

THREE ESSAYS ON ECONOMIC GROWTH AND THE ENVIRONMENT:  
A COMPARATIVE ANALYSIS OF DEVELOPED AND DEVELOPING COUNTRIES

---

A Dissertation

presented to

the Faculty of the Graduate School

at the University of Missouri

---

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

---

by

IDDISAH SULEMANA

Dr. Harvey S. James, Jr., Dissertation Supervisor

DECEMBER, 2014

© Copyright by Iddisah Sulemana 2014

All Rights Reserved

The undersigned, appointed by the dean of the Graduate School, have examined the dissertation entitled

THREE ESSAYS ON ECONOMIC GROWTH AND THE ENVIRONMENT:  
A COMPARATIVE ANALYSIS OF DEVELOPED AND DEVELOPING COUNTRIES

presented by Iddisah Sulemana, a candidate for the degree of Doctor of Philosophy, and hereby certify that, in their opinion, it is worthy of acceptance.

---

Dr. Harvey S. James, Jr.

---

Dr. Laura M. J. McCann

---

Dr. Corinne B. Valdivia

---

Dr. James S. Rikoon

Dedicated to my parents Sulemana Saaka and Jinche Mengu, uncle Moses D. Mengu and his wife Adishetu A. Mengu.

## ACKNOWLEDGEMENTS

First and foremost, I would like to thank God Almighty for all His mercies and blessings on me. It has been a long, tortuous journey. But The Good Lord has been very faithful and never failing. May His name be praised. Amen.

I am deeply indebted to Dr. Harvey S. James, Jr. for many reasons. Aside from serving as my dissertation supervisor, he taught me what it means to do academic research. His useful guidance, comments, constructive criticisms and encouraging suggestions have tremendously helped to shape my academic career and focus. Since co-authoring a paper published in *Ecological Economics* with him, that experience has propelled me onto a trajectory of noteworthy scholarly productivity. Thank you so much for believing in me and for shaping me into a scholar.

I am so very grateful to my other dissertation committee members - Dr. Laura M. J. McCann, Dr. Corinne Valdivia, and Dr. James S. Rikoon. They have significantly influenced my current and future research. Their comments and criticisms have pushed, motivated and challenged me, leading to the scholarly better version of me that I believe I have become. I am very appreciative of your contributions to my professional growth.

My sincere gratitude also goes to my uncle, Moses Mengu and his wife, Adishetu Mengu. Without their (financial) support, I probably would have never made it through college. My cousin and best friend, Honorable James Kipo Sunyehzi and his wife, Abiba Soale have also been very instrumental to my academic pursuits. To my friends who have supported my academic dreams in diverse ways including advising, motivations, and prayers, please know that I appreciate everything you have done for me. I am particularly thankful to Dr. Sandra E. Safo, Dr. Baffuor K. Takyi, Dr. Chris Opoku-Agyeman, Dr. Kweku Opoku-Agyemang, Dr. David Amponsah, Dr. Emmanuel A. Codjoe, Dr. Edward Nketiah-Amponsah, Dr. Mornah Dekumwini, Conrad Y. Puozaa, George M. Akpandjar, Jude E. Kyoore, Stanley Dery, Godwin K. Arthur, Charles Teye, Evarist J. N. Muhaya, Daniel Kpianbaareh, Clement Tuonuur, Dipo Akandji, Daniel A. Kanyam, Yakubu S. Mengu and Modeste T. Tchouaso for their support.

Finally, I am very grateful to my wife Akayla J. Jones for her patience, understanding, encouragement and support, as well as for proofreading my work. Thank you.

## TABLE OF CONTENTS

ACKNOWLEDGEMENTS.....	ii
LIST OF FIGURES.....	v
LIST OF TABLES.....	vi
ABSTRACT.....	vii
CHAPTER	
1. INTRODUCTION.....	1
2. PERCEIVED ENVIRONMENTAL QUALITY AND SUBJECTIVEWELL-BEING: ARE DEVELOPING COUNTRIES DIFFERENT FROM DEVELOPED COUNTRIES?.....	7
2. 1. Introduction.....	7
2. 2. Literature Review .....	9
2. 2.1. Subjective Well-being .....	9
2. 2.2. Perceptions and Subjective Well-being .....	11
2. 2.3. Environmental Quality and Subjective Well-being .....	12
2. 2.4. Summary .....	15
2. 3. Conceptual Framework .....	16
2. 4. Data and Empirical Methods .....	19
2. 5. Findings .....	22
2. 6. Conclusions .....	35
3. PERCEIVED SOCIOECONOMIC STATUS AS A PREDICTOR OF ENVIRONMENTAL CONCERN IN DEVELOPED AND DEVELOPING COUNTRIES.....	46
3. 1. Introduction .....	46
3. 2. Related Literature .....	48
3. 2. 1. Explaining the Sources of Environmental Concern .....	48
3. 2. 2. Perceptions and Socioeconomic Phenomena .....	52

3. 2. 3. Environmental Concern in African Countries: Expected Outcomes.....	54
3. 3. Data and Empirical Methods.....	56
3. 4. Findings .....	60
3. 5. Discussion .....	68
3. 6. Robustness Checks .....	70
3. 7. Summary and Conclusion.....	72
APPENDIX A.....	84
4. ENVIRONMENTAL KUZNETS CURVES FOR AIR POLLUTION IN DEVELOPED AND DEVELOPING COUNTRIES: EXPLORING TURNING POINT INCOMES AND THE ROLE OF DEMOCRACY.....	85
4. 1. Introduction.....	85
4. 2. Background Literature .....	87
4. 2. 1. Economic Growth and Environmental Pollution.....	87
4. 2. 2. Democracy and Environmental Pollution.....	90
4. 3. Theoretical Explanations.....	92
4. 4. Methods and Procedures.....	96
4. 4.1. Data.....	96
4. 4. 2. Empirical model.....	98
4. 5. Results and Discussion.....	101
4. 6. Summary and Conclusion.....	109
APPENDIX B.....	121
5. CONCLUSION.....	122
VITA.....	131

## LIST OF FIGURES

### Chapter 2

- Figure 1. Life satisfaction among respondents in African countries.....25
- Figure 2. Life satisfaction among respondents in developed countries.....25
- Figure 3. Distribution of perceptions about the seriousness or otherwise of poor water quality in respondent's own community.....25
- Figure 4. Distribution of perceptions about the seriousness or otherwise of poor air quality in respondent's own community.....26
- Figure 5. Distribution of perceptions about the seriousness or otherwise of poor sewage and sanitation in respondent's own community.....26
- Figure 6. Distribution of perceptions about the seriousness or otherwise of global warming or the greenhouse effect for the world as a whole.....26
- Figure 7. Distribution of perceptions about the seriousness or otherwise of loss of plant or animal species or biodiversity for the world as a whole.....26
- Figure 8. Distribution of perceptions about the seriousness or otherwise of pollution of rivers, lakes and oceans for the world as a whole.....27

### Chapter 4

- Figure 9. Income – pollution relationships.....95



## LIST OF TABLES

Table 1. Variable descriptions and summary statistics by country groupings.....	24
Table 2. OLS regression results for the effect of perceived local environmental quality on life satisfaction .....	30
Table 3. OLS regression results for the effect of perceived global environmental quality on life satisfaction .....	31
Table 4. Two-stage least squares using life satisfaction and perceived local environmental quality as dependent variables .....	33
Table 5. Two-stage least squares using life satisfaction and perceived global environmental quality as dependent variables .....	34
Table 6. Variable descriptive statistics.....	61
Table 7. Distribution of responses to environmental concern questions by country.....	63
Table 8. Logistic regression results showing the effect of perceived socioeconomic status on “Environmental protection vs. economic growth and jobs”.....	65
Table 9. Logistic regression results showing the effect of perceived socioeconomic status on willingness to sacrifice income for environmental protection.....	67
Table 10. Linear probability models for the effect of perceived socioeconomic status on environmental concern.....	71
Appendix A: Table I. Variable descriptions and summary statistics .....	84
Table 11. Variable summary statistics.....	102
Table 12. Correlation matrices.....	102
Table 13. Regression results for basic and augmented quadratic models for CO <sub>2</sub> emissions in African and OECD countries.....	105
Table 14. Regression results for basic and augmented quadratic models for PM <sub>10</sub> emissions in African and OECD countries .....	106
Table 15. Regression results for cubic specifications for air pollution emissions in African and OECD countries.....	108
Appendix B: Table II. List of countries for chapter 4.....	121

THREE ESSAYS ON ECONOMIC GROWTH AND THE ENVIRONMENT:  
A COMPARATIVE ANALYSIS OF DEVELOPED AND DEVELOPING COUNTRIES

Iddisah Sulemana

Dr. Harvey S. James, Jr., Dissertation Supervisor

ABSTRACT

This dissertation extends our understanding of the relationships among economic growth, the environment and well-being. It is motivated by the facts that (i) global environmental change and environmental degradation are major policy concerns among world leaders, policymakers and scholars due to their deleterious consequences for human well-being, and (ii) because everyone ultimately wants to be happy, world leaders are increasingly embracing happiness reports as an alternative measure of national well-being.

The first essay examines whether, and to what extent, individual perceptions about the seriousness or otherwise of poor local and global environmental quality influences their happiness. As measures of local environmental quality, poor water, poor air, and poor sewage and sanitation in the respondent's *own community* are considered. The global environmental quality measures include global warming or greenhouse effect, loss of animal or plant species and biodiversity, and the pollution of rivers, lakes and oceans in *the world as a whole*. The empirical results indicate that while both local and global environmental quality measures diminish happiness for residents of developed countries, only local environmental quality measures have a negative effect on the well-being of people in developing countries.

The second essay explores the role of perceived socioeconomic status as a predictor of environmental concern. The results suggest conclusively that in addition to being more likely to

choose environmental protection over economic growth and job creation, people who perceive themselves as belonging to the working class, lower middle, upper middle and upper class are significantly more willing to make income sacrifices (i.e., give part of their income and/or agree to pay higher taxes) to prevent environmental pollution than those who believe they are in the lower class in both developed and developing countries.

Finally, the third essay studies the relationship between economic growth and environmental pollution within the Environmental Kuznets Curve (EKC) framework. Aside from testing for EKCs for carbon dioxide (CO<sub>2</sub>) and particulate matter (PM<sub>10</sub>), it compares turning point incomes for these air pollutants for developed and developing countries. Because democracy is likely to influence the design, implementation and enforcement of environmental laws and regulations, the study empirically tests whether a country's extent of democracy influences its level of air pollution. However, results from fixed and random effects models do not support this claim.

Each essay compares developed and developing countries with respect to its outcomes. While the developed countries are a sample of Organization for Economic Co-operation and Development (OECD) countries, the developing countries are mainly countries in Africa. This focus on African countries is partially anchored on the following reasons. First, the region is the least happy region in the world. Second, it is argued that developing countries are more vulnerable to climate change than developed countries. Climate change and environmental pollution have destructive implications for agricultural productivity, health and human well-being generally. Because agriculture is the main source of livelihood for the majority of Africans, focusing on the region is seemly.

# CHAPTER 1

## INTRODUCTION

This dissertation addresses several questions pertaining to the relationships among economic growth, the environment and well-being. On the one hand, global environmental change has become a major public policy concern for world leaders, policymakers and scholars. In particular, because of the devastating effects of climate change and other environmental problems on human well-being, an enormous interdisciplinary literature seeks answers to questions on the well-being impacts of global environmental change and what adaptation measures countries can put in place to ameliorate these adverse effects. On the other hand, it is argued that virtually everyone ultimately wants to be happy (Frey and Stutzer, 2002; Helliwell, Layard and Sachs 2013). Because public policy should aim to increase well-being among people (e.g., Frey and Stutzer, 2002; Tavits, 2008), and because economic measures of well-being (e.g., GDP per capita) have many criticisms, world leaders are increasingly embracing the use of survey data to measure happiness and what factors make people happy (Helliwell, Layard and Sachs 2013). Therefore, the prime objectives of the three essays in this dissertation are to address some of the relationships among economic growth, the environment and happiness.

An important tranche of the literature on happiness examines the effect of environmental quality on self-reported measures of well-being (Ferrer-i-Carbonell and Gowdy, 2007; Welsch, 2002, 2006, 2007; Van Praag and Baarsma, 2005; Rehdanz and Maddison, 2005, 2008; Brereton et al., 2008; Luechinger, 2010; Cunado and de Gracia, 2013; Weinhold, 2013).<sup>1</sup> Some studies focus on objective, measurable indicators of environmental quality (e.g., Welsch, 2002, 2006, 2007; Beja, 2012) while other studies explore how perceptions about environmental quality are

---

<sup>1</sup> The terms happiness, well-being, subjective well-being and life satisfaction are used interchangeably (see e.g., Easterlin, 2001, 2005; Gerdtham and Johannesson, 2001).

correlated with happiness (e.g., Van Praag and Baarsma, 2005; Ferrer-i-Carbonell and Gowdy, 2007; Weinhold, 2013). However, there is little research examining the relationship between perceptions of environmental quality and subjective well-being in developing countries. Chapter 2 examines how people's perceptions about the seriousness or otherwise of local environmental quality (poor water, poor air, and poor sewage and sanitation) and global environmental quality (global warming or greenhouse effect, loss of animal or plant species and biodiversity, and pollution of water bodies) are correlated with their well-being in cross-country samples using data from the World Values Survey. The chapter also compares the effect of perceived environmental quality on well-being for residents of developed and developing countries.

There is also an extensive literature on the determinants of environmental concern within and across countries (e.g., Inglehart, 1990, 1995, and 1997; Dunlap et al., 1993; Dunlap and Mertig, 1995; 1997; Dunlap and York, 2008; Diekmann and Franzen, 1999; Franzen, 2003; Gelissen, 2007; Franzen and Meyer, 2010; Fairbrother, 2013; Knight and Messer, 2012). In particular, much of the literature focuses on whether affluence (as measured by a country's GDP per capita) is a good predictor of environmental concern among its citizenry. However, this debate remains unsettled. Consequently, an increasing number of studies now acknowledge the importance of individual level characteristics as predictors of environmental concern. Chapter 3 contributes to this literature by examining how individual perceptions about their socioeconomic status may influence their concern for the natural environment while explicitly comparing results for residents of developed and developing countries using data from the World Values Survey. In doing so, three measures of environmental concern are employed. First, individuals were asked to indicate whether they prefer environmental protection or economic growth and jobs. Second, they were asked to indicate the extent to which they are willing to give part of their income to prevent

environmental pollution. Finally, survey subjects were asked about their (dis) agreement with paying higher taxes if the extra income were used to prevent environmental pollution.

Chapter 4 examines the relationship between economic growth and air pollution for developed and developing countries within the Environmental Kuznets Curve (EKC) framework. Consistent with the argument that environmental concern is influenced by affluence, the EKC hypothesis advances an inverted U-shaped relationship between economic growth and environmental pollution (e.g., Grossman and Krueger, 1991, 1995; Shafik and Bandyopadhyay, 1992). In other words, in the initial stages of economic growth, countries generally experience rising environmental degradation. However, once they reach and exceed a certain “turning point” income, environmental degradation would begin to decline. Within this framework, scholars have estimated turning point incomes for various pollutants within and across countries.

However, the majority of these studies were conducted for developed countries (e.g., Grossman and Krueger, 1995, Panayotou, 2003, Everett et al., 2010, Unruh and Moomaw, 1998; Holtz-Eakin and Seldon, 1992). Very few studies have focused on developing countries. In particular, the relationship between economic growth and air pollution in Africa remains largely unexplored. Therefore, chapter 4 investigates whether or not the EKC hypothesis holds for carbon dioxide (CO<sub>2</sub>) and particulate matter (PM<sub>10</sub>) emissions in African countries. In order to compare results for African and industrialized countries for EKCs for air pollution, chapter 4 also examines data for high-income OECD countries. Because it is argued that democracy plays a crucial role in the design, implementation and enforcement of environmental regulations, empirical tests are conducted to determine whether or not democracy influences environmental degradation.

## References

- Beja, E. (2012). Subjective well-being approach to environmental valuation: evidence for greenhouse gas emissions. *Social Indicators Research*, 109(2), 243–266.
- Brereton, F., Clinch, J.P., Ferreira, S. (2008). Happiness, geography and the environment. *Ecological Economics*, 65 (2), 386–396.
- Cunado, J. & de Gracia, F. P. (2013). Environment and Happiness: New Evidence for Spain. *Social Indicators Research*, 112(3), 549-67.
- Diekmann, A. & Franzen, A. (1999). The Wealth of Nations and Environmental Concern. *Environment and Behavior*, 31(4), 540–549.
- Dunlap, R. E., Gallup Jr, G. H., & Gallup, A. M. (1993). Of global concern: Results of the health of the planet survey. *Environment: Science and Policy for Sustainable Development*, 35(9), 7-39.
- Dunlap, R. E., & Mertig, A. G. (1995). Global concern for the environment: is affluence a prerequisite? *Journal of Social Issues*, 51(4), 121-137.
- Dunlap, R. E., & Mertig, A. G. (1997). Global environmental concern: An anomaly for postmaterialism. *Social Science Quarterly*, 78(1), 24-29.
- Dunlap, R. E. & York, R. (2008). The globalization of environmental concern and the limits of the postmaterialist values explanation: evidence from four multinational surveys. *Sociological Quarterly*, 49(3), 529–563.
- Easterlin, R. A. (2001). Income and Happiness: Towards a Unified Theory. *The Economic Journal*, 111(473), 465-484.
- Easterlin, R. A. (2005). *Building a Better Theory of Well-being*, in: Luigino Bruni and Pier L. Porta (eds.), *Economics and Happiness: Framing the Analysis*. Oxford, UK: Oxford University Press: 29–64.
- Everett, T., Ishwaran, M., Ansaloni, G. P., and Rubin, A. (2010). Economic Growth and the Environment. *Department for Environment, Food and Rural Affairs Evidence and Analysis Series*, Paper 2.
- Fairbrother, M. (2013). Rich people, poor people, and environmental concern: Evidence across nations and time. *European Sociological Review*, 29(5), 910-922.
- Ferrer-i-Carbonell, A. & Gowdy, J. M. (2007). Environmental degradation and happiness. *Ecological Economics*, 60(3), 509–516.

- Franzen, A. (2003). Environmental Attitudes in International Comparison: An Analysis of the ISSP surveys 1993 and 2000. *Social Science Quarterly*, 84(2), 297–308.
- Franzen, A. & Meyer, R. (2010). Environmental Attitudes in Cross-national Perspective: A Multilevel Analysis of the ISSP 1993 and 2000. *European Sociological Review*, 26(2), 219–234.
- Frey, B. & Stutzer, A. (2002). What can economists learn from happiness research? *Journal of Economic Literature*, 40(2), 402–435.
- Gelissen, J. (2007). Explaining Popular Support for Environmental Protection: A Multilevel Analysis of 50 Nations. *Environment and Behavior*, 39(3), 392-415.
- Gerdtham, U. G., & Johannesson, M. (2001). The relationship between happiness, health, and socio-economic factors: results based on Swedish microdata. *The Journal of Socio-Economics*, 30(6), 553-557.
- Grossman, G. M., & Krueger, A. B. (1991). Environmental impacts of a North American Free Trade Agreement. National Bureau of Economic Research Working Paper 3914, NBER, Cambridge MA.
- Grossman, G. M., and Krueger, A. B. (1995). Economic Growth and the Environment. *The Quarterly Journal of Economics*, 110(2), 353-377.
- Helliwell, J. F., Layard, R. & Sachs, J.(eds.) (2013). *World Happiness Report 2013*. UN Sustainable Development Solutions Network, New York.
- Holtz-Eakin, D. and Seldon, T. M. (1992). Stoking the Fires? CO<sub>2</sub> Emissions and Economic Growth. *NBER Working Paper Series*, Working Paper No. 4248.
- Inglehart, R. (1990). *Culture shift in advanced industrial society*. Princeton University Press.
- Inglehart, R. (1995). Public Support for Environmental Protection: Objective Problems and Subjective Values in 43 societies. *PS: Political Science & Politics*, 28(01), 57–72.
- Inglehart, R. (1997). *Modernization and Postmodernization: Cultural, Economic, and Political Change in 43 Societies*. Princeton, NJ: Princeton University Press.
- Knight, K. W., & Messer, B. L. (2012). Environmental Concern in Cross-National Perspective: The Effects of Affluence, Environmental Degradation, and World Society. *Social Science Quarterly*, 93(2), 521-537.
- Luechinger, S. 2010. Life satisfaction and transboundary air pollution. *Economics Letters*, 107(1), 4–6.



- Panayotou, T. (2003). Economic Growth and the Environment. *Economic Survey of Europe*, 2, 45-72.
- Rehdanz, K. & Maddison, D. (2005). Climate and Happiness. *Ecological Economics*, 52(1), 111-125.
- Rehdanz, K. & Maddison, D. (2008). Local environmental quality and life-satisfaction in Germany. *Ecological Economics*, 64(4), 787 – 797.
- Shafik, N. & Bandyopadhyay, S. (1992). Economic Growth and Environmental Quality: Time Series and Cross-Country Evidence. Policy Research Working Paper No. WPS 904. Washington, D. C. The World Bank.
- Tavits, M. (2008). Representation, Corruption, and Subjective Well-Being. *Comparative Political Studies*, 41(12), 1607-1630.
- Unruh, G. C and Moomaw, W. R. (1998). An Alternative Analysis of Apparent EKC-type Transitions. *Ecological Economics*, 25(2), 221-229.
- Van Praag, B.M.S., Baarsma, B.E. (2005). Using happiness surveys to value intangibles: the case of airport noise. *The Economic Journal*, 115(500), 224–246.
- Welsch, H. (2002). Preferences over prosperity and pollution: environmental valuation based on happiness surveys. *Kyklos*, 55 (4), 473–494.
- Welsch, H. (2006). Environment and happiness: Valuation of air pollution using life satisfaction data. *Ecological Economics*, 58(4), 801–813.
- Welsch, H. (2007). Environmental welfare analysis: A life satisfaction approach. *Ecological Economics*, 62(3), 544-551.
- Weinhold, D. (2013). The Happiness-reducing Costs of Noise Pollution. *Journal of Regional Science*, 53(2), 292-303.

## CHAPTER 2

### **PERCEIVED ENVIRONMENTAL QUALITY AND SUBJECTIVE WELL-BEING: ARE DEVELOPING COUNTRIES DIFFERENT FROM DEVELOPED COUNTRIES?**

#### **2.1. Introduction**

There is a growing body of research examining the environmental attitudes, awareness, and concerns of individuals. Some scholars contend that residents of developed countries are more concerned about the environment than their counterparts in developing countries (Inglehart, 1995, 1997; Bruneau and Echevarria, 2009). One reason can be derived from Maslow's (1954) hierarchy of needs (Kollmuss and Agyeman, 2002). According to Inglehart's (1995, 1997) post-materialism hypothesis, economic struggles take priority over other concerns for people in developing countries, except insofar as air and water pollution and other environmental quality issues threaten human health and survival. In contrast, to the extent that environmental problems are less prevalent in developed countries, environmental concern in these countries would result from how the environment affects people's quality of life (Inglehart, 1995). In addition, some researchers argue that environmental quality is a luxury good (Baumol and Oates, 1979), leading them to suggest that the poor are "too poor to green" (Bruneau and Echevarria, 2009). In fact, Martinez-Alier (1995) attributes this to two factors – the poor have more "immediate necessities" and/or they lack the money required to invest in the environment.

However, other scholars reject the view that environmental concerns are higher in developed countries (Broad, 1994; Stern, 2004; Fairbrother, 2012). Dunlap and Mertig (1994) note that environmental concern has become a global phenomenon and not just a concern among people in industrialized countries. Diekmann and Franzen (1999) find that while people in developing countries do not rank environmental problems as among the most serious problems, pro-

environmental issues are often ranked high with respect to severity of various problems. Broad (1994) wonders if the poor and the environment are friends or foes. Using data for the Philippines, the author demonstrates that poor people can switch from being “environmental degraders” to “environmental protectors.”

There is also evidence of an association between income and happiness or subjective well-being (Easterlin, 1995, 2001). Moreover, studies suggest a relationship between economic growth and environmental pollution, e.g., the Environmental Kuznets Curve hypothesis (see, for instance, Dinda, 2004; Grossman and Krueger, 1995). If economic growth correlates with happiness, and economic growth correlates with environmental quality, then is environmental quality correlated with happiness? Although this is the question a growing number of studies seeks to answer (e.g., Ferrer-i-Carbonell and Gowdy, 2007; Welsch, 2002, 2006, 2007; Van Praag and Baarsma, 2005; Rehdanz and Maddison, 2005, 2008; Brereton et al., 2008; Luechinger, 2010; Cunado and de Gracia, 2013; Weinhold, 2013), there remains a paucity of research on the *direct* relationship between the environment and well-being from a cross-national perspective. While most of these studies use objective indicators of environmental pollution such as emissions of carbon dioxide, nitrogen dioxide, and sulphur dioxide and correlate these with country or regional averages of subjective well-being (SWB) at the macro-level, there is little research directly linking environmental attitudes towards measures of subjective well-being in cross-national samples.

This chapter examines whether perceived local environmental quality (PLEQ) and perceived global environmental quality (PGEQ) are correlated with happiness as well as contrasting effects for developed and developing countries. For PLEQ, we examine perceptions about the seriousness or otherwise of poor water quality, poor air quality, and poor sewage and sanitation in the individual’s *own* community. We consider global warming or greenhouse effect,

loss of animal or plant species and biodiversity, and pollution of rivers, lakes and oceans as measures of PGEQ. Using data from the World Values Survey, we find a negative and significant effect of each PLEQ measure on happiness for both developed and developing countries. Our results also show that all three measures of PGEQ exert a negative and significant effect on happiness of respondents in developed countries. However, only pollution of water bodies is (weakly) significantly correlated with happiness for people in developing countries.

By understanding people's perceptions about environmental situations, researchers can gain useful insights into what people care about and how policy could affect their happiness. In particular, this paper is motivated by the fact that research on happiness is very relevant for social and economic policy and policy valuation (Frey and Stutzer, 2002). Frey and Stutzer (2002) argue that "happiness research is not a futile or eccentric activity" for economists (p. 431). They note that how happy individuals are may have significant impacts on a wide range of economic variables, such as consumption activities, work behavior, investment behavior, and political behavior, among others. Gowdy (2005) argues that for sustainability purposes, by focusing public policy on well-being, society may benefit in two ways. First, policy could increase happiness. Second, because it is argued that happier people are more willing to contribute to environmental sustainability, by increasing happiness, policy could increase support for policies aimed at promoting environmental sustainability (p. 219). More importantly, a major justification for pollution control is the harmful effect of environmental pollution on societal well-being (Welsch, 2006).

## **2.2. Literature Review**

### **2.2.1. Subjective Well-being**

The study of happiness utilizes self-reports of subjective well-being (SWB) from survey data. Historically, it was the preserve of sociologists and psychologists until catching the attention of economists (see e.g., Frey and Stutzer, 2002; Wang & Van derWeele, 2011). According to Diener et al. (1999, p. 277), SWB includes “people’s emotional responses, domain satisfactions, and global judgments of life satisfaction.” SWB has two components – affective and cognitive domains. The affective domain encompasses pleasant (e.g., happiness, joy, affection, etc.) and unpleasant (e.g., sadness, depression, stress, etc.) feelings while the cognitive domain encompasses satisfaction with past, present, and future life, and the desire to change life.

Easterlin (1974) used data for nineteen developed and developing countries to examine the relationship between economic growth and happiness. Questions he considered include (1) “Are wealthier members of society usually happier than the poor?” (2) “Are more developed countries typically happier?” (3) “Does economic growth improve the human lot?” In what became known as the *Easterlin Paradox*, he found evidence that within and across countries, there is a positive association between income and happiness, but in a time series framework, there is a nil relationship between income and happiness (see also Easterlin et al., 2010).

Demonstration of the Easterlin Paradox encouraged widespread investigation by economists of what factors are correlated with happiness. This “birth” of happiness economics and its subsequent growth has led some researchers to brand happiness research in economics as a “revolution in economics” (Frey, 2008). Examples include the effect of economic growth on happiness (Gerdtham and Johannesson, 2001; Kenny, 1999; Hagerty and Veenhoven, 2003; Deaton and Stone, 2013); happiness and politics, institutions, and democracy (e.g. Frey and Stutzer, 2000; Inglehart et al., 2008); happiness and economic performance (Oswald, 1997), happiness and ethics (e.g. James, 2011); happiness and crime victimization or fear of crime (e.g.,

Davies and Hinks 2010; Powdthavee 2005; Di Tella et al. 2008; Kuroki 2013; Sulemana, 2014a) and happiness and social capital (Bjørnskov, 2003, 2008; Helliwell, 2001, 2006; Ram, 2010; Sarracino, 2013; Sulemana, 2014b).

### 2.2.2. Perceptions and Subjective Well-being

An important part of SWB research emphasizes the role perceptions play in happiness (Veenhoven, 1991; Wills-Herrera et al., 2011; Stack and Eshleman, 1998; Subramanian et al., 2005; Graham, 2008; James, 2011; Guven and Sørensen, 2012). For example, Veenhoven (1991) argues that happiness is relative, in the sense that people are happier if they perceive themselves as better off than others. Guven and Sørensen (2012) use data from the US General Social Survey between 1972 and 2004 to explore whether individual perceptions about their relative income, social status, and dwelling affect their happiness. They find not only that people who perceive their relative income as higher than others tend to report higher levels of happiness, but also that individual perceptions about their social class and dwelling status are strongly correlated with happiness. Many studies also show that perceptions about corruption negatively influence well-being (Helliwell, 2003; Welsch, 2008; Helliwell and Huang, 2008; Tavits, 2008; Samanni and Holmberg, 2010; Rothstein, 2010). Wills-Herrera et al. (2011) study the link between perceptions about insecurity and happiness. Using data from 742 rural producers in conflict-prone Colombia, they find that perceptions about economic, political and communitarian insecurity have a negative correlation with happiness. The reason is that perceptions about and feelings of insecurity relate to a sense of reduced control over life and life choices.

A general consensus that has emerged in the economics of happiness literature is that health is a very significant determinant of happiness (Gerdtham and Johannesson, 2001; Stack and

Eshleman, 1998; Graham, 2008; Subramanian et al., 2005). Yet a number of studies examining how health is correlated with happiness use perceptions about health – i.e., self-rated health status (Graham, 2008; MacKerron and Mourato, 2009; Subramanian et al., 2005). For instance, Stack and Eshleman (1998) find that health status is the second most important determinant of happiness, while financial satisfaction is the most important. Beyond health of the individual, the perceptions of health of a broader community also affect well-being, as shown by Subramanian et al. (2005) who note that people who report poor health are unhappier, while living in a healthier community enhances happiness.

### 2. 2.3. Environmental Quality and Subjective Well-being

One of the Millennium Development Goals is to halve “the proportion of people without access to safe drinking-water and basic sanitation” by 2015 (World Health Organization, 2013). According to the United Nations, about 768 million people lacked access to safe drinking-water in 2011. In addition, in 2012, about 2.5 billion people did not have improved sanitation, with the highest proportion of these people living in Africa (United Nations, 2014).

There is a growing consensus among scholars that environmental degradation poses serious threats to the health and well-being of humans (McMichael, 2003; Githeko and Woodward 2003; Patz et al., 2005; Ebi et al., 2003; Berry et al., 2010). Experts argue that global environmental change will impact the world’s regions at varying degrees, the most adversely affected and vulnerable groups residing in developing countries (Ebi et al., 2003; Mertz et al., 2009). This is especially true because the majority of people in developing countries depend directly on the natural environment for their livelihoods (Hillie and Hlophe, 2007). Importantly, most people in developing countries lack treated water. Thus, water-borne diseases such as cholera, malaria,

giardiasis, and cryptosporidiosis are expected to increase with climate change and increased water pollution, thereby hurting the health of these populations (Malakooti et al., 1998; Githeko and Woodward, 2003; Mouchet et al., 1998; Gadgil, 1998).

In developed countries such as the US and countries in Europe, it is estimated that ozone depletion could increase the risk of skin cancer by about 5 to 10% (McMichael, 2003). Colligan (1981) notes that ozone depletion may lead to symptoms of dryness of upper respiratory tract, throat and nose irritation, coughing, subternal pressure, and fatigue, and possibly drowsiness and inability to concentrate. Due to rising world population, there is also animal and plant species loss that could reduce the (health) benefits humans derive from biodiversity (McMichael, 2003). Therefore, changing local and global environmental quality has implications for human well-being. Additionally, the World Health Organization (WHO, 2011) reports that air pollution is a major environmental risk to health, with an estimated 1.3 million deaths per year worldwide being attributed to urban outdoor pollution.

The relationship between self-reported SWB, income and pollution (environmental quality) has been studied within the framework of the life satisfaction approach to environmental valuation. According to Welsch and Kuhling (2009), the life satisfaction approach considers the income a person would need to compensate for a given decline in the quality of specific environmental indicators. Most studies using this approach use objective measures of environmental quality, such as nitrogen dioxide (Welsch, 2002, 2006, 2007), sulphur dioxide (Luechinger 2010) or temperature and precipitation (Rehdanz and Maddison, 2005). For instance, Welsch (2002) explores the relationship among SWB, economic prosperity and nitrogen dioxide emissions and finds that environmental pollution has a negative and significant effect on SWB. Welsch (2006) shows that improved air quality from reduction in nitrogen dioxide and lead are



respectively worth \$1400 and \$750 per capita per year in Europe. Similarly, Welsch (2007) estimates the monetary benefits of pollution abatement as well as income sacrifices associated with such abatement for nitrogen dioxide. Arguing that climate change may affect individual happiness, Rehdanz and Maddison (2005) study how climate variables are correlated with self-reported happiness for 67 countries and find that individuals are happier when winter temperatures are higher.

Other scholars have studied the relationship between SWB and environmental quality based on attitudes toward the environment or perceptions about the level of environmental pollution such as noise pollution. For example, Van Praag and Baarsma (2005) demonstrate that perceptions about the level of aircraft noise have a negative effect on reported well-being. Ferrer-i-Carbonell and Gowdy (2007) observe that concern about ozone pollution and SWB are negatively correlated while concern about species extinction and SWB are positively related. Brereton *et al.* (2008) note that climate, environment and urban conditions have a significant effect on well-being. Rehdanz and Maddison (2008) use data from the German socio-economic panel (SOEP) survey to find that feeling affected by air and noise pollution makes people less happy. Using data from 26,000 respondents across 28 countries, Weinhold (2013) finds that perceptions of noise pollution are correlated with lower reported happiness. Thus perceptions about environmental quality (as opposed to actual environmental quality) may actually affect individual well-being.

This survey of the environment and happiness literature reveals two noteworthy points. First, one group of studies focuses on macro-level analyses. These studies use GDP and objective indicators of environmental quality (e.g., carbon dioxide, nitrogen dioxide, sulphur dioxide emissions) and correlate these with average happiness scores for a sample of countries or regions.

Second, another group of studies uses individual-level measures of environmental attitudes or perceptions and focuses on a single country or a city. There is a dearth of research that considers perceptions of environmental quality in a cross-country comparison. To the best of our knowledge, only Beja (2012) has examined the effect of environmental attitudes (in addition to greenhouse emissions) on happiness for a cross-national sample. Using data from the World Values Survey, the author focuses on two attitudinal questions. The first pertains to the seriousness or otherwise of poor air quality in the respondent's own community while the second concerns the seriousness or otherwise of global warming or the greenhouse effect in the world as a whole. The country-level averages for each variable were then computed (as is often done for SWB).

Apart from Latin America, where a negative and significant relationship was found, his results show no significant association between perceptions about the seriousness of poor local air quality and SWB for Africa, Asia and Pacific, and Europe and United States. Regarding perceptions about the seriousness of global air quality and SWB, he observes a positive and significant relationship for Africa, Asia and Pacific, and Europe and United States. Explaining this counter-intuitive result for global air quality, Beja points to the “not-in-my-backyard” syndrome, where people are less concerned about global environmental quality (i.e., greenhouse gas emissions). However, it may be that global warming is relatively less important for residents of developing countries as they face more local environmental problems such as polluted water, air, sewage and sanitation problems (Maslow, 1954; Inglehart, 1995; Hillie and Hlophe, 2007).

#### 2. 2.4. Summary

This chapter extends the literature in several ways. First, in addition to the two environmental attitude variables studied by Beja (2012), our study examines four other variables

of perceived environmental quality (PEQ) in a cross-national sample. We use poor local air quality, poor water quality, and poor sewage and sanitation as local environmental quality measures. For global environmental quality measures, we consider the seriousness or otherwise of global warming or greenhouse effect, loss of animal or plant species and biodiversity, and pollution of rivers, lakes and oceans.<sup>2</sup> Second, even though we are undertaking a cross-country study, our analyses are at the micro-level. This allows us to focus on the individual as the unit of analysis, rather than use country level averages. Third, most of the studies on the relationship between the environment and happiness have focused on developed countries. Moreover, very little research has explicitly compared the relationship between perceived environmental quality and SWB in developed and developing countries. In this paper we investigate whether countries differ in the environment-happiness relationship on the basis of income by comparing African countries with a sample of developed countries.

This research is important because developing countries can be the most adversely affected by environmental degradation, especially climate change (Mertz et al., 2009). Furthermore, because “it is predominantly the poor of the world who depend directly on water and other natural resources for their livelihoods” (Hillie and Hlophe, 2007), it is also important to understand how perceptions of environmental quality affect the well-being of individuals in developing countries. The existence of a considerable body of research on the environmental and happiness relationship in developed countries therefore provides an appropriate basis for comparison.

### **2. 3. Conceptual Framework**

---

<sup>2</sup> We recognize that pollution of rivers, lakes and oceans should probably be part of local environmental quality as people in developing countries rely on rivers and lakes as sources of drinking water. However, we treat this as global environmental issue in line with the wording of the survey instrument.

Because health is an important correlate of SWB, being cognizant of the health implications of poor environmental quality may affect people's moods and demeanor, which may in turn affect their overall happiness. Thus, perceptions about environmental quality may directly affect people's happiness. Silva et al. (2012) propose a conceptual model that shows how environmental quality (actual air pollution) affects self-reported SWB. The first step takes air quality as a component of the natural environment. Individuals then express their satisfaction with the level of air quality, which in turn is modeled as a component affecting their SWB. They argue that both air pollution and satisfaction with air quality could also each directly affect SWB.

As reviewed above, the literature on perceptions (health, income, social class, insecurity, corruption, etc.) and SWB suggests a strong relationship between them. Also, it has been established that environmental indicators (both actual and perceived) correlate with human well-being. Individual (dis)satisfaction with environmental quality may be related to actual levels of environmental quality. Silva et al. (2012) find a significant association between subjective satisfaction with air quality and actual air pollution while Day (2007) notes that perceptions about air pollution and actual air pollution are positively associated. Consequently, if actual environmental quality influences happiness, then perceptions about environmental quality could also affect happiness.

In some studies, scholars model SWB as a function of environmental attitudes and controls. For instance, Ferrer-i-Carbonell and Gowdy (2007) use individual concerns about ozone pollution and species extinction as measures of environmental attitudes to examine how these affect SWB. Using a model of life satisfaction approach to environmental valuation, Beja (2012) models SWB as a function of environmental indicators, income, environmental attitudes, and controls. Even though Ferrer-i-Carbonell and Gowdy (2007) treat concern about species extinction as an

environmental attitude, we believe that this variable is essentially identical to the loss of animal or plant species, and biodiversity, a variable we use as one of our measures of PGEQ. In addition, Beja's (2012) measures of local and global environmental attitudes are part of the variables we term perceived local and global environmental quality, respectively. Finally, MacKerron and Mourato (2009, p. 1443) state that:

“Awareness of environmental bads such as air pollution, and of their negative impacts on humans and ecosystems, may act to reduce individuals' LS levels directly and independently of health effects.”<sup>3</sup>

If perceptions about poor environmental quality have an effect on well-being and actual environmental pollution diminishes well-being, then we hypothesize that perceptions about poor environmental quality would be correlated with well-being too. Specifically, if an individual perceives environmental quality as poor, then they would report lower levels of well-being. We expect this to be true for perceptions about local environmental quality as well as perceptions about global environmental quality:

H1: PLEQ (e.g., poor water quality, poor air quality, and poor sewage and sanitation) will be negatively correlated with SWB for people in both developed and developing countries.

H2: PGEQ (e.g., global warming or greenhouse effect, loss of plant or animal species or biodiversity, and pollution of rivers, lakes and oceans) will be negatively correlated with SWB for people in both developed and developing countries.

Ferrer-i-Carbonell and Gowdy (2007) point out that, as with most survey questions, when asked “All things considered, how satisfied are you with your life as a whole these days?” responses are self-reports that may or may not accurately reflect the actual well-being internal to the respondent

---

<sup>3</sup> LS = Life Satisfaction

(see also Beja, 2012). We follow the approach outlined in Ferrer-i-Carbonell and Gowdy (2007) and Beja (2012) as follows: Let the unobserved, latent well-being measure be  $SWB^*$  and the self-reported measure be  $SWB$ . To determine how perceptions about environmental quality are correlated with happiness, our conceptual model takes the form:

$$SWB^* = f(\text{PEQ} + \text{controls}) \quad (2.1)$$

The relationship between the latent  $SWB^*$  measure and the self-reported  $SWB$  measure ( $SWB$ ) is then given by:

$$SWB = h[SWB^*] = h[f(\text{PEQ} + \text{controls})] \quad (2.2)$$

where  $SWB$  is a positive monotonic transformation of  $SWB^*$  (see Beja, 2012).

#### **2. 4. Data and Empirical Methods**

We draw on data from the World Values Survey Wave 5 (WVS, 2009) for our empirical analyses. The survey contains questions on perceptions about the seriousness or otherwise of environmental problems in the respondent's community and the world as a whole. The WVS contains data for seven African countries (Burkina Faso, Ethiopia, Ghana, Mali, Rwanda, South Africa and Zambia). In order to obtain a comparable sample size as the African sample, we consider six developed countries (Australia, Canada, Japan, Norway, Sweden and United States) in which all environmental problems questions were asked. We control for individual demographic characteristics, social capital, *inter alia*. Our measure of  $SWB$  is based on the question typical for  $SWB$  studies: "All things considered, how satisfied are you with your life as a whole these days?" (1=completely dissatisfied and 10=completely satisfied).

We consider two sets of questions on perceived environmental quality. One focuses on local problems while the other focuses on global problems. Respondents were presented with the

following question: “I am going to read out a list of environmental problems facing many communities. Please, tell me how serious you consider each one to be here in your own community. Is it very serious, somewhat serious, not very serious or not serious at all? Poor water quality, poor air quality, and poor sewage and sanitation.” Because the question references respondent’s *own* community, we treat these problems as *local* problems. Respondents were also asked to indicate the seriousness of global environmental problems with this question: “Now let’s consider environmental problems in the world as a whole. Please, tell me how serious you consider each of the following to be for the world as a whole. Is it very serious, somewhat serious, not very serious or not serious at all?” Concerns included global warming and the greenhouse effect, loss of plant or animal species or biodiversity, and pollution of rivers, lakes and oceans. Because the environmental problems presented are problems in the “world as a whole”, we treat these measures as *global* problems. For each environmental problem, we combine the “Very serious” and “Somewhat serious” responses to construct a variable that indicates that the respondent perceives that poor environmental problem as serious (i.e., dummy equal to 1 if “Very serious” or “Somewhat serious”, and 0 otherwise). We control for other correlates of SWB – age, gender, education, health status, marital status, unemployment, social capital, size of town, income scale, satisfaction with household finances, children, control over life, and religiosity.

Our econometric model, which follows directly from the conceptual model, is adapted from Ferrer-i-Carbonell and Gowdy (2007) and is given by:

$$SWB_{ij}^* = \alpha + \beta * PEQ_{ij} + \gamma * X_{ij} + \varepsilon_{ij} \quad (2.3)$$

where  $SWB_{ij}^*$  denotes subjective well-being of individual  $i$  in country  $j$ ;  $PEQ_{ij}$  is a vector of perceived environmental quality measures;  $X_{ij}$  is a vector of controls;  $\varepsilon_{ij}$  is the idiosyncratic error term;  $\alpha$  is the intercept, and  $\beta$  and  $\gamma$  are vectors of coefficients to be estimated. We expect each

perceived environmental quality measure to have a negative effect on life satisfaction, i.e.,  $\beta_1, \beta_2, \beta_3, \dots, \beta_n < 0$ .

One major problem with equation (2.3) is that it does not capture unobserved heterogeneity across countries such as differences in cultural or institutional quality (Heukamp and Arino, 2011). Consequently, we control for country level unobserved heterogeneity by including country fixed effects in the model. The empirical model we estimate therefore becomes:

$$SWB_{ij}^* = \alpha + \beta * PEQ_{ij} + \gamma * X_{ij} + \delta_j + \varepsilon_{ij} \quad (2.4)$$

where  $\delta_j$  captures the country fixed effects. Although individual psychological traits may play a role in explaining the relationship between PEQ and SWB (Ferrer-i-Carbonell and Frijters, 2004; Ferrer-i-Carbonell and Gowdy, 2007; Sulemana and James, 2014), we do not control for individual fixed effects.

Another problem with equations (2.3) and (2.4) is that there might be endogeneity or bidirectional causal relationship between SWB and PEQ. Stated differently, does PEQ influence one's happiness or does being happy affect one's perceptions about the environment, or is there an unobserved common factor that affects both SWB and PEQ? For example, Beja (2012) wonders "Do people who are more worried about the environment report lower well-being; or, are people with low well-being more worried about the environment?" Similarly, James (2011) identifies a similar problem in his investigation of a bicausal relationship between ethics and SWB. He asks whether being ethical makes someone happy, or that being happy makes one ethical. A common way of controlling for endogeneity is using an instrumental variable approach in the econometric model. Given the difficulty of identifying suitable instruments, we consider a second-best strategy of using a two-stage least squares (2SLS) regression procedure to examine a potential for



bidirectional causality. Evidence of bidirectional causality will motivate subsequent research on identifying appropriate instruments to identify more carefully the nature of endogeneity.

## **2. 5. Findings**

Table 1 presents the variables used in the study along with their descriptions and summary statistics.<sup>4</sup> Because we are interested in comparing African countries and developed countries, we present the means and standard deviations of each variable for each set of countries. For the African countries as a group, the average life satisfaction score is 6.11 compared to 7.45 for the developed countries, suggesting that the average respondent in developed countries is more satisfied with their life than their counterpart in Africa. When asked about the seriousness of poor local environmental quality, about 32%, 27%, and 31% of respondents in Africa consider as “very serious” or “somewhat serious” poor water quality, poor air quality, and poor sewage and sanitation, respectively. For the developed countries, the corresponding figures are 11%, 12% and 10%. If perceptions about environmental quality and actual environmental quality are significantly correlated (Day, 2007), then these figures suggest that environmental quality is probably worse in Africa.

With respect to global environmental problems, 29% of respondents in Africa consider global warming or the greenhouse effect as very or somewhat serious. Also, about 31% of respondents in Africa consider loss of plant or animal species and biodiversity as very or somewhat serious, while 32% consider the pollution of rivers, lakes and oceans as very or somewhat serious. Among residents of developed countries, the proportion of respondents who consider these global

---

<sup>4</sup> It should be pointed out that due to data unavailability for some of the countries included in our analyses, some of the categorical variables do not sum up to 100%. For example, “size of town” is unavailable for Japan and South Africa.

environmental problems (i.e., global warming or the greenhouse effect, loss of plant or animal species and biodiversity, and the pollution of rivers, lakes and oceans) as very or somewhat serious are respectively 24%, 24% and 26%. Relative to local environmental quality, these figures suggest that residents of developed countries rate global environmental problems as more serious, whereas people in Africa tend to rate both local and global environmental quality fairly equally. Thus, contrary to what we would expect, although Africans are faced with more environmental pollution, they also report high perceptions about global environmental degradation.

We present the average life satisfaction scores by country for Africa in Figure 1 and developed countries in Figure 2. Among African respondents, these scores range from a low of 4.98 in Rwanda to 7.40 in South Africa. Four of the seven African countries have average scores above 6. On the other hand, all six developed countries have average life satisfaction scores above 7. These range from 7.04 in Japan to 7.98 in the Norway.

The distributions of perceptions about the seriousness or otherwise of each of the six environmental problems are presented in Figures 3 through 8. Perceptions about both local and global environmental problems have a consistent pattern among Africans: the majority of respondents consider each environmental problem as very serious. Also, the proportion of respondents indicating “somewhat serious” exceeds those indicating “Not very serious,” which in turn exceeds those indicating “Not serious at all.”

Among the developed countries, this pattern only holds for global environmental problems. The sum of the proportion of respondents who consider each of the local environmental problems as either “Very serious” or “Somewhat serious” exceeds the sum of the “Not very serious” and “Not serious at all” for the global problems. Also, perceptions about global environmental quality are relatively similar for respondents of both African and developed countries.

Table 1. Variable descriptions and summary statistics by country groupings

Variable	Description	Africa		Developed		All Countries	
		Mean	S. D.	Mean	S.D.	Mean	S.D.
Life satisfaction	10 – Point scale variable based on the question: “All things considered, how satisfied are you with your life as a whole these days?” (1=completely dissatisfied and 10=completely satisfied)	6.11	2.68	7.45	1.88	6.78	2.41
Poor water	Dummy equal to 1 if respondent considers the poor water quality in their own community to be “very serious” or “somewhat serious”; 0 otherwise	0.32	0.47	0.11	0.31	0.22	0.41
Poor air	Dummy equal to 1 if respondent considers the poor air quality in their own community to be “very serious” or “somewhat serious”; 0 otherwise	0.28	0.45	0.12	0.33	0.20	0.40
Poor sewage and sanitation	Dummy equal to 1 if respondent considers the poor sewage and sanitation in their own community to be “very serious” or “somewhat serious”; 0 otherwise	0.31	0.46	0.10	0.30	0.20	0.40
Global warming or greenhouse effect	Dummy equal to 1 if respondent considers global warming or the greenhouse effect in the world as a whole to be “very serious” or “somewhat serious”; 0 otherwise	0.29	0.45	0.24	0.43	0.26	0.44
Loss of plant or animal or biodiversity	Dummy equal to 1 if respondent considers the loss of plant or animal species or biodiversity in the world as a whole to be “very serious” or “somewhat serious”; 0 otherwise	0.31	0.46	0.24	0.43	0.27	0.45
Pollution of rivers, lakes and oceans	Dummy equal to 1 if respondent considers the pollution of rivers, lakes and oceans in the world as a whole to be “very serious” or “somewhat serious”; 0 otherwise	0.32	0.47	0.26	0.44	0.29	0.45
Age	Age of respondent	35.13	14.08	45.90	17.18	40.51	16.60
Age <sup>2</sup> /100	Age of respondent, squared and divided by 100	14.32	11.96	24.02	16.84	19.17	15.39
Female	Dummy equal to 1 if respondent is female; 0 otherwise	0.47	0.50	0.53	0.50	0.50	0.50
Primary or less (Ref.)	Dummy equal to 1 if respondent’s highest level of educational attainment is primary (complete or incomplete) or less (i.e., no formal education); 0 otherwise	0.41	0.49	0.21	0.41	0.31	0.46
Secondary	Dummy equal to 1 if respondent’s highest level of educational attainment is secondary (complete or incomplete); 0 otherwise	0.46	0.50	0.48	0.50	0.47	0.50
College	Dummy equal to 1 if respondent’s highest level of educational attainment is university (with or without degree); 0 otherwise	0.07	0.26	0.15	0.36	0.11	0.32
Good health	Dummy equal to 1 if respondent described their health status as “good” or “very good”; 0 otherwise	0.72	0.45	0.67	0.47	0.70	0.46
Fair health (Ref.)	Dummy equal to 1 if respondent described their health status as “fair”; 0 otherwise	0.21	0.41	0.21	0.40	0.21	0.41
Poor health	Dummy equal to 1 if respondent described their health status as “poor”; 0 otherwise	0.06	0.23	0.05	0.21	0.05	0.22
Married	Dummy equal 1 if married or living together as married; 0 otherwise	0.55	0.50	0.65	0.48	0.60	0.49
Divorced/ separated	Dummy equal to 1 if divorced or separated; 0 otherwise	0.04	0.19	0.08	0.27	0.06	0.24
Other marital status (Ref.)	Dummy equal 1 if marital status is other (e.g., widowed, single, never married, etc.); 0 otherwise	0.41	0.49	0.26	0.44	0.34	0.47
Unemployed	Dummy equal 1 if unemployed; 0 otherwise	0.19	0.39	0.05	0.21	0.12	0.32
Generalized trust	Dummy equal to 1 if respondent thinks “most people can be trusted”; 0 otherwise	0.16	0.37	0.43	0.50	0.30	0.46
Voluntary organization	Measure of membership in non-religious voluntary organizations	2.88	1.52	2.96	1.49	2.92	1.50
Urban	Dummy equal to 1 if size of town is 100,000 or more; 0 otherwise	0.24	0.43	0.25	0.43	0.25	0.45
Mid-size	Dummy equal 1 if size of town is between 10,000 and 100,000; 0 otherwise	0.16	0.37	0.18	0.38	0.17	0.37
Rural (Ref.)	Dummy equal 1 if size of town is less than 10,000; 0 otherwise	0.11	0.31	0.14	0.34	0.12	0.33
Income scale	10 – point income scale in respondent’s country where respondent believes their household income is (1 = lowest decile; 10 = highest decile)	4.54	2.43	5.34	2.79	4.94	2.65
Satisfied w/ Finances	10 – point scale showing how satisfied respondent is with their household financial situation (1 = completely dissatisfied; 10 = completely satisfied)	5.22	2.80	6.54	2.29	5.85	2.65
Children	Number of children respondent has	2.16	2.13	1.75	1.51	1.96	1.86
Control over life	10 – point scale indicating the extent to which the respondent believes they have freedom of choice and control over the way their life turns out (1 = no choice at all; 10 = A great deal of choice)	6.73	2.58	7.19	2.04	6.96	2.34
Religiosity	Dummy equal 1 if respondent indicates that religion is “Very important” or “Rather important” in their life; 0 otherwise	0.88	0.33	0.39	0.49	0.64	0.48

Data Source: World Values Survey Wave 5 (WVS 2009)

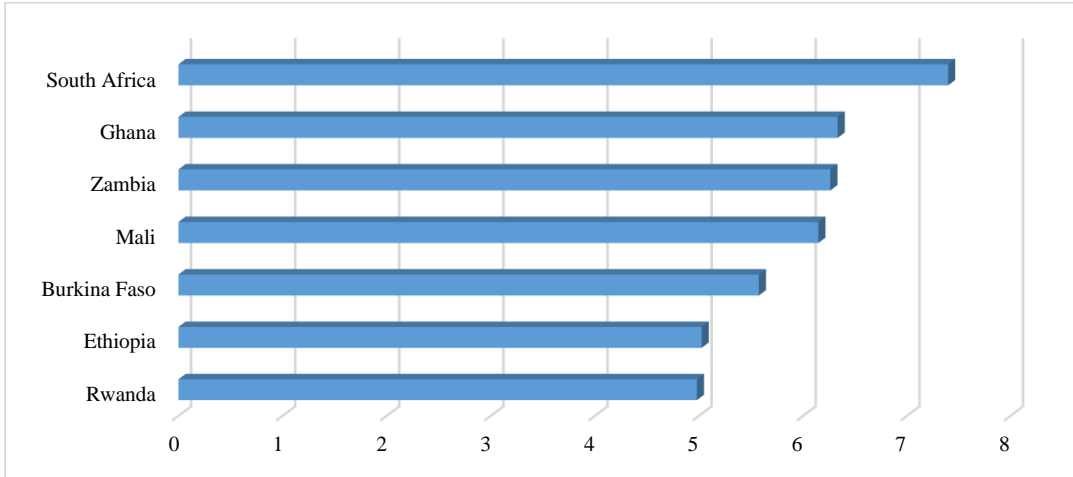


Figure 1. Life satisfaction among respondents in African countries.

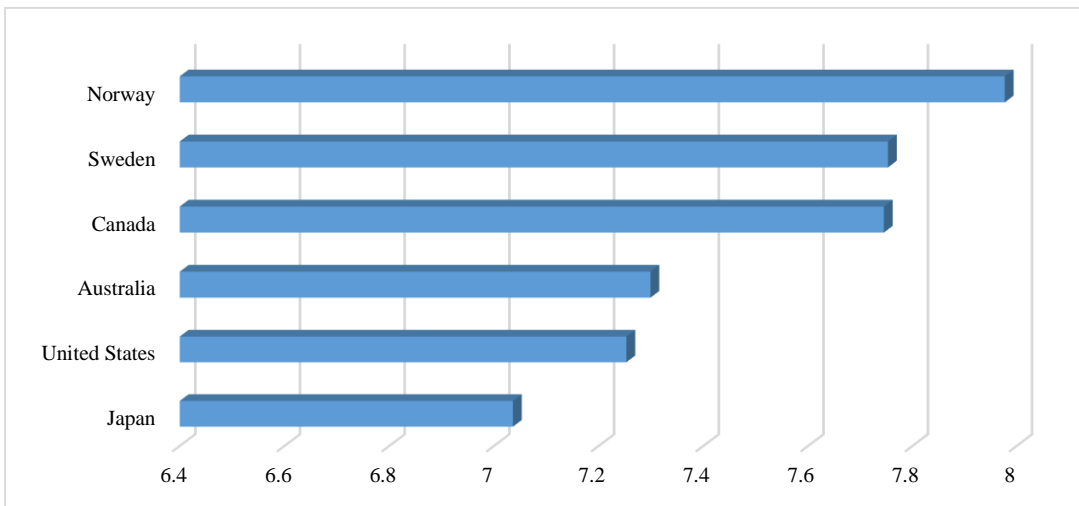


Figure 2. Life satisfaction among respondents in developed countries.

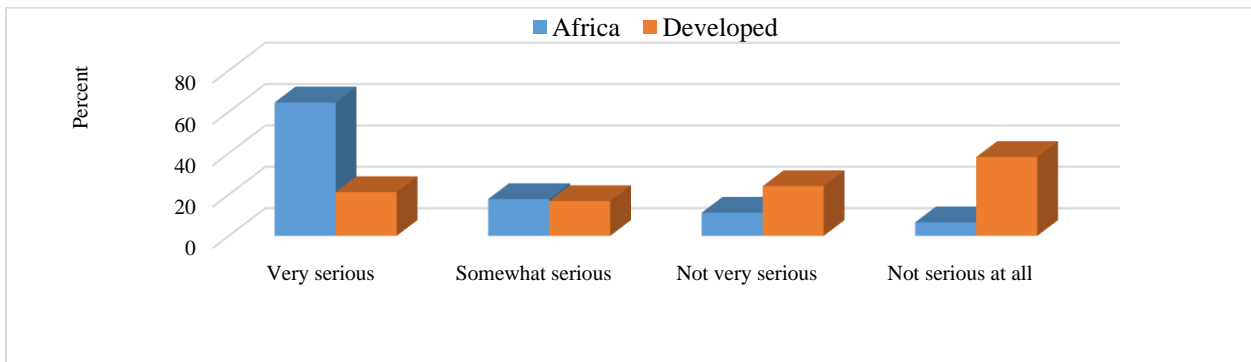


Figure 3. Distribution of perceptions about the seriousness or otherwise of poor water quality in respondent's own community.

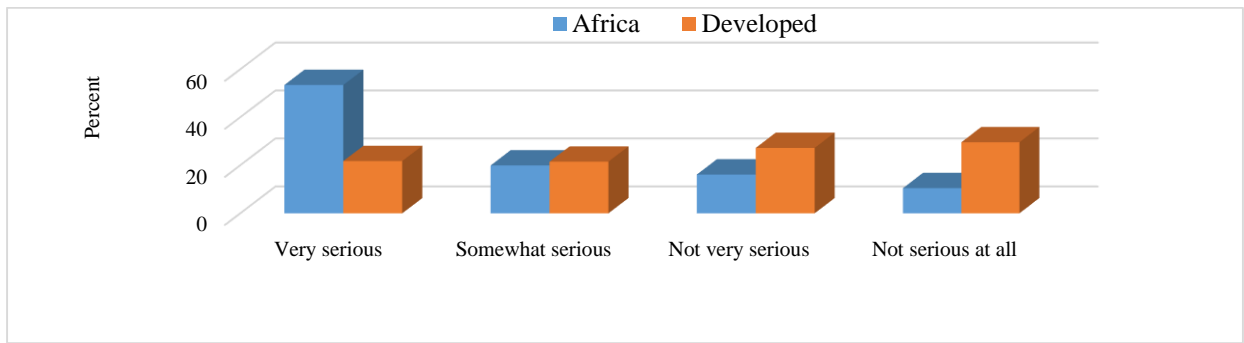


Figure 4. Distribution of perceptions about the seriousness or otherwise of poor air quality in respondent's own community.

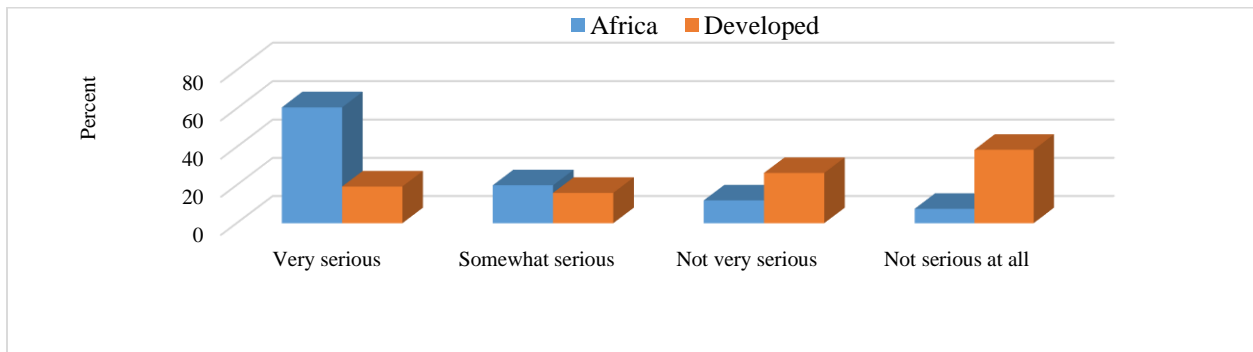


Figure 5. Distribution of perceptions about the seriousness or otherwise of poor sewage and sanitation in respondent's own community.

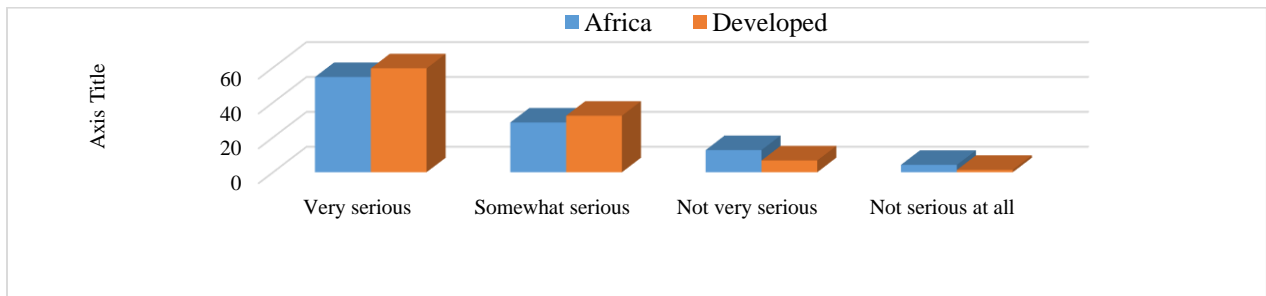


Figure 6. Distribution of perceptions about the seriousness or otherwise of global warming or the greenhouse effect for the world as a whole.

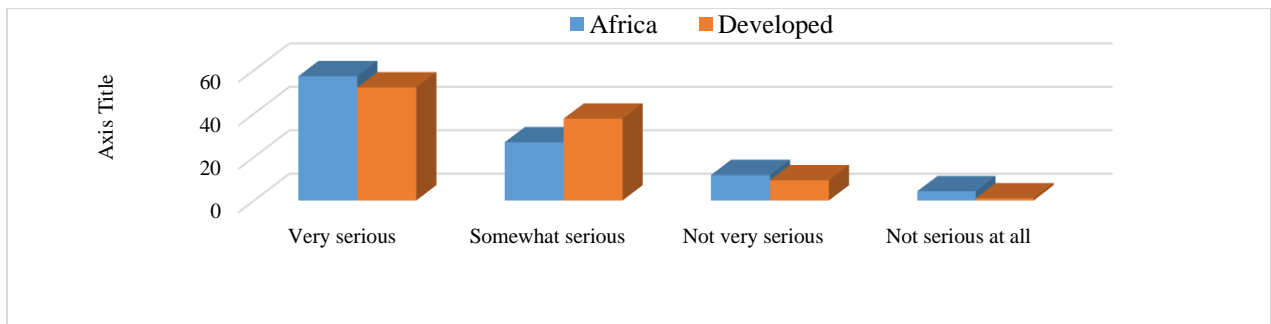


Figure 7. Distribution of perceptions about the seriousness or otherwise of loss of plant or animal species or biodiversity for the world as a whole.

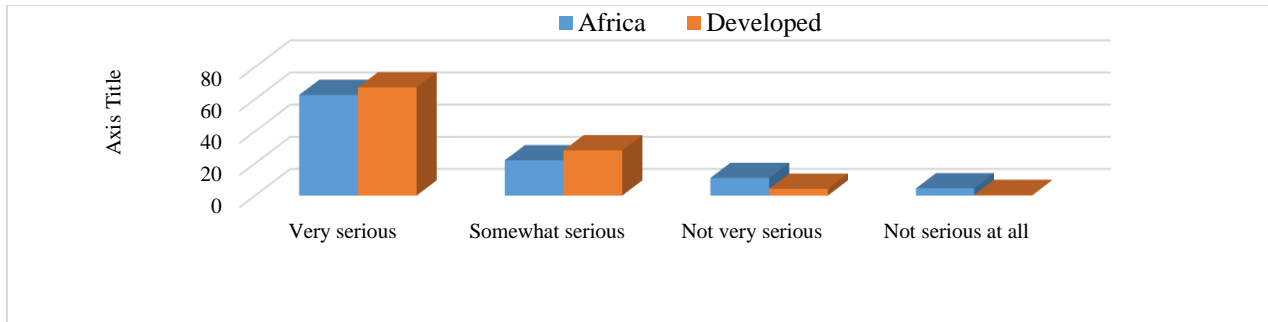


Figure 8. Distribution of perceptions about the seriousness or otherwise of pollution of rivers, lakes and oceans for the world as a whole.

We now turn to the econometric analyses of the effect of PEQ on SWB. Table 2 reports the regression results for the relationship between the PLEQ measures and SWB. We test each environmental problem separately. We start by regressing SWB on poor water quality, while controlling for a multitude of variables found to be significant correlates of SWB in the literature. Next, we regress SWB on poor air quality, and finally, on poor sewage and sanitation for each set of countries. Our results indicate that each local environmental problem has a negative and significant effect on SWB. This suggests that people are less happy when they believe their own community has poor water quality, air quality, and sewage and sanitation problems. One explanation is that awareness of the health implications of poor water, air, and sewage and sanitation may diminish people's happiness (MacKerron and Mourato, 2009). Poor environmental quality may also affect people's perceptions about their health which consequently affects their happiness. For instance, our results confirm that self-rated health status is significantly associated with SWB. That is, good or very good health status has the highest positive effect on happiness, while poor health status exerts the greatest negative effect on happiness (see Tables 2 and 3).

Table 3 presents the results for the effect of PGEQ measures on life satisfaction. For both African and developed countries, the effect of each global environmental problem on SWB is negative. However, only pollution of rivers, lakes and oceans is statistically significant at the 10%

level for Africa. Global warming/greenhouse effect and loss of plant/animal species and biodiversity are not significantly correlated with life satisfaction. Among residents of developed countries, each global environmental problem exerts a negative and significant effect on SWB. Thus, our findings suggest that residents of African countries are more concerned about their local environment than they are about environmental degradation at the global level, whereas residents of developed countries are concerned about both local and global environmental quality.

These results are consistent with results from some previous studies about environmental concern around the world (e.g., Inglehart's 1995, 1997; Franzen and Meyer, 2010; Bruneau and Echevarria, 2009). It could be argued that local environmental quality *is not* a luxury good, while global environmental quality *is*. In Maslowian terms, while local environmental quality is a "lower order" need, global environmental quality is a "higher order" need. A plausible explanation may be that Inglehart's (1995) "objective problems and subjective values" argument (that environmental concern among Africans is a result of the actual environmental pollution they face) is supported here. A further examination of the significance of the global environmental quality measures supports this thesis. For the African sample, global warming or greenhouse effect, and loss of plant or animal species and biodiversity are not significantly correlated with life satisfaction, yet pollution of water bodies has a significant effect, although this effect is also weak. The first two measures are far more "remote" to Africans than the pollution of water bodies. Thus, it seems that residents of Africa are more concerned about their local environment than they are about the global environment.

The control variables mostly have the expected signs and significance. Age has a U-shaped relationship with SWB. Females are significantly happier than males. Individuals who attained secondary or college education are significantly happier than those with primary or no formal

education in Africa. However, educational attainment has no significant impact on SWB among residents of developed countries. Good health status has a positive effect on happiness, while poor health significantly reduces happiness. Being married has a positive and significant effect on happiness while divorce or separation reduces happiness. Unemployment has a negative effect on happiness even though it is not significant for the developed countries sample. Our results show that generalized trust is positively and significantly correlated with happiness for residents of both African and developed countries as expected and the magnitudes are similar while membership in non-religious voluntary organizations has a significant effect on happiness for the African sample. Also, relative to respondents who live in a rural area, those who reside in mid-size and urban towns are generally less happy.

While having children significantly increases happiness among residents of developed countries, it has no effect on happiness for residents of Africa. Luechinger (2010) finds no evidence of significant association between having children and life satisfaction for European countries and Norway while MacKerron and Mourato (2009) obtained a similar result for residents of London. We find a positive and significant effect of relative income within country on happiness for the African sample but a negative and significant effect for residents of developed countries. These results contrast with James (2011) who obtained a positive effect of income on happiness for USA, Mexico, and Brazil, but not for Canada. Satisfaction with household finances, freedom and control over life and religiosity (i.e., religious importance) all exert a positive and significant effect on SWB for residents of both African and developed countries. Finally, respondents in Africa are significantly less happy than their counterparts in developed countries.



Table 2. OLS regression results for the effect of perceived local environmental quality on life satisfaction

Variable	Africa			Developed		
Poor water	-0.09*** (0.03)			-0.10*** (0.03)		
Poor air		-0.07** (0.03)			-0.09*** (0.03)	
Poor sewage & sanitation			-0.06** (0.03)			-0.13*** (0.04)
Age	-0.03*** (0.01)	-0.03*** (0.01)	-0.03*** (0.01)	-0.03*** (0.00)	-0.03*** (0.00)	-0.03*** (0.00)
Age <sup>2</sup> /100	0.04*** (0.01)	0.04*** (0.01)	0.04*** (0.01)	0.03*** (0.00)	0.03*** (0.00)	0.03*** (0.00)
<b>Gender</b> (Ref=Male)						
Female	0.16*** (0.03)	0.16*** (0.03)	0.16*** (0.03)	0.09*** (0.02)	0.09*** (0.02)	0.09*** (0.02)
<b>Education</b> (Ref=Primary or Less)						
Secondary	0.20*** (0.03)	0.21*** (0.03)	0.21*** (0.03)	-0.01 (0.02)	-0.01 (0.02)	-0.01 (0.02)
College	0.21*** (0.06)	0.22*** (0.06)	0.23*** (0.06)	-0.02 (0.03)	-0.01 (0.03)	-0.02 (0.03)
<b>Health Status</b> (Ref=Fair Health)						
Good Health	0.73*** (0.03)	0.73*** (0.03)	0.73*** (0.03)	0.60*** (0.03)	0.60*** (0.03)	0.60*** (0.03)
Poor Health	-0.58*** (0.06)	-0.59*** (0.06)	-0.59*** (0.06)	-0.56*** (0.05)	-0.56*** (0.05)	-0.57*** (0.05)
<b>Marital Status</b> (Ref=Other Marital)						
Married	0.09** (0.04)	0.09** (0.04)	0.09** (0.04)	0.43*** (0.03)	0.43*** (0.03)	0.43*** (0.03)
Divorced/Separated	-0.21*** (0.07)	-0.21*** (0.07)	-0.21*** (0.07)	0.01 (0.04)	0.01 (0.04)	0.01 (0.04)
<b>Employment Status</b> (Ref=Other)						
Unemployed	-0.13*** (0.04)	-0.13*** (0.04)	-0.13*** (0.04)	-0.06 (0.05)	-0.06 (0.05)	-0.06 (0.05)
<b>Social Capital</b>						
Generalized Trust	0.12*** (0.04)	0.12*** (0.04)	0.12*** (0.04)	0.11*** (0.02)	0.11*** (0.02)	0.11*** (0.02)
Voluntary Organization	0.03*** (0.01)	0.03*** (0.01)	0.03*** (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)
<b>City Size</b> (Ref=Rural)						
Urban	0.00 (0.04)	-0.00 (0.04)	0.00 (0.04)	-0.10*** (0.03)	-0.10*** (0.03)	-0.10*** (0.03)
Mid-size	-0.18*** (0.04)	-0.18*** (0.04)	-0.18*** (0.04)	-0.03 (0.03)	-0.03 (0.03)	-0.03 (0.03)
<b>Other Controls</b>						
Income Scale	0.05*** (0.01)	0.05*** (0.01)	0.05*** (0.01)	-0.02*** (0.00)	-0.02*** (0.00)	-0.02*** (0.00)
Satisfied w/ Finances	0.47*** (0.01)	0.47*** (0.01)	0.47*** (0.01)	0.31*** (0.01)	0.31*** (0.01)	0.31*** (0.01)
Children	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)	0.06*** (0.01)	0.05*** (0.01)	0.05*** (0.01)
Control over life	0.18*** (0.01)	0.18*** (0.01)	0.18*** (0.01)	0.25*** (0.01)	0.25*** (0.01)	0.25*** (0.01)
Religiosity	0.24*** (0.05)	0.24*** (0.05)	0.24*** (0.05)	0.12*** (0.02)	0.12*** (0.02)	0.12*** (0.02)
<b>Country dummies</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Intercept</b>	1.65*** (0.13)	1.64*** (0.13)	1.64*** (0.13)	3.57*** (0.09)	3.57*** (0.09)	3.57*** (0.09)
Adj - R <sup>2</sup>	0.43	0.43	0.43	0.39	0.39	0.39
F-statistic	881.15***	880.89***	880.77***	687.85***	687.76***	688.08***
N	23170	23170	23170	21264	21264	21264

Note: Our model fit statistics suggest that the models fit the data well. The Adj - R<sup>2</sup>s suggest that our models are able to explain over 40% of the total variation in happiness. We note that goodness of fit measures are typically low in the economics of happiness literature. The F-statistic for each model is significant at the 1% level, suggesting that overall the models are valid. We checked for multicollinearity by running OLS models (not reported here) and found that the variance inflation factors (VIFs) were between 1 and 2 for the right hand side variables with the exception of age and age.<sup>2</sup> Each regression includes country dummies. Standard errors are in parentheses. \* Significant at the 10% level, \*\* significant at 5%, and \*\*\* significant at 1%.

Table 3. OLS regression results for the effect of perceived global environmental quality on life satisfaction

Variable	Africa			Developed		
Global warming or greenhouse effect	-0.05 (0.03)			-0.07*** (0.02)		
Loss of plant or animal or biodiversity		-0.04 (0.03)			-0.05** (0.02)	
Pollution of rivers, lakes and oceans			-0.06* (0.03)			-0.07*** (0.02)
Age	-0.03*** (0.01)	-0.03*** (0.01)	-0.03*** (0.01)	-0.03*** (0.00)	-0.03*** (0.00)	-0.03*** (0.00)
Age <sup>2</sup> /100	0.04*** (0.01)	0.04*** (0.01)	0.04*** (0.01)	0.03*** (0.00)	0.03*** (0.00)	0.03*** (0.00)
<b>Gender</b> (Ref =Male)						
Female	0.16*** (0.03)	0.16*** (0.03)	0.16*** (0.03)	0.09*** (0.02)	0.09*** (0.02)	0.09*** (0.02)
<b>Education</b> (Ref=Primary or Less)						
Secondary	0.21*** (0.03)	0.22*** (0.03)	0.21*** (0.03)	-0.00 (0.02)	-0.01 (0.02)	-0.00 (0.02)
College	0.23*** (0.06)	0.23*** (0.06)	0.23*** (0.06)	-0.01 (0.03)	-0.01 (0.03)	-0.01 (0.03)
<b>Health Status</b> (Ref=Fair Health)						
Good Health	0.73*** (0.03)	0.73*** (0.03)	0.73*** (0.03)	0.60*** (0.03)	0.60*** (0.03)	0.60*** (0.03)
Poor Health	-0.59*** (0.06)	-0.59*** (0.06)	-0.57*** (0.06)	-0.56*** (0.05)	-0.57*** (0.05)	-0.56*** (0.05)
<b>Marital Status</b> (Ref=Other Marital)						
Married	0.09** (0.04)	0.09** (0.04)	0.09** (0.04)	0.43*** (0.03)	0.43*** (0.03)	0.43*** (0.03)
Divorced/Separated	-0.21*** (0.07)	-0.21*** (0.07)	-0.21*** (0.07)	0.01 (0.04)	0.01 (0.04)	0.01 (0.04)
<b>Employment Status</b> (Ref=Other)						
Unemployed	-0.13*** (0.04)	-0.13*** (0.04)	-0.13*** (0.04)	-0.06 (0.05)	-0.06 (0.05)	-0.06 (0.05)
<b>Social Capital</b>						
Generalized Trust	0.12*** (0.04)	0.12*** (0.04)	0.12*** (0.04)	0.11*** (0.02)	0.11*** (0.02)	0.11*** (0.02)
Voluntary Organization	0.03*** (0.01)	0.02*** (0.01)	0.03*** (0.01)	0.011 (0.01)	0.01 (0.01)	0.01 (0.01)
<b>City Size</b> (Ref=Rural)						
Urban	-0.00 (0.04)	-0.00 (0.04)	-0.00 (0.04)	-0.20*** (0.03)	-0.10*** (0.03)	-0.10*** (0.03)
Mid-size	-0.18*** (0.04)	-0.18*** (0.04)	-0.18*** (0.04)	-0.02 (0.03)	-0.02 (0.03)	-0.02 (0.03)
<b>Other Controls</b>						
Income Scale	0.05*** (0.01)	0.05*** (0.01)	0.05*** (0.01)	-0.02*** (0.00)	-0.02*** (0.00)	-0.02*** (0.00)
Satisfied w/ Finances	0.47*** (0.01)	0.47*** (0.01)	0.47*** (0.01)	0.31*** (0.01)	0.31*** (0.01)	0.31*** (0.01)
Children	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)	0.05*** (0.01)	0.05*** (0.01)	0.05*** (0.01)
Control over life	0.18*** (0.01)	0.18*** (0.01)	0.18*** (0.01)	0.25*** (0.01)	0.25*** (0.01)	0.25*** (0.01)
Religiosity	0.24*** (0.05)	0.24*** (0.05)	0.24*** (0.05)	0.12*** (0.02)	0.12*** (0.02)	0.12*** (0.02)
<b>Country dummies</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Intercept</b>	1.63*** (0.13)	1.64*** (0.13)	1.64*** (0.13)	3.56*** (0.09)	3.56*** (0.09)	3.56*** (0.09)
Adj - R <sup>2</sup>	0.43	0.43	0.43	0.39	0.39	0.39
F-statistic	880.61***	880.55***	880.71***	687.71***	687.41***	687.71***
N	23170	23170	23170	21264	21264	21264

Note: Each regression includes country dummies. Standard errors are in parentheses. \* Significant at the 10% level, \*\* significant at 5%, and \*\*\* significant at 1%

In order to determine the direction of causality between PEQ and SWB, we implement a 2SLS procedure (using instrumental variables) as follows. First, consider the following equations:

$$SWB_{ij} = \beta_0 + \beta_1 * PEQ_{ij} + \beta_2 * X_{ij} + \varepsilon_{ij} \quad (2.5)$$

$$PEQ_{ij} = \phi_0 + \phi_1 * Z_{ij} + \phi_2 * X_{ij} + \mu_{ij} \quad (2.6)$$

where Z is an instrument for PEQ in equation (2.6). An appropriate instrument must be correlated with PEQ but uncorrelated with  $\varepsilon_{ij}$ . By estimating equation (2.6), the predicted values of PEQ (i.e.,  $\widehat{PEQ}$ ) are generated. Equation (2.5) is then estimated using  $\widehat{PEQ}$  as follows:

$$SWB_{ij} = \beta_0 + \beta_1 * \widehat{PEQ}_{ij} + \beta_2 * X_{ij} + \varepsilon_{ij} \quad (2.7)$$

In the next step, the structural model specifies PEQ as the dependent variable and SWB as the independent variable. Therefore, we need an instrument Z for SWB:

$$PEQ_{ij} = \beta_0 + \beta_1 * SWB_{ij} + \beta_2 * X_{ij} + \mu_{ij} \quad (2.8)$$

$$SWB_{ij} = \phi_0 + \phi_1 * Z_{ij} + \phi_2 * X_{ij} + \varepsilon_{ij} \quad (2.9)$$

After generating predicted values from an estimation of equation (2.9) for SWB (i.e.,  $\widehat{SWB}$ ), we re-estimate equation (2.8) by plugging in  $\widehat{SWB}$ , yielding:

$$PEQ_{ij} = \beta_0 + \beta_1 * \widehat{SWB}_{ij} + \beta_2 * X_{ij} + \mu_{ij} \quad (2.10)$$

If SWB and PEQ are indeed bicausal, then the coefficient of PEQ in the second stage regression for SWB should be negative and significant, and the coefficient of SWB in the second stage regression of PEQ should be negative and significant too. The results are reported on Tables 4 and Table 5.<sup>5</sup> An instrument for PEQ is “unwillingness to pay for environmental protection,”<sup>6</sup> while “poor health” is used as an instrument for SWB in the first stage regressions (e.g., James, 2011).

<sup>5</sup> For economy of space, only the second stage regressions are reported.

<sup>6</sup> This variable is based on the WVS question that asked respondents to indicate their agreement or disagreement with the statement “The Government should reduce environmental pollution, but it should not cost me any money” (1=Strongly agree, 2=Agree, 3=Disagree, 4=Strongly disagree). Thus, although a respondent may be unwilling to sacrifice income to protect the environment, they might still have some concern for the environment.

Table 4. Two-stage least squares using life satisfaction and perceived local environmental quality as dependent variables

	Africa						Developed					
	SWB	Poor water	SWB	Poor air	SWB	Poor sewage and sanitation	SWB	Poor water	SWB	Poor air	SWB	Poor sewage and sanitation
SWB		-0.19*** (0.05)		-0.16*** (0.01)		-0.17*** (0.01)		-0.09*** (0.01)		-0.09*** (0.01)		-0.08*** (0.01)
Poor water	-1.26*** (0.11)						-0.90*** (0.14)					
Poor air			-1.35*** (0.13)						-0.92*** (0.14)			
Poor sewage and sanitation					-1.22*** (0.11)						-0.90*** (0.15)	
Age	-0.08*** (0.01)	-0.02*** (0.00)	-0.08*** (0.01)	-0.02*** (0.00)	-0.08*** (0.01)	-0.02*** (0.00)	-0.05*** (0.00)	-0.00* (0.00)	-0.05*** (0.00)	-0.00 (0.00)	-0.05*** (0.00)	-0.00* (0.00)
Age <sup>2</sup> /1000	0.09*** (0.01)	0.02*** (0.00)	0.09*** (0.01)	0.02*** (0.00)	0.09*** (0.01)	0.02*** (0.00)	0.06*** (0.00)	0.00*** (0.00)	0.06*** (0.00)	0.00*** (0.00)	0.06*** (0.00)	0.00*** (0.00)
Female	0.22*** (0.03)	0.04*** (0.01)	0.23*** (0.03)	0.03*** (0.01)	0.22*** (0.03)	0.03*** (0.01)	0.10*** (0.02)	0.01*** (0.00)	0.10*** (0.02)	0.01* (0.00)	0.10*** (0.02)	0.00 (0.00)
Secondary	0.18*** (0.04)	-0.13*** (0.01)	0.22*** (0.04)	-0.10*** (0.01)	0.21*** (0.04)	-0.12*** (0.01)	0.06* (0.03)	0.09*** (0.01)	0.07* (0.03)	0.10*** (0.01)	0.05 (0.03)	0.08*** (0.00)
College	0.16* (0.07)	-0.21*** (0.02)	0.222** (0.07)	-0.16*** (0.02)	0.20** (0.07)	-0.19*** (0.02)	0.06 (0.04)	0.07*** (0.01)	0.09* (0.04)	0.10*** (0.01)	0.05 (0.04)	0.05*** (0.00)
Married	0.20*** (0.04)	0.02* (0.01)	0.20*** (0.04)	0.02* (0.01)	0.20*** (0.04)	0.02 (0.01)	0.55*** (0.02)	0.04*** (0.01)	0.54*** (0.03)	0.03*** (0.01)	0.55*** (0.02)	0.03*** (0.01)
Unemployed	-0.26*** (0.04)	-0.01 (0.01)	-0.28*** (0.04)	-0.02* (0.01)	-0.26*** (0.04)	-0.01 (0.01)	-0.29*** (0.05)	-0.00 (0.01)	-0.29*** (0.05)	-0.00 (0.01)	-0.29*** (0.05)	0.00 (0.01)
Income scale	0.30*** (0.01)	0.07*** (0.00)	0.30*** (0.01)	0.06*** (0.00)	0.30*** (0.01)	0.07*** (0.00)	0.06*** (0.00)	0.00 (0.00)	0.07*** (0.00)	0.00*** (0.00)	0.07*** (0.00)	0.00 (0.00)
Generalized trust	0.27*** (0.04)	0.01*** (0.01)	0.27*** (0.04)	0.01 (0.01)	0.26*** (0.04)	0.00 (0.01)	0.20*** (0.02)	-0.00 (0.01)	0.21*** (0.02)	0.01 (0.01)	0.21*** (0.02)	-0.00 (0.00)
Control over life	0.30*** (0.01)	0.06*** (0.00)	0.30*** (0.01)	0.05*** (0.00)	0.31*** (0.01)	0.06*** (0.00)	0.37*** (0.01)	0.03*** (0.00)	0.37*** (0.01)	0.04*** (0.00)	0.37*** (0.01)	0.03*** (0.00)
Intercept	4.27*** (0.14)	1.23*** (0.05)	4.20*** (0.14)	1.04*** (0.05)	4.24*** (0.14)	1.19*** (0.05)	4.90** (0.09)	0.46*** (0.05)	4.88*** (0.09)	0.44*** (0.05)	4.91*** (0.09)	0.40*** (0.05)
Adj – R <sup>2</sup>	0.21	0.04	0.21	0.03	0.21	0.04	0.23	0.02	0.23	0.02	0.23	0.02
F – Statistic	605.27***	98.13***	598.22***	78.46***	605.34***	93.23***	644.06***	42.15***	642.94***	46.71***	646.30***	37.94***
N	24587	24587	24587	24587	24587	24587	23883	23883	23883	23883	23883	23883

Note. All regressions are second stage regressions. \* Significant at the 10% level, \*\* significant at 5%, and \*\*\* significant at 1%

Table 5. Two-stage least squares using life satisfaction and perceived global environmental quality as dependent variables

	Africa						Developed					
	SWB	Global warming or greenhouse effect	SWB	Loss of plant or animal species or biodiversity	SWB	Pollution of rivers, lakes and oceans	SWB	Global warming or greenhouse effect	SWB	Loss of plant or animal species or biodiversity	SWB	Pollution of rivers, lakes and oceans
SWB		-0.15*** (0.01)		-0.19*** (0.01)		-0.18*** (0.01)		-0.13*** (0.01)		-0.13*** (0.01)		-0.15*** (0.01)
Global warming or greenhouse effect	-1.29*** (0.12)						-0.51*** (0.08)					
Loss of plant or animal or biodiversity			-1.26*** (0.11)						-0.49*** (0.08)			
Pollution of rivers, lakes and oceans					-1.17*** (0.11)						-0.47*** (0.08)	
Age	-0.08*** (0.01)	-0.02*** (0.00)	-0.08*** (0.01)	-0.02*** (0.00)	-0.08*** (0.01)	-0.02*** (0.00)	-0.05*** (0.00)	-0.00 (0.00)	-0.05*** (0.00)	-0.00 (0.00)	-0.05*** (0.00)	-0.00 (0.00)
Age <sup>2</sup> /1000	0.09*** (0.01)	0.02*** (0.00)	0.09*** (0.01)	0.03*** (0.01)	0.09*** (0.01)	0.02*** (0.00)	0.06*** (0.00)	0.01*** (0.00)	0.06*** (0.00)	0.00** (0.00)	0.06*** (0.00)	0.01*** (0.00)
Female	0.21*** (0.03)	0.02* (0.01)	0.22*** (0.03)	0.03*** (0.01)	0.22*** (0.03)	0.03*** (0.01)	0.11*** (0.02)	0.03*** (0.01)	0.11*** (0.02)	0.03*** (0.01)	0.10*** (0.02)	0.02*** (0.01)
Secondary	0.24*** (0.04)	-0.09*** (0.01)	0.22*** (0.04)	-0.10*** (0.00)	0.24*** (0.04)	-0.10*** (0.00)	0.07* (0.03)	0.18*** (0.01)	0.07* (0.03)	0.17*** (0.01)	0.07* (0.03)	0.19*** (0.01)
College	0.24*** (0.07)	-0.15*** (0.02)	0.22** (0.07)	-0.16*** (0.02)	0.23*** (0.07)	-0.17*** (0.02)	0.12** (0.04)	0.23*** (0.01)	0.11** (0.04)	0.22*** (0.01)	0.11** (0.04)	0.23*** (0.01)
Married	0.20*** (0.04)	0.01 (0.01)	0.20*** (0.04)	0.03* (0.01)	0.20*** (0.04)	0.02 (0.01)	0.55*** (0.02)	0.06*** (0.01)	0.55*** (0.02)	0.05*** (0.01)	0.55*** (0.02)	0.07*** (0.01)
Unemployed	-0.30*** (0.04)	-0.03*** (0.01)	-0.30*** (0.04)	-0.05*** (0.01)	-0.28*** (0.04)	-0.02* (0.01)	-0.30*** (0.05)	-0.01 (0.02)	-0.30*** (0.05)	-0.00 (0.02)	-0.30*** (0.05)	-0.01 (0.02)
Income scale	0.31*** (0.01)	0.07*** (0.00)	0.30*** (0.01)	0.07*** (0.00)	0.30*** (0.01)	0.07*** (0.00)	0.07*** (0.00)	0.00* (0.00)	0.07*** (0.00)	0.00 (0.00)	0.07*** (0.00)	0.00* (0.00)
Generalized trust	0.27*** (0.04)	0.00 (0.01)	0.26*** (0.04)	0.01 (0.01)	0.25*** (0.04)	-0.01 (0.01)	0.23*** (0.02)	0.05*** (0.01)	0.23*** (0.02)	0.05*** (0.01)	0.23*** (0.02)	0.06*** (0.01)
Control over life	0.31*** (0.01)	0.05*** (0.00)	0.31*** (0.01)	0.06*** (0.00)	0.31*** (0.01)	0.06*** (0.00)	0.38*** (0.01)	0.06*** (0.00)	0.38*** (0.01)	0.06*** (0.00)	0.38*** (0.01)	0.06*** (0.01)
Intercept	4.17*** (0.14)	1.03*** (0.05)	4.25*** (0.14)	1.21*** (0.05)	4.17*** (0.14)	1.17*** (0.05)	4.85*** (0.09)	0.57*** (0.07)	4.83*** (0.09)	0.52*** (0.07)	4.84*** (0.09)	0.62*** (0.07)
Adj – R <sup>2</sup>	0.21	0.03	0.21	0.03	0.21	0.04	0.23	0.05	0.23	0.05	0.23	0.05
F – Statistic	596.51***	76.89***	600.86***	81.76***	604.91***	83.94***	648.36***	104.56***	648.36***	104.00***	649.83***	111.36***
N	24587	24587	24587	24587	24587	24587	23883	23883	23883	23883	23883	23883

Note. All regressions are second stage regressions. \* Significant at the 10% level, \*\* significant at 5%, and \*\*\* significant at 1%

As shown in Table 4, the second stage regressions reveal that each local environmental quality measure has a negative and significant effect on SWB at the 1% level for residents of both African and developed countries. Also, SWB is negatively and significantly correlated with each local environmental quality measure at the 1% level. These results also hold for the global environmental quality measures summarized in Table 5. That is, each global environmental quality measure has a negative and significant effect on SWB at the 1% level and SWB has a negative and significant effect on each perceived global environmental quality measure at the 1% level. Therefore, our results suggest that there is a bicausal relationship between each measure of PEQ and SWB.

It could also be that some underlying correlate(s) is (are) determining the suggested bicausal relationship between PEQ and SWB. For instance, it is possible that individual personality or psychological traits could be influencing the bicausal relationship between PEQ and SWB (Ferrer-i-Carbonell and Gowdy, 2007). However, because Ferrer-i-Carbonell and Gowdy (2007) demonstrate that including and controlling for psychological traits does not significantly affect the environment-happiness relationship, we do not examine such variables.

## **2. 6. Conclusions**

The aim of this chapter is to examine how perceptions about environmental quality are correlated with self-reported well-being. We consider the effect of individual perceptions about the seriousness or otherwise of local as well as global environmental concerns on reported subjective well-being. Local environmental issues include poor water, poor air, and poor sewage and sanitation in respondent's own community (perceived local environmental quality) while global environmental issues include global warming or greenhouse effect, loss of plant or animal

species and biodiversity, and pollution of water bodies (rivers, lakes and oceans) in the world as a whole (perceived global environmental quality). We also compare these correlations for residents of developed and developing countries.

We find that each of the three PLEQ measures has a negative impact on life satisfaction for people in both African and developed countries, suggesting that people are less happy if they consider their local environment as poor. Our results also provide strong evidence that perceptions about global environmental degradation reduce happiness for residents of developed countries. However, among African respondents, only the pollution of water bodies has a negative, though weak, effect on happiness. We therefore conclude that while people in developed countries are concerned about both local and global environmental quality, residents of Africa are more concerned about their local environment than they do about the global environment. This makes sense if individuals in developing countries, especially Africa, have a significant reliance on natural resources for their survival. And, since water is particularly important for these residents, it is unsurprising that they would feel an effect from both local as well as global water pollution concerns.

The WHO (2013) reports that “air pollution is now the world’s largest single environmental health risk.” In 2012, about 7 million people around the world died due to air pollution, 88% of which occurred in low- and middle-income countries. Additionally, unsafe drinking-water and poor sanitation are a major environmental health risk largely because these are a source of water-borne diseases and infections. In Africa, the majority of the people in rural areas and shanty urban towns lack access to treated water and improved sanitation. Thus, we believe our findings have policy implications. As Welsch (2006) notes, one of the justifications for environmental policy or pollution control is the undesirable effect of environmental degradation on human well-being.

Therefore, leaders and policymakers ought to take improving environmental quality seriously as this would benefit the present generations while bequeathing posterity a cleaner environment than we otherwise could (Cunado & de Gracia, 2013). But this is not only for the direct and obvious reason that improved water quality affects the overall health of individuals. Our results show that perceptions about environmental quality also matter, and that such perceptions affect the sense of happiness, satisfaction or well-being of individuals. Thus, policymakers should consider SWB in addition to general health indicators in their design of environmental policies with particular attention to improvements in local environmental quality.

The literature on the relationship between the environment and happiness is growing, yet still limited. We contribute to this literature in several ways. First, we focus on perceptions rather than objective measures of environmental quality. Second, we contrast the relationship between perceptions about environmental quality and subjective well-being in developed and developing countries (specifically Africa). As far as we know, our study is the first to make such an explicit comparison between African and developed countries in regards to how perceived local and global environmental quality affect life satisfaction. Third, we consider perceptions about both local and global environmental quality. This enables us to explore which environmental problems matter more for people in Africa and developed countries. Fourth, by focusing on the individual as the unit of analysis, we avoid some of the problems associated with aggregating cross-national data, such as masking country differences. Finally, our analysis suggests that there is a bi-directional causal relationship between perceptions about environmental quality and happiness.

Our study has a number of limitations. In our analyses, residents in rural areas (defined here as towns with less than 10,000 people) are underrepresented. Because the majority of people in Africa live in rural areas, more work needs to be done to incorporate their perceptions in models



of subjective well-being and environmental perceptions. Furthermore, most Africans depend on agriculture for their livelihoods. Therefore, a special focus on rural people, particularly farmers, would be an important focus of research. Moreover, we have focused on 11 countries in Africa and 10 developed countries. This sample needs to be expanded to include developing countries in other parts of the world to determine if these results are consistent in Latin America and Asia, for instance. Lastly, we recognize the need for additional research to understand more fully the nature of the potential endogeneity between SWB and PEQ, especially for residents in developing countries. For example, an important question to consider is whether instruments useful for controlling for endogeneity in developed countries also work for developing countries.

## References

- Baumol, W. J. & Oates, W. E. (1979). *Economics, Environmental Policy, and the Quality of Life*. Englewood Cliffs, NJ: Prentice Hall.
- Beja, E. (2012). Subjective well-being approach to environmental valuation: evidence for greenhouse gas emissions. *Social Indicators Research*, 109(2), 243–266.
- Berry, H. L., Bowen, K., & Kjellstrom, T. (2010). Climate change and mental health: a causal pathways framework. *International Journal of Public Health*, 55(2), 123-132.
- Bjørnskov, C. (2003). The happy few: Cross-country evidence on social capital and life satisfaction. *Kyklos*, 56(1), 3–16. doi:10.1111/1467-6435.00207.
- Bjørnskov, C. (2008). Social capital and happiness in the United States. *Applied Research Quality Life*, 3(1), 43–62.
- Broad, R. (1994). The poor and the environment: friends or foes? *World Development*, 22(6), 811-822.
- Brereton, F., Clinch, J.P., & Ferreira, S. (2008). Happiness, geography and the environment. *Ecological Economics*, 65(2), 386–396.
- Bruneau, J. & Echevarria, C. (2009). The Poor Are Green Too. *Journal of International Cooperation Studies*, 16(3), 1-22.
- Colligan, M. J. (1981). The psychological effects of indoor air pollution. *Bulletin of the New York Academy of Medicine*, 57(10), 1014-1026.
- Cunado, J. & de Gracia, F. P. (2013). Environment and Happiness: New Evidence for Spain. *Social Indicators Research*, 112(3), 549-67.
- Davies, S., & Hinks, T. (2010). Crime and happiness amongst heads of households in Malawi. *Journal of Happiness Studies*, 11(4), 457-476.
- Day, R. (2007). Place and the experience of air quality. *Health & Place*, 13(1), 249–260.
- Deaton, A. & Stone, A. A. (2013). Two Happiness Puzzles. *American Economic Review Papers & Proceedings*, 103(3), 91-97.
- Di Tella, R., MacCulloch, R., & Ñopo, H. (2008). *Happiness and beliefs in criminal environments* (No. 662). Working paper//Inter-American Development Bank, Research Department.

- Diekmann, A. & Franzen, A. (1999). The Wealth of Nations and Environmental Concern. *Environment and Behavior*, 31(4), 540–549.
- Diener, E., Suh, E. M., Lucas, R. E., & Smith, H. L. (1999). Subjective well-being: Three decades of progress. *Psychological Bulletin*, 125(2), 276-302.
- Dinda, S. (2004). Environmental Kuznets Curve Hypothesis: A Survey. *Ecological Economics*, 49(4), 431–455.
- Dunlap, R. E., & Mertig, A. G. (1994). Global environmental concern: a challenge to the post-materialism thesis. In *XIII. World Congress of Sociology in Bielefeld, Mimeo*.
- Easterlin, R. A. (1974). *Does Economic Growth Improve the Human Lot? Some Empirical Evidence*. In: Paul A. David and Melvin W. Reder (eds). *Nations and Households in Economic Growth: Essays in Honor of Moses Abramowitz*. New York: Academic Press: 89-125.
- Easterlin, R. A. (1995). Will Raising the Incomes of All Increase the Happiness of All? *Journal of Economic Behavior and Organization*, 27(1), 35-48.
- Easterlin, R. A. (2001). Income and Happiness: Towards a Unified Theory. *The Economic Journal*, 111(473), 465-484.
- Easterlin, R. A. (2005). Building a Better Theory of Well-being. In: Luigino Bruni and Pier L. Porta (eds.), *Economics and Happiness: Framing the Analysis*. Oxford, UK: Oxford University Press: 29–64.
- Easterlin, R. A., McVey, L. A., Switek, M., Sawangfa, O., & Zweig, J. S. (2010). The happiness–income paradox revisited. *Proceedings of the National Academy of Sciences*, 107(52), 22463-22468.
- Ebi, K. L., Mearns, L. O., & Nyenzi, B. (2003). Weather and climate: changing human exposures. *Climate Change and Health: Risks and Responses (McMichael AJ, Campbell-Lendrum DH, Corvalan CF, Ebi KL, Githeko A, et al., eds)*. Geneva: World Health Organization.
- Fairbrother, M. (2012). Rich People, Poor People, and Environmental Concern: Evidence across Nations and Time. *European Sociological Review*, 29(5), 910-922.
- Ferrer-i-Carbonell, A. (2005). Income and well-being: an empirical analysis of the comparison income effect. *Journal of Public Economics*, 89(5-6), 997–1019.
- Ferrer-i-Carbonell, A. & Fijters, P. (2004). How important is methodology for the estimates of the determinants of happiness? *The Economic Journal*, 114(497), 641–659.
- Ferrer-i-Carbonell, A. & Gowdy, J. M. (2007). Environmental degradation and happiness.

- Ecological Economics*, 60(3), 509–516.
- Franzen, A. & Meyer, R. (2010). Environmental Attitudes in Cross-national Perspective: A Multilevel Analysis of the ISSP 1993 and 2000. *European Sociological Review*, 26(2), 219–234.
- Frey, B.S. & Stutzer, A. (2000). Maximizing Happiness? *German Economic Review*, 1(2), 145-167.
- Frey, B.S. & Stutzer, A. (2002). What can economists learn from happiness research? *Journal of Economic Literature*, 40(2), 402 – 435.
- Frey, B.S. (2008). *Happiness: A Revolution in Economics*. MIT Press, Cambridge, MA.
- Gadgil, A. (1998). Drinking water in developing countries. *Annual Review of Energy and the Environment*, 23(1), 253-286.
- Gerdtham, U. G., & Johannesson, M. (2001). The relationship between happiness, health, and socio-economic factors: results based on Swedish microdata. *The Journal of Socio-Economics*, 30(6), 553-557.
- Githeko, A., & Woodward, A. (2003). International consensus on the science of climate and health: the IPCC Third Assessment Report. *Climate change and human health: risks and responses*, 43-60.
- Gowdy, J. (2005). Toward a new welfare foundation for sustainability. *Ecological Economics*, 53(2), 211–222.
- Graham, C. (2008). Happiness and health: Lessons—and questions—for public policy. *Health Affairs*, 27(1), 72-87.
- Grossman, G. M., and Krueger, A. B. (1995). Economic Growth and the Environment. *Quarterly Journal of Economics*, 110(2), 353-377.
- Guyen, C., & Sørensen, B. E. (2012). Subjective well-being: Keeping up with the perception of the Joneses. *Social Indicators Research*, 109(3), 439-469.
- Hagerty, M.R. & Veenhoven, R. (2003). Wealth and happiness revisited – growing national income does go with greater happiness. *Social Indicators Research*, 64(1), 1-27.
- Helliwell, J. F. (2001). Social Capital, the Economy and Well-Being, in: Keith Banting, Andrew Sharpe and France St-Hilaire (eds.), *The Review of Economic Performance and Social Progress. The Longest Decade: Canada in the 1990s*. Montreal: Institute for Research on Public Policy: 43 – 60.
- Helliwell, J. F. (2003). How's Life? Combining Individual and National Variables to Explain

- Subjective Well-Being. *Economic Modelling*, 20 (2), 331- 360.
- Helliwell, J. F. (2006). Well-being, Social Capital, and Public Policy: What's New? *The Economic Journal*, 116(510), C34–C45.
- Helliwell, J. F. & Huang, H. F. (2008). How's your government? International evidence linking good government and well-being. *British Journal of Political Science* 38(3), 595-619
- Heukamp, F. & Arino, M. (2011). Does Country Matter for Subjective Well-Being? *Social Indicators Research*, 100(1), 155–170.
- Hillie, T., & Hlophe, M. (2007). Nanotechnology and the challenge of clean water. *Nature Nanotechnology*, 2(11), 663-664.
- Inglehart, R. (1995). Public Support for Environmental Protection: Objective Problems and Subjective Values in 43 societies. *PS: Political Science & Politics*, 28(01), 57–72.
- Inglehart, R. (1997). *Modernization and Postmodernization: Cultural, Economic, and Political Change in 43 Societies*. Princeton, NJ: Princeton University Press.
- Inglehart, R., Foa, R., Peterson, C. & Welzel, C. (2008). Development, Freedom, and Rising Happiness: A Global Perspective (1981–2007). *Perspectives on Psychological Science*, 3(4), 264-285.
- James, H. S. (2011). Is the Just Man a Happy Man? An Empirical Study of the Relationship between Ethics and Subjective Well-Being. *KYKLOS*, 64 (2), 193–212.
- Kenny, C. (1999). Does Growth Cause Happiness, or Does Happiness Cause Growth? *KYKLOS*, 52 (1), 3-26.
- Kollmuss, A., & Agyeman, J. (2002). Mind the gap: why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, 8(3), 239-260.
- Kuroki, M. (2013). Crime victimization and subjective well-being: Evidence from happiness data. *Journal of Happiness Studies*, 14(3), 783-794.
- Luechinger, S. (2010). Life satisfaction and transboundary air pollution. *Economics Letters*, 107(1), 4–6.
- MacKerron, G. & Mourato, S. (2009). Life satisfaction and air quality in London. *Ecological Economics*, 68(5), 1441–1453.
- Malakooti, M. A., Biomndo, K., & Shanks, D. G. (1998). Re-emergence of epidemic malaria in the highlands of western Kenya. *Emerging Infectious Diseases*, 4(4), 671-6.

- Martinez-Alier, J. (1995). The environment as a luxury good or “too poor to be green”? *Ecological Economics*, 13(1), 1-10.
- Maslow, A. H. (1954). *Motivation and Personality*, 3rd ed. New York: Longman.
- McMichael, A. J. (2003). Global climate change and health: an old story writ large. *Climate Change and Human Health: Risks and Responses* (McMichael AJ, Campbell-Lendrum DH, Corvalán CF, Ebi KL, Githeko A, Scheraga JD, et al. eds). Geneva: World Health Organization, 1-17.
- Mertz, O., Halsnæs, K., Olesen, J. E., & Rasmussen, K. (2009). Adaptation to climate change in developing countries. *Environmental Management*, 43(5), 743-752.
- Mouchet, J., Manguin, S., Sircoulon, J., Laventure, S., Faye, O., Onapa, A., ... & Fontenille, D. (1998). Evolution of malaria in Africa for the past 40 years: impact of climatic and human factors. *Journal of the American Mosquito Control Association*, 14(2), 121-130.
- Oswald, A. (1997). Happiness and economic performance. *The Economic Journal*, 107(445), 1815–1831.
- Patz, J. A., Campbell-Lendrum, D., Holloway, T., & Foley, J. A. (2005). Impact of regional climate change on human health. *Nature*, 438(7066), 310-317.
- Powdthavee, N. (2005). Unhappiness and crime: evidence from South Africa. *Economica*, 72(287), 531-547.
- Ram, R. (2010). Social capital and happiness: additional cross-country evidence. *Journal of Happiness Studies*, 11(4), 409-418.
- Rehdanz, K. & Maddison, D. (2005). Climate and Happiness. *Ecological Economics*, 52(1), 111-125.
- Rehdanz, K. & Maddison, D. (2008). Local environmental quality and life-satisfaction in Germany. *Ecological Economics*, 64(4), 787 – 797.
- Rothstein, B. (2010). Corruption, Happiness, Social Trust and the Welfare State: A Causal Mechanisms Approach. The Quality of Government Institute, University of Gothenburg, Working paper 2010:9.
- Rothstein, B. & Eek, D. (2009). Political Corruption and Social Trust - An Experimental Approach. *Rationality and Society*, 21(1), 81-112.
- Sarracino, F. (2013). Determinants of subjective well-being in high and low income countries: Do happiness equations differ across countries? *The Journal of Socio-Economics*, 42, 51–66.
- Silva, J., F. de Keulenaer & Johnstone, N. (2012). Environmental Quality and Life Satisfaction:

- Evidence Based on Micro-Data. OECD Environment Working Papers, No. 44, OECD Publishing. <http://dx.doi.org/10.1787/5k9cw678dlr0-en>.
- Stack, S. & Eshleman, J. R. (1998). Marital status and happiness: A 17-nation study. *Journal of Marriage and the Family*, 60(2), 527–536.
- Stern, D. I. (2004). The Rise and Fall of the Environmental Kuznets Curve. *World Development*, 32(8), 1419–1439.
- Subramanian, S. V., Kim, D., & Kawachi, I. (2005). Covariation in the socioeconomic determinants of self-rated health and happiness: a multivariate multilevel analysis of individuals and communities in the USA. *Journal of Epidemiology and Community Health*, 59(8), 664-669.
- Sulemana, I. (2014a). The Effect of Fear of Crime and Crime Victimization on Subjective Well-Being in Africa. *Social Indicators Research*. DOI 10.1007/s11205-014-0660-4.
- Sulemana, I (2014b). An Empirical Investigation of the Relationship between Social Capital and Subjective Well-Being in Ghana. *Journal of Happiness Studies*. DOI 10.1007/s10902-014-9565-9.
- Sulemana, I. & James, H. S. (2014). Farmer Identity, Ethical Attitudes and Environmental Practices. *Ecological Economics*, 98, 49-61.
- Tavits, M. (2008). Representation, Corruption, and Subjective Well-Being. *Comparative Political Studies*, 41(12), 1607-1630. DOI: 10.1177/0010414007308537.
- United Nations Secretary General’s Advisory Board on Water and Sanitation. (2008). Monitoring and reporting progress of access to water & sanitation. An assessment by UNSGAB. New York, United Nations.
- United Nations (2014). The Millennium Development Goals Report. New York, United Nations.
- Van Praag, B.M.S., Baarsma, B.E. (2005). Using happiness surveys to value intangibles: the case of airport noise. *The Economic Journal*, 115(500), 224–246.
- Veenhoven, R. (1991). Is happiness relative? *Social Indicators Research*, 24(1), 1-34.
- Wang, P. & Van der Weele, T. J. (2011). Empirical research on factors related to the SWB of Chinese urban residents. *Social Indicators Research*, 101(3), 447–459.
- Weinhold, D. (2013). The Happiness-reducing Costs of Noise Pollution. *Journal of Regional Science*, 53(2), 292-303.
- Welsch, H. (2002). Preferences over prosperity and pollution: environmental valuation based on happiness surveys. *Kyklos*, 55 (4), 473–494.

- Welsch, H. (2006). Environment and happiness: Valuation of air pollution using life satisfaction data. *Ecological Economics*, 58(4), 801–813.
- Welsch, H. (2007). Environmental welfare analysis: A life satisfaction approach. *Ecological Economics*, 62(3), 544-551.
- Welsch, H. (2008). The welfare costs of corruption. *Applied Economics*, 40(14), 1839–1849.
- Welsch, H. & Kuhling, J. (2009). Using happiness data for environmental valuation: Issues and Application. *Journal of Economic Surveys*, 23(2), 385 - 406.
- Wills-Herrera, E., Orozco, L. E., Forero-Pineda, C., Pardo, O., & Andonova, V. (2011). The relationship between perceptions of insecurity, social capital and subjective well-being: Empirical evidences from areas of rural conflict in Colombia. *The Journal of Socio-Economics*, 40(1), 88-96.
- World Health Organization. (2011). Air quality and health. Fact sheet N°313. URL: <http://www.who.int/mediacentre/factsheets/fs313/en/>. (Assessed November 26, 2013).
- World Health Organization. (2013). *The World Health Report 2013: Research for Universal Health Coverage*. World Health Organization.
- World Values Survey (2009). World Values Survey 2005 Official Data File v.20090901. Madrid, Spain: World Values Survey Association, ASEP/JDS. <http://www.worldvaluessurvey.org>.



## CHAPTER 3

### PERCEIVED SOCIOECONOMIC STATUS AS A PREDICTOR OF ENVIRONMENTAL CONCERN IN DEVELOPED AND DEVELOPING COUNTRIES

#### 3. 1. Introduction

Environmentalism has traditionally been considered a preserve of the rich (e.g., Davey, 2009). Some scholars argue that people in developed countries are more concerned about environmental quality and are more willing to pay for environmental improvements than their counterparts in developing countries. Consistent with this view, some argue that there is the tendency for people to demand higher environmental quality as national income rises (e.g., Diekmann and Franzen, 1999; Franzen, 2003). In addition, some researchers contend that within countries, wealthier people have a greater concern about the environment and are more willing to pay for environmental protection than people with low incomes (see e.g., Inglehart, 1990, 1995, and 1997). However, others advance the thesis that residents of developing countries have concern for environmental quality too (e.g., Stern, 2004; Fairbrother, 2013; Bruneau and Echevarria, 2009; Gelissen, 2007) and that national wealth is not directly correlated with environmental concern (Dunlap and Mertig, 1995, 1997).

Most studies that examine environmental attitudes, concerns and behaviors, and the determinants of these environmental phenomena are macro in nature. They use country-level variables (e.g., GDP, income inequality, inflation, unemployment, etc.), and where individual survey variables are used, they are averaged for each country (e.g., Inglehart 1995, 1997; Gelissen, 2007; Franzen and Meyer, 2010; Fairbrother, 2013; Knight and Messer, 2012). A growing number of studies suggest that individual level characteristics are important for environmental concern or attitudes (Israel and Levinson, 2004; Gelissen, 2007; Franzen and Meyer, 2010; Sulemana and

James, 2014). While a small number of studies explore the determinants of willingness-to-pay for environmental protection (e.g., Huang et al., 1997; Carlsson and Johansson-Stenman, 2000; Israel and Levinson, 2004; Witzke and Urfei, 2001), very few of them pay close attention to environmental concern among residents of developing countries, especially African countries (e.g., White and Hunter, 2009; Ogunbode, 2013).

At the micro level, numerous factors (such as age, gender, education, religious beliefs, socioeconomic status and political affiliation) could influence environmental concern. Yet, how individual perceptions about their socioeconomic status affect their concern for the environment remains relatively unexamined. This chapter explores two main issues. First, we examine whether, and to what extent, perceived socioeconomic status (PSES) influences concern for the natural environment, focusing on individual preferences for environmental protection over economic growth and job creation, and their willingness to sacrifice income to prevent environmental pollution. Second, we compare residents of African and developed countries on the basis of these relationships. Using data from the World Values Survey (WVS), we find that PSES is positively and significantly correlated with environmental concern for residents of both African and developed countries. Compared to lower class individuals, those who believe that they belong to the working class, lower middle class, upper middle class and upper class tend to report significantly more environmental concern in both African and developed countries.

This study is important because environmental degradation has dire consequences for humanity, e.g., health effects, extreme weather, and species loss (Donohoe, 2003). Furthermore, in developing countries where people are heavily reliant on natural resources (Hillie and Hlophe, 2007), environmental protection is particularly important for conserving these resources for sustainable livelihoods (Anderson, 2003). We focus on residents of Africa because of the belief

that developing countries are more vulnerable to climate change (Mertz et al., 2009; Ebi et al., 2003). In addition, African countries have historically been underrepresented in cross-national surveys of environmental issues (Dunlap and York, 2008). Finally, we focus on micro, rather than macro, level variables because this enables us to determine how variations in individual level characteristics affect environmental concern (see e.g., Gelissen, 2007, p. 394).

### **3. 2. Related Literature**

#### **3. 2. 1. Explaining the Sources of Environmental Concern**

There is evidence that concern for the environment has grown across the globe. Indeed, a substantial amount of research exists that seeks to provide alternative explanations for environmental concern among and across countries (e.g., Dunlap and Van Liere, 1978; Stern, 1992; Dunlap et al., 2000; Dunlap et al., 1993; Dunlap and Mertig, 1995; 1997; Inglehart, 1990, 1995, and 1997; Diekmann and Franzen, 1999; Franzen and Meyer, 2010). For instance, Stern (1992) identifies four value orientations that explain environmental concern. First, the New Ecological Paradigm (NEP) scale developed by Dunlap and Van Liere (1978) (and its revised version, Dunlap et al., 2000) constitutes a “new way of thinking” in terms of ecological awareness that replaces anthropocentrism (Stern, 1992, p. 280). Second, Stern argues that environmental concern is a result of anthropocentric altruism. That is, humans care about the environment because of the deleterious effect of environmental degradation to human well-being. Closely related to this view is egoism. However, the effect of environmental degradation on well-being here pertains to the well-being of one’s own-self or their close kin rather than on a larger population (Stern, 1992, p. 280). Finally, Stern alludes to some “deeper cause” (e.g., religious beliefs, shifts to post-materialist values, etc.) as a source of environmental concern.

The NEP scale seems to be the commonest measure of environmental attitudes or concern especially among sociologists and social-psychologists. In spite of the convergence of evidence to support its validity, there is still debate as to whether the scale measures a one-dimensional or multidimensional construct (Dunlap et al., 2000). Researchers praise the NEP for its ability to use statistical methods (quantitative and qualitative) to explain differing attitudes of people toward the environment across regions (geography), time, and social groupings (LaLonde and Jackson, 2002). However, it has been criticized for outliving its usefulness because the nature and scope of key environmental issues and values of the time when the NEP was constructed are no longer applicable to contemporary contexts, both in their substance and wording (LaLonde and Jackson, 2002).

There are several other competing theories seeking to explain why people differ in their environmental concern, e.g., Inglehart's (1990, 1995, 1997) post-materialism hypothesis; environmental globalization by Dunlap et al. (1993) and Dunlap and Mertig (1995, 1997); and the prosperity or affluence hypothesis (Diekmann and Franzen, 1999). Inglehart (1990, 1995, and 1997) argues that as economies grow and become affluent, citizens no longer have to deal with materialist priorities such as economic struggles, fighting crime, fighting inflation, etc. Instead, and consistent with Maslow's (1954) hierarchy of needs, they concern themselves with post-materialist values such as self-fulfillment, self-expression, political freedom, and environmental protection. Thus, environmental concern as a "higher order need" (in Maslowian terms) tends to be higher as countries become more affluent. He argues that willingness to sacrifice financial resources for environmental protection was highest among post-materialist publics (Inglehart, 1995, p.57). However, using WVS data to empirically test this, Inglehart finds only partial support for this claim. In fact, his results reveal that residents of developing countries tend to show high

environmental concern. For this reason, Inglehart proposed the “objective problems and subjective values” thesis. Accordingly, he notes that environmental concern among residents of developing countries is due to their direct experiences of environmental problems such as air and water pollution. Therefore, drivers of environmental concern could differ among people in different places.

Contrary to Inglehart’s (1995, 1997) thesis, Dunlap et al. (1993) and Dunlap and Mertig (1995, 1997) contend that environmental awareness or concern has become a global phenomenon independent of the wealth of nations. Dunlap and Mertig (1995) correlate per capita income with aggregate measures of environmental concern for 24 countries and find that “overall national affluence is more often negatively rather than positively related to citizen concern for environmental quality” (p. 121). In another study, Dunlap and Mertig (1997) observe that the negative association between post-materialist values and environmentalism contravenes previously held notions that the wealthy and people in developed countries have more environmental concern. In addition, they state that personal characteristics, social networks, media, etc. are all important in shaping environmental perceptions as much as the objective environmental conditions Inglehart alludes to as triggering environmental concern in developing countries. Thus, the findings by these studies are inconsistent with Inglehart’s post-materialism argument. An interesting conclusion Dunlap and Mertig (1995) draw is that, on Maslow’s hierarchy of needs, “environmental quality seems to be moving from a “higher order” value to a “lower order” need” (p. 135).

Based in part on the works of some economists (e.g., Baumol and Oates, 1979; Fried 1994), Diekmann and Franzen (1999) propose the prosperity or affluence theory. They argue that, aside from being a public good, environmental quality is also a normal good. Thus, wealthier societies

and individuals would tend to demand higher environmental quality. Therefore, they have higher concern for the environment than their less wealthy counterparts. Examining data from the International Social Survey Programme (ISSP) for 1993 and 2000, and employing multilevel analysis, Franzen and Meyer (2010) find that while 85% of the total variation in within-country differences in environmental concern is explained by differences in wealth, wealth accounts for only 15% of the total variation in cross-country differences. Furthermore, Dunlap and York (2008) use data from three waves of the WVS to replicate results of Gallup's 24-nation "Health of the Planet" survey conducted in 1992 that revealed that environmental concern and national affluence are inconsistently correlated. Their results indicate that citizen concern for environmental protection does *not* depend on national affluence or on post-materialist values.

Among economists, the Environmental Kuznets Curve (EKC) hypothesis (Grossman and Krueger, 1991, 1995; Shafik and Bandyopadhyay, 1992) is probably the most widely accepted thesis used to explain the sources of environmental concern. According to this hypothesis, at early stages of economic growth, countries usually have less concern for environmental quality. However, as incomes increase, reach and exceed a certain turning-point level, people begin to demand higher environmental quality. This yields an inverted U-shape relationship between income and environmental pollution similar to the pattern Kuznets (1955) discovers between economic growth and income inequality. One implication of the EKC hypothesis is that poor countries are "too poor to green" (Bruneau and Echevarria, 2009). For example, economists like Baumol and Oates (1979) view environmental quality as a luxury good so that only people who lack economic struggles (e.g., food, housing, etc.) are concerned about it. Within the EKC framework, Israel and Levinson (2004) examine implications of several competing theoretical models of economic growth and the environment for people's marginal willingness-to-pay

(MWTP) for environmental improvements. They test for these implications empirically using data from the WVS and The World Bank and find little evidence of a systematic relationship between MWTP for environmental protection and economic growth. They, however, find strong relationships between MWTP and individual characteristics (e.g., age, income, education).

### 3. 2. 2. Perceptions and Socioeconomic Phenomena

Individual perceptions have been shown to influence a variety of socioeconomic phenomena, including environmental concern, happiness, health, child development and academic achievement. For instance, studies suggest a strong effect of perceptions on well-being (Guyen and Sørensen, 2012; Cárdenas et al. 2009). Such perceptions include perceived or self-rated health (Subramanian et al., 2005; Stack and Eshleman, 1998; Gerdtham and Johannesson, 2001), perceived income (Veenhoven, 1991; Guven and Sørensen, 2012), perceived insecurity (Wills-Herrera et al., 2011), perceived discrimination (Chen, 2013), and perceived corruption (Welsch, 2008; Helliwell, 2003; Tavits, 2008; Helliwell and Huang, 2008). Some scholars even argue that the effect of perceived or subjective measures outweighs the effect of objective measures on well-being. Posel and Casale (2011) demonstrate a stronger effect of perceived relative status than actual, objective relative status on well-being in South Africa. In addition, Veenhoven (1991) argues that the effect of “social comparison” on happiness is that people are happier if they think they are better than others in their society. Furthermore, Guven and Sørensen (2012) note that perceived relative income among Americans significantly influences well-being insofar as the individual thinks their household income is above the average American household income. They also note that perceptions about “social class” and dwelling status are significantly associated with happiness.

There are also studies that explain how perceived economic, socioeconomic or class differences affect a variety of socioeconomic outcomes. For example, the “perceived social class differences” thesis is one of the commonly used theories to explain residential segregation in the United States (Bobo and Zubrinsky, 1996; Iceland and Wilkes, 2006). Socioeconomic status also has implications for health of people at all levels of the socioeconomic status ladder (Adler and Ostrove, 1999; Sobal and Stunkard, 1989; Baum II and Ruhm, 2009). Extending the Sobal and Stunkard (1989) study, McLaren (2007) notes a less striking effect of socioeconomic status on obesity among women in developed and developing countries. Baum II and Ruhm (2009) observe that adult obesity is significantly influenced by socioeconomic status at young ages. They argue that this finding is consistent with a body of research that suggests that early life conditions have lasting effects on health.

Perceptions about one’s socioeconomic status also significantly influence their rating of their health status (Goodman et al., 2007). Other studies show that socioeconomic status affects child development (e.g., Bradley and Corwyn, 2002), academic achievement (White, 1982), and willingness to sacrifice financial resources to protect the environment (Blocker and Eckberg, 1997; Worsley and Skrzypiec, 1998; Barkan, 2004; Torgler and Garcia-Valiñas, 2007). Worsley and Skrzypiec (1998) find that “students with lower socioeconomic status tended to be more supportive of environmental exploitation” while Barkan (2004) asserts that individuals from higher socioeconomic backgrounds are more likely to support environmental movements. Torgler and Garcia-Valiñas (2007) use data from multiple waves of the WVS and European Values Survey to investigate the predictors of attitudes toward environmental protection in Spain. Among other variables, they test for the effect of economic situation on environmental attitudes. They find that, relative to the working and lowest classes, respondents in the lower middle and upper middle



classes are respectively 3.3% and 3.4% significantly more likely to agree to higher taxes to prevent environmental damage (see Table 2; p. 544). However, those in the upper class are not significantly different from the reference group. Thus PSES matters for socioeconomic outcomes including environmental concern. Therefore, we hypothesize that:

H1: The higher the individual perceives their socioeconomic status, the more likely they are to choose environmental protection over economic growth and jobs.

H2: The higher the individual perceives their socioeconomic status, the higher their willingness to give part of their income to prevent environmental pollution.

H3: The higher the individual perceives their socioeconomic status, the higher their willingness to pay higher taxes to prevent environmental pollution.

### 3. 2. 3. Environmental Concern in African Countries: Expected Outcomes

Environmental concern may differ among people in developed and developing countries depending on what problem one looks at. For instance, in developing countries, especially in rural areas and shanty urban towns, people lack access to treated water, have poor or unimproved sanitation, and more polluted air (United Nations, 2008). Therefore, residents of developing countries may be more concerned about environmental problems of their immediate environment (Inglehart, 1995, 1997). On the other hand, people in developed countries may not have such local environmental problems and would therefore tend to focus on global environmental and seemingly less pressing problems such as climate change, loss of plant or animal species and biodiversity, etc. Also, residents of developing countries have relatively more economic struggles (Jones and Dunlap, 1992). Therefore, we would expect that they would choose economic growth and jobs over environmental protection, *ceteris paribus*.

On willingness to sacrifice income to prevent environmental pollution, Gelissen (2007) provides two explanations why “Publics of wealthier nations may be less willing to pay for environmental protection than publics from poorer nations” (p. 396). The first argument is that residents of less wealthier nations may have been paying relatively less for environmental protection than their counterparts in wealthier nations. Also, asserting that environmental exploitation triggers national wealth, he notes that residents of wealthier nations may have already been enduring the costs of environmental exploitation and so would be less willing to pay for environmental protection. Thus, we expect that residents of African countries may express higher willingness to sacrifice financial resources for environmental protection.

The social class hypothesis posits that education and income influence environmental concern (Fransson and Gärling, 1999). The “broadening base” hypothesis postulates a diffusion of environmental concern across the populace, thereby increasing public support for environmental protection while the “economic contingency” hypothesis predicts that economically struggling individuals would tend to be less concerned about the environment (Jones and Dunlap, 1992). On the one hand, because average educational attainments and income levels are relatively lower in developing countries (e.g., Barro and Lee, 2001, 2013) and poverty is more widespread in these countries (Grindle, 2004), in general, we would expect that environmental concern would be lower among residents of developing countries. On the other hand, if environmental pollution threatens human survival in these countries, then we would expect that people would express more environmental concern (Inglehart, 1995). Therefore, the extent to which residents of developing countries care about the environment would depend on the magnitude of their economic struggles relative to the extent to which environmental pollution threatens their livelihoods.

### **3. 3. Data and Empirical Methods**

We use data from the Wave 5 of the World Values Survey (WVS) for our empirical analyses. The survey contains data on a variety of environmental issues that allows us to examine the relationship between PSES and environmental concern across countries. Since we are interested in environmental concern among residents of developing countries and how they compare with their counterparts in developed countries, we consider 7 African countries (Burkina Faso, Ethiopia, Ghana, Mali, Rwanda, South Africa and Zambia) and 11 developed countries (Australia, Canada, Finland, Germany, Italy, Japan, New Zealand, Norway, Sweden, Switzerland and United States). The characteristics of the respondents in our sample are as follows: For the African sample, the average age of the respondents was 36, forty-seven percent (47%) of them were female, 55% were married (or living together as married), and 20% were unemployed. The average age for the residents of developed countries was 46, about 52% of them were female, 65% were married while 5% were unemployed (see Table 1).

We note that there are many ways of measuring environmental concern. However, because environmental concern refers to “the degree to which people are aware of problems regarding the environment and support efforts to solve them and/or indicate the willingness to contribute personally to their solution” (Dunlap and Jones, 2002, p.485), we focus on only three measures of environmental concern: (1) environmental protection versus economic growth and jobs (2) willingness to give income for the environment and (3) willingness-to-pay higher taxes to prevent environmental pollution.

Our first dependent variable is one of the commonest ways of measuring environmental concern. It seeks respondents’ preferences about environmental protection and economic growth and jobs (see e.g., Klineberg et al., 1998; Israel and Levinson, 2004; Carroll et al., 2009; Bruni and

Schultz, 2010; Neumayer, 2004). The question is presented as follows: “Here are two statements people sometimes make when discussing the environment and economic growth. Which of them comes closer to your own point of view? 1. Protecting the environment should be given priority, even if it causes slower economic growth and some loss of jobs. 2. Economic growth and creating jobs should be the top priority, even if the environment suffers to some extent. 3. Other answer.” We created a binary variable for “Protecting the environment” equal to 1 if the respondent indicated option 1 and 0 if they indicated option 2.<sup>7</sup>

The survey also asked respondents to indicate the degree to which they agree with giving part of their income or agree to an increase in taxes for environmental protection. The question was presented as follows: “I am going to read out some statements about the environment. For each one, can you tell me whether you strongly agree, agree, disagree or strongly disagree? 1. I would give part of my income if I were certain that the money would be used to prevent environmental pollution. 2. I would agree to an increase in taxes if the extra money were used to prevent environmental pollution” (1=Strongly Agree; 2=Agree; 3=Disagree; 4=Strongly disagree). These constitute willingness to sacrifice income for environmental protection (see Inglehart 1995, p. 60). We create “Willingness to give income” and “Willingness to pay higher taxes” equal to 1 if the respondent indicated “Agree” or “Strongly agree” and zero otherwise to the first and second statement, respectively.<sup>8</sup>

The main explanatory variable – PSES – is derived from the survey item that asked respondents to indicate what socioeconomic class they think they belong to: “People sometimes

---

<sup>7</sup> Only 1.28% of the respondents in Africa and 5.09% of respondents in developed countries indicated “3. Other answer” to this question. Therefore, we excluded these respondents.

<sup>8</sup> The practice of combining “Agree” and “Strongly agree” responses is common in the literature (e.g., Israel and Levinson, 2004; Owen and Videras, 2006). In addition, consistent with Owen and Videras (2006), our results are quantitatively identical if we specify each willingness to sacrifice income equal to 1 if the respondent indicated “Strongly agree” instead.

describe themselves as belonging to the working class, the middle class, or the upper or lower class. Would you describe yourself as belonging to the: 1. Upper class, 2. Upper middle class, 3. Lower middle class, 4. Working class, 5. Lower class.” Because these responses are self-reports of what the individual thinks or believes their socioeconomic status is rather than an objective measure of their socioeconomic status, such as, based on income, occupation, and education (see e.g., Hauser, 1994; Cirino et al., 2002), we refer to it as *perceived socioeconomic status*.

We control for demographic characteristics (age, gender, education, marital status and unemployment), perceptions about local and global environmental quality, materialist and post-materialist values, self-rated health, social capital, and the size of respondent’s city of residence. Stern (1992) notes that among other contextual variables, socio-demographic characteristics like education, gender, income, and so forth, are important determinants of environmental concern. It is argued that older people are less concerned or willing to make income sacrifices for the environment because they may not be around in the future to enjoy the benefits of environmental protection (Torgler and Garcia-Valiñas, 2007). Females may express more concern because they are naturally “caregivers and nurturers” (Zelezny et al., 2000; Torgler and Garcia-Valiñas, 2007) although Van Liere and Dunlap (1980) note that earlier studies reveal an inconsistent effect of gender on environmental concern. Education is known to positively affect many socioeconomic phenomena. Previous studies demonstrate that respondents with higher education tend to have higher concern for the environment (García-Valiñas et al., 2012; Zhou, 2013; Torgler and Garcia-Valiñas, 2007). Marriage may also positively influence environmental concern especially if the couple has children because married people are concerned about the future well-being of their children (e.g. Dupont, 2004). Individuals who are employed may be more concerned about the environment than the unemployed for two reasons. First, the unemployed are more likely to favor

economic growth and jobs over environmental protection since they do not have a job. Second, because they are unemployed, they are more likely to have financial challenges that would make them less willing to contribute income to prevent environmental pollution. However, the empirical evidence only partly supports this. Veisten et al. (2004) find that the unemployed have lower environmental concern while other scholars obtain an insignificant effect of unemployment on environmental concern (Torgler and Garcia-Valiñas, 2007; Witzke and Urfei, 2001)

Scholars also explore the effect of perceived environmental quality (local and global) on environmental concern (Gelissen, 2007; Franzen and Meyer, 2010; Franzen and Vogl, 2013). Environmental concern may stem from people's experiences with objective environmental problems (Inglehart, 1995). However, even if their immediate environment were not polluted, people might still have higher environmental concern because they are aware of the health effects of poor environmental quality (e.g., Stern, 1994; Bord and O'Connor, 1997; Givens and Jorgenson, 2011). As a result, self-reported health status could influence environmental concern. Hence we control for perceived local and global environmental quality, as well as health status. We also test for materialist versus post-materialist values because Inglehart (1995, 1997; Gelissen, 2007) argue that people who have economic struggles may have lower concern for the environment. Social capital is an important predictor of many socioeconomic phenomena, including GDP per capita, happiness, etc. (Algan and Cahuc, 2013). Torgler and Garcia-Valiñas (2007) found that social capital significantly influences people's attitudes toward making income sacrifices for the environment in Spain. Therefore, we control for generalized trust and membership in environmental organization as measures of social capital.<sup>9</sup> Finally, scholars have examined the

---

<sup>9</sup> Torgler and Garcia-Valiñas (2007) test for endogeneity between membership in environmental organization and attitudes toward willingness to sacrifice income for environmental protection, and find no case of endogeneity. Hence, we do not test for endogeneity between membership in environmental organization and environmental concern here.

importance of urbanity or city size on environmental concern (Veisten et al., 2004; Torgler and Garcia-Valiñas, 2007; Israel and Levinson, 2004). The argument often made is that urbanites face more environmental pollution than their rural counterparts (Fransson and Gärling, 1999). Hence, we control for size of town.

To empirically test the effect of PSES on environmental concern, we estimate the following econometric model:

$$ENVCON_{ij} = \alpha + \beta * PSES_{ij} + \gamma * \sum_{i=1}^n CONTROLS_{ij} + \delta_j + \varepsilon_{ij} \quad (3.1)$$

where *ENVCON* denotes environmental concern, PSES represents the individual's perceived socioeconomic status, *CONTROLS* are the control variables discussed above,  $\alpha$  is the intercept,  $\beta$  and  $\gamma$  are vectors of coefficients to be estimated,  $\delta$  captures country fixed effects, and  $\varepsilon$  is the error term. We estimate equation (3.1) using logistic regression for each environmental concern measure. Based on the hypotheses above, we expect that  $\beta > 0$ . That is, we expect each PSES category to be positively correlated with each environmental concern measure.

### 3. 4. Findings

Table 6 presents the descriptive statistics for the variables used in the study (a complete description of these variables are summarized and presented in Table I in the appendix). When asked about environmental protection versus economic growth and jobs, 28% of respondents in Africa and 47% of respondents in developed countries indicated a preference for environmental protection over economic growth and jobs, suggesting that more people in developed countries favor environmental protection than their African counterparts. Regarding the willingness to sacrifice income for the environment measures, 41% of African respondents indicated agreement to give part of their income, compared to 32% for residents of developed countries.

Table 6. Variable descriptive statistics

Variable	Africa				Developed			
	N	Mean	SD	Range	N	Mean	SD.	Range
<b>Dependent Variables: Environmental Concern</b>								
Environment vs. economy	22111	0.28	0.45	0-1	35880	0.47	0.50	0-1
Give income	22111	0.41	0.49	0-1	35880	0.32	0.47	0-1
Increase taxes	22111	0.42	0.49	0-1	35880	0.49	0.50	0-1
<b>Explanatory Variable</b>								
Socioeconomic status								
Upper class	22111	0.02	0.15	0-1	35880	0.01	0.09	0-1
Upper middle class	22111	0.13	0.34	0-1	35880	0.22	0.42	0-1
Lower middle class	22111	0.18	0.34	0-1	35880	0.29	0.45	0-1
Working class	22111	0.17	0.37	0-1	35880	0.23	0.42	0-1
Lower class ( <i>Reference</i> )	22111	0.25	0.43	0-1	35880	0.04	0.20	0-1
<b>Control variables</b>								
<b>Demographics</b>								
Age	20348	36.01	14.73	15-98	33547	46.22	17.01	14-97
Gender (Female=1)	22111	0.47	0.50	0-1	35880	0.52	0.50	0-1
Highest Education attained	20329	3.82	2.27	1-8	30142	5.06	2.10	1-8
Married	22111	0.55	0.50	0-1	35880	0.65	0.48	0-1
Unemployed	22111	0.20	0.40	0-1	35880	0.05	0.22	0-1
<b>Perceived environmental quality</b>								
Local environmental quality	22111	0.34	0.47	0-1	35880	0.10	0.29	0-1
Global environmental quality	22111	0.34	0.47	0-1	35880	0.29	0.45	0-1
<b>Self-rated health status</b>								
Good health	22111	0.70	0.46	0-1	35880	0.70	0.46	0-1
Poor health	22111	0.06	0.24	0-1	35880	0.05	0.21	0-1
Fair health ( <i>Reference</i> )	22111	0.22	0.41	0-1	35880	0.22	0.41	0-1
<b>Materialist and Post-materialist values</b>								
Post-materialist values	22111	0.28	0.46	0-1	35880	0.48	0.50	0-1
Materialist values ( <i>Reference</i> )	22111	0.70	0.45	0-1	35880	0.46	0.50	0-1
<b>Social capital</b>								
Generalized trust	22111	0.16	0.37	0-1	35880	0.43	0.50	0-1
Member of environmental organization	30168	0.15	0.36	0-1	35880	0.09	0.29	0-1
<b>Size of town</b>								
Large	22111	0.21	0.41	0-1	35880	0.22	0.42	0-1
Middle	22111	0.16	0.37	0-1	35880	0.20	0.40	0-1
Small ( <i>Reference</i> )	22111	0.11	0.31	0-1	35880	0.18	0.39	0-1
<b>Occupation/Profession</b>								
Employer/Manager	22111	0.05	0.22	0-1	35880	0.10	0.30	0-1
Professional worker	22111	0.07	0.26	0-1	35880	0.11	0.31	0-1
Supervisor	22111	0.03	0.17	0-1	35880	0.07	0.26	0-1
Non-manual office worker	22111	0.06	0.23	0-1	35880	0.16	0.34	0-1
Foreman or supervisor	22111	0.01	0.18	0-1	35880	0.02	0.15	0-1
Manual worker	22111	0.22	0.42	0-1	35880	0.24	0.43	0-1
Farmer: Has own farm	22111	0.04	0.19	0-1	35880	0.03	0.16	0-1
Agricultural worker	22111	0.06	0.23	0-1	35880	0.01	0.08	0-1
Security worker	22111	0.01	0.10	0-1	35880	0.01	0.08	0-1
Other worker ( <i>Reference</i> )	22111	0.07	0.26	0-1	35880	0.03	0.16	0-1

Note: Categorical variables do not necessarily add up to 100% because of missing data for some countries.

In addition, 42% of respondents in Africa and 49% of residents of developed countries would agree to an increase in taxes. Thus, while more people in Africa are willing to give part of their income than residents of developed countries, the latter are more willing to pay higher taxes



to prevent environmental pollution than the former. Also, as we would expect, people exhibit post-materialist and materialist attitudes fairly equally in developed countries (48% versus 46%) while materialist values significantly dominate post-materialist attitudes among African respondents (70% versus 28%).

Table 7 presents the individual country figures for the three environmental concern measures. The table shows substantial variations in responses across countries for each environmental issue. Among the African countries, Rwanda recorded the highest preference for environmental protection (57.73%) while South Africa recorded the least (19.70%). Among the developed countries, 69.05% of respondents in Norway chose environmental protection while the figure is 20.80% for Japan. The general trend is that more people in developed countries favor the environment over economic growth than in Africa. However, consistent with findings of some previous studies that some developing countries show high environmental concern (e.g., Israel, 2004; Dunlap and York, 2008; Fairbrother, 2013), the figures here show that residents of some African countries display much higher willingness to sacrifice income for the environment than their counterparts in some developed countries. For instance, while more than half of respondents in 5 of the 7 African countries are willing to give part of their income for the environment, this is true for only 2 of the 11 developed countries (Canada with 67.89% and Italy with 56.42%).

In terms of willingness to pay higher taxes, again, residents of 5 African countries (Burkina Faso, Ethiopia, Ghana, Mali and Rwanda) scored above 50% compared to residents of 4 developed countries (Canada, Norway, Sweden and United States). Thus, it seems that African respondents are more willing to make income sacrifices to prevent environmental pollution than their

counterparts in developed countries.<sup>10</sup> One explanation is that African countries (and developing countries in general) have more objective environmental problems. Therefore, willingness to sacrifice income is a response to these problems rather than altruism (Inglehart, 1995).

Table 7. Distribution of responses to environmental concern questions by country

	Environment vs. economy (%)	Willingness to give income (%)	Willingness to pay higher taxes (%)
<b>Africa</b>			
Burkina Faso	44.59	72.62	68.64
Ethiopia	21.73	78.00	72.00
Ghana	44.33	81.55	72.95
Mali	36.05	78.55	74.06
Rwanda	57.73	61.85	60.45
South Africa	19.70	21.79	26.63
Zambia	33.93	44.73	41.00
<b>Developed</b>			
Australia	45.52	17.35	46.60
Canada	63.44	67.89	59.85
Finland	35.29	19.01	36.65
Germany	35.62	16.80	44.50
Italy	53.76	56.42	48.81
Japan	20.80	33.25	39.27
New Zealand	44.50	14.90	47.52
Norway	69.05	32.34	71.33
Sweden	63.63	49.29	75.09
Switzerland	34.93	20.48	31.82
United States	52.59	36.33	54.27

Source: Author's calculations based on World Values Survey Wave 5

Table 8 presents the logistic regression results for the effect of PSES on “Environmental protection vs. economic growth and jobs” while controlling for numerous individual level variables. We find that PSES is positively and significantly correlated with choosing environmental protection over economic growth and jobs for residents of both African and

<sup>10</sup> We note that “willingness” as used here is more attitudinal than behavioral. However, scholars have demonstrated that attitudes predict behavior (e.g., Fazio, 1986; Ajzen, 1991; Kraus, 1995; Fishbein and Ajzen, 2005). Nonetheless, we are cognizant of some studies that criticize the attitude-behavior relationship (e.g., Wicker, 1969)

developed countries. In Africa, relative to people who believe they are in the lower class, those in the working class and lower middle class are 11% and 12%, respectively, more likely to choose the environment over the economy. Those in the upper middle class are 19% more likely to choose the environment while the upper class respondents are 16% more likely to favor the environment over the economy. Similarly, for residents of the developed countries, those in the working class are about 9% more likely to favor environmental protection, the lower middle class about 12%, upper middle class 13%, and upper class about 12% than people who believe they are in the lower class. Thus, perceptions about one's socioeconomic status matter for their preferences for the environment over the economy.

For the control variables, we find that age is positively and significantly correlated with preferences for the environment over the economy for developed countries, but negative and insignificant for the African sample. Gender has no effect. Respondents with more education are less likely to favor environmental protection in Africa but more likely to choose the environment in developed countries. While married people are less likely to choose the environment among respondents of developed countries, being married has no effect for residents of Africa. The unemployed are less likely to choose the environment in Africa. However, unemployment has no effect for the residents of developed countries. A possible explanation is that developed countries have safety nets for the unemployed while African countries generally do not. In both African and developed countries, perceptions about poor local environmental quality (poor air quality, poor water quality, and poor sewage and sanitation) do not affect the likelihood that the individual would choose the environment. However, respondents who think that global environmental problems are serious are more likely to choose environmental protection over economic growth and jobs in both African and developed countries.

Table 8. Logistic regression results showing the effect of perceived socioeconomic status on “Environmental protection vs. economic growth and jobs”

Variable	Africa			Developed		
	Estimate	SE	Marginal Effect	Estimate	SE	Marginal Effect
<b>Socioeconomic status</b>						
Upper class	0.62***	0.11	0.16	0.50***	0.14	0.12
Upper middle class	0.73***	0.05	0.19	0.58***	0.05	0.13
Lower middle class	0.47***	0.04	0.12	0.50***	0.04	0.12
Working class	0.41***	0.04	0.11	0.37***	0.05	0.09
Lower class ( <i>Reference</i> )						
<b>Demographics</b>						
Age/100	-0.09	0.01	-0.02	0.44***	0.08	0.10
Gender (Female=1)	-0.04	0.03	-0.01	0.02	0.03	0.00
Highest Education attained	-0.07***	0.01	-0.02	0.13***	0.01	0.03
Married	-0.05	0.03	-0.01	-0.06**	0.03	-0.01
Unemployed	-0.15***	0.04	-0.04	-0.01	0.06	-0.03
<b>Perceived environmental quality</b>						
Local environmental quality	-0.04	0.05	-0.01	-0.14	0.05	-0.05
Global environmental quality	0.49***	0.04	0.13	1.68***	0.03	0.39
<b>Self-rated health status</b>						
Good health	-0.05	0.04	-0.01	-0.36***	0.03	-0.08
Poor health	-0.04	0.07	-0.01	-0.35	0.07	-0.08
Fair health ( <i>Reference</i> )						
<b>Materialist v. post-materialist Values</b>						
Post-materialist values	-0.10**	0.05	-0.03	0.17***	0.03	0.04
Materialist values ( <i>Reference</i> )						
<b>Social capital</b>						
Generalized trust	0.01	0.04	0.00	0.33***	0.03	0.07
Member of environmental organization	0.38***	0.04	0.10	-0.22***	0.04	-0.05
<b>Size of town</b>						
Large	0.22***	0.04	0.20	0.34***	0.03	0.09
Middle	0.60***	0.04	0.16	-0.02	0.03	-0.00
Small ( <i>Reference</i> )						
<b>Intercept</b>	-1.11***	0.08	-0.29	-2.51***	0.03	-0.58
<b>Fixed Effects</b>						
Country fixed effect	Yes			Yes		
Pseudo-R <sup>2</sup>	0.08			0.24		
% Correctly predicted	65.0			75.0		
Likelihood Ratio (df=20)	1177.95***			5661.84***		
Average density	0.26			0.23		
N	20178			30067		

Note: \*\*\* Significant at the 0.1% level; \*\* significant at the 1% level; \* significant at the 5% level. Marginal effects are calculated by multiplying the coefficient by the average density.

The individual’s state of health has no effect on their choosing of the environment for residents of African countries. However, people who believe that their health is good or very good in developed countries tend to not favor the environment. In Africa, relative to respondents who

hold materialist priorities, post-materialist publics are less likely to choose the environment while the reverse is true for the developed countries. It could be that, in Africa, such people are more focused on other post-materialist priorities such as freedom of speech and having a voice in government decisions. Regarding the social capital measures, we find that generalized trust has no effect on choosing the environment among residents of Africa but has a positive and significant effect for people in developed countries. Respondents who belong to an environmental organization are more likely to choose environmental protection in Africa but less likely to do so in developed countries. Finally, size of town in which the respondent resides seems to matter. Relative to small town dwellers, those who live in mid-size and large towns in Africa are more likely to choose the environment. For the developed countries, respondents who live in large towns are more likely to choose the environment although there are no significant differences between mid-size and small town dwellers.

Table 9 reports the regression results for the two “willingness to sacrifice income” measures. For each measure, our results show that PSES matters for environmental concern. Among the African respondents, we find that respondents who perceive themselves as belong to the working class, lower middle class, upper middle class and the upper class are 18%, 20%, 22% and 23%, respectively, more willing to give part of their income to prevent environmental pollution compared to those in the lower class. In developed countries, the working class, lower middle class, upper middle class, and upper class are 9%, 12%, 13%, and 12%, respectively, more likely to give part of their income to protect the environment. The effect of PSES is relatively stronger for willingness to pay higher taxes for environmental protection among residents of both African and developed countries than for willingness to give income. Each PSES class has a larger effect on willingness to pay higher taxes than on willingness to give income.

Table 9. Logistic regression results showing the effect of perceived socioeconomic status on willingness to sacrifice income for environmental protection

Variable	Willingness to give income						Willingness to pay higher taxes					
	Africa			Developed			Africa			Developed		
	Estimate	SE	Marginal Effect	Estimate	SE	Marginal Effect	Estimate	SE	Marginal Effect	Estimate	SE	Marginal Effect
<b>Socioeconomic status</b>												
Upper class	1.05***	0.12	0.23	0.50***	0.14	0.12	1.02***	0.11	0.28	0.54***	0.12	0.18
Upper middle class	0.98***	0.05	0.22	0.58***	0.05	0.13	0.95***	0.05	0.26	0.83***	0.04	0.28
Lower middle class	0.93***	0.05	0.20	0.50***	0.04	0.12	0.87***	0.04	0.23	0.75***	0.04	0.26
Working class	0.80***	0.05	0.18	0.36***	0.05	0.09	0.86***	0.04	0.20	0.66***	0.04	0.22
Lower class ( <i>Reference</i> )												
<b>Demographics</b>												
Age/100	-1.29***	0.12	-0.28	0.44***	0.08	0.10	-0.80***	0.12	-0.22	-0.02	0.07	0.01
Gender (Female = 1)	-0.12***	0.03	-0.03	0.02	0.03	0.0	-0.05	0.03	-0.01	0.04	0.02	0.01
Highest Education attained	-0.14***	0.01	-0.03	0.13***	0.01	0.03	-0.10***	0.01	-0.03	0.09***	0.01	0.03
Married	0.02	0.04	0.0	-0.06*	0.03	-0.01	0.04	0.03	0.01	-0.05	0.03	-0.02
Unemployed	0.04**	0.04	0.01	-0.01	0.06	-0.00	0.12**	0.04	0.04	0.09	0.06	0.03
<b>Perceived environmental quality</b>												
Local environmental quality	0.87***	0.04	0.19	-0.00	0.04	-0.00	0.57***	0.04	0.15	-0.03	0.04	0.01
Global environmental quality	1.15***	0.04	0.25	1.68***	0.03	0.39	0.74***	0.04	0.20	0.11***	0.03	0.04
<b>Self-rated health status</b>												
Good health	-0.01	0.04	-0.00	-0.36***	0.03	-0.08	0.01	0.04	0.00	-0.11***	0.03	-0.04
Poor health	-0.11	0.07	-0.02	-0.35***	0.07	-0.08	0.04	0.07	0.01	-0.14	0.08	-0.05
Fair health ( <i>Reference</i> )												
<b>Materialist v. post-materialist values</b>												
Post-materialist values	0.12***	0.04	0.03	0.17***	0.03	0.04	0.16***	0.03	0.04	0.27***	0.02	0.04
Materialist values ( <i>Reference</i> )												
<b>Social capital</b>												
Generalized trust	-0.25***	0.05	-0.06	0.33***	0.03	0.08	-0.06	0.04	-0.02	0.50***	0.03	0.17
Member of environmental organization	0.34***	0.04	0.07	-0.22***	0.04	0.05	0.56***	0.04	0.15	0.62***	0.04	0.21
<b>Size of town</b>												
Large	-0.28***	0.04	-0.06	0.34***	0.03	0.08	0.30***	0.04	0.08	0.26***	0.03	0.09
Middle	0.11***	0.05	0.02	-0.02	0.03	-0.00	0.65***	0.04	0.18	0.07*	0.03	0.02
Small ( <i>Reference</i> )												
<b>Intercept</b>	-0.44***	0.08	-0.10	-2.51***	0.08	-0.58	-0.86	0.07	-0.23	-1.27***	0.10	-0.43
<b>Fixed effects</b>												
Country fixed effect	Yes			Yes			Yes			Yes		
Pseudo-R <sup>2</sup>	0.31			0.34			0.23			0.10		
% Correctly predicted	78.8			75.0			74.3			65.1		
Likelihood Ratio(df=20)	5307.12***			5661.84***			3815.41***			2278.49***		
Average density	0.22			0.23			0.27			0.34		
N	20178			30067			20178			30067		

Note: \*\*\* Significant at the 0.1% level; \*\* significant at the 1% level; \* significant at the 5% level. Marginal effects are calculated by multiplying the coefficient by the average density.

Among the control variables, age, being female, higher education, generalized trust and large city size are negatively and significantly correlated with willingness to give income among

African respondents. In addition, age and higher education exert a negative effect on willingness to give income. Conversely, unemployment, perceived poor local and global environmental quality, post-materialist values and membership in an environmental organization each has a positive and significant effect on both environmental concern measures for residents of Africa. In the case of developed countries, the factors that are positively and significantly associated with both willingness to give income and willingness to pay higher taxes are higher education, perceived poor global environmental quality, post-materialist values, generalized trust, and large city size.

### **3. 5. Discussion**

The main objective of this chapter is to examine the relationship between perceptions about one's socioeconomic status and their concern for the environment. In doing so, we compare residents of Africa with their counterparts in developed countries. As measures of environmental concern, we consider whether the individual favors environmental protection over economic growth and jobs, and their willingness to make income sacrifices to prevent environmental pollution. The social class hypothesis suggests that people in the upper and middle classes tend to show higher environmental concern (Fransson and Gärling, 1999).

Based on perceptions of one's own socioeconomic status, the primary results suggest that in both African and developed countries, PSES matters for environmental concern after we control for a multitude of factors that the literature identifies as significant correlates of environmental concern.

The proportion of respondents showing high environmental concern in Africa dominates that in developed countries. Therefore, one pertinent question is whether environmental concern is based on survival needs or on personal values such as altruism? A plausible explanation is that

because environmental problems are generally more prevalent in countries in Africa – for instance, lack of access to safe drinking water, poor sanitation, polluted air – than in developed countries, environmental concern among residents of Africa may be a response to such objective and immediate environmental problems (Inglehart, 1995, 1997). In other words, environmental concern in Africa may be because people feel threatened by the health implications of environmental deterioration rather than being perfunctorily altruistic toward the environment (Hansla, et al. 2008).

While perceptions about the seriousness of poor local environmental quality do not seem to matter for choosing between environmental protection and economic growth and jobs, perceived poor local environmental quality is positively and significantly correlated with both willingness to give income and willingness to pay higher taxes for residents of Africa. Yet, it has no effect on either measure of environmental concern for residents of developed countries. Thus, it could be argued that the challenge-response model is at work in the case of willingness to sacrifice income for the environment in Africa (Knight and Messer, 2012; Dunlap and Mertig, 1995; Franzen, 2003; Zhou, 2013). That is, environmental concern in Africa may be due to people’s direct experiences with environmental problems. On the other hand, perceived global environmental quality positively influences all three measures of environmental concern for residents of both African and developed countries. It could be that awareness of the deleterious effects of climate change and other global environmental problems has led to an increasing “pro-environmental world model” whereby people recognize a society-environment interdependency (Zhou, 2013, p. 457).

Another interesting finding is that people who hold post-materialist values seem to be more willing to make income sacrifices to prevent environmental pollution than those who hold materialist values. Our results suggest that post-materialist publics are more likely to make income



sacrifices to prevent environmental pollution for both African and developed countries. Similarly, post-materialist values have a positive and significant effect on choosing the environment over economic growth and jobs among residents of developed countries, but a negative influence for African respondents. These results are largely consistent with the findings of previous studies on the empirical testing of the effect of post-materialism on environmental concern (e.g., Franzen and Meyer, 2010; Gelissen, 2007).

### **3. 6. Robustness Checks**

We check the robustness of our results by estimating linear probability models for the models and by controlling for the individual's occupation while omitting the country fixed effects. There is reason to believe that a person's occupation may affect their concern for the natural environment. If people rely on the natural environment as their main source of livelihood, they are more likely to favor environmental protection than if they do not (see e.g., Freudenburg, 1991; Gilles et al., 2013) although the evidence on this is mixed. For instance, in Africa, the majority of people are smallholder farmers while only a minute proportion of people in industrialized countries are farmers. Thus, the differences in environmental concern between residents of Africa and their counterparts in developed countries could be explained in part by occupation type. Therefore, we control for the respondent's occupation. The results are presented in Table 10.

As shown on Table 10, the regression results are consistent with earlier results presented in Tables 8 and 9. PSES is positively and significantly correlated with all three measures of environmental concern. That is, relative to the respondents who perceive themselves as belonging to the lower class, those who think they belong to the other classes are significantly more likely to choose the environment over the economy, as well as to sacrifice income for the environment.

Table 10. Linear probability models for the effect of perceived socioeconomic status on environmental concern

Variable	Protecting the environment		Willingness to give income		Willingness to pay higher taxes	
	Africa	Developed	Africa	Developed	Africa	Developed
<b>Socioeconomic status</b>						
Upper class	0.12***	0.12***	0.20***	0.09***	0.21***	0.12***
Upper middle class	0.14***	0.15***	0.18***	0.11***	0.19***	0.19***
Lower middle class	0.09***	0.16***	0.17***	0.09***	0.17***	0.18***
Working class	0.07***	0.14***	0.15***	0.06***	0.17***	0.15***
Lower class ( <i>Reference</i> )						
<b>Demographics</b>						
Age/100	-0.04	-0.13***	-0.23***	0.08***	-0.18***	-0.01
Gender (Female=1)	-0.00	-0.00	-0.02***	0.00	-0.01	0.01
Highest Education attained	-0.01***	0.02***	-0.03***	0.03***	-0.02***	0.02***
Married	-0.01	-0.02**	0.01	-0.01	0.01	-0.01
Unemployed	-0.02*	-0.03*	0.01	-0.01	0.03***	0.01
<b>Perceived environmental quality</b>						
Local environmental quality	-0.09	-0.03***	0.18***	-0.01	0.12***	-0.07***
Global environmental quality	0.10***	0.15***	0.25***	0.37***	0.17***	0.02**
<b>Self-rated health status</b>						
Good health	-0.01	-0.01	-0.00	-0.07***	0.00	-0.00***
Poor health	-0.01	-0.01	-0.02	-0.06***	0.01	-0.00*
Fair health ( <i>Reference</i> )						
<b>Materialist v. post-materialist values</b>						
Post-materialist values	-0.02*	0.07***	0.02**	0.03***	0.03***	0.06***
Materialist values ( <i>Reference</i> )						
<b>Social capital</b>						
Generalized trust	0.00	0.09***	-0.04***	0.06***	-0.01	0.12***
Member of environmental organization	0.06***	0.13***	0.06***	-0.04***	0.12***	0.13***
<b>Size of town</b>						
Large	0.04***	0.05***	-0.06***	0.07***	0.06***	0.05***
Middle	0.13***	0.00	0.19*	-0.00	0.14***	0.01*
Small ( <i>Reference</i> )						
<b>Occupation/Profession</b>						
Employer/Manager	-0.02	-0.04***	-0.07***	-0.04***	-0.05***	-0.06***
Professional worker	0.05***	0.04***	0.06***	-0.04***	0.05***	-0.00
Supervisor	0.03	0.02	-0.03	-0.05***	0.05*	0.02
Non-manual office worker	0.04**	-0.05***	0.02	-0.05**	0.04**	-0.05***
Foreman or supervisor	0.00	-0.01	-0.03	-0.06***	0.03	-0.01
Manual worker	0.03**	0.01	-0.01	-0.02*	0.02*	-0.01
Farmer: Has own farm	0.06***	-0.01	0.07***	0.03	0.06**	-0.03
Agricultural worker	0.07***	0.05	0.01	-0.06	0.02	-0.08*
Security worker	-0.00	-0.04	-0.02	-0.01	0.04	-0.05
Other worker ( <i>Reference</i> )						
<b>Intercept</b>	0.24***	0.23***	0.38***	0.01	0.30***	0.23***
Adjusted-R <sup>2</sup>	0.06	0.10	0.25	0.18	0.18	0.08
F-Statistic	47.98***	121.28***	244.45***	250***	163.20***	91.29***
N	20178	30067	20178	30067	20178	30067

Note: \*\*\* Significant at the 0.1% level; \*\* significant at the 1% level; \* significant at the 5% level.

With regards to the effect of occupation on environmental concern, we find that being a farmer significantly increases the likelihood that the individual will favor environmental protection in Africa. Farmers are also likely to give part of their income, and pay higher taxes to prevent

environmental pollution in Africa. Among residents of developed countries, being a farmer has no effect on choosing environmental protection, giving part of their income or willing to pay higher taxes for the environment. Interestingly, agricultural workers are less likely to agree to pay higher taxes in developed countries. While our results show consistent evidence of farmers showing concern for the environment among African respondents, the results are mixed for the developed countries. Therefore, we conclude that the effect of farming as an occupation on environmental concern is stronger for African respondents than for their counterparts in developed countries.

Although the fit statistics suggest that our models fit the data well, the adjusted-R<sup>2</sup>s imply that our models are able to explain only about 25% or less of the total variation in environmental concern. Our checks for multicollinearity reveal no cases of multicollinearity in the data as all variance inflation factors (VIFs) were between 1 and 2.5.<sup>11</sup>

### **3. 7. Summary and Conclusion**

This chapter examines whether people's perceptions about their socioeconomic status are correlated with their environmental concern. The results suggest that relative to people who believe they are in the lower class, those in the working class, lower middle class, upper middle class, and upper class tend to show significantly more environmental concern in both African and developed countries. In general, they are more likely to choose the environment over economic growth and jobs, give part of their income to protect the environment as well as being more willing to pay higher taxes to prevent environmental pollution. By focusing on the individual as the unit of analysis, we demonstrate the importance of individual level variables as correlates of environmental concern. This is consistent with other studies that emphasize individual level

---

<sup>11</sup> Standard errors and VIFs are not reported here for economy of space.

characteristics and attributes as predictors of environmental concern (e.g., Israel and Levinson, 2004; Torgler and Garcia-Valiñas, 2007; Franzen and Meyer, 2010; Gelissen, 2007; Zhou, 2013; Sulemana and James, 2014).

Our study is not without limitations. Although our measures of environmental concern are typical in the interdisciplinary literature on environmental concern, we note that some issues with such measures still remain unresolved. First, the environmental protection versus economic growth and jobs measure dichotomizes responses that imply a trade-off between the two. However, Kaplowitz et al. (2013) demonstrate that “most respondents do not view environmental protection and economic development policy goals to be mutually exclusive” (p. 413). Therefore, “middle ground respondents” who want both environmental protection and economic growth and jobs are not being well represented (see Kaplowitz et al., 2013 for discussion). Hence, future research could examine how PSES influences people’s attitudes toward “the environment versus the economy” while accounting for those who are in-between.

Second, our measures of willingness to sacrifice financial resources to protect the environment are *vague*. In other words, these questions are uninformative because respondents do not know what environmental issue is being referenced (see e.g., Bloom and Sevilla, 2004). For instance, would the income generated from “giving part of my income” or “agree to pay higher taxes” be used to prevent water pollution, air pollution, or to reduce the greenhouse effect? We believe that knowing the particular environmental issue before hand when responding to such environmental questions is important because people face different environmental problems in difference places. Specifically, because we are interested in how residents of developing countries compare with their counterparts in developed countries, and because environmental problems are

not uniform in these countries, specific contexts are necessary to better appreciate people's environmental concern.

Finally, studies show that post-materialism influences environmental concern in two ways: compositional effect and contextual effect. The former refers to the effect at the individual level while the latter pertains to the effect of country-level such as GDP and GDP growth on environmental concern (Franzen and Meyer, 2010; Gelissen, 2007). Because our study is a micro-level study, we are only able to show the compositional effect of post-materialist attitudes on environmental concern.

## References

- Adler, N. E., & Ostrove, J. M. (1999). Socioeconomic status and health: what we know and what we don't. *Annals of the New York academy of Sciences*, 896(1), 3-15.
- Algan, Y., & Cahuc, P. (2013). *Trust, Growth and Well-being: New Evidence and Policy Implications*. North Holland, Elsevier.
- Anderson, S. (2003). Animal genetic resources and sustainable livelihoods. *Ecological Economics*, 45(3), 331-339.
- Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179-211.
- Barkan, S. E. (2004). Explaining Public Support for the Environmental Movement: A Civic Voluntarism Model. *Social Science Quarterly*, 85(4), 913-937.
- Barro, R. J., & Lee, J. W. (2001). International data on educational attainment: updates and implications. *Oxford Economic Papers*, 53(3), 541-563.
- Barro, R. J., & Lee, J. W. (2013). A new data set of educational attainment in the world, 1950-2010. *Journal of Development Economics*, 104, 184-198.
- Baumol, W. J. and Oates, W. E. (1979). *Economics, Environmental Policy, and the Quality of Life*. Englewood Cliffs, NJ: Prentice Hall.
- Blocker, T. J., & Eckberg, D. L. (1997). Gender and environmentalism: Results from the 1993 general social survey. *Social Science Quarterly*, 78(4), 841-858.
- Bobo, L., & Zubrinsky, C. L. (1996). Attitudes on residential integration: Perceived status differences, mere in-group preference, or racial prejudice? *Social Forces*, 74(3), 883-909.
- Bord, R. J., & O'Connor, R. E. (1997). The gender gap in environmental attitudes: the case of perceived vulnerability to risk: research on the environment. *Social Science Quarterly*, 78(4), 830-840.
- Bradley, R. H., & Corwyn, R. F. (2002). Socioeconomic status and child development. *Annual Review of Psychology*, 53(1), 371-399.
- Bruneau, J. & Echevarria, C. (2009). The Poor Are Green Too. *Journal of International Cooperation Studies*, 16(3), 1-22.
- Bruni, C. M., & Schultz, P. (2010). Implicit beliefs about self and nature: Evidence from an IAT game. *Journal of Environmental Psychology*, 30(1), 95-102.

- Baum II, C. L., & Ruhm, C. J. (2009). Age, socioeconomic status and obesity growth. *Journal of Health Economics*, 28(3), 635-648.
- Bloom, D., & Sevilla, J. (2004). Willingness to Pay for Environmental Quality: Testable Empirical Implications of the Growth and Environment Literature: Comment. *Contributions in Economic Analysis & Policy*, 3(1), Article 7.
- Cárdenas, M., Mejía, C., & Di Maro, V. (2009). *Education and Life Satisfaction: Perception or Reality? Paradox and Perception: Measuring Quality of Life in Latin America*. Washington: The Brookings Institution and the Inter-American Development Bank.
- Carroll, P., Casswell, S., Huakau, J., Perry, P., & Chapman, P. H. (2009). Environmental attitudes, beliefs about social justice and intention to vote Green: lessons for the New Zealand Green Party? *Environmental Politics*, 18(2), 257-278.
- Carson, R. T., Flores, N. E., & Meade, N. F. (2001). Contingent Valuation: Controversies and Evidence. *Environment and Resource Economics*, 19(2), 173-210.
- Chen, J. (2013). Perceived Discrimination and Subjective Well-being among Rural-to-Urban Migrants in China. *Journal of Sociology & Social Welfare*, 40(1), 131-156.
- Cirino, P. T., Chin, C. E., Sevcik, R. A., Wolf, M., Lovett, M., & Morris, R. D. (2002). Measuring socioeconomic status reliability and preliminary validity for different approaches. *Assessment*, 9(2), 145-155.
- Davey, I. (2009). Environmentalism of the Poor and Sustainable Development: An Appraisal. *Journal of Administration and Governance*, 4 (1), 1-10.
- Dean, J. M. (2002). Does trade liberalization harm the environment? A new test. *Canadian Journal of Economics*, 35(4), 819-842.
- Diekmann, A. & Franzen, A. (1999). The Wealth of Nations and Environmental Concern. *Environment and Behavior*, 31(4), 540-549.
- Dinda, S. (2004). Environmental Kuznets Curve Hypothesis: A Survey. *Ecological Economics*, 49(4), 431-455.
- Donohoe, M. (2003). Causes and health consequences of environmental degradation and social injustice. *Social Science & Medicine*, 56(3), 573-587.
- Dunlap, R. E., Gallup Jr, G. H., & Gallup, A. M. (1993). Of global concern: Results of the health of the planet survey. *Environment: Science and Policy for Sustainable Development*, 35(9), 7-39.

- Dunlap, R. E. & Jones, R. E. (2002). Environmental concern: Conceptual and Measurement Issues. In Dunlap, R. E. and Michelson, W. (Eds.), *Handbook of Environmental Sociology*. Westport: Greenwood Press, 482–524.
- Dunlap, R. E., & Mertig, A. G. (1995). Global concern for the environment: is affluence a prerequisite? *Journal of Social Issues*, 51(4), 121-137.
- Dunlap, R. E., & Mertig, A. G. (1997). Global environmental concern: An anomaly for postmaterialism. *Social Science Quarterly*, 78(1), 24-29.
- Dunlap, R. E., & Van Liere, K. D. (1978). The “new environmental paradigm”: A proposed measuring instrument and preliminary results. *Journal of Environmental Education*, 9(1), 10–19.
- Dunlap, R. E., VanLiere, K. D., Mertig, A. G., & Jones, R. E. (2000). Measuring endorsement of the New Ecological Paradigm: A revised NEP scale. *Journal of Social Issues*, 56(3), 425-442.
- Dunlap, R. E. & York, R. (2008). The globalization of environmental concern and the limits of the postmaterialist values explanation: evidence from four multinational surveys. *Sociological Quarterly*, 49(3), 529–563.
- Dupont, D.P. (2004). Do children matter? An examination of gender differences in environmental valuation. *Ecological Economics*, 49(3), 273–286.
- Ebi, K. L., Mearns, L. O., & Nyenzi, B. 2003. *Weather and climate: changing human exposures. Climate Change and Health: Risks and Responses* (McMichael AJ, Campbell-Lendrum DH, Corvalan CF, Ebi KL, Githeko A, et al., eds). Geneva: World Health Organization.
- Fairbrother, M. (2013). Rich people, poor people, and environmental concern: Evidence across nations and time. *European Sociological Review*, 29(5), 910-922.
- Fazio, R. H. (1986). How do attitudes guide behavior? *Handbook of Motivation and Cognition: Foundations of Social Behavior*, 1, 204-243.
- Field, B. C. (1994). *Environmental Economics: An Introduction*. New York: McGraw-Hill.
- Fishbein, M., & Ajzen, I. (2005). The influence of attitudes on behavior. *The Handbook of Attitudes*, 173-222.
- Flavin, P., Pacek, A. C., & Radcliff, B. (2010). Labor unions and life satisfaction: Evidence from new data. *Social Indicators Research*, 98(3), 435-449.
- Fransson, N., & Gärling, T. (1999). Environmental concern: Conceptual definitions, measurement methods, and research findings. *Journal of Environmental Psychology*, 19(4), 369-382.



- Franzen, A. (2003). Environmental Attitudes in International Comparison: An Analysis of the ISSP surveys 1993 and 2000. *Social Science Quarterly*, 84(2), 297–308.
- Franzen, A. & Meyer, R. (2010). Environmental Attitudes in Cross-national Perspective: A Multilevel Analysis of the ISSP 1993 and 2000. *European Sociological Review*, 26(2), 219–234.
- Franzen, A., & Vogl, D. (2013). Two decades of measuring environmental attitudes: A comparative analysis of 33 countries. *Global Environmental Change*, 23(5), 1001-1008.
- Freudenburg, W. R. (1991). Rural-Urban Differences in Environmental Concern: A Closer Look. *Sociological Inquiry*, 61(2), 167-198.
- García-Valiñas, M. A., Macintyre, A., & Torgler, B. (2012). Volunteering, pro-environmental attitudes and norms. *The Journal of Socio-Economics*, 41(4), 455-467.
- Gelissen, J. (2007). Explaining Popular Support for Environmental Protection: A Multilevel Analysis of 50 Nations. *Environment and Behavior*, 39(3), 392-415.
- Gerdtham, U. G., & Johannesson, M. (2001). The relationship between happiness, health, and socio-economic factors: results based on Swedish microdata. *The Journal of Socio-Economics*, 30(6), 553-557.
- Gilles, J. L., Thomas, J. L., Valdivia, C., & Yucra, E. S. (2013). Laggards or leaders: Conservers of traditional agricultural knowledge in Bolivia. *Rural Sociology*, 78(1), 51-74.
- Givens, J. E., & Jorgenson, A. K. (2011). The effects of affluence, economic development, and environmental degradation on environmental concern: a multilevel analysis. *Organization & Environment*, 24(1), 74-91.
- Goodman, E., Huang, B., Schafer-Kalkhoff, T., & Adler, N. E. (2007). Perceived socioeconomic status: a new type of identity that influences adolescents' self-rated health. *Journal of Adolescent Health*, 41(5), 479-487.
- Gowdy, J. (2005). Toward a new welfare economics for sustainability. *Ecological Economics*, 3(2), 211-222.
- Grindle, M. S. (2004). Good enough governance: poverty reduction and reform in developing countries. *Governance: An International Journal of Policy, Administration, and Institutions*, 17(4), 525-548.
- Grossman, G. M., & Krueger, A. B. (1991). Environmental impacts of a North American Free Trade Agreement. National Bureau of Economic Research Working Paper 3914, NBER, Cambridge MA.

- Grossman, G. M. & Krueger, A. B. (1995): Economic Growth and the Environment. *The Quarterly Journal of Economics*, 110(2), 353-377.
- Guven, C., & Sørensen, B. E. (2012). Subjective well-being: Keeping up with the perception of the Joneses. *Social Indicators Research*, 109(3), 439-469.
- Hansla, A., Gamble, A., Juliusson, A., & Gärling, T. (2008). The relationships between awareness of consequences, environmental concern, and value orientations. *Journal of Environmental Psychology*, 28(1), 1-9.
- Hauser, R. M. (1994). Measuring socioeconomic status in studies of child development. *Child Development*, 65(6), 1541-1545.
- Helliwell, J. F. (2003). How's Life? Combining Individual and National Variables to Explain Subjective Well-Being. *Economic Modelling*, 20(2), 331-360.
- Helliwell, J. F. & Huang, H. F. (2008). How's your government? International evidence linking good government and well-being. *British Journal of Political Science*, 38(3), 595-619.
- Hillie, T., & Hlophe, M. (2007). Nanotechnology and the challenge of clean water. *Nature Nanotechnology*, 2(11), 663-664.
- Huang, J. C., Haab, T. C., & Whitehead, J. C. (1997). Willingness to pay for quality improvements: should revealed and stated preference data be combined? *Journal of Environmental Economics and Management*, 34(3), 240-255.
- Iceland, J., & Wilkes, R. (2006). Does socioeconomic status matter? Race, class, and residential segregation. *Social Problems*, 53(2), 248-273.
- Inglehart, R. (1990). *Culture shift in advanced industrial society*. Princeton University Press.
- Inglehart, R. (1995). Public Support for Environmental Protection: Objective Problems and Subjective Values in 43 societies. *PS: Political Science & Politics*, 28(01), 57-72.
- Inglehart, R. (1997). *Modernization and Postmodernization: Cultural, Economic, and Political Change in 43 Societies*. Princeton, NJ: Princeton University Press.
- Israel, D. K. (2004). International support for environmental protection. *Environment and Development Economics*, 9(06), 757-780.
- Israel, D. & Levinson, A. (2004). Willingness to pay for environmental quality: testable empirical implications of the growth and environment literature. *Contributions to Economic Analysis & Policy*, 3(1), Article 2.
- James, H. S. & Hendrickson, M. K. (2008). Perceived economic pressures and farmer ethics. *Agricultural Economics*, 38(3), 349-361.

- Jones, R. E., & Dunlap, R. E. (1992). The Social Bases of Environmental Concern: Have They Changed Over Time? *Rural Sociology*, 57(1), 28-47.
- Kaplowitz, M. D., Lupi, F., Yeboah, F. K., & Thorp, L. G. (2013). Exploring the middle ground between environmental protection and economic growth. *Public Understanding of Science*, 22(4), 413-426.
- Klineberg, S. L., McKeever, M., & Rothenbach, B. (1998). Demographic predictors of environmental concern: It does make a difference how it's measured: Research on the environment. *Social Science Quarterly*, 79(4), 734-753.
- Knight, K. W., & Messer, B. L. (2012). Environmental Concern in Cross-National Perspective: The Effects of Affluence, Environmental Degradation, and World Society. *Social Science Quarterly*, 93(2), 521-537.
- Kraus, S. J. (1995). Attitudes and the prediction of behavior: A meta-analysis of the empirical literature. *Personality and social psychology bulletin*, 21(1), 58-75.
- Kuznets, S. (1955). Economic Growth and Income Inequality. *The American Economic Review*, 45(1), 1-28.
- LaLonde, R. & Jackson, E. L. (2002). The New Environmental Paradigm scale: Has it outlived its usefulness? *The Journal of Environmental Education*, 33(4), 28-36.
- Martínez-Alier, J. (1995). The environment as a luxury good or “too poor to be green”? *Ecological Economics*, 13(1), 1-10.
- Maslow, A. H. (1954). *Motivation and Personality*. New York: Harper.
- McLaren, L. (2007). Socioeconomic status and obesity. *Epidemiologic Reviews*, 29(1), 29-48.
- Mertz, O., Halsnæs, K., Olesen, J. E., & Rasmussen, K. (2009). Adaptation to climate change in developing countries. *Environmental Management*, 43(5), 743-752.
- Neumayer, E. (2004). The environment, left-wing political orientation and ecological economics. *Ecological Economics*, 51(3), 167-175.
- O'Connor, R. E., Bord, R. J., Yarnal, B., & Wiefek, N. (2002). Who wants to reduce greenhouse gas emissions? *Social Science Quarterly*, 83(1), 1-17.
- Ogunbode, C. A. (2013). The NEP scale: measuring ecological attitudes/worldviews in an African context. *Environment, Development and Sustainability*, 15(6), 1477-1494.
- Owen, A. L., & Videras, J. (2006). Civic cooperation, pro-environment attitudes, and behavioral intentions. *Ecological Economics*, 58(4), 814-829.

- Pampel, F. C. (2013). The Varied Influence of SES on Environmental Concern. *Social Science Quarterly*, 95(1), 57-75.
- Pienaar, E. F., Lew, D. K., & Wallmo, K. (2013). Are environmental attitudes influenced by survey context? An investigation of the context dependency of the New Ecological Paradigm (NEP) Scale. *Social Science Research*, 42(6), 1542-1554.
- Shafik, N. & Bandyopadhyay, S. (1992). Economic Growth and Environmental Quality: Time Series and Cross-Country Evidence. Policy Research Working Paper No. WPS 904. Washington, D. C. The World Bank.
- Sharp, J., & Adua, L. (2009). The Social Basis of Agro-Environmental Concern: Physical versus Social Proximity. *Rural Sociology*, 74(1), 56-85.
- Sobal, J., & Stunkard, A. J. (1989). Socioeconomic status and obesity: a review of the literature. *Psychological Bulletin*, 105(2), 260-275.
- Subramanian, S. V., Kim, D., & Kawachi, I. (2005). Covariation in the socioeconomic determinants of self-rated health and happiness: a multivariate multilevel analysis of individuals and communities in the USA. *Journal of Epidemiology and Community Health*, 59(8), 664-669.
- Sulemana, I., & James Jr, H. S. (2014). Farmer identity, ethical attitudes and environmental practices. *Ecological Economics*, 98, 49-61.
- Stack, S. & Eshleman, J. R. (1998). Marital status and happiness: A 17-nation study. *Journal of Marriage and the Family*, 60(2), 527-536.
- Stern, P. C. (1992). Psychological dimensions of global environmental change. *Annual Review of Psychology*, 43(1), 269-302.
- Stern, P. C., & Dietz, T. (1994). The value basis of environmental concern. *Journal of Social Issues*, 50(3), 65-84.
- Stern, D. I. (2004): The Rise and Fall of the Environmental Kuznets Curve. *World Development*, 32(8), 1419-1439.
- Stern, P. C., Dietz, T., Abel, T., Guagnano, G. A., & Kalof, L. (1999). A value-belief-norm theory of support for social movements: The case of environmentalism. *Human Ecology Review*, 6(2), 81-98.
- Tavits, M. (2008). Representation, Corruption, and Subjective Well-Being. *Comparative Political Studies*, 41(12), 1607-1630. DOI: 10.1177/0010414007308537.

- Torgler, B. & García-Valiñas, M.A. (2007). The determinants of individuals' attitudes towards preventing environmental damage. *Ecological Economics*, 63(23), 536–552.
- United Nations Secretary General's Advisory Board on Water and Sanitation. (2008). Monitoring and reporting progress of access to water & sanitation. An assessment by UNSGAB. New York, United Nations.
- Van Liere, K. D. & Dunlap, R. E. (1980). The social bases of environmental concern: A review of hypotheses, explanations and empirical evidence. *Public Opinion Quarterly*, 44(2), 181-197.
- Veenhoven, R. (1991). Is happiness relative? *Social Indicators Research*, 24(1), 1-34.
- Veisten, K., Fredrik Hoen, H., Navrud, S., & Strand, J. (2004). Scope insensitivity in contingent valuation of complex environmental amenities. *Journal of Environmental Management*, 73(4), 317-331.
- Welsch, H. (2008). The welfare costs of corruption. *Applied Economics*, 40(14), 1839–1849.
- White, K. R. (1982). The relation between socioeconomic status and academic achievement. *Psychological Bulletin*, 91(3), 461-481.
- White, M. J., & Hunter, L. M. (2009). Public Perception of Environmental Issues in a Developing Setting: Environmental Concern in Coastal Ghana. *Social Science Quarterly*, 90(4), 960-982.
- Whittaker, M., Segura, G. M., & Bowler, S. (2005). Racial/ethnic group attitudes toward environmental protection in California: Is “environmentalism” still a white phenomenon? *Political Research Quarterly*, 58(3), 435–447.
- Wicker, A. W. (1969). Attitudes versus actions: The relationship of verbal and overt behavioral responses to attitude objects. *Journal of Social Issues*, 25(4), 41–78.
- Wills-Herrera, E., Orozco, L. E., Forero-Pineda, C., Pardo, O., & Andonova, V. (2011). The relationship between perceptions of insecurity, social capital and subjective well-being: Empirical evidences from areas of rural conflict in Colombia. *The Journal of Socio-Economics*, 40(1), 88-96.
- Witzke, H. P., & Urfei, G. (2001). Willingness to pay for environmental protection in Germany: coping with the regional dimension. *Regional Studies*, 35(3), 207-214.
- World Values Survey (2009): 1981-2008 Official Aggregate v.20090901. World Values Survey Association ([www.worldvaluessurvey.org](http://www.worldvaluessurvey.org)). Aggregate File Producer: ASEP/JDS, Madrid.
- Worsley, A., & Skrzypiec, G. (1998). Environmental attitudes of senior secondary school students in South Australia. *Global Environmental Change*, 8(3), 209-225.

Zelezny, L. C., Chua, P. P., & Aldrich, C. (2000). New ways of thinking about environmentalism: Elaborating on gender differences in environmentalism. *Journal of Social Issues*, 56(3), 443-457.

Zhou, M. (2013). A Multidimensional Analysis of Public Environmental Concern in Canada. *Canadian Review of Sociology/Revue Canadienne de Sociologie*, 50(4), 453-481.

**Appendix A: Table I: Variable descriptions and summary statistics**

<b>Variable</b>	<b>Description</b>	<b>Mean</b>	<b>S.D</b>
Environment vs. economy	Unity if respondent indicated that “Protecting the environment should be given priority, even if it causes slower economic growth and some loss of jobs”; 0 otherwise	0.40	0.49
Willingness to give income	Unity if respondent indicated “Agree” or “Strongly agree” to the statement “I would give part of my income if I were certain that the money would be used to prevent environmental pollution.” 0 otherwise	0.36	0.48
Willingness to pay higher taxes	Unity if respondent indicated “Agree” or “Strongly agree” to the statement “I would agree to an increase in taxes if the extra money were used to prevent environmental pollution.” 0 otherwise	0.46	0.50
Upper class	Unity if respondent described themselves as belonging to the upper class; 0 otherwise	0.01	0.12
Upper middle class	Unity if respondent described themselves as belonging to the upper middle class; 0 otherwise	0.18	0.39
Lower middle class	Unity if respondent described themselves as belonging to the lower middle class; 0 otherwise	0.24	0.43
Working class	Unity if respondent described themselves as belonging to the working class; 0 otherwise	0.20	0.40
Lower class ( <i>Reference</i> )	Unity if respondent described themselves as belonging to the lower class; 0 otherwise	0.11	0.35
Age	Age of respondent	42.43	16.71
Gender (Female=1)	Unity if female; 0 otherwise	0.50	0.50
Highest education attained	Respondent’s highest educational attainment (1=No formal education; 9=University level, with degree)	4.56	2.25
Married	Unity if married or living together as married; 0 otherwise	0.61	0.49
Unemployed	Unity if unemployed; 0 otherwise	0.11	0.31
Local environmental quality	Unity if respondent indicated “Somewhat serious” or “Very serious” to each of poor water quality, poor air quality, and poor sewage and sanitation in their own community; 0 otherwise	0.19	0.39
Global environmental quality	Unity if respondent indicated “Somewhat serious” or “Very serious” to each of Global warming or the greenhouse effect, loss of plant or animal species or biodiversity, and pollution of rivers, lakes, and oceans in the world as a whole; 0 otherwise	0.27	0.44
Good health	Unity if respondent described their overall state of health as “Good” or “Very Good”; 0 otherwise	0.70	0.46
Poor health	Unity if respondent described their overall state of health as “Poor”; 0 otherwise	0.05	0.22
Fair health	Unity if respondent described their overall state of health as “Fair”; 0 otherwise	0.22	0.41
Post-materialist values	Unity if respondent chose either “Giving people more say in important government decisions” or “Protecting freedom of speech” as first or second choice as one of the things they believe is most important to them; 0 otherwise	0.40	0.49
Materialist values( <i>Reference</i> )	Unity if respondent chose either “Maintaining order in the nation” or “Fighting rising prices” as first or second choice as one of the things they believe is most important to them; 0 otherwise	0.55	0.50
Generalized trust	Unity if respondent indicated that “Most people can be trusted” based on the question “Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?”; 0 otherwise	0.33	0.47
Member of environmental organization	Unity if respondent was an active member of an environmental organization; 0 otherwise	0.11	0.32
Large	Unity if respondent lived in a town with 100,000 people and above; 0 otherwise	0.22	0.41
Middle	Unity if respondent lived in a town with between 10,000 and 100,000 people; 0 otherwise	0.18	0.39
Small ( <i>Reference</i> )	Unity if respondent lived in a town with 10,000 and below	0.15	0.36
Employer/Manager	Unity if respondent is employer or manager at an establishment; 0 otherwise	0.08	0.27
Professional worker	Unity if respondent is a professional worker (e.g., lawyer, accountant, teacher, etc.); 0 otherwise	0.10	0.29
Supervisor	Unity if respondent is an office worker who supervises others; 0 otherwise	0.06	0.23
Non-manual office worker	Unity if respondent is a non-manual office worker in a non-supervisory role; 0 otherwise	0.12	0.33
Foreman or supervisor	Unity if respondent is Foreman or supervisor; 0 otherwise	0.02	0.13
Manual worker	Unity if respondent is a skilled, semi-skilled, or unskilled manual worker; 0 otherwise	0.23	0.42
Farmer: Has own farm	Unity if respondent is a farmer who owns a farm; 0 otherwise	0.03	0.17
Agricultural worker	Unity if respondent is an agricultural worker; 0 otherwise	0.02	0.16
Security worker	Unity if respondent is a member of armed forces or some security agency; 0 otherwise	0.01	0.09
Other worker ( <i>Reference</i> )	Unity if respondent never had a job or has other job type; 0 otherwise	0.04	0.20

Note: The means and standard deviations here are for the combined sample of 22 countries. For Africa and Developed countries means and standard deviations, refer to Table 6.

## CHAPTER 4

### ENVIRONMENTAL KUZNETS CURVES FOR AIR POLLUTION IN DEVELOPED AND DEVELOPING COUNTRIES: EXPLORING TURNING POINT INCOMES AND THE ROLE OF DEMOCRACY

#### 4. 1. Introduction

Global environmental change has become a major public policy concern for world leaders, policymakers, and scholars. The Intergovernmental Panel on Climate Change (IPCC) estimates that between 2000 and 2030, global greenhouse gas emissions could increase by between 25 and 90% (IPCC, 2007). Climate change is expected to adversely affect ecosystems, food, water and health of people, leading to increased malnutrition, diseases and deaths (IPCC, 2007, p. 48). Studies suggest that developing countries are more vulnerable to climate change than developed countries (e.g., Ebi et al., 2003; Mertz et al., 2009; Fankhauser and McDermott, 2014). The Economist (2009) notes that developing countries are already climate change's greatest victims. In Africa, it is anticipated that the effects of climate change are likely to be very severe (e.g., Collier et al., 2008; Nelson et al., 2010). Although the region has relatively lower carbon dioxide (CO<sub>2</sub>) emissions, studies show that it will experience relatively more significant climatic variations (Collier et al., 2008). For example, Collier et al. (2008) observe that Africa contributes only 3.6% to the world's CO<sub>2</sub> emissions. Climate change has serious repercussions for human well-being, e.g., sea-level rise, storms, and floods (e.g., Stern, 2008), agricultural development and sustainability (Barrios et al., 2008; Nelson et al., 2010), exposure to skin diseases and cancer (e.g., Van der Leun and de Gruijl, 2002), *inter alia*.

Rural production and consumption activities are a major source of environmental pollution in developing countries (Bulte and van Soest, 2001). This is especially true because the majority



of households in developing countries derive energy for cooking by burning fuel wood, charcoal, etc., producing indoor air pollution that could result in lung cancer, pulmonary tuberculosis and asthma (Bruce et al., 2000; Smith et al., 2000; Ezzati and Kammen, 2001). The World Health Organization (WHO, 2014) estimates that about 4.3 million people die every year from indoor air pollution; the majority of these deaths occur in developing countries. In addition, as a major source of air pollution in Africa (e.g., Orubu and Omotor, 2011), outdoor particulate air pollution is detrimental to human health due to its ability to penetrate the human respiratory system and cause chronic or even fatal respiratory and other health problems (Dockery et al., 1989; Ravindra et al., 2001; KuÈnzli et al., 2000). According to Pope et al. (1995), a  $10\mu\text{g}/\text{m}^3$  increase in particulate matter ( $\text{PM}_{10}$ ) leads to a decline in lung function (although this decline is usually less than 1%). Other scholars demonstrate that particulate air pollution is associated with mortality (e.g., Hoek et al., 1997; KuÈnzli et al., 2000). For instance, KuÈnzli et al. (2000) show that a  $50\mu\text{g}/\text{m}^3$  increase in  $\text{PM}_{10}$  (i.e., particulate matter) is correlated with a 2% increase in mortality rate in Western European cities. In Africa, outdoor air pollution in the form of suspended particulate matter may emanate from industrial and non-industrial activities as well as fuel consumption that produce “chemically stable substances such as dust, soot, ash, smoke, and liquid droplets” (Orubu and Omotor, 2011, p. 4181).

The Environmental Kuznets Curve (EKC) hypothesis posits an inverted U-shaped relationship between economic growth and environmental pollution. Within this framework, studies that have estimated turning point incomes for various pollutants within and across countries have predominantly done so for industrialized countries. Very few studies have examined African countries. In this paper, we examine the relationship between economic growth and air pollution for African countries and compare to the results for high-income OECD countries. Specifically,

we test whether the EKC holds for CO<sub>2</sub> and PM<sub>10</sub> by exploiting panel data for 47 African countries and 31 high-income Organization for Economic Co-operation and Development (OECD) countries for the period 1990-2010. Additionally, we compare turning point incomes between African and OECD countries for these pollutants. Finally, because countries with relatively well-functioning institutions are generally more likely to design and implement environmental policies that would improve environmental quality, we test whether democracy influences the relationship between economic growth and air pollution for these sets of countries.

Our study is important for a number of reasons. First, the majority of Africans derive their livelihoods from agriculture, the mainstay of most African economies (e.g., Andanda, 2009; Barrios et al., 2008; Oladeji and Oyesola, 2011). The sector also employs about 50% of the labor force in Africa (Barrios et al., 2008). Because climate change adversely affects agricultural productivity, an understanding of the relationship between economic growth and CO<sub>2</sub> emissions among African countries is important for policy. Second, because particulate matter is a significant air pollutant in Africa, and because particulate air pollution has deadly health hazards, studying the relationship between economic growth and PM<sub>10</sub> emissions is appropriate. Finally, institutions play an important role in the design and implementation of environmental policies (Congleton, 1992; Panayotou, 1997; Li and Reuveny, 2006; Farzin and Bond, 2006; Bernauer and Koubi, 2009; Vatn, 2005; Coggan et al., 2010; McCann, 2013). Therefore, examining how democracy affects environmental degradation in Africa is appropriate.

## **4. 2. Background Literature**

### **4. 2.1. Economic Growth and Environmental Pollution**

The Environmental Kuznets Curve (EKC) hypothesis posits that economic growth leads to environmental degradation in the initial stages of growth, but environmental quality eventually improves as incomes rise (Grossman and Krueger, 1991, 1995; Shafik and Bandyopadhyay, 1992). In other words, the hypothesis postulates that pollution tends to rise initially as a country's per capita income increases, reaches some "turning point", and thereafter declines. The EKC concept first emerged in the 1990s following Grossman and Krueger's (1991) seminal work on the potential environmental effects of the North American Free Trade Area (Stern, 2004). Because the relationship between economic growth and environmental pollution tends to follow the pattern of economic growth and income inequality described by Kuznets (1955), the income-pollution relationship came to be known as the EKC hypothesis.<sup>12</sup>

Many scholars have estimated turning point incomes for various pollutants, which mostly occur between \$3,000 and \$10,000 (Dinda, 2004). Panayotou (2003) reports that earlier studies find the turning point incomes for several air pollutants like sulfur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>) and suspended particulate matter (SPM) to be in the range of \$3,000 - \$5,000 per capita. Examining a reduced-form relationship between per capita income and various environmental indicators, Grossman and Krueger (1995) note that the turning points for different pollutants vary, but mostly occur before a country reaches per capita income of \$8,000. Everett et al. (2010) observe that the pollution peak beyond which increases in GDP per capita would result in reduction in air pollution (e.g., suspended particulates and NO<sub>x</sub>) as evaluated in more recent studies is about \$34,000. List and Gallet (1999) estimate the peak turning point (in 1987 \$) for NO<sub>x</sub> at income levels close to \$9,000 and SO<sub>2</sub> around \$21,000. Using a group of 16 countries, Unruh and Moomaw

---

<sup>12</sup> Kuznets (1955) addressed inequality in the distribution of income in the course of a country's economic growth and the factors that determine the secular levels and trends in income inequality. He argued that income inequality first rises as economies grow, but eventually declines (i.e., an inverted U-shaped relationship).

(1998) suggest that peak turning point incomes range between \$7,900 and \$14,500 while Holtz-Eakin and Seldon (1992) arrive at a turning point income of \$35,000 (in 1985 \$) for CO<sub>2</sub>.

Most of the previous studies that have estimated turning point incomes for various pollutants within the EKC-framework tend to focus on developed countries (e.g. Grossman and Krueger, 1995, Panayotou, 2003, Everett et al., 2010, Unruh and Moomaw, 1998; Holtz-Eakin and Seldon, 1992). Undoubtedly, most developing countries have per capita incomes far below the turning points suggested by these studies. In particular, GDP per capita in most countries in Africa are less than \$2,000. With the exception of a few studies (e.g., Vincent, 1997; Bulte and van Soest, 2001; Bhattarai and Hammig, 2001, 2004; Orubu and Omotor, 2011), little attention has been paid to turning point incomes for various pollutants in developing countries (especially African countries). Furthermore, some scholars wonder whether the EKC hypothesis applies in developing country contexts. For instance, He (2007) asks: “Is the Environmental Kuznets Curve hypothesis valid for developing countries?” The author contends that there is no one EKC model that fits all countries. The author further asserts that if developing countries are able to manage their structural, institutional and technical policies, then they may be able to bypass the pollution-income path the EKC predicts.

Other studies question the specification of the EKC. In lieu of a quadratic specification, Sobhee (2004) argues that the EKC should take a logistic form especially when estimating marginal environmental degradation. With a new specification of the EKC accounting for fixed effects, Bradford et al. (2005) employ the data originally used by Grossman and Krueger (1995) to test for the existence of EKC for various environmental pollutants. They find that the EKC holds for only six out of fourteen pollutants. This contrasts sharply with the thirteen out of fourteen pollutants for which Grossman and Krueger (1995) had previously discovered EKC relationships.

Other studies claim that the EKC does not fit the data for some pollutants. For example, using data for Malaysia, Vincent (1997) tests the EKC hypothesis and finds that none of the six pollution-income relationships he studied conforms to the EKC hypothesis.

The EKC hypothesis has also been criticized for other reasons. Rothman (1998) argues that some pollutants such as CO<sub>2</sub> are consumption-based measures of environmental quality that do not decline with higher income levels, and so proposes that alternative consumption-based impacts be used when assessing environmental impact of economic growth and development. In a critical review of the history of the EKC hypothesis, Stern (2004) argues that developing countries now care about environmental quality as much as developed countries do, noting that some developing countries have adopted environmental standards that are as good as those adopted by developed countries with shorter time lags. Other scholars argue that the EKC relationships fail to pass sensitivity tests (e.g., Harbaugh et al., 2002; Selden and Song, 1994).

#### 4. 2. 2. Democracy and Environmental Pollution

The level of development of institutions and governance structures inevitably affects the design, enforcement and monitoring of environmental policies and regulations, and consequently environmental degradation (Panayotou, 1997; Bhattarai and Hammig, 2001; Dinda, 2004; Lopez and Mitra, 2000). For instance, corruption may influence the implementation of environmental policies and thereby affect the income-pollution relationship (e.g., Lopez and Mitra, 2000). Local and national policies would also affect the relationship between economic growth and environmental quality (Dinda, 2004). Though there is not a unique measure of institutional quality, the general prediction is that countries with better institutions tend to have lower levels of environmental pollution (Congleton, 1992; Panayotou, 1997; Li and Reuveny, 2006; Farzin and

Bond, 2006; Bernauer and Koubi, 2009; Culas, 2007; Bhattarai and Hamigg, 2001, 2004) although the existence of special interest groups may affect the provision of such public goods as air quality (Midlarsky, 1998). Furthermore, Dinda (2004, p. 435) notes, “In most cases where emissions have declined with rising income, the reductions have been due to local and national institutional reforms, such as environmental legislation and market-based incentives to reduce environmental degradation.”

In their examination of the effect of political institutions on SO<sub>2</sub> concentrations for 107 cities in 42 countries, Bernauer and Koubi (2009) find that democracy positively and significantly influences air quality. Li and Reuveny (2006) establish that although a country’s degree of democracy significantly influences environmental quality, this effect varies in magnitude across specific environmental issues. They note that, while the effect of democracy on deforestation, NO<sub>x</sub> emissions, land degradation and size of forested land tends to be substantial, the influence of democracy on water pollution and CO<sub>2</sub> emissions is relatively small. Bhattarai and Hamigg (2004) estimate turning point incomes for deforestation using data for 66 countries in Latin America, Asia and Africa for the period 1972-1991. Farzin and Bond (2006) show that environmental pollution is lower in democratic countries because democracy (and its concomitant freedoms) affords people an ability to express environmental preferences than do individuals in autocratic regimes.

Li and Reuveny (2006) show that a one standard deviation increase in democracy above the mean reduces deforestation by about 271%. This may be explained in part by the fact that countries with better institutions tend to have better environmental regulations and are able to enforce these regulations thereby resulting in lower environmental pollution. Gallagher and Thacker (2008) argue that some studies examining this relationship in the EKC literature consider only static measures (i.e., stocks) of country regimes. As a result they employ a panel data approach

that allows for time-series from 1960 to 2001 as well as across countries. They find that there is no short-run effect of democracy on SO<sub>2</sub> and CO<sub>2</sub> emissions. However, their results show that in the long-run, there is strong evidence that democracy reduces emissions of these pollutants.

#### **4. 3. Theoretical Explanations**

There are numerous theoretical explanations underlying the EKC hypothesis. We discuss several of these theories here (see e.g., Dinda, 2004 for a detailed review). One theory advances the argument that “the inverted U-shaped pollution-income path reflects the natural progression of economic development from clean agrarian economies to dirty industrial economies to clean service economies” (Israel and Levinson, 2004; p. 2). Thus, as a long run phenomenon, the EKC underlies transitions of an economy through its growth stages (Dinda, 2004). Other scholars argue that environmental quality is a luxury good, the demand for which increases only when people have attained sufficiently high-incomes to no longer worry about economic struggles (Baumol and Oates, 1979; Selden and Song, 1994; Gangadharan and Valenzuela, 2001). This is consistent with Inglehart’s (1990, 1995, 1997) post-materialism hypothesis. According to Inglehart, it is only when economies become sufficiently affluent so that citizens no longer have material struggles do people begin to focus on post-materialist values, including environmental concern.<sup>13</sup> Therefore, among people with low incomes, the demand for environmental improvement would be low because the poor are “too poor to green” (Martínez-Alier, 1995; Bruneau and Echevarria, 2009).

Other scholars argue that international trade influences environmental quality, e.g., through scale, technique and composite effects (Grossman and Krueger, 1991; Copeland and Taylor,

---

<sup>13</sup> Note, however, that when Inglehart tested this hypothesis using survey data, it was only partly supported as some developing countries exhibited high environmental concern. This led him to propose the “objective problems and subjective values” thesis. He argued that in developing countries, environmental concern is due to people’s direct experiences of environmental problems.

2004). Also, the pollution haven hypothesis postulates that as incomes rise in developed countries, individuals would increase pressure on their governments to regulate polluting industries. These industries would therefore move their “dirty” production processes to developing countries where people are relatively less concerned about environmental quality and more concerned about economic growth (Dinda, 2004; Cole, 2004; Taylor, 2004; Levinson and Taylor, 2008; Kearsley and Riddell, 2010). This often happens through foreign direct investment (FDI) (e.g., He, 2006; Wagner and Timmins, 2009; Smarzynska Javorcik and Wei, 2001). Close to this view is another argument that richer countries tend to import goods whose production causes the most environmental pollution from developing countries where “dirty” industries have been exported (Israel and Levinson, 2004). Because poor countries have no industries to export, Israel and Levinson (2004) argue that this pattern cannot repeat indefinitely. On the other hand, the “Porter hypothesis” posits that, rather than export dirty industries to developing countries, industries in developed countries would innovate environmentally friendly production processes at home due to stringent environmental controls in their home countries (Porter and Van der Linde, 1995). Also, as international trade generates higher incomes among residents of developing countries, and as these countries receive more international assistance, developing countries may pursue policies that would reduce environmental degradation (Dasgupta et al., 2002; Dinda, 2004).

Israel and Levinson (2004) also provide three theoretical explanations underlying the EKC hypothesis. First, the technological constraint explanation puts forth the idea that low income countries have *excess* environmental quality. But in order to grow their income, they must use dirty technologies, causing environmental pollution to rise. This is based on Stokey’s (1998) static model. On the other hand, John and Pecchenino’s (1994) overlapping generations model of technology constraint implies that in order to obtain other goods, citizens must degrade their



environment to obtain income until such a time when they can afford these goods. They can then begin to care about the environment. These models yield an inverted V-shaped relationship between economic growth and environmental quality (Israel and Levinson, 2004). The second thesis suggests that institutional constraints prevent poor countries from being able to pass legislation to clean up their economies (Israel and Levinson 2004). They argue that this model yields either an inverted-U, monotonically increasing or a “sideways-mirrored-S” (i.e., “N-Shaped”) income-pollution relationship. Finally, the “returns to scale” argument pertains to technology for pollution abatement. Based on Adroeni and Levinson’s (2001) model, the prediction is that if environmental quality is a normal good and pollution abatement has increasing returns to scale, then environmental pollution will initially increase, but eventually decline as wealth increases (Israel and Levinson, 2004).

The role of democracy in reducing environmental pollution has also been recognized (e.g., Scruggs, 1999; Congleton, 1992; Li and Reuveny, 2006) although some studies suggest that democracy may rather worsen environmental quality (e.g., Hardin, 1968; Midlarsky, 1998; Gleditsch and Sverdrup, 2003).<sup>14</sup> In developing countries, however, institutional constraints prevent authorities from designing, implementing and enforcing environmental regulations (Israel and Levinson, 2004) although local communities are sometimes able to influence the environmental performance of industries (see e.g., Dasgupta et al., 2002; p. 155). In addition, individuals are able to express their demand for environmental improvements if their political regime is democratic while citizens under autocratic regimes are unable to do so (Congleton, 1992; Li and Reuveny, 2006).

---

<sup>14</sup> See Li and Reuveny (2006) for a detailed review.

Finally, Grossman and Krueger (1995) argue that as the awareness of environmental hazards increase, and with the development of new and cleaner technologies, low income countries may begin to preserve the natural environment even at early stages of development. Consistent with this view, Dunlap et al. (1993), and Dunlap and Mertig (1995, 1997) assert that environmental concern has become a global phenomenon, and no longer the preserve of the industrialized world. Therefore, residents of developing countries may begin to demand environmental quality even at lower levels of economic growth.

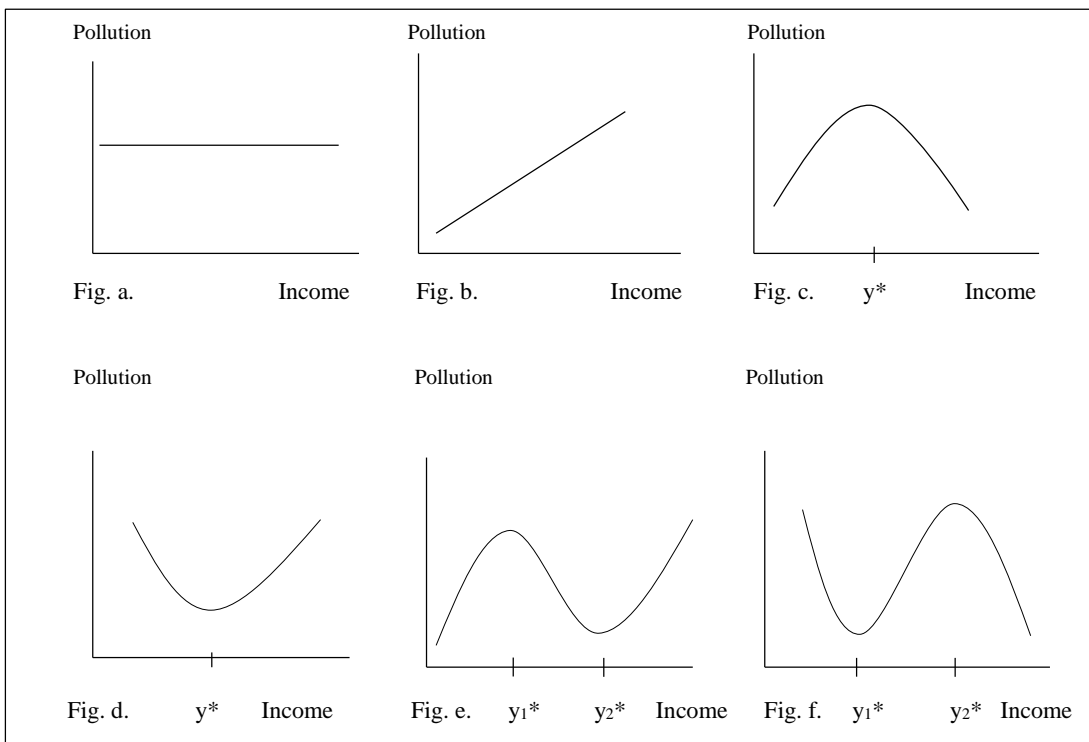


Figure 9. Income – pollution relationships

Figure 9 summarizes conceptually the various possible outcomes of the pollution – income relationships.<sup>15</sup> We are interested in knowing whether there are EKC's for air pollution in Africa. The discussions above reveal that turning point incomes vary for various countries, regions, and/or

<sup>15</sup> One possibility not shown in Figure 9 is a monotonically declining relationship indicating that pollution declines as income increases.

groups of countries. Therefore, if there are EKC's for air pollution in Africa, then how do turning point incomes for these pollutants in Africa compare with those for the high-income OECD countries? Because African countries have relatively lower GDP per capita, we expect lower turning point incomes too. Finally, the literature suggests that democracy may positively influence environmental quality. Therefore, we examine the effect of degree of democracy on air pollution for both African and high-income OECD countries.

#### **4. 4. Methods and Procedures**

##### **4. 4. 1. Data**

We use annual data for African and high-income OECD countries for the period 1990 – 2010.<sup>16</sup> The African sample includes 47 of the 48 Sub-Saharan African countries.<sup>17</sup> Although the OECD comprises of 34 member countries, we focus on 31 of them that are categorized as high-income countries by the World Bank. Thus, the three OECD countries excluded from our sample which are not high-income OECD countries are Hungary, Mexico and Turkey. Our dependent variables include two measures of air pollution: (1) country level carbon dioxide (CO<sub>2</sub>) emissions measured in kilotons (kt), and (2) country level particulate matter with diameter of 10 micrograms per cubic meter (PM<sub>10</sub>) emissions. We focus on these two measures for several reasons. First, CO<sub>2</sub> emissions are the commonest of air pollutants in EKC studies. Second, with increasing concern about climate change, including CO<sub>2</sub> emissions is appropriate because CO<sub>2</sub> emissions constitute a

---

<sup>16</sup> A complete list of these countries is presented in Table II in the Appendix.

<sup>17</sup> The excluded country is South Sudan which became independent in 2011 and therefore has no data for the period under consideration. Note also that Sub-Saharan African countries excludes the Arab countries in Africa (i.e., Algeria, Egypt, Libya, Morocco and Tunisia). According to the World Bank, as of 2012, a developing country is a country with GNI per capita of less than \$11,905. Although South Africa is a member of the G20 and is among the list of Newly Industrialized Countries (NICs), we include it in the African sample as a developing country because its GNI per capita for the period under consideration (1990-2010) was less than \$11,905. Additionally, excluding South Africa from the African sample does not substantially alter the results.

significant proportion of greenhouse emissions (World Bank, 2007). Finally, particulate matter has the ability to cause severe chronic respiratory problems and lead to morbidity (Dockery et al., 1989; Ravindra et al., 2001; KuÈnzli et al., 2000). Because particulate matter is a major source of air pollution in Africa (Orubu and Omotor, 2011), we also focus on PM<sub>10</sub> emissions. The right hand side variables include GDP per capita (in constant 2005 US \$), population density (people per square km of land area), foreign direct investment (net inflows as % of GDP), trade openness (trade as % of GDP) and degree of democracy. All variables (except the degree of democracy) are obtained from The World Bank's World Development Indicators (WDI) online.

According to Glaeser et al. (2004), several measures of institutions exist in the literature. They discuss three of these measures. The first measure is a set of indicators of institutional quality taken from the International Country Risk Guide that reflects risk for international investors with respect to law and order, risk of expropriation by government, etc. The second measure is a composite index of "government effectiveness" by Kaufmann et al. (2004). The third measure is "degree of democracy" from the POLITY IV dataset collected by Marshall and Jaggers (2002). The current research focuses on the POLITY measure. It is a composite measure of the extent of institutionalized democracy or autocracy in each country. Institutionalized democracy reflects "three essential, interdependent elements" (Marshall and Jaggers, 2002, p. 13) as follows:

"One is the presence of institutions and procedures through which citizens can express effective preferences about alternative policies and leaders. Second is the existence of institutionalized constraints on the exercise of power by the executive. Third is the guarantee of civil liberties to all citizens in their daily lives and in acts of political participation. Other aspects of plural democracy, such as the rule of law, systems of checks

and balances, freedom of the press, and so on are means to, or specific manifestations of, these general principles.”

An eleven-point (0-10) democracy variable is constructed based on the competitiveness of executive recruitment, openness of executive recruitment, constraint on chief executive and the competitiveness of political participation (see Marshall and Jaggers, 2002, p. 14). The negative versions of these tenets are used to construct an eleven-point “autocracy” variable. Subtracting the autocracy score from the democracy score yields the “combined polity score” (POLITY) ranging from –10 (strongly autocratic) to 10 (strongly democratic).

#### 4. 4. 2. Empirical model

The basic empirical model is often presented in a reduced-form (e.g., Stern, 2004; Stern and Common, 2001) as follows:

$$\ln E_{it} = \beta_0 + \beta_1 \ln y_{it} + \beta_2 (\ln y_{it})^2 + \varepsilon_{it} \quad (4.1)$$

where  $E_{it}$  is environmental pollution in country  $i$  at time  $t$ ;  $y_{it}$  is GDP per capita in country  $i$  at time  $t$ ;  $\varepsilon_{it}$  is the error term;  $\beta$ 's are parameters to be estimated. According to Grossman and Krueger (1995),<sup>18</sup> there are two advantages with estimating a reduced-form model as opposed to a structural model that treats income as a function of technology, composition of economic output and environmental policy. They contend that reduced-form models yield the net effect of income on pollution, and do not require acquisition of data on pollution regulations and state of technology (that are often hard to collect anyway). However, the authors point out that with reduced-form models, “it is unclear why the estimated relationship between pollution and income exists.”

---

<sup>18</sup> Although we use log of environmental pollution and GDP per capita (consistent with many studies), earlier studies used levels for these variables (e.g., Grossman and Krueger, 1995).

Nonetheless, reduced-form models are only descriptive of the correlations among income and environmental pollutants contrary to causal mechanisms (e.g., Cole et al., 2001).

In order for an inverted U-Shaped relationship between economic growth and environmental pollution to be met (i.e., an EKC to exist), it is expected that  $\beta_1 > 0$  and  $\beta_2 < 0$  and both should be statistically significant (see e.g., Dinda, 2004; Lee et al., 2010). The “turning point income” for each pollutant is obtained by setting the first derivative of equation (4.1) to zero, and solving for  $y$ .

Therefore, the turning point income is given by:

$$y^* = \exp\left(-\frac{\beta_1}{2\beta_2}\right) \quad (4.2)$$

Scholars frequently include a cubic term as well as other covariates of environmental pollution, e.g., trade openness, population density, and foreign direct investment (Grossman and Krueger, 1995; Shafik and Bandyopadhyay, 1992). In addition, because countries differ in many ways (e.g., culture, location, climate, resource endowment, etc.), we control for time-invariant country fixed-effects,  $\alpha_i$ . Examples of such country fixed-effects include climate, geography and resource endowments (Heil and Selden, 2001; Neumayer, 2004). To account for time-variant omitted variables as well as stochastic shocks that may be common to all countries (Stern, 2004; Stern and Common, 2001; Orubu and Omotor, 2011), we control for time effects by including  $\gamma_t$ . Time effects are often used as a crude measure of technical change as well as other time related phenomena that could influence environmental pollution (Stern and Common, 2001; Giovanis, 2013; Bhattarai and Hammig, 2001) including macroeconomic effects and national environmental policy implementation (see e.g., Millimet et al., 2003). Because we test for the effect of democracy on environmental degradation, we include the term DEMO. Therefore, the augmented cubic model is given by:

$$\ln E_{it} = \beta_0 + \beta_1 \ln y_{it} + \beta_2 (\ln y_{it})^2 + \beta_3 (\ln y_{it})^3 + \beta_4 z_{it} + \beta_5 DEMO + \alpha_i + \gamma_t + \varepsilon_{it} \quad (4.3)$$

where  $z_{it}$  denotes other correlates of environmental quality and DEMO captures degree of democracy. The peak and trough turning point incomes are given by (see e.g., Onafowora and Owoye, 2014, p. 50; Yang et al., 2010, p. 67):

$$y^* = \exp\left(\frac{-\beta_2 \pm \sqrt{\beta_2^2 - 3\beta_1\beta_3}}{3\beta_3}\right) \quad (4.4)$$

Consistent with previous studies (e.g., Panayotou, 1997; Harbaugh et al. 2002; Stern, 2004; Stern and Common, 2001; Orubu and Omotor, 2011), we estimate the equations using fixed effects (FE) and random effects (RE) models. In FE models,  $\alpha_i$  and  $\gamma_t$  are treated as parameters in the regression equation. However, RE models treat these effects as components of the random disturbance term,  $\varepsilon_{it}$  (Stern, 2004; Stern and Common, 2001; Orubu and Omotor, 2011). The RE model cannot generate consistent estimates if  $\alpha_i$  is correlated with  $\gamma_t$ , while the FE model yields consistent estimates, suggesting that a FE model is preferred (Stern and Common, 2001, p. 168). Therefore, to test for consistency or otherwise from a RE model, a Hausman test is implemented to determine whether there are significant differences between the FE and RE slope parameters. A rejection of the null hypothesis suggests that the error term is correlated with some of the explanatory variables, and therefore the RE estimates are inconsistent (Hausman, 1978; Stern and Common, 2001).

With equation (4.3), the following relationships between economic growth and environmental pollution can be tested (see e.g., Dinda, 2004, p. 441; Lee et al., 2010, p. 15).

- (a) If  $\beta_1 = 0$ ,  $\beta_2 = 0$ , and  $\beta_3 = 0$ , then there is no relationship between income and pollution (see Fig. 9a.).

- (b) If  $\beta_1 > 0$ ,  $\beta_2 = 0$ , and  $\beta_3 = 0$ , then environmental pollution increases monotonically as income rises (see Fig. 9b.).
- (c) If  $\beta_1 > 0$ ,  $\beta_2 < 0$  and  $\beta_3 = 0$ , then there is an inverted U-shaped relationship between income and pollution (see Fig. 9c.).
- (d) If  $\beta_1 < 0$ ,  $\beta_2 > 0$  and  $\beta_3 = 0$ , then there is a U-shaped relationship (see Fig. 9d.)
- (e) If  $\beta_1 > 0$ ,  $\beta_2 < 0$  and  $\beta_3 > 0$ , then there is an N-shape relationship (see Fig. 9e.)
- (f) If  $\beta_1 < 0$ ,  $\beta_2 > 0$  and  $\beta_3 < 0$ , then there is an inverted-N-Shaped relationship (see Fig. 9f.)

#### 4. 5. Results and Discussion

The summary statistics of the variables are summarized in Table 11 below. While CO<sub>2</sub> emissions are higher in OECD countries on average, PM<sub>10</sub> emissions are higher in African countries. The average GDP per capita are \$1,385.69 in Africa and \$29,535.39 for OECD countries. GDP per capita are generally very low among African countries – ranging from \$50 (Liberia) to \$13,518 (Seychelles) – compared to a range of \$4,121 (Chile) to \$87,716.73 (Luxembourg) among the OECD countries. Population density in OECD countries is almost twice that for the African countries. Net inflows of FDI are slightly higher for Africa. OECD countries are relatively more open to international trade than African countries.

Finally, the degree of democracy reveals the significant institutional differences between African and OECD countries. Whereas the average score is 0.51 for the former, it is 9.58 for the latter. For the period under consideration, the majority of African countries were under autocratic regimes. Only Cape Verde and Mauritius were completely democratic (i.e., a score of 10). Conversely, among the OECD countries, Slovenia scored – 5 in 1991 while Estonia scored 0 in 1990. Aside from Belgium, Chile, Czech Republic, Estonia, Slovak Republic, Slovenia, South



Korea, Poland, France and Israel which scored less than a 10 at some point between 1990 and 2010, the rest of the OECD countries scored a perfect 10, indicating they were completely democratic.<sup>19</sup>

Table 11. Variable summary statistics

Variable	Africa				OECD			
	N	Mean	S. D.	Range	N	Mean	S. D.	Range
CO <sub>2</sub> (kt)	962	12399.46	57388.10	3.67-503941.14	642	383899.75	966098.74	1767.49-5828696.50
PM <sub>10</sub> (µg/m <sup>3</sup> )	945	55.84	39.57	11.41-255.84	644	34.74	14.50	14.14-92.93
GDP per capita (2005 US\$)	954	1385.69	2264.23	50.04-13518.04	648	29535.39	15418.97	4121.34-87716.73
Population density (people per sq. km of land area)	987	76.31	106.45	1.72-631.00	631	133.70	130.44	2.22-508.86
FDI (net inflows as % of GDP)	944	4.17	10.45	-82.89-161.82	614	3.80	6.82	-55.07-74.71
Openness (Trade as % of GDP)	946	74.94	48.40	10.95-531.74	648	83.20	47.73	15.92-333.53
Democracy score	942	0.51	5.54	-10.00-10.00	609	9.58	1.13	-5.00-10.00

Data Source: World Bank Development indicators except democracy score drawn from the POLITY IV project

Table 12. Correlation matrices

Africa							
Variable	1	2	3	4	5	6	7
1. lnCO <sub>2</sub>	1.00						
2. lnPM <sub>10</sub>	0.35*	1.00					
3. lnGDP per capita	0.26*	-0.16*	1.00				
4. Population density	-0.14*	-0.32*	0.08*	1.00			
5. FDI	-0.11*	-0.12*	0.09*	-0.07*	1.00		
6. Openness	-0.04	-0.19*	0.45*	-0.02	0.56*	1.00	
7. Democracy score	0.07*	0.11*	0.14*	0.21	-0.04	-0.03	1.00
OECD							
Variable	1	2	3	4	5	6	7
1. lnCO <sub>2</sub>	1.00						
2. lnPM <sub>10</sub>	0.02	1.00					
3. lnGDP per capita	0.00	-0.58*	1.00				
4. Population density	0.32*	0.32*	0.03	1.00			
5. FDI	-0.21*	-0.19*	0.11*	-0.01	1.00		
6. Openness	-0.54*	-0.17*	0.10*	0.08*	0.49*	1.00	
7. Democracy score	0.07*	-0.32*	0.51*	-0.12*	-0.02	-0.16*	1.00

Note: \* denotes significance at the 10% level or better.

<sup>19</sup> Data on democracy score were unavailable for Iceland and Luxembourg.

Table 12 presents the correlations for the variables for the two samples. The upper half of the table shows the Pearson's correlation coefficients for the African sample while the lower half shows the correlations for the OECD countries. Among the African countries, those that have higher CO<sub>2</sub> emissions also tend to have higher PM<sub>10</sub> emissions. In contrast, there is no significant correlation between these emissions for the OECD sample. For the right hand side variables (i.e., income, population density, FDI, openness and extent of democracy), GDP per capita is significantly correlated with all the other variables for the African sample and for the OECD countries except population density. The highest correlation between any pair of independent variables is between FDI and openness (i.e.,  $r = 0.56$  for Africa and  $r = 0.49$  for OECD), suggesting a lack of multicollinearity in the data.<sup>20</sup>

We now turn to the econometric analyses. We start by examining the basic quadratic specifications and their augmented versions for each pollutant. Table 13 reports the FE and RE models for CO<sub>2</sub> for each specification. Models 1 and 3 estimate the basic quadratic forms while Models 2 and 4 estimate the augmented quadratic forms, respectively. We find an EKC for CO<sub>2</sub> for both African and OECD samples for the basic models because  $\beta_1 > 0$  and  $\beta_2 < 0$  for each sample. These estimates are also statistically significant at the 1% level. The estimated turning point incomes are \$6,295.39 and \$7,753.35 for the FE and RE models, respectively for the African sample.<sup>21</sup> The corresponding figures are \$19,204.72 and \$19,515.38 for the OECD countries. Thus,

---

<sup>20</sup> A general rule of thumb is that correlations near unity (e.g., 0.8) suggest the presence of multicollinearity (see e.g., Farrar & Glauber, 1967). In addition, we tested for multicollinearity by examining the variance inflation factors (VIFs) in OLS models (not reported for economy of space). All VIFs were below 5 (except for the lower and higher order values of GDP per capita) suggesting the absence of multicollinearity in the data. Consistent with polynomial regressions, some collinearity is expected among the GDP per capita variables (see e.g., Panayotou 1997).

<sup>21</sup> The turning point income for a quadratic specification is given by  $\exp(-\beta_1/2\beta_2)$  as shown in equation (2) where  $\beta_1$  is the coefficient of log of GDP per capita and  $\beta_2$  is the coefficient of the square of the log of GDP per capita. Take the FE model for Africa for example.  $-\beta_1/2\beta_2 = -1.802/[2*(-0.103)] = 8.747573$ . Taking the exponent of 8.747573 generates the turning point income of \$6,295.39.

the turning point income for CO<sub>2</sub> for OECD is three times the turning point income for Africa using the FE model. Similarly, for the RE model, the OECD turning point income is 2.52 times that for the African countries. The Hausman test produced a weak but statistically significant (at the 10% level) figure of 6.75 for the African sample, suggesting that the country and time effects are correlated with the explanatory variables. As a result, the FE model is preferred over the RE model because the FE estimates are more consistent. However, the Hausman statistic is insignificant for the OECD countries, indicating that the RE model is preferred.

After controlling for, FDI, openness and degree of democracy (Models 2 and 4 on Table 3), the coefficients for  $\ln\text{GDP}$  and  $(\ln\text{GDP})^2$  retain their signs but lose their statistical significance for the OECD sample. Additionally, in the case of the African sample, the coefficient for  $(\ln\text{GDP})^2$  becomes positive although insignificant. Thus, we conclude that the EKC for CO<sub>2</sub> is sensitive for both samples. This finding is consistent with previous evidence on the sensitivity of EKC to alternative specifications (e.g., Harbaugh et al., 2002).

Regarding the other covariates, the results indicate that while population density is negatively correlated with CO<sub>2</sub> emissions in Africa, it is positively associated with these emissions in OECD countries. One explanation is the sparsely populated nature of African countries relative to OECD countries (Selden and Song, 1994). Another possibility is that because African residents generally have lower vehicle per capita and tend to live closely together, emissions from transportation would tend to be lower among African countries (e.g., Selden and Song, 1994). Hence, the negative effect of population density on CO<sub>2</sub> emissions in Africa.

On the other hand, the high vehicle per capita and energy consumption in OECD countries mean that CO<sub>2</sub> emissions would tend to be positively and significantly correlated with population density as our results show. FDI increases CO<sub>2</sub> emission for OECD while openness reduces CO<sub>2</sub>

emission for both samples. With respect to the effect of democracy on CO<sub>2</sub> emissions, we find no evidence that democracy improves environmental quality although it is negatively correlated with CO<sub>2</sub> emissions for both samples. The Hausman statistic for each augmented quadratic EKC model reveals that the FE model is preferred to the RE model for each sample.

Table 13. Regression results for basic and augmented quadratic models for CO<sub>2</sub> emissions in African and OECD countries

Variable	Africa				OECD			
	Model 1		Model 2		Model 3		Model 4	
	FE	RE	FE	RE	FE	RE	FE	RE
Intercept	0.654 (1.974)	-0.098 (1.842)	5.262** (2.207)	4.129** (2.093)	-85.489*** (12.708)	-83.495*** (12.177)	6.098 (10.661)	6.731 (10.359)
lnGDPPC	1.802*** (0.557)	1.827*** (0.537)	0.473 (0.630)	0.528 (0.613)	19.785*** (2.580)	19.343*** (2.473)	1.472 (2.211)	1.157 (2.147)
(lnGDPPC) <sup>2</sup>	-0.103*** (0.040)	-0.102*** (0.038)	0.023 (0.045)	0.019 (0.044)	-1.003*** (0.131)	-0.979*** (0.125)	-0.063 (0.112)	-0.044 (0.108)
Population density			-0.003*** (0.000)	-0.002*** (0.000)			0.003*** (0.000)	0.003*** (0.000)
FDI			0.005 (0.007)	0.007 (0.007)			0.027** (0.012)	0.035*** (0.011)
Openness			-0.011*** (0.002)	-0.011*** (0.002)			-0.027*** (0.001)	-0.026*** (0.001)
Democracy score			-0.015 (0.010)	-0.005 (0.009)			-0.102 (0.068)	-0.078 (0.066)
R <sup>2</sup>	0.110	0.074	0.260	0.197	0.132	0.088	0.514	0.487
Turning point	6,295.39	7,753.35			19,204.72	19,515.38		
Hausman test		6.75**		16.50**		0.98		17.06***
N	935	935	885	885	641	641	583	583

Note: Turning point incomes are in 2005 US \$. Standard errors are in parentheses. \*\*\* Significant at the 1% level; \*\* significant at the 5% level; \* significant at the 10% level.

The basic and augmented EKC regression results for PM<sub>10</sub> are summarized in Table 14. The results suggest the existence of an EKC for PM<sub>10</sub> for Africa before and after controlling for other covariates (Models 5 and 6). The turning point incomes range from \$580.97 to \$637.35. These are relatively higher than the turning point incomes for PM<sub>10</sub> estimated by Orubu and Omotor (2011). In that study, they obtained turning point incomes of \$103.33 for a basic FE model and \$366.39 for an augmented EKC model using OLS. While their data spans 1990-2002, our data covers the period 1990-2010. Thus, a possible explanation is that increased average incomes in Africa may account for the relatively higher turning point incomes we obtain here. Unlike the CO<sub>2</sub>

results above, controlling for population density, FDI, openness and degree of democracy does not change the relationship between income and PM<sub>10</sub> emissions for the African sample. Conversely, controlling for these variables for the OECD sample affects the results (Model 8). While we find evidence of EKC for PM<sub>10</sub> in the basic models with turning point incomes of \$1,598.66 and \$1,744.61 for the FE and RE, models respectively, controlling for other correlates causes the coefficients of lnGDP and (lnGDP)<sup>2</sup> to become statistically insignificant.

Table 14. Regression results for basic and augmented quadratic models for PM<sub>10</sub> emissions in African and OECD countries

Variable	Africa				OECD			
	Model 5		Model 6		Model 7		Model 8	
	FE	RE	FE	RE	FE	RE	FE	RE
Intercept	0.479 (0.750)	0.218 (0.700)	1.303* (0.773)	0.778 (0.730)	0.247 (2.430)	0.058 (2.377)	8.696 (2.908)	8.340*** (2.842)
lnGDPPC	1.082*** (0.214)	1.169*** (0.207)	0.918*** (0.220)	1.058*** (0.214)	0.959* (0.494)	1.045** (0.483)	-0.799 (0.603)	-0.654 (0.589)
(lnGDPPC) <sup>2</sup>	-0.085*** (0.016)	-0.092*** (0.015)	-0.073*** (0.016)	-0.082*** (0.015)	-0.065*** (0.025)	-0.070*** (0.024)	0.023 (0.030)	0.015 (0.030)
Population density			-0.002*** (0.000)	-0.002*** (0.000)			0.001*** (0.000)	0.001*** (0.000)
FDI			-0.005** (0.002)	-0.005** (0.002)			-0.005* (0.003)	-0.005* (0.003)
Openness			-0.001** (0.000)	-0.001** (0.000)			0.001** (0.000)	0.001*** (0.000)
Democracy score			0.023*** (0.004)	0.021*** (0.003)			0.025 (0.019)	0.018 (0.018)
R <sup>2</sup>	0.100	0.064	0.259	0.212	0.426	0.329	0.521	0.445
Turning point	580.97	574.36	537.90	637.35	1,598.66	1,744.61		
Hausman test		2.36		12.96**		7.08**		13.97**
N	935	935	881	881	641	641	579	579

Note: Turning point incomes are in 2005 US \$. Standard errors are in parentheses. \*\*\* Significant at the 1% level; \*\* significant at the 5% level; \* significant at the 10% level.

Among the other covariates, we obtain a negative effect of population density, FDI, and openness on PM<sub>10</sub> emissions for Africa. Population density and openness are positively associated with PM<sub>10</sub> emissions while FDI is negatively correlated with PM<sub>10</sub> emissions for the OECD countries. FDI reduces PM<sub>10</sub> emissions for this sample. Contrary to our expectations, the extent of democracy is positively associated with PM<sub>10</sub> emissions for Africa. However, it has an

insignificant effect on PM<sub>10</sub> emissions for the OECD sample. For the African countries, The RE model is preferred in basic models whereas the FE model is preferred for the augmented models. In the case of OECD countries, FE model is preferred for both basic and augmented specifications.

The finding that FDI increases CO<sub>2</sub> emissions among OECD countries suggests that these countries may have increased their resource depletion with increased influx of FDI (Xing and Kolstad, 2002; Zhang, 2011) as they export more products (Hitam and Borhan, 2012). Yet the results for PM<sub>10</sub> emissions reveal that FDI actually improves air quality in both African and OECD countries. In this case, it could be argued that technological progress from increased FDI contributed to reducing environmental degradation in these countries (List and Co, 2000; Tamazian et al., 2009). If trade increases pollution in developing countries and reduces pollution in developed countries as per the pollution haven hypothesis, then we would expect a positive and significant relationship between trade and air pollution in Africa and a negative and significant effect for the OECD countries. Consistent with the results of Shafik and Bandyopadhyay (1992), we find mixed results for the effect of trade on environmental pollution, although they demonstrate weak evidence that less pollution is associated with more open economies. Our results reveal that openness is negatively and significantly correlated with CO<sub>2</sub> emissions for both samples. Furthermore, it is negatively and significantly correlated with PM<sub>10</sub> emissions for Africa but has a positive and significant effect for OECD countries.

We expect that democracy would lower air pollution for the OECD sample (e.g., Gleditsch and Sverdrup, 2003; Li and Reuveny, 2006). Contrary to this expectation, our results indicate that democracy has no effect on either of the air pollutants we investigate for OECD countries. In addition, democracy has no effect on CO<sub>2</sub> emissions for the African sample but has positive and significant effect on PM<sub>10</sub> emissions. This finding corroborates the thesis that democracy may tend

to worsen environmental quality (e.g., Hardin, 1968; Midlarsky, 1998; Gleditsch and Sverdrup, 2003). A plausible reason for the positive effect of democracy on PM<sub>10</sub> emissions for Africa is that particulate matter is the main air pollutant among African countries generated by production and consumption activities such as burning of fuel wood, charcoal, industrial construction, transportation, etc. Therefore, regardless of the level of democracy, PM<sub>10</sub> emissions continue to increase. Indeed, Congleton (1992) observes an identical association between democracy on the one hand, and methane and Chlorofluorocarbon emissions on the other hand. In addition, Scruggs (1998) finds no effect of democracy on particulate emissions but a positive and significant effect on SO<sub>2</sub> emissions.

Table 15. Regression results for cubic specifications for air pollution emissions in African and OECD countries

Variable	Africa				OECD			
	Model 9		Model 10		Model 11		Model 12	
	CO <sub>2</sub>		PM <sub>10</sub>		CO <sub>2</sub>		PM <sub>10</sub>	
	FE	RE	FE	RE	FE	RE	FE	RE
Intercept	27.745*** (8.777)	23.630*** (8.399)	-3.376 (3.467)	-1.424 (3.297)	1225.441*** (148.200)	1156.858*** (139.200)	-123.768*** (29.852)	-105.659*** (29.053)
lnGDPPC	-10.449*** (3.907)	-8.938** (3.757)	2.857* (1.573)	1.926 (1.500)	-380.918*** (45.207)	-359.774*** (42.464)	38.856*** (9.106)	33.359*** (8.863)
(lnGDPPC) <sup>2</sup>	1.710*** (0.574)	1.493*** (0.552)	-0.353 (0.235)	-0.206 (0.225)	39.679*** (4.585)	37.502*** (4.305)	-3.911*** (0.923)	-3.350*** (0.899)
(lnGDPPC) <sup>3</sup>	-0.088*** (0.028)	-0.077*** (0.027)	0.011 (0.012)	0.006 (0.011)	-1.372*** (0.155)	-1.297*** (0.145)	0.130*** (0.031)	0.111*** (0.030)
R <sup>2</sup>	0.121	0.082	0.101	0.065	0.211	0.189	0.4426	0.3412
Turning point	139.21 [3036.75]	110.84 [3708.19]			8,247.80 [28,643.08]	7,957.99 [29,565.03]	8,618.81 [59,558.16]	8,487.41 [64,458.8]
Hausman test		8.79**		7.68*		4.94		11.11*
N	935	935	912	912	641	641	641	641

Note: Turning point incomes are in 2005 US \$. Peak turning point incomes are in brackets. Standard errors are in parentheses. \*\*\* Significant at the 1% level; \*\* significant at the 5% level; \* significant at the 10% level.

For further analyses, we consider cubic specifications for the models. The results are presented in Tables 15. We find an inverted N-shaped relationship (see Fig. 9f) between CO<sub>2</sub> and income for both samples. The trough (peak) turning point incomes are \$ 139.21 (\$3,036.75) and

\$8,247.80 (\$28,643.08) for the FE models for Africa and OECD while the RE models estimate the trough (peak) incomes at \$110.84 (\$3,708.19) and \$7,957.99 (\$29,565.03) for African and OECD countries, respectively. Although we find no cubic EKC relationship for PM<sub>10</sub> for the African sample, the results for the OECD sample for PM<sub>10</sub> reveal an N-Shaped relationship (Fig. 9e), with trough (peak) incomes occurring at \$8,618.81 (\$59,558.16) and \$8,487.41 (\$64,458.80) for the FE and RE models, respectively. The Hausman test rejects the RE models in favor of the FE models for both CO<sub>2</sub> and PM<sub>10</sub> for the African sample. In the case of the OECD sample, the RE model is preferred for CO<sub>2</sub> to the FE model while the FE is preferred for PM<sub>10</sub> to the RE model.

We note that the results for cubic specifications alter the signs of the coefficients and therefore the relationship between economic growth and pollution significantly. This is consistent with the results of other studies. For instance, sensitivity analyses conducted by Harbaugh et al. (2002) using extended version of the Grossman and Krueger (1995) data reveals that when cubic terms are included, signs and turning point incomes are altered significantly. As a result, they conclude “that the evidence is less robust than it appears” for the inverse U-shaped relationship between economic growth and pollution (p. 541). In addition, all turning point incomes for both CO<sub>2</sub> and PM<sub>10</sub> are within the GDP per capita data range for each sample.

#### **4. 6. Summary and Conclusion**

This chapter explores the relationship between economic growth and air pollution within the EKC framework. In doing so, we are concerned with a number of issues. First, we test for the existence of EKC in quadratic forms for CO<sub>2</sub> and PM<sub>10</sub> for African and OECD countries. We find an EKC for each pollutant for both samples. However, when we extend the models by controlling for population density, FDI, openness and the extent of democracy, only PM<sub>10</sub> retains this



relationship with economic growth for the African sample. Additionally, we examine income-pollution relationships for cubic specifications for both pollutants. Our results show an inverted U-shaped relationship between economic growth and CO<sub>2</sub> emissions for both samples, and an N-shaped relationship for PM<sub>10</sub> for the OECD sample.

Second, the comparison of the turning point incomes for these pollutants for African and OECD countries indicate vastly distinct peak and trough incomes. Consistent with *a priori* expectations, we find that the peak income for CO<sub>2</sub> for the OECD countries is about three times the peak income for Africa. The differences in magnitudes are even more pronounced for the cubic models as the trough incomes for the OECD countries are at least fifty times the trough incomes for the African countries, and about nine times for the peak incomes. The OECD peak incomes for PM<sub>10</sub> are also almost three times the peak incomes for Africa. Finally, among other correlates of environmental degradation, we test whether democracy as measured by a country's degree of democracy is correlated with air pollution. Our results reveal that the degree of democracy has no effect on CO<sub>2</sub> emissions for either sample. Also, democracy has an insignificant effect on PM<sub>10</sub> emissions for the OECD countries but a positive and significant effect for Africa.

These results indicate that, like OECD countries, there are EKC's for CO<sub>2</sub> and PM<sub>10</sub> in Africa. Nonetheless, the turning point incomes for these set of countries differ significantly, reflecting the differences in income levels. That is, because GDP per capita are generally higher in OECD countries and lower in Africa, the relatively lower turning point incomes for the African sample and relatively higher turning point incomes for the OECD countries are consistent with the income differentials and *a priori* expectations. Our findings support the argument that there is no universal EKC for all countries, regions, or states (e.g., List and Gallet, 1999; He, 2007) or that developing countries have a distinct set of EKC's and turning point incomes (e.g., He, 2007).

Indeed, while the majority of African countries have incomes less than the turning point incomes for each pollutant, most of the OECD countries have exceeded their turning point peak incomes. Thus, developed and developing countries are on different trajectories of economic growth – pollution paths (He, 2007). Finally, our results corroborate the findings of previous studies suggesting that democracy may worsen environmental quality (e.g., Hardin, 1968; Midlarsky, 1998; Gleditsch and Sverdrup, 2003).

This chapter contributes to the literature by focusing on air pollution in Africa and explicitly comparing African and OECD countries with respect to economic growth – air pollution relationships and turning point incomes. Although we are cognizant of Orubu and Omotor (2011) who examined suspended particulate matter (PM<sub>10</sub>) and organic water pollution focusing on Africa, their study does not compare outcomes for Africa with other countries as we have done. Thus, to the best of our knowledge, our study is the first to make an explicit comparison of results for air pollution (CO<sub>2</sub> in addition to PM<sub>10</sub>) and their turning point incomes for African and OECD countries. This study is also the first to examine the association between democracy and these air pollutants for Africa.

Nonetheless, this study has several limitations. Unlike other studies (e.g., List and Gallet, 1999; Millimet, et al., 2003), we do not estimate EKC models for individual countries because the sample size for each country is small (n=21). Furthermore, although we carefully chose the 1990-2010 period for our analyses, the datasets, especially the African sample, were not without missing observations. Consequently, we do not generate individual country turning point incomes for these pollutants. Instead, our models are based on pooled samples. Therefore, future research could extend our analyses by examining turning point incomes for individual African countries. Finally,

we focus on only CO<sub>2</sub> and PM<sub>10</sub> emissions. Thus future research could examine other air pollutants as well as other environmental pollutants for Africa and how results compare with other countries.

## References

- Andreoni, J., & Levinson, A. (2001). The simple analytics of the environmental Kuznets curve. *Journal of Public Economics*, 80(2), 269-286.
- Andanda, P. (2009). Status of biotechnology policies in South Africa. *Asian Biotechnology and Development Review*, 11(3), 35-47.
- Barrios, S., Ouattara, B., & Strobl, E. (2008). The impact of climatic change on agricultural production: Is it different for Africa? *Food Policy*, 33(4), 287-298.
- Baumol, W. J. and Oates, W. E. (1979). *Economics, Environmental Policy, and the Quality of Life*. Englewood Cliffs, NJ: Prentice Hall.
- Bernauer, T., & Koubi, V. (2009). Effects of political institutions on air quality. *Ecological Economics*, 68(5), 1355-1365.
- Bhattarai, M. and Hammig, M. (2001). Institutions and the Environmental Kuznets Curve for Deforestation: A cross-country Analysis for Latin America, Africa and Asia. *World Development*, 29(6), 995-1010.
- Bhattarai, M. and Hammig, M. (2004). Governance, economic policy, and the environmental Kuznets curve for natural tropical forests. *Environment and Development Economics*, 9(03), 367-382.
- Bradford, D. F., Fender, R. A., Shore, S. H., & Wagner, M. (2005). The environmental Kuznets curve: exploring a fresh specification. *Contributions in Economic Analysis & Policy*, 4(1), 1-28.
- Bruneau, J. & Echevarria, C. (2009). The Poor Are Green Too. *Journal of International Cooperation Studies*, 16(3), 1-22.
- Bruce, N., Perez-Padilla, R., & Albalak, R. (2000). Indoor air pollution in developing countries: a major environmental and public health challenge. *Bulletin of the World Health Organization*, 78(9), 1078-1092.
- Bulte, E. H., & Van Soest, D. P. (2001). Environmental degradation in developing countries: households and the (reverse) Environmental Kuznets Curve. *Journal of Development Economics*, 65(1), 225-235.
- Coggan, A., Whitten, S. M., & Bennett, J. (2010). Influences of transaction costs in environmental policy. *Ecological Economics*, 69(9), 1777-1784.
- Cole, M. A. (2004). Trade, the pollution haven hypothesis and the environmental Kuznets curve: examining the linkages. *Ecological Economics*, 48(1), 71-81.

- Cole, M.A., Rayner, A., & Bates, J.M. (2001). The environmental Kuznets curve: an empirical analysis. *Environment and Development Economics*, 2(4), 401–416.
- Collier, P., Conway, G., & Venables, T. (2008). Climate change and Africa. *Oxford Review of Economic Policy*, 24(2), 337-353.
- Congleton, R. D. (1992). Political Institutions and Pollution Control. *The Review of Economics and Statistics*, 74(3), 412-421.
- Copeland, B. R., & Taylor, M. S. (2004). Trade, Growth, and the Environment. *Journal of Economic Literature*, 42(1), 7-71.
- Culas, R. J. (2007). Deforestation and the environmental Kuznets curve: An institutional perspective. *Ecological Economics*, 61(2-3), 429-437.
- Dasgupta, S., Laplante, B., Wang, H., & Wheeler, D. (2002). Confronting the environmental Kuznets curve. *The Journal of Economic Perspectives*, 16(1), 147-168.
- Dinda, S. (2004). Environmental Kuznets curve hypothesis: a survey. *Ecological Economics*, 49(4), 431-455.
- Dockery, D. W., Speizer, F. E., Stram, D. O., Ware, J. H., Spengler, J. D., & Ferris Jr, B. G. (1989). Effects of inhalable particles on respiratory health of children. *American Review of Respiratory Disease*, 139(3), 587-594.
- Dunlap, R. E., Gallup Jr, G. H., & Gallup, A. M. (1993). Of global concern: Results of the health of the planet survey. *Environment: Science and Policy for Sustainable Development*, 35(9), 7-39.
- Dunlap, R. E., & Mertig, A. G. (1995). Global concern for the environment: is affluence a prerequisite? *Journal of Social Issues*, 51(4), 121-137.
- Dunlap, R. E., & Mertig, A. G. (1997). Global environmental concern: An anomaly for postmaterialism. *Social Science Quarterly*, 78(1), 24-29.
- Ebi, K. L., Mearns, L. O., & Nyenzi, B. (2003). Weather and climate: changing human exposures. *Climate Change and Health: Risks and Responses (McMichael AJ, Campbell-Lendrum DH, Corvalan CF, Ebi KL, Githeko A, et al., eds). Geneva: World Health Organization.*
- Economist, The. (2009). A bad climate for development. URL: <http://www.economist.com/node/14447171> (Accessed July 2, 2014).
- Everett, T., Ishwaran, M., Ansaloni, G. P., and Rubin, A. (2010). Economic Growth and the Environment. *Department for Environment, Food and Rural Affairs Evidence and Analysis Series*, Paper 2.

- Ezzati, M., & Kammen, D. M. (2001). Quantifying the effects of exposure to indoor air pollution from biomass combustion on acute respiratory infections in developing countries. *Environmental Health Perspectives*, 109(5), 481.
- Fankhauser, S., & McDermott, T. K. (2014). Understanding the adaptation deficit: why are poor countries more vulnerable to climate events than rich countries? *Global Environmental Change*, 27, 9-18.
- Farrar, D. E., & Glauber, R. R. (1967). Multicollinearity in regression analysis: the problem revisited. *The Review of Economic and Statistics*, 49(1), 92-107.
- Farzin, Y. H., & Bond, C. A. (2006). Democracy and environmental quality. *Journal of Development Economics*, 81(1), 213–235.
- Gallagher, K. P. and Thacker, S. C. (2008). *Democracy, Income, and Environmental Quality*. Political Economy Research Institute Working Paper Number 164.
- Gangadharan, L., & Valenzuela, M. R. (2001). Interrelationships between income, health and the environment: extending the Environmental Kuznets Curve hypothesis. *Ecological Economics*, 36(3), 513-531.
- Giovanis, E. (2013). Environmental Kuznets Curve: evidence from the British household panel survey. *Economic Modelling*, 30, 602-611.
- Glaeser, E. L., La Porta, R., Lopez-de-Silanes, F., & Shleifer, A. (2004). Do institutions cause growth? *Journal of Economic Growth*, 9(3), 271-303.
- Gleditsch, N. P., & Sverdrup, B. O. (2003). Democracy and the Environment. In *Human Security and the Environment: International Comparisons*, edited by Edward Paper and Michael Redclift. London: Elgar.
- Grossman, G. M., & Krueger, A. B. (1991). Environmental impacts of a North American Free Trade Agreement. National Bureau of Economic Research Working Paper 3914, NBER, Cambridge MA.
- Grossman, G. M., and Krueger, A. B. (1995). Economic Growth and the Environment. *The Quarterly Journal of Economics*, 110(2), 353-377.
- Harbaugh, W. T., Levinson, A., & Wilson, D. M. (2002). Reexamining the empirical evidence for an environmental Kuznets curve. *Review of Economics and Statistics*, 84(3), 541-551.
- Hardin, G. (1968). The tragedy of the commons. *Science*, 162(3859), 1243-1248.
- Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica*, 46(6), 1251-1271.

- He, J. (2006). Pollution haven hypothesis and environmental impacts of foreign direct investment: The case of industrial emission of sulfur dioxide (SO<sub>2</sub>) in Chinese provinces. *Ecological Economics*, 60(1), 228-245.
- He, J. (2007). Is the Environmental Kuznets Curve hypothesis valid for developing countries? A survey. *Cahier de Recherche, GREDI*, 07–03.
- Heil, M. T., & Selden, T. M. (2001). International trade intensity and carbon emissions: a cross-country econometric analysis. *The Journal of Environment & Development*, 10(1), 35-49.
- Hitam, M. B., & Borhan, H. B. (2012). FDI, growth and the environment: impact on quality of life in Malaysia. *Procedia-Social and Behavioral Sciences*, 50, 333-342.
- Hoek, G., Schwartz, J. D., Groot, B., & Eilers, P. (1997). Effects of ambient particulate matter and ozone on daily mortality in Rotterdam, the Netherlands. *Archives of Environmental Health: An International Journal*, 52(6), 455-463.
- Holtz-Eakin, D. and Seldon, T. M. (1992). Stoking the Fires? CO<sub>2</sub> Emissions and Economic Growth. *NBER Working Paper Series*, Working Paper No. 4248.
- Inglehart, R. (1990). *Culture shift in advanced industrial society*. Princeton University Press.
- Inglehart, R. (1995). Public Support for Environmental Protection: Objective Problems and Subjective Values in 43 societies. *PS: Political Science & Politics*, 28(01), 57–72.
- Inglehart, R. (1997). *Modernization and Postmodernization: Cultural, Economic, and Political Change in 43 Societies*. Princeton, NJ: Princeton University Press
- Intergovernmental Panel on Climate Change (2007). Climate Change Synthesis Report. URL: [http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4\\_syr.pdf](http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf) (Accessed August 7, 2014).
- Israel, D. and Levinson, A. (2004). Willingness to pay for environmental quality: testable empirical implications of the growth and environment literature. *Contributions to Economic Analysis & Policy*, 3, Article 2.
- Jänicke, M. (1992). Conditions for environmental policy success: an international comparison. *Environmentalist*, 12(1), 47-58.
- John, A., & Pecchenino, R. (1994). An overlapping generations model of growth and the environment. *The Economic Journal*, 104 (427), 1393-1410.
- Kaufmann, D., Kraay, A., & Mastruzzi, M. (2004). Governance matters III: Governance indicators for 1996, 1998, 2000, and 2002. *The World Bank Economic Review*, 18(2), 253-287.
- Kearsley, A., & Riddel, M. (2010). A further inquiry into the Pollution Haven Hypothesis and the Environmental Kuznets Curve. *Ecological Economics*, 69(4), 905-919.

- KuÈnzli, N., Kaiser, R., Medina, S., Studnicka, M., Chanel, O., Filliger, P., ... & Sommer, H. (2000). Public-health impact of outdoor and traffic-related air pollution: a European assessment. *The Lancet*, 356(9232), 795-801.
- Kuznets, S. (1955). Economic Growth and Income Inequality. *The American Economic Review*, 45(1), 1-28.
- Lee, C. C., Chiu, Y. B., & Sun, C. H. (2010). The environmental Kuznets curve hypothesis for water pollution: Do regions matter? *Energy Policy*, 38(1), 12-23.
- Levinson, A., & Taylor, M. S. (2008). Unmasking the pollution haven effect. *International Economic Review*, 49(1), 223-254.
- Li, Q., & Reuveny, R. (2003). Economic globalization and democracy: An empirical analysis. *British Journal of Political Science*, 33(01), 29-54.
- Li, Q., & Reuveny, R. (2006). Democracy and environmental degradation. *International Studies Quarterly*, 50(4), 935-956.
- List, J. A., & Co, C. Y. (2000). The effects of environmental regulations on foreign direct investment. *Journal of Environmental Economics and Management*, 40(1), 1-20.
- List, J. A. & Gallet, C. A. (1999). The Environmental Kuznets curve: does one size fit all? *Ecological Economics*, 31(3), 409-423.
- Londregan, J. B., & Poole, K. T. (1996). Does high income promote democracy? *World Politics*, 49(01), 1-30.
- Lopez, R. (1994). The environment as a factor of production: the effects of economic growth and trade liberalization. *Journal of Environmental Economics and Management*, 27(2), 163-184.
- Lopez, R., & Mitra, S. (2000). Corruption, pollution, and the Kuznets environment curve. *Journal of Environmental Economics and Management*, 40(2), 137-150.
- Martínez-Alier, J. (1995). The environment as a luxury good or “too poor to be green”? *Ecological Economics*, 13(1), 1-10.
- Marshall, M. G., & Jaggers, K. (2002). Polity IV Project: Political Regime Characteristics and Transitions, 1800-2002: Dataset Users' Manual. Maryland: University of Maryland.
- McCann, L. (2013). Transaction costs and environmental policy design. *Ecological Economics*, 88, 253-262.
- Mertz, O., Halsnæs, K., Olesen, J. E., & Rasmussen, K. (2009). Adaptation to climate change in developing countries. *Environmental Management*, 43(5), 743-752.



- Midlarsky, M. I. (1998). Democracy and the environment: an empirical assessment. *Journal of Peace Research*, 35(3), 341-361.
- Millimet, D. L., List, J. A., & Stengos, T. (2003). The environmental Kuznets curve: Real progress or misspecified models? *Review of Economics and Statistics*, 85(4), 1038-1047.
- Nelson, G. C., Rosegrant, M. W., Palazzo, A., Gray, I., Ingersoll, C., Robertson, R., ... & You, L. (2010). *Food security, farming, and climate change to 2050: Scenarios, results, policy options* (Vol. 172). Intl Food Policy Res Inst.
- Neumayer, E. (2004). National carbon dioxide emissions: geography matters. *Area*, 36(1), 33-40.
- Oladeji, J. O., & Oyesola, O. B. (2011). Use of Information and Communication Technologies (ICTs) Among Private Agricultural Organization Workers in Oyo State, Nigeria. *Journal of Agricultural & Food Information*, 12(3-4), 258-269.
- Onafowora, O. A., & Owoye, O. (2014). Bounds testing approach to analysis of the environment Kuznets curve hypothesis. *Energy Economics*, 44, 47-62.
- Orubu, C. O., & Omotor, D. G. (2011). Environmental quality and economic growth: Searching for environmental Kuznets curves for air and water pollutants in Africa. *Energy Policy*, 39(7), 4178-4188.
- Panayotou, T. (2003). Economic Growth and the Environment. *Economic Survey of Europe*, 2, 45-72.
- Panayotou, T. (1997). Demystifying the environmental Kuznets curve: turning a black box into a policy tool. *Environment and Development Economics*, 2(4), 465-484.
- Pope, C. A., Bates, D. V., & Raizenne, M. E. (1995). Health effects of particulate air pollution: time for reassessment? *Environmental Health Perspectives*, 103(5), 472-480.
- Porter, M. E., & Van der Linde, C. (1995). Toward a new conception of the environment-competitiveness relationship. *The Journal of Economic Perspectives*, 9(4), 97-118.
- Ravindra, K., Mittal, A. K., & Van Grieken, R. (2001). Health risk assessment of urban suspended particulate matter with special reference to polycyclic aromatic hydrocarbons: a review. *Reviews on Environmental Health*, 16(3), 169-189.
- Rothman, D. S. (1998). Environmental Kuznets curves—real progress or passing the buck? A case for consumption-based approaches. *Ecological Economics*, 25(2), 177-194.
- Scruggs, L. A. (1998). Political and economic inequality and the environment. *Ecological Economics*, 26(3), 259-275.

- Scruggs, L. A. (1999). Institutions and environmental performance in seventeen western democracies. *British Journal of Political Science*, 29(01), 1-31.
- Selden, T. M., & Song, D. (1994). Environmental quality and development: is there a Kuznets curve for air pollution emissions? *Journal of Environmental Economics and Management*, 27(2), 147-162.
- Shafik, N. & Bandyopadhyay, S. (1992). Economic Growth and Environmental Quality: Time Series and Cross-Country Evidence. Policy Research Working Paper No. WPS 904. Washington, D. C. The World Bank.
- Smarzynska Javorcik, B., & Wei, S. J. (2001). *Pollution havens and foreign direct investment: dirty secret or popular myth?* (No. 2966). CEPR Discussion Papers.
- Smith, K. R., Samet, J. M., Romieu, I., & Bruce, N. (2000). Indoor air pollution in developing countries and acute lower respiratory infections in children. *Thorax*, 55(6), 518-532.
- Sobhee, S. K. (2004). The environmental Kuznets curve (EKC): a logistic curve? *Applied Economics Letters*, 11(7), 449-452.
- Stern, D. I. (2004). The Rise and Fall of the Environmental Kuznets Curve. *World Development*, 32(8), 1419–1439.
- Stern, D. I., and Common, M. S. (2001). Is There an Environmental Kuznets Curve for Sulfur? *Journal of Environmental Economics and Management*, 41(2), 162–178.
- Stern, N. (2008). The economics of climate change. *The American Economic Review*, 98(2), 1-37.
- Stokey, N. L. (1998). Are there limits to growth? *International Economic Review*, 39(1), 1-31.
- Tamazian, A., Chousa, J. P., & Vadlamannati, K. C. (2009). Does higher economic and financial development lead to environmental degradation: evidence from BRIC countries. *Energy Policy*, 37(1), 246-253.
- Taylor, M. S. (2004). Unbundling the pollution haven hypothesis. *Advances in Economic Analysis & Policy*, 3(2), Article 8.
- Tietenberg, T. (2000). *Environmental and Natural Resource Economics*, 7th Edition, Pearson, Addison-Wesley, Boston, MA.
- United States Environmental Protection Agency (1995). National Air Quality and Emissions Trends Report. <http://www.epa.gov/airtrends/aqtrnd95/report/>. (Accessed July 8, 2014).
- Unruh, G. C and Moomaw, W. R. (1998). An Alternative Analysis of Apparent EKC-type Transitions. *Ecological Economics*, 25(2), 221-229.

- Van der Leun, J. C., & de Gruijl, F. R. (2002). Climate change and skin cancer. *Photochemical & Photobiological Sciences*, 1(5), 324-326.
- Vatn, A. (2005). Rationality, institutions and environmental policy. *Ecological Economics*, 55(2), 203-217.
- Vincent, J. R. (1997). Testing for Environmental Kuznets Curves within a Developing Country. *Environment and Development Economics*, 2(4), 417-431.
- Wagner, U. J., & Timmins, C. D. (2009). Agglomeration effects in foreign direct investment and the pollution haven hypothesis. *Environmental and Resource Economics*, 43(2), 231-256.
- World Bank (2007). Growth and CO<sub>2</sub> emissions: how do different countries fare. Environment Department, Washington, DC.
- World Health Organization (2014). Global Health Observatory Data Repository. URL: <http://apps.who.int/gho/data/node.main.140?lang=en>. (Accessed July 3, 2014).
- Xing, Y., & Kolstad, C. D. (2002). Do lax environmental regulations attract foreign investment? *Environmental and Resource Economics*, 21(1), 1-22.
- Yang, H., Zhou, Y., & Abbaspour, K. C. (2010). An Analysis of Economic Growth and Industrial Wastewater Pollution Relations in China. *Consilience: The Journal of Sustainable Development*, 4(1), 60-79.
- Zhang, Y. J. (2011). The impact of financial development on carbon emissions: An empirical analysis in China. *Energy Policy*, 39(4), 2197-2203.

**Appendix B:** Table II. List of countries for chapter 4

Africa			OECD	
Angola	Gabon	Nigeria	Australia	Japan
Benin	Gambia, The	Rwanda	Austria	Korea, Republic
Botswana	Ghana	Sao Tome and Principe	Belgium	Luxembourg
Burkina Faso	Guinea	Senegal	Canada	Netherlands
Burundi	Guinea – Bissau	Seychelles	Chile	New Zealand
Cape Verde	Kenya	Sierra Leone	Czech Republic	Norway
Cameroon	Lesotho	Somalia	Denmark	Poland
Central African Republic	Liberia	South Africa	Estonia	Portugal
Chad	Madagascar	Sudan	Finland	Slovak Republic
Comoros	Malawi	Swaziland	France	Slovenia
Congo, Democratic Republic of	Mali	Tanzania	Germany	Spain
Congo, Republic	Mauritania	Togo	Greece	Sweden
Cote Divoire	Mauritius	Uganda	Iceland	Switzerland
Equitorial Guinea	Mozambique	Zambia	Ireland	United Kingdom
Eritrea	Namibia	Zimbabwe	Israel	United States
Ethiopia	Niger		Italy	

## **CHAPTER 5**

### **CONCLUSION**

This dissertation extends our understanding of the relationships among economic growth, the environment and happiness. Premised on the fact that environmental pollution hurts the well-being of people, and because everyone wants to be happy, it compares these empirical relationships for residents of developed countries with those of developing countries, focusing on African countries. This focus is based in part on the fact that developing countries are generally more vulnerable to climate change and other environmental problems, and that Africa is the least happy region in the world.

Chapter 2 explores the relationship between perceived environmental quality and subjective well-being. Noting that environmental problems differ significantly across developed and developing countries, we examine the effect of local and global environmental problems on well-being. The measures of local environmental quality include poor water quality, poor air quality, and poor sewage and sanitation. On the other hand, global environmental quality measures are global warming and greenhouse effects, loss of animal or plant species and biodiversity, and the pollution of rivers, lakes and oceans. The empirical results reveal a negative and significant relationship between perceptions about the seriousness of poor local environmental quality and subjective well-being for both developed and developing countries. In other words, we find that each poor local environmental quality measure significantly diminishes well-being in both developed and developing countries. However, perceived poor global environmental quality is negatively correlated with happiness only for developed countries.

Chapter 3 contributes to the literature on the determinants of environmental concern. It investigates whether individual perceptions about their socioeconomic status are a good predictor

of environmental concern in both developed and developing countries. As measures of environmental concern, it focuses on whether people would choose environmental protection over economic growth and jobs, and the extent to which they are willing to make income sacrifices (give part of their income and/or agree to pay higher taxes) to prevent environmental pollution. The results show that in both developed and developing countries, individual perceptions about their socioeconomic status are positively correlated with environmental concern. Specifically, aside from choosing environmental protection over economic growth and job creation, people who perceive themselves as belonging to the working class, lower middle, upper middle and upper class are significantly more willing to make income sacrifices to prevent environmental pollution than those who believe they are in the lower class in both developed and developing countries.

Chapter 4 contributes to the literature on the relationship between economic growth and environmental pollution within the Environmental Kuznets Curve framework. It investigates whether the EKC hypothesis holds for two air pollutants ( $\text{CO}_2$  and  $\text{PM}_{10}$ ) in developed and developing countries. Results from fixed effects and random effects models using data for 47 African countries and 31 OECD countries reveal that the EKC hypothesis holds for both  $\text{CO}_2$  and  $\text{PM}_{10}$  for both samples. Further, our examination of the effect of democracy on air pollution reveals an insignificant effect for  $\text{CO}_2$  for both samples. However, democracy is positively and significantly correlated with  $\text{PM}_{10}$  emissions for African countries.

Indeed, climate change and other environmental problems are major public policy concerns among world leaders and researchers alike. To the extent that environmental degradation hurts human well-being, this dissertation provides some insights into the relative importance of local and global environmental problems for people in developed and African countries. The results of chapter 2 suggest that both local and global environmental problems significantly diminish the

happiness of people in developed countries. Conversely, only local environmental problems seem to matter for the happiness of people in African countries as global environmental problems are not significantly correlated with their happiness.

Additionally, the differences in perceptions about local and global environmental problems between respondents of African and developed countries reflect differences in actual environmental problems in these sets of countries. While perceptions about local environmental problems do not seem to influence the willingness to give income and/or willingness to pay higher taxes to prevent environmental pollution for respondents of developed countries, the reverse is true for people in Africa. Yet, perceptions about global environmental problems affect the willingness to sacrifice financial resources for the environment in both African and developed countries. Thus, it could be concluded that, consistent with Maslow's hierarchy of needs (Maslow, 1954), Inglehart's (1990, 1995, 1997) post-materialism hypothesis and his subsequent "objective problems and subjective values" argument may be at work. That is, environmental concern in Africa may be due to people's direct experiences with actual environmental problems. In developing countries, local environmental pollution remains a major challenge (e.g., World Health Organization, 2013; Bruce et al., 2000; Bulte and Van Soest, 2001). In fact, a substantial proportion of people in developing countries lack access to safe drinking water and improved sanitation (United Nations, 2014). Rivers, lakes and dams remain important sources of drinking water for many communities in developing countries (Hillie and Hlophe, 2007). On the other hand, the majority of the people especially in rural areas may not appreciate the implications of climate change and other global environmental problems; or even if they do, their concern about these problems may be relatively lower because these problems are "not in their backyard" (Beja, 2012).

The results of chapter 3 suggest that, while people in developed countries attach importance

to materialist and post-materialist values fairly equally, Africans rate materialist priorities relatively more importantly than post-materialist values. Furthermore, post-materialist publics in both African and developed countries appear to be more willing to make income sacrifices for the environment than people who hold materialist priorities. Again, this is unsurprising because when people have high crime rates, economic struggles and conflicts in their country, solving those problems takes precedence over agitating for “freedom of speech” or “giving people more say in important government decisions” (Inglehart, 1990, 1995, 1997).

The dissertation also demonstrates that African countries are on the rising portion of their EKC's especially for CO<sub>2</sub> emissions. This is because the majority of African countries have per incomes below the CO<sub>2</sub> turning incomes of about \$6,295.39 and \$7,753.35. Does that mean African countries should continue to pollute? As noted earlier on, developing countries, including African countries, are believed to be more vulnerable to climate change (Ebi et al., 2003; Mertz et al., 2009; Fankhauser and McDermott, 2014). Therefore, environmental policies in both developed and developing countries ought to aim to reduce CO<sub>2</sub> emissions as the United States and China recently agreed to do (Lander, 2014). The pursuit of economic growth should not compromise the natural environment (Lele, 1991; Giddings et al., 2002; Hopwood et al., 2005). African countries need to balance economic and environmental policies so that they do not face the kinds of environmental challenges other rapidly growing countries like India are being confronted with (see e.g., Pinto, 2014).

The empirical evidence on income-happiness relationships projects that higher incomes would increase average happiness (e.g., Easterlin, 1974, 1995, 2001; Diener and Biswas-Diener, 2002; Caporale et al., 2009; Ball and Chernova, 2008) although over time, higher incomes do not necessarily make people happier (Easterlin 1974, 1995, 2001, 2003). Scholarship also shows that



economic growth causes environmental pollution (Grossman and Krueger, 1991, 1995; Shafik and Bandyopadhyay, 1992; List and Gallet, 1999; Orubu and Omotor, 2011; Panayotou, 2003; Selden and Song, 1994; Stern, 2004; Stern and Common, 2001). Finally, the literature on the environment – happiness nexus reveals that environmental pollution diminishes happiness (e.g., Ferrer-i- Carbonell and Gowdy, 2007; Welsch, 2002, 2006, 2007; Welsch and Kuhling, 2009; Van Praag and Baarsma, 2005; Rehdanz and Maddison, 2005, 2008; Brereton et al., 2008; Luechinger, 2010; Cunado and de Gracia, 2013; Weinhold, 2013). So, what does this dissertation tell us about the relationships among economic growth, the environment and happiness? Because of the trade-offs among these variables, the overarching lesson from this dissertation is that developing countries, especially African countries, ought to pursue economic, environmental and well-being policies that could yield a balanced combination of optimal outcomes of these variables. In other words, while making efforts to raise average incomes and happiness, developing countries must be mindful of the environmental implications of economic growth and, therefore, design and implement policies that can generate sustainable development.

## References

- Ball, R., & Chernova, K. (2008). Absolute income, relative income, and happiness. *Social Indicators Research*, 88(3), 497-529.
- Beja, E. (2012). Subjective well-being approach to environmental valuation: evidence for greenhouse gas emissions. *Social Indicators Research*, 109(2), 243-266.
- Brereton, F., Clinch, J.P., & Ferreira, S. (2008). Happiness, geography and the environment. *Ecological Economics*, 65(2), 386-396.
- Bruce, N., Perez-Padilla, R., & Albalak, R. (2000). Indoor air pollution in developing countries: a major environmental and public health challenge. *Bulletin of the World Health Organization*, 78(9), 1078-1092.
- Bulte, E. H., & Van Soest, D. P. (2001). Environmental degradation in developing countries: households and the (reverse) Environmental Kuznets Curve. *Journal of Development Economics*, 65(1), 225-235.
- Caporale, G. M., Georgellis, Y., Tsitsianis, N., & Yin, Y. P. (2009). Income and happiness across Europe: Do reference values matter? *Journal of Economic Psychology*, 30(1), 42-51.
- Cunado, J. & de Gracia, F. P. (2013). Environment and Happiness: New Evidence for Spain. *Social Indicators Research*, 112(3), 549-67.
- Diener, E., & Biswas-Diener, R. (2002). Will money increase subjective well-being? A literature review and guide to needed research. *Social Indicators Research*, 57, 119-169.
- Easterlin, R. A. (1974). *Does Economic Growth Improve the Human Lot? Some Empirical Evidence*. In: Paul A. David and Melvin W. Reder (eds). *Nations and Households in Economic Growth: Essays in Honor of Moses Abramowitz*. New York: Academic Press: 89-125.
- Easterlin, R. A. (1995). Will raising the incomes of all increase the happiness of all? *Journal of Economic Behavior & Organization*, 27(1), 35-47.
- Easterlin, R. A. (2001). Income and Happiness: Towards a Unified Theory. *The Economic Journal*, 111(473), 465-484.
- Easterlin, R. A. (2003). Explaining happiness. *Proceedings of the National Academy of Sciences*, 100(19), 11176-11183.
- Ebi, K. L., Mearns, L. O., & Nyenzi, B. (2003). Weather and climate: changing human exposures. *Climate Change and Health: Risks and Responses (McMichael AJ, Campbell-Lendrum DH, Corvalan CF, Ebi KL, Githeko A, et al., eds)*. Geneva: World Health Organization.

- Fankhauser, S., & McDermott, T. K. (2014). Understanding the adaptation deficit: why are poor countries more vulnerable to climate events than rich countries? *Global Environmental Change*, 27, 9-18.
- Ferrer-i-Carbonell, A. & Gowdy, J. M. (2007). Environmental degradation and happiness. *Ecological Economics*, 60(3), 509–516.
- Giddings, B., Hopwood, B., & O'brien, G. (2002). Environment, economy and society: fitting them together into sustainable development. *Sustainable Development*, 10(4), 187-196.
- Grossman, G. M., & Krueger, A. B. (1991). Environmental impacts of a North American Free Trade Agreement. National Bureau of Economic Research Working Paper 3914, NBER, Cambridge MA.
- Grossman, G. M., and Krueger, A. B. (1995). Economic Growth and the Environment. *The Quarterly Journal of Economics*, 110(2), 353-377.
- Hillie, T., & Hlophe, M. (2007). Nanotechnology and the challenge of clean water. *Nature Nanotechnology*, 2(11), 663-664.
- Hopwood, B., Mellor, M., & O'Brien, G. (2005). Sustainable development: mapping different approaches. *Sustainable Development*, 13(1), 38-52.
- Inglehart, R. (1990). *Culture shift in advanced industrial society*. Princeton University Press.
- Inglehart, R. (1995). Public Support for Environmental Protection: Objective Problems and Subjective Values in 43 societies. *PS: Political Science & Politics*, 28(01), 57–72.
- Inglehart, R. (1997). *Modernization and Postmodernization: Cultural, Economic, and Political Change in 43 Societies*. Princeton, NJ: Princeton University Press.
- Lander, M. (2014). U.S. and China Reach Climate Accord After Months of Talks. *The New York Times*, November 11, 2014. URL: <http://www.nytimes.com/2014/11/12/world/asia/china-us-xi-obama-apec.html?module=Search&mabReward=relbias%3As%2C%7B%22%22%3A%22RI%3A12%22%7D&r=0>. Accessed December 3, 2014.
- Lele, S. M. (1991). Sustainable development: a critical review. *World development*, 19(6), 607-621.
- List, J. A. & Gallet, C. A. (1999). The Environmental Kuznets curve: does one size fit all? *Ecological Economics*, 31(3), 409-423.
- Luechinger, S. (2010). Life satisfaction and transboundary air pollution. *Economics Letters*, 107(1), 4–6.

- Maslow, A. H. (1954). *Motivation and Personality*. New York: Harper.
- Mertz, O., Halsnæs, K., Olesen, J. E., & Rasmussen, K. (2009). Adaptation to climate change in developing countries. *Environmental Management*, 43(5), 743-752.
- Orubu, C. O., & Omotor, D. G. (2011). Environmental quality and economic growth: Searching for environmental Kuznets curves for air and water pollutants in Africa. *Energy Policy*, 39(7), 4178-4188.
- Panayotou, T. (2003). Economic Growth and the Environment. *Economic Survey of Europe*, 2, 45-72.
- Pinto, J. (2014). In India, Growth Breeds Waste. *The New York Times*, November 16, 2014. URL: [http://www.nytimes.com/2014/11/17/opinion/in-india-growth-breeds-waste.html?emc=edit\\_th\\_20141118&nl=todaysheadlines&nlid=37857173](http://www.nytimes.com/2014/11/17/opinion/in-india-growth-breeds-waste.html?emc=edit_th_20141118&nl=todaysheadlines&nlid=37857173). Accessed December 3, 2014.
- Rehdanz, K. & Maddison, D. (2005). Climate and Happiness. *Ecological Economics*, 52(1), 111-125.
- Rehdanz, K. & Maddison, D. (2008). Local environmental quality and life-satisfaction in Germany. *Ecological Economics*, 64(4), 787 – 797
- Selden, T. M., & Song, D. (1994). Environmental quality and development: is there a Kuznets curve for air pollution emissions? *Journal of Environmental Economics and Management*, 27(2), 147-162.
- Shafik, N. & Bandyopadhyay, S. (1992). Economic Growth and Environmental Quality: Time Series and Cross-Country Evidence. Policy Research Working Paper No. WPS 904. Washington, D. C. The World Bank.
- Stern, D. I. (2004). The Rise and Fall of the Environmental Kuznets Curve. *World Development*, 32(8), 1419–1439.
- Stern, D. I., and Common, M. S. (2001). Is There an Environmental Kuznets Curve for Sulfur? *Journal of Environmental Economics and Management*, 41(2), 162–178.
- United Nations (2014). The Millennium Development Goals Report. New York, United Nations.
- Van Praag, B.M.S., Baarsma, B.E. (2005). Using happiness surveys to value intangibles: the case of airport noise. *The Economic Journal*, 115(500), 224–246.
- Weinhold, D. (2013). The Happiness-reducing Costs of Noise Pollution. *Journal of Regional Science*, 53(2), 292-303.
- Welsch, H. (2002). Preferences over prosperity and pollution: environmental valuation based on happiness surveys. *Kyklos*, 55 (4), 473–494.

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

Welsch, H. (2007). Environmental welfare analysis: A life satisfaction approach. *Ecological Economics*, 62(3), 544-551.

Welsch, H. (2008). The welfare costs of corruption. *Applied Economics*, 40(14), 1839–1849.

Welsch, H. & Kuhling, J. (2009). Using happiness data for environmental valuation: Issues and Application. *Journal of Economic Surveys*, 23(2), 385 - 406.

World Health Organization. (2013). *The World Health Report 2013: Research for Universal Health Coverage*. World Health Organization.

## VITA

Iddisah Sulemana was born on 8<sup>th</sup> February 1981 in Tuna, a village in the Northern Region of Ghana. After obtaining distinction at both the Basic Education Certificate Examination (1997) and the Senior Secondary School Certificate Examination (2000) from St. Peter's J.S.S, Tuna and Ghana Secondary School, Tamale, respectively, he proceeded to the University of Ghana, Legon in 2002 where he obtained a Bachelor's degree in Economics in 2006, graduating with First Class Honors. At the University of Ghana, he was awarded the Sadhu T. L. /Vaswani Indian Association Scholarship for Excellent Performance in Economics (2005) and the Professor Ben Amoako-Adu's Award for Best Graduating Student in Economics (2006). In 2010, Mr. Sulemana received a Master of Arts in Economics from The University of Akron, Ohio, USA. He also holds a Master's degree in Economics from the University of Missouri (awarded December 2012) where he completed his Doctoral Degree in Agricultural and Applied Economics in 2014. He enjoys watching soccer, (American) football and basketball.