Revisiting the inactivity - (un) happiness relationship, a cross-country exploratory analysis

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Abstract

The relationship between happiness and physical activity is revisited using cross country data in an exploratory analysis. The estimated results show that the countries with lower values in the happiness index account for lower levels of physical activity, or, higher levels of inactivity/sedentarism. Moreover, it is found that the most recent data show that the more antidepressants people take in a country, the higher the happiness index. The main contribution of this note is providing important clues for future research about happiness, physical activity and antidepressants, a potential conditional factor of the measurement of happiness in a country.

Keywords

happiness, physical activity, sedentarism, antidepressants, cross-country analysis

1. Introduction

The starting point of this work is a trilogy defined by health, physical activity and happiness. These three elements interact such that we may draw a triangle of relationships. The top corner of this triangle is the ultimate goal of human life, happiness, and the base corners are the means which contribute to that goal and which are interrelated–health and physical activity (Figure 1).

Figure 1: The health-physical activity-happiness triangle
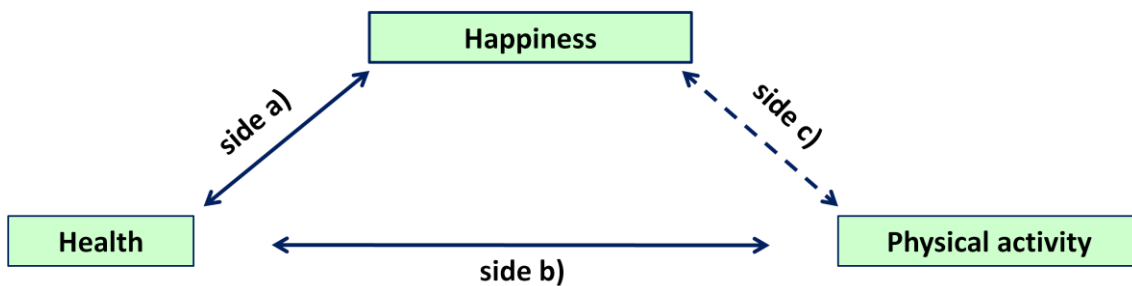
The triangle sides reflect the relationship between the corners:

Side a) Health - Happiness

Health has been identified as one of the factors that contributes to happiness and also happiness seems to improve as people feel healthier. In addition, happiness appears to be inversely related to levels of stress, allergy, asthma and other chronic conditions (Kahneman and Riis, 2005; Borghesi and Vercelli, 2008; Dolan, Peasgood and White, 2008; Huang and Humphreys, 2012; Rasciute and Downward, 2010; Easterlin, 2004).

Side b) Health - Physical Activity

The relationship between health and physical activity has long been established. The health benefits which accrue from physical activity are well-known (Baumen, 2004; Brown et al, 2007) and physical activity programs are supported by most governments and institutions (WHO, 2002; EU, 2008; USDHHS, 2008; European Council, 2013). These benefits include the prevention of the most common non-communicable diseases such as cardiovascular diseases, type II diabetes, obesity, and certain types of cancer.

Side c) Physical activity - Happiness

The positive relationship between physical activity and happiness has been found, mainly in medical and psychology arenas. It seems to be increasingly well

documented, in particular, concerning the mental health benefits. Practicing sport or engaging in some sort of physical activity has a positive effect preventing and treating conditions such as depression, anxiety and stress, promoting mental well-being and even reducing suicide (Fox, 1999; Scully et al, 1998; Glenister, 1996; Penedo et al, 2005; Taylor et al, 1985; Babyak et al, 2000; Koivuma et al, 2001; Pollock, 2001). A less medical and psychology-based approach to the contribution of physical activity to happiness and life satisfaction may be found in the work of Huang and Humphreys (2012)(for the US); Melin et al (2003) (in Sweden); Forrest and McHale (2009) (for British adults); and Kavetsos (2011) and Pawlowskiet al (2011) boh for cross-country studies. However, research is still patchy in this area, in particular, using aggregated data cross country. This is the main contribution of this note and reflects the dashed line in Figure 1.

The previous literature based on microdata (or individual data) established the existence of a "positive correlation between happiness and physical activity". From the opposite point of view, this is the same as saying that there is a "positive correlation between unhappiness and inactivity". Or, in other words, assuming perfect complementarity between happiness and unhappiness, a "negative correlation between happiness and inactivity".

Hence, this note has two important facets: firstly we use a cross country data, and secondly it inverts the normal statement correlating happiness and physical activity by looking at happiness and inactivity. This approach seems to be little explored in the literature. Moreover, this work considers different measures of happiness across countries so that different methods of measuring it are covered.

Before we proceed, some discussion is necessary on the basic three concepts used for the triangle corners. The terms health, physical activity and happiness in this article are wide and broad. While the term health is, in general, consensual (meaning the absence of illness), the two other definitions require some further explanation.

Firstly, the term happiness is by nature subjective and difficult to compare between different people, in particular across cultures and countries. Nevertheless, the large data sets across nations and time seem to show that there are consistent determinants of happiness. Happiness may be measured using subjective measures (usually surveys), or objective measures (such as income and education).

In this work, happiness is measured using a subjective approach. Moreover, the term happiness used here considers that there is no difference between subjective well-being and happiness *per se*, as sometimes considered in the literature (Blanchflower, 2008). Subjective well-being reflects the way people evaluate their lives. Usually it is assessed by people answering a question of the sort: "on the whole are you very satisfied, fairly satisfied, not very satisfied or not at all satisfied with the life you lead?".

Happiness *per se*, on the other hand, refers to how a person evaluates the quality of his life and so the question which will be asked is identical to the following: "taken all together, how would you say things are these days – would you say that you are happy, pretty happy or not too happy?" (Oswald, 1997; Frey and Stutzer, 2002).

Finally, in this work, doing physical activity means "not being sedentary and doing some sort of active activity". This activity may be of any kind: it may be daily physical activities, such as walking and gardening, or more energetic activities, such as running and biking, or physical preparation, such as push-ups or fitness exercises or even practicing sports. Thus, physical activity may include all kinds of activities which are not sitting on the couch or laying on bed.

The three sides of the triangle health-physical activity-happiness have been explored in the literature. However, the relationship between physical activity and happiness is on-going research. While some work has been based on surveys targeting individuals and focusing on what happens within a country, or even across a number of countries using individual data, little work has been done analyzing aggregated cross country data. The main reason for this is that it is difficult to gather data which is comparable across countries. In order to account for comparability, we consider the data for "never doing physical activity", which has a highly consensual definition and interpretation across countries and may also be interpreted as sedentarism.

On the other hand, data on happiness across countries has been presented in (at least) three different ways, varying according to the authors who collate it and the different parts composing the index measuring happiness. For this reason, we use the three different indexes of happiness which have data suitable for comparing countries.

As a result, by analyzing the correlation between the levels of happiness and physical inactivity across countries, it is possible to confirm previous findings regarding the relationship.

2. Method

The method used for this work is based on the estimation of a linear regression, using the minimum square method. The model is as follows, with estimation carried out using SPSS 11:

happiness = constant + β control variables + error.

The dependent variable is happiness and it is measured by the three different indexes, at three different time points. The control variables, or covariates, are:

i) the human development index, which is assumed to capture most of the determinant factors of happiness across countries (for instances, Frey and Stutzer (2002), Kacapyr(2008), and Blanchflower (2008))

ii) the non-physical activity variable, which indicates the percentage of people in a country who never do physical activity, or the inactivity of people in a country, and finally

iii) the amount of antidepressants taken in that country, since this drug is supposed to influence the happiness and well-being of individuals.

The coefficients β and the constant are estimated by the linear regression.

The dependent variable is an index measuring happiness, allowing the ranking of countries. Data on happiness has three possible sources, which implies three different concepts at different moments in time. The sources are either the Satisfaction with Life Index ranking (2006), the UN World Happiness ranking (2010-12), or the OECD's Life Satisfaction index (2014). The next three paragraphs briefly describe these indexes.

i) White's satisfaction index ranking (2006)–beginning of 21st century

The Satisfaction with Life Index was created by Adrian G. White, an analytic social psychologist at the University of Leicester, UK, using data from a meta study. It is an attempt to show life satisfaction in different nations. In this index, subjective well-being correlates most strongly with health, wealth, and education. As the value of this index increases, so does the happiness in the country.

ii) UN World Happiness ranking (2010-12)–first decade of 21st century

The World Happiness ranking, published by the United Nations Sustainable Development Solutions Network, uses data from the Gallup World Poll and measures happiness or subjective well-being. The index comprises six factors which are real GDP per capita, healthy life expectancy, having someone to count on,

perceived freedom to make life choices, freedom from corruption, and generosity. The higher the value of the index, the more well-being is found in a country.

iii) OECD Life Satisfaction (2014)–most recently

The Life Satisfaction index, or subjective well-being index, measures how people evaluate their life as a whole rather than their current feelings. It captures a reflective assessment of which life circumstances and conditions are important for subjective well-being, which is slightly different from the other indexes. This index aims to measure the presence of positive experiences and feelings such as enjoyment, feeling well-rested, smiling or laughing, and/or the absence of negative experiences and feelings such as pain, worry or sadness. As with the other indexes, as the value of this index increases, so does the happiness in the country.

The control variables used to explain happiness are the Human Development Index (HDI), the amount of antidepressants consumed in the country and physical inactivity.

The HDI is used to capture the most important factors which contribute to the levels of happiness in one country, that is, education, income and health. In this way, by using the Human Development Index as control variable, most of the variability of happiness across countries can be explained. Some of the unexplained variability can then be captured by the component which captures physical inactivity in each the country. The value of the HDI is available for 2004, 2009 and 2014.

Another variable considered is the amount of antidepressants consumed in a country measured by defined daily dose (DDD) per 1 000 people per day. The DDD is the assumed average maintenance dose per day for a drug used for its main curative purpose in adults. The availability of this statistical information is strongly limited and so the closest year to that of the happiness index was used. That is, the anti-depressant data is available for 2000, 2009 and 2011.

Data on physical activity across countries is scarce and very often non-comparable. This may be because the data have different sources, or because people have different interpretations about what is meant by a certain question. The only concept which seems to be highly consensual across countries is "never doing physical activity". Thus, the data on being physically inactive is provided by the Eurobarometers of 2004, 2009 and 2014. Eurobarometers are surveys done in several European countries. The question of interest here is "How often do you exercise or play sport?" and the relevant answer is "Never".

The number of European countries in the sample depends on the data availability. The maximum number of observations is 25 which implies that the sample is small. Nevertheless, the available data has a sufficient number of observations to perform descriptive statistics and linear regressions. The database is presented in the Appendix.

The descriptive statistics for the set of variables is presented in Table 1.

Table 1 - Descriptive statistics

beginning of 21st century	Happ	NPH	HDI	AntiD
mean	223.33	0.38	0.90	27.63
variance	1102.73	0.02	0.00	167.85
minimum	156.67	0.04	0.82	6.40
maximum	273.33	0.66	0.98	47.70
Nr countries	25	25	25	15

first decade of 21st century	Happ	NPH	HDI	AntiD
mean	6.51	0.36	0.93	50.29
variance	0.60	0.02	0.00	355.91
minimum	5.10	0.06	0.87	14.40
maximum	7.69	0.67	0.97	78.20
Nr countries	22	25	25	16

Recently	Happ	NPH	HDI	AntiD
Mean	6.46	0.37	0.87	54.24
Variance	0.81	0.03	0.00	382.83
Minimum	4.70	0.09	0.81	17.80
Maximum	7.60	0.75	0.97	85.20
Nr countries	21	24	25	17

Notes: Happ - happiness index; NPA - No Physical Activity variable; HDI - Human Development Index; AntiD - AntiDepressant variable.

The relationship between the four variables is a relevant piece of information. The linear correlations are shown in Table 2 with the statistical significance displayed in brackets:

Table 2 - Bivariate correlations

beginning of 21st century

	HDI	NPA	AntiD	Happ
HDI	1			
NPA	-0.423			
	(0.035)	1		
AntiD	**0.919**	**-0.479**		
	(0.000)	**(0.071)**	1	
Happ	0.904	**-0.544**	**0.803**	
	(0.000)	**(0.005)**	**(0.000)**	1

first decade of 21st century

	HDI	NPA	AntiD	Happ
HDI	1			
NPA	-0.494			
	(0.012)	1		
AntiD	**0.675**	**-0.455**		
	(0.004)	**(0.077)**	1	
Happ	0.759	**-0.805**	0.168	
	(0.000)	**(0.000)**	(0.582)	1

more recently

	HDI	NPA	AntiD	Happ
HDI	1			
NPA	-0.591			
	(0.002)	1		
AntiD	0.273	-0.170		
	(0.288)	(0.513)	1	
Happ	0.592	**-0.669**	**0.535**	
	(0.005)	**(0.001)**	**(0.027)**	1

There are three relevant observations which can be made looking at the correlations. Firstly, no matter the type of happiness index, the correlation with no physical activity is negative. The higher the level of happiness, the lower the percentage of inactive people in a country.

Secondly, the same negative correlation is found between inactivity and the amount of antidepressants. That is, the more widespread physical activity is among the population, the lower the amount of antidepressants taken. However, this correlation is not significant for the most recent data.

Lastly, the correlation between happiness and anti-depressants is positive and significant, except for the beginning of the first decade of 2000.

3. Results

The results are presented in three sub-sections corresponding to the three different points in time and different happiness indexes used in this analysis. All the regressions are estimated either considering or omitting the independent variable for the amount of antidepressants. In this way, a sensibility analysis may be performed and the potential endogeneity of this variable tested. We have also computed the correlation between the residuals of the second estimated regression in each period and the amount of antidepressants; no correlation was found in any case.

Missing cases are omitted from estimations, for this reason the number of observations are different across the results.

The statistical significant level considered is 10% because the sample size in each estimation is small, which may cause high standard errors and therefore low levels of significance.

3.1. Beginning of the 21st century

The estimated results for the equation explaining happiness at the beginning of the 21st century are presented in Table 3. As explained above, this period used happiness data from White's Satisfaction Index.

Table 3 - Linear regressions for the beginning of 21st century

	Happiness (2004) – model 1			Happiness (2004) – model 2		
	Coef	stat t	p value	coef	stat t	p value
AntiD	-	-	-	-0.409	-0.578	0.575
NPH	**-43.196**	-2.151	0.043	**-44.314**	-1.772	0.104
HDI	653.016	8.970	0.000	760.513	3.116	0.010
const	-350.866	-5.050	0.000	-437.551	-2.118	0.058
R^2 adj	0.835			0.808		
F	61.748	0.000		20.631	0.000	
N	25			15		

Results show that there is a negative and statistically significant correlation between inactivity (NPH) and happiness: the higher the percentage of inactive people, the lower the value of the index for happiness. The estimated coefficient for the antidepressants control variable is not significant. As expected the HDI coefficient is positive and significant.

3.2. First decade of 21st century

The results obtained at the end of the first decade of 21st century (using UN World happiness ranking) are not so different from those obtained at the beginning of the decade. It is found that the more inactive people there are in the country, the lower the happiness index. Moreover and again, the coefficient for the antidepressants variable is not significant.

Table 4 - Linear regressions for the end of the first decade of 21st century

	Happiness (2009) – model 1			Happiness (2009) – model 2		
	coef	stat t	p value	coef	stat t	p value
AntiD				-0.003	-0.357	0.729
NPH	**-2.973**	-5.271	0.000	**-2.653**	-2.699	0.024
HDI	11.705	4.468	0.000	18.885	2.958	0.016
const	-3.384	-1.328	0.200	-10.170	-1.644	0.135
R^2 adj	0.810			0.723		
F	45.717	0.000		11.452	0.002	
n	22			13		

3.3. More recently

The results obtained for 2014 using the OECD's Life Satisfaction index are presented in Table 5. It can be observed that the estimated coefficients convey a meaningfully different correlation from the previous estimations. The HDI coefficient is not significant; the NPH coefficient is significant and it shows that there is a negative relationship between happiness and people's inactivity. Finally the estimated coefficient for antidepressants (unlike previously observed) is significant and positive, meaning that the country has an increasing level of happiness as it takes more antidepressants. Recall that there is no significant correlation between the antidepressants and the percentage of people who are inactive, so no collinearity exists here.

Table 5 - Linear regressions for recent observations

	Happiness (2014) – model 1			Happiness (2014) – model 2		
	coef	stat t	p value	coef	stat t	p value
AntiD	-	-	-	**0.017**	2.144	0.052
NPH	**-2.846**	-2.468	0.024	**-2.001**	-1.767	0.101
HDI	7.775	1.577	0.132	6.134	1.310	0.213
const	0.632	0.139	0.891	0.870	0.205	0.841
R^2 adj	0.461			0.495		
F	9.539	0.001		6.233	0.007	
n	21			17		

4. Discussion and conclusion

The positive relationship between physical activity and happiness has been established in medical and psychology studies. Some works in social sciences and economics have shown the positive correlation between both terms. Even so, cross-country analysis remains an area of on-going study, as shown in this note.

Defining and measuring happiness is a challenging task and for this reason three different indexes are used in this work. The main aim is to gather evidence of a relationship between happiness and doing physical activity across different countries.

Using linear-regression estimations, our most important result shows that no matter the happiness index used, there is always a negative relationship between the level of happiness and the amount of inactive people in a country. In this way, this result confirms previous analysis which used different approaches for the same purpose.

The second most relevant result of this work is the role played by the amount of antidepressants consumed in a country in the level of happiness. Although there is a significant linear correlation between happiness and antidepressants at the beginning and the end of the first decade of this century, such an effect is not observable for the most recent period, where no significant linear correlation exists between happiness and antidepressants. But antidepressants do show a significant positive relationship with happiness in an estimated linear equation. This inconsistency provides a strong indication that further research is needed on this particular area. The increasing consumption of antidepressants worldwide (OECD, 2013) is changing the way people feel about their life satisfaction and also how they feel about being physically active. The question for future research is "How can we describe the intricate relationship between antidepressants, happiness and being physically active?".

On the other hand, we found astrong correlation between antidepressants and happiness as measured by White's Satisfaction index, a medium correlation with the

UN World Happiness Index and no correlation with the OECD's Life Satisfaction Index. This may indicate that antidepressants are not a good proxy for the level of happiness found in a country. Moreover, since antidepressants are drugs which directly influence health, then it may be expected that they are a contributing factor in happiness, as found for the more recent time period.

The third result is the unexpected statistical insignificance of the coefficient for the Human Development Index in explaining the happiness index used for the most recent period (OECD Life Satisfaction). However, this happiness index is measuring the presence of positive experiences and feelings such as enjoyment, feeling well-rested, smiling or laughing, and/or the absence of negative experiences and feelings such as pain, worry or sadness, which may have no direct connection to the different components integrating the HDI. Certainly, this calls for further research in order to establish the relationship between happiness indexes, such as the OECD's Life Satisfaction, and the HDI. The controversy raises even more since it seems that happiness depends on the context (Kavetsos et al, 2014).

Despite the contribution made by this work to the discussion on the relationship between happiness and physical activity, it has some limitations. The most important limitation is the number of countries in the sample. Unfortunately, the available data across countries is scarce and statistical and econometric analysis becomes hard to perform.

The second limitation one may point to is the approach used to gather statistical data, choosing the nearest year to that of the happiness index when data was not available. This implied using data from different years in the same regression equation, which could cause some bias in the results. However, the variables considered are not subject to strong variations across consecutive years and so the results are still be consistent with what is observed.

A third limitation arises from the inability to analyse the causality and the direction of the relationship between happiness and physical (in)activity on a macro level. For this purpose, time series are needed to run causality tests.

Despite the limitations, this exploratory analysis has contributed to the ongoing research and discussion about the relationship between happiness and physical activity and also to the controversial role of antidepressants in influencing happiness and health. More data is needed to continue this analysis which definitely contributes to the understanding of people's attitudes and the design of health policies.

I certify that I have the right to deposit the contribution with MPRA.

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Database

	HDI2004	HDI2009	HDI2014	NPA2004	NPA2009	NPA2014
Germany	0.925	0.947	0.911	0.36	0.31	0.29
Austria	0.934	0.955	0.881	0.34	0.29	0.27
Belgium	0.942	0.953	0.881	0.36	0.28	0.31
Cyiprus	0.883	0.914	0.845	0.47	0.46	0.54
Denmark	0.932	0.955	0.9	0.17	0.18	0.14
Slovakia	0.842	0.88	0.83	0.36	0.35	0.41
Slovenia	0.895	0.929	0.974	0.24	0.22	0.19
Spain	0.922	0.955	0.869	0.47	0.42	0.44
Estonia	0.853	0.883	0.84	0.4	0.41	0.18
Finland	0.935	0.959	0.879	0.04	0.07	0.15
France	0.932	0.961	0.884	0.35	0.34	0.42
Greece	0.902	0.942	0.853	0.57	0.67	0.59
Holand	0.942	0.964	0.915	0.31	0.28	0.29
Hungary	0.848	0.879	0.818	0.6	0.53	0.44
Irland	0.936	0.965	0.899	0.28	0.26	0.34
Italy	0.92	0.951	0.872	0.58	0.55	0.6
Latvia	0.823	0.866	0.81	0.48	0.44	0.39
Lithuania	0.842	0.87	0.834	0.48	0.44	
Luxembourg	0.933	0.96	0.881	0.4	0.32	0.29
Malta	0.975	0.902	0.829	0.43	0.38	0.75
Polond	0.85	0.88	0.834	0.46	0.49	0.52
Portugal	0.897	0.909	0.822	0.66	0.55	0.64
Czeck Rep	0.868	0.903	0.871	0.34	0.37	0.35
UK	0.936	0.947	0.892	0.31	0.32	0.35
Sweden	0.946	0.963	0.898	0.07	0.06	0.09

	Happ2006	Happ2010	Happ2014	AntiD2000	AntiD2009	AntiD2011
Germany	240	6.672	7	20.7	41.8	50.0
Austria	260	7.369	7.5			
Belgium	243.33	6.967	7.1	38.7	66.9	70.0
Cyprus	230	6.466				
Denmark	273.33	7.693	7.6	34.8	78.2	85.2
Slovakia	180		5.9	8.6	27.0	30.7
Slovenia	220	6.06	6		43.2	50.0
Spain	233.33	6.322	6.2	28.2	57.7	63.9
Estonia	170		5.4	6.4	14.4	17.8
Finland	256.67	7.389	7.4	35.5	66.4	70.2
France	220	6.764	6.7	39.5	49.8	49.8
Greece	210	5.435	4.7			
Holand	250	7.512	7.4	31.4	40.1	41.8
Hungary	190		4.9	13.5	25.5	27.3
Irland	253.33	7.076	6.8			
Italy	230	6.021	6			41.7
Latvia	156.67	5.426				
Lithuania	156.67	5.426				
Luxembourg	253.33	7.054	7.1	36.1	48.6	51.2
Malta	250	5.964				
Polond	196.67	5.822	5.7			
Portugal	203.33	5.101	5.2	26.0	71.9	78.3
Czeck Rep	213.33	6.29	6.7	9.7	38.1	44.1
UK	236.67	6.883	6.9	37.6	60.9	70.7
Sweden	256.67	7.48	7.4	47.7	74.1	79.4