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Happiness and Environmental Degradation: A Global Analysis

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Abstract

This study contributes to the happiness-environment nexus by introducing the novel measures of environmental degradation such as species protection, marine protected areas and water quality unlike previous literature that mainly emphasized the importance of carbon dioxide emissions (CO_2) in influencing happiness levels. The study also holds the distinction of using for the first time Environmental Performance Index (EPI) data for environmental degradation indicators. The empirical analysis is based on Ordinary Least Squares (OLS), Pooled OLS, Two Stage Least Squares (2SLS) and Generalized Method of Moments (GMM) techniques. The results suggest that CO_2 emissions have strong negative impact on happiness whereas species protection and marine protected areas increase the level of happiness across the selected sample. Furthermore, economic affluence is improving the life satisfaction levels. This analysis emphasizes the need of environmental policies that aim at reducing harmful gasses such as CO_2 and nitrous oxide emissions and promoting the factors like protection of bio diversities to ensure healthy functioning of environment and human society. Finally, findings of the study are shown to be robust to different specification, alternative estimation methods, and additional control variables.

Keywords: happiness, environmental degradation, CO_2 emissions, marine protected areas, species protection, biodiversity, water quality, nitrous oxide emissions.

1. Introduction

Happiness research has made significant contributions to economic literature. It has gained interest mainly because of the rising discontent among policymakers, environmentalists and nationals as the economic growth has not been much successful in achieving the promised benefits. The literature of happiness dates back to the times of ancient Greek, by the works of Aristippus's Hedonic view and Aristotle who define happiness as a central purpose and goal of human life (Tiwari and Mutascu, 2015).

The empirical investigation into happiness research started with the pioneer studies of Easterlin (1974), Scitovsky (1976) and Hirsch (1976). These studies mainly modeled income as key determinant of happiness. However, soon it was realized that income had little impact on the quality of life and happiness. The literature on happiness asserted that

income alone cannot guarantee enhanced human well-being (Easterlin, 1974; Tukker et al., 2008). To attain the larger benefits there is need to build such economic models that can ensure higher levels of happiness.

The idea that income alone cannot ensure larger happiness led to the investigation of other variables such as health, socio-economic conditions and environmental quality that can potentially affect well-being. Since environmental quality influences human psychology, it has inherent relationship with happiness (Kellert and Wilson, 1983). Person surrounded by green view and beautiful scenery is more likely to be happier than person living in lower quality and grimy environment. Areas with greener environments manifest higher life expectancy and well-being of their residents. In a case study of Pennsylvania over the period 1972-1982, Ulrich (1984) finds out that the recovery rate of patients who stayed in rooms with trees outside was much higher than those who were in rooms with brick wall. They also required much less medications as they received healthier effects from nature. Similarly, a research report shows that the beautiful sight improves workers efficiency and helps to mitigate negative health conditions (California Energy Commission, 2003). This highlights the importance of natural environment in securing happiness at large.

In happiness-environment nexus the most important concern is of environmental degradation. Many studies have consensus that environmental degradation is a serious threat to human happiness and health (McMichael, 2003; Ferrer-i-Carbonell and Gowday, 2007; Tiwari, 2011; Li et al., 2014). The World Health Organization (2013) report says that almost 7 million deaths have been reported due to air pollution. Along with air pollution, water quality and lack of sanitation are major environmental risks that cause many infectious diseases. According to United Nations Office for Disaster Risk Reduction Report (2004) environmental degradation is an outcome of decline in environmental quality resulting from ambient effluence, inappropriate use of land and natural calamities. The emergence of industrial revolution and rapid economic growth has deteriorated the quality of environment to an alarming extent culminating major concerns globally. All these developments transforming earth into "new state" that appears to be less welcoming to humans. So to preserve the amenity of environment and thereby human happiness, environmental degradation has been incorporated as the core subject of happiness research.

A substantial work has been produced on the relationship between happiness and environmental degradation. The studies mostly consider greenhouse gases especially CO_2 emissions as an indicator of environmental degradation. However, these studies ignore the other dimensions of environmental degradation such as species protection, marine protected areas and water quality. As these dimensions are the important constituents of environment and also affect the happiness. Therefore, the present study attempts to incorporate these dimensions along with CO_2 emissions as main indicator of environmental degradation and fulfills some of the research gaps of previous literature. Previous studies are either country specific or covering small samples or using simple econometric techniques. For instance, Tiwari (2011) covers a panel of only 21 countries, Lenzen and Cummins (2013) merely integrate the two surveys to trace the impact of CO_2 emissions on subjective well-being only in case of Australia and Welsch (2006) simply uses OLS to estimate the relationship of happiness with environment for ten European countries.

However, this research is not specific to some countries' analysis like studies discussed rather include the entire world scenario. Secondly, we have added the new dimensions of environment such as species protection, marine protected areas and water quality. Finally,

this study addressed the issue of endogeneity which is altogether ignored in the previous literature.

The broader objectives of the study include how different proxies of environmental degradation affect happiness level, whether the individual effect of environmental variables on happiness is consistent with overall impact and whether the conventional role of income in maintaining happiness holds or not. This research paper emphasizes the importance of non-income factors such as biodiversity, gasses and water quality in determining happiness levels which have been long ignored in theoretical and empirical analysis. The main implication of this research is that environmental degradation exerts powerful impact on happiness as compared to economic and demographic dimensions. It creates the awareness about importance of environment and its protection. The research suggests that policies aimed at reducing environmental hazards can lead to a happy and healthy society.

The remaining study is arranged as follows. Section 2 includes the review of literature pertaining happiness and environmental degradation relationship. Section 3 explains the model and variables used in the study. Section 4 presents data description and sources of variables. In Section 5 regressions results are interpreted and Section 6 concludes the analysis.

2. Literature Review

The theories of happiness holds the different views about what determines and matters for happiness. Some theories predict that happiness depends on the absolute quality of life while others argue that it depends on relative quality of life or personal feelings of a person. For instance, livability theory and objective list theory emphasis the absolute quality of life while the comparison theory, hedonic theory, utilitarianism and desire theory support the contrary view that is happiness depends more on how one feels about his life or relative life quality regardless of the fulfillment of needs (Hagerty, 1999; Seligman and Royzman, 2003).

Livability theory implies that happiness depends on the extent to which material and non-material needs of person are satisfied. It applies to a society where living conditions supplement person's needs and desires (Veenhoven et. al, 1993). This theory basically gives the concept of happiness that is based on fulfillment of human wants. Similarly, objective list theory contains the list of number of factors that are considered necessary to lead a happy and healthy life. This enlists the ingredients of happiness that includes success, health, better life opportunities, comforts, money, education and affection (Seligman and Royzman, 2003). Thus, these are some of the thresholds used to evaluate one's happiness.

In contrast, the commonly held belief that happiness depends on relative quality of life finds a support in following theories. Comparison theory suggests that happiness is determined by comparing present life with past and with other people's experiences (Hagerty, 1999). People determine their levels of happiness by constantly comparing and making judgments about their life relative to others' experiences. Hedonic theory underlies comparison theory where people derive life satisfaction levels by comparing their pain over pleasures (Seligman and Royzman, 2003). The theory of utilitarianism also finds its roots in Hedonism. In earlier works of happiness Jeremy Bentham (1822) gives the concept of human well-being based on utilitarianism. Utilitarian holds the view that every person's satisfaction is composed of total balance of pleasures over sufferings and this view should

be the ultimate consideration of government. Similarly, desire theory says happiness is achieved when one gets what he/she aspires for.

Relating to our study, there are theories which relates happiness with environment. One of the earlier works by Wilson (1983) gives the concept of 'biophilia hypothesis' which establishes the relationship between happiness and environment. The biophilia hypothesis asserts that person who interacts more with natural environment receives positive mental and physical well-being. The reason behind this attraction is the mankind history where humans spent centuries living in natural environments (Kellert and Wilson, 1993). The study by Kent et al. (2017) endorses the biophilia hypothesis. It shows that green and beautiful community contributes to the happy society furthermore, environmental characteristics such as urban planning plays an important role in life satisfaction levels of people. Similarly, Ecopsychology Theory says that a detachment from nature not only leads to poor environment but also increases unhappiness and poor health (Conn, 1998).

With the evolution of happiness research many theories have been put forward to explain its importance, factors and dimensions. Initially studies focused more on income as major determinant of happiness. Easterlin (1974) was the first economist to empirically test whether income contributes to greater happiness. Easterlin contradicts this notion of positive impact of economic development on happiness in his famous theory "Easterlin Paradox" (1995). He showed that higher levels of happiness were associated with higher incomes within the country but not across the countries for nineteen countries of Latin America, Asia and Africa over the period of 1946-1970. Easterlin argues that increase in income only increases happiness up to a certain point. Blanchflower and Oswald (2005) also find that Australia being less happy despite being one of the highest in the rank of Human Development Index (HDI). Findings of these studies are similar to the notion of happiness given by comparison theory which asserts that happiness depends on the perceptions of people about their lives rather than actual conditions in life. However, studies by Veenhoven (1991) and Gardner and Oswald (2001) reject the Easterlin argument that income does not affect happiness and believe that money does buy happiness. Different Studies including livability theory lend support to the belief that rich countries are happier than poor ones (Gerdtham and Johannesson, 1997; Lelkes, 2006). This implies the importance of economic factors such as income, employment in shaping better life satisfaction levels with one's own life.

The analysis in past few decades has extended to include other socio-economic and demographic variables as important determinants of happiness. Morawetz et al. (1977) showed that income inequality lowers the life satisfaction levels. Unemployment has also resulted in higher levels of psychological stress by lowering the better aspects of living (Clark and Oswald, 1994; Winkelmann and Winkelmann, 1998; Di Tella et al., 2001). Diener et al. (2000) conclude that married people reported higher joy than people who are not married which in turn reported greater subjective well-being than previously married individual. While no significant impact of economic development on happiness levels in different countries is found (Blanchflower and Oswald 2004).

Apart from economic factors environment has also very important place in happiness literature. The study of Ulrich (1984), carried in Pennsylvania between 1972 and 1981, shows that the recovery rate of patients who stayed in rooms with trees outside was much higher than those who were in rooms with brick wall. They also required much less medications as they received healthier effects from nature. Considerable amount of

theoretical and empirical literature shows the negative impact of environmental degradation on human happiness. Welsch (2006) shows that Nitrogen dioxide, LEAD and Particles, proxies of air pollution, have harmful effect on person's well-being in ten European countries over the period of 1990-1997. Likewise, Ferrer-i-Carbonell and Gowdy (2007) find a negative impact of environmental degradation on happiness and a positive association between caring for species protection and well-being.

Brereton et al. (2006) indicate that people living close to big transport points have low levels of satisfaction due to noise while those living near to coast have higher happiness levels. Tiwari (2011) shows that decrease in happiness follows the increase in environmental degradation. These empirical findings also find their support in theories of Ecopsychology and Biophilia Hypothesis that say healthy environment leads to positive physical and mental satisfaction levels. Contrary, few studies such as Gu et. al (2017) find that pollution positively affects happiness of high income section while negatively affects those lies in middle and lower income section. While Tiwari and Mutascu (2015) show no significant impact of environmental degradation and GDP on happiness.

Previous literature mostly considered the pollutants commonly known such as greenhouse gases especially CO_2. The studies using carbon dioxide emissions are generally narrow in scope, countries specific and cover shorter time span (Lele, 2013; Tiwari, 2011). This study adds to the existing literature by incorporating the broader view of environmental degradation and happiness. The analysis covers previous literature gaps by looking into the general and segregated impact of different environmental indicators on life satisfaction. This study empirically examines the effect of different and new dimensions of environmental degradation on happiness across the globe. To attain the unbiased and robust estimates we have tackled the issue of endogeneity which is ignored in earlier studies.

3. Methodology

The pioneering work in happiness research is attributed to Easterlin (1974) in his famous theory "Easterlin Paradox". Easterlin (1974, 1995) was one of the social scientist who studied data on self-reported level of happiness in United States. The author considered happiness as a function of economic affluence and suggest that income does not entirely guarantee happiness. This paper incorporates happiness as a function of environmental degradation including income as a cause of happiness. To empirically examine the relationship between happiness and environmental degradation the following model is constructed which is consistent with Tiwari (2011).

$$H_{it} = a_0 + a_1 ED_{it} + a_2 logYPP_{it} + a_3 UP_{it} + a_4 A_{2it} + \mu_{it} \qquad (1)$$

ED represents environmental degradation measured through the CO_2, species protection, marine protected areas, water quality and nitrous oxide. As measures of socio-economic and demographic variables, GDP (YPP), urban population (UP) and age (A) are included in econometric analysis to understand what influences happiness.

Tiwari (2011) mainly uses CO_2 as a measure of environmental degradation. This study also takes CO_2 along with the new indicators of environmental degradation including marine life, species protection, water quality and nitrous oxide indicators. The analysis also incorporates demographic and socio-economic variables.

The existing levels of greenhouse emissions are disturbing the natural pace of earth's temperature and warming the atmosphere at a startling rate. Carbon dioxide is the second

most rich greenhouse gas after water vapor. The rise of industrial revolution, businesses and economic growth economies dependence on fossil fuels has increased which has accelerated the surge of CO_2. These escalating levels of CO_2 are increasing the global warming and exacerbating climate change. This climate change has direct impact on happiness such as the study by Rehdanz and Maddison (2005) shows that higher winter temperatures adds to happiness while higher summer temperatures decrease happiness.

$$H_{it} = a_0 + a_1 logCO_{2it} + a_2 logYPC_{it} + a_3 UP_{it} + a_4 A_{2it} + \mu_{it} \quad (1.1)$$

The second proxy for environmental degradation is marine protected areas (MPA) as oceans are the source of food and livelihoods for marine ecosystem. These areas also support world tourism and recreational industries.

$$H_{it} = a_0 + a_1 MPA_{2it} + a_2 logYPC_{it} + a_3 UP_{it} + a_4 A_{2it} + \mu_{it} \quad (1.2)$$

The third proxy for environmental degradation is species protection (SP). The biodiversities and habitats are vital to sustain planet biological and physical cycles. However, some of these factors are in declines which have further repercussions. The disappearance of biodiversity and extinction of species are environment disasters that inflict damage to human societies. Ferrer-i-Carbonell and Gowday (2007) explore that ozone depletion and biodiversity loss have negative impact on well-being.

$$H_{it} = a_0 + a_1 SP_{2it} + a_2 logYPC_{it} + a_3 UP_{it} + a_4 A_{2it} + \mu_{it} \quad (1.3)$$

The fourth proxy is unsafe water quality which is named as water quality (WQ). Access to safe water is crucial for promoting human health, socioeconomic development and individual well-being. Better access to clean drinking water is one of the goals of Millennium Development Goals (Environmental Performance Report, 2016).

$$H_{it} = a_0 + a_1 WQ_{2it} + a_2 logYPC_{it} + a_3 UP_{it} + a_4 A_{2it} + \mu_{it} \quad (1.4)$$

Finally, apart from CO_2, another important greenhouse gas known as nitrous oxide (NO) is included to check its impact on happiness.

$$H_{it} = a_0 + a_1 NO_{2it} + a_2 logYPC_{it} + a_3 UP_{it} + a_4 A_{2it} + \mu_{it} \quad (1.5)$$

4. Data and Variables Description

The analysis covers 99 countries dataset used in the empirical model for the period of 1980-2015. Happiness is the focused dependent variable of study. CO_2, species protection, marine protected areas, water quality and nitrous oxide are main independent variables while GDP, urban population and age are used as control variables. Table A1 in appendix shows the brief description, construction and sources of the variables used in the analysis. Table A2 shows the summary statistics of data that gives a detailed review of data. It provides the maximum values and information on mean and standard deviation of happiness and environmental degradation indicators. Happiness levels show variation across countries. The people of Andorra are the happiest with 7.52 (out of 10) value as against the general belief that people of developed countries are the happiest one while Croatians are less happy with value 2.78 (out of 10). Andorra is surrounded with beautiful mountains and climate where people are more connected to nature and its natural beauty attracts huge number of tourists. In the case of CO_2 emissions Chad with -3.517 is the country that has lowest CO_2 emissions while Qatar has highest CO_2 emissions standing at 3.87.

Table 1: Summary Statistics of Cross-Sectional Data and Variables

Variable	Observations	Mean	Std. Dev.	Min	Max
Independent Variable					
Happiness	99	4.139199	0.886266	2.7875	7.52
Dependent Variables					
CO_2	197	0.564095	1.621848	-3.51749	3.878691
Species protection	202	10.37874	5.46788	0	17
Marine prot. areas	203	5.826601	10.91998	0	75.13333
Water quality	179	0.612	0.348495	0	0.996179
Nitrous oxide	199	7.391938	7.174069	0	50.3368
Control Variables					
GDP	190	8.849981	1.210175	6.30724	11.65673
Urban population	208	54.16002	24.68545	7.879416	100
Age	192	6.707162	4.402217	1.045787	17.63407

In marine protection Ecuador is at the top with highest value at 73.13 while Hong Kong, Eritrea, Iraq, Kazakhstan, Sao Tome and Principe, San Marino, Montenegro, Uzbekistan, Zambia and Zimbabwe doing poor performance in saving these areas as their value stood at 0. The countries including American Samoa, Bermuda, Hong Kong, Guamand Monaco are doing better in protecting species while Marshall Islands, San Marino, Nauru, Sao Tome and Principe, Macao the situation of species protection is worse. The countries including Australia, Austria American Samoa, Aruba, Brunei Darussalam, Canada, Cyprus, Finland, France, Italy UK, US have better water quality due to their advanced technologies and development in water and sanitation facilities. In the case of nitrous oxide people of Andorra, Greenland, Marshall Islands, Nauru, Palau and Tuvalu are happier due to less emissions while Equatorial Guinea have maximum nitrous oxide emissions. In economic development Qatar shows the best performance with highest GDP and Congo Dem Repuplic lags behind with lowest GDP. The countries of Bermuda, Gibraltar, Monaco, Nauru, Singapore and Sint Maarten (Dutch part) are found to be most urbanized.

5. Results

The cross sectional and panel data estimation techniques are used to examine the impact of environmental degradation on happiness.

5.1. Cross Sectional Results

In estimation we followed the strategy of using different environmental proxies with fixed control variables in every regression. Table 2 shows the OLS results of CO_2 emissions, species protection, marine protected areas and water quality indicators for 99 cross sections averaged over 1980-2015. Column 1 presents estimated coefficients of happiness and carbon dioxide emissions along with control variables. The coefficient of CO_2 indicates that with 1 percent increase in carbon dioxide emissions decreases happiness up to 0.46 units. The negative sign shows that with high carbon dioxide emissions people will have low life satisfaction levels. Mainly because increasing levels of CO_2 are escalating the global warming and exacerbating climate change. Climate change warming earths' temperature and disturbing the ecological balance conferring overall negative impact on psychological well-being of people. The findings are consistent with the theoretical argument that is growing carbon dioxide emissions are increasing the levels of environmental pollution leading to many respiratory and other diseases (Tiwari, 2011). The studies of Tiwari, (2011), Lele (2013) and Lenzen and Cummins (2013) support our result.

Column 2 shows the positive relationship between happiness and species protection. The results show that with one percent increase in protection of species the level of happiness increases by 0.06 units. This result finds its support in Ecosystem Services Approach which advocates the protection of species and thereby contributing to human societies' welfare (Gascon et. al, 2015). The study by Ferree-i-Carbonell and Gowday (2007) also highlights the positive psychological advantages individuals receive from protecting the species. Because species are the vital part of environment and their losses endanger the environment as well as market economies. For instance, extinction of pollinators is threatening the agricultural production across the globe (Hsu *et al.*, 2014).

Table 2: OLS Regression of Happiness and Environmental Degradation

	(1)	(2)	(3)	(4)	(5)
Variables	**Dependent Variable: Happiness**				
GDP	0.929***	0.279**	0.342**	0.320**	0.368**
	(0.203)	(0.137)	(0.145)	(0.159)	(0.144)
Urban Population	-0.00969*	-0.00462	-0.00798	-0.00888	-0.00894
	(0.00570)	(0.00569)	(0.00601)	(0.00621)	(0.00600)
Age	-0.0944***	-0.118***	-0.106***	-0.121***	-0.102***
	(0.0212)	(0.0213)	(0.0225)	(0.0355)	(0.0223)
Co_2	-0.465***				
	(0.123)				
Species Protection		0.0650***			
		(0.0170)			
Marine Prot. Areas			0.00720		
			(0.00594)		
Water Quality				-0.369	
				(0.552)	
Nitrous Oxide					-0.0867*
					(0.0462)
Constant	-2.530	2.092**	2.338**	2.946**	2.953***
	(1.563)	(0.932)	(1.000)	(1.467)	(1.067)
Observations	96	97	97	95	96
R-squared	0.321	0.321	0.225	0.218	0.242
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1					

Columns 3-4 depict that marine protected areas have positive while water quality (unsafe) have negative impact on happiness but insignificant. This insignificance is may be justified on the basis of lack of data on marine protected and water quality variables. Like CO_2 emissions, nitrous oxide emissions also have detrimental and significant impact on happiness as 1 percent increase in nitrous oxide emissions brings 0.08 units decline in happiness. The results of control variables are consistent with previous studies' findings. In all four specifications, GDP is positive and highly significant in explaining happiness.

As one percent increase in GDP leads to 0.92, 0.27, 0.34 and 0.32 units increment in happiness (columns1-4). This result clearly negates the Easterlin Paradox and joins the studies of Tiwari (2011), Inglehart (1995) and Oswald (1997) who believe that income increases the likelihood of happiness. The theoretical argument behind this is as income increases it improves the prospects of life, purchasing power and quality of living. Urban population in first specification lowers happiness, as with one percent increase in urban population happiness decrease by 0.009, units. Ecopsychology theory says that disengagement from greenery and nature reduces person happiness as we see urbanization removes the green spaces therefore it lowers the well-being human receives from natural environments (white *et al.,* 2013). On demographic side age is incorporated that appears to have negative relationship with happiness. The coefficient shows that a one year increase in age leads to 0.09, 0.11, 0.10 and 0.12 units decrease in happiness, respectively. The negative sign of age refers that people in their 60s will have lower levels of happiness among total population. Lele (2013) gives the justification and say the increase in percentage of these people put more pressure on social security program and tax burden (Lele, 2013).

There are studies that show happiness also affects environment. For instance, Frey and Stutzer (2002) argue that person with greater happiness shows more care for environmental protection. The study by Duroy (2005) shows the positive impact of happiness on environmental knowledge and positive environmental behaviors. According to Tiwari and Mutascu (2015) there exits reverse causality between happiness and environmental degradation where environmental degradation affects happiness and happiness in turn affects environment. So the literature also suggests the reverse causality between happiness and environmental quality. As a result there is possibility of endogeneity in our model. To tackle the above issue, this study incorporates the instrumental variable technique Two Stage Least Square Method (2SLS) on cross sectional data.

The 2SLS method gives efficient and reasonable results even in the presence of endogeneity. Table 3 is based on the 2SLS regression results. In all specifications different proxies of environmental degradation except water quality significantly affects happiness. Carbon dioxide and nitrous oxide emissions again show negative association with happiness while species protection and marine protected areas increase the level of happiness. For control variables we get the similar results obtained in Table 2. There exists positive relationship between GDP and happiness implying that income increases the psychological wellbeing of individual by improving different aspects of life (Winkelmann and Winkelmann, 1998; Gerdtham and Johannesson, 2001). The coefficient indicates a one percent increase in GDP raises happiness by 0.93, 0.27, 0.32 and 0.31 respectively. Whereas urbanization here is having insignificant impact on happiness and age negatively affects happiness.

Table 3: 2SLS Regression of Happiness and Environmental Degradation

	(1)	(2)	(3)	(4)	(5)
Variables	**Dependent Variable: Happiness**				
GDP	0.936***	0.277**	0.325**	0.318**	0.373***
	(0.245)	(0.135)	(0.144)	(0.155)	(0.140)
Urban Population	-0.00899	-0.00426	-0.00762	-0.00828	-0.00859
	(0.00556)	(0.00560)	(0.00594)	(0.00608)	(0.00588)
Age	-0.0956***	-0.119***	-0.108***	-0.123***	-0.102***
	(0.0207)	(0.0210)	(0.0222)	(0.0352)	(0.0218)
CO_2	-0.468***				
	(0.169)				
Species Protection		0.0673***			
		(0.0191)			
Marine Prot. Areas			0.0119*		
			(0.00721)		
Water Quality				-0.401	
				(0.550)	
Nitrous Oxide					-0.137**
					(0.0681)
Constant	-2.605	2.073**	2.471**	2.969**	3.337***
	(1.952)	(0.912)	(0.994)	(1.442)	(1.126)
Sargan Test	(P = 0.4666)	(P = 0.2073)	(P = 0.0541)	(P = 0.0848)	(P = 0.0518))
Basmann Test	(P = 0.4798)	(P = 0.2182)	(P = 0.0572)	(P = 0.0901)	(P = 0.0547)
Observations	95	96	95	94	95
R-Squared	0.327	0.317	0.220	0.220	0.242
Standard Errors In Parentheses *** P<0.01, ** P<0.05, * P<0.1					

5.2. Panel Data Results

Panel data has more degree of freedom and sample variability. It has the capability to incorporate complexity of human behavior as compared to cross sectional data. Panel data gives more accurate predictions for outcomes by pooling the data (Hsiao, 2007). Considering the following we turn to panel data analysis for validity and accuracy of our results. The findings of pooled panel, Fixed and Random Effects models are consistent with the findings of OLS and 2SLS as shown in Table 4 and Table 5.

Table 4: Pooled OLS Regression of Happiness and Environmental Degradation

	(1)	(2)	(3)	(4)	(5)
Variables	**Dependent Variable: Happiness**				
GDP	1.157***	0.497***	0.843***	0.700***	0.694***
	(0.115)	(0.0958)	(0.285)	(0.218)	(0.0936)
Urban Population	-0.0156***	-0.0145***	-0.0355***	-0.0193**	-0.0202***
	(0.00419)	(0.00420)	(0.0123)	(0.00949)	(0.00421)
Age	-0.0329**	-0.0652***	-0.0187	-0.000195	-0.0556***
	(0.0147)	(0.0144)	(0.0438)	(0.0508)	(0.0146)
CO_2	-0.572***				
	(0.0770)				
Species Protection		0.0675***			
		(0.0113)			
Marine Prot. Areas			0.0263**		
			(0.0129)		
Water Quality				0.798	
				(0.776)	
Nitrous Oxide					-0.0866***
					(0.0309)
Constant	-4.348***	0.366	-0.0525	-1.004	0.403
	(0.839)	(0.610)	(1.857)	(1.951)	(0.650)
Observations	1,018	1,066	159	251	1,053
R-Squared	0.093	0.077	0.100	0.040	0.054
Standard Errors In Parentheses *** P<0.01, ** P<0.05, * P<0.1					

Table 5: FEM and REM Regression of Happiness and Environmental Degradation

	FEM	REM	FEM	REM	FEM	REM	FEM	REM	FEM	REM
Variables	**Dependent Variable: Happiness**									
GDP	2.647 ***	1.475 ***	1.400 ***	0.608 ***	3.429 ***	0.843 ***	1.618 *	0.700 ***	1.839 ***	0.847 ***
	(0.373)	(0.148)	(0.323)	(0.127)	(0.821)	(0.28)	(0.876)	(0.218)	(0.322)	(0.125)
Urban	-0.007	-0.01 ***	-0.046	-0.0187 ***	0.137	-0.035 ***	-0.051	-0.0193 **	-0.025	-0.026 ***
Population	(0.035)	(0.005)	(0.035)	(0.0057)	(0.092)	(0.012)	(0.090)	(0.009)	(0.035)	(0.005)
Age	0.196 **	-0.029	0.337 ***	-0.0661 ***	0.986 ***	-0.018	0.478 **	-0.000	0.369 ***	-0.051 **
	(0.094)	(0.019)	(0.080)	(0.0203)	(0.168)	(0.043)	(0.185)	(0.050)	(0.084)	(0.020)
CO_2	-1.64 ***	-0.76 ***								
	(0.347)	(0.099)								
Species			0.140 ***	0.089 ***						
Protection			(0.032)	(0.014)						
Marine Prot.					0.061 **	0.026 **				
Areas					(0.028)	(0.012)				
Water							5.822	0.798		
Quality							(10.06)	(0.776)		
Nitrous									-0.476	-0.101 **
Oxide									(0.320)	(0.0449)
Constant	-19.1 ***	-6.78 ***	-10.31 ***	-0.547	-43.06 ***	-0.0525	-13.84	-1.004	-9.962 ***	-0.432
	(2.445)	(1.083)	(2.292)	(0.812)	(5.396)	(1.857)	(9.767)	(1.951)	(3.361)	(0.896)
Observations	1,018	1,018	1,066	1,066	159	159	251	251	1,053	1,053
R-Squared	0.156	0.14	0.151	0.10	0.753	0.46	0.117	0.07	0.138	0.086
No Of Id	95	95	97	97	95	95	95	95	96	96
Standard Errors In Parentheses *** P<0.01, ** P<0.05, * P<0.1										

There is possibility of reverse causality between happiness and environmental degradation. Happier people pay more attention to preserve environment and environment in turn affects psychological well-being of individuals (Frey and Stutzer, 2002). To the best of our knowledge the issue of endogeneity between happiness and environmental degradation has

not been considered seriously and addressed in the previous literature. So we tackle the issue of endogeneity by using Arrelano Bond Model. We have used foreign direct investment as external instrument along with own lags as internal instruments. The instruments used are valid for CO_2 emissions and species protection. Foreign direct investment is the major determinant of CO_2 emissions. Though FDI increases investment and economic growth in a country but it also imposes cost on environment in the form of increased pollution and increased CO_2 emissions (Peng *et al.*, 2015).The foreign direct investment also affects species protection by bringing the cleaner investment and improves the environmental performance including biodiversities' protection (Mabey and McNally, 1999).

Table 6: System GMM Regression of Happiness and Environmental Degradation

	(1)	(2)
Variables	**Dependent Variable: Happiness**	
Happiness	0.348***	0.665***
	(0.0771)	(0.00895)
GDP	0.761***	0.0752***
	(0.195)	(0.00774)
Urban Population	-0.000736	-0.00599***
	(0.00622)	(0.000259)
Age	0.0364	-0.00431*
	(0.0239)	(0.00224)
CO_2	-0.697***	
	(0.177)	
Species Protection		0.0342***
		(0.000535)
Constant	-3.830***	0.595***
	(1.358)	(0.0485)
AR(1)	Pr > Z = 0.005	Pr > Z = 0.002
AR(2)	Pr > Z = 0.980	Pr > Z = 0.393
Observations	525	549
Number Of Id	92	94
Standard Errors In Parentheses *** P<0.01, ** P<0.05, * P<0.1		

System GMM results shows the clear association between happiness and environmental degradation proxies where CO_2 having negative and species protection positive relationship with happiness (Tiwari, 2001; Ferrer-i-Carbonell and Gowdy 2007; Welsch, 2006).

The overall results based on the empirical findings of cross-sectional and panel data show that environmental degradation is bad for psychological well-being of individual following the effects of carbon dioxide emissions and water quality (unsafe) on happiness and environmental quality. Furthermore, good environment quality increases happiness. For instance, species protection and marine protection improve the states of happiness while

CO_2 emissions have negative impact on happiness. The empirical estimates are robust and sound based on the results of diagnostic tests.

5.3. Sensitivity Analysis

We have conducted the sensitivity analysis to check the robustness of our findings. In sensitivity analysis, three additional control variables unemployment, life expectancy and inflation have been introduced. Table 7 shows the estimation results of independent variables after adding sensitivity variables. The impact of CO_2 emissions on happiness remains same, significant and negative across all sensitivity variables. Similarly, the positive impact of species protection on environmental degradation remains intact. However, the inclusion of these additional control variables does alter the results for marine protected areas and water quality which becomes insignificant. The nitrous oxide still remains negative and significant. Overall results of sensitivity analysis suggest that the variables of study are robust.

Table 7: Sensitivity Analysis of Variables

	Sensitivity Variables		
	Unemployment	**Life Expectancy**	**Inflation**
Variables	**Dependent Variable: Happiness**		
CO_2 Emissions	-0.378**	-0.412**	-0.498***
	(0.187)	(0.163)	(0.170)
R-squared	0.3467	0.3517	0.3431
Species protection	0.0591***	0.0803***	0.0680***
	(0.0193)	(0.0191)	(0.0190)
R-squared	0.3483	0.3670	0.3211
Marine prot. areas	0.0101	0.0111	0.0124*
	(0.00698)	(0.00713)	(0.00718)
R-squared	0.2800	0.2374	0.2234
Water quality	-0.307	-0.380	-0.512
	(0.530)	(0.544)	(0.557)
R-squared	0.2821	0.2385	0.2280
Nitrous oxide	-0.170**	-0.145**	-0.141**
	(0.0661)	(0.0683)	(0.0679)
R-squared	0.326	0.248	0.246
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1			

6. Conclusion

Literature on happiness adds to new findings and knowledge to existing views. One of the most significant is the large impact of non-financial variables on happiness. This does not imply the triviality of economic factors such as income in determining happiness rather it suggests the more relevance of non-financial factors to happiness. In particular environment has innate relationship with psychological well-being (Wilson, 1984).

Given this importance of happiness and environment link, this study used cross sectional and panel datasets to explore the relation between happiness and different environment

indicators. The study carries the analysis of 99 countries and covers the time period of 1980-2015. Estimation techniques of cross-sectional and panel data are used to estimate empirical results. We have also conducted the sensitivity analysis by including three additional variables where results were found to be insensitive. All the measures of environmental degradation have significant impact on happiness based on cross-sectional and panel data methods findings. The magnitude of greenhouse gases coefficient implies the strong negative impact of carbon dioxide (CO_2) and nitrous oxide emissions on happiness. Increasing levels of greenhouse gases especially CO_2 proves to be damaging to environment and human happiness. Secondly, protection of biodiversities and marine life can ensure larger benefits for human via tourism and broaden economic activity suggested by empirical results.

In the light of above findings it is argued that governments and policy makers should formulate strict environmental laws that root out the causes of environmental deterioration and to create awareness about protecting the environment for present and future generations' greater happiness.

6.1. Limitations of Study

The study has some limitations. Due to limited resources we cannot conduct primary research using questionnaires and surveys that can give more accurate picture of what really matters for individuals' happiness. This research did not consider some other indicators of environmental degradation such as noise pollution (SPL/dB), land deforestation, soil erosion and forest degradation in future. Furthermore, we have seen the overall impact of environmental degradation on happiness instead of separately looking into developed and developing world.

6.2. Contribution of Study

Previous studies mostly take common indicators of environmental degradation such as CO_2 emissions, nitrous oxide, sulfur and others. Secondly, mostly the analysis is restricted to some countries and for shorter time span. Thirdly, much of the work ignores the issue of simultaneity between happiness and environmental degradation. By considering the gaps in literature, this paper intends to do better on them. First, we use broad and new measures of environmental degradation. Secondly, the analysis is not restricted to some country specific cases rather include broad spectrum of countries to obtain bigger picture of environmental degradation implications. Thirdly, this is the first study to utilize new index of Environmental Performance Index for environmental data that required lot of effort and time. Finally, we highlight and tackle the issue of endogeneity that may exist between happiness and environmental degradation unlike previous literature.

6.3. Theoretical Implications

Theories of happiness postulate different standards on which happiness depends. Some theories such as livability theory and objective list theory suggest absolute standards while others such as comparison theory and hedonism suggest relative standards. However, the empirical findings of this study mostly support logics of livability and objective list theories which predict that satisfaction of needs is the ultimate cause of happiness. As the empirical findings clearly proves clean environment and income as important human needs and their gratification does have impact on happiness.

6.4. Directions for Future Research

Since we have worked with secondary data, the same work can be done with primary data using Logit and Probit models to extract more accurate picture about people's happiness and environmental degradation. This research can be extended to incorporate new indicators of environmental degradation such as noise pollution (SPL/dB), land deforestation, soil erosion and forest degradation in future. The study invites the decision makers to revise their welfare and environmental policies and focus more on the strategies that promote good environmental quality and people's happiness.

REFERENCES

Alesina, A., Di Tella, R., & MacCulloch, R. (2004). Inequality and happiness: Are Europeans and Americans different? *Journal of Public Economics*, *88*(9), 2009-2042.

Binder, M. & Blankenberg, A. (2016). Environmental concerns, volunteering and subjective well-being: Antecedents and outcomes of environmental activism in Germany. *Ecological Economics*, *124(1),* 1-16.

Blanchflower, D. G. and Oswald, A. J. (2004). Well-being over time in Britain and the USA. *Journal of Public Economics*, *88*(7), 1359-1386.

Blanchflower, D. G., & Oswald, A. J. (2005). Happiness and the Human development index: the paradox of Australia. *Australian Economic Review*, *38*(3), 307-318.

California Energy Commission (2003). Windows and offices: A study of office worker performance and the indoor environment, Technical Report P500-03-082-A-9, Fair Oaks, California, CA.

Carson, R. (2002). *Silent spring*. Houghton Mifflin Harcourt. New York, NY.

Clark, A. E., & Oswald, A. J. (1994). Unhappiness and unemployment. *The Economic Journal*, *104*(424), 648-659.

Conn, S. A. (1998). Living in the Earth: Ecopsychology, health and psychotherapy. *The Humanistic Psychologist*, *26*(1-3), 179-198.

Daly, H. E. (1987). The economic growth debate: What some economists have learned but many have not. *Journal of Environmental Economics and Management*, *14*(4), 323-336.

Daly, H., Jacobs, M., & Skolimowski, H. (1995). Discussion of Beckerman's Critique of Sustainable Development. *Environmental Values*, *4*(1), 49-70.

DeLucia, E. H., Casteel, C. L., Nabity, P. D., & O'Neill, B. F. (2008). Insects take a bigger bite out of plants in a warmer, higher carbon dioxide world. *Proceedings of the National Academy of Sciences*, *105*(6), 1781-1782.

Duroy, Q. M. (2005). The determinants of environmental awareness and behavior (Working Paper No. 0501). Rensselaer Polytechnic Institute.

Easterlin .R.A. (1995). Will raising the incomes of all increase the happiness of all? *Journal of Economic Behavior and Organization, 27(1),* 35-47.

Easterlin, R. A. (1974). Does economic growth improve the human lot? Some empirical evidence. *Nations and Households in Economic Growth*, *89*, 89-125.

Ferrer-i-Carbonell, A., & Gowdy, J. M. (2007). Environmental degradation and happiness. *Ecological Economics*, *60*(3), 509-516.

Frey, B. S., & Stutzer, A. (2002). The economics of happiness. *World Economics*, *3*(1), 1-17.

Frey, B. S., & Stutzer, A. (2002). What can economists learn from happiness research? *Journal of Economic literature*, *40*(2), 402-435.

Frijters, P., & Van Praag, B. M. (1998). The effects of climate on welfare and well-being in Russia. *Climatic Change*, *39*(1), 61-81.

Gascon, C., Brooks, T. M., Contreras-MacBeath, T., Heard, N., Konstant, W., & Al Mubarak, R. K. (2015). The importance and benefits of species. *Current Biology*, *25*(10), 431-438.

Gu, L., Rosenberg, M. W., & Zeng, J. (2017). Competing forces of socioeconomic development and environmental degradation on health and happiness for different income groups in China. *International Journal of Health Services*, *47*(4), 752-777.

Hirsch, F. (1976). Social limits to growth, Harvard University Press, New York, NY.

Hsiao, C. (2007). Panel data analysis—advantages and challenges. *Test*, *16*(1), 1-22.

Hsu, A., J. Emerson, M. Levy, A. de Sherbinin, L. Johnson, O. Malik, J. Schwartz, and M. Jaiteh. (2014). The 2014 Environmental Performance Index. New Haven, CT: Yale Center for Environmental Law and Policy. Available at: http://www.epi.yale.edu.

Inglehart, R. (1995). Public support for environmental protection: Objective problems and subjective values in 43 societies. *Political Science and Politics*, *28*(01), 57-72.

Kellert, S. R., and Wilson, E. O. (1993). The Biophilia Hypothesis. Washington, DC: Island Press.

Kent, J. L., Ma, L., & Mulley, C. (2017). The objective and perceived built environment: What matters for happiness? *Cities & Health*, 59-71 [Published online: 27 Sep 2017].

Lele, F. F. (2013). Happiness and the environment: Finding out a relationship (Unpublished Doctoral Dissertation). University of Porto. Portugal.

Lelkes, O. (2006). Tasting freedom: Happiness, religion and economic transition. *Journal of Economic Behavior & Organization*, *59*(2), 173-194.

Lenzen, M. and Cummins, R.A. (2013). Happiness versus the Environment—A case study of Australian lifestyles. *Challenges, 4(1),* 56-74.

Mabey, N., & McNally, R. (1999). Foreign direct investment and the environment. *Godalming, Surrey: WWF-UK*.

McMichael, A. J. (2003). Global climate change and health: An old story writ large. Climate change and human health: Risks and responses. Geneva, Switzerland: World Health Organization.

Morawetz, D., Atia, E., Bin-Nun, G., Felous, L., Gariplerden, Y., Harris, E. & Zarfaty, Y. (1977). Income distribution and self-rated happiness: Some empirical evidence. *The Economic Journal*, *87*(347), 511-522.

Peng, H., Tan, X., Li, Y., & Hu, L. (2016). Economic growth, foreign direct investment and CO_2 emissions in China: A panel granger causality analysis. *Sustainability*, *8*(3), 233.

Rehdanz, K., & Maddison, D. (2005). Climate and happiness. *Ecological Economics*, *52*(1), 111-125.

Scitovsky, T. (1976). The joyless economy: An inquiry into human satisfaction and consumer dissatisfaction. *The Journal of Consumer Affairs, 11(2),* 147-149.

Tiwari, A. K. (2011). Happiness and environmental degradation: What determines happiness?. *Economics Bulletin, 31(4),* 3192-3210.

Tiwari, A. K., & Mutascu, M. (2015). The relationship between environmental degradation and happiness in 23 developed contemporary economies. *Management of Environmental Quality: An International Journal*, *26*(2), 301-321.

Tukker, A., S. Emmert, M. Charter, C. Vezzoli, E. Sto, M.M. Andersen, T. Geerken, U. Tischner and S. Lahlou (2008). Fostering change to sustainable consumption and production: An evidence based view. *Journal of Cleaner Production, 16(11)*, 1218-1225.

Ulrich, R. (1984). View through a window may influence recovery. *Science*, *224*(4647), 420-421.

Veenhoven, R. (1991). Is happiness relative?. *Social Indicators Research*, *24*(1), 1-34.

Veenhoven, R., Ehrhardt, J., Ho, M. S. D., & de Vries, A. (1993). *Happiness in nations: Subjective appreciation of life in 56 nations 1946–1992*. Erasmus University Press, Rotterdam.

Welsch, H. (2006). Environment and happiness: Valuation of air pollution using life satisfaction data. *Ecological Economics, 58*(4), 801-813.

White, M. P., Alcock, I., Wheeler, B. W., & Depledge, M. H. (2013). Would you be happier living in a greener urban area? A fixed-effects analysis of panel data. *Psychological Science*, *24*(6), 920-928.

Wilson, E.O. (1984). Biophilia. Harvard University Press, Cambridge.

Winkelmann, L., & Winkelmann, R. (1998). Why are the unemployed so unhappy? Evidence from panel data. *Economica*, *65*(257), 1-15.

World Bank. (2013). World Development Indicators. [Online] Available at: http://data.worldbank.org/indicator (September 20th, 2015).

World Health Organization (2013). Air Quality and Health, Fact Sheet N°313 [Online] Available at: http://www.who.int/mediacentre/factsheets/fs313/en/ (September 17th, 2015).

Zhang, X., Zhang, X., & Chen, X. (2015). Happiness in the air: How does dirty sky affect subjective well-being? (Working Paper No. 1463). International Food Policy Research Institute (IFPRI). USA.

Appendix

Table A1: Data and Variables Description

Variables	Definition	Construction	Sources of Data
Happiness	Happiness is mental state characterized by positive feelings ranging from satisfaction to delight.	1(very happy) to 4 (not at all happy) 0(least happy) to 10 (most happy)	World Values Survey(2014) World Database of Happiness (2016)
Carbon Dioxide (CO_2) Emissions	Carbon dioxide is one of the greenhouse gases and released into atmosphere through human activities like fossil fuel burning.	(Metric tons per capita)	World Development indicators (2016)
Marine Protected Areas	Marine protected areas are areas of intertidal or subtidal terrain--and overlying water and associated flora and fauna and historical and cultural features.	(% of territorial waters)	World Development indicators (2016)
Species Protection	The average area of species - bird, mammals, and amphibians - distributions in a country under protection.	The average area of species - bird, mammals, and amphibians - distributions in a country under protection(Percentage)	Hsu *et al.* (2014)
Water Quality	Exposure to unsafe water quality and population lacking access to drinking water.	min(0) max (0.9999745)	Hsu *et al.* (2014)
GDP per capita	GDP is the "sum of gross value added by all resident producers in the economy".	(Current US$)	World Development indicators (2016)
Urban Population	Urban population refers to people living in urban areas.	(% of actual population)	World Development indicators (2016)
Gini Index	Gini measures the income distribution of nations' residents.	(World Bank estimate)	World Development indicators (2016)
Income Scale	Income scale of respondent	1 (lowest income) to 10(highest income)	World Development indicators (2016)
Age	Population ages 65 and above as a percentage of the total population.	(% of total population)	World Development indicators (2016)

Table A2: List of Countries (in the study)

No	Country	No	Country	No	Country
1	Albania	34	Georgia	67	Niger
2	Algeria	35	Germany	68	Norway
3	Andorra	36	Ghana	69	Pakistan
4	Argentina	37	Greece	70	Paraguay
5	Armenia	38	Guatemala	71	Peru
6	Australia	39	Honduras	72	Philippines
7	Austria	40	Hong Kong	73	Poland
8	Azerbaijan	41	Hungary	74	Portugal
9	Bangladesh	42	Iceland	75	Puerto Rico
10	Belarus	43	India	76	Romania
11	Belgium	44	Indonesia	77	Russian Federation
12	Bolivia	45	Iran, Islamic Rep.	78	Rwanda
13	Bosnia & Herzegovina	46	Iraq	79	Saudi Arabia
14	Brazil	47	Ireland	80	Serbia
15	Bulgaria	48	Israel	81	Singapore
16	Burkina Faso	49	Italy	82	Slovak Republic
17	Canada	50	Japan	83	Slovenia
18	Chile	51	Jordan	84	South Africa
19	China	52	Kyrgyz Republic	85	Spain
20	Colombia	53	Latvia	86	Sweden
21	Costa Rica	54	Lithuania	87	Switzerland
22	Croatia	55	Luxembourg	88	Tanzania
23	Cyprus	56	Macedonia, FYR	89	Thailand
24	Czech Republic	57	Malaysia	90	Trinidad and Tobago
25	Denmark	58	Mali	91	Turkey
26	Dominican Rep.	59	Malta	92	Uganda
27	Ecuador	60	Mexico	93	Ukraine
28	Egypt, Arab Rep.	61	Moldova	94	United Kingdom
29	El Salvador	62	Montenegro	95	United States
30	Estonia	63	Morocco	96	Uruguay
31	Ethiopia	64	Netherlands	97	Venezuela, RB
32	Finland	65	New Zealand	98	Zambia
33	France	66	Nicaragua	99	Zimbabwe