ESRI ECONOMIC & SOCIAL RESEARCH INSTITUTE

Public park attributes, park visits, and associated health status

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VENUE
ESRI

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Conclusions

- Visit parks twice per week!

- Planning a new urban park:
  - Water features
  - Walking paths
  - Facilities (fitness, toilets and coffee shops)

Background and Literature review

- 2050: 67% of world population in urban areas (UN, 2014)
- Less exposition to green/natural environments (Hartig et al. 2014)
- Importance of urban parks for well-being

Background and Literature review

Benefits of Green Spaces (GS):

- Mental health (Lee and Maheswaran 2011)
- Obesity reduction (Dempsey et al. 2018)
- Life satisfaction (Brereton et al. 2008)
- Stress reduction (Roe et al. 2013)
- Air quality (Zupancic et al. 2015)
- Illness prevention (Kindo et al. 2018)
- Physical activity (Barton and Pretty 2010)

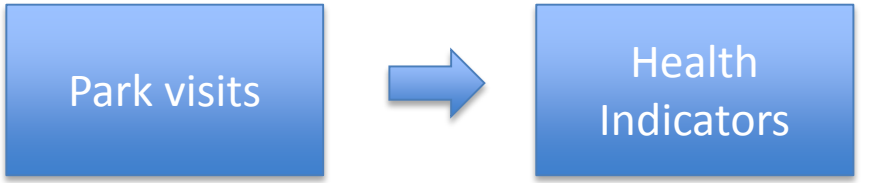
Objectives

- Estimate the association between GS use and health in Ireland
- Evaluate people's preferences for GS attributes
- Provide scenarios that increase the probability of visiting

Methodology

Model 1

Is there a GS visits- health association?

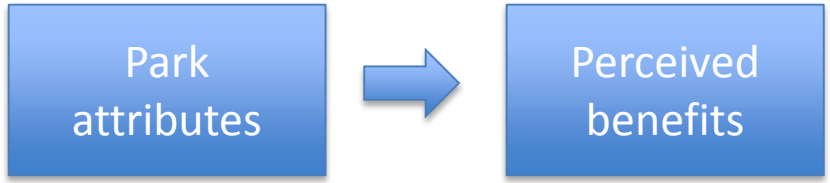


Visits in the past 4 weeks

- Self-rated health
- Mental well-being
- Cardiovascular health

Model 2

Will visitation be affected by GBS features?



Assessing the expected impact of new GS features on visitation and related health

Methodology

Data Collection: Questionnaire survey

- 1,050 adult Irish citizens, stratified by:
  - Gender
  - Hometown
  - Age
  - Education

The questionnaire

39 questions - 5 sections

- Section A: GS use and attitudes
- Section B: Preferences for GS attributes
- Section C: Leisure time and physical activity
- Section D: Health and well-being
- Section E: Socio-demographics

Methodology

Model 1

Is there a GS visits- health association?

MODEL 1

Visits in the past 4 weeks

- Self-rated health
- Mental well-being
- Cardiovascular health

The questionnaire

Indicator variables for Model 1: (Source: Healthy Ireland)

1. Self-rated health

Overall, how would you describe your health status? Please rate on a scale of 1-5, where 1 is very bad and 5 is very good

- Very bad
- Bad
- Fair

Coded 0

- Good
- Very good

Coded 1

The questionnaire

Indicator variables for Model 1: (Source: Healthy Ireland)

2. Mental well-being How much of the time during the past 4 week have you felt the following:

	All of the time	Most of the time	A good bit of the time	Some of the time	A little of the time	None of the time
a) Very nervous or anxious	1	2	3	4	5	6
b) Downhearted and blue	1	2	3	4	5	6
c) Calm and peaceful	6	5	4	3	2	1
d) Full of energy	6	5	4	3	2	1
e) A happy person	6	5	4	3	2	1

The questionnaire

Indicator variables for Model 1: (Source: Healthy Ireland)

3. Cardiovascular health (Source: Healthy Ireland)

Have you suffered from any of the following conditions in the past 12 months?

(Tick all that apply)

1. Heart Attack or chronic consequences of heart attack	
2. High blood pressure	
3. A stroke or the chronic consequences of stroke (cerebral haemorrhage or cerebral thrombosis)	

Coding:

1 = none
0 = at least one

Modelling approach

2 stage estimation

1st stage

$\text{Visits} = \Theta Z' + \eta$

2nd stage

Self-rated health $= \alpha_1 \log(\text{Visits}) + \beta X' +$

Mental well-being $= \alpha_2 \log(\text{Visits}) + \partial X' + \varepsilon$

Cardiovascular health $= \alpha_3 \log(\text{Visits}) + \rho X' + \upsilon$

Matrix Z →
- AGE
- GENDER
- DOG
- INCOME
- NEIGHBOURHOOD
- MEANS OF TRANSPORT
- LONG ILLNESSES

Matrix X →
- AGE
- GENDER
- EDUCATION
- PHYSICAL ACTIVITY
- LONG ILLNESSES

Modelling approach

2 stage estimation

1st stage

Visits = ΘZ' + η

Negative binomial regression

$$LL = \frac{\Gamma(\alpha^{-1} + y)}{\Gamma(\alpha^{-1})\Gamma(y+1)} \left(\frac{\alpha^{-1}}{\alpha^{-1} + \mu}\right)^{\alpha^{-1}} \left(\frac{\mu}{\alpha^{-1} + \mu}\right)^{y}$$

2nd stage

Self-rated health = $\alpha_1$log(Visits) + βX' +

Mental well-being = $\alpha_2$log(Visits) + ∂X' + ε

Cardiovascular health = $\alpha_3$log(Visits) + ρX' + υ

Binary logit regression

$$LL = \left(\frac{e^{\theta}}{e^{\theta} + 1}\right)^{y} + \left(1 - \frac{e^{\theta}}{e^{\theta} + 1}\right)^{1-y}$$

Results

Effects of park visits on health indicators:

Linear relationship

Self-rated health	Mental well-being	Cardiovascular health
.041* (.022)	.060*** (.017)	.070*** (.023)

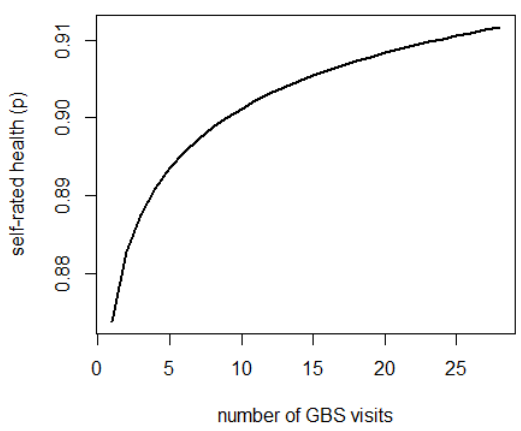
Log-Linear relationship

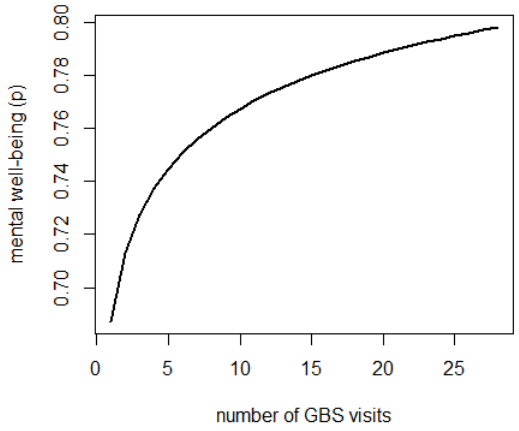
Self-rated health	Mental well-being	Cardiovascular health
.119* (.072)	.176*** (.054)	.229*** (.077)

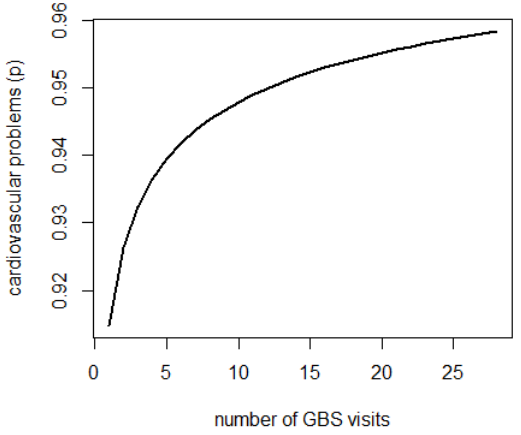
p-value <.10, ** p-value <.05, *** p-value <.01
(st. errors in parenthesis)

Results

Marginal effects of visitation:







Results

Visits	1	8	15
	Self-rated general health		
Marginal probability at # visits	0.0132***	0.0014***	0.0007***
Standard error	(.0079)	(.0007)	(.0003)
Probability of healthy outcome	87%	90%	91%
	Mental well-being		
Marginal probability at # visits	0.0379***	0.0040***	0.0020***
Standard error	(.017)	(.001)	(.0005)
Probability of healthy outcome	69%	76%	78%
	Cardiovascular health		
Marginal probability at # visits	0.0178***	0.0015***	0.0007***
Standard error	(.006)	(.0003)	(.0001)
Probability of healthy outcome	91%	95%	95%

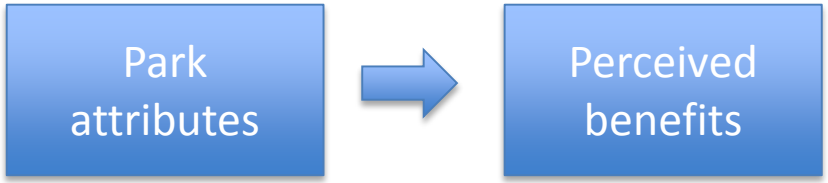
$***p < 0.01$

Methodology

Model 2

Will visitation be affected by GBS features?

MODEL 2



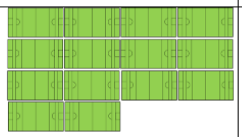
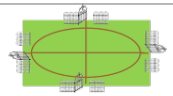
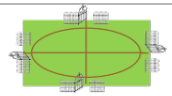
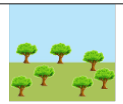
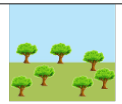
Assessing the expected impact of new GS features on visitation and related health

Methodology

Attributes	Levels
Size (in ha)	2.5; 7.5; 12.5; 17.5
Water	Flawing water Lake or pond No water
Length and variety of walking paths	Few, Medium, High
Facilities	Toilets Coffee shops Gym facilities No
Number of trees	Few, Medium, High
Average distance from home in km (miles)	.8 1 1.6 3.2 6.4 10 (.5 .6 1 2 4 6.2)

Methodology

Model 2: Example of a choice card

Attribute	Alternative 1	Alternative 2		
Size	 17.5 hectares (14 Croke parks)	 2.5 hectares (2 Croke parks)	**I will make some visits but not to one of the these**	**I will not visit public parks at all**
Blue space	 Flowing water	 Flowing water		
Walking or running path	 Medium length	 Medium length		
Facilities	 Toilets	 Coffee shops		
Trees	 Medium number of trees	 Medium number of trees		
Distance from home	6.4 Km (4 miles)	1 Km (0.6 miles)		
Number of monthly visits				

Card 1

Methodology

- 6 choice cards per respondents
- 4 different versions of the questionnaire
- *d-efficient* design
- Design updated after 50 and 250 interviews

Modelling approach

Utility of park alternatives:

$$U_{in} = \beta'_n x_{in} + \varepsilon_n$$

X = park attributes
β = coefficients to be estimated
ε = random disturbance

Estimation: Mixed logit (MXL) model:

$$P_{ni} = \int \prod_{n=1}^{N} \frac{e^{\beta'_n X_{ni}}}{\sum_j e^{\beta'_n X_{ni}}} \varphi(\beta \,|b, \Omega) d\beta$$

Welfare measure:

$$WTP_j = \frac{-\beta_j}{\beta_{cost}}$$

Results

Willingness to visit:

Attribute	WTV
size	0.05
pond	7.92***
Fl_water	7.18***
path_med	11.7***
path_large	2.6
coffee	11.2***
gym	5.76***
toilet	9.01***
tree_med	-2.88**
tree_large	-4.52***

Results

Scenarios	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Size (ha)	2	4	7	10	10
Pond	YES	NO	YES	YES	YES
Flowing water	NO	YES	NO	NO	YES
Path	MEDIUM	MEDIUM	LARGE	LARGE	LARGE
Coffee shops	NO	NO	NO	NO	YES
gym facilities	NO	NO	NO	YES	YES
toilets	NO	YES	YES	YES	YES
Trees	MEDIUM	MANY	MANY	MEDIUM	MEDIUM
Consumer surplus	3.28 (1.42)	9.80 (1.90)	10 (1.97)	15.53 (2.64)	19.30 (3.41)

Discussions

- Positive and statistically significant association between GS visits and health
- Health benefits increase at decreasing rate (log model)

- Largest health improvement on mental well-being

Discussions

- Positive attitudes towards:
  - Water features
  - Facilities
  - Walking path

- Size of GS not important
- Preferences towards fewer trees

Thank You for your attentions!

Questions?

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