extend the baseline model given in the previous section to motivate the possible consequences of recession on one's recreation demand behavior. Our interest lies in knowing what happens to $R^*(c, t, w, H, T, q)$ when recession hits an individual through change in employment.³ Facing a recession, the individual might experience fall in income, $Y = wH$, which might be channeled through two different exogenous ways: (a) fall in income due to fall in working hours H , and, or (b) fall in income due to fall in wage, w . Letting $\bar{T} = T - H$, we first consider the case for fall in H

$$\frac{\delta R^*(wH, T - H, c, t, q)}{\delta H} = \frac{\partial R^*}{\partial Y} * \frac{\partial(wH)}{\partial H} + \frac{\partial R^*}{\partial \bar{T}} * \frac{\partial(T - H)}{\partial H}$$

$$\frac{\delta R^*}{\delta H} = \frac{\partial R^*}{\partial Y} * w + \frac{\partial R^*}{\partial \bar{T}} * \frac{\partial \bar{T}}{\partial H}$$

Note that since T is fixed by nature, $\frac{\partial \bar{T}}{\partial H} = \frac{\partial(T-H)}{\partial H} = -1$. Substituting this into the above gives

$$\frac{\delta R^*}{\delta H} = \left(\frac{\partial R^*}{\partial Y} * w \right) - \frac{\partial R^*}{\partial \bar{T}} \quad (6)$$

Next, let us consider the case for the fall in wage, w . Wages are usually sticky downward because of minimum wage law and unions, and businesses, therefore, often lay workers off to cut cost in the face of recession. Yet, we might consider the impact of a fall in wage on recreation demand. Arguments in $R^*(wH, T - H, c, t, q)$ reveal that fall in wage would affect the demand for recreation through income $Y = wH$, i.e.,

$$\frac{\delta R^*}{\delta w} = \frac{\partial R^*}{\partial Y} * \frac{\partial(wH)}{\partial w}$$

$$\frac{\delta R^*}{\delta w} = \frac{\partial R^*}{\partial Y} * H \quad (7)$$

Total effect on R^* would be the combined effect of change in wage, w , and change in working hours, H . Combining equation (6) and (7) offers

³ The arguments of R^* reveal that recreation demand is determined by income (wH), out-of-pocket money expenses to meet travel cost (c), net of work time, ($T - H$), available for leisure and recreation, and t , per unit time cost for R .

$$\frac{\delta R^*}{\delta H} + \frac{\delta R^*}{\delta w} = \left(\frac{\partial R^*}{\partial Y} * w \right) - \frac{\partial R^*}{\partial \bar{T}} + \frac{\partial R^*}{\partial Y} * H$$

$$\frac{\delta R^*}{\delta H} + \frac{\delta R^*}{\delta w} = \frac{\partial R^*}{\partial Y} * (w + H) + \left(-\frac{\partial R^*}{\partial \bar{T}} \right) \quad (8)$$

The effect of recession on R actually depends on the sign of $\frac{\partial R^*}{\partial Y}$ and $\frac{\partial R^*}{\partial \bar{T}}$. The first term in equation 8, $\frac{\partial R^*}{\partial Y} * (w + H)$, is actually showing the direction of change in R from the change in income, and, this is something like income effect (IE) on R . The second term $\frac{\partial R^*}{\partial \bar{T}}$ is showing the effect on R from change in available net-of-work time \bar{T} , which can be termed as substitution effect(SE).⁴ If recreation is a normal good, $\frac{\partial R^*}{\partial Y} > 0$, and, since recreation is time intensive we can assume that R is increasing in endowment of time \bar{T} , $\frac{\partial R^*}{\partial \bar{T}} > 0$. In the event of a recession, we are interested in knowing whether $\frac{\delta R^*}{\delta H} + \frac{\delta R^*}{\delta w} > 0, or < 0, or = 0$.

Under the normal good assumption, the first term in equation 8 indicates that R would decrease and the second term including the - sign also indicates that R would decrease. We are certain that facing a recession, recreation demand decreases if it is normal good. However, if R is an inferior good, impact on R is inconclusive. Because the first term in equation (8) would then be positive while the second term would exert a negative effect, and we do not know which affect would dominate. Change in recreation demand, being an inferior good in nature, would depend on the relative strength of the two effects: if for an individual IE ($\frac{\partial R^*}{\partial Y} * (w + H)$), dominates over SE ($-\frac{\partial R^*}{\partial \bar{T}}$), recession might cause an individual taking more recreation and vice versa. The above arguments imply that impact of recession on recreation demand can go either way.

Second order conditions

We can exploit the first order conditions (equation 1-5) from the baseline model in previous section to derive the second order conditions to understand the impact of recession.

⁴ Decreased working hours, fall in H , provides more time for leisure and recreation, which implies that there is a substitution from work hours to recreation or leisure.

Assuming an interior solution, and substituting (2) and (3) into (1) gives us the following equilibrating condition among all three goods, R , l , and z in the model⁵

$$U_R = c * U_Z + t * U_l \quad (9).$$

For simplicity, here we assume that goods in the model have no cross partial effect on utility, i.e., marginal utility of recreation does not affect marginal utility of leisure. Taking total differential of the above equation offers

$$U_{RR} dR = c * U_{ZZ} dz + U_Z * dc + t * U_{ll} dl + U_{ll} * dt \quad (10).$$

Suppose work hours H change exogenously and all other parameters in the model remains constant. So, $dc = dt = 0$, but $dH > 0$. Substituting this into the above equilibrating condition and dividing by $dH > 0$ manipulate the equation 10 into

$$U_{RR} \frac{dR^*}{dH} = c * U_{ZZ} \frac{dz^*}{dH} + t * U_{ll} \frac{dl^*}{dH} \quad (11).$$

In equilibrium income constraint, $wH = cR^* + Z^*$ binds. Differentiating this w.r.t H gives $w = c * \frac{dR^*}{dH} + \frac{dz^*}{dH}$, which can again be expressed as $\frac{dz^*}{dH} = w - c * \frac{dR^*}{dH}$. In our model, in equilibrium time resource constraint also binds: $T - H = l^* + tR^*$. Taking the derivative of this w.r.t H gives us: $-1 = \frac{dl^*}{dH} + t \frac{dR^*}{dH}$. Manipulating this gives $\frac{dl^*}{dH} = -1 - t * \frac{dR^*}{dH}$. Substituting these expressions for $\frac{dz^*}{dH}$ and $\frac{dl^*}{dH}$ into (11) offers

$$U_{RR} \frac{dR^*}{dH} = c * U_{ZZ} (w - c * \frac{dR^*}{dH}) + t * U_{ll} (-1 - t * \frac{dR^*}{dH}).$$

Rearranging the above gives

⁵ If an individual is at corner and consume 0 recreation in equilibrium, we can argue what s/he might do if hit by a recession. If an individual is on the corner solution for R , the first order conditions in (1) and (2) can be combined to find $\frac{U_R}{U_Z} < c + \phi t + \kappa$, where κ is addressing that non-negativity constraint for R has been binding. In the face of recession, for such an individual, the shadow value of time, ϕ , is expected to fall. It would reduce the marginal cost by reducing the time cost of R , and there is a possibility that the person would start consuming some R . However, for the recession affected individual if the shadow value of time does not fall enough such that the above condition turns into equality, s/he would not move from the corner.

$$U_{RR} \frac{dR^*}{dH} = c * U_{zz}(w - c * \frac{dR^*}{dH}) + t * U_{ll}(-1 - t * \frac{dR^*}{dH})$$

$$\frac{dR^*}{dH} (U_{RR} + c^2 * U_{zz} + t^2 * U_{ll}) = c * w * U_{zz} - t * U_{ll}$$

$$\frac{dR^*}{dH} = \frac{c * w * U_{zz} - t * U_{ll}}{(U_{RR} + c^2 * U_{zz} + t^2 * U_{ll})} \quad (12)$$

Regular properties, such as concavity of the utility function, imply that denominator of equation (12) is positive, *i.e.*, $(U_{RR} + c^2 * U_{zz} + t^2 * U_{ll}) < 0$. However, the numerator $c * w * U_{zz} - t * U_{ll}$ can be either positive or negative depending on the curvature of utility function, and magnitude of w , c , and t . Following are the all three possible scenarios-

Scenario One:	$c * w * U_{zz} - t * U_{ll} > 0$	$\frac{dR^*}{dH} < 0$
Scenario Two:	$c * w * U_{zz} - t * U_{ll} = 0$	$\frac{dR^*}{dH} = 0$
Scenario Three:	$c * w * U_{zz} - t * U_{ll} < 0$	$\frac{dR^*}{dH} > 0$

Dynamic Model with a two-period setting

In the static one period setting above, the analysis reveals that an individual's recreation demand can move in any direction in response to a recession. However, since recession involves decisions across periods, we would extend our basic one period model into a two-period setting to get dynamic insights on impact of recession on recreation behavior. Suppose there are two time periods: $t=1, 2$. The two periods are related through savings S . Individual can save some portion of money income Y to use across periods. If one experiences a recession at the beginning of period one, the future income, second period in our model, becomes uncertain. We will consider first a frictionless world with no recession and thus certain second period, and then incorporate uncertainty due to recession to understand the dynamics of recession and recreation demand. In the model, we would have two money income constraints for two periods as following-

$t=1$	$w_1 H_1 = S_1 - c_1 R_1 - z_1$	<i>a</i>
$t=2$	$w_2 H_2 = (1 + r)S_1 - c_2 R_2 - z_2$	<i>b</i>

where r is the market rate of interest on savings, S , in period one which could be realized in period two. Two time resource constraints are:

$$t=1 \quad \bar{T}_1 = T - H_1 = l_1 + t * R_1 \quad c$$

$$t=2 \quad \bar{T}_2 = T - H_2 = l_2 + t * R_2 \quad d.$$

Since time endowments cannot be carried over across periods, the time remaining after work hours, $\bar{T}_t = T - H_t$, would have to be used for leisure(l) or recreation(R) in every period t .

Case One: Certain World

The rational individual maximizes the following discounted utility function

$$\max_{z_t, R_t, L_t} U(z_1, R_1, l_1; q) + \beta[U(z_2, R_2, l_2; q)]$$

s. t. constraints a, b, c, d.

In the above equation β is the discount rate. The problem might also be written as an unconstrained problem by substituting time and money constraints directly into the utility function as follows-

$$\begin{aligned} \max_{z_t, R_t, L_t, S} & U(w_1 H_1 - c_1 R_1 - S_1, R_1, \bar{T}_1 - t R_1; q) \\ & + \beta[U(w_2 * [H_2] + (1 + r)S_1 - c_2 R_2, R_2, \bar{T}_2 - t R_2; q)] \end{aligned}$$

Similar to the static model, here, we would also consider the interior solution case only. First order conditions are then as follows

$$R_1: \quad U_{R_1}^* = c_1 * U_{Z_1}^* + t * U_{l_1}^* \quad (13)$$

$$R_2: \quad U_{R_2}^* = c_2 * U_{Z_2}^* + t * U_{l_2}^* \quad (14)$$

$$S_1: \quad U_{S_1}^* = \beta(1 + r)U_{Z_2}^* \quad (15)$$

$$S_1^* = w_1 H_1 - c_1 R_1^* - z_1^* \quad (16)$$

$$\text{Binding constraints in} \quad T_1 = l_1^* + t R_1^* \quad (17)$$

$$\text{equilibrium} \quad T_2 = l_2^* + t R_2^* \quad (18)$$

The system of equations in (13)-(18) above defines the equilibrium values for all of our endogenous variables across both periods- $\{R_1^*, Z_1^*, l_1^*, R_2^*, Z_2^*, l_2^*, S^*\}$. Rearranging the equations (13), (14), and (15) above we get the following equation

$$U_{R_1^*} - t * U_{l_1^*} = \beta \frac{c_1}{c_2} (1 + r)(U_{R_2^*} - t * U_{l_2^*}) \quad (19)$$

Equation (15) and (19) above are the famous *Euler* equation revealing the equilibrating condition relating consumption across goods and time periods. Utilizing these two *Euler* equations along with the other first order conditions in (13)-(18), we would develop our intuition on what happens to recreation demand R if there is a shock in income through reduced working hours in period one. Suppose, agent's hours of work in period 1, H_1 falls resulting in an income fall as well, but everything else remains the same. Agent knows that nothing would happen to work hours, H_2 , in period 2, i.e., there is no uncertainty regarding period 2.

Our specific question is, if H_1 decreases by 1 unit, what happens to R_1^* and R_2^* ? In the event of experiencing a reduction in work hours, the agent has more available time to spend for l and R . There are several possibilities in which this extra time might be allocated given that income has fall, and the equilibrium conditions stated in (13)-(19) have to be satisfied. Following are the possibilities.

All extra hours to recreation, R_1 : the agent cannot allocate all extra hours to R_1 . Because in that case U_{l_1} stays same but U_{R_1} falls causing the left hand side of equation (19) to decrease. However, reduced income would reduce savings, which would again reduce R_2^* . But Reduced R_2^* implies increased l_2^* to cause right hand side of (19) to actually increase. So, if all the hours are allocated to R_1 , it would violate Euler equation(15), and a rational agent would never do that.

All extra hours to leisure l_1 : this involves two possibilities with R_1^* might decrease, or stay constant. If l_1^* absorbs all extra time saved from not working, and R_1^* stay constant, left hand side of equation(19) would increase while right hand side might increase as well by allocating more time to l_2^* and less to R_2^* , which is consistent with reduced savings. So, this is a possible case. Again, another possibility is that an individual agent might reduce recreation R_1^* , which would cause the left hand side of Euler equation (15) to grow bigger. However, this is consistent since the individual might balance the right hand side of the *Euler* equation through appropriate reallocation between l and R .

Dividing extra time b/w R_1 and l_1 : if the small portion of the extra time is allocated to recreation, this is also a possible case This would cause the left hand side to rise, and may be

matched by an equivalent rise in right hand side through fall in R_2 , which is obvious as S decreases, and a rise in l_2 .

The above analysis imply that if working hours decrease in an exogenous way at the beginning of period one, recreation demand may decrease, stay the same or even increase a little, compared to what would be the case in absence of such shocks. All these responses of recreation demand to exogenous shock are consistent and coherent with the notion of consumption smoothing. However, since recreation is time and money intensive good, individual response might differ from that of a pure money intensive good.

Case Two: Uncertain World

Suppose recession hits in period 1, which introduces uncertainty in the economic environment. Individuals might fear job loss (reduced work hours, H_2 in our model) and, thus period- two income would be uncertain. Agents only know the distribution of period 2 work hours, and relevant moments. Therefore, in recessionary situation, while optimizing at the beginning of period one, an agent optimizes based on the expected income in uncertain period.

An individual maximizes the following discounted expected utility function

$$\begin{aligned} \max_{z_t, R_t, l_t, S} & U(w_1 H_1 - c_1 R_1 - S_1, R_1, \bar{T}_1 - t R_1; q) \\ & + \beta E[U(w_2 * [H_2] + (1 + r)S_1 - c_2 R_2, R_2, \bar{T}_2 - t R_2; q)] \end{aligned}$$

Applying the similar procedures we used in certain case to derive the first order conditions, we get the following *Euler* equations relating period one and two across goods

$$U_{R_1}^* - t * U_{l_1}^* = \beta \frac{c_1}{c_2} (1 + r) E(U_{R_2}^* - t * U_{l_2}^*) \quad (20a)$$

$$U_{z_1}^* = \beta (1 + r) E(U_{z_2}^*). \quad (20b)$$

Under uncertainty, how does the individual rational agent behave? Intuitively, s/he would save more for period 2 even in the absence of experiencing any income shock in period one. Following the procedures of any standard consumption model under uncertainty, we demonstrate it below using equation (20b)-the *Euler* equation for our *numeraire* good z . For simplicity, let us assume that market interest rate perfectly compensates discount factor, i.e., $\beta(1 + r) = 1$, and monetary cost does not change overtime, which reduces the said equation to $U_{z_1} = E(U_{z_2})$.

Under certainty, $U_{z_1} = E(U_{z_2})$ implies that an agent consumes equal amount in both period to maximize utility. Let us assume that the certain consumption bundle is (\bar{Z}_1, \bar{Z}_2) while that under uncertainty it is $(\widetilde{Z}_1, \widetilde{Z}_2)$. Further assume that the utility is separable across goods. Taking a Taylor series approximation of the first order condition $U_{\widetilde{Z}_1} = E(U_{\widetilde{Z}_2})$ across the certainty point \bar{Z}_2 gives-

$$U'(\widetilde{Z}_2) = U'(\bar{Z}_2) + U''(\bar{Z}_2) * (\widetilde{Z}_2 - \bar{Z}_2) + 0.5 * U'''(\bar{Z}_2) * (\widetilde{Z}_2 - \bar{Z}_2)^2.$$

Taking expectation on both sides of the above, we get

$$E[U'(\widetilde{Z}_2)] = E[U'(\bar{Z}_2)] + E[U''(\bar{Z}_2) * (\widetilde{Z}_2 - \bar{Z}_2)] + 0.5 * E[U'''(\bar{Z}_2)(\widetilde{Z}_2 - \bar{Z}_2)^2]$$

Utilizing the fact that $E[U'(\bar{Z}_2)] = \bar{Z}_2$, and $Var(\widetilde{Z}_2) = E(\widetilde{Z}_2 - \bar{Z}_2)^2$, we derive the following

$$\begin{aligned} E[U'(\widetilde{Z}_2)] &= U'(\bar{Z}_2) + U''(\bar{Z}_2) * E(\widetilde{Z}_2 - \bar{Z}_2) + 0.5 * U'''(\bar{Z}_2) * E(\widetilde{Z}_2 - \bar{Z}_2)^2 \\ E[U'(\widetilde{Z}_2)] &= U'(\bar{Z}_2) + 0.5 * U'''(\bar{Z}_2) * Var(\widetilde{Z}_2) \end{aligned} \quad (20c)$$

Note that in the above equation, we exploit the fact that mean consumption does not change, i.e., $E(\widetilde{Z}_2 - \bar{Z}_2) = 0$. Now, if $U''' > 0$ then $0.5 * U'''(\bar{Z}_2) * Var(\widetilde{Z}_2) > 0$. Applying this into equation (20c) above implies that $E[U'(\widetilde{Z}_2)] > U'(\bar{Z}_2)$. Again, since $U'(\widetilde{Z}_1) = E[U'(\widetilde{Z}_2)]$, these together imply

$$U'(\widetilde{Z}_1) > U'(\bar{Z}_1) \quad (20d)$$

Being a regular utility function, $U'' < 0$ means that U' is decreasing in Z . Consumption under uncertainty is lower than consumption under certainty: $(\widetilde{Z}_1) < (\bar{Z}_1)$. This has interesting implication for recreation demand R_1^* .

Note that one of the within period first order condition is: $c_1 * U_{z_1}^* = U_{R_1^*} - t * U_{l_1}^*$.⁶ Equation (20d) above demonstrates that due to uncertainty in second period, a risk averse individual would consume less compared to the certain case. Therefore, in the above within period first order condition, left hand side under uncertainty is always greater than what it would be under the certainty case. It implies that in equilibrium, under uncertainty the right hand side

⁶ This is similar to equation (15) in the certain case. Since individual is uncertain about the second period, this within first period first order condition does not involve any expectation sign.

would be greater as well compared to the certain case, which, in turn, makes it obvious that $(\widetilde{R}_1^*) < (\overline{R}_1^*)$, i.e., the recreation demand for a risk averse individual in period one must be lower than what it would be in the absence of any uncertainty. Since both of R and Z decrease during recessionary uncertainty, savings S^* must be higher in such cases compared to the certain case.

Risk Neutral and Risk Loving Recreationist

We also need to consider the case for a risk lover and risk neutral recreationist. Utilizing the same framework as we use above for the risk-averse individual, we know that for a risk neutral individual, $U'' = 0$ means that U' is not responding in Z . Therefore, for an individual with neutral risk attitude, consumption under uncertainty would remain the same as consumption under certainty: $U'(\widetilde{Z}_1) > U'(\overline{Z}_1)$ and $U'' = 0$ together imply that $(\widetilde{Z}_1) = (\overline{Z}_1)$. This suggests that a risk neutral individual would not change her recreation demand, i.e., $(\widetilde{R}_1^*) = (\overline{R}_1^*)$ in the face of recessionary uncertainty. However, if the individual is risk lover ($U'' < 0$), the implication for recreation demand \widetilde{R}_1^* under uncertainty would be completely different from those of a risk neutral or risk loving attitude. Equation (20d) for a risk loving agent would imply that $(\widetilde{Z}_1) > (\overline{Z}_1)$, which together with the within period first order condition $c_1 * U_{Z_1^*} = U_{R_1^*} - t * U_{I_1^*}$ would indicate that the risk loving individual would consume more recreation and less leisure in the event of a recession induced uncertainty, i.e., $(\widetilde{R}_1^*) > (\overline{R}_1^*)$.

The analysis above reveals that in the event of a recession individuals might be exposed to income shock, and even if not exposed to any such shock, they might be affected due to uncertainty about the future. In the former case, by reallocating time individuals would try to smooth consumption of leisure and recreation overtime while in the latter case, if one is risk averse then precautionary motive would take place, and, they would reduce consumption of recreation for sure. The combined affect might go in any direction, and depend on the relative strength of precautionary motive, and consumption smoothing effects. For a risk neutral agent or risk loving agent, the precautionary motive either does not exist or work in an opposite fashion, and the resulting combined effect might therefore be in any direction as well. Individual exposure to recession would vary by type and intensity, and, in accordance, responses to such shocks might vary as well. The implication is that the net effect is ambiguous and difficult to predict.

4. Econometric Framework

Our study on the impact of employment change during recession on lake recreation is a non-experimental setting. In non-experimental setting treatment assignment is non-random. In our case, the treatment group would comprise those who experience a change in employment status facing a recession, and assignment to this treatment group is surely non-random. This non-random treatment assignment is also known as selection problem, and selection can be both due to observables and unobservable factors. The selection problem would hide the true causal effect of change in employment status during recession on recreation behavior; there might be confounding factors that affect both selection into the treatment (experience of a change in employment status) and the outcome variable (trip taking to lake). Propensity Score Matching (PSM) method, due to Rosenbaum Rubin (1983), is one approach to overcome the selection problem.

PSM is widely used and popular method in program evaluation literature [Ravallion, (2003, 2005)]. Under certain assumptions, the method solves the problem of missing counterfactual in non-experimental setting. In the first step of a two-step procedure, the method estimates a propensity score (one's probability of being included in the treatment group) for each individual in the treatment and control groups based on observed covariates, and on the basis of that score in the second step it matches the treatment observations with the appropriate control to find the differential impact of treatment.

Empirical Design and Strategy

In this study, we would like to investigate empirically, how the individual trip taking to lakes changes in response to change in employment status during recession. The relevant periods for analysis are 2005, the pre-recession year, and 2009, the recession affected year. Recession is mostly an exogenous economic shock, and there are several observable ways an individual recreationist might respond to such exogenous shocks. An individual who used to visit lakes before shocks might stop visiting any lake at all after the shock, and in the opposite manner, a non-lake-recreationist might turn into lake-recreationist after being exposed to the shock. This is the response to employment change during recession on lake trips at extensive margin.⁷ Again, a

⁷ Throughout the paper we use the following two terms interchangeably- "recreation trip at extensive margin" and "participation in outdoor lake recreation".

visitor might also respond by increasing or decreasing the total number of trips, which we would term as response to change in employment status during recession on lake trips at intensive margin. There might be confounding factors that affect an individual's chance of experiencing employment change during recession as well as his/her lake recreation behavior. For example, an individual in his fifties, who is an avid trip taker, might choose voluntary unemployment during recession, i.e., is more likely to be affected by economic shock. In this regard, a non-parametric approach such as the above described PSM method would be more appealing. Following is a sketch of our research design.

Treatment group: for our analysis, the treatment group would be defined as the set of individuals whose employment status has changed during recession in the following manner. Facing the recession, a previously fulltime employed individual might turn into unemployed, part-time employed, or retired. Since retiree group might be different from others, we will form three treatment groups including and excluding the retiree groups. The control group for our analysis would consist of the group of recreationist who are full-time employed in both of the period 2005 and 2009.

$$T_{1i} = \begin{cases} 1 & \text{if "i" is fulltime employed in 2005 but Unemployed/Part time/Retired in 2009} \\ 0 & \text{if "i" is fulltime employed in year 2005 and 2009} \end{cases} \quad (21)$$

$$T_{2i} = \begin{cases} 1 & \text{if "i" is fulltime employed in 2005 but Unemployed/Part time employed in 2009} \\ 0 & \text{if "i" is fulltime employed in year 2005 and 2009} \end{cases} \quad (22)$$

$$T_{3i} = \begin{cases} 1 & \text{if "i" is fulltime employed in 2005 but Retired in 2009} \\ 0 & \text{if "i" is fulltime employed in year 2005 and 2009} \end{cases} \quad (23)$$

Outcome Variable: as mentioned above, the outcome variable for our interest would be of two different types. The first would be a binary outcome variable indicating whether an individual takes any trip at all in the year 2005 and 2009. Let us denote it as $Trip_{T,t}$ with treatment group indicator $T = \{0,1\}$, and year indicator $t = \{Y09, Y05\}$. $Trip_{1,Y09}$ indicates whether individuals experiencing shock in employment status take any trip at all in the year 2009 while $Trip_{0,Y09}$ is the similar indicator for individuals not exposed to any such shock. $Trip_{1,Y05}$ and $Trip_{0,Y05}$ are similar binary indicators for these two groups in the year 2005.

Another outcome variable of our interest would be the total number of trips. $NTrip_{1,Y09}$ would denote total number of trips for treatment group while $NTrip_{0,Y09}$ would denote total number of trips for the control group in the recession year 2009. $NTrip_{1,Y05}$, and $NTrip_{0,Y05}$ would capture total number of trips for these two groups in the pre-recession year 2005.

Propensity Score Estimation: applying *PSM* method for the analysis first requires us estimating the propensity score, which would give us one's probability of being exposed to employment shock during recession. There is no clear set of standards on what variables to be included in the propensity score estimation equation. One approach is to specify the covariates in the equation in such a way so that it satisfies the conditional independence assumption based on which the *PSM* technique is built upon. We will discuss this condition separately in the following sub-section. Heckman, Ichimura, and Todd (1997) and, Smith and Todd (2005) demonstrate that exclusion of important and relevant variables from the model would increase bias in the second stage estimation of treatment effect. They suggest including a set of variables that would influence both treatment status and outcome, and in this regard, economic theory, previous research, and institutional setting might help to characterize the covariates. For our setting, we could not trace previous research that could guide us specifying the propensity score estimation equation. Again, our longitudinal lake recreation data do not include a rich set of information that would affect one's probability of losing employment during recession, although it provides all the relevant variables important for lake recreation.

Based on the available information in the data, the independent variables we would include in the propensity score estimation regression are individual age, polynomials of age, education, gender, number of child in the households, ownership of boat, and, interaction terms between education, age, and gender. All of these variables form the covariate vector, and in the propensity score estimation equation would assume values from the pre-shock period 2005. Education, age, and their interaction terms are motivated by the earning function estimation in labor literature [Mincer(1974), Heckman, Lochner and Todd(2007)].⁸

⁸ In the original earning function specification, due to Mincer (1974), experience and its quadratic was used. However, it is also common to use age instead of experience since experience is defined as (age-education-6) assuming schooling starts at age 6.

We assume that factors that determine one's earning ability are also strong predictor for their labor market status. An individual with a college degree and considerable experience is less likely to be exposed to a recession compared to an individual of similar experience but with only a high school degree. Other variables, such as number of children in the household, ownership of boat might also affect the exposure to recession. If someone loves outdoor recreation and have no children in the household, facing a depressed wage during the recessionary period, s/he might be more likely to take a temporary off from work (voluntary unemployment) to be able to do more recreation compared to an individual with similar preference but having children in the household. Ownership of boat might also be an indicator of one's inclination to outdoor water activities. Utilizing the treatment indicators, as defined in equation (21)-(23), as the dependent variable, and the covariate \mathbf{X} as explanatory variables, we will estimate the propensity score using three separate logistic regression models for three treatment groups. The specification would be as following

$$\Pr(T_l = 1|\mathbf{X}) = P(\mathbf{X}) = \frac{\exp(\mathbf{X}'\boldsymbol{\beta})}{1 + \exp(\mathbf{X}'\boldsymbol{\beta})} \quad (24)$$

where, l denotes the treatment group 1, 2, or 3.

Identification Assumption: we assume that once we control for propensity score, $P(\mathbf{X})$, the treatment and the control group would satisfy the *ignorability* condition, as stated in equation (25) and (26) below. This condition implies that once propensity score is controlled, exposure to recession induced employment change is independent of recreation outcome. In other words, recreation behavior does not determine one's chance of being exposed to employment shock. For all of the three treatment groups, and control in our analysis, we assume that the following two equations, one for each of the two outcome variables, must hold for identification purpose:

$$Trip_{1,Y09}, Trip_{0,Y09} \perp T | P(\mathbf{X}) \quad (25)$$

$$NTrip_{1,Y09}, NTrip_{0,Y09} \perp T | P(\mathbf{X}) \quad (26)$$

One implication of the above stated *ignorability* condition is the balancing condition, which implies that once propensity score is controlled for, the exposed group to employment change during recession(treatment) and not-exposed group (control) should have similar distribution for pre-treatment covariate vector \mathbf{X} : $T \perp \mathbf{X} | P(\mathbf{X})$. This implies that the following mean equivalence condition must hold

$$E[\mathbf{X}|P(\mathbf{X}), T = 1] = E[\mathbf{X} |P(\mathbf{X}), T = 0]$$

Balancing condition is recommended for testing the quality of the matching estimator. We will perform this test after each round of matching done to check the validity of our matching method, i.e., if the treatment group and their matched controls exhibit statistically similar mean across elements in covariate \mathbf{X} .

Estimation: since we do not observe what the recreationists experiencing employment shock during recession would do were they not affected by the recession, we have to construct some form of counterfactual for them. The weak *ignorability* assumptions, a weaker assumption compared to that in equation 25 and 26, imply the following mean independence condition, which would help us to find the required counterfactuals for our treatment observations.

$$E[Trip_{0,Y09}|P(\mathbf{X}), T = 1] = E[Trip_{0,Y09} |P(\mathbf{X}), T = 0] = E[Trip_{0,Y09}|P(\mathbf{X})] \quad (27)$$

$$E[NTrip_{0,Y09}|P(\mathbf{X}), T = 1] = E[NTrip_{0,Y09} |P(\mathbf{X}), T = 0] = E[NTrip_{0,Y09}|P(\mathbf{X})] \quad (28)$$

Equation 27 and 28 above imply that matching based on the propensity score would provide us the counterfactual trip taking behavior of treatment group individuals, both at intensive and extensive margin. Next, exploiting these counterfactuals, we would estimate the impact of employment status change during recession on the recreation behavior with the following two average treatment effect on the treated (ATT) estimators.

$$\widehat{ATT}_{extensive} = \frac{1}{N_T} \left[\sum_{i \in I_1 \cap S_p} [Trip_{1,Y09} - \widehat{Trip}_{0,Y09}] \right] \quad (29)$$

$$\widehat{Trip}_{0,Y09} = \sum_{j \in I_0} (\widehat{W}_{ij}) Trip_{0,Y09}$$

$$\widehat{ATT}_{intensive} = \frac{1}{N_T} \left[\sum_{i \in I_1 \cap S_p} [NTrip_{1,Y09} - \widehat{NTrip}_{0,Y09}] \right] \quad (30)$$

$$\widehat{NTrip}_{0,Y09} = \sum_{j \in I_0} (\widehat{W}_{ij}) NTrip_{0,Y09}.$$

where I_1 is the set of treated observations, I_0 is the set of control observations, S_p is the region of common support, and N_T is the number of observations who belong to the set $I_1 \cap S_p$. $\widehat{Trip}_{0,Y09}$ is the matched outcome of control observation for treatment “ i ”, which actually is constructed as the weighted average of all of the matched non-treatment outcomes. Similarly, \widehat{W}_{ij} is the weight

assigned to each matched control “ j ” corresponding to the treatment observation “ i ”. Weight would depend on the distance between the propensity scores of treatment “ i ” and match “ j ”, and the number of matches as well. For unmatched observations, weight would be zero. The matching would be done using the following three algorithms-

- (i) Nearest neighbor matching: for each recessionary employment shocked individual, we would pick the non-exposed individual with closest propensity score. This will be done both with and without replacement.
- (ii) Nearest five neighbors matching: for each exposed individual, we would pick the five non-exposed individuals with the closest propensity score.
- (iii) Radius matching: for each exposed individual, we would pick all the non-exposed individuals whose propensity score lies within the radius caliper of 0.01 and 0.05 of the propensity score of the exposed individual.

Difference-in-Difference matching to control for time invariant unobservable

The *ignorability* assumption, as we discussed in the previous sub-section, imply that once we control for observable covariates \mathbf{X} , the exposure into recessionary employment shock is independent of individual recreation behavior. However, there could still exist some *unobservable* factors that might affect the likelihood of both of an individual’s exposure to employment shock during recession as well as her post shock recreation behavior. These *unobservable* factors might be both time variant as well as time invariant in nature. Heckman, Ichimura, and Todd (1997), & Smith and Todd (2005) suggest using difference in difference (DID) matching approach in the presence of potential confounding factors. For example, in our context, geographic factors (such as distance to lake, local amenities, local labor market conditions etc.) might confound the results. Since we have a balanced panel data comprising year 2005 and 2009, we are able to control for time invariant unobservable factors by applying difference in difference (DID) matching approach.

The *DID* matching approach requires us to redefine the outcome variables first. The outcome variable on participation in lake recreation for the recessionary employment shocked group would be redefined as $\Delta Trip_1 = Trip_{1,Y09} - Trip_{1,Y05}$ while that for control group would

be defined as $\Delta Trip_0 = Trip_{0,Y09} - Trip_{0,Y05}$. Note that the dependent variable, here, is the difference between the binary lake trip participation indicator in pre-recession year and recession year. The outcome variable on total number of lake trips, outcome variable for recreation behavior at intensive margin, is similarly redefined for the treatment and the control group as $\Delta N Trip_1 = N Trip_{1,Y09} - N Trip_{1,Y05}$ and, $\Delta N Trip_0 = N Trip_{0,Y09} - N Trip_{0,Y05}$. Next, we would exploit the DID estimator using the redefined outcome variables in the formula given in equation 29-30. As can be noticed from the construction of the outcome variables, the DID estimator is actually the difference of before and during recession estimates of treatment effect on the treated, which can be related in the following manner

$$DID_{extensive} = \widehat{ATT}^{Y09}_{extensive} - \widehat{ATT}^{Y05}_{extensive} \quad (31)$$

$$DID_{intensive} = \widehat{ATT}^{Y09}_{intensive} - \widehat{ATT}^{Y05}_{intensive} \quad (32)$$

5. Data

In this study we have used data from Iowa lake survey, a random population survey, which collects rich set of information on Iowan's lake visitation pattern as well as demographic data on gender, age, education, employment status, income, and household composition. The survey has been administered five times in total, once in each of the four consecutive years 2002-2005, and the latest is in 2009. The survey in 2009 was sent to 10,000 people out of which 4500 were those who responded to a similar survey conducted in 2005. The survey response rate in 2009 was around 60%. This provides us a panel of 2773 individuals whom we can observe both before and during the recession in terms of their recreation behavior (both participation and number of trips) and relevant demographic information. The first step for us is to identify the group of people who have experienced a change in employment status during the recessionary shock, and those who have not to construct the treatment and control group for our study. Table one below contains the employment pattern of individuals over the year 2005 and 2009.

In the sample panel, 32.5% of the respondents (900 individuals) do not provide any information on employment status in the year 2009, which is quite high compared to similar

nonresponse of 5.27% for the year 2005. Again, 52% of these 900 individuals were full-time employed in the pre-recession year 2009. There is good possibility that these previously unemployed individuals might have experienced some employment shock during the recession, and are unwilling to share this information. All of these individuals could be included in our sample if such non-response were absent. Since in this study, we construct our sample based on individuals' employment status, significant numbers of respondents are dropping out due to this missing data. This implies that our study might be subject to sample selection bias.

Table 1: Number of survey respondents by employment status in 2005 and 2009

Employment Status in 2005	Employment Status in 2009					Total
	Full-time	Part-time	Student	Unemployed	Retired	
Full-time	848	43	4	23	100	1,018
Part-time	29	69	2	8	37	145
Student	8	0	2	1	1	12
Unemployed	17	6	1	20	13	57
Retired	14	24	1	1	506	546
Total	916	142	10	53	657	1778

In our 2005-2009 panel, 64.12% of the respondents have provided the employment status information for both years. Approximately 6.5% of the people, who were full time employed in year 2005, have either lost jobs or experienced a fall in working hours during recessionary year 2009. In addition, 10% of the previously full-time employed people have retired in 2009. Such a high retirement of the previously employed people in the recession year naturally invokes interest. Is this a normal event, or something similar to a forced retirement phenomenon one usually encounters during economic shock? An investigation into a similar panel for 2004-2005 shows that 3.5% of the full time employed people has turned into unemployed/ part time employed in the later year 2005, which was actually a normal economic year. Similarly, only 2.5% of the full-employed people in 2005 have gone into retirement. This leads us to incorporate the retired people in our analysis. Table 2 illustrates the three treatment group we have constructed, both incorporating and excluding the retiree people in the treatment groups.

Table 2: Size and decomposition of Treatment and Control Groups

Treatment group	Employment Status in year 2009	Number of Treatment Observations	Number of Control Observations
1	Unemployed	42	
	Part-time Employed	21	
	Retired	92	
	Total	155	816
2	Unemployed	42	
	Part-time Employed	21	
	Total	63	816
3	Retired	92	816
	Total	92	816

Following the definitions given in equations 21-23, we have constructed the treatment and control groups for our analysis. Compared to table one, the frequencies seem different because we have excluded those observations, who reports more than 52 trips in either of the year 2005 or 2009.⁹ This reduces the control group size from 848 to 816. Similarly we adjust the treatment group sizes as well. Expectedly, the treatment group one is the largest in size consisting 155 treatment observations in total, as it includes retired group besides unemployed and part-time employed.

Information on participation, average number of trips, and demographics across treatment and control groups are reported in Table 3. The participation variable is a dummy variable, which simply takes into account whether an individual in our sample takes a trip or not. This depicts the trip taking pattern in extensive margin. Participation on average remains unchanged for the control group people across the years 2005 and 2009. It is because the number of recreationists start participating in lake recreation in year 2009 exactly equals the number of people who previously took some trip but have stopped taking any trip in 2009. This is

⁹ Restriction of 52 trips in one year is to account for explicit day trips. Because some survey respondents might live near a lake, casually visit the lake while passing, and report inflated number of total trips.

seemingly a by chance event. However, participation increases for treatment group 1 and 2 while decreases for treatment group 3.

Table 3: Participation, Total Trips, and Demographics across Year and Treatment Group

	Control Group		Treatment Group 1		Treatment Group 2		Treatment Group 3	
	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.
Participation								
Participation in 2005	0.68	.016	0.60	0.039	0.57	0.063	0.62	0.051
Participation in 2009	0.68	.016	0.66	0.038	0.75	0.055	0.61	0.051
Total Trip								
Total Trip in 2005	7.4	0.36	7.1	0.93	4.7	0.93	8.7	1.4
Total Trip In 2009	6.9	0.35	6.8	0.78	5.6	0.94	7.6	1.2
Demographics								
Pre-recession Year: 2005								
Age	4.4	0.026	5.1	0.072	4.7	0.11	5.4	0.089
Gender	1.2	0.016	1.3	0.041	1.4	0.066	1.3	0.052
Education	3.4	0.036	3.3	0.09	3.1	0.14	3.3	0.12
Number of children in Household	0.94	0.042	0.31	0.058	0.49	0.11	0.18	0.062
ownership of boat	1.3	0.029	1.3	0.069	1.4	0.1	1.2	0.093

For total trip, the pattern is little different. For control group, treatment group1 and 3, mean trip has decreased in 2009 from year 2005. But for the second treatment group, mean number of trips has actually increased in 2009. Since treatment group 2 is behaving differently compared to treatment group 1 and 3, it gives us indication of possible differences in recreation behavior of retired people vs. unemployed and part-time employed people.

6. Results & Discussions

A. Propensity Score Estimation

The matching is conducted based on propensity scores. First, we estimate the logistic regression to construct propensity score for each of the individual in each sample group. Table A1-A3 in the appendix report propensity score regression results for each of the three samples including same controls but three different treatment groups. Again, as discussed in section 4, the propensity score equation has incorporated all the variables from our available information set that might be relevant for outcome equation as well as probability of being in the treatment group. All of the interaction terms and polynomials are included in the score estimation process so that matching based on those propensity scores satisfies conditional independence assumption. For treatment group one, education, number of children, gender and interaction between age and education turns out to be significant predictor of ones probability of being affected by the recession. Similarly, for treatment group 3, education, interaction between age and education, and polynomial terms of age turns out to be statistically significant predictors of one's chance to be retired during the recession. For treatment group 2 we do not find any significant predictor for one's chance to be unemployed or experience shrink in work hours, which might be due to small size of the treatment group (63 individuals). Since the purpose of these regression estimates is to obtain propensity scores, based on which we would conduct matching, we are not focusing here interpreting the parameters.

We then utilized this propensity scores to match each treatment individual with appropriate counterfactuals following five matching algorithms (i) Nearest Neighbor matching without replacement, (ii) Nearest Neighbor with replacement, (iii) Nearest 5 Neighbors, (iv) Radius matching within caliper of 0.01, and (v) Radius matching within caliper of 0.05. All these five matching techniques have been tried for each of the three treatment groups in our analysis. All of the matching estimation is conducted utilizing package “*psmatch2*” in STATA 10. We conduct the balancing test for all of our covariates utilized in the propensity score estimation after completing each of the matching process discussed above. In all the cases, although there were statistically significant differences across the treatment and control group while unmatched; the covariates balance after the matching is done. The satisfaction of balancing condition

illustrates that the average values of the covariates do not show any statistically significant difference across the treatment group and matched control group.

B. Impact on Participation

Table 4 and 5 below present the impact of recession on participation in lake recreation for people who experienced employment status change during recession. For treatment group 1, only nearest five neighbors matching out of five matching algorithms we apply here show that the treatment group participates in outdoor lake recreation more compared to control group. In the nearest five neighbors matching, to form the counterfactual we match each treatment individual with five individuals with similar likelihood to experience employment status change during the recession but who did not actually experience any such change. These employment-status affected individuals are 10.8 percentage points more likely to participate in at least one lake-trip compared to non- affected individuals. This is different from what we see from unmatched comparison: the treated group shows less average participation compared to the unmatched control group although the difference is not statistically significant. However, we need to be careful in interpreting the results in a causal manner since other matching algorithms did not show any such impact.¹⁰

The retired individuals might have different recreation preference compared to those of unemployed and part-time employed group. So, we split our treatment group one into two groups: one excluding the retired people (group 2) and the other is including only retired people (group 3). Table 4 shows that after decomposing the treatment group with employed and part-time employed people, 4 matching techniques including nearest neighbor matching with and without replacement, nearest five neighbors matching and matching within a radius caliper of 0.01, reveal statistically significant impact of unemployed or part-time employment during recession on participation in taking lake recreation.

¹⁰ In this paper we report the treatment effect (ATT) is statistical significant only if the p value is at least less than or equal to 0.1. In calculating the p-value, the standard errors are constructed based on 1000 replication of bootstrapping sample. Each bootstrap sample calculates the propensity score and matching in that sample is done based on that score.

Table 4: Estimates of Average Treatment Effect on the Treated for Participation in Lake Recreation

Matching Algorithm	Treated	Controls	Difference	Bootstrapped S.E.	t-stat
Treatment Group1: includes unemployed part-time employed and retired					
Unmatched	0.665	0.675	-0.011	0.041	-0.26
Nearest Neighbor without replacement	0.664	0.586	0.079	0.056	1.41
Nearest Neighbor with replacement	0.664	0.546	0.118	0.090	1.32
Nearest 5 Neighbors	0.664	0.557	0.108	0.063	1.72
Radius (caliper=0.01)	0.664	0.590	0.074	0.054	1.36
Radius (caliper=0.05)	0.664	0.605	0.060	0.052	1.15
Treatment Group2: includes unemployed and part-time employed					
Unmatched	0.746	0.675	0.071	0.061	1.160
Nearest Neighbor without replacement	0.742	0.565	0.177	0.083	2.13
Nearest Neighbor with replacement	0.742	0.548	0.194	0.115	1.69
Nearest 5 Neighbors	0.742	0.584	0.158	0.077	2.06
Radius (caliper=0.01)	0.742	0.637	0.104	0.067	1.57
Radius (caliper=0.05)	0.742	0.648	0.094	0.065	1.45
Treatment Group3: includes only retired people					
Unmatched	0.609	0.675	-0.067	0.052	-1.29
Nearest Neighbor matching without replacement	0.615	0.549	0.066	0.075	0.87
Nearest Neighbor with replacement	0.615	0.549	0.066	0.105	0.62
Nearest 5 Neighbors	0.615	0.602	0.013	0.081	0.16
Radius (caliper=0.01)	0.615	0.586	0.029	0.078	0.37
Radius (caliper=0.05)	0.615	0.596	0.019	0.068	0.28

For these matching techniques, the numbers on mean differences states that an average individual who were employed in 2005 but either lost employment or turned into part-time employed during the recession might be 10.4-17.7 percentage points more likely to recreate in any of the Iowa lakes compared to what she would have done if were still full-time employed during a recession year. This is completely different from what we have seen for treatment group one above.

To investigate how the retired group people behave, we apply the same matching processes again taking the retired people only in the treatment group. The bottom panel in Table 4 displays that for the retired only people, none of the five estimates of ATT turn out to be significant. It indicates that people who were employed before, but retired during the recession does not start participating more in lake recreation. The recession period retirees' average participation is in no way different from that of their counterfactuals. So, recession does not boost their participation behavior in outdoor lake recreation.

In the matching processes discussed above, although we assume no selection on observables, there can still be confounding unobservable factors hiding the true causal relationship between employment change during recession and participation in lake recreation. There might exist unobservable time variant confounding factors such as one's location or distance of residence from the lakes. We do not use any control for one's residence amenities or attributes in this analysis. An individual residing near lakes but not used to taking any lake trip for recreation before recession may find it relatively easier and cheaper to make some trips after experiencing employment change during the recession due to having more available time and negligible cost of making a trip. On the other hand, one who is living at a place with no lakes in the surrounding amenities, but was used to taking trips before recession might find it relatively expensive to make trips after being affected by employment change during recession. Let us call the former individual as type A, and the later as type B. Without taking into account of influences of location and distance, if we match a type A treatment individual with a control observation who lives in a lake-rich county, and is used to taking lake trips anyway, we will not capture true changes in recreation participation from change in employment status. Similarly, we may end up matching a type B individual with controls who are dissimilar in terms of locational attributes. In such cases if we use the difference in difference (DID) matching, we would use

information on an individual's participation in lake recreation both before and during the recession, which would help us netting out the effects of such time invariant unobservable factors. Heckman, Ichimura, and Todd(1997) and Smith and Todd(2005) strongly recommends using difference-in-difference approach when geographic and other individual specific fixed factors might play potentially confounding role.

The DID matching results for participation are presented in table 5. For treatment group 1, the results in table 5 are in contrast to those in table 4. For all of the different methods of matching, we notice significant differences between treatment and control people in terms of their participation in lake visits. When we exclude the retired group and conduct DID matching on unemployed and part-time employed people only (treatment group2), all of the matching processes show significant impact of unemployment and part-time employment during recession on participation in taking outdoor lake trip. This is indicating that the people who lost employment or experience contraction in working hours during recession have a tendency in taking trips in lakes in Iowa.

In the analysis with treatment group two, all of the mean differences between the affected group and the counterfactual group are bigger in size compared to those with treatment group one. We check if this size difference is due to reduced trip participation by retired group. To investigate this, we repeat the whole DID matching process including retired people only in the treatment group. Bottom panel of table 5 depicts that none of the matching processes except one of nearest neighbor matching with replacement indicate any statistically significant impact of retirement during recession on participation in lake recreation. However, although these estimates do not suggest any statistically significant impact on the lake recreation participation of the retiree group, their mean difference between participation in 2005 and participation in 2009 is negative. These negative numbers reveal that retiree people participated less in outdoor lake recreation during the recession year compared to the pre-recession year, which explains the relatively larger size of estimated impact for treatment group two compared to treatment group one. This again imply that the impact of recessionary employment shocks we obtain for treatment group 1 is basically driven by the stronger and larger effect from the unemployed and part-time employed group, i.e., treatment group 2. However, the treatment group two is smaller compared to the treatment group 3 (63 vs. 92observations).

Table 5: Average Treatment Effect on the Treated estimates for participation in lake recreation from Difference in Difference matching.

Matching Algorithm	Treated	Controls	Difference	Bootstrapped S.E.	t-stat
Treatment Group1: includes unemployed, part-time employed and retired					
Unmatched	0.065	0.000	0.065	0.044	1.48
Nearest Neighbor w/o replacement	0.059	-0.079	0.138	0.058	2.37
Nearest Neighbor w replacement	0.059	-0.191	0.250	0.088	2.85
Nearest 5 Neighbors	0.059	-0.087	0.146	0.061	2.38
Radius (caliper=0.01)	0.059	-0.067	0.126	0.059	2.15
Radius (caliper=0.05)	0.059	-0.046	0.105	0.054	1.94
Treatment Group2: includes unemployed and retired					
Unmatched	0.175	0.000	0.175	0.065	2.67
Nearest Neighbor w/o replacement	0.161	-0.145	0.306	0.1	3.07
Nearest Neighbor with replacement	0.161	-0.113	0.274	0.12	2.28
Nearest 5 Neighbors	0.161	-0.055	0.216	0.089	2.42
Radius (caliper=0.01)	0.161	-0.023	0.185	0.079	2.26
Radius (caliper=0.05)	0.161	-0.017	0.178	0.083	2.24
Treatment Group3: includes Only Retired People					
Unmatched	-0.011	0.000	-0.011	0.054	-0.20
Nearest Neighbor w/o replacement	-0.011	-0.077	0.066	0.072	0.91
Nearest Neighbor with replacement	-0.011	-0.209	0.198	0.113	1.75
Nearest 5 Neighbors	-0.011	-0.055	0.044	0.078	0.57
Radius (caliper=0.01)	-0.011	-0.073	0.062	0.074	0.83
Radius (caliper=0.05)	-0.011	-0.042	0.031	0.063	0.49

C Impact on Total Trips

Besides participation, another important question of our interest was how the total number of trips changes for an individual in response to an employment shock during recession. Similar to the analysis for participation, we did the analysis for total number of trips as well. From our arguments presented in sections on literature review and theoretical motivations, we infer that it may increase, decrease, or remain unchanged. However, in the propensity score matching analysis, none of the treatment groups show any significant impact of employment change during recession on total number of trips. Table 6 reports the findings for total number of trips. Although the differences across treatment and control group were not statistically significant, the mean number of trips for the treatment group one and three are higher compared to those of their corresponding matched controls. But this pattern turns reverse for treatment group two, in which case mean total trips for the unemployed and part-time employed people are almost always lower than their corresponding counterfactuals, i.e., total number of trips decreases for treatment group two. However, the statistical insignificance of the mean differences does not support any impact from recession on total number of trips. Yet, we need to be cautious in interpreting these estimates as zero impact of unemployment (or, reduction in work hours during recession) on individual's frequency of trips, since there is possibility of confounding affects from unobservable factors.

Table 6: Estimates of Average Treatment Effect on the Treated for Total Number of Lake-Trips

Treatment Group1 : includes unemployed part-time employed and retired

Matching Algorithm	Treated	Controls	Difference	Bootstrapped S.E.	t-stat
Unmatched	6.806	6.933	-0.126	0.868	-0.15
Nearest Neighbor w/o replacement	6.888	5.901	0.987	1.099	0.89
Nearest Neighbor w replacement	6.888	5.007	1.882	1.88	1.00
Nearest 5 Neighbors	6.888	6.068	0.820	1.298	0.63
Radius (caliper=0.01)	6.888	6.875	0.013	1.216	0.01
Radius (caliper=0.05)	6.888	6.921	-0.032	1.10	-0.029

Treatment Group2: includes unemployed and part-time employed

Unmatched	5.619	6.933	-1.314	1.278	-1.03
Nearest Neighbor matching w/o replacement	5.645	6.306	-0.661	1.577	-0.42
Nearest Neighbor w replacement	5.645	5.113	0.532	2.427	0.22
Nearest 5 Neighbors	5.645	6.519	-0.874	1.408	-0.63
Radius (caliper=0.01)	5.645	6.781	-1.136	1.256	-0.91
Radius (caliper=0.05)	5.645	7.069	-1.424	1.089	-1.31

Treatment Group 3: includes Only Retired People

Unmatched	7.620	6.933	0.687	1.105	0.62
Nearest Neighbor w/o replacement	7.703	6.187	1.516	1.584	0.96
Nearest Neighbor w replacement	7.703	5.659	2.044	2.357	0.87
Nearest 5 Neighbors	7.703	7.404	0.299	1.831	0.16
Radius (caliper=0.01)	7.703	7.147	0.556	1.788	0.31
Radius (caliper=0.05)	7.703	7.526	0.177	1.559	0.11

Similar to the arguments presented for participation, we suspect the confounding impact from unobservable factors for total trips as well. To control for the time invariant unobservable, we conduct DID matching for all of the three treatment groups. DID estimator would help to wipe out the mean effects from individually varying but time-constant unobservable factors. Table 7 lists the DID results. For treatment group 1, utilizing the DID estimators, we did not find any significant impact of employment change during recession on total number of trips. For the treatment group 2, 2 out of 5 matching methods show that there exists some marginally statistically significant impact of unemployment and part-time employment on one's frequencies of outdoor lake trips. Nearest neighbor matching with and without replacement and caliper matching within a radius of 0.01 shows that once we control for time varying unobservable, unemployed and part-time employed people during recession experience an increase in total number of lake-trips compared to those who do not experience any such employment shock during recession. This positive affect on total number of lake trips might be attributed to couple of factors as we discussed in section 2 and 3; lake recreation might be an inferior good, or unemployed individuals during recession are on average risk lovers, or they might have allocated a portion of released time for lake recreation. But we cannot exactly disentangle which factors are working. Similar to the analysis for participation, the estimates do not show any impact of retirement during recession on the total number of trips taken. The finding is robust across matching estimators we used. The DID matching did not change this pattern as well. None of the mean differences in table 6 and 7 turn out to be statistically significant. People retiring during the recessionary pressure do not seem to change their total lake recreation trips compared to total trips they would take had they been still employed.

We checked the balancing property here as well. All of the covariates across the treatment and control group turn out to balance well after matching. Figure A1, A2, and A3 in the appendix show the histogram of matched treatment and control as well as non-matched treatment for our three treatment groups respectively. For treatment group 1 and 3, we have 1 treated observation which did not find any match while for treatment group 2, 3 treatment observations did not find any match. So, during the mean comparison, we did not consider the treatments that are out of the common support.

Table 7: Estimates of Average Treatment Effect on the Treated for Total Number of Trips from Difference in Difference Matching

Matching Algorithm	Treated	Controls	Difference	Bootstrapped S.E.	t-stat
Treatment Group includes unemployed part-time employed and retired					
Unmatched	-0.265	-0.422	0.157	0.756	0.21
Nearest Neighbor w/o replacement	-0.309	-1.711	1.401	1.029	1.36
Nearest Neighbor w replacement	-0.309	-1.559	1.250	1.389	0.91
Nearest 5 Neighbors	-0.309	-0.918	0.609	1.062	0.57
Radius (caliper=0.01)	-0.309	-0.742	0.433	0.986	0.44
Radius (caliper=0.05)	-0.309	-0.768	0.459	0.893	0.51
Treatment Group includes unemployed and retired					
Unmatched	0.921	-0.422	1.342	1.111	1.21
Nearest Neighbor w/o replacement	0.871	-2.032	2.903	1.44	2.01
Nearest Neighbor w replacement	0.871	-2.161	3.032	2.065	1.47
Nearest 5 Neighbors	0.871	-0.990	1.861	1.355	1.38
Radius (caliper=0.01)	0.871	-0.901	1.772	1.11	1.60
Radius (caliper=0.05)	0.871	-0.377	1.248	1.034	1.21
Treatment Group includes Only Retired People					
Unmatched	-1.076	-0.422	-0.655	0.959	-0.68
Nearest Neighbor w/o replacement	-1.088	-0.890	-0.198	1.335	0.15
Nearest Neighbor with replacement	-1.088	-1.571	0.484	1.788	0.27
Nearest 5 Neighbors	-1.088	-0.424	-0.664	1.421	-0.47
Radius (caliper=0.01)	-1.088	-1.207	0.119	1.417	0.08
Radius (caliper=0.05)	-1.088	-0.805	-0.283	1.244	-0.23

7. Conclusion

In this paper we take an attempt to measure the impact of employment status change during recession on Iowans' lake recreation behavior. The theory motivates that in the face of a recessionary shock, an individual might increase or decrease taking lake-recreation trips or, even keep such demand unchanged depending on her evaluation of lake recreation as normal or inferior good, risk attitude, and preference for consumption smoothing. The Iowa lake survey panel data provides us an opportunity to investigate on how recreationists' participation as well as frequencies of lake trips actually responds to employment shock during recession. Exploiting various non-parametric matching techniques, including *difference in difference* matching that utilizes same individual's information before and during the recession, our analysis show that Iowans, who experience an unemployment or reduction in working hours during recession, participate more in lake recreation. However, one might argue that such positive effects on recreation might be confounded by the actions from voluntarily retired group, since relatively older people might have strong preference for outdoor recreation, and thus, might choose early retirement facing a recession. Taking the retired group both within the treatment group comprising the unemployed and part-time employed, as well as in a separate treatment group, we confirm that people going into retirement during a recession do not exhibit any systematic differences in recreation behavior compared to their full-time employment status. Interestingly, none of the treatment groups show any statistically significant changes in frequency of trips during the recession. Changes in employment status did not affect how many times an individual would take lake trips for recreation: Iowans were visiting lake as frequently as they were doing before the recession.

The positive and upward pattern in recreation behavior is observed only for individuals who turned into unemployed or part-time employed during recession from a previously full-employment status. The findings suggests that individual who was not a recreationist might experience a lower opportunity cost of time to be able make a trip due to less restriction from work hours during recession. Similarly an individual experiencing an employment shock during recession, who was a lake recreationist before the recession, might utilize the available time

resources from unemployment or underemployment for cheap lake recreation trips. Several cautions are due before exploiting these results for any policy implications.

We are aware of the problems associated with standard errors in the propensity score matching analysis. The standard errors we report in various cases utilize bootstrapping method. However, Abadie and Imbens (2006) criticized bootstrapping and argued that there is no formal evidence to justify bootstrapping for nearest neighbor matching. Again, we conduct the matching with replacement in most of the cases to improve the quality of matches by reducing bias. But this comes at the cost of efficiency.

Our findings would inform the policymakers for public investment in natural resource based development. Since demand for recreations in lakes is found to be stable and unaffected by economic shocks such as recession, it would imply that public amenity-based, rural, non-farm economic activities as well as employment are recession proof. Although we have accounted for effects of mean time unvarying unobservable, we still recognize that we might end up finding estimates confounded by time-variant fixed factors. For example, rural areas and metropolitans might be affected differently during a recession. Unemployment status across regions in the pre-recession year might be affected differently from that during a recessionary year. So matching individuals within a specific region deserves merits to control for such time variant confounding effects. Future research on this paper would also take care of this.

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Appendix

Table A1: Propensity Score Estimation Results for Treatment Group 1

<i>Probit</i> Model Estimation			Number of observations= 971	
LR chi2(9) = 134.43			Prob > chi2 = 0.0000	
Log likelihood = -359.105			Pseudo R2 = 0.1577	
Variables	Coefficients	Std. Err.	z	P> z
Age	-3.26	2.96	-1.10	0.27
Age square	0.77	0.65	1.19	0.23
Age-cube	-0.04	0.05	-0.96	0.34
Gender	0.17	0.36	0.47	0.64
Education	0.53	0.35	1.51	0.13
Age*Education	-0.12	0.06	-1.88	0.06
Education*Gender	0.03	0.10	0.29	0.77
Number of Children in Household	-0.13	0.07	-2.05	0.04
Ownership of boats	-0.03	0.06	-0.51	0.61
constant	1.61	4.61	0.35	0.73

Table A2: Propensity Score Estimation Results for Treatment Group 2

<i>Probit</i> Model Estimation			Log likelihood = -213.25	
Number of obs = 879			Prob > chi2 = 0.0026	
LR chi2(10) = 26.96			Pseudo R2 = 0.059	
Variables	Coefficients	Std. Err.	z	P> z
Age	-0.43	4.35	-0.10	0.92
Age square	0.13	0.96	0.13	0.90
Age cube	0.00	0.07	-0.06	0.95
Gender	0.35	0.44	0.79	0.43
Education	0.27	0.43	0.61	0.54
Age*Education	-0.08	0.08	-0.96	0.34
Education*Gender	0.01	0.13	0.05	0.96
Number of Children in Household	-0.12	0.08	-1.60	0.11
Ownership of boats	0.05	0.08	0.63	0.53
constant	-1.97	6.64	-0.30	0.77

Table A3: Propensity score estimation results for treatment group 3

Probit Model Estimation			Number of obs	=	908
LR chi2(9)	=	166.99	Prob > chi2	=	0.0000
Log likelihood	=	-214.3107	Pseudo R2	=	0.2804
Variable	Coefficients	Std. Err.	z	P> z	
Age	-5.56	3.84	-1.45	0.15	
Age square	1.66	0.83	1.99	0.05	
Age cube	-0.11	0.06	-1.93	0.05	
Gender	0.18	0.46	0.40	0.69	
Education	1.99	0.58	3.43	0.00	
Age*Education	-0.36	0.10	-3.58	0.00	
Education*Gender	-0.01	0.13	-0.10	0.92	
Number of Children in Household	-0.15	0.10	-1.53	0.13	
Ownership of boats	-0.08	0.08	-1.06	0.29	
constant	-1.16	6.22	-0.19	0.85	

Figure A1: Distribution of Propensity score by treatment Status for Treatment Group 1.

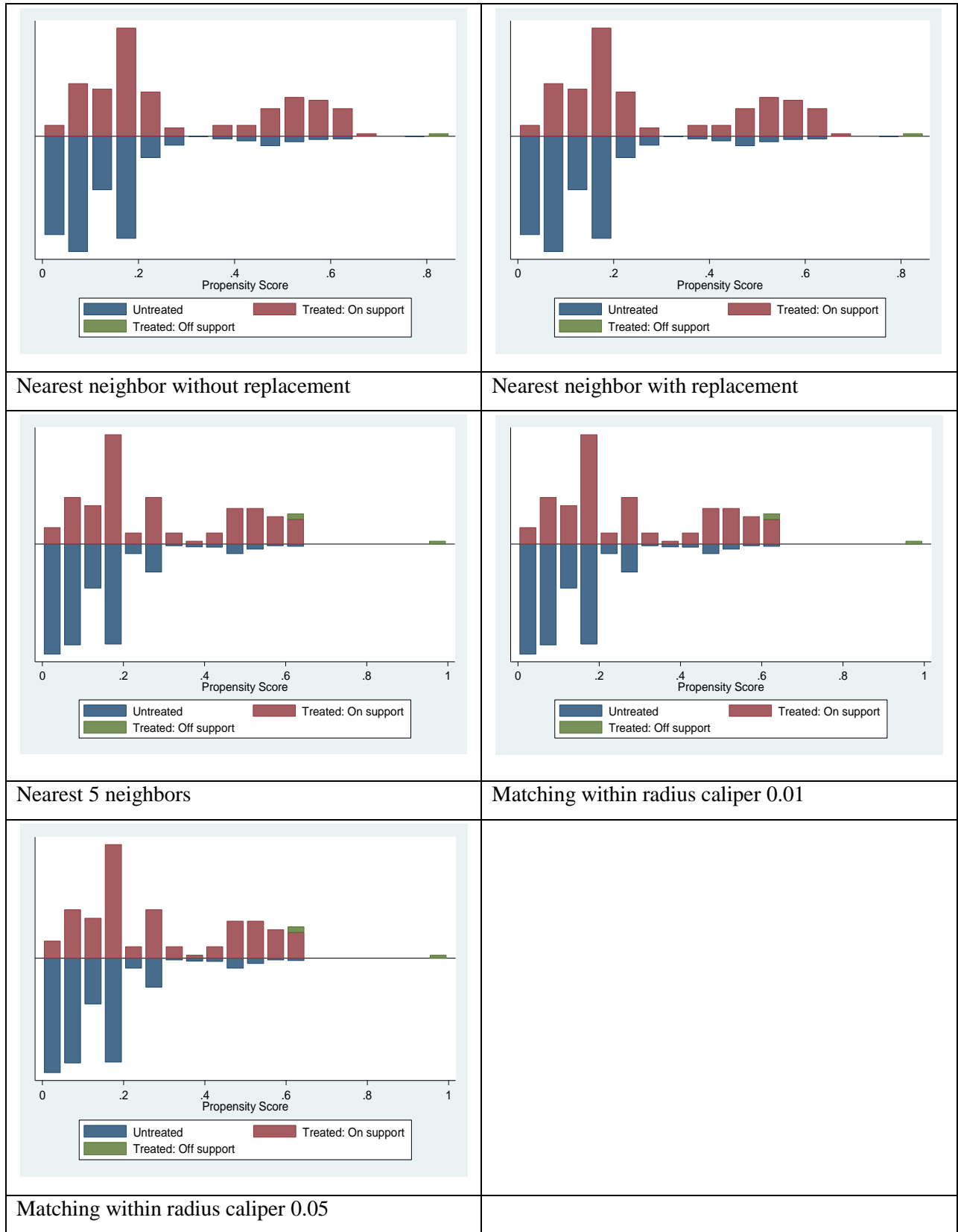


Figure A2: Distribution of Propensity score by treatment status for Treatment Group 2

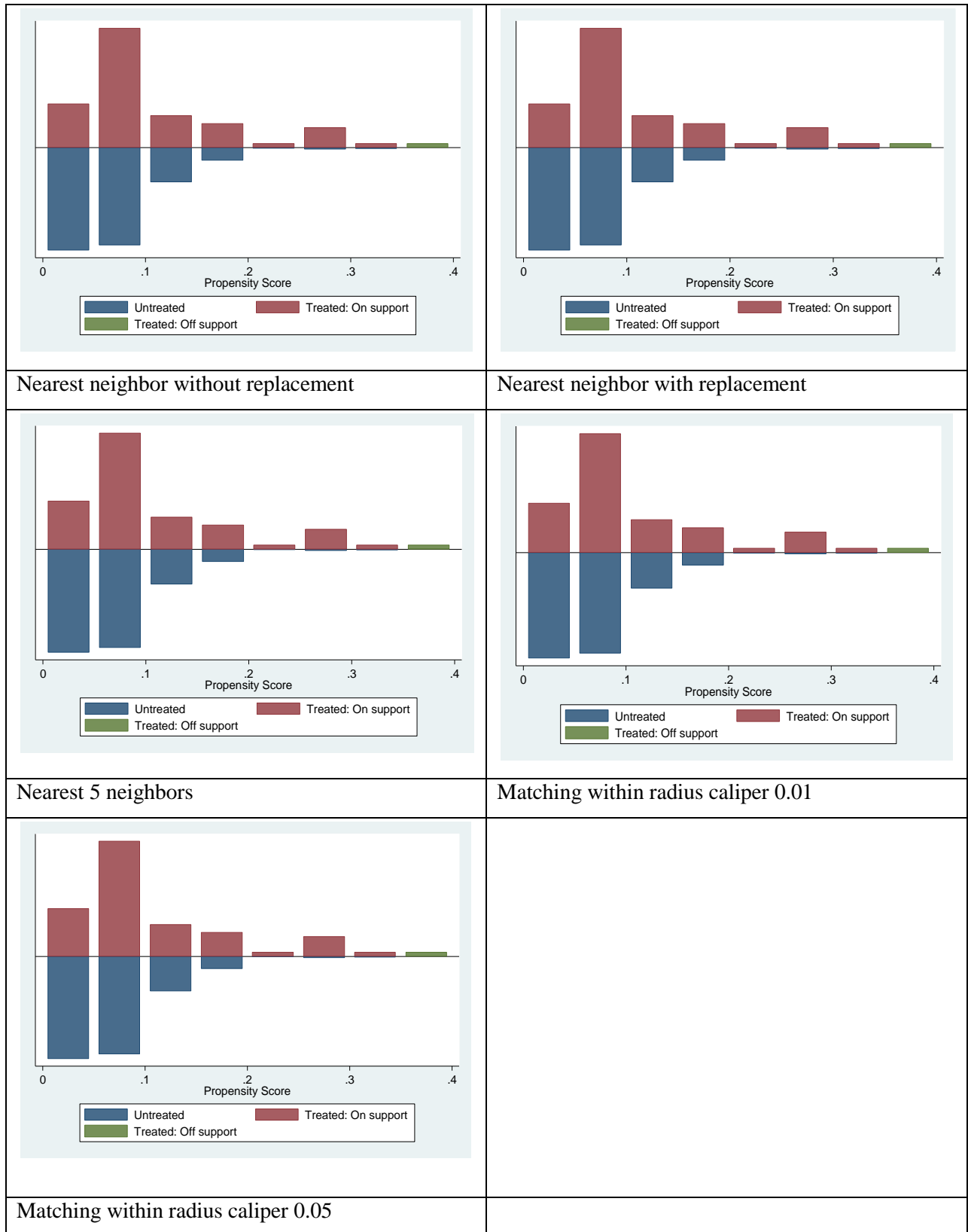


Figure A3: Distribution of Propensity score by treatment Status for Treatment Group 3.

