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Jonah H. Chilton April 18, 2012

Happiness and Parks: An Empirical Approach

By

Jonah H. Chilton

Dr. Sue H. Mialon

Adviser

Department of Economics

Dr. Sue H. Mialon

Adviser

Dr. Tilman Klumpp

Committee Member

Dr. Richard Prior

Committee Member

2012

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Jonah H. Chilton

Dr. Sue H. Mialon

Adviser

Department of Economics

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Abstract

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This paper investigates the empirical relationship between parks and subjective happiness. Using a data set of 3,143 United States counties, I show that increasing the number of parks per 25,000 people by one will increase the proportion of happy population by .04%. I argue that building a new park is more effective than augmenting the size of an existing one. The results suggest that accessibility is an important factor in the efficacy of the provision of public parks.

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List of Tables

I. Introduction

In 2006, nearly 30 billion dollars were allocated to state and local park budgets. User and park entrance fees generated 15% of these funds; the remaining 85% came from tax dollars (Walls, 2009). It is imperative that policy makers determine the impact of such park investments, thereby ensuring this large sum of tax dollars is spent effectively. The impact of spending on public goods is typically analyzed using monetary measures. From a pure cost-benefit perspective, these measures allow for easy comparison. However, many public goods, especially parks, provide individuals with a level of "intangible" benefit. This benefit can be quantified by subjective well-being, and is an essential piece in the analysis of the impact of public good provision.

This paper examines the empirical relationship between happiness and parks at the county level. The results establish that parks have a positive and significant effect on happiness. An addition of one park per 25,000 people increases the proportion of happy population by .04%. The data also show that building new parks is a more effective tool for increasing welfare than augmenting the size of existing ones. The primary model uses OLS, and robustness is demonstrated over a generalized linear model and variable selection. This study is a first attempt at analyzing the welfare impact of the public provision of parks. The results will show policy makers that parks are effective in increasing well-being, and can advise them on the most efficient way of allocating investments of this type.

This paper is loosely related to several strands of prior happiness research. In 1974, Richard Easterlin pioneered the economic study of happiness with his paper "Does

Economic Growth Improve the Human Lot?" His results showed that happiness does not necessarily increase with income (Easterlin, 1974). Since then, a number of economists have attempted to quantify the well-being impact of changes in social and economic variables. For example, Di Tella showed that unemployment and inflation have a negative effect on well-being (Di Tella, MacCuloch, & Oswald, 2001). A 2004 study by Blanchflower & Oswald demonstrated a positive relationship between marriage, sex, and happiness (Blanchflower & Oswald, 2004). Other studies measure leisure (Eriksson, Rice, & Goodin 2007), life expectancy, (Papavlassopulos & Keppler, 2011), and freedom (Frey & Stutzer 2000).

Section II provides an overview of the data used in this study. Section III introduces the primary model, and discusses analysis of the data. Section IV demonstrates various checks for stability of estimations, and Section V offers concluding remarks.

II. Data

The data for this study consist of county-level variables for all 3,143 United States counties[1]. Unless otherwise noted, all variables are from 2008. This section focuses primarily on well-being and parks data. For a discussion of the full list of variables, their sources, and estimation methodologies, see Appendix I. Table 1 presents summary statistics for all variables used in this analysis. Note that 5 outliers were dropped from the population density set.

[1] A county is a geographic subdivision of a state. 48 out of 50 states call these subdivisions counties. Louisiana is divided into parishes, and Alaska into boroughs. The United States Federal Government labels boroughs and parishes as "county-

Table 1. Summary Statistics

Variable	Mean	Std. Dev.	Min	Max	Observations
% Happy with Life	61.48%	4.52%	40.57%	84.47%	3116
Number of Parks[1]	4.39	12.086	0	427.35	3139
Parkland Area[2]	2859.8	25577.4	0	989249.4	3139
Number of Parks (Radius)[3]	450.65	1170.99	0.58	43803.42	3138
Parkland Area (Radius)[4]	9390.3	46098.74	0.78	1104739	3139
Population Density	174.13	556.22	0.02	9537.39	3135
% Obese	28.93%	3.71%	11.7%	43.7%	3141
% With Diabetes	9.91%	2.06%	3%	18.2%	3141
% Unemployment	5.8%	2.08%	1.3%	22.3%	3140
% In Poverty	15.24%	6.06%	3.1%	54.4%	3141
Median Household Income	44177.31	11459.61	19182	111582	3141
% White	87.15%	16.04%	6.42%	100%	3142
% Married	12.26%	1.3%	4.55%	17.58%	3141
Median Family Size	3.2	0.23	2.6	5.21	3097

For detailed definition of variables, see Appendix I.
1. Number of Parks per 25,000 people.
2. Square Miles of Parkland per 25,000 people.
3. Number of Parks per 25,000 people within a 200-mile radius calculated around the geographical center of each county.
4. Square Miles of Parkland per 25,000 people within a 200-mile radius calculated around the geographical center of each county

Well-Being Data. Well-being data were taken from the SimmonsLOCAL Fall 2008 full year consumer survey. The survey measures 210 American DMA's (Designated Market Areas) with data estimated down to the block group level using samples averaging 30,000 per market for ages 18+. Individuals were asked to respond to the statement "I am very happy with life as is." The data were grouped by response into three aggregate categories: "any agree," and "any disagree," and "neither agree nor disagree[2]. For the purpose of this analysis, I assume that well-being data is cardinal level comparable[3].

[2] The original survey consists of the five response categories "disagree a lot," "disagree a little," "agree a little, "agree a lot," and "neither agree nor disagree."
[3] For a full discussion of comparability in well-being data, see (Ng 1996) and (Kahneman, Wakker, & Sarin, 1997).

Parks Data. All parks data are from 2010 and were gathered using the Geographical Information System (GIS)[4]. Number of parks is the total number of local, county, state, and national parks in a county. Parkland area is the square miles of parkland in a county. To account for the notion that a resident has access to parks outside of his county, data for number of parks and square miles of parkland were gathered for a two hundred mile radius around the geographical center of each county. A park and its total area were counted if any part of that park fell within the county border (or calculated radius). Parks variables were converted to a per 25,000 population format to account for heterogeneity coming out of population size. For the remainder of this study, I will refer to these variables as parks, parks (radius), parkland area, and parkland area (radius).

III. Results

The Model. The primary empirical approach is to estimate a simple linear equation of the following form:

$$(1)\ Y_i = \beta_0 + \beta_1 PARKS_i + \beta_2 POPDEN_i + \beta_3 OBESE_i + \beta_4 UNEMPL_i + \beta_5 POVERTY_i + \beta_6 MEDINCOME_i + \beta_7 DIABETES_i + \beta_8 WHITE_i + \beta_9 MARRIED_i + \beta_{10} FAMSIZE_i + \varepsilon_i$$

In (1), for county i, Y denotes the percentage of happy population, PARKS denotes one of the four measure of park access, POPDEN denotes population density, MEDINCOME denotes median family income, FAMSIZE denotes median family size, and OBESE, UNEMPL, POVERTY, DIABETES, and WHITE denote the percentage of obese, unemployed, impoverished, diabetic, and white population. ε_i denotes the

[4] Parks data are from 2010 while all other data are from 2008. The comparability issues are minimal as park infrastructure change is slow and varies only slightly with a marginal change in time.

error term for county i. The model is designed to demonstrate the marginal effect of an increase in parks on happiness. I anticipate that parks will have a positive effect on happiness, as parks provide leisure space, aesthetic pleasure, increased quality of air, and a number of other benefits. Obesity and diabetes variables were included as a proxy for overall physical health. I anticipate that these variables will correlate negatively with happiness, as poor health can cause discomfort, and reduce an individual's ability to earn wages. I also anticipate that poverty will correlate negatively with happiness, as it can greatly impede the ability to acquire a basic set of needs. Unemployment was shown to decrease well-being in a 2001 study by Rafael Di Tella (Di Tella, MacCuloch, & Oswald, 2001). I expect to find the same relationship, as unemployment increases financial uncertainty, and can hinder an individual's sense of purpose. Conversely, marriage has been shown to correlate positively with happiness (Blanchflower & Oswald, 2004).

Main Results. Table 2 shows four regressions in the form of (1). These regressions represent the principal economic model of this analysis, and stem from the hypothesis that parks have a positive effect on well-being. Regression (1) shows a strong and statistically significant effect of parks on the percentage of happy people. Increasing the number of parks per 25,000 people (the median county size) by one will lead to a .04% increase in the percentage of happy people in a county. These results demonstrate that the provision of parks is an effective tool for increasing welfare.

The signs on the control variable coefficients match previous expectations. Obesity, unemployment, poverty, diabetes, and a population density

Table 2. The Effect of Parks on Happiness

	% Happy with Life			
Parks Measure (*):	(1) Number of Parks[1]	(2) Number of Parks (Radius)[2]	(3) Sq. Miles of Parkland[3]	(4) Sq. Miles of Parkland (Radius)[4]
Parks Measure (*)	0.041***	0.003***	-0.0000009	-0.000002
	(4.9)	(3.21)	(-0.3)	(-1.00)
Population Density	-0.0005***	-0.0005***	-0.0004***	-0.0005***
	(-3.19)	(-3.1)	(-3.23)	(-3.27)
% Obese	-0.216***	-0.228***	-0.232***	-0.236***
	(-7.08)	(-7.47)	(-7.6)	(-7.66)
% Unemployment	-0.1413***	-0.145***	-0.142***	-0.141***
	(-3.56)	(-3.64)	(-3.56)	(-3.53)
% In Poverty	-0.067***	-0.0711***	-0.074***	-0.074***
	(-2.57)	(-2.74)	(-2.84)	(-2.84)
Median Household Income	-0.00002	-0.00003*	-0.00003**	-0.00003**
	(-1.65)	(-2.2)	(-2.22)	(-2.27)
% With Diabetes	-0.274***	-0.315***	-0.306***	-0.307***
	(-4.47)	(-5.15)	(-4.99)	(-5.02)
% White	0.018**	0.015*	0.015*	0.0151*
	(2.4)	(1.98)	(2.04)	(2.02)
% Married	0.658***	0.666***	0.669***	0.670***
	(7.38)	(7.46)	(7.47)	(7.49)
Family Median Size	0.401**	0.97**	0.872**	0.861*
	(2.46)	(2.41)	(2.17)	(2.14)
N	3066	3066	3066	3066
Adj. R	0.2098	0.206	0.2036	.2038
F-Value	0.000	0.000	0.00	0.00

For detailed definition of variables, see Appendix I.
***,**,*: Significant at 1%, 3%, and 5%.
t-values are reported in parenthesis below each coefficient.
1. Referred to as "parks."
2. Referred to as "parks (radius)."
3. Referred to as "parkland area."
4. Referred to as "parkland area (radius)."

correlate negatively with happiness, while median family size, the percentage of white population, and the percentage of married population correlate positively with happiness. The positive coefficient on percentage of white population could

suggest that diversity is negatively correlated with well-being. The average county is 87.15% white, and an increase in that proportion will lead to an even more racially uniform population. Regressions (2)-(4) check for robustness across different measures of park access. The signs and significance of all control variable coefficients remain consistent over these regressions. However, the significance and size of the coefficients on parks measures vary. Notice that the coefficient on parks (radius) is significantly smaller than the coefficient on parks. This indicates that parks inside county borders have a stronger impact on happiness than those that are outside the borders but still accessible. In other words, the data show that society places a high value on park accessibility. Increased availability of a park that is close to home provides a significantly larger increase in well-being. Regressions (3) and (4) show that the relationship between parkland area and well-being is not significant. The t-value for the coefficient on parkland area is -0.3, as opposed to 4.9 for the coefficient on parks. Thus, it is more effective to build a new park than to increase an existing park's area. This corresponds with the preceding conclusion about accessibility. Increasing a park's area has little effect on its accessibility. Therefore, it will not necessarily cause an increase in happiness. These implications contain particular value to policy makers and local politicians. Building new parks is a more effective allocation of park investment than increasing the size of an existing one. The data not only establish that parks increase happiness, but also suggest the most efficient way of allocating parks investment.

IV. Robustness Checks

This section features checks for robustness over a generalized linear model and different dependent and independent variable selections. It also discusses potential issues with multicollinearity and endogeneity.

Generalized Linear Model. Some economists have raised issues with the validity of using the OLS method on a dependent variable in proportion form[5]. As a final check for robustness, and to ensure that the normality assumption has not been violated, I use a generalized linear model with a logit link and the binomial family.

Note that in previous regressions all percentage variables were in the format XX.XX%. To facilitate the GLM regression, each percentage variable was divided by 100 to ensure that its distribution fell between 0 and 1. Table 4 demonstrates that the primary model is consistent from OLS to GLM. The parks and parks (radius) coefficients remain significant and positive in sign. Notice that the coefficients on parkland area and parkland area (radius) are insignificant across both OLS and GLM. This provides further support for the importance of park accessibility. The signs on control variable coefficients also remain consistent over both methods of estimation. Population density, unemployment, poverty, and diabetes correlate negatively with well-being, while income, family size, and the percentage of married or white population has correlate positively. Thus, the results are robust across different methods of estimation. Note that the coefficient on parks is much larger in the GLM model.

[5] See (McCullagh & Nelder, 1989) and (Nelder & Wedderburn, 1972).

Table 3. Generalized Linear Model

	% Happy with Life			
Parks Measure(*):	(1) Number of Parks	(2) Number of Parks 200-Mile Radius	(3) Sq. Miles of Parkland	(4) Sq. Miles of Parkland 200-Mile Radius
Parks Measure(*)	0.002**	0.00001*	-0.00000004	-0.00000007
	(2.2)	(1.96)	(-0.15)	(-0.38)
Population Density	-0.00002***	-0.00002***	-0.00002***	-0.00002***
	(-3.3)	(-3.24)	(-3.36)	(-3.39)
% Obese	-0.918***	-0.967***	-0.986***	-0.999***
	(-6.7)	(-6.88)	(-7.13)	(-7.35)
% Unemployment	-0.598***	-0.613***	-0.6***	-0.596***
	(-3.36)	(-3.45)	(-3.35)	(-3.33)
% In Poverty	-0.277**	-0.296**	-0.308**	-0.309**
	(-2.27)	(-2.4)	(-2.52)	(-2.52)
Median Household Income	-0.0000009	-0.000001*	-0.000001*	-0.000001*
	(-1.42)	(-1.88)	(-1.92)	(0.051)
% With Diabetes	-1.154***	-1.333***	-1.295***	-1.299***
	(-4.07)	(-4.85)	(-4.69)	(-4.72)
% White	0.07*	0.057*	0.059*	0.058*
	(2.08)	(1.67)	(1.76)	(1.73)
% Married	2.771***	2.807***	2.814***	2.821***
	(6.26)	(6.36)	(6.35)	(6.35)
Family Median Size	0.0419*	0.041*	0.037*	0.036*
	(2.1)	(2.08)	(1.85)	(1.85)
N	3066	3066	3066	3066

For detailed definition of variables, see Appendix I.
***,**,*: Significant at 1%, 3%, and 10%.
z-scores are reported in parenthesis below each coefficient.

Variable Selection. The next set of regressions checks for robustness over different sets of control variables. Table 3 demonstrates that coefficient estimates do not change erratically in response to small changes in the model. Each regression is a version of the primary model with two control variables omitted. Obesity and poverty are dropped from (1), median household income and diabetes are dropped from (2), and population density and median family size are dropped from (3). Excluding family size and household income, the signs and significance of the coefficient estimates are consistent across models. Most importantly, the coefficient

on parks remains positive and significant to 1%. As a test for multicollinearity, the VIF was calculated for all independent variables in the model. Each variable has a VIF less than 5.

Table 4. Variable Selection

	% Happy with Life		
	(1)	(2)	(3)
Number of Parks	0.05***	0.04***	0.04***
	(5.71)	(4.99)	(4.97)
Population Density	-0.0003**	-0.0006***	-
	(-2.24)	(-3.93)	
% Obese	-	-0.290***	-0.177***
		(-11.84)	(-5.98)
% Unemployment	-0.165***	-0.167***	-0.143***
	(-4.19)	(-4.23)	(-3.59)
% In Poverty	-	-0.050***	-0.083***
		(-3.11)	(-3.42)
Median Household Income	0.00001	-	-0.00003*
	(1.37)		(-2.12)
% With Diabetes	-0.515***	-	-0.27***
	(-10.04)		(-4.56)
% White	0.027***	0.031***	0.033***
	(3.82)	(4.46)	(4.72)
% Married	0.696***	0.582***	0.279***
	(7.85)	(6.7)	(4.26)
Family Median Size	0.184	1.167***	-
	(0.49)	(3.28)	
N	3066	3066	3066
Adj. R	0.1963	.2036	.1912
F-Value	0.000	0.000	0.000

For detailed definition of variables, see Appendix I.
***,**,*: Significant at 1%, 3%, and 5%.
t-values are reported in parenthesis below each coefficient.

These results show that the model is not susceptible to multicollinearity, and is robust across different control variable selections.

The Effect of Parks on Unhappiness. As a final test for stability, the regressions in Table 1 were run with percentage of unhappy population as the dependent variable.

The effect is consistent; increasing the number of parks per 25,000 by one will lead to a .036% decrease in the proportion of happy people. The full table of results can be seen in Table V at the end of this study[6].

Endogeneity. The existence of endogeneity in the well-being and parks variables may cause a bias in the estimated coefficients for the effects of parks on well-being. If the data were at the individual level, this would be a major concern because reverse causality can appear if people who place a high value on parks relocate to a place where they are prevalent. However, this model is based on the county level aggregate percentage of people who are happy. Therefore, the effect of individual preference to live in close proximity to parks is not an issue. The only issue, if any, would arise if such a choice of relocation occurs mainly across counties. However, reasons for inter-county relocation usually involve employment, finances, school zones, or personal relationships. It is doubtful that an individual would move counties because of the number of parks. Therefore, endogeneity issues are unlikely to be present.

IV. Conclusion.

This paper uses parks and well-being data to quantify the impact of the provision of parks as a public good. The results indicate that, overall, parks have a significant and positive effect on well-being at the county level. The results also indicate that park accessibility plays an important role in its effect on well-being. That is, building a new park can be more effective than increasing the size of an existing one, and a

[6] Note that the percentage of unhappy people does not equal 1 minus the percentage of happy people. The survey allowed for respondents to "neither agree nor disagree" with the statement "I am very happy with life as is."

park inside county borders is more effective than one that is outside. These results provide a statistical confirmation to policy makers that the provision of parks is beneficial to welfare. They also inform policy makers on the most effective way of increasing well-being through the parks investment.

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Data Appendix

1. Happiness

See section II.

2. Parks, Parks(radius), Parkland area, Parkland area(radius)

See section II.

3. Population Density

County area obtained from the U.S. Department of Health and Human Services: Health Resources and Services Administration; Area Resource File. Population data obtained from the U.S. Census Bureau, Small Area Estimates Branch
Population Density is the population of people per square mile. For a detailed methodology of population estimates, see http://www.census.gov/did/www/saipe/methods/statecounty/20062009county.html.

4. Obesity

Data obtained from Center for Disease Control and Prevention: National Diabetes Surveillance System. Obesity is the percentage of county population that has a body mass index of 30 or greater. For a detailed methodology of estimation, see http://apps.nccd.cdc.gov/DDT_STRS2/FAQ.aspx#countylevelestimates.

5. Diabetes

Data obtained from Center for Disease Control and Prevention: National Diabetes Surveillance System. Diabetes is the percentage of county population with diabetes. A person was considered to have diabetes if they ever answered yes to the question: "has a doctor ever told you that you have diabetes." For a detailed methodology of estimation, see http://apps.nccd.cdc.gov/DDT_STRS2/FAQ.aspx#countylevelestimates.

6. Unemployment

Data obtained from the Bureau of Labor Statistics (Local Area Unemployment Statistics). Unemployment is the percentage of county population that is unemployed. For a detailed methodology of estimation, see http://www.bls.gov/lau/laumthd.htm.

7. Poverty

Data obtained from the U.S. Census Bureau, Small Area Estimates Branch. Poverty is the percentage of county population living in poverty. For a definition of current poverty thresholds, see http://www.census.gov/hhes/www/poverty/about/overview/measure.html. For a detailed methodology of estimation, see http://www.census.gov/did/www/saipe/methods/statecounty/20062009county.html.

8. Median Household Income

Data obtained from the U.S. Census Bureau, Small Area Estimates Branch. For a detailed methodology of estimation, see http://www.census.gov/did/www/saipe/methods/statecounty/20062009county.html.

9. Percentage of White Population, Percentage of Married Population, Median Family Size.

Data are taken from the SimplyMap database. (http://geographicresearch.com/simplymap/) Data are estimated from 2000 Census (SF1, SF3, and SF4 Files), U.S. Census Bureau and Bureau of Labor Statistics Current Population Survey (Mid March 2007); American Community Survey (1/1/2008); U.S. Census Bureau, and Population Division, Population Estimates Branch.

Table 5. The Effect of Parks on Unhappiness

	% Unhappy with Life			
Parks Measure(*):	(1) Number of Parks	(2) Number of Parks 200-Mile Radius	(3) Sq. Miles of Parkland	(4) Sq. Miles of Parkland 200-Mile Radius
Parks Measure(*)	-0.036***	0.00001	-0.000004	-0.000001***
	(-5.8)	(0.19)	(-1.75)	(-1.03)
PopulationDensity	0.0005***	0.0005***	0.0005***	0.0005***
	(4.74)	(4.77)	(4.69)	(4.71)
% Obese	0.149***	0.164***	0.160***	0.160***
	(6.41)	(7.03)	(6.89)	(6.820
% Unemployment	0.0834***	0.0844***	0.087***	0.086***
	(2.76)	(2.77)	(2.88)	(2.83)
% In Poverty	0.058***	0.064***	0.063***	0.064***
	(2.93)	(3.24)	(3.15)	(3.22)
Median Household Income	0.00004***	0.00005***	0.00005***	0.00005***
	(4.5)	(5.15)	(5.02)	(5.07)
% With Diabetes	0.371***	0.396***	0.391***	0.396***
	(7.95)	(8.48)	(8.38)	(8.5)
% White	0.044***	0.046***	0.046***	0.046***
	(7.79)	(8.12)	(7.99)	(8.09)
% Married	-0.353***	-0.362***	-0.363***	-0.361***
	(-5.2)	(-5.3)	(-5.32)	(-5.3)
Family Median Size	-2.877***	-2.776***	-2.772***	-2.783***
	(-9.44)	(-9.04)	(-9.06)	(-9.09)
Constant	15.152***	13.527***	13.811***	13.71957***
	(9.6)	(8.65)	(8.8)	(8.73)
N	3066	3066	3066	3066
Adj. R	.1416	.1349	0.1311	0.1325
F-Value	0.000	0.000	0.000	0.000

For detailed definition of variables, see Appendix I.
***,**,*: Significant at 1%, 3%, and 5%.
t-values are reported in parenthesis below each coefficient.