

# Health or Happiness? What is the Impact of Physical Activity on the Individual?

*Taking Part User Event  
Department of Culture, Media and Sport  
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# Overview

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1. Introduction: Theme and Policy Context
2. Literature:
  1. Subjectively Stated Health and Well-Being
3. Data and Variables
  1. Estimation (3.1) Health and Well-being
  2. Results & conclusions
  3. Estimation (3.2) Social Interactions
  4. Results & conclusions
4. Overall Conclusions

...in other words, this



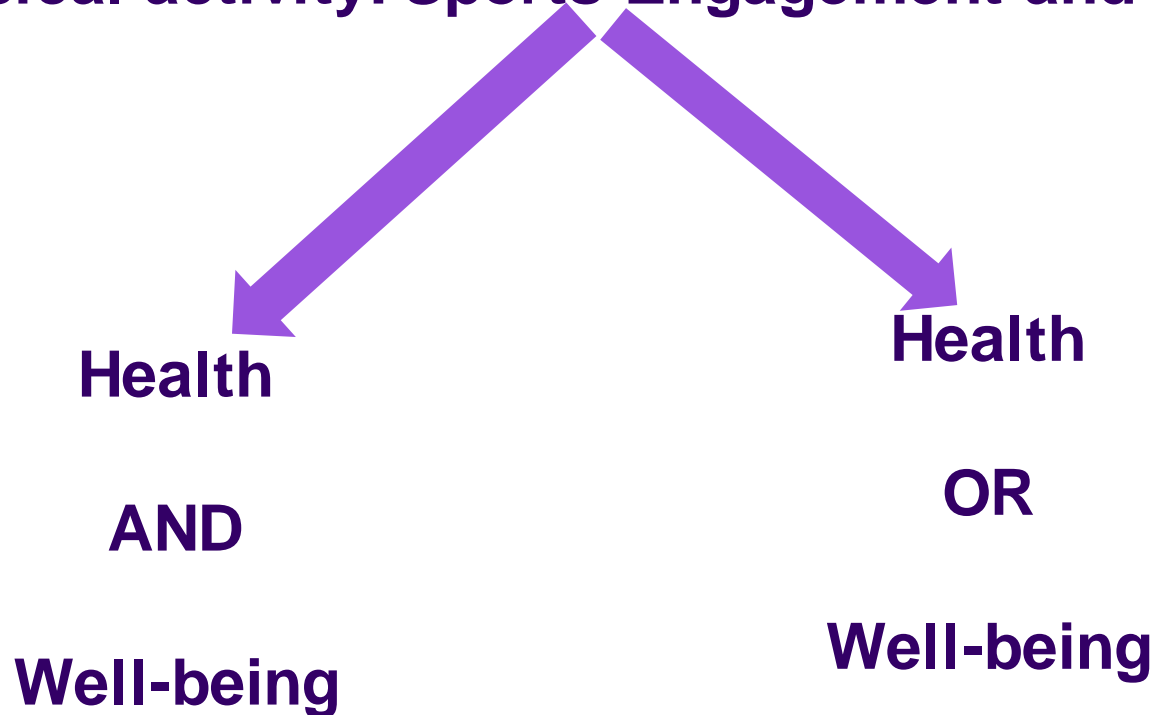
# And/Or...



# 1. Introduction

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**Physical activity: Sports Engagement and Forms**



# 1. Policy Context

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- Policy initiatives target well-being and health
  - UK focus on
    - Physical Activity e.g. sport
    - Active Travel e.g. walking and cycling

(DCMS/Strategy Unit, 2002; Department of Health, Physical Activity, Health Improvement and Prevention, 2004; Department for Transport, 2004; Cycling England, 2007).

# 1. Policy Context

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- Explore the impact of these factors on health and/or well-being
- Try to put scale on impacts
- Inform policy priorities

## 2. Literature: Well-Being and Health often bracketed together

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- Policy documents
  - Psychological and physiological benefits
  - Social and community benefits  
(Biddle and Ekkakkis, 2005; Department of Health, Physical Activity, Health Improvement and Prevention, 2004; Department of Health, 2004; WHO World Health Day, 2002; Scully *et al.*, 1999).
- Academic Literature (e.g. Dolan *et al* 2008)
  - Life satisfaction; Happiness; Health questionnaires e.g. GHQ12
  - Dimensions of ‘experienced’ rather than ‘decision’ utility
    - ‘Hedonic’: externalities, social interactions and relational goods



## 2. Literature: Findings

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- 'Economic'
  - Income – Easterlin 'paradox' (?)
  - Employment/self-employment (+)
- Individual/Social
  - Quadratic age effect – (u shaped)
  - Marriage (+)
  - Divorce, separation, bereavement (-) but...dynamic adjustment
  - Well-being of family members (+)
  - Sex – less partners for higher educated (+)
    - A physical activity effect 😊
  - Social interaction with friends; volunteering; communal activities and gatherings etc (+)
- External
  - German reunification (+)
  - Drought (-)

## 2. Health?

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- Large physiological/psychological literature that supports physical activity and active travel impacts

Biddle *et al.* (2004) Pate *et al.* (1995), Oja *et al.* (1998) WHO World Health Day, (2002), Cervero *et al.* (2003), Wendel-Vos *et al.* (2004) Smith and Bird (2004), Shephard (2008) and Basset *et al.* (2008)

- Economics
  - De Mello and Tjongson (2009)
  - Papers by Blanchflower and Oswald (2008); Oswald and Powdthavee (2007) ...blood pressure, BMI

## 2. Physical Activity and Well-being (+)

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### 1. Sports participation

1. Becchetti *et al* (2008) SOEP OLS/FE participation (+)
2. Lechner (2009) SOEP Matching estimator participation (+) on SWB of males
3. Lee and Park (2010) – for disabled in Korea
4. Pawlowski, Downward and Rasciute (2011) ISSP OLS/IV (+) effect which grows with age though participation falls

### 2. Sports events

- Kavetsos and Szymanski (2010) Eurobarometer data 12 countries examine better than expected athletic performance and hosting Events
  - Olympic Games World Cup. European cup
  - OP/Difference-in-Difference estimator →(+) hosting effects

# 3. Data and Variables

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- Two waves of Taking Part Survey
  - BMRB
  - Began in 2005
  - > 16 years
- 'Happiness' (1....10) & Self-reported health (1....5)
- 67 sports
- Walking
  - Walking and recreational walking
- Cycling
  - Health and recreation
  - Utilitarian
  - Sport

# 3.

# Covariates

Table 2: Independent variables					
Nominal Variable	Dataset 1		Dataset 2		Variable Description
	Frequency	%	Frequency	%	
single	5 491	32.99	4 898	34.15	Single = 1, 0 = otherwise
married	8 013	48.14	6 703	46.74	Married = 1, 0 = otherwise
separate	2 284	13.72	2 024	14.11	Separated = 1, 0 = otherwise
widow*	858	5.15	717	5	Widowed = 1, 0 = otherwise
white	14 219	85.42	12 638	88.12	White = 1, 0 = otherwise
asian	1 246	7.49	872	6.08	Asian = 1, 0 = otherwise
black	775	4.66	551	3.84	Black = 1, 0 = otherwise
othereth*	406	2.44	281	1.96	Other ethnic origin = 1, 0 = otherwise
working	11 039	66.32	9 344	65.15	Working = 1, 0 = otherwise
student	534	3.21	479	3.34	Student = 1, 0 = otherwise
keephouse	1 130	6.79	1 007	7.02	Keep house = 1, 0 = otherwise
retired	2 504	15.04	2 141	14.93	Retired = 1, 0 = otherwise
illnotwork	509	3.06	498	3.47	Ill and can't work = 1, 0 = otherwise
unemployed	504	3.03	474	3.3	Unemployed = 1, 0 = otherwise
otherwk*	426	2.56	399	2.78	Other work = 1, 0 = otherwise
he	7 007	42.09	6 158	42.94	Higher education or equivalent = 1, 0 = otherwise
alevel	3 267	19.63	2 752	19.19	A Levels = 1, 0 = otherwise
apprentice	888	5.33	736	5.13	Apprentice = 1, 0 = otherwise
olevel5	3 141	18.87	2 721	18.97	5 GCSEs = 1, 0 = otherwise
othered*	2 343	14.08	1 975	13.77	Other education = 1 0 = otherwise
sex: male	7 784	46.76	6 738	46.98	Male = 1, 0 = female
sex: female*	8 862	53.24	7 604	53.02	
drinkdaily	1 746	10.49	1 405	9.8	Drink alcohol every day = 1, 0 = otherwise
drink4to6	1 763	10.59	1 581	11.02	Drink alcohol 4 to 6 days a week = 1, 0 = otherwise
drink1to3	5 764	34.63	5 074	35.38	Drink alcohol 1 to 3 days a week = 1, 0 = otherwise
drinkless1	4 507	27.07	3 862	26.93	Drink alcohol less than 1 day a week = 1, 0 = otherwise
notdrink	2 866	17.22	2 420	16.87	Don't drink alcohol = 1, 0 = otherwise
voluntar	4 581	27.52	3 969	27.67	Undertaken any voluntary work = 1, 0 otherwise
cyclespr	158	0.95	136	0.95	Cycled for sport in the last 4 weeks = 1, 0 = otherwise
cyclehea	1835	11.02	1521	10.61	Cycled for health, recreation in the last 4 weeks = 1, 0 = otherwise
cycleuti	877	5.27	771	5.38	Cycled for utility reasons in the last 4 weeks = 1, 0 = otherwise
walk	12113	72.77	10376	73.25	Walked for at least 30 minutes in the last 4 weeks = 1, 0 = otherwise
walkrec	9412	56.54	8033	56.01	Walked for recreation in the last 4 weeks = 1, 0 = otherwise
anysport	9790	58.81	8231	57.39	Participated in anysport in the last 4 weeks = 1, 0 = otherwise
<b>Cardinal Variables</b>	<b>Mean</b>	<b>St. Dev</b>	<b>Mean</b>	<b>St. Dev</b>	
Age	43.54	16.35	43.61	16.33	Age in years
nadult	1.98	0.86	1.96	0.85	Number of adults in the household
nchild	0.65	0.99	0.64	0.98	Number of children in the household
Indinen	18.02	13.86	18.3	14.12	Total gross annual personal income £000s
<b>n</b>	<b>16 646</b>		<b>14 342</b>		

# 3. Dependent Variable

Table 1: Distribution of Happiness and Health

<u>Happiness</u> Scale Value	<u>Dataset 1</u>		<u>Dataset 2</u>	
	Frequency	Percent	Frequency	Percent
1	100	0.6	76	0.53
2	103	0.62	76	0.53
3	287	1.72	180	1.26
4	361	2.17	278	1.94
5	1 296	7.79	948	6.61
6	1 231	7.4	1 073	7.48
7	3 079	18.5	2 644	18.44
8	5 006	30.07	4 308	30.04
9	2 881	17.31	2 518	17.56
10	2 302	13.83	2 241	15.63
<b>Total</b>	<b>16 646</b>	<b>100</b>	<b>14 342</b>	<b>100</b>
<u>Health</u> Scale Value	<u>Dataset 1</u>		<u>Dataset 2</u>	
	Frequency	Percent	Frequency	Percent
1	95	0.57	115	0.8
2	609	3.66	523	3.65
3	2 845	17.09	2 483	17.31
4	6 998	42.04	6 201	43.24
5	6 099	36.64	5 020	35
<b>Total</b>	<b>16 646</b>	<b>100</b>	<b>14 342</b>	<b>100</b>

# 3. Estimation

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- Cardinal versus discrete
  - Ontological issues
  - Estimation issues: censoring, convergence etc
- Simultaneity
  - Recognise joint distribution of Health and SWB
  - ‘Reduced’ forms estimated
    - Causality is a problem
    - IV but ordered
    - Cross-section?

# 3. Bivariate Probit

No convergence of Bivariate ordered!

$$y_1^* = x_1' \beta_1 + \varepsilon_1, \quad y_1 = 1 \text{ if } y_1^* > 0, \quad 0 \text{ otherwise,}$$
$$y_2^* = x_2' \beta_2 + \varepsilon_2, \quad y_2 = 1 \text{ if } y_2^* > 0, \quad 0 \text{ otherwise,}$$

$$E[\varepsilon_1 | x_1, x_2] = E[\varepsilon_2 | x_1, x_2] = 0$$

$$\text{Var}[\varepsilon_1 | x_1, x_2] = \text{Var}[\varepsilon_2 | x_1, x_2] = 1$$

$$\text{Cov}[\varepsilon_1, \varepsilon_2 | x_1, x_2] = \rho$$

1. Explanatory variables may/may not be the same
2. Errors assumed to be jointly normally distributed
3. Four possible outcomes based on
  - Good/bad health
  - High/low happiness
  - Values of the latent variables  $y_1^*$ ;  $y_2^*$

**Walk and Recreational Walking  
Regressions  
Health and Happiness**



# 3. Interpretation

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- Coefficients have no obvious meaning as refer to latent variables
  - Can calculate marginal effects
    - Effect on probability of an outcome given a change in a covariate e.g. probability in good health (univariate)
    - Marginal effect of a change in a covariate on the joint probability of an outcome e.g. good health and high level of happiness
    - Marginal effect of a change in a covariate on conditional probabilities e.g. good health given they have high levels of happiness
      - N.B. There will be direct and indirect effects as both sets of regressors across the equations impact on the results

# 3.1 Results TPS1

	Ordered Choice model				OLS				Bivariate Probit Model			
	Happiness		Health		Happiness		Health		Happiness	Health	Happiness	Health
CycleSPR	-0.0249 {-0.40}	-0.0279 {-0.448}	0.1073 {1.526}	0.1019 {1.45}	-0.0692 {-0.692}	-0.0742 {-0.742}	0.0620 {1.331}	0.0575 {1.236}	-0.0203 {-0.19}	0.1496 {1.3}	-0.0149 {-0.14}	0.1535 {1.34}
CycleHEA	-0.0021 {-0.106}	0.0045 {0.222}	0.2046* {9.143}	0.2164* {9.698}	-0.0037 {-0.115}	0.0074 {0.228}	0.1279* {8.474}	0.1362* {9.054}	-0.0018 {-0.05}	0.2268* {6.94}	-0.0126 {-0.35}	0.2146* {6.54}
CycleUTI	0.0408 {1.496}	0.0319 {1.17}	0.1782* {5.89}	0.1601* {5.289}	0.0792*** {1.805}	0.0642 {1.464}	0.1162* {5.695}	0.1027* {5.032}	0.0691 {1.47}	0.202* {4.48}	0.0838*** {1.78}	0.2257* {5.00}
AnySp	0.0875* {6.85}	0.0898* {7.05}	0.1954* {14.293}	0.1992* {14.6}	0.1542* {7.526}	0.1582* {7.738}	0.1395* {14.642}	0.1418* {14.916}	0.1531* {7.34}	0.2143* {11.76}	0.1496* {7.16}	0.2107* {11.54}
WalkRec	0.0967* {7.811}		0.1882* {14.17}		0.1636* {8.228}		0.1383* {14.959}				0.1457* {7.25}	0.2134* {12.08}
Walk		0.1012* {7.491}		0.2081* {14.431}		0.1718* {7.914}		0.1584* {15.69}	0.1517* {7.11}	0.2375* {12.35}		
Rho						0.2400 {1784.757} <sup>a</sup>			0.325* {25.91}		0.3257* {26.02}	

# 3.1 Marginal Effects TPS1

	Bivariate Probit Model				Ordered Choice Model			
	Happiness		Health		Happiness		Health	
CycleSP	-0.0059	-0.0067	0.0376	0.0369	-0.0054	-0.0060	0.0400	0.0380
CycleHEA	-0.0069	-0.0055	0.0518	0.0543	-0.0005	0.0010	0.0770	0.0815
CycleUTI	0.0074	0.0058	0.0513	0.0466	0.0091	0.0071	0.0671	0.0601
AnySport	0.0180	0.0185	0.0514	0.0523	0.0190	0.0195	0.0709	0.0722
WalkRec	0.0173		0.0521		0.0210		0.0684	
Walk		0.0180		0.0603		0.0216		0.0744

## 3.2 Willingness to Pay Results (£000)

### TPS 1 & 2

	Happy (1)	Health (1)	Happy (1)	Health (1)	Happy (2)	Health (2)	Happy (2)	Health (2)
CycSp					62.15		65.16	
CycHea		48.64		49.16		24.77		23.49
CycUtil		27.53		34.50		35.88		40.57
AnySp	23.36	43.11	23.37	44.90	18.25	32.11	18.54	32.89
Walk	18.03	46.36	N/A	N/A	23.65	38.44	N/A	N/A
WalkRec	N/A	N/A	20.29	45.11	N/A	N/A	19.38	34.83

Table 3: Regression Results Dataset 1

Regressors	Happy		Health		Happy		Health	
	Coefficient	z	Coefficient	z	Coefficient	z	Coefficient	z
Constant	0.2127	1.2020		0.1668	0.2759	1.5630	0.3579	2.1500
NUMADULT	0.061	3.5840	0.0175	1.1050	0.0608	3.5820	0.0180	1.1340
CYCLESPR	-0.2550	-1.9230	0.0820	0.5430	-0.2498	-1.8860	0.0838	0.5600
CYCLEHEA	0.0164	0.3440	0.2531	5.7030	0.0049	0.1020	0.2414	5.4190
CYCLEUTI	0.1001	1.5970	0.1433	2.3830	0.1133	1.8100	0.1694	2.8110
ANYSPNOT	0.1678	6.0120	0.2244	8.9620	0.1631	5.8380	0.2205	8.7970
WALK	0.1294	4.4960	0.2413	9.1420	n/a	n/a	n/a	n/a
WALKREC	n/a	n/a	n/a	n/a	0.1417	5.2640	0.2215	9.2040
SINGLE	0.2529	3.7740	-0.1319	-2.0790	0.2562	3.8240	-0.1263	-1.9960
MARRIED	0.6127	9.5830	0.0225	0.3840	0.6115	9.5660	0.0211	0.3610
SEPARATE	0.1553	2.3780	-0.1328	-2.1090	0.1589	2.4350	-0.1271	-2.0260
INCOME	0.0072	6.1840	0.0052	4.8500	0.0070	6.0030	0.0049	4.5740
NORTHE	0.2562	4.5370	0.0172	0.3440	0.2588	4.5850	0.0199	0.3980
NORTHW	0.2169	3.9440	0.0990	1.9940	0.2177	3.9590	0.0998	2.0100
YORKS	0.2225	4.0360	0.0833	1.6820	0.2244	4.0730	0.0855	1.7240
EMID	0.2230	3.8280	-0.0427	-0.8590	0.2249	3.8610	-0.0428	-0.8610
WMID	0.1882	3.5040	0.0634	1.3150	0.1953	3.6330	0.0727	1.5050
EAST	0.1823	3.3300	0.0873	1.8080	0.1857	3.3940	0.0924	1.9110
LONDON	0.0040	0.0770	0.0651	1.2980	0.0152	0.2900	0.0808	1.6110
SOUTHE	0.1185	2.3620	0.1193	2.6410	0.1252	2.4960	0.1288	2.8500
WHITE	0.2381	3.1210	0.0517	0.6510	0.2413	3.1580	0.0608	0.7700
ASIAN	0.0090	0.1050	-0.0404	-0.4570	0.0165	0.1910	-0.0285	-0.3230
BLACK	0.1455	1.5890	0.1736	1.8010	0.1577	1.7170	0.1943	2.0210
WORKING	0.2377	2.9530	0.4475	6.5070	0.2411	2.9950	0.4503	6.5200
STUDENT	0.2439	2.2750	0.4956	4.9490	0.2491	2.3240	0.5021	5.0280
KEEPHOUS	-0.0108	-0.1180	0.2335	2.8930	-0.0089	-0.0970	0.2393	2.9540
RETIRED	0.2835	2.8890	0.1523	1.8650	0.2820	2.8740	0.1506	1.8390
ILLNOTWO	-0.4320	-4.3810	-1.3270	-13.4680	-0.4341	-4.4010	-1.3388	-13.5690
UNEMPLOY	-0.2263	-2.2540	0.1846	1.9980	-0.2197	-2.1870	0.1954	2.1110
HE	0.1036	2.5510	0.2367	6.4630	0.0966	2.3720	0.2287	6.2310
ALEVEL	0.1317	2.9650	0.1058	2.6620	0.1271	2.8550	0.1009	2.5330
APPRENTI	0.0465	0.7040	-0.0652	-1.1490	0.0423	0.6400	-0.0710	-1.2490
OLEVEL5	-0.0033	-0.0770	0.1428	3.6290	-0.0084	-0.1950	0.1360	3.4550
SEX	-0.0548	-1.8960	-0.0754	-2.9020	-0.0516	-1.7840	-0.0722	-2.7820
AGE	-0.0225	-4.5060	-0.0069	-1.4950	-0.0245	-4.8810	-0.0096	-2.0730
AGESQUAR	0.0002	4.4130	-0.182200D-04	-0.3740	0.0003	4.7020	-0.173067D-05	0.0350
VOLUNTAR	0.1087	3.5560	0.0431	1.6140	0.1083	3.5390	0.0447	1.6710
NUMCHILD	-0.0057	-0.3760	-0.0047	-0.3330	-0.0043	-0.2810	-0.0032	-0.2290
RHO(1,2)	0.308	18.005			0.307	18.026		
<b>WTP £000s</b>								
CYCLESPR								
CYCLEHEA			48.635				49.158	
CYCLEUTI			27.526				34.499	
ANYSPNOT	23.364		43.110		23.366		44.897	
WALK	18.026		46.356					
WALKREC					20.290		45.108	

# 3.1 Other results

1. Married etc (+)
2. Income (+)
3. Working (+)
4. Male (+)
5. Education (+)
6. Age quadratic

Table 4: Regression Results Dataset 2

Regressors	Happy		Health		Happy		Health	
	Coefficient	z	Coefficient	z	Coefficient	z	Coefficient	z
Constant	0.590	2.921	0.715	3.856	0.667	3.313	0.811	4.382
NUMADULT	0.069	3.586	0.007	0.408	0.069	3.613	0.009	0.494
CYCLESPR	0.482	2.144	0.263	1.402	0.495	2.181	0.271	1.452
CYCLEHEA	-0.052	-0.938	0.153	3.072	-0.062	-1.120	0.140	2.805
CYCLEUTI	-0.011	-0.155	0.221	3.177	0.005	0.074	0.242	3.464
ANYSPOUT	0.141	4.250	0.198	7.086	0.141	4.237	0.196	6.997
WALK	0.183	5.673	0.237	8.395	n/a	n/a	n/a	n/a
WALKREC	n/a	n/a	n/a	n/a	0.155	5.041	0.209	8.003
SINGLE	0.140	1.761	-0.148	-2.149	0.144	1.817	-0.141	-2.052
MARRIED	0.506	6.612	0.056	0.869	0.501	6.540	0.051	0.793
SEPARATE	-0.017	-0.214	-0.140	-2.074	-0.017	-0.216	-0.139	-2.069
INCOME	0.008	5.588	0.006	5.357	0.008	5.487	0.006	5.170
NORTHE	0.050	0.749	-0.025	-0.450	0.051	0.757	-0.026	-0.458
NORTHW	0.060	0.933	-0.001	-0.018	0.062	0.967	0.001	0.027
YORKS	0.007	0.107	-0.021	-0.391	0.011	0.172	-0.017	-0.318
EMID	0.096	1.417	0.008	0.146	0.104	1.540	0.016	0.287
WMID	0.031	0.488	0.027	0.501	0.034	0.532	0.030	0.563
EAST	0.085	1.293	0.041	0.753	0.093	1.406	0.050	0.924
LONDON	-0.052	-0.859	0.051	0.971	-0.036	-0.608	0.072	1.364
SOUTHE	0.029	0.476	0.027	0.531	0.032	0.527	0.030	0.586
WHITE	0.352	3.675	0.088	0.855	0.349	3.649	0.083	0.810
ASIAN	0.185	1.719	-0.134	-1.202	0.179	1.670	-0.142	-1.268
BLACK	0.254	2.263	0.147	1.220	0.254	2.262	0.145	1.203
WORKING	0.158	1.769	0.276	3.763	0.163	1.830	0.282	3.839
STUDENT	0.158	1.289	0.469	4.289	0.173	1.410	0.487	4.451
KEEPHOUS	-0.151	-1.486	-0.013	-0.157	-0.137	-1.352	0.003	0.040
RETIRED	0.249	2.295	0.045	0.522	0.252	2.328	0.051	0.588
ILLNOTWO	-0.635	-6.076	-1.467	-14.696	-0.640	-6.127	-1.472	-14.735
UNEMPLOY	-0.214	-1.931	-0.080	-0.838	-0.195	-1.766	-0.058	-0.605
HE	0.095	2.078	0.244	6.226	0.093	2.017	0.241	6.128
ALEVEL	0.106	2.089	0.217	5.018	0.107	2.121	0.218	5.042
APPRENTI	0.155	1.963	0.097	1.548	0.147	1.865	0.088	1.402
OLEVEL5	0.003	0.062	0.160	3.769	0.001	0.022	0.157	3.704
SEX	-0.058	-1.735	-0.139	-4.915	-0.053	-1.607	-0.133	-4.684
AGE	-0.026	-4.624	-0.017	-3.394	-0.028	-4.830	-0.018	-3.724
AGESQUAR	0.000	4.228	.453801D-04	0.879	0.000	4.341	.551407D-04	1.069
VOLUNTAR	0.114	3.225	0.005	0.181	0.114	3.220	0.006	0.206
NUMCHILD	0.008	0.439	0.012	0.748	0.009	0.509	0.013	0.836
RHO(1,2)	0.350	18.725			0.351	18.866		
<b>WTP £000s</b>								
CYCLESPR	62.151				65.164			
CYCLEHEA			24.765				23.494	
CYCLEUTI			35.877				40.571	
ANYSPOUT	18.246		32.109		18.543		32.886	
WALK	23.647		38.436					

# 3.1 Other Results

## 3.2 Conclusions

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- Significant cross equation effects; suggest unobserved characteristics affecting impacts
  - Taste for SWB and Health
- Broad qualitative consistency across data sets
  - Cycling for health and recreation; utilitarian cycling connected to health but not happiness (disutility – congestion; motorised transport?)
  - Walking increases health and happiness
  - Sports participation increases health and happiness

## 3.2 Conclusions

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- Qualitative variance
  - Sports cycling raises happiness for dataset 2 – small sample size dangers (0.95%)?
- Quantitative variance
  - Walking or sports participation £18k-£24k re happiness; but reverses in order of scale across datasets
  - Health benefits of walking in dataset 1 are 2 x wellbeing; less so for dataset 2
  - Health benefits cycling for health/recreation £10k-£15 larger than cycling for utility in dataset 1, but £6k-£10k less in dataset 2.
  - Health benefits generally lower in dataset 2



## 3.3 Social Interactions?

Swimming or diving indoors (18.46%)	Table tennis (SI) (1.61%)
Swimming or diving outdoors (4.58%)	Track and field athletics (0.27%)
BMX, cyclo-cross, mountain biking (0.94%)	Jogging, cross-country, road running (6.31%)
Cycling for health, recreation, training, competition (10.99%)	Angling or fishing (1.89%)
Cycling to get to places (5.26%)	Yachting or dingy sailing (0.81%)
Bowls indoors (1.00%)	Canoeing (0.60%)
Bowls outdoors (0.60%)	Windsurfing or boardsailing (0.19%)
Tenpin bowling (4.00%)	Ice skating (0.89%)
Health, fitness, gym, conditioning activities (16%)	Curling (SI) (0.04%)
Keepfit, aerobics, dance exercise, exercise bike (8.00%)	Golf, pitch and putt, putting (6.03%)
Judo (0.05%)	Skiing (0.61%)
Karate (0.40%)	Horse riding (1.43%)
Taekwando 0.19%)	Climbing/mountaineeringincluding indoor climbing (0.74%)
Other Martial Arts including self defence, tai chi (1.01%)	Hill trekking or backpacking (1.54%)
Weight training including body building (3.81%)	Motor sports (0.84%)
Weightlifting (1.55%)	Shooting (0.97%)
Gymnastics (0.34%)	Volleyball (SI) (0.37%)
Snooker, pool, billiards exclude bar billiards (8.61%)	Orienteering (0.18%)
Darts (3.36%)	Rounders (SI) (0.57%)
Rugby League (SI) (0.14%)	Rowing (0.38%)
Rugby Union (SI) (0.69%)	Triathlon (0.08%)
American football (SI) (0.08%)	Boxing (0.63%)
Football indoors including 5-a-side and 6-a-side (SI) (3.07%)	Waterskiing (0.12%)
Football outdoors including 5-a-side and 6-a-side (SI) (6.82%)	Lacrosse (SI) (0.02%)
Gaelic sports (SI) (0.02%)	Yoga (3.17%)
Cricket (SI) (1.85%)	Fencing (SI) (0.06%)
Hockey (SI) (0.40%)	Frisbee (0.05%)
Archery (0.38%)	Trampolining (0.19%)
Baseball/softball (SI) (0.19%)	Rambling/walking for pleasure (0.10%)
Netball (SI) (0.49%)	Skittles (0.17%)
Tennis (SI) (3.03%)	Pilates (0.16%)
Badminton (SI) (3.32%)	Any other water sport (0.35%)
Squash (SI) (1.63%)	Other sport (1.57%)
Basketball (SI) (1.35%)	

# 3.4 Results: Ordered Probit Heterogeneous Thresholds

**Table 5. Partial Effects and WTP Measures**

	<b>Partial Effects</b>	<b>Willingness to Pay Measures</b>	<b>t-stats</b>	<b>Log-likelihood Ratio Index</b>
AnySport12	0.0312*	18.8861	3.13	
AnySport4	0.0374*	23.2078	4.54	
NumSport12	0.0059*	3.4416	4.54	
NumSport4	0.0026*	1.5610	2.72	
TotalMinutes	0.0004*	0.2152	4.94	
NumDays4	0.0006*	0.3293	4.38	
NumSI sport12	0.0031***	1.9367	1.70	6.74
NumNotSI sport12	0.0011	0.6835	1.38	
NumSI sport4	0.0053***	3.2250	1.84	8.02
NumNotSI sport4	0.0018	1.1000	1.52	
AnySI sport12	0.0065***	1.9316	1.70	8.18
AnyNotSI sport12	0.0031	0.6835	0.74	
AnySI sport4	0.0086***	5.2025	1.72	8.87
AnyNotSI sport4	0.0077**	4.7468	2.16	
TotalSI minutes	0.0007*	0.4375	2.92	25.48
TotalNotSI minutes	0.0003*	0.1875	3.78	
NumSI days	0.0008***	0.5063	1.87	17.28
NumNotSI days	0.0005*	0.3165	3.49	

\* Significant at 1 percent level \*\* Significant at 5 percent level \*\*\* Significant at 10 percent level

Partial effects are reported for the highest outcome of the dependent variable

The critical value of Chi-squared at 5 percent significance level is 5.99

The dependent variable, happiness, takes values between 1 and 10, where '1' indicates extremely unhappy and '10' extremely happy

# 4. Conclusions

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- Social Interaction sports valued higher
- 4 week results greater typically
  - Dynamic adjustment?
- Anysport values higher (SI plus NonSI)
  - complex aggregation? Increasing returns

# 4. Conclusion

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- WTP measures time variant
  - Longitudinal analysis to refine estimates for policy priorities
  - Evidence of dynamic effects noted in the literature