

ENVIRONMENTAL CONCERN AND PRO-ENVIRONMENTAL BEHAVIORS:
ATTITUDES AND BEHAVIORS IN URBAN CHINESE RESIDENTS

By

CHUNTIAN LU

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirement
for the degree of

DOCTOR OF PHILOSOPHY

Sociology

2012

ABSTACT

ENVIRONMENTAL CONCERN AND PRO-ENVIRONMENTAL BEHAVIORS: KNOWLEDGE, ATTITUDES AND BEHAVIORS IN RUBAN CHINESE RESIDENTS

By

CHUNTIAN LU

Since 1978, China's rapid economic growth has also generated numerous environmental problems, which cause substantial economic losses, social conflict, and rising health costs. This requires us to examine the factors affecting attitudes and behaviors toward the environment among the Chinese. This study used data from 2003 General Social Survey in China to answer the following questions: Is the measurement of environmental concern in China different from in western societies? Will the selection of particular measure of environmental concern affect its relation to social-demographic variables? What are the effects of individual and community level variables on two types of environmental behaviors?

The results showed that environmental concern in China includes four dimensions: economical trade off, pro-environmental behaviors, perceived locally environmental problems and NEP. However, the results are somewhat different from those in western societies. The analysis suggests that more attention should be paid to the selection of particular measure of environmental concern and demonstrates that it really makes a difference how environmental concern is measured. Our findings indicate that except for gender and income, the effects of other individual variables follow the same pattern as in the West. As for municipal level variables, our analysis demonstrates that the affluence hypothesis, which states that the level of national income per capita influences the level of environmental concern, is partially supported while the objective hypothesis, which argues that the rising of environmental concern is consequence of deteriorating objective environmental problems, is not fully supported here.

This research provides some guidelines for future study of environmental concern and fills an important gap in the environmental attitudes and behaviors research in China.

ACKNOWLEDGMENT

I owe my gratitude to all those people who have made this dissertation possible and because of whom my graduate experience has been one that I will cherish forever.

My deepest gratitude is to my major advisor, Dr. Stan Kaplowitz. I would like to sincerely thank Dr. Kaplowitz for his intellectual guidance and strong support whenever and for whatever I need. His extensive experience in quantitative methodology and insightful understanding on attitudes and behavior exhibit me an exciting world for exploring. I am always impressed by his enthusiasm on research, his hard working, and his visions on new research fields.

Thanks from my heart also go to Dr. Zhenmei Zhang. I am grateful to her for providing me opportunities to touch on various projects. Her instructions help me enrich but focus my ideas at different stages. I also appreciate her support all the time, and her care about my living at school. I would like to extend my special thanks to my committee members, Dr. Sandra Marquart-Pyatt and Dr. Aaron McCright. Their insightful critics, constructive comments, guidance, and careful reviews on my dissertation help me overcome difficulties and finalize my research. I am also grateful for their kind understanding, patience and encouragement when I was slow of going forward.

I am also grateful to faculty and staff at the Department of Sociology. I learned a lot from classes, seminars and discussions; and helps from staff make it so comfortable studying at the Department. I would also like to express gratitude to my graduate colleagues and friends at MSU. Their care and friendships make my staying and working at MSU an enjoyable and awarding experience.

Finally, and the most importantly, I would like to thank my parents Yongkang Lu and Caiying Huang, my sister Chunyu Lu, and my brothers Chunhui Lu and Chunfeng Lu and their

families. They are there for me all the time and home is always the place I most dream to go. My family accompanied me going through all ups and downs, and I would not ask more than they always give me: love, care, encouragement, strength and happiness.

TABLE OF CONTENTS

LIST OF TABLES	viii
LIST OF FIGURES	ix
Chapter 1 Introduction	1
1.1 Background	1
1.2 The Purpose of This Study.....	4
1.3 Research Questions	6
1.4 Dissertation Outline	7
BIBLIOGRAPHY	10
Chapter 2 Environmental Concern in China	13
2.1 Background	13
2.2 A Brief Introduction of Environmental Concern	15
2.3 Literature on the Dimensions of Environmental Concern	17
2.4 Data and Method	22
2.5 Measurement Model of Environmental Concern.....	24
2.6 Result and Discussion	31
2.7 Conclusion	37
BIBLIOGRAPHY	40
Chapter 3 Social Demographic Characteristics of Environmental Concern	44
3.1 Introduction	44
3.2 Literature Review.....	46
3.3 Data and Method	52
3.4 Results	58
3.5 Discussion	61
3.6 Conclusion and Summary	64
BIBLIOGRAPHY	66
Chapter 4 Multi-level Analysis of Urban Chinese Residents' Environmental Attitude and Behaviors	71
4.1 Introduction	71
4.2 Literature Review.....	73
4.2.1 Individual-Level Variables: Socio-demographic Characteristics	74
4.2.2 Individual Level Variables: Socio-psychological Characteristics	77
4.2.3 Contextual -Level Variables	78
4.3 Data Sources	81
4.3.1 Variables Measurement: Dependent Variables.....	82
4.3.2 Independent variables	84
4.5 Analysis Strategy	88

4.6 Results.....	91
4.7 Discussions and Conclusion	99
BIBLIOGRAPHY	105
Chapter 5 Conclusion and Discussion	110
5.1 Overview	110
5.2 Summary of Research Findings	110
5.3 Significance and Limitations of the Study.....	113
BIBLIOGRAPHY	116

LIST OF TABLES

Table 2-1 Discription of Indicators	30
Table 2-2 Unstandardized (Standardized) Factor Loading from CFA	32
Table 2-3 Correlation among these Four Factors	34
Table 3-1 Three Items of Pro-environmental Behaviors	55
Table 3-2 Seven Items of the Perceived Local Environmental Problems	56
Table 3-3 Six Items of New Environmental Paradigm Scale Items and Percentage Frequencies in China and U.S.	56
Table 3-4 Social Demographic and Economic Variables	58
Table 3-5 Standardized Regression Coefficients on Each of Four Factors.....	59
Table 4-1 Six New Environmental Paradigm Scale Items and Percentage Frequencies	82
Table 4-2 Ten Items of Environmental Behaviors and Percentage Frequencies	84
Table 4-3 Seven Items of the Perceived Local Environmental Problems and Percentage Frequencies	85
Table 4-4 Descriptions of City Level Variables	87
Table 4-5 City Level Variables Correlation Matrix.....	87
Table 4-6 Multi-level Analysis of Environmental Attitudes	92
Table 4-7 Multi-level Analysis of Private Environmental Behaviors	95
Table 4-8 Multi-level Analysis of Public Environmental Behaviors.....	98

LIST OF FIGURES

Figure 2-1 Measurement Model of Environmental Concern.....	28
Figure 3-1 Socio-demographic characteristics of Environmental Concern.....	53

Chapter 1 Introduction

1.1 Background

Since the start of economic reform in 1978, China's rapid economic growth has become a major driving force in the global economy with an average annual GDP growth rate of 8%, which has lifted nearly 400 million people out of poverty between 1979 and 2005. However, China's rapid economic growth has also generated numerous major environmental problems. These problems not only threaten the health and prospects of current and future generations, but also undermine the sustainability of long-term growth. For example, according to a report in *People Daily* on Aug 11th, 2009, more than 300 children suffered from lead poisoning that was likely caused by pollution from a smelter in Shanxi Province. This incident was only one of a recent string of pollution disasters in China that have prompted social discontents and violent protests in some areas. News reports are showing that such incidents have become common in other provinces of China.

Current severe environmental degradation in China cannot wholly be attributed to economic policies and development strategies in the post-reform period. It is also related to economic policies and development philosophy of Chinese Communist Party in the era of Mao Zedong, who controlled absolute ruling power in China until he died in 1976. Under Mao, the traditional Chinese ideal of "harmony between heaven and humans" was abrogated and in favor of Mao's insistence that "man must conquer nature." Then, nature was the enemy to be conquered, but it was not the only one. Anyone who disagreed with Mao was also viewed as a public enemy too. According to Shapiro's research (Shapiro,2001), a series of utopian mass development campaign such as Great Leap Forward aiming to achieve unrealistic steel production, led to ecosystem collapse in many of China's rural areas and create a famine that claimed 30 million lives. During

Mao's period, attempts to conquer nature reached the peak and environmental degradation in effect became a state policy (Shapiro, 2001).

The past command economy established in the Mao time has been abandoned and transformed to a market orientated economy during the reform period.

However, China is still regarded as an authoritarian state. This authoritarian state has made a deliberate effort to pursue economic growth while maintaining the rule of the Chinese communist party. This effort is evidenced by its decisions on issues such as large construction projects. One obvious example is the construction of the Three Gorges Dam. Although concerned scientists and scholars gave the warning that the project might be an ecological and social disaster, the Chinese government regarded this dam as a sign of the advantages of socialism. Political repression and forced relocations in the Three Gorges Dam project have demonstrated that the Chinese government has not learned the lessons from the past causalities of the wars against nature. The Three Gorges Dam is just one of a numerous big projects during the period of the market transition of China. Today, more and more Chinese people are involuntarily involved in the side effects of these projects due to combination of command economy and authoritarian state.

China's environmental damage is not restricted to its borders, as its environmental problems affect other countries. China is now the largest emitter of global greenhouse gasses. It was reported that its dust and aerial pollutants are transported eastwards to neighboring countries and even to North America. China also surpassed the United States to become the largest source of carbon dioxide, which is a main factor causing global warming. China accounts for 33% of global fish and seafood consumption and 15% of the world fish catch (Liu & Diamond, 2005).

As a 'world factory', China not only exports products around the world but also consumes and imports raw materials and natural resources. By doing so, it leaves pollutants in its wake.

At the same time, other countries also impact China's environment through globalization and pollution transferring. In 1980, China produced 1.0% in world trade exports, while in 2003 China produces 5.8% in world trade exports (Rumbaugh and Blancher, 2004). Such fast increases also let China overuse its internal natural resources and raw materials from other countries. China holds 37% of total exports to the advanced countries market, and these countries include the United States, Japan and European Union (Rumbaugh and Blancher, 2004)

Increasing international exports means advanced countries also contribute to environmental problems in China. In 2006, China attracted the most foreign direct investments among developing countries, ranking the third worldwide. For the foreign investors from advanced countries or areas, maximizing their profit is their interest, Therefore, they tend to transfer their investments to countries with weak environmental protections to locate their polluting facilities and will use their influences to make those protections weak (Shandra, John M, Bruce London, Owen P Whooley, and John B Williamson, 2004). Although China's per capita environmental impact is still far below that of developed countries, there is no doubt that the increase in total human impacts on the world's environments will be enormous if China's per capita impact catches up with middle-income level countries, let alone the US. Globalization may be partly to blame for this situation, but it is hardly the only explanation.

There is a growing literature on the nature and scale of environmental destruction in China (World Bank & SEPA, 2007). The environmental problems includes air pollution, concerns over biodiversity, water pollution, and desertification, salinization, soil erosion and the accumulation of trash. All of these problems cause substantial economic losses, social conflict, and rising

health costs in China. According to a recent report published in 2008, environmental problems had become regarded as a top ten social problem in China (Chinese Environmental and Cultural Advance Association, 2008). It is estimated that in the next ten years, the success of sustainable development in China depends on whether the country can curtail this trend of environmental degradation.

The spread of global, national and local environmental problems in the 1980s has led the Chinese government and its citizens to recognize the importance of nature and the need for its protection. For example, when the United Nations Conference on Environment and Development (UNCED) was held in Rio de Janeiro in 1992, the Chinese government launched a call for a massive environmental education campaign. The national postal service of China even published a series of stamps to mark the importance of this meeting. Since that meeting, many new terms linked to the environment, such as *acid rain*, *bio-diversity* and *sustainable development* have gradually come to be accepted by most Chinese. Therefore, protection of the natural environment has become an emergent and important task within the national agenda as well as a focal point for academic research.

1.2 The Purpose of This Study

Human behavior is the product of individual and collective values. With regards to environmental degradation in China, some scholars try to seek answers from the traditions and values which underpinned the action logics behind the Chinese behaviors. Harris (2004), for example, argued that some traditional values which may offer benign guidelines for environmental protection are impotent when placed against new consumption habits that mimic those in the West. Peterson (2001: 96) has argued that “attitudes toward the environment in China are not Western in origin, but stem from values and belief rooted in such religious

institutions as Buddhism, Confucianism and Taoism”. However, Li (1998) believes that Confucianism, despite any non-anthropocentric orientation, can help to mitigate the recent trend of environmental destruction. Scholars and policymakers have offered several solutions to environmental pollutions in China. Some believe that technical and economic development will eventually solve environmental problems as proponent of environmental Kuznets curve propose. Others suggest that humans should pay attention to current knowledge, attitudes and behaviors related to the environment. That is, human attitudes and behaviors must be changed to be compatible with the environment. Instead of seeking an explanation buried in past traditions and value, I focus on the state of environmental concern and behaviors rooted in contemporary Chinese daily life.

Current environmental degradation requires us to take a close look at the factors affecting knowledge of, and attitudes and behaviors toward the environment among the Chinese. Harris (2006) found that Chinese people tended to hold anthropocentric viewpoints of and instrumental values toward, , the natural world. That is, nature is meant to serve humans. With this in mind, it is not surprising that economic growth takes priority over environmental protection. Due to its large population and the scale of its current economic development, Harris (2006:5) concluded “one would be hard pressed to find a more explicit and profound example of how human behavior can adversely affect the ecological environment than the ongoing experience of China.”

Measuring the level of environmental concern, attitudes, and behaviors among the Chinese will be extremely important to develop a new approach to environmental protection. Without having environmental concern, it is difficult for the public to understand the need for sustainable environmental behaviors. Therefore, developing a conceptual framework explaining

environmental concern is also important to understand the underlying forces related to environmental behaviors in China.

1.3 Research Questions

There has been much research done on environmental concern and pro-environmental behaviors in developed countries. However, very little effort has been expended on systematic investigations of environmental attitudes and different types of environmental behaviors in China. Several scholars have pointed out that determinants of environmental views and behaviors vary between countries and cultures (Hunter 2000, Marguart-Pyatt 2007). Considering the huge differences between China and most western countries, not only in their political structure but also in their cultures, it is time to study environmental concern and its causes in the social context of China and reveal its social differences of individual environmental concerns and build an appropriate model for further behavior analysis. Although some Chinese scholars have conducted similar research (Shen and Saijo, 2008), their investigations were restricted to a few large cities. Due to the fact that China is the largest developing country as well as its huge impact on global environmental protection, our research aims to fill this gap through a national urban survey.

To assess the current state and nature of environmental concern, and behavior in China today, this research focused on the expressed opinions about the new environmental paradigm and related issues and reported environmental behaviors of a general social survey of China in 2003. It also uses a 2003 urban statistical book, from which our community level variables such as GDP per capital and pollution indicators are extracted. The following research questions are addressed:

1) How many dimensions should be used to measure environmental concern in China and are these dimensions different from those in Western societies?

2) How will the selection of particular measure of environmental concern affect its relation to social-demographic variables?

3) Controlling for individual socio-demographic variables, what is the effect of the community level variables such as GDP per capita, local air or water pollution level, or industry structure in the individual's community on environmental attitudes and behaviors?

1.4 Dissertation Outline

In addition to this introduction and the summary chapter, this dissertation includes the following three papers.

Paper one (Chapter 2): The debate on dimensionality of environmental concern still remains. Inferring from the concept of environmental concern defined by Dunlap and Jones, I attempt to model measures of environmental concern based on the data collected in 2003 Chinese General Social Survey through CFA analysis. I assumed that our measurement model includes four latent factors: balance between economic development and environmental protection, perceived local environmental problems, pro-environmental behaviors and New Ecological Paradigm. The first order measurement model has a higher CFI and different strength and direction of association among those four dimensions than the second order measurement model. Therefore, I argue that the first order measurement model fits better than its second order measurement model. In addition, the strength and direction of relations among those four factors indicate that environmental concern is not a single attitudinal dimension, as some scholars have argued. It also suggests that modeling environmental concern is complex due to it having multiple dimensions.

Paper two (Chapter 3): There is a lot of research that has been done on the social bases of environmental concern in the Western society. However, we still know little about this in Chinese society. Employing 2003 Chinese General Social Survey data, I examined the five hypotheses which are summarized from the literature review through the structural equation model. Different from results in the Western society, our research indicates that old men have more environmental concern than young women. People living in the metropolitan areas have more environmental concern than those living in the small or midsize cities. As expected, education is positively related to environmental concern; while income has no effects on the environmental concern. The inconsistent results on the social base of environmental concern between the Western society and Chinese society deserve further study.

Paper three (Chapter 4): Using 2003 Chinese General Social Survey Data and some selected variables from Urban Statistical Book in China, I use a Hierarchical Linear and Nonlinear Model based on the proposed analytic framework will estimate the effects of individual and municipal level variables on environmental attitudes and two types of environmental behaviors: public vs. private behaviors. In the individual level, I find that education and gender are two strongest predictors. Our analysis shows that different from our expectation, some environmental pollution indicators in municipal level do not play a significant role in environmental attitude and two type of pro-environment behavior. In addition, some economic indicators in municipal level, such as GDP per capita are also not significantly related to some type of pro-environmental behavior. This result challenges our traditional wisdom. This study has also great policy implications for government policy making. It will help government agencies develop more effective environmental policies, which lead more and more pro-environmental behaviors.

Finally, is the chapter of summary and conclusions. This session outlines some important research conclusions from those three papers. Through the analysis of CGSS2003 data, I find that the dimensionality of environmental concern includes four dimensions, which share some commonalities as well as differences with previous research in the Western society. In the multi-level analysis of environmental attitudes and pro-environmental behaviors, the results indicate that objective problem hypothesis does not get a full support in the Chinese situation. In the end, this session discusses their policy implications and data limitations.

BIBLIOGRAPHY

BIBLIOGRAPHY

China Environmental and Cultural Advance Association. (2008). Chinese Public Environmental Protection Index

<http://www.tt65.net/zhuanli/zhishu/2008gongzhongzhishu/zishuzongshu2008.pdf>.

Harris, P. G. (2004). "Getting rich is glorious": Environmental values in the People's Republic of China. *Environmental Values*, 13, 145-165.

Harris, P. G. (2006). Environmental Perspectives and Behavior in China - Synopsis and Bibliography. *Environment and Behavior* 38(1), 5-21.

Hunter, L. M. (2000). A Comparison of the Environmental Attitudes, Concern, and Behaviors of Native-born and Foreign- Born U.S. Residents. *Population and Environment: A Journal of Interdisciplinary Studies*, 21, 565-580.

Li, H.-l. (1998). Some Thoughts on Confucianism and Ecofeminism. In M. E. Tucker & J. Berthrong (Eds.), *Confucianism and Ecology: The Interrelation of Heaven, Earth, and Humans* (pp. 293-307). Cambridge, MA: Harvard University Press.

Liu, J., & Diamond, J. (2005). China's Environment in a Globalizing World. *Nature*, 435 1179-1186.

Marguart-Pyatt, S. T. (2007). Concern for the Environment among General Publics: A Cross-national Study. *Society and Natural Resources*, 20, 883-898.

Peterson, A. L. (2001). *Being Human: Ethics, Environment, and Our Place in the world*. Berkley: University of California Press.

Rumbaugh, T., & Blancher, N. (2004). China: International Trade and WTO Accession, *IMF Working Paper* ([Http://imf.org/external/pubs/ft/wp/2004/wp0436.pdf](http://imf.org/external/pubs/ft/wp/2004/wp0436.pdf)).

Shandra, J. M., London, B., Whooley, O. P., & Williamson, J. B. (2007). International Nongovernmental Organizations and Carbon Dioxide Emissions in the Developing World: A Quantitative, Cross-National Analysis. *Sociological Inquiry* 74(4).

Shapiro, J. (2001). *Mao's War against Nature: Politics and the Environment in Revolutionary China*. Cambridge: Cambridge University Press.

Shen, J., & Saijo, T. (2008). Reexamining the relations between socio-demographic characteristics and individual environmental concern: Evidence from Shanghai data. *Journal of Environmental Psychology*, 28, 42-50.

World Bank and SEPA. (2007). The Cost of Pollution: Economic Estimates of Physical Damages:

http://siteresources.worldbank.org/INTEAPREGTOPENVIRONMENT/Resources/China_Cost_of_Pollution.pdf.

Chapter 2 Environmental Concern in China

2.1 Background

After World War II, fast economic development, population growth and modern technology change have caused the overuse and destruction of natural resources. As environmental problems gradually become recognized as pressing social problems, social scientists pay more and more attention to environmental problems and their related issues. As a result, many surveys have been used to document the degree to which the public perceived environmental problems as serious and supported efforts to solve them as well as trends in environmental concern over time (Buttel, 1975). These studies have grown fast in number. By the end of the 1970s, there were about 300 empirical studies of environmental concern by environmental sociologists and other social scientists from a wide variety of disciplines (Dunlap and Van Liere, 1978). Early efforts to improve the measures of environmental concern followed two directions (Van Liere and Dunlap 1981). First, researchers increasingly used multiple items rather single item indicators to measure environmental concern to improve reliability and advanced statistical tools. Second, in order to make measurement comparisons possible among studies, they tried to standardize measures.

In subsequent years, empirical research on environmental concern has still expanded enormously. In spite of the burgeoning body of research on environmental concern and its related topics in industrialized countries, there are three main foci related to these studies on environmental concern. The first focus is the measure of environmental concern. Due to the unclear definition of environmental concern, survey design, and the structure of environmental opinion itself, the dimensionality of environmental concern has been the center of debate (Dunlap and Jones, 2002; Xiao and Dunlap, 2007; Marquart-Pyatt, 2008; Guber, 1996). This debate still continues in the Western world.

The second focus is to examine the social bases of environmental concern. These studies attempt to examine variation in concern for environmental quality among differing sectors of the public. However, difficulties in research on environmental concern might cause inconsistent findings of social demographic correlates of environmental concern.

The third focus is to study a corresponding relationship between environmental concern and behaviors based on different theoretical perspectives. This approach assumes that environmental concern can work as an important predictor of environmental behaviors (Kaiser et al., 1999). For example, in the Value-Belief-Norm Theory, environmental attitude measured by the New Ecological Paradigm scale is an important mediated variable in predicting different types of environmental behaviors (Stern, 2000).

As noted above, how to measure environmental concern plays a key role in determining research quality of the latter two trends methodologically and theoretically. In methodology, examining its dimensions is necessary for developing reliable measures; while in theory, its dimensionality is closely related to meaningful construct of environmental concern (Xiao and Dunlap, 2007). As several researchers (Van Liere and Dunlap, 1981; Klineberg et al., 1998) pointed out, that in terms of demographic predictors of environmental concern, how it is measured makes a difference. In the similar rationale, the measurement of environmental concern also determines the explanatory power of environmental concern when it works as a predictor of environmental behaviors.

In the West, environmental concern has been conceptualized in numerous ways. Still, we know little about environmental concern in developing countries, especially in China. The Chinese General Social Survey in 2003 provides such a chance to examine and model environmental concern in urban Chinese residents

The present paper proceeds as follows. I will first introduce a brief description of environmental concern. Then, I will provide a review of literature on dimensionality of environmental concern. Later, I will offer a detailed description of the analytical strategy, data and variables. Following this, I will report and interpret key findings. Finally, I will conclude with a discussion of this research's implication and limitation.

2.2 A Brief Introduction of Environmental Concern

As environmental problems become more complex, the meaning of environmental concern is also more diverse due to the definition of environmental concern related to inclusion of some environmental problems. Some researchers posit that the meaning of environmental concern is self evident and doesn't need a clear definition, while others assume that environmental concern is equated with environmental attitudes. Still, various definitions of environmental concern have been offered by different scholars. Although environmental concern is a broad concept, it is necessary to clarify the meaning of environmental concern and to make better sense of current research of its construct.

The earliest definition was provided by Dutch scholars, Nelissen and Scheurs (1975). They argued that environmental concern represented "the totality of ideas on the protection and control of and interference with the natural and artificial environment, as well as the behavioral dispositions connected with them" (Ester, 1981:86). Later, Ester and van der Meer (1982:72) defined environmental concern "as the degree to which a person recognizes environmental problems and is ready to contribute to their solution." An article by Fransson and Gärling (1999:370) summarized environmental concern as "an evaluation of or an attitude towards facts, one's own behavior, or others' behavior with consequences for the environment. Later, in a recent review paper by Dunlap and Jones (2002:485), environmental concern is referred to as

“the degree to which people are aware of problems regarding the environment and support efforts to solve them and /or indicate a willingness to contribute personally to their solution.” Although there are many versions in the definitions of environmental concern, I believe that Dunlap and Jones’s definition (2002) provide the most comprehensive one and will be used here as our guiding framework.

Taken these definitions together, Van Liere and Dunlap (1981) pointed out that environmental concern consists of two components: the “environmental” and “concern” component. In their view, the environmental component represents substantive content of environmental concern and is examined by environmental topics chosen from respondents, while the concern component refers to individual’s expressions of concern about environmental issues. As the universe of environmental issue is vast, the inherent complexity of the environmental component also helps to explain the huge diversity in existing measures of environmental concern. Since environmental issues take place in different geographical levels, it also gives us a caution that we need to clarify if they are local or global environmental issues when trying to measure the environmental component of environmental concern.

In terms of the concern component, there are also two broad approaches to conceptualizing it. One is a policy approach, in which researchers focus on the studies of public opinion toward environmental issues. The other is a theoretical approach and its studies conceptualize the concern component based on the theory of attitude consisting of affective, cognitive and conative dimensions (Dunlap and Jones, 2002). These two approaches differ in their emphasis on the role of individuals and their behaviors in creating and solving environmental problems. A theoretical approach focuses on individuals’ beliefs, attitudes, intentions and behaviors in the related environmental behaviors. The policy approach emphasizes the role of social institutions, policies

and collective action in protecting the environment. Frequently used dimensions in the policy approach include perceptions of the seriousness of environmental problems, support for government policy, and an individual's willingness to pay for environmental protection. Since the data used here does not include items necessary for attitude theory, I will take the policy approach to measure the concern component of environmental concern.

2.3 Literature on the Dimensions of Environmental Concern

Since the field of environmental concern is relatively new and survey researchers design their questionnaires independently and statistical tools are changing over time, researchers are inclined to use different environmental measurements. It is estimated that there are over 1000 published studies on the measurement of environmental concern (Dunlap and Jones, 2002). Their measurements of environmental concern range from 1 dimension to 6 dimensions. Therefore, we can only examine some important and representative studies and hopefully illustrate the conceptual distinction mentioned above and finally provide a roadmap for understanding existing measurement efforts.

Earlier studies usually take one dimension as measure of environmental concern. The widely used one is the New Ecological Paradigm (NEP) scale (Dunlap and Van Liere, 1978; Dunlap et al., 2000). When environmental problems achieved a prominent position in the mid- to late- 20th centuries, sociologists began to reflect on the tradition of the discipline of sociology regarding the environment (Dunlap & Van Liere 1978; Buttel 2002; Dunlap et al. 2002). In 1978, Dunlap and Van Liere summarized their efforts to measure a fairly new environmental attitude through the NEP scale with 12 items. Dunlap and Catton (1979) found that there had been a paradigm shift from the anthropocentric worldview underlying contemporary and classical theories, labeled the "human exceptionalism paradigm" (HEP), to a "new environmental paradigm"

(NEP), which has been renamed in subsequent versions as the "new ecological paradigm". In the view of Dunlap and Canton, the HEP makes mainstream sociologists not only neglect the importance of environmental problems, but also accept the optimism inherent in the Dominant Western Worldview (DWW) by assuming that the endless economic growth will not be threatened by resource scarcities or other ecological constraints (Dunlap, 2002).

In 2000, Dunlap and his colleagues (2000) revised the NEP scale and made it consist of 15 items. 2003 General Social Survey in China applied 2000 revised NEP scale. Despite its widespread use, several studies conducted in the U.S have challenged whether the NEP scale is a single construct or inherently multidimensional. Through using identical measure in a survey of Iowa residents, Albrecht et al. (1982) concluded that the NEP can be loaded onto three distinct dimensions. They labeled these three dimensions as "Balance of Nature", "Limits to Growth", and "Human over Nature". Geller and Lasley (1985) argued that their findings across three different samples identified 3 dimensions of the NEP but cannot confirm the same factor structure across samples. Later, through analyzing a survey conducted in Pennsylvania residents, Scott and Willits (1994) identified the NEP scale as 2 dimensions: "Humans-with-Nature" and "Balance of Nature/Limits of Growth".

In China, some scholars also began to focus on the measure of environmental concern. The NEP scale was introduced by Hong in the 2003 general social survey. Two years later, based on this data, Hong (2006) pointed out that some items in the NEP scale have a low reliability due to Chinese social background. Further research using the same data failed to provide the convincing evidence of a single construct of environmental concern in China (Xiao and Hong, 2007). Using the data collected from Shanghai in China, Shen and Saijo (2008) identified 3 factors through exploratory factor analysis (EFA). They labeled these three factors as concern about general and

global environmental problems, concern about local environmental problems and pro-environmental behavior measure respectively.

However, most previous studies I mentioned above only include bivariate correlations analysis and EFA. Although EFA can be a useful tool in detecting possible patterns and relationships in the data, confirmatory factor analysis (CFA), CFA is superior to EFA in two aspects. First, researchers can specify a measurement model in advance based on priori information about the structure of environmental concern. Second, it allows researchers to take into account both measurement error that is uncorrelated with other variables and measurement errors that are correlated with each other.

Several studies highlight CFA's potential for helping us understand the measurement of environmental concern. The first study was conducted by Guber (1996). After pointing out disadvantages in previous research, she used national Gallup surveys to develop and test a model of environmental concern. She proposed three latent factors: perceived seriousness of environmental problems, pro-environmental behaviors and self-identification as an environmentalist. She found that these three dimensions are highly correlated ranging from 0.64 to 0.8, which led her conclude that environmental concern is a single construct. Later, Guber (2003) revised her model by "replacing pro-environmental behavior with an "environmental policy preference" dimension. Unfortunately, her study also has some pitfalls as Dunlap and Jones (2002) pointed out. First, she did not make a clear distinction between global and other environmental problems. Second, in the concern component of environmental concern, she ignored items that deal with tradeoff between economic development and environmental protection. Third, its measure of self-identification only included a single item indicator, which might cause measurement quality problems.

Two years later, Carman (1998) used Michigan's National Election Survey data to measure environmental policy support. Carman contended that environmental policy support in the United States consists of three latent factors: the *environmental economic concern* factor, which reflects a willingness to give environmental protection priority over economic growth, the *environmental regulation concern* factor reflecting support for such regulations, and the *environmental quality assessment* factor reflecting perceived seriousness of environmental problem. Carman's finding demonstrated that environmental policy support in the United States is "a complex, multidimensional, and multilevel set of attitudes." (Carman, 1998:731) However, like Guber's research, Carman's research also has some weaknesses. First, he did not make a clear distinction between environmental policy support and environmental concern. Second, Dunlap and Jones (2002:514) argued, he "failed to see the possibility that his measure of perceived seriousness may not correlate as highly as the economic and regulatory dimensions." Third, Carmen also did not consider the geographical levels when he evaluated perceived seriousness of environmental problems.

In the same year, using the Texas Environmental Survey, Klineberg et al. (1998) proposed four measures of environmental concern: (1) *economic/government trade-offs*, (2) *perceived seriousness of pollution*, (3) *reported pro-environmental behaviors*, and (4) *ecological worldview*. Each measure consists of multiple items. Their findings suggest that the determinants of environmental concern vary in a predictable way and that it really does make a difference how environmental concern is measured. However, there are also some pitfalls in this research. First, they did not explore relationships among these four measures of environmental concern. Second, they used a summary index to represent each measure of environmental concern and failed to verify each summary index's internal consistency. Third, like Carmen's model, they used

perceived seriousness of pollution as one dimension, and did not make a clarification if such pollution is perceived in the global level or local level.

The most recent CFA study on environmental concern by Xiao and Dunlap (2007) employs a comparative design by using national probability samples of citizens from Canada and the United States. They identified eight facets of environmental concern: community environmental issues (C-ISSUES), national environmental issues (N-ISSUES), global environmental issues (G-ISSUES), perceived importance of environmental problems (IMPORTANCE), willingness to pay for environmental protection (ENV-ECO-TRADEOFFS), support for governmental policies and regulations (POLICY SUPPORT), new ecological paradigm (NEP) and pro-environmental behaviors and activism (BEHAVIOR & ACTIVISM). Their final model indicates that except for N-ISSUES and C-ISSUES, six other key facets of environmental concern have moderate to high factor loadings on one underlying construct, environmental concern. The similarity in the U.S. and Canadian findings increases the confidence in the validity of their measurement model of environmental concern. Unfortunately, their measurement model also has some disadvantages. First, it tried to establish a comprehensive model with a second order latent construct while they ignored some important factors such as, C-ISSUES and N-ISSUE in their final measurement model. Second, different pro-environmental behaviors have different social-demographic characteristics and causes (Stern et al., 1999). It is inappropriate that these different types of environmental behaviors can be regarded as a general type in the measurement model.

In a word, environmental concern has different measures ranging from 1 dimension to 6 dimensions. However, most of this research focusing on environmental concern was conducted in advanced industrial countries such as the United States (Dunlap et al., 2000; Klineberg et al., 1998), and their measurement model might be also limited to those societies. By comparing

industrialized countries, Marquart-Pyatt (2008) also pointed out that difference remains in terms of measuring environmental concern in the industrialized countries. Even if a comprehensive conceptualization model was claimed by Xiao and Dunlap (2007), they also acknowledged that one should be cautious to apply their measurement model outside U.S and Canadian societies. Environmental concern is thought to be the result of a complex interaction of many social, economic, cultural and regional factors. Knowing that there are huge differences between China and most western countries in social, economic, cultural, and political systems, it is worthwhile and necessary to build a measurement model which is fit with the Chinese society. The present study aims to fill this gap, because China is the largest developing nation and its environmental impact is also the largest. I believe that this study based on the Chinese survey will help to build a measurement model which is suited for the Chinese society background and examine internal relationships among those measurements and then find whether measures of environmental concern in China are different from those in industrialized societies.

2.4 Data and Method

The dataset we use in this paper comes from the General Social Survey of 2003 administered jointly by the Department of Sociology at Renmin University of China and the Survey Research Center of the Hong Kong University of Science and Technology. The survey was conducted in urban regions in the mainland of China, and respondents were sampled in five stages. The first stage targeted districts of cities and counties of 22 provinces, 3 autonomous regions (provincial-level administrative subdivisions of China), and 4 central government designed municipalities (the most economically and politically important cities among the highest populations of Chinese cities, major cities hereafter). Tibet, an autonomous region, was excluded due to logistic constraints. The second through fifth stages differed by targeting townships of counties or sub-

districts of cities, neighborhood committees in towns or city sub-districts, households, and eligible respondents respectively.

The data was collected by face to face interviews in the randomly selected urban areas in China. Based on the sample frames, the name list of the household in each selected area was prepared through various channels like the household registration institutions and residential committees. The interviewers were trained both at the national and provincial levels through lecturing, imitated interviews, discussions and workshops. To improve the responses rate, each interviewer is provided with the formal introduction letter issued by Renmin University of China. A formal introduction letter was used to establish some kind of mutual trust between letter holders and interviewees. The survey was warmly welcomed and actively coordinated by the interviewees and their families through giving selected household gifts and other material benefits.

The questionnaire includes two parts : Questionnaire A and measurement of environmental items (Questionnaire B). Due to the difficulty of obtaining cooperation from local partners, Questionnaire B was not conducted in four provinces (Heilongjiang, Jilin, Hubei, and Guangdong), which caused the current sample to be 902 respondents less than originally designed. The random sample included 5980 people, and 5894 respondents were successfully interviewed (98.6% of the sample). For those returning both questionnaires A and B, the sample size is 5073 (Hong and Xiao 2007) ,whose respondents are living in 88 city districts. Survey data were collected through in-person interviews. In terms of some missing values, I use mean value to replace them. In the Questionnaire B, there are 48.2% male respondents and 51.8% female. The respondents' average age is 43 years and average education level is high school (12 years).

Questionnaire B is the first survey that research agencies conducted to investigate Chinese environmental attitudes and behaviors on the national scale.

Different from previous studies relying on exploratory factor analysis or principal component analysis, confirmatory factor analysis (CFA) will be applied in this paper. CFA is superior in that it tests latent sources of variation and covariation based on prior specified patterns or relationships among the dimensions of environmental concern (Guber, 1996). In addition to its great emphasis on theory testing, the CFA framework can offer many other analytic tools, which are not available in EFA (Brown, 2006).

2.5 Measurement Model of Environmental Concern

To investigate the dimensions of environmental concern, it is necessary to follow Dunlap and Jones' definition (2002) and previous studies based on CFA (Guber, 1996, 2003; Carmen, 1998; Klineberg et al. 1998; Xiao and Dunlap 2007). I assume that environmental concern is a latent construct with four factors and each factor has multiple indicators. I propose a latent construct of environmental concern as consisting of four dimensions: (1) environmental-economic tradeoffs (Econ Trade Off), (2) pro-environmental behaviors (PEB), (3) perceived local environmental problems (Perceived Local Problems) and (4) new ecological paradigm (NEP). Local environmental problems can be considered as "the degree to which people are aware of local or global problems, respectively regarding the environment" Environmental-economic tradeoffs and pro-environmental behaviors represents "support for efforts to solve them and/or indicate a willingness to contribute personally to their solution" in Dunlap and Jones' definition of environmental concern.

The environmental-economic tradeoffs dimension is essentially the same as economic concern factor in Carmen's (1998) model, which include four indicators: environmental spending,

increasing car cost, protecting environment and maintaining jobs, and restricting business. Xiao and Dunlap (2007) also included this factor in their model and this factor consists of four indicators which range from the priority to economy vs. environment to the priority of job security vs. preventing a polluted environment. However, these four indicators have different scales. It might influence the validity of measurement. There are two types of validity: construct validity and predictive validity. Since these indicators have different scales, it might confuse respondents and then reduce construct validity.

Both Guber's model and Carmen's model did not make a geographical classification of perceived environmental problems factor. In Guber's model, the perceived seriousness of environmental problems factor only focuses on global environmental problems. The qualitative assessment factor in Carmen's model included two national level environmental problems and two local level environmental problems. In the model tested by Xiao and Dunlap (2007), they included beliefs about three levels of perceived environmental problems: global, national, and community level. After a series of CFAs, they just kept globally perceived environmental problems in their final model. However, in my model, due to data limitations, I focus on perceived local level environmental problems.

Guber's model and Xiao and Dunlap's model include a pro-environmental behavior factor, but they used different items to measure pro-environmental behaviors. For example, the behaviors and activism factor in Xiao and Dunlap's model includes three types of environmental behaviors. This causes some indicators of pro-environmental behavior to have lower item reliabilities than other measurement indicators. Here, based on a series of preliminary analyses, I construct pro-environmental behaviors with high item reliabilities.

Like the model constructed by Klineberg et al. (1999) and Xiao et al. (2007), I added the NEP scale as one dimension of environmental concern, because it has not only been widely used to explore the interrelationships between human activities and natural systems but also it has been frequently used as a general environmental attitude or ecological worldview. Each of these dimensions is measured with multiple items. Of these four dimensions, they capture policy-relevant facets of environmental concern and are measured by eighteen items in total.

I hypothesized that there are intercorrelations among those four dimensions as I describe below.

H1. The perception of local environmental problems has a positive relationship with ecological worldview measured by the NEP. That is, those people who have perceptions of more serious local environmental problems can transform their traditional worldview to ecological world view easily.

H2. The perception of local environmental problems has positive association with pro-environmental behaviors. Those people who have perceptions of more serious local environmental problems are more willing to take pro-environmental behaviors.

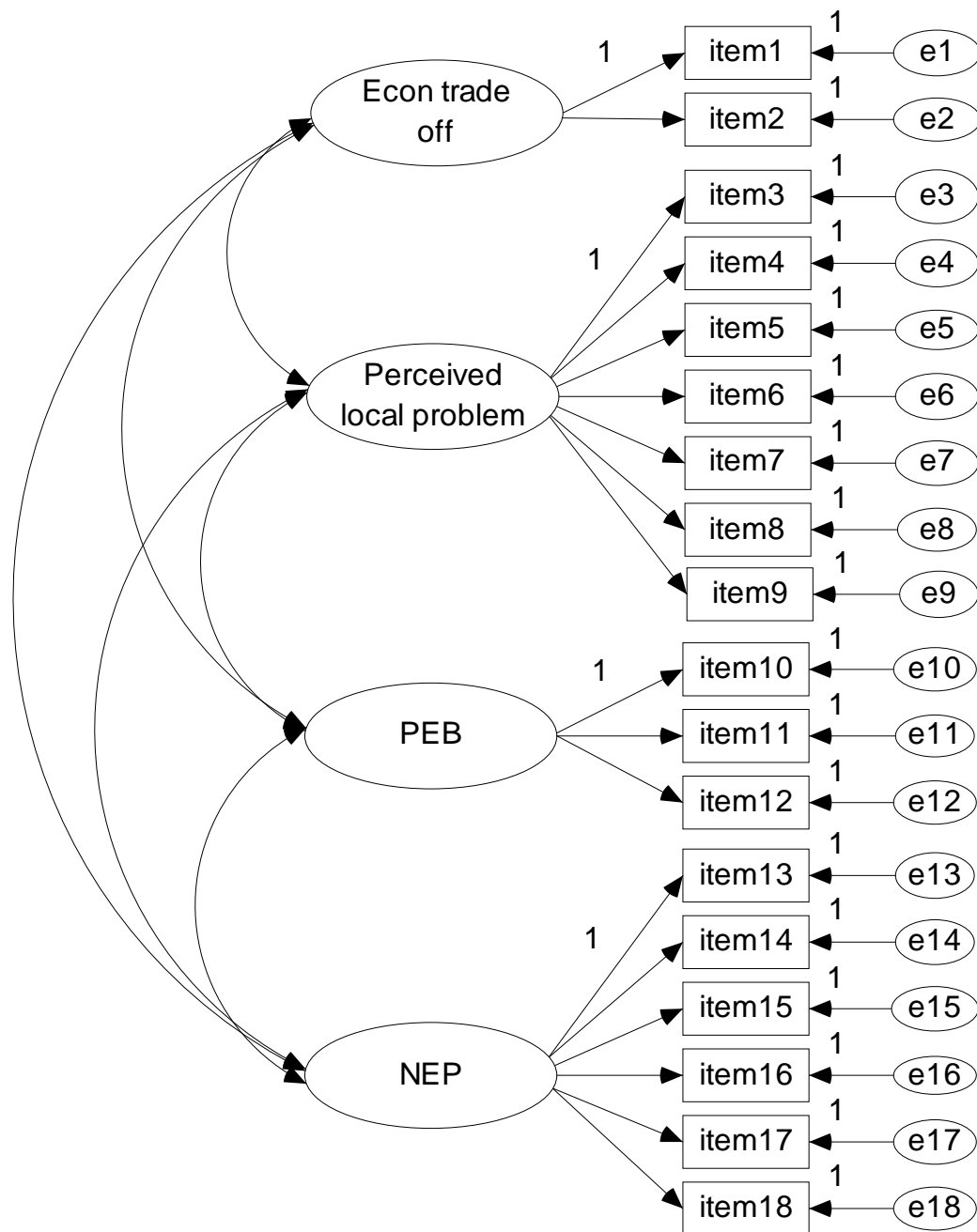
H3. The NEP has a positive correlation relationship with environmental-economic tradeoff factor.-The formation of their ecological worldview can be expected to help people make some adjustments in public policies of environmental protection and then reach a balance between environmental protection and economic growth.

H4. The economic trade off factor has positive correlation relationship with perceived local environmental problems. Those people who have more perceptions of seriously local environmental problems are more likely to prefer environmental protection to economic growth.

Before determining the final measurement model of environmental concern, I conducted a series of preliminary CFA analyses. Tabachnic and Fidell (2007) suggest that the standardized loadings under 0.32 indicate that items do not relate strongly enough to the factor and cannot be used as indicators of the model. This criterion is usually applied to first-order factor loadings. Here, I use a stricter criterion that the standardized loadings below 0.40 will not be kept in this model. Therefore, the final measurement model for environmental concern in urban China will be the Figure 2.1.

All rectangular boxes are indicators, which are questionnaire items, loading onto the factors showed in ovals. These four factors in ovals are assumed to be correlated with each other. Each indicator is also assumed to be affected by a measurement error from e1 to e18 (whose names start with the letter, e).

Figure 2.1 Measurement Model of Environmental Concern



Economic trade off factor includes 2 items. The first one is “If a certain place faces the dilemma of developing economy and protecting environment, which of the following view answers for your opinion better?” There are three choices for this item: 1) development first; 2) Not sure; 3) environment first. The second one is “Suppose in a certain community there is a

factory that enjoys economic success and brings many economic benefits to the local residents, but the factory also produces wastewater that pollutes the riverhead of downstream areas. If you were one of the residents in the community where the factory rests, which of the following attitude answer stands for yours better? ” There are also three answers for this question: 1) agree to close factory; 2) disagree to close factory 3) Not sure.

The factor of *perceived local problems* originally consisted of 10 indicators. However, I kept only 7 out of 10 indicators since 3 indicators have standardized factor loadings which are less than 0.5. The question preceding all of them is “could you tell us how severe these problems are, which exist in your community?” These 7 indicators include air pollution, water pollution, noise pollution, industrial waste pollution, urban garbage pollution, green space deficiency, and destruction of natural vegetation in forests respectively. Answers to these questions are following: 1) very serious; 2) somewhat serious; 3) passable; 4) not very serious, and 5) not serious at all.

The *pro-environmental behaviors (PEB)* factor is also a latent construct including 3 items. The survey lists 10 pro-environmental behaviors. CFA analysis showed that there are lower reliabilities in the measurement of pro-environmental behaviors. Therefore, I kept three items with standardized factor loading more than 0.5. The statement is “In the past one year, have you conducted these following behaviors?” The three pro-environmental behaviors include: 1, donating money for environmental protection; 2, actively participate in environmental campaigns sponsored by government and workplace; 3. actively participate in environmental protection activities held by Non-governmental organization. Possible answers to these behaviors are: 1) Never, 2) Sometimes, 3) Often.

The NEP scale includes 15 indicators. Due to low factor loadings in some items, I only kept 6 out of 15 indicators. Here, I kept factor loadings which are greater than or equal to 0.5 in the

preliminary analysis. This is a stricter requirement on factor loadings than Xiao and Hong (2010)'s work.

In their paper, they used ten NEP items which included some factor loadings less than 0.4. So the *NEP* factor here includes 6 items. The first indicator is “When humans interfere with nature it often produces disastrous consequences.” The second indicator is “Humans are severely abusing the environment.” The third indicator is “Despite our special abilities, humans are still subject to the law of nature.” The fourth indicator is “The earth is like a spaceship with very limited room and resources.” The fifth indicator is “The balance of nature is very delicate and easily upset.” The sixth indicator is “If things continue on their present course, we will soon experience a major catastrophe.” The answers to these indicators are following: 1) strongly agree; 2) mildly agree; 3) not sure; 4) mildly disagree and 5) strongly disagree.

All indicators are recoded so that higher scores reflect higher levels of environmental concern. For coding and exact question wording of all items corresponding to each factor, see Table 2-1.

Table 2-1 Description of Indicators

Factor	Indicator	Description of indicators	Code
Environ- mental economic Trade-Off	Item1	If a certain place faces the dilemma of developing economy and protecting environment, which of the following view answers for your opinion better?	1,Development first; 2,Not Sure 3,Environment, first;
	Item2	Suppose in a certain community there is a factory that brings many economic benefits to the local residents, but the factory also produces waste water that pollutes the riverhead of downstream areas. If you were one of the residents in the community which of the following attitude answer stands for your better?	1, Disagree to close factory; 2, Not Sure 3, Agree to close factory

Table 2-1 (cont'd) Description of Indicators

Factor	Indicator	Description of indicators	Code
Perceived Local Problems	Item3	Air pollution	5-Very serious to 1 -not serious at all
	Item4	Water pollution	5-Very serious to 1 -not serious at all
	Item5	Noise pollution	5-Very serious to 1 -not serious at all
	Item6	Industrial waste pollution	5-Very serious to 1-not serious at all
	Item7	Urban garbage pollution	5-Very serious to 1 -not serious at all
	Item8	Green space deficiency	5-Very serious to 1 -not serious at all
	Item9	Destruction of natural vegetation in forests	5-Very serious to 1 -not serious at all
Pro-Environmental Behaviors	Item10	Donating money for environmental protection	3-Often 2-Sometimes 1-Never
	Item11	Actively participate in environmental campaigns sponsored by government and workplace	3- Often 2-Sometimes 1-Never
	Item12	Actively participate in environmental protection activities held by Non-governmental organization	3- Often 2-Sometimes 1-Never
NEP	Item13	When humans interfere with nature it often produces disastrous consequences	5-strongly agree to 1-strongly disagree
	Item14	Humans are severely abusing the environment	5-strongly agree to 1-strongly disagree
	Item15	Despite our special abilities humans are still subject to the law of nature	5-strongly agree to 1-strongly disagree
	Item16	The earth is like a spaceship with very limited room and resources	5-strongly agree to 1-strongly disagree
	Item17	The balance of nature is very delicate and easily Upset	5-strongly agree to 1-strongly disagree
	Item18	If things continue on their present course, we will soon experience a major ecological catastrophe	5-strongly agree to 1-strongly disagree

2.6 Result and Discussion

Through the CFA analysis, I got the following results (Table 2-2) for the measurement model.

The Chi- square test of this model is statistically significant with the value of 1143.94 and 129

degrees of freedom. However, using the Chi-square value to evaluate the model's overall goodness-of-fit is not valid due to the following reasons. First, in many cases, the underlying distribution of the model is not a Chi-square distribution. Second, the Chi-square value is influenced by sample size and we have a large sample size. Therefore, in addition to providing Chi-square statistics, I also report two other measurements of goodness-of-fit: comparative fit indices (CFI) and root mean square error of approximation (RMSEA). Following Brown's recommendation (2006), when CFI values are close to 0.95 or greater and RMSEA values are close to 0.06 or below, it indicates this model is a good model fit. In the model I mentioned above, CFI is 0.943 and RMSEA is 0.039, this suggests that our model with four factors has a good fit. Each indicator's unstandardized and standardized loadings can be found in Table 2-2.

There are five columns in the Table 2-2, the first column includes four factors which I use to build the measurement model. The second column lists our 18 measurement indicators. The third and fourth columns are the loadings and standard error. The final one is the t-ratio to test the significance of the factor loadings.

Table 2-2 Unstandardized (Standardized) Factor Loading from CFA

Factor	Items	Factor Loadings	Standard Error	t -ratio
Econ Trade off	Item1	1(0.56)		
	Item2	0.85 (0.60)	0.079	10.75
Perceived Local Problem	Item3	1(0.72)		
	Item4	0.94(0.68)	0.023	40.84
	Item5	0.82(0.60)	0.022	36.73
	Item6	0.84(0.63)	0.022	38.33
	Item7	0.82(0.58)	0.023	35.97
	Item8	0.56(0.43)	0.021	26.87
	Item9	0.45(0.42)	0.017	26.30
Pro-Environmental Behaviors	Item10	1(0.52)		
	Item11	1. 88(0.76)	0.021	29.56
	Item12	1. 51(0.76)	0.017	29.57

Table 2-2 (Cont'd) Unstandardized (Standardized) Factor Loading from CFA

Factor	Items	Factor Loadings	Standard Error	t-ratio
NEP	Item13	1(0.58)		
	Item14	1.13(0.59)	0.038	29.58
	Item15	0.74(0.47)	0.03	24.98
	Item16	0.89(0.53)	0.033	27.21
	Item17	0.96(0.57)	0.033	28.88
	Item18	1.12(0.63)	0.037	30.51
Chi-square	1143.94	DF	129	P<0.001
RMSEA	0.037		CFI	0.947

Note: In the column 3, the values in parenthesis are standardized solutions.

From the table above, all the factor loadings are statistically significant at $p=0.05$ and their values in standardized form range from 0.42 to 0.76. All the loadings to these four factors are positive and each value is higher than 0.4, which suggests that the measurement model of environmental concern in urban China has a high degree of consistency. In all four factors, it is striking to find that the factor loadings of pro-environmental behaviors have the highest value in the standardized form and its corresponding factor loading for item 10, item11 and item 12 is 0.51, 0.76 and 0.76 respectively while the factor loading of perceived local problems has a lowest value and the standardized factor loadings for item9 is 0.42.

Generally speaking, our measurement model has a good fit and each item can be regarded as a reliable indicator of its factor based on the size of the loading. Although Table 2-2 offers goodness of fit statistics and its unstandardized and standardized solutions, we still do not know what these factors' internal relationships are? In the next step, I would like to further explore the correlation among these four factors and their statistical significance. Table 2-3 shows the correlation among four factors.

Table 2-3 Correlation among these Four Factors

Correlation Coefficient	Econ-Trade off	Perceived Local Problem	PEB	NEP
Econ Trade off	1	-0.026	0.142***	0.322***
Perceived Local Problems		1	0.114***	0.142***
PEB			1	0.149***
NEP				1

Note : * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

From table 2-3, all correlations between factors are significant at $p < .001$ except for correlation between *Econ Trade off* factor and *Perceived Local Problem* factor. Therefore, Hypotheses 1, 2, and 3 get supports here and only hypothesis 4 cannot be verified in this Table 2-3. Different from our assumption (H4) in the measurement model, I find that *perceived local problems* factor has a near zero and non-significant associated with *economic trade off* factor. Therefore, the relationship between *perceived local problems* factor and *economic trade off* factor might be independent.

According to the study by Xiao and Dunlap (2007), due to the small loading value of perceived local environmental problems, they did not keep this factor in their measurement model. However, according to definition of environmental concern by Dunlap and Jones (2002) and deHaven-Smith's (1991) conclusion that average citizens' environmental concern is largely localized, it is necessary to keep perceived local problem in the measurement model. In addition, deleting this factor in our model, the value of CFI and RMSEA is almost the same, so I keep this factor in this model.

There are two possible explanations for the very weak or even independent relationship between *perceived local problem* factor and *economic trade off* factor. First, China is a centralized country or authoritarian state. This means that the central government controls and allocates most of the important resources and the top officials in the local government were

appointed by central government. The Chinese government at different levels takes a top -down policy making process and rules out the possibility of public participation. Without appropriate participation channels, the perception of local environmental problems by the local residents cannot be converted to their action in participating the policy making in environmental protection.

This is quite different from the western societies. For example, in the U.S., if the public perceives environmental problems in their community, they can launch social movements or organize social protests to express their opinion. Considering the real situation of China, such movements or protests are very rare.

Second, according to Inglehart (1995), people in developing countries are more likely to have materialist values, which pursue economic growth and national security while ignore environmental quality, than those in developed countries. Based on the same dataset, Hong (2005) concluded that Chinese people are still in the phase of materialist values. In addition, central government and Communist party policies also emphasize the priority of economic growth over other issues. For most of common Chinese people, getting rich is glorious whether such process will destroy the environment or not. As Chinese people care more about economic growth instead of environmental quality, it is also understandable that although Chinese people perceived more local environmental problems while still try to get the benefits from economic growth and leave consequences of environmental pollution to the next generation

The *NEP* factor has the strongest positive association with the factor of *economical trade off factor*. This suggests that the *NEP* factor is an important measurement tool for environmental concern. It also indicates that individuals with a high score in the *NEP* scale are more inclined to take environmental protection priority over economic growth. Like other research in western

societies, we find that there are positive and significant association between the *NEP* factor and *pro-environmental behaviors* factor. This also reveals the facts that people with the higher *NEP* factor score are more likely to conduct pro-environmental behaviors.

It is worth noting that the *pro-environmental behaviors* factor has a comparatively mild positive relationship with *pro-perceived local problems* factor and *economic trade off* factor. This conclusion is consistent to conventional thinking. In the conventional wisdom, local environmental problems influence local residents more directly than global environmental problem, which might cause local people to take actions on reducing the influence of local environmental problems and those who conducted more pro-environmental behaviors are more likely to favor environmental protections prior to economic growth.

To simplify our measurement model, can a high order measurement model with these four factors represent a more meaningful construct of environmental concern than our measurement model above? The second order factor will be environmental concern while the first order factors still keep the same items. However, through data analysis, I prefer not to take a second order measurement model based on the following reasons. First, from goodness of fit indices, CFI and RMSEA in the second order measurement is 0.94 and 0.04 (CFI is 0.943 and RMSEA is 0.39 in the first order measurement model). Therefore, the first order measurement model seems to fit my data essentially equal to high order measurement. Second, perceived local environmental problem factor has a different correlation pattern with other factors. It is unwise to ignore complex correlation relationship among those four factors just for making a model parsimonious. Third, a single second order model's factors have relatively equal correlation strength and the same direction. However, the correlation matrix among those four factors in our measurement

model ranges from -0.026 to 0.322. Thus, I conclude that my measurement model represents a more meaningful construct of environmental concern.

2.7 Conclusion

In this study, adopting Dunlap and Jones's conceptualization of environmental concern and focusing on its policy orientation, I followed the example of Guber (1996), Carman (1998), Klineberg et al. (1998) and Xiao and Dunlap (2007) in applying CFA to avoid the traditional shortcomings of more commonly utilized techniques such as EFA and PCA to evaluate the dimensionality of environmental concern.

I used the 2003 Chinese general social survey data to address an important question: is the measurement of environmental concern in China different from the measurement of this concept in Western societies? In terms of the dimensions measured between the West and China, My answer is that measures of environmental concern in China share some commonalities with those measures in Western societies; however, it also has some distinctions. The four dimensions I chose here can be found in the most of Western research. For example, Guber's (1996) model includes *perceived seriousness of environmental problems* factor and *pro-environmental behavior* factor while Xiao and Dunlap model (2007) consists of *environmental economic tradeoff* factor and the *NEP* factors. Even though our measurement model shares two factors with Guber's (1996) model, Guber used additive indexes to measure these two factors. Compared to Carman's model (1998), our measurement model is not limited to the dimension of support for environmental policies.

The results indicate that environmental concern in China includes four dimensions: *economical trade off*, *pro-environmental behavior*, *perceived local problems* and *NEP*. In general, these measures are well represented as multiple item latent constructs in the national

sample. The measurement model I proposed is different from Xiao and Dunlap's second order measurement model based on Western societies, which was regarded as the most comprehensive measurement model in current Western study, while ignored the internal correlation relationship among all six key dimensions of environmental concern. Here, I explore the correlation pattern among the constructed four latent factors and found that this pattern has some kinds of specialty rooted in the Chinese society. For example, the independent relationship between *perceived local problems* factor and *economic tradeoff* factor might reveal the fact that unlike the common people in western societies, most of Chinese people lack channels in participating policy decision making. In addition, in China the correlation among our four factors are less than 0.2, while in Guber's (1996) study, the correlations among three factors are quite high at 0.64, 0.73 and 0.8 in the U.S.

My analysis indicates that the *NEP* factor has a high association with *economical trade off* factor and *pro-environmental behavior* factor, which is consistent with the concept of environmental concern developed by Dunlap and Jones (2002). It emphasizes its policy approach since it focuses on the degree of willing to take actions to environmental protection in individual level and collective level.

Although some previous studies recognized the importance of perceived local environmental problem in constructing environmental concern (Xiao and Dunlap, 2007), their research did not take perceived local environmental problem into account in their constructed model. Through adding *perceived local environmental problems* factor in my measurement model, I found that except for the relationship between *economic trade off* factor and *perceived local environmental problems* factor, other relationships among these factors are fit with the original expectation., *Perceived local environmental problems* factor have no statistically significant correlation with

the *economical trade off* factor. Does it mean that the distinctiveness of the perceived seriousness of local environmental problem only exist in China due to its social, economical, and political system? This question is in need of further research.

To my knowledge, this research is the first systematic study of environmental concern with CFA in China, a country with the largest population in the world where we know little about the level of environmental concern and how to measure it. This model can be used as a baseline for the future research based on the Chinese society background. This research also has implications to establish a corresponding link between attitudes and behaviors. However, since our sample does not include rural Chinese residents, it cannot be regarded as a representative of all Chinese. This also restricts measurement model of environmental concern to urban residents in China. Future research should focus on if there is rural and urban difference in the measurement of environmental concern.

BIBLIOGRAPHY

BIBLIOGRAPHY

Albrecht, D., Bultena, G., Hoiberg, E., & Nowak, P. (1982). The New Environmental Paradigm Scale. *Journal of Environmental Education*, 13, 39-43.

Brown, T. A. (2006). *Confirmatory Factor Analysis for Applied Research*. New York: The Guilford Press.

Buttel, F. H. (1975). The Environmental Movement: Consensus, Conflict and Change. *Journal of Environmental Education*, 7, 53-63.

Buttel, F. H. (2002). Environmental Sociology and the Classical Sociological Tradition: Some Observations on Current Controversities. In R. E. Dunlap, F. H. Buttel, P. Dickens & A. Gijswijt (Eds.), *Sociological Theory and the Environment: Classical Foundations, Contemporary Insights*. New York: Rowman&Littlefield Publishers, INC.

Carman, C. (1998). Dimensions of Environmental Policy Support in the United States. *Social Science Quarterly*, 79, 717-733.

deHaven-Smith, L. (1991). *Environmental Concern in Florida and the Nation*. Gainesville, FL: University of Florida Press.

Dunlap, R. E. (2002). Paradigms, Theories, and Environmental Sociology. In R. E. Dunlap, F. H. Buttel, P. Dickens & A. Gijswijt (Eds.), *Sociological Theory and the Environment: Classical Foundations, Contemporary Insights*. New York: Rowan&Littlefield Publishers, INC.

Dunlap, R. E., & Catton, W. R. J. (1979). Environmental Sociology. *Annual Review of Sociology*, 5, 243-273.

Dunlap, R. E., & Jones, R. E. (2002). Environmental Concern: Conceptual and Measurement Issues. In R. E. Dunlap & W. Michelson (Eds.), *Handbook of Environmental Sociology* (pp. 482-524). Westport, CT: Greenwood Press.

Dunlap, R. E., & Valn Liere, K. D. (1978). The "new environmental paradigm": A Proposed Measuring Instrument and Preliminary results. *Journal of Environmental Education*, 9, 10-19.

Dunlap, R. E., Van Liere, 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.

Ester, P. (1981). Environmental Concern in the Netherlands. In T. O'Riordan & R. K. Turner (Eds.), (Vol. 3, pp. 81-108). Chichester: John Wiley & Sons.

Ester, P., & Meer, F. v. d. (1982). Determinants of Individual Environmental Behavior: An Outline of a Behavior Model and Some Research Findings. *The Netherlands' Journal of*

Sociology, 18, 57-94.

Fransson, N., & Gärling, T. (1999). Environmental Concern: Conceptual Definitions, Measurement Methods and Research Findings. *Journal of Environmental Psychology*, 19, 369-382.

Geller, J. M., & Lasley, P. (1985). The New Environmental Paradigm Scale: A Reexamination. *Journal of Environmental Education*, 17, 9-12.

Guber, D. L. (1996). Environmental Concern and the Dimensionality Problem. *Social Science Quarterly*, 77, 644-662.

Guber, D. L. (2003). *The Grassroots of a Green Revolution, Polling America on the Environment*. Cambridge, MA: MIT press.

Hong, D. (2005). Urban Chinese Residents' Environmental Concern *Jiangsu Social Science*, 1(127-132).

Hong, D. (2006). Measurement of Environmental Concern: NEP Scale's Application in China. *Chinese Journal of Society*, 5, 71-91.

Inglehart, R. (1995). Public Support for Environmental Protection: Objective Problems and Subjective Values in 43 Societies. *PS: Political Science and Politics*, 15.

Kaiser, F. G., Sybille, W., & Fuhrer, U. (1999). Environmental Attitude and Ecological Behavior. *Journal of Environmental Psychology*, 19, 1-19.

Klineberg, S. L., McKeever, M., & Rothenbach, B. (1998). Demographic Predictors of Environmental Concern: It Does Make a Difference How it's Measured. *Social Science Quarterly*, 79(734-753).

Marquart-Pyatt, S. T. (2008). Are There Similar sources of environmental concern? Comparing Industrialized countries. *Social Science Quarterly*, 89(5), 1312-1335.

Nelissen, NL.M. and Schreurs, L.(1975),. *Het Meten van Milieubesef*, Maastricht

Scott, D., & Willits, F. K. (1994). Environmental Attitudes and Behaviors: A Pennsylvania Survey. *Environment and Behavior*, 26(2), 239-260.

Shen, J., & Saijo, T. (2008). Reexamining the relations between socio-demographic characteristics and individual environmental concern: Evidence from Shanghai data. *Journal of Environmental Psychology*, 28, 42-50.

Stern, P. C. (2000). Toward a Coherent Theory of Environmentally Significant Behavior. *Journal of Social Issues*, 56, 407-424.

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 Environmental Concern. *Human Ecology Review*, 6, 81-97.

Tabachnic, B. G., & Fidell, L. S. (2007). *Using Multivariate Statistics (5th Ed.)*. . Boston,MA Allyn and Bacon.

Van Liere, K. D., & Dunlap, R. E. (1981). Environmental Concern: Does It Make a Difference How It's Measured. *Environment and Behavior*, 13, 651-676.

Xiao, C., & Dunlap, R. E. (2007). Validating a comprehensive Model of Environmental Concern Cross-Nationally: A U.S.-Canadian Comparison. *Social Science Quarterly*, 88(2), 471-493.

Chapter 3 Social Demographic Characteristics of Environmental Concern

3.1 Introduction

Over the past three decades, interests in issues of environmental concern have provoked a huge amount of research on the social-demographic predictors of environmental concern. Growth in the number of these studies has been accompanied by focusing on the measurement of environmental concern and its social bases. Although there are difficulties inherent in gauging this complex concept, two conclusions can be drawn from those studies related to its social determinants. First, when all social demographic predictors are combined, they explain a small portion of the variance in environmental concern (Van Liere and Dunlap, 1980, Buttel and Flinn, 1978, Jones and Dunlap, 1992, Fransson, 1999). Second, in terms of social demographic variable, there are no consistent results in predicting environmental concern (Van Liere and Dunlap, 1980; Klineberg et al., 1998; Mohai et al., 2010; Mobley et al., 2010).

The findings above are based on the background of Western societies, though some researchers argue that the model specification errors associated with the inherent assumptions of the statistical tools partially caused it (Xiao and McCright, 2007). According to the view of Van Liere and Dunlap (1981:653), existing measures of environmental concern differ in two aspects: the “substantive issues” included in the measure, and the “theoretical conceptualization” used in developing the measurement. As a result, various combinations of substantive issues and theoretical conceptualization have caused many different measures. For example, in terms of substantive issues, some researchers (Tognacci et al. 1972; Lounsbury and Tornatzky, 1977) have treated attitudes toward pollution, population, and natural resources as distinct dimensions of environmental concern, while other researchers tended to combine these substantive items into a single environmental concern measure (Maloney et al., 1975; Weigel and Weigel, 1978; Buttel

and Flinn, 1976). As for the debate of theoretical conceptualization of environmental concern, this has implications for what specific components should be included to measure environmental concern (Van Liere and Dunlap 1981). For example, can environmental problems perceived by individuals be classified into different geographic levels according to those problems' sphere of influence? Should tradeoffs between economic growth and environmental protection be employed in the measure of environmental concern?

Even with the same measurement scale, researchers are still diverging as to whether this scale can be divided into several dimensions or subscales. For example, Dunlap and Van Liere (1978, 2000) proposed the new ecological paradigm (NEP) scale to measure public environmental concern and argued that the scale is both a valid and reliable indicator of it. However, Albrecht et al. (1982) concluded that the NEP scale can be divided into three distinct dimensions which are labeled respectively as "Balance of Nature", "Limits to Growth", and "Human over Nature". Still today, many scholars use this scale as a general measure of environmental concern (Hong, 2006, Xiao and Hong, 2010; Dunlap and Van Liere, 2000). Therefore, to understand the relationship between social demographic variables and environmental concern, specifying which measures of environment concern we are examining is extremely necessary.

The purpose of the present study is to empirically examine social demographic predictors of various environmental concern measures. First, I review related literature and explore their variation of social demographic variables in predicting environmental concern both in Western Society and in China. Then, I outline four distinct ways of measuring that concern: 1) tradeoff between economic growth and environmental protection, 2) pro-environmental behaviors, 3) perceived local environmental problems, and 4) the NEP scale. Following that, a structural equation model is developed to test hypotheses based on the literature review. Finally, I discuss

how the choice of measure greatly influences the obtained results and make the conclusion with the direction of future research in China.

3.2 Literature Review

Previous researchers have done a lot of work in terms of social bases of environmental concern, and most of their work was conducted in industrialized countries. By reviewing different literature sources between the Western societies and the Chinese societies, I summarized five hypotheses, which have been tested in different ways in many researchers' published work (e.g., Van Liere and Dunlap, 1980; Shen & Saijo, 2008; Fransson & Garling 1999).

Firstly, in what is known as the *Age Hypothesis*, Van Liere and Dunlap (1980) argued that younger people are more concerned about environmental deterioration than older generations. Later, Howell and Laska (1992) also continued to provide support for this hypothesis. One explanation for the age hypothesis, at least in the USA, is the age-group difference (Malkis and Grasmick, 1977). It states that compared to older people, younger people are less integrated into the American economic and cultural systems. Since the solutions to environmental problems require a radical social reform in traditional economic, social, and cultural systems, it is logical to expect that younger people can accept such changes more easily.

However, based on a survey of urban residents in Shanghai, China, Shen and Saijo (2008) stated that age has a positive relation to environmental attitudes, which implies that older generations are more concerned about the environment than the younger population. The authors argued that since old Shanghai residents suffered serious environmental problems due to heavy pollution during 1980s and early 1990s than more recently, they cared more about the environment than younger generations. Luo and Deng (2008) used the 2000 version of the NEP

scale to examine the socio-demographic predictors of visitors to a national forestry park in China. Their results also indicated that older females and higher educated respondents have more environmental concern, as reflected by their higher NEP scores. Through surveying urban residents in China, Xiao and Hong (2010) found that age has a positive association with environmental concern measured by the NEP scale, when they controlled other variables.

The second hypothesis is the *Gender Hypothesis*. A number of studies have targeted the gender difference with regard to environmental attitudes. Based on a series of studies on industrialized societies, women have been reported to be more concerned about general environmental issues than men (McStay and Dunlap 1983, Stern, Dietz and Kalof, 1993; Mohai, 1992, Zelezny et al., 2000; Hunter et al. 2004). One widely used theory regarding the relationship between gender and environmental concern is called gender socialization theory. This theory states that early childhood socialization leads women to become the role of caregiver. With this role in their mind, women tend to care about the health and welling-being of family members and which leads them to a higher level of environmental concern. In contrast, through early childhood socialized experiences, men, who are assigned the role of the primary family “breadwinner” are more likely to care about economic issues (Wehrmeyer and McNeil, 2000). However, through examining data collected from the state of Kentucky in the USA, Arcury and Christianson (1990) found that men were more environmentally concerned than women. Later, in a cross national analysis, Hayes (2001) argued that although men and women have differences in environmental knowledge, this has little or no effect on their attitudes toward environment.

Recent research by Shen and Saijo (2008) however, has shown that women in Shanghai seem less concerned about the environment than men. Using the 2003 general social survey data, Xiao

and Hong (2010) demonstrated that Chinese women expressed lower levels of concern, measured by the NEP scale, than men when controlling other socio-demographic variables and environmental knowledge. However, women are also more involved in environmental behaviors inside of the home, such as recycling, than men. Following the mixed findings about the gender effect, it makes me ask if there are other mechanisms causing the mixed gender effect under the Chinese society.

The third hypothesis is the *Residence Hypothesis*. This hypothesis is that urban residents are more environmentally conscious than rural residents. Earlier studies on environmental concern have shown that urban residents exhibited greater concern. Dunlap and Van Liere (1978) and Fransson and Gärling (1999) gave one possible explanation, arguing that this could be because urban residents are more exposed to the signs of environmental deterioration, such as air and water pollution, therefore, they have more urgent need to prevent environmental deterioration.

In my view, there are two more explanations for this hypothesis. First, urban residents are more likely to receive environmental information from mass media than those in rural areas. Second, rural people are usually economically more dependent on mining and agriculture, and to perform these activities in a way that can be very harmful to the environment, than are urban residents. For example, in some rural areas of China, it is still very common for farmers to use wood to do some cooking.

Other studies have challenged such rural-urban differences in environmental concern. Recent work by Jones, Fly, and Cordell (1999) indicated that there are no significant differences between urban and rural residents of Southern Appalachian region on issues related to environment. As our sample is restricted to urban areas in China, I do not test residence hypotheses here. Based on available information in the data, I hypothesize that those living in

large metropolitan areas are significantly more environmentally concerned than people in the small or middle size counties or cities. Similar results can be found research in western societies (Howell and Laska, 1992). However, it still needs to be verified in the Chinese social context.

The fourth hypothesis is the *Socio-economic Status Hypothesis*. This hypothesis states that education and income have a positive relationship with environmental concerns. The higher education and income people have, the more likely they are to be environmentally conscious. One possible explanation of this is based on Maslow's theory hierarchy of needs (Maslow, 1970) and post-materialist values (Inglehart, 1995). It argues that only when basic material needs, such as food, shelter, and economic security, are met, can people pursue higher needs such as environmental quality. It also states that people with "post-materialist" values - emphasizing self-expression and quality of life - are much more likely to give high priority to protecting the environment than those with materialist values. Another possible explanation is that highly educated people are more likely to be in education, research, and high tech jobs that do not involve environmental destruction. This means that people who don't want to destroy the environment are more likely to go into such jobs and that if you are in such a job, there will be less economic incentive to destroy the environment..

In terms of effects of *occupational prestige* on environmental concern, different scholars draw mixed conclusions from different sources. First, people with high social class occupations make more money and have more free time. Therefore, those people are expected to have more concern than low classes. Most studies has found occupational prestige has a positive association with environmental concern, though such association is light and it is hard to reach a conclusion that such relationship really existed (Van Liere and Dunlap,1980). For example, Dillman and Christenson (1972) argued that there are moderate relationships between prestige and

environmental concern. Second, as individuals with some occupations might have more chances to access polluted environment than other occupations, those people might express more concern than other people in less polluted working condition due to their suffering environmental pollution. However, such relationships have received limited attention in the empirical research. It deserves further research in the Chinese context.

Most studies in the West have found a positive relationship between education and environmental concern (Scott & Willits 1994; Klineberg et al., 1998). However, as for the relationship between income and environmental concerns, the findings have created controversy. Arcury (1990) argued that income is significantly correlated to both environmental knowledge and environmental attitudes. However, based on a 1992 international survey, Dunlap and Mertig (1995) stated that wealth is negatively related to citizen environmental concern. In China, different scholars also reached different results based on the different samples and methods. For example, through using the data collected from Shanghai city, Shen and Saijo (2008) found that households with higher income have reacted positively to environmental concern, while Xiao and Hong (2010) used a national urban sample and concluded that income has no influence on environmental concern.

The final hypothesis is the *Political Orientation Hypothesis*. It states that liberals have a more environmental concern than conservatives. Dunlap (1975:432) offered three possible explanations for this assumption. First, business and industry, which are major supporters of conservatives, are against environmental reforms due to the costs involved. Second, environmental reform entails an extension of government activities and regulation, which conservatives are against. Finally, conservatives do not like innovative actions which are

required to launch environmental reform. Later research by Howell and Laska (1992) has also supported this assumption.

However, in the social context of China, such a political classification about people's political orientation does not exist. Based on China's situation, I grouped our respondents as "Communist Party member" or "non-Chinese Communist Party member". In my preliminary analysis, I found there were no significant differences between the environmental attitudes of Chinese Communist Party members and non Communist Party members.

As a whole, the studies mentioned above focus mainly on those individuals in developed countries, especially in the United States. China, the largest developing country in this world, has still received little attention on the relationships between various socio-demographic characteristics and environmental concern. In 2007, the Central Committee of Communist Party of China proposed the "Scientific Outlook on Development", which requires a sustainable development in China. Research on environmental concern in China has begun to grow, partly due to that fact that the Chinese government is increasingly emphasizing the importance of environmental protection. However, compared to a large body of similar research in the West, we still know little about environmental concern in China. Therefore, using a nationally urban sample, I have a chance to take this issue into consideration in a more systematic way.

The review above indicates that researchers have had inconsistent results in explaining the social bases of environmental concern, whether in the West or in China. Although existing scholarship in China is limited in scope and number, findings from this Chinese based research are difficult to compare with each other or the studies from other settings due to differences in measures of environmental concern. For example, Shen and Saijo (2008) classified environmental concern into three dimensions: concern about general and global environmental

problems, concern about local environmental problems, and pro-environmental behavior measures, while Xiao and Hong used only the NEP scale to represent measurement of environmental concern.

The mixed findings of the social demographic correlates of environmental concerns whether in the West or in China, reflects the idea that it is necessary to build comparable and systematic measures in environmental concern. For example, in terms of substantive issues measured in environmental concern, researchers can classify diverse issues, such as, air and water pollution, global warming, and acid rain, into global measures and local measures of environmental concern. Therefore, to improve researchers' ability to explain the social bases of environmental concern, one point should be kept in the mind: environmental concern cannot be regarded as a general concern on environmental quality. To examine its social bases, we should focus on each measures of environmental concern.

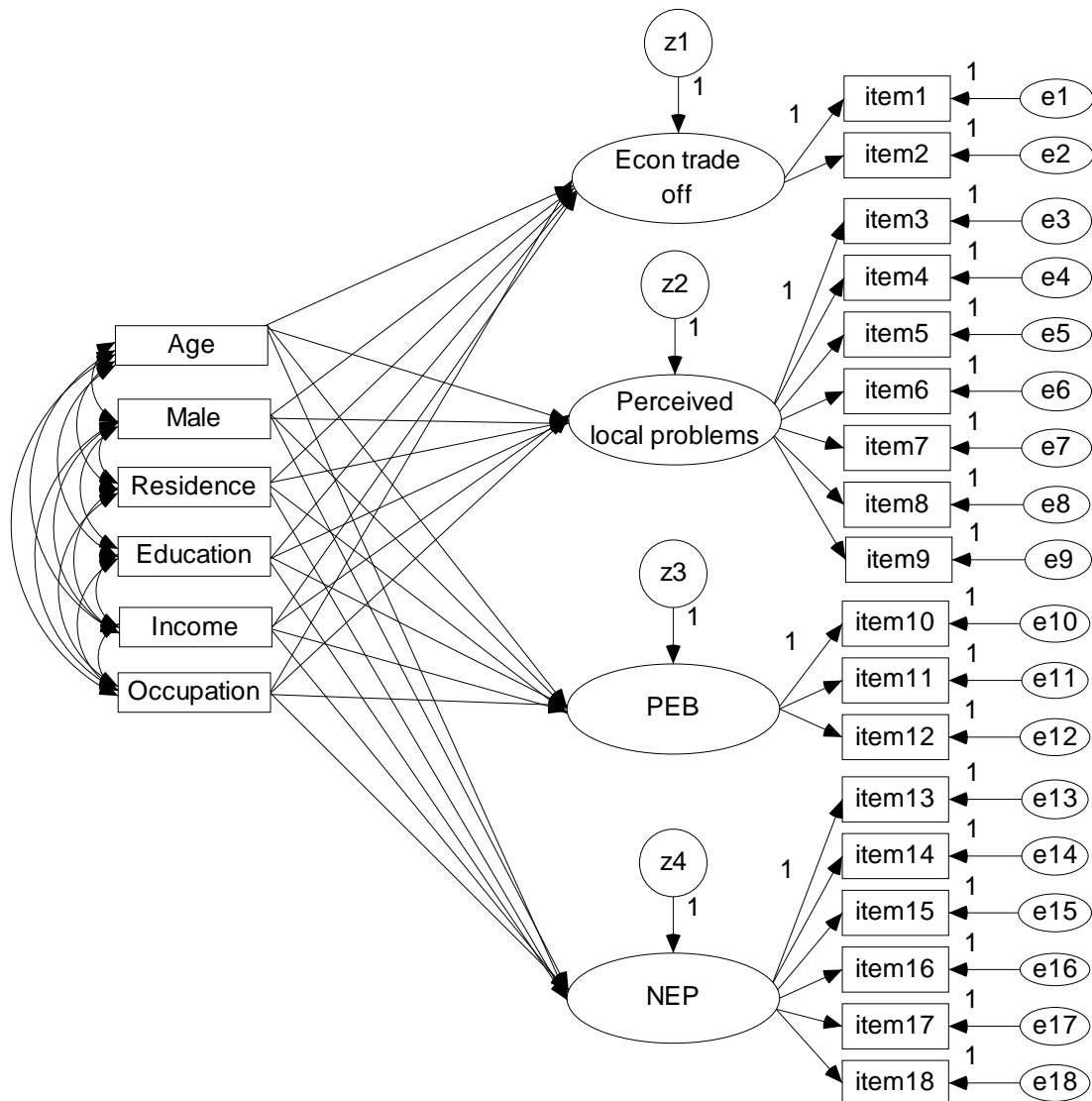
3.3 Data and Method

The data for this study was drawn from the 2003 General Social Survey of urban residents of the People's Republic of China. The sample was obtained through a five stage probability procedure resulting in the selection of 5980 urban residents. The survey includes two parts : Part A and Part B. The questionnaire consisted of a socio-economic (questionnaire A) and an environmental (questionnaire B) part. The number of respondents who answered both questionnaire A and B is 5073. In this sample, 48.2% are male and 51.8% are female. The respondents' average age is 43.51 years and the average education level is high school (10.44 years).

To examine whether the selection of measure of concern has an effect on the social bases of environmental concern in China, I proposed a structural equation model here. This model

includes the measurement part and structural part. In the measurement part, there are 4 latent factors of environmental concern and each factor has its own corresponding items and residual variance (z1-z4). In the structural parts, I add 6 social demographic and economic variables to each of the four factors (See the Figure 3-1). Thus, those six social demographic variables are hypothesized to have direct impacts on each of those four factors.

Figure 3-1 Socio-demographic characteristics of Environmental Concern



In chapter 2 (paper one), I have constructed a measurement model of environmental concern based on the same data. To examine the social base of environmental concern, I retrieve the

measurement model I built in chapter 2 (paper one). This measurement model includes four latent construct: tradeoffs between economic growth and environmental protection (ECON TRADEOFF), pro-environmental behaviors (PEB), the perceived local environmental problems (PERCEIVED LOCAL PROBLEMS), and the NEP.

Tradeoff between economic growth and environmental protection is one widely used measure in environmental concern. This measurement asks respondents to make a choice between environmental protection and economic security, such as keeping jobs and economic growth. Klineberg et al. (1998) pointed out that the popularity of this measure is due to its inclusion in the General Social Survey in the United States. In 2003, this measure was first introduced to the General Social Survey in China. This measure consists of two indicators. The first indicator is, “If a certain place faces the dilemma of developing economy and protecting environment, which of the following view answers for your opinion better?” The percentage frequencies for the answers to this question are the following: 24.5% of respondents choose “developing economy comes first”, 2.5% of respondents said they are not sure on this issue, and 73% of respondents prefer “protecting environment comes first”. The second indicator is, “Suppose in a certain community there is a factory that enjoys economic success and brings many economic benefits to the local residents, but the factory also produces wastewater that pollutes the riverhead of downstream areas. If you were one of the residents in the community where the factory rests, which of the following attitude answers stand for you better? ” There are also three answers for this question: 1) disagree with closing the factory; 2) not sure; 3) agree to close the factory. The percentage frequencies for the answers to this question are the following: 13.3% of respondents choose “disagree to close factory”; 1.4% of respondents said they are not sure on this issue; 85.3% of respondents choose “agree to close factory”.

The second type of environmental concern asks respondents if they conducted the following pro-environmental behaviors. In the survey, it listed 10 questions. Due to some low factor loading, I kept only 3 out 10 items. This measure includes three indicators: 1, donate money for environmental protection; 2, actively participate in environmental campaigns sponsored by government and workplace; 3, actively participate in environmental protection activities held by Non-governmental organization. (For the exact wording of these items, see Table 3-1)

Table 3-1 Three Items of Pro-environmental Behaviors

	Never (%)	Sometimes (%)	Often (%)
Donating money for environmental protection	69.1	27.7	3.2
Actively participate in environmental campaigns sponsored by government and workplace	58.7	30.4	10.9
Actively participate in environmental protection activities held by Non-governmental organization	76.1	18.9	5

Note: Missing data was minimal (less than 0.5%) and recorded as “Sometimes”

The third type of environmental concern is called the perceived local environmental problems. A confirmatory analysis shows that 3 items have a low factor loading, so I kept 7 out of 10 items. It asks respondents if their living communities have the following environmental problems: air pollution, water pollution, noise pollution, industrial waste pollution, urban garbage pollution, green space deficiency, and destruction of natural vegetation in forests. The answers for 7 items are the following: 1, Not serious at all, 2, Not serious, 3, Unsure, 4, Somewhat serious and 5, Very serious. (For the exact wording, see Table 3-2).

Table 3-2 Seven Items of the Perceived Local Environmental Problems

	1=Not serious at all; 2=Not very serious;3=Unsure;4=Somewhat serious,5=Very serious				
	1(%)	2(%)	3(%)	4(%)	5(%)
1. Air pollution	3.8	16.8	32.3	28.9	18.1
2. Water pollution	4.3	18.6	35.9	26.3	14.8
3. Noise pollution	3.9	16.8	35.5	27.2	16.6
4. Industrial waste pollution	6.2	16.9	46.6	18.6	11.6
5. Urban garbage pollution	4.4	17.1	33.1	28.8	16.7
6. Green space deficiency	4.3	12.5	43.3	24.9	15.0
7. Destruction of natural vegetation in forests	4.1	10.2	63.9	13.9	7.9

Note: Missing data and those who answer “don’t know” or “don’t exist” are recoded as “Unsure”.

A final and common way of measuring environmental concern is to use the NEP scale. It asks relatively abstract questions to explore the interrelationships between human activities and ecosystems. The original NEP scale had 12 items. Later, Dunlap and Van Liere (2000) revised it to include 15 items. However, a confirmatory factor analysis of the 15 items showed that 9 items had low factor loadings. Therefore, I kept 6 items out of 15 items, which also can help us make comparisons with similar studies in the U.S (Table3- 3)

Table 3-3 Six Items of New Environmental Paradigm Scale Items and Percentage Frequencies in China and U.S

	1=Strongly disagree; 2=Mildly disagree 3=Unsure; 4=Mildly agree; 5=Strongly agree					
NEP Items	%	1	2	3	4	5
1. When humans interfere with nature it often produces disastrous consequences	China	2.7	4.6	11.1	31.3	50.4
	US	2.5	11.2	4	37.6	44.6
2. Humans are severely abusing the environment	China	3.6	8.9	13.2	33.9	40.4
	US	1.5	9.3	2.6	35.3	51.3
3. Despite our special abilities humans are still subject to the law of nature	China	1.1	5.1	19.3	39.5	35
	US	0.8	2.9	5.4	31.3	59.6
4. The earth is like a spaceship with very limited room and resources	China	1.7	6.5	26.4	33.1	32.3
	US	4.8	13.4	7.5	36.3	38

Table 3-3 (cont'd) Six Items of New Environmental Paradigm Scale Items and Percentage Frequencies in China and U.S

NEP items	%	1	2	3	4	5
5. The balance of nature is very delicate and easily upset	China	1.7	6.5	25.1	36.9	29.7
	US	1.4	14.1	5.9	32.8	45.9
6. If things continues on their present course, we will soon experience a major ecological catastrophe	China	2.2	7.1	18.7	32.9	39.1
	US	3.6	14.1	16.9	31	34.3

Notes: data from China are recoded so that higher scores show more support for the NEP. Data from U.S. is from the paper by Dunlap et al.(2000)

Do Chinese respondents appear to show more environmental concern than in the U.S and other developed countries? From Table 3-3 above, it seems that the U.S respondents have higher percentages agreeing with 4 out of 6 NEP items than their Chinese counterparts.

What if using the NEP measured by 15 items? According to CGSS2003 data, the total score in the NEP scale is 51.7 out of 75; while using 1995 survey data on environmentalism, Gunnar (1999) found that the total score in the NEP is 55.36 out of 75 in the U.S. Huddart-Kennedy et al. (2009) used data from a national survey in Canada and found that the average score in the NEP from both rural and urban areas is 55.05 out of 75. Considering CGSS2003 excluded respondents in rural areas, it can be inferred that Chinese respondents might have a lower environmental concern than US and many developed countries.

Our socio-demographic variables include gender (female=0 vs. male=1), age (continuous variable ranging from 18 to 72), and individual socio-economic variables consist of education (years of schooling-- those who did not get any school education are coded as 0; those who only finished primary school are coded as 6; those who finished middle school are coded as 9; those who have high school or middle professional school diploma are coded as 12, those who have associate degree are coded as 15; those who have a bachelor degree are coded as 16 year and those who have a post graduate degree or above are coded as 19 years),

Other variables are *income* (continuous variable), The average income of urban residents in China is 10,000 *yuan* (1 U.S.D=8.2 *yuan* in 2003), and *occupation status* (0, those without any occupation, 1, those who neither have management positions nor professional titles as non-management and non professional and 2, those who either have management position or professional technique titles). Finally, our *residency* variable is a categorical variable (town level=0, county level=1, city level=2, capital city level=3) (See Table 3-4 for the details).

Table 3-4 Social Demographic and Economic Variables

Variables	Description of Variables	Mean	S.D
Age	Continuous Variable (year)	43.51	13.17
Gender	Female=0, Male=1	0.48	0.49
Community Size	Small town=0, County level city=1, Median size city=2, Large city=3	2.03	1.03
Education	Continuous Variable (year)	10.44	3.69
Income of a year (Yuan)	Continuous Variable (thousand unit)	10.01	12.83
Occupation status	No occupation=0 Non-management and non professional occupation=1, Management and professional occupation=2	0.67	0.71

3.4 Results

The results of the structural equation model (Table 3-5) indicate that social, demographic, and economic variables have different effects on each of these four factors. In terms of explanatory power, these variables together explain no more than 12.6% of variance in any of the four factors, which is similar to the findings from the Western setting (Marquart-Pyatt, 2008). It should be noted here that these four factors are not highly correlated. Among all four factors, social, demographic, and economic variables account for the highest percentages of variance in the perceived global problems factor ($R^2=0.12$), while they explain the least variance in the

economic tradeoff factor ($R^2=0.031$). In terms of goodness-of-fit indices, Chi-square value is 1807.85 with 219 degrees of freedom and p-level less than 0.001. CFI and RMSEA are 0.927 and 0.038, respectively which implies good model fit.

Table 3-5 Standardized Regression Coefficients on Each of Four Factors

	<i>Economic Trade off</i>	<i>Perceived Local problems</i>	<i>PEB</i>	<i>NEP</i>
Age	0.092***	0.011	-0.011	0.076***
Male	0.014	0.035*	-0.026	0.095***
Community size	-0.038	0.129***	0.062***	0.023
Education	0.178***	0.024	0.23***	0.338***
Income	0.021	-0.015	0.082***	0.018
Occupation	-0.005	-0.022	0.109***	0.002
R^2	0.031	0.02	0.089	0.126

Note : * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

The second column of Table 3-5 shows that age has a positive relationship to *economic - tradeoff* factor and education. This means that older people are more likely to prefer environmental protection to economic growth than younger people. Education has the strongest effect on the factor of *economic tradeoff* ($b=0.178$). It is interesting to find that the size of the residential community was not significantly associated with the economic tradeoff factor. It might reflect the fact that ordinary urban residents, whether living in big city or small city, cannot do much in environmental protection in terms of public policy decision making. As for the other variables, such as gender, income, and occupation status, there is no significant association with the *economic tradeoff* factor.

Contrary to the result in the second column, the third column indicates that the size of the residential community is significantly positive related to the factor of *perceived local problems*. People living in the big cities perceive more severe environmental problems due to two reasons. First reason is that the industrial development strategy planned by the Chinese government after

the foundation of People's Republic of China followed the road of the former Soviet Union and then large cities usually had priority to develop heavy industry. Although this situation has been changed in recent years, the consequences of heavy industry in large cities are still evident. For example, air pollution due to steel factories built inside the city. Second is that due to mass media's fast development in big cities, residents of larger cities have easy access to environmental information. In addition, it has the strongest effect on the perceived local problem factor relative to other variables. This finding is essentially the same as Tremblay and Dunlap (1978) conclusion that residential differences in concern are most pronounced when the environmental issue studied was of local concern.

Age and gender have no significant association with *pro environmental behaviors (PEB)* factor. In terms of the gender effect, the result suggests that males seem to perceive more local environmental problems than females. The reason might be related to different social roles in the family. It was argued that women took greater share of domestic duties, which might reduce their availability of perception of different kinds of environmental problems, while men used to go out for work and increase their access to various environmental problems. However, such effect also does not exist in the *PEB* factor. Surprisingly, education had no significant association with perceived local problems, contrary to common findings in the West and Chinese settings. For example, Klineberg et al. (1998) regressed on different kinds of local pollution and found that education is a significant predictor of perceived local problems. In addition, income and occupation status also have no significant associations with perceived local problems factor.

The fourth column exhibits that all socio-economic variables which include education, income, and occupation status have a significant relationship to the *PEB* factor. However, age

and gender has no effect on the pro-environmental behaviors. The size of the residential community has a significant and positive relationship with the *PEB* factor.

Why does community size have a positive association with the *perceived local problems* factors? One possible explanation for it is that there are more urgent environmental problems objectively existing in their lives, while those individuals in the large cities subjectively perceive more environmental problems due to easily accessing environmental information through mass media. Such patterns also exist in the perceived local problem factor. Regarding gender effect, there are no statistically significant differences in the *PEB* factor. The socio-economic status variables: income, education, and occupation ranking, have a positively significant association with the *PEB* factor, and like the effect of *economic -trade off* factor, education becomes the strongest predictor again.

The fifth column demonstrates the social bases of the *NEP* factor. Different from the finding in the *PEB* factor, age is found to be positively related to the *NEP* factor. The analysis suggests that an older individual has a higher *NEP* factor score than a younger person. As for gender effect, males seem to have a higher score on the *NEP* factor than females. These two results are similar to the findings provided by Xiao and Hong (2010). Different than its role in other factors, the size of residential community does not play any significant role on the *NEP* factor and *economic trade off* factor. Like most findings in the West, income and occupation status has no effect on the *NEP* factor. Compared to other variables, education is still the strongest predictor in the *NEP* factor.

3.5 Discussion

Applying the national data collected in urban China, I first constructed a measurement model of environmental concern and then examined how the selection of particular measure of

environmental concern influences social demographic characteristics through the structural equation model. There are many reasons for inconsistent findings on the social bases of environmental concern, such as methodological issues, different measurement models, and analytical tools. Here, the results revealed that the selection of particular measure of environmental concern does affect its relation to social-demographic variables.

In terms of age hypothesis, our finding is different from the findings by (Howell and Laska, 1992, Van Liere and Dunlap, 1980), but it is consistent with the conclusion by Shen and Saijo (2008). Gender is consistently correlated with environmental concern across the *NEP* and *perceived local problems* factors. In terms of gender effect, the result here suggests that males have more environmental concern than females in urban China, which is different from some previous research results in Western societies. (Schahan and Holzer, 1990; Mohai, 1992; Hunter et al., 2004). However, this result fits with Marquart-Pyatt (2008)'s research in the former communist countries and Shen and Saijo (2008) conclusion based on the data collected from Shanghai in China. Does it mean that some source of environmental concern is related to the countries' ideological differences and developing levels? This question needs further research. Regarding education hypothesis, the result exhibits that the more educated person generally has more concern for the environment, which is parallel with most previous research (Dunlap et al., 2000; Jones and Dunlap, 1992, Klineberg et al., 1998; Weaver, 2002).

For some demographic variables, the data presented here tell different stories. Age is positively associated with the econ tradeoff factor and the *NEP* factor, while has no relation to the factor of the *PEB*. This suggests that some aspects of environmental concern might be more apparent in some specific age groups while less obvious in other age groups. The type of residential community has a significant association with the *PEB* factor and perceived local

problems factor among four selected measures. The result here shows that individuals in the larger cities are slightly more likely to conduct pro-environmental behaviors at the same time. Individuals in the large cities also perceived more local environmental problems. Different effects of age and residence on the selected measures also suggest that the selection of certain measure of environmental concern really matters (Dunlap and Jones, 2002). Through cross-national studies, Marquart-Pyatt (2008) also reinforced this argument.

Except for their effects on the *PEB* factor, income, and occupation status have little effect on the other measures of environmental concern. The significant associations between income, occupation status and the *PEB* factor may reflect the fact that environmental quality is usually treated as a luxury good, and the privilege of upper and middle classes (Van Liere and Dunlap, 1980). The result here illustrates that people with high income and occupation status are more likely to conduct pro-environmental behaviors. However, it is surprising to note that education has no association with *the perceived local problems* factor. This might reflect that perceiving local problems is essentially a process of what they see and experience by themselves. This process is not a matter of individual's education level. Due to data limitation, I did not construct perceived global problems factor as some researchers did. Is individual's education level closely related to perceived global problem because only literacy individual can easily access the mass media such as newspapers, TVs and Internet? This question warrants future research.

Theorizing measures and models, which capture individual level and context-level sources of environmental concern, may be essential for future research. Inglehart (1995) argued that sources of concern for the environment are the combination of "objective problems" and "subjective values", he attributed concern for the environment as resulting from objective problems (environmental degradation). These context-level sources are also considered as objective reality.

Through the survey data collected from Israel's urban centers, Drori and Yuchtman-Yaar (2002) concluded that urban public's concern for the environment is responsive to the environmental vulnerability of its community. For example, due to different industrial structures and environmental regulations, air pollution might differ across contexts. Therefore, to further understand the social bases of environmental concern, some context- level variables might be considered when examining the sources of environmental concern. This kind of analysis requires more advanced statistical tools.

3.6 Conclusion and Summary

In sum, this research is not only systematically study of social determinants of environmental concern measured by four dimensions in urban China, but also examines some significant differences between urban Chinese residents and their western counterparts. The results suggest that more attention should be paid to the selection of particular measure of environmental concern. The data used here clearly demonstrates that it really makes a difference how environmental concern is measured (Van Liere and Dunlap, 1981; Klineberg et al., 1998; Samdahl and Robertson, 1989). This study thus provides a baseline for future research to explore possible driving forces of environmental concern in urban China.

This study also has some obvious limitations. I would like to suggest several areas for future research in China. First, four dimensions are used here to measure environmental concern in urban China. There are still other ways to conceptualize environmental concern. For example, Morrissey and Manning (2000) used environmental values and ethics as an alternative measure of environmental concern. Future studies employing greater numbers of dimensions for environmental concern will be helpful to ensure the validity of the findings. Second, as economic and social transformations are still under way in modern China, it will be useful to examine

whether the meaning of environmental concern is also changing over time. Since this study is cross sectional, it cannot verify this possibility. Future research should consider this point. Finally, rural and urban places may exert different influences on environmental concern (Arcury and Christenson 1993; Fortmann and Kusel 1990, Van Liere and Dunlap 1980). This urban sample makes it impossible to explore urban and rural differences of environmental concern in China. It will be helpful for continued research to collect samples from both rural and urban areas in China.

BIBLIOGRAPHY

BIBLIOGRAPHY

- Albrecht, D., Bultena, G., Hoiberg, E., & Nowak, P. (1982). The New Environmental Paradigm Scale. *Journal of Environmental Education*, 13, 39-43.
- Arcury, T. A. (1990). Environmental Attitude and Environmental Knowledge. *Human Organization*, 49, 300-304.
- Arcury, T. A., & H.Christianson, E. (1990). Environmental Worldview in Response to Environmental Problems: Kentucky 1984 and 1988 Compared. *Environment and Behavior*, 22(3), 387-407.
- Buttel, F. H., & Flinn, W. L. (1978). Social Class and Mass Environmental Beliefs: A Reconsideration. *Environment and Behavior*, 10, 433-450.
- Buttel, F. H., & W.L.Flinn. (1976). Economic Growth Versus the environment: Survey Evidence. *Social Science Quarterly*, 57, 410-420.
- Drori, I., & Yuchtman-Yaat, E. (2002). Environmental Vulnerability in Public Perceptions and Attitudes: The Case of Israel's Urban Centers. *Social Science Quarterly*, 83(1), 53-63.
- Dunlap, R. E. (1975). The impact of political orientation on environmental attitudes and actions. *Environment and Behavior*, 7, 428-454.
- Dunlap, R. E., & G.Mertig, A. (1995). Global Concern for the Environment: Is Affluence a Prerequisite? *Journal of Social Issues*, 51(122-137).
- Dunlap, R. E., & Jones, R. E. (2002). Environmental Concern: Conceptual and Measurement Issues. In R. E. Dunlap & W. Michelson (Eds.), *Handbook of Environmental Sociology* (pp. 482-524). Westport, CT: Greenwood Press.
- Dunlap, R. E., & Valn Liere, K. D. (1978). The "new environmental paradigm": A Proposed Measuring Instrument and Preliminary results. *Journal of Environmental Education*, 9, 10-19.
- Dunlap, R. E., Van Liere, 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.
- Fransson, N., & Gärling , T. (1999). Environmental Concern: Conceptual Definitions, Measurement Methods and Research Findings. *Journal of Environmental Psychology*, 19, 369-382.
- Hayes, B. C. (2001). Gender, Scientific Knowledge, and Attitudes toward the Environment: A Cross-National Analysis. *Political Research Quarterly*, 54(3), 657-671.
- Hong, D. (2006). Measurement of Environmental Concern: NEP Scale's Application in China.

Chinese Journal of Society, 5, 71-91.

Howell, S. E., & Laska, S. B. (1992). The changing face of the environmental coalition: A Research Note. *Environment and Behavior*, 24(134-144).

Hunter, L. M., Hatch, A., & Johnson, A. (2004). Cross-National Gender Variation in Environmental Behaviors. *Social Science Quarterly*, 85(3), 677-694.

Inglehart, R. (1995). Public Support for Environmental Protection: Objective Problems and Subjective Values in 43 Societies. *PS: Political Science and Politics*, 15, 57-72.

Jones, R. E., Fly, J., & K.Cordell. (1999). How green is my valley? Tracking rural and urban environmentalism in the southern Appalachian Ecosystem. *Rural Sociology*, 64(3), 484-499.

Jones, Robert Emmet and Riley E.Dunlap. 1992. "The social Bases of Environmental Concern: Have They changes Over Time?" *Rural Sociology* 57:28-47.

Klineberg, S. L., McKeever, M., & Rothenbach, B. (1998). Demographic Predictors of Environmental Concern: It Does Make a Difference How it's Measured. *Social Science Quarterly*, 79(734-753).

Lounsbury, J. W., & Tornatzky, I. G. (1977). A Scale for assessing Attitudes toward Environmental quality. *Journal of Social Psychology*, 101, 299-305.

Luo, Y., & Deng, J. (2008). The new environmental paradigm and nature-based tourism motivation. *Journal of Travel Research*, 46, 392-402.

Malkis, A., & Grasmick, H. G. (1977). Support for the Ideology of the Environmental Movement: Tests of Alternative Hypotheses. *Western Sociological Review*, 8, 25-47.

Maloney, M. P., & Braucht, G. N. (1975). A Revised Scale for the Measurement of Ecological Attitudes and Knowledge. *American Psychologist*, 30, 787-790.

Marquart-Pyatt, S. T. (2008). Are There Similar sources of environmental concern? Comparing Industrialized countries. *Social Science Quarterly*, 89(5), 1312-1335.

Maslow, A. H. (1970). *Motivation and personality*. New York: Harper Press.

Mobley, Catherine, Wade M. Vagias, and Sarah L. DeWard. (2010). "Exploring Additional Determinants of Environmentally Responsible Behavior: The Influence of Environmental Literature and Environmental Attitudes." *Environment and Behavior* 42:420-447.

McStay, J., & Dunlap, R. E. (1983). Male-Female Differences in Concern for Environmental Quality. *International Journal of Women's Studies*, 6(291-301).

Mohai, P. (1992). Men, women and the environment: An examination of the gender gap in

environmental concern activism. *Society and Natural Resources*, 5, 1-19.

Mohai, Paul, Solange Simoes, and Steven R. Brechin. (2010). "Environmental Concerns, Values and Meanings in the Beijing and Detroit Metropolitan Areas." *International Sociology* 25:778-817.

Morrissey, J., & Manning, R. (2000). Race, Residence and Environmental Concern: New Englanders and the White Mountain National Forest. *Human Ecology Review*, 7(1), 12-23.

Samdahl, D. M., & Robertson, R. (1989). Social derminants of environmental concern: Specification and test of the model. *Environment and Behavior*, 21, 57-81.

Schahn, J., & Holzer, E. (1990). Studies of individual environmental concern: The role of knowledge, gender and background variables. *Environment and Behavior*, 22, 767-786.

Scott, D., & Willits, F. K. (1994). Environmental Attitudes and Behaviors: A Pennsylvania Survey. *Environment and Behavior*, 26(2), 239-260.

Shen, J., & Saijo, T. (2008). Reexamining the relations between socio-demographic characteristics and individual environmental concern: Evidence from Shanghai data. *Journal of Environmental Psychology*, 28, 42-50.

Stern, P. C., Dietz, T., & Kalof, L. (1993). Value orientations, gender, and environmental concern. *Environment and Behavior*(25), 322-348.

Tognacci, L. N., Weigel, R. H., M.F.Wideen, & Vernon, D. T. A. (1972). Environmental Quality: How Universal is Public Concern? *Environment and Behavior*, 4, 73-86.

Tremblay, K. R., & R.E.Dunlap. (1978). Rural-urban residence and concern with environmental quality: A replication and extension. *Rural Sociology*, 43(3), 474-491.

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.

Van Liere, K. D., & Dunlap, R. E. (1981). Environmental Concern: Does It Make a Difference How It's Measured. *Environment and Behavior*, 13, 651-676.

Weaver, A. A. (2002). Determinants of environmental attitudes: A five county comparison. *International Journal of Sociology*, 32, 77-108.

Wehrmeyer, W., & McNeil, M. (2000). Activists, pragmatists, technophiles and tree-huggers? Gender differences in employees' environmental attitudes. *Journal of Business Ethics*, 28, 211-222.

Weigel, R. H., & J.Weigel. (1978). Environmental Concern: the Development of a Measure.

Environment and Behavior, 10, 3-15.

Xiao, C., & Hong, D. (2010). Gender Differences in Environmental Behaviors in China. *Population and Environment*, 32(1), 88-104.

Xiao, C., & M.McCright, A. (2007). Environmental Concern and Sociodemographic Variables: A Study of Statistical Model. *The Journal of Environmental Education*, 38(2), 3-12.

Zelezny, L. C., Chua, P.-P., & Aldrich, C. (2000). Elaborating on Gender Differences in Environmentalism. *Journal of Social Issues*, 56, 443-457.

Chapter 4

Multi-level Analysis of Urban Chinese Residents' Environmental Attitude and Behaviors

4.1 Introduction

For several decades, the Chinese economy has experienced unprecedented growth with an average annual GDP growth rate of 8%. This rapid economic growth, along with a huge population in China, has resulted in serious environmental problems, ranging from air and water pollution to loss of biodiversity and deforestation. For example, about 40% of China's land is affected by soil erosion and deforestation (Wang, 2004). All of these problems not only cause substantial economic losses, but also threaten the health of Chinese residents. It was estimated that annual loss from air pollution was 40 billion US dollars (Duan et al., 1993). At the same time, according to a recent published research, after adjustment for individual level socioeconomic variables, air pollution increased the odds of developing ADLs (here, activities of daily living was used to describe difficult level of functioning in performing daily tasks), cognitive impairment and other health deficits (Zeng et al., 2010).

The reasons behind most of environmental problems mentioned above are closely related to the behaviors and underlying attitudes of the Chinese people. However, we know little of the environmental concern and behaviors of the Chinese public, which are important contributors to environmental impact (Xiao and Hong, 2010). Therefore, studying the underlying forces of environmental-related behaviors at different levels in China is extremely important for policy makers and researchers seeking solutions to environmental problems that require behavioral change.

The current literature has largely focused on the individual level determinants of environmental attitude and pro-environmental behavior (PEB) from different disciplines or

subjects. For example, economists try to examine the influence of external conditions, such as income, price, and other economic characteristics, on individuals' behaviors (Clark et al., 2003). This approach assumes that individual decisions are the consequence of rational choice. Sociologists also tend to emphasize the effect of individual's social characteristics on attitude and behaviors. For example, some researchers examine the role of gender, education, political orientation and residency on pro-environmental behaviors (Zelezny, et al., 2000; Hunter et al., 2004; Xiao and Hong, 2010). On the other hand, some social scientists focus on the internal forces of pro-environmental behaviors, such as intention, value, belief, and personal norms. There are two main theories according to this line of research.

The first main theory is called the Theory of Planned Behavior (TPB), which has developed from an earlier version of Fishbein and Ajzen's (1975) Theory of Reasoned Action. The second main theory is called Value-Belief-Norm (VNB) theory, which was developed to elucidate the link between attitude and behaviors (Stern 2000; Stern, Dietz and Guagnano, 1995; Schultz and Oskamp, 1996). Despite the plethora of studies on environmental attitude and PEB, most of these studies in the Western societies have some major limitations. First, previous work either using TPB or VBN mostly focused on the developed countries; published analyses of data from developing countries, including China, are rare. Second, most previous research collected data are either from a few areas in one country or from selected developed countries. Third, most of their work, especially for those applying these two main theories in environmental behaviors, focused on the individual level determinants of PEB, since these two theories emphasize on important roles of intention, attitude and value on the formation of individual behavior.

Several scholars have suggested the significant role of contextual level variables such as local pollution levels and extent of economic development influence environmental attitude and

pro-environmental behaviors in the community. For example, Sandar (2008:1331) argued that “we should also address perceived seriousness of objective conditions as influences on environmental concerns in formulating regionally-based hypothesis and further explore contextual explanation.” Through discussing changes in public transport use when individual relocated to other place, Bamberg (2006) argued that the change in the environment and its interaction with intervention policies (a free public transport ticket) were responsible for the changes of behaviors. Through a multilevel analysis of 50 nations, Gelissen (2007) argued that it is necessary to examine the combined effects of individual level and contextual level factors on pro-environmental attitudes.

Our main goal in this paper is to identify the effects of individual-level as well as contextual -level determinants on environmental attitude and PEB in China, through using a national sample with a nested data structure, which is rare in current environmental social science research. The following section provides an interdisciplinary literature review on pro-environmental behaviors. Following that, I offer a detailed description of our analytical models, data and variables. After that, I present our analyze results. Finally, I conclude with a discussion of insights gained.

4.2 Literature Review

Since the 1970s, there has been an increasing interest among social scientists in the study of attitudes and behaviors with environmental consequences. These studies not only have theoretical value, but also have practical value, because policy makers can take actions from these studies to increase the level of environmental concern and pro-environmental behavior and thus prevent environmental degradation. Previous research has demonstrated that individuals with high environmental concern are more likely to conduct pro-environmental behavior. Pro-environmental behavior is also referred to as environmentally-friendly behavior,

environmentally-responsible behavior and conservation behavior. Cottrell (2003:356) defined environmentally-friendly behavior as “any individual or group action aimed to do what is right to help protect the environment in a general daily practice.” There are several types of environmentally-friendly behaviors. Recent developments on environmentally-significant behaviors have provided theoretical support for this classification (Tindall et al., 2003; Stern 2000). So it is necessary to understand environmental behaviors in the specific level. In this research, I will adopt Stern’s (2000) classification of pro-environmental behavior: private and public environmental behaviors. Private environmental behaviors represent that those behaviors take place in the private sphere: “the purchase, use and disposal of personal and household products that have environmental impact” (Stern, 2000:409). Public environmental behaviors are those behaviors that happen in the public sphere and attempt to influence public policy, such as donating money for environmental activities and actively joining environmental organization.

4.2.1 Individual-Level Variables: Socio-demographic Characteristics

Previous research has revealed that age, income, education, and gender are slight or moderate correlates of environmental attitude and EFB (Dunlap and Van Liere, 1984; Ostman and Parker, 1987; Hines et al., 1987; Scott and Willits, 1994; Mobley et al., 2010). However, like the social bases of environmental concern measured by the NEP scale, some effects of individual characteristics on general or specific environmental behaviors are inconsistent.

In Western settings, most research has shown that age has a significant association with environmental concern, though environmental concern can be measured by different dimensions. Theodor and Luloff’s (2002) research suggested that age is not a significant predictor of pro-environmental behaviors, which include private and public environmental behaviors. Cottrell’s (2003) research continued to confirm this argument. Through surveying recreational boaters in

Maryland in 1992, Cottrell found that age is not significantly related to general responsible environmental behavior, though it has a significant effect on environmental concern. However, based on a national sample in China, Xiao and Hong (2010) provided different results about the age effect in two types of environmental behaviors. They found that age has a positive significant effect on private environmental behavior but a negative significant effect on public environmental behavior.

As for the income effect on environmentally-friendly behaviors, Hines et al. (1987) found that income has a positive correlation with responsible environmental behaviors in a meta-analysis. Later, through surveying Pennsylvania residents, Scott and Willits (1994)'s research continued to support the positive effect of income on pro-environmental behaviors. However, some research also challenged this argument. For example, Cottrell (2003)'s result suggested that income has no significant effect on responsible environmental behaviors. Kasapoğlu and Ecevit (2003) also found that there are no significant association between income and responsible environmental behaviors. In terms of public environmental behaviors, Theodori and Luloff (2002)'s research indicated that respondents with higher incomes were significantly more likely than those with lower incomes to contribute money and time to environmental organizations. However, in China, researchers (Xiao and Hong, 2010) found that individual with a higher income are more likely to conduct private environmental behaviors (e.g., recycling).

Among social demographic variables, education is reported to have the most consistent effect on environmental concern and different types of environmental behaviors (Ostman and Parker, 1987; Scott and Willits, 1994; Xiao and McCright, 2007). Most of the research in developed and developing countries has indicated that individuals with higher levels of education have more environmental concern and are more likely to engage in environmentally-responsible behaviors.

For example, using data collected in four communities in Pennsylvania, Theodori and Luloff (2002) found that more highly educated respondents were significantly more likely than those with lower education to conduct both public and private environmental behaviors. In China, through path analysis, Xiao and Hong (2010) concluded that except for gender, education was the only predictor with considerable indirect regression weights on environmental behaviors and environmental concern.

In the past several decades, there has been a huge amount of research on environmental attitudes or behaviors in the U.S. This includes an analysis of the effect of gender in individual's attitudes and behaviors (e.g., Davidson and Freudenburg, 1996; Hunter et al., 2004; Hayes, 2001; Dietz et al., 2002). Gender differences in environmental behaviors have aroused more debates than other social determinants of environmental behaviors. Many studies have indicated that women tend to have greater levels of participation than men in various environmental behaviors (Zelezny et al., 2000; Sherkat & Ellison, 2007). In addition, the effects of gender are consistently stronger on environmental behaviors than on environmental attitudes (Zelezny et al., 2000).

However, other research challenged this argument and stated that there are no significant gender differences in environmental behaviors (Blankenau et al., 2008; Bergenguer et al., 2003). Additionally, according to classification of public and private environmental behaviors, some research in China and U.S. suggested that women are more likely to engage in private environmental behaviors (recycling, buying/eating organic) as compared to men (Hunter et al., 2004; Xiao and Hong, 2010), while men are more actively engaged in public environmental behaviors than women (Blocker and Eckberg, 1997; Davidson and Freudenburg, 1996).

4.2.2 Individual Level Variables: Socio-psychological Characteristics

Both TVB and VBN theory emphasize the role of environmental attitudes in predicting environmental behaviors. The New Ecological Paradigm (NEP) developed by Dunlap and his colleagues has been widely used to explore the changing attitudes about environment, not only in the developed countries such as the U.S., but also in developing countries, including China (Dunlap, Van Liere, Mertig, and Jones, 2000). Past research has indicated that general environmental attitude measured by NEP has a mixed effect on environmental behaviors. According to a meta-analysis by Hines et al. (1987), psycho-social variables, including general environmental attitude, have a more significant effect than social-demographic variables on environmental behaviors. However, Scott and Willits (1994) found that the influence of the NEP on environmental behaviors is very weak or absent. Using the NEP as a measure of general environmental attitude, the current study aims to provide further clarity to this debate.

Despite the NEP's widespread use, some researchers (Frantz and Meyer, 2004; Stern, Dietz and Guagnao, 1995) have pointed out that the NEP has limitations, due to its focusing on the general and abstract relationship between humans and nature. Thus, the measure of general environmental attitude would be better complemented with a measure of specific environmental concern (Mobley, Vagias and DeWard, 2010). Related works assume that individual behaviors toward environment should have something to do with what they think and feel with respect to the environmental problems around them. In this research, perceived seriousness of environmental problems in local communities is used to measure what people think and feel with respect to environmental problems around them.

4.2.3 Contextual -Level Variables

Despite the wide range of studies investigating individual differences of environmental attitude and behaviors, only a few of them examine the effect of different contexts such as local economic development level and local pollution level, on environmental attitude and behaviors. One of the few examples that do so, Dolnicar and Grün (2009) argued that it is necessary to focus on both inter-individual heterogeneity and context/environmental heterogeneity. Through a multilevel analysis of 50 nations, Gelissen (2007) concluded that contextual-level variables, such as GDP per capita, GDP growth rate, are related directly to levels of support for environmental protection among nations. Based on the past literature in Western societies, I summarize below, two hypotheses which are related to our contextual level variables. Although the contextual-level variables in this research only includes macro economic development and industrial pollution variables, some western scholars (Haller and Halder, 2008) argued that role of the state and religion, as the contextual level variables, also needs to be considered in the multi-level analysis. It should be noted that due to data limitation, only two main hypotheses are tested in this research.

The first hypothesis is called the objective problems hypothesis. This hypothesis comes from Inglehart (1995)'s argument that the growth of environmentalism is the combination of "objective problems" and "subjective values". Inglehart (1995) also found evidence for the hypothesis that the public in some developing countries has a high environmental concern partially due to the existing serious environmental problems. But, this thesis arouses much debate. Through comparing results from three waves of the "World Values Survey" to those of the Health of Planet Survey, Dunlap and York (2008) argued that citizen concern for the environment is neither dependent on national affluence, nor on postmaterialist values. The

“objective problems” here referred to various environmental problems such as air pollution and water pollution. Based on the challenge-response model, this argument stated that people are more likely to conduct environmentally friendly behaviors because they are directly confronted with serious environmental problems (Gelissen, 2007).

The second hypothesis is called the affluence hypothesis. From the view of environmental economics, environmental quality is regarded as a luxury good. It is logical then to expect that people in wealthier countries have high environmental concern which will lead them to convert their concern to participate more environmentally friendly behaviors. Several studies found positive evidence for this hypothesis in the environmental concern and pro-environmental behaviors research (Diekmann and Franzen, 1999; Franzen, 2003; Glissen, 2007; Franzen and Meyer, 2009). In a multilevel analysis of 50 nations, Glissen (2007) found that the public in comparatively wealthy countries has a higher support for environmental protection. Later, through the ISSP (International Social Survey Program) data, Franzen and Meyer (2009) have indicated that more concern is reported in wealthier countries than in poor nations. Through analyzing the 2000 ISSP data, Freymeyer and Johnson (2010) found that respondents living in wealthier countries, no matter the environmental quality, more frequently join public pro-environmental behaviors such as joining environmental groups, signing petitions concerning the environment and giving money for environmental causes.

These two hypotheses have aroused some debate in the studies of environmental concern. For example, through investigating the data from the Health of Planet Survey, Dunlap and Mertig (1995) argued that environmental concern has no significant association with a country’s wealth. Despite some debate about these two hypotheses, four conclusions can be drawn from the literature related to these two hypotheses. First, even if these two hypotheses could find evidence

in the study of environmental concern, further systematic investigations are needed to see where these two hypotheses apply. Second, although environmental concern or attitude can be one of the driving sources of environmental behaviors, we still know little about how much the degree of environmental concern or attitudes can be translated into an action. Third, most of the current multilevel analysis for these two hypotheses focuses on two levels: the individual level and the cross-national level. However, it is well-known that each nation or country has its own cultural, historical, and economic background. Using data collected from the different cities in the single nation setting can help us to rule out the possibilities which might happen in the analyses of data collected from different countries. That is, other factors, such as different cultural, historical and economic variables might deviate the research results. Fourth, few of the studies that have examined the role of contextual level variables, have also proposed an analytical approach that integrated both the individual and contextual bases of environmental attitudes and pro-environmental behavior in developing countries, especially in China.

All in all, to examine possible multilevel effects involving individual and contextual-level variables on environmental attitudes and pro-environmental behaviors, I test several sets of hypotheses. Individual level hypotheses variables include the effects of individual level variables (age, income, gender, and education), one general environmental attitude and perception of local environmental problems. Contextual-level hypothesis include affluence and “objective problem” hypothesis.

Therefore, the detailed hypotheses in individual and contextual level are following: Individual level hypotheses (all with effects of other variables being controlled): women have more pro-environmental attitudes than men. Women are more likely to conduct private environmental behavior while men are more likely to conduct public environmental behavior.

Personal income, age, education attainment, NEP and perception of local environmental problems are positively related to pro-environmental attitudes and public and private environmental behaviors. Contextual level hypotheses (all with effects of other variables being controlled): city type, GDP per capita, and percent GDP from the primary sector are positively related to environmental attitudes and public and private environmental behaviors (the affluence hypotheses). Industrial waste water, industrial sulfur dioxide, and industrial dust are positively related to environmental attitudes and public and private environmental behaviors respectively (objective problems hypotheses).

4.3 Data Sources

The first dataset I use comes from the Chinese General Social Survey of 2003 (CGSS) administered jointly by the Department of Sociology at Renmin University of China and the Survey Research Center of the Hong Kong University of Science and Technology. The survey with the Environmental Module (Hong and Xiao 2007) was only conducted in urban regions in the mainland of China. The final sample has 5073 urban respondents.

The second dataset comes from the urban statistical yearbook in 2003. The data was published by the National Bureau of Statistics of China. The data were collected from the city level. Here, I selected socio-economic development variables and industrial pollution indicators. Our socio-economic development indicators include GDP per capita, city type and percentages contributions to the total GDP for each selected city of each of three industrial sectors. Our industrial pollution indicators consist of industrial waste water emissions, industrial dust emissions, and industrial sulfur dioxide (SO₂) emissions, from each city for which I have the 2003 CGSS data.

Since the 2003 CGSS data have corresponding city identification codes for each respondent, I combined the city level data with CGSS data. The combined data set is our final dataset and its data structure includes two levels. The first level is from respondent's social and economic characteristics and his or her environmental attitudes and behaviors. The second level is the macro socio-economic and environmental indicators in the respondent's city where they reside.

4.3.1 Variables Measurement: Dependent Variables

In this research, environmental attitudes first worked as dependent variables in the multi-level analysis. Later, they were used as a control variable in modeling the effect of individual and city level variables on public and private pro-environmental behaviors. Our first psychological variables include the general environmental attitude measured by the NEP. A complete 15 item 2000 version of the NEP scale was used in the 2003 CGSS. There is no consistent standard about how many items are used to measure the NEP. A confirmatory factor analysis of the 15 items showed that 9 worded items had low factor loadings. Therefore, I kept 6 items out of 15 items (Cronbach's Apha is 0.748). Based on these six items, factor score weight output was used to create the revised NEP scale (see the Table 4-1).

Table 4-1 Six New Environmental Paradigm Scale Items and Percentage Frequencies and Factor Score Weight in Index

Question Wording	SD=Strongly disagree; D=Mildly disagree U=Unsure; MA=Mildly agree; SA=Strongly agree					Factor Score Weight
	SD	D	U	A	SA	
Six NEP items	(%)	(%)	(%)	(%)	(%)	
1.When humans interfere with nature it often produces disastrous consequences	2.7	4.6	11.1	31.3	50.4	0.14
2.Humans are severely abusing the environment	3.6	8.9	13.2	33.9	40.4	0.13

Table 4-1 (cont'd) Six New Environmental Paradigm Scale Items and Percentage Frequencies and Factor Score Weight in Index

Six NEP items	(%)	(%)	(%)	(%)	(%)	Factor Score Weight
3.Despite our special abilities humans are still subject to the law of nature	1.1	5.1	19.3	39.5	35	0.10
4.The earth is like a spaceship with very limited room and resources	1.7	6.5	26.4	33.1	32.3	0.11
5.The balance of nature is very delicate and easily upset	1.7	6.5	25.1	36.9	29.7	0.13
6.If things continues on their present course, we will soon experience a major ecological catastrophe	2.2	7.1	18.7	32.9	39.1	0.15

Note: Items were recoded so that higher scores show more support for the NEP. Missing data were recorded as “unsure”

As for public and private environmental behaviors, two behavioral indices will be classified based on ten survey items. Respondents were asked to answer whether in the past year they had never, sometimes, or often taken ten different pro-environmental friendly behaviors (see Table 4-1). Through the results of a preliminary principle component analysis, items 1, 2, 3, 4, and 6, were combined to create a private environmental index (the “private index”) and items 5,7,8,9, and 10 were combined to form a public environmental behavior index (the “public index”). Some scholars suggested that using additive indexes might not be the best way to catch the measurement of these two kinds of behaviors. Despite it not being the best way, there has to be a way to compare to the findings of the previous literature which use additive indexes to present these two types of environmental behaviors. For example, Xiao and Hong (2010) classified ten items and combined each of those ten items to create a public environmental behavior index and a private environmental behavior index.

Table 4-2 Ten Items of Environmental Behaviors and Percentage Frequencies

	Never (%)	Sometimes (%)	Often (%)
Question wording			
Private Environmental Behavior			
Classifying rubbish	62.9	22	15.1
Discuss environmental issues with relatives and friends	31.6	56.8	11.6
Bring your own shopping bags to grocery stores	49.6	27.8	22.6
Recycling plastic shopping bags	29	24.9	46.1
Actively pay attention to environmental problems and information in the media	23	45.3	31.7
Public Environmental Behavior			
Donating money for environmental protection	69.1	27.7	3.2
Actively participate in environmental campaigns sponsored by government and workplace	58.7	30.4	10.9
Actively participate in environmental protection activities held by non-governmental organization	76.1	18.9	5
Maintain public woods and grasslands at your own expenses	82	12.4	5.6
Participate in appeal and express grievances about environmental problems.	82.6	14.8	2.6

Missing data were minimal from 0.2 % to 0.4% and recoded as the mid-point, “sometimes”

4.3.2 Independent variables

Our socio-demographic variables include age (continuous variable), gender (female=0 vs. male=1), education (continuous variable), and income (continuous variable)

There are two attitudinal variables in this research: environmental attitudes and perceived local environmental problems. As mentioned above, we will first examine the effect of individual and contextual level variables on the environmental attitudes measured by the NEP scale with 6 items. Later, the environmental attitudes will be used as one of individual level variables in multi-level analysis of two kinds of pro-environmental behaviors. The second attitudinal variable is called the perceived local environmental problems. A confirmatory analysis shows that 3 items out of 10 items have a low factor loading, so I kept 7 out of 10 items (Cronbach’s Alpha is 0.784). It asks respondents if their living communities have the following environmental problems: air

pollution, water pollution, noise pollution, industrial waste pollution, urban garbage pollution, green space deficiency and destruction of natural vegetation in forests. Based on these seven items, I used factor score weight output to create the perception of local environmental problems (For the exact wording, see table 3).

Table 4-3 Seven Items of the Perceived Local Environmental Problems and Percentage Frequencies

Question wording	1=Not serious at all; 2=Not very serious;3=Unsure;4=Somewhat serious, 5=Very serious				
	1(%)	2(%)	3(%)	4(%)	5(%)
1. Air pollution	3.8	16.8	32.3	28.9	18.1
2. Water pollution	4.3	18.6	35.9	26.3	14.8
3. Noise pollution	3.9	16.8	35.5	27.2	16.6
4. Industrial waste pollution	6.2	16.9	46.6	18.6	11.6
5. Urban garbage pollution	4.4	17.1	33.1	28.8	16.7
6. Green space deficiency	4.3	12.5	43.3	24.9	15.0
7. Destruction of natural vegetation in forests	4.1	10.2	63.9	13.9	7.9

Missing data and those who answered “don’t know” or “don’t exist” are recoded as “unsure”

Contextual- Level Variables

City economic development level is measured by three variables: GDP per capita, industry structure (the percentage of the total GDP generated from the primary sector) and city size. These three indicators were selected to represent city economic development level based on the following reasons. First, GDP per capita is often considered an indicator of a country’s standard of living and the related literature (e.g. Franzen, 2003; Gelissen, 2007) also used the GDP per capita to test the effect of wealth in certain areas of environmental concern and support for environmental protection. Second, the industry classification system is used by the government usually divides industry into three sectors. The primary sector of industry includes agriculture, mining and raw material extraction. The secondary sector of industry is manufacturing. The third sector of industry is service production. Some political scientists (e.g. Inglehart, 1990) argued

that environmentalism stems from the emergence of post-materialist value among the member of a new class and most of them holding jobs in the service and information sector instead of the traditional extraction and industrial sectors. As income per capita rises, agriculture loses its primacy, giving way first to a rise in the industrial sector, then to rise in the service sector. These two shifts are called industrialization and post industrialization. China had been an agricultural country in the past centuries. Therefore, using the percentage of the total GDP generated from the primary sector (% GDP from the primary sector) catches the essentials of Chinese economic growth and helps to examine whether decreasing the primary sector contributes to environmentalism.

City type is an ordinal variable (small and midsize city =1, capital city level=2, large city =3). In the Chinese society, due to its population size, city type is direct related to all kinds of resource allocation controlled by the government. Large city here refers to a municipality directly under the central government and its population size is more than 15 millions. Capital city is the capital of each province. When the city type moves up a level, its population generally multiplies by about three. In addition, our previous analysis in chapter 3 showed that the type of residency is significant to perceived local problems factors and pro-environmental behaviors in the previous analysis

Industrial pollution is measured by the amount of industrial waste water emission, industrial sulfur dioxide (SO₂), and industrial dust respectively. These three variables are chosen due to their accessibility in the city statistical yearbook. In China, many pollution indicators are not publicly released and kept as top secrets by the government. (See Table 4-4 and Table 4-5 for their correlation matrix and descriptive tables respectively).

Table 4-4 Descriptions of City Level Variables

City level variable	City number=72	Mean	S.D
City size	1=mid size city; 2=capital city;3=large city;	1.32	0.58
GDP per capita	Continuous (Yuan)	18559.57	11775.44
%GDP from the primary sector	Continuous	16.08	9.61
Industrial wastewater	Continuous (Ten thousand tons)	12025.05	15043.86
Industrial Sulfur dioxide	Continuous (Ten thousand tons)	36283.34	73701.82
Industrial dust	Continuous (Ten thousand tons)	36792.59	40820.01

From Table 4-4, we can find that economic development is uneven in urban areas in China. The highest GDP per capita in Chinese cities is 55280 in the coastal city, while the lowest GDP per capita is 3371 in the interior of China, which also reflects in their percentage of the total GDP generated from the primary sector. The higher GDP per capita a city is, the lower first industry a city is. From the Table 4-5, GDP per capita is negatively correlated with the percentage of the total GDP generated from the primary sector and positively correlated with city size. As for three indicators of industrial pollution, industrial wastewater is positively associated with industrial sulfur dioxide and industrial dust. It should be noted that GDP per capita has no significant relationship with three indicators of industrial pollution. However, the higher level city size is, the higher some industrial pollution indicators. The possible reason might be the effect of pollution size and industrial scale.

Table 4-5 City Level Variables Correlation Matrix

	City size	GDP per capita	First Industry rate	Industrial Wastewater	Industrial Sulfur Dioxide	Industrial Dust
City size	1					
GDP per capita	0.301*	1				
%GDP from the primary sector	-0.521**	-0.654**	1			

Table 4-5 (cont'd) City Level Variables Correlation Matrix

	City size	GDP per capita	First Industry rate	Industrial Wastewater	Industrial Sulfur Dioxide	Industrial Dust
Industrial wastewater	0.556**	0.219	-0.289*	1		
Industrial sulfur dioxide	0.270*	-0.018	-0.159	0.428**	1	
Industrial dust	0.220	0.043	-0.155	0.269*	0.098	1

Note: %GDP from the primary sector is the percentage of the total GDP generated from the primary sector since China is a developing country and 47% of labors are employed in this industry. GDP per capita was measured in Chinese *yuan*. Industrial wastewater was measured in ten thousand tons, and SO₂ and dust was measured in tons. *p<0.1, **p<0.05, ***p<0.01

4.5 Analysis Strategy

A multilevel analysis will be applied to test the hypotheses above. The hierarchical linear model (HLM) has the capacity to break down the influence of individual-level and municipal-level factors on the outcome variable (Raudenbush & Bryk, 2002). HLM models were run to predict environmental attitudes and two types of environmental behaviors using HLM software (Raudenbush, Bryk, & Congdon, 2005). A two-level hierarchical linear model (HLM) was run to reveal the influences of the individual and contextual factors on environmental attitude and two types of environmental behaviors. The level 1 model specifies the influence of individual factors including socio-demographic and psychological variables. The level 2 model tests the effects of measures of city economic development and pollution level on the individual growth parameters, when controlling for the effects of social demographic and psychological characteristics. Due to the different measurement units of dependent variables, standardizing dependent variables was applied before running the analysis.

This analysis will follow several steps. First, a null model (Model1) was estimated. That is a model without any explanatory individual and contextual variables. Here, I modeled an

individual's environmental attitudes and two types of environmental behaviors (Private vs. Public) as Y_{ij} follows.

$$\text{Individual level: } Y_{ij} = \beta_{0j} + r_{ij}$$

$$\text{Contextual level: } \beta_{0j} = \gamma_{00} + u_{0j}$$

Here, Y_{ij} is the dependent variable and represents certain type of environmental attitudes and behaviors for the responder i in j city. β_{0j} is mean environmental attitudes and behaviors for city j and r_{ij} refers to the usual residual error term. The variance of r_{ij} is equal to σ^2 , which represents within- city variability in environmental attitudes and behaviors. γ_{00} refers to the grand mean of environmental attitudes and behaviors. The variance of u_{0j} is equal to τ_{00} , which represents the between city variance in environmental attitudes and behaviors. The aim of this model is to decompose how much variance there was in the individual level and city level. Intra-class Correlation Coefficient (ICC) is defined as $\tau_{00} / (\tau_{00} + \sigma^2)$ that gives the proportion of the total variance in the dependent variable that exists among cities. A low value indicates that there is little variance among cities.

After this null model, the hypotheses were systematically tested in the following models. To examine the individual level determinants of environmental attitudes and behaviors, I included all the individual-level variables with their fixed regression slopes in Model 2; however, I did not add the city level variables in Model 2. To test the affluence hypothesis, I added city economic development level variables, such as, GDP per capita, GDP % from the primary sector, and city size in Model 3.

In Model 4, the final model, all contextual level variables are included. There are several options for model selection. Here, I chose the random intercept model, because the intercept in this model can be regarded as city level mean of environmental attitudes or behaviors and is allowed to vary. In addition, individual level coefficients are assumed to be fixed and the random intercepts is the only random “group effect” (Gelissen, 2007). Therefore, the complete model with individual- and contextual- level variables can be represented as following:

Individual level:

When Y_{ij} represents environmental attitudes for the responder i in j city,

$$Y_{ij} = \beta_{0j} + \beta_{1j} (\text{Gender}) + \beta_{2j} (\text{Age}) + \beta_{3j} (\text{Income}) + \beta_{4j} (\text{Education}) + \beta_{5j} (\text{Perceptions of local environmental problems}) + \epsilon_{ij}$$

When Y_{ij} represents two types of environmental behaviors for the responder i in j city,

$$Y_{ij} = \beta_{0j} + \beta_{1j} (\text{Gender}) + \beta_{2j} (\text{Age}) + \beta_{3j} (\text{Income}) + \beta_{4j} (\text{Education}) + \beta_{5j} (\text{NEP}) + \beta_{6j} (\text{Perceptions of local environmental problems}) + \epsilon_{ij}$$

Municipal level:

$$\beta_{0j} = \gamma_{00} + \gamma_{01} (\text{GDP per capita}) + \gamma_{02} (\text{The First Industry Rate}) + \gamma_{03} (\text{City size}) + \gamma_{04} (\text{Industrial wastewater}) + \gamma_{05} (\text{Industrial Sulfur dioxide}) + \gamma_{06} (\text{Industrial dust}) + u_{0j}$$

$$\beta_{1j} = \gamma_{10}$$

$$\beta_{2j} = \gamma_{20}$$

$$\beta_{3j} = \gamma_{30}$$

$$\beta_{4j} = \gamma_{40}$$

$$\beta_{5j} = \gamma_{50}$$

$$\beta_{6j} = \gamma_{60}$$

These equations emphasize that the slope coefficients are fixed. In the full model, β_{0j} presents the effects of city level variables on the mean level of environmental attitudes and behavior on the j th city while the regression coefficients are assumed to have no variation across units. HLM (Version 6.08) was used here to analyze the data. Full maximum likelihood was used here to estimate parameters.

4.6 Results

The results regarding individual level and municipal level effects on environmental attitudes and private and public environmentally friendly behavior are presented in Table 4- 6, Table 4-7 and Table 4-8, respectively.

Multi-level Analysis of Environmental Attitudes

Model 1 in table 4-6 shows a two level-random intercept null model. I examine how much of the total variance can be attributed to the individual level and how much to the contextual level. The points estimate for the grand-mean level of environmental attitude is 23.87. The variance among cities (0.807) is much smaller than the variance among individuals within cities (14.56). The chi-square test of the estimate between cities variance component proved to be highly significant (Chi-square=342.53, DF=71).

For Model 2 in Table 4-6, five individual level variables were added. Some findings are consistent with previous research. For example, education is the strongest predictor of environmental attitudes among social demographic variables. Age, income and perceived environmental problems are positively related to environmental attitudes. Different from some

results in the western research, this study found that males have more pro-environmental attitudes than female.

In Model 3, measures of economic development variables are added in the model. When I controlled the individual level variables, the percentage of the total GDP generated from the primary sector is significant negatively related to pro-environmental attitudes while the effects of the other two variables (GDP per capita and city type) are not significant. An area with a high percentage of the total GDP generated from the primary sector means the area is under-developed. From the perspective of proportion reduction in variance, adding these three macro-economic variables can help explain 4% of city level variance.

In the final model of table 4-6, three variables used to measure industrial pollution are added. The percentage of the total GDP generated from the primary sector is still statistically significant related to environmental attitudes while none of these three industrial pollution indicators are significant associated to environmental attitudes. Regarding proportion reduction in variance, city level variance in Model 4 is even higher than in Model 3. This suggests that these three industrial pollution indicators do not explain any variance in the city level variance.

Table 4-6 Multi-level Analysis of Environmental Attitudes

Model	Model 1	Model 2	Model 3	Model 4
Fix effect	Coefficient (S.E)	Coefficient (S.E)	Coefficient (S.E)	Coefficient (S.E)
Intercept	23.875*** (0.123)	23.990*** (0.108)	23.977*** (0.105)	23.97*** (0.109)
Individual level Variable				
Age		0.207*** (0.049)	0.202*** (0.049)	0.201*** (0.049)
Education		1.087*** (0.083)	1.082*** (0.084)	1.082*** (0.084)
Income		0.086** (0.041)	0.083** (0.04)	0.082** (0.04)

Table 4-6(cont'd) Multi-level Analysis of Environmental Attitudes

Model	Model 1	Model 2	Model 3	Model 4
Male		0.311*** (0.071)	0.313*** (0.072)	0.313*** (0.072)
Perceived local Problems		0.339*** (0.066)	0.337** (0.066)	0.338** (0.066)
Municipal level variable				
City Type			-0.054 (0.111)	-0.009 (0.114)
GDP per capita			-0.081 (0.153)	-0.094 (0.156)
%GDP from the Primary sector			-0.302** (0.120)	-0.317** (0.124)
Industrial Waste Water				-0.025 (0.1)
Industrial Sulfur Dioxide				-0.151 (0.084)
Industrial dust				-0.02 (0.082)
Random Effect	Variance Component (χ^2)	Variance Component (χ^2)	Variance Component (χ^2)	Variance Component (χ^2)
EFB average level in cities	0.807 (342.53)	0.568 (274.192)	0.545 (254)	0.572 (249.56)
Level 1 effect	14.656	13.364	13.365	13.362

Note: *p<0.1, **p<0.05, ***p<0.01

Multi-level Analysis of Private Environmental Behaviors

Model 1 in Table 4-7 represents a two-level random intercept null model. I investigated how much of the total variance can be attributed to the individual level and how much to the contextual level. The point estimate for the grand-mean level of PEF is 9.033. The variance among cities (0.289) is much smaller than the variance among individuals within cities (4.373). This is also reflected in the value of ICC, which is $0.289 / (0.289 + 4.373) = 0.058$. This means that about 6% of the total variance is among cities. I also can find that a chi-square test of the estimated between cities variance component proved to be highly significant (chi-square=656.67, DF=71).

Model 2 in Table 4-7 examines the extent to which individual-level explanatory variables are related to private environmental behaviors. Most of the findings fit with our expectations and all of the findings reported below are statistically significant at $p < .001$. Older people have more private environmental behavior than younger ones ($b=0.117$). NEP has a positive impact on private environmental behavior. Compared to other determinants, education has the strongest effect on private environmental behavior. The more educated people are, the more likely they are to conduct private environmental behaviors. This result also shows that people who perceived more local environmental problems are more likely to convert their perceptions into private environmentally friendly behaviors. Although some studies (Aoyagi-Usui et al., 2008) reported significantly higher participation in environmental behaviors for men, the study here found that males conducted fewer environmental friendly behaviors in the private sphere ($b=-0.156$). Contrary to my expectations, income did not have a significant effect on private environmental behaviors.

In Model 2 (Table 4-7), these individual-level variables are included, the individual level variance decreased from 4.373 to 3.893 and the municipal level variance also decreased from 0.289 to 0.178 (compared to Model 1). This amounts to a proportion of explained variances of 10.9% at the individual level and 38.4% at the municipal level. Therefore, there is a noticeable evidence of a compositional effect. According to views of some scholars (Diez Roux, 2002; Gelissen, 2007), compositional effect occurs when individual characteristics explain, to some extent, a person's environmental private behaviors. At the same time, if these individual characteristics are unequally distributed among cities, they also explain some differences in environmental private behavior among across cities. Since the added individual level variables

also explain some part of the municipal level variance, I believe that individual characteristics may influence the differences of the averages of these cities on environmental private behaviors.

In Models 3 to 4 in Table 4-7, we investigate how macro economic development and pollution indicators relate to private environmental behaviors. The results show that both national wealth measured by GDP per capita and percentage of the total GDP generated from the primary sector have no significant effect on private environmental behaviors. However, city size has a positive significant association with private environmental behavior. People living in the big cities are more likely to conduct private environmental behaviors. When macro economic development indicators were added, the individual level variance kept the same. At the same time, municipal level variance decreased from 0.178 to 0.146, compared to Model 2. Model 4 in Table 5 also allows us to examine the relationship between private environmental behaviors and municipal level pollution indicator. The results show that none of these three pollution indicators, which include industrial waste water, industrial dust and industrial sulfur dioxide, have significant relationship with private environmental behaviors.

Table 4-7 Multi-level Analysis of Private Environmental Behavior

Model	Model 1	Model 2	Model 3	Model 4
Fixed effect	Coefficient (S.E)	Coefficient (S.E)	Coefficient (S.E)	Coefficient (S.E)
Intercept	9.033*** (0.072)	9.11*** (0.059)	4.793*** (0.257)	4.798*** (0.258)
Individual level Variable				
Age		0.117*** (0.032)	0.114*** (0.03)	0.111*** (0.03)
Education		0.57*** (0.03)	0.563*** (0.03)	0.563*** (0.03)
Income		0.037 (0.028)	0.033 (0.028)	0.033 (0.028)

Table 4-7 (cont'd) Multi-level Analysis of Private Environmental Behavior

Model	Model 1	Model 2	Model 3	Model 4
Male		-0.156*** (0.03)	-0.153*** (0.03)	-0.153*** (0.03)
NEP		0.352*** (0.03)	0.35*** (0.03)	0.35*** (0.03)
Perceived local Problems		0.088** (0.034)	0.082** (0.034)	0.08** (0.034)
Municipal level variable				
City Type			0.131** (0.069)	0.143* (0.085)
GDP per capita			0.046 (0.07)	0.062 (0.073)
GDP % from the Primary sector			-0.047 (0.085)	-0.036 (0.088)
Industrial Waste Water				-0.053 (0.052)
Industrial Sulfur Dioxide				0.02 (0.028)
Industrial dust				0.042 (0.037)
Random Effect	Variance Component (χ^2)	Variance Component (χ^2)	Variance Component (χ^2)	Variance Component (χ^2)
EFB average level in cities	0.289 (656.67)	0.178 (458.04)	0.146 (283.16)	0.154
Level 1 effect	4.373	3.893	3.894	3.894

Note: *p<0.1, **p<0.05, ***p<0.01

Multi-level Analysis of Public Environmental Behaviors

In the analyses of public environmental behaviors, the point estimate for the grand-mean level of private environmental behaviors is 6.493. It is lower than the point estimate for the grand-mean level of private environmental behaviors. The variance among cities (0.182) also turns out to be much smaller than the variance among individuals within cities (3.468). The value of ICC in public environmental behavior is $0.182 / (0.182 + 3.468) = 0.049$, which means that about 5% of the total variance is among cities. A chi-square test of the estimated between cities

variance component is found to be highly significant ($\chi^2=326.56$, $DF=71$). The significant chi-square tests of the estimated between-cities variance component in private and public environmental behaviors indicates that significant variation among cities in these two kinds of environmental friendly behaviors can be explained by contextual and individual characteristics.

Model 2 in Table 4-8 examined whether these individual level characteristics such as, age, income, and gender, which are associated with private environmental behavior have a similar association with public environmental behavior. The findings are mixed. Income still does not have any effect on public environmental behavior. Education, NEP and perceived local problems factors have a positive association with public environmental behaviors. Education is the strongest predictor in public environmental behaviors.

Some results here tell a different story. Different from private environmental behaviors, younger people play a more active role in the public environmental behaviors ($b=-0.006$) and males are more likely to participate in public environmental behaviors ($b=0.005$). Like Model 2 in Table 4-7, there is also a compositional effect in public environmental behaviors. Compared to Model 1, with added individual level variables, I found that the variance for individual level variables decreased from 3.468 to 3.264 and variance for municipal level decreased from 0.182 to 0.165, equal to a proportion of explained variances of 5.8 % at the individual level and 9.3 % at the municipal level.

In terms of public environmental behaviors, Models 3 and 4 in Table 4-8 tell a different story. When macro-economic development indicators are added, that municipal variance decreased from 0.165 to 0.147 while individual level variance is almost same. Different from what we found in private environmental behavior, Model 3 in Table 4-8 indicates that city type

does not have a significant effect on public environmental behaviors. It is worth noting here that the percentage of the total GDP generated from the primary sector has a significant positive association with public environmental behaviors. GDP per capita, is found to be not significantly associated with public environmental behaviors. Regarding the effect of objective environmental problems, like our previous findings in private environmental behaviors, no evidence is found for the hypothesis that higher levels of environmental problems are positively related to public environmental behaviors.

Table 4-8 Multi-level Analysis of Public Environmental Behaviors

Model	Model1	Model2	Model3	Model4
Fix effect	Coefficient (S.E)	Coefficient (S.E)	Coefficient (S.E)	Coefficient (S.E)
Intercept	6.493*** (0.059)	6.531*** (0.056)	6.535*** (0.054)	6.535*** (0.054)
Individual level Variable				
Age		-0.062* (0.035)	-0.06** (0.035)	-0.06* (0.035)
Education		0.374*** (0.029)	0.375*** (0.03)	0.375*** (0.03)
Income		0.004 (0.02)	0.005 (0.02)	0.005 (0.02)
Male		0.006 (0.034)	0.005 (0.034)	0.005 (0.034)
NEP		0.09*** (0.027)	0.09*** (0.027)	0.09*** (0.027)
Perceived local Problems		0.181*** (0.027)	0.18*** (0.027)	0.181*** (0.027)
Municipal level variable				
City Type			0.086 (0.056)	0.080 (0.064)
GDP per capita			0.053 (0.084)	0.048 (0.087)
GDP % from Primary sector			0.211** (0.098)	0.206** (0.098)
Industrial Waste Water				0.022 (0.044)

Table 4-8 (cont'd) Multi-level Analysis of Public Environmental Behavior

Model	Model1	Model2	Model3	Model4
Industrial Sulfur Dioxide				-0.015 (0.035)
Industrial dust				-0.014 (0.048)
Random Effect	Variance Component (χ^2)	Variance Component (χ^2)	Variance Component (χ^2)	Variance Component (χ^2)
EFB average level in cities	0.182 (326.56)	0.165 (296.39)	0.147 (326.56)	0.156 (326.56)
Level 1 effect	3.468	3.264	3.265	3.265

Note: *p<0.1, **p<0.05, ***p<0.01

4.7 Discussions and Conclusion

This study attempts to identify how and to what extent individual level and municipal level variables are related to environmental attitudes and private vs. public environmental behaviors through the HLM and finds the existence of compositional effects, which have been examined in the Western literature (Gelisseon, 2007). As expected, only a small portion of variance (5%) can be explained by municipal level variables either in public environmental behavior or private environmental behavior. However, several important conclusions arise from the analysis.

Our findings concerning the individual level variables are largely congruent with the findings by earlier studies: education, the NEP factor and the perceived local problems factor have a positive association with private environmental behaviors as well as public environmental behaviors. Education has the strongest effect on environmental attitude, private environmental behaviors and public environmental behaviors. It is interesting to find that the NEP factor has the second strongest effect on private environmental behavior while perceived environmental problems shows the second strongest effect on public environmental behavior. Does this mean that NEP, which measures people's general environmental attitude, drives individuals to practice more private environmental behaviors while public environmental behavior is driven more by

perceived environmental problems? Since our data is cross-sectional, a longitudinal analysis is needed to confirm these two driving sources.

Second, our results indicate that women in urban China have higher levels of participation in private environmental behaviors, while men in urban China have higher levels of environmental attitudes measured by the NEP scale. As for public environmental behaviors, there are no significant gender differences. This conclusion is consistent with other findings in both the West and China (Xiao and Hong, 2010; Tindall et al., 2003). Since most private environmental behaviors are undertaken in the context of daily routines and since women share greater share of daily routines, such findings are not surprising. A possible explanations for why men seems to have higher levels of public environmental behaviors than women is that women spend more time in their daily routines, and men spend more time outside of housework. This might relate to traditional gender socialization. Men's work is in charge of making money to support family while female is responsible for doing housework. However, since I do not have additional information about hours of housework done by urban Chinese respondents, this explanation cannot be confirmed in this research.

Third, our results suggest that being older in urban China results in a high level of environmental attitudes and increase participation in private environmental behaviors while being younger in urban China increase the possibility of participation in public environmental behaviors. Since the coefficient of age is extremely small, it is a further indication that age has a weak or no association with environmental behaviors. This finding is also consistent with results commonly found in the Western settings: age explains a small part of variance of environmental concern and behaviors.

To my surprise, compared to other individual-level socio-economic variables, the influence of income on environmental behavior is almost negligible. This conclusion is different from the findings by Guerin et al (2001). In their multilevel analysis of predictors of conservation behavior in the European Countries, they found that income is a statistically significant determinant of recycling behavior.

Fourth, regarding the municipal level section of the analysis, our research partially supports the conclusion that private environmental behavior is greatly influenced by the type of city in which the individual lives. It is surprising to know that, except for city type, the municipal level variables, and GDP per capita do not have a significant effect on environmental attitude and two types of environmental behaviors. However, the percentage of the total GDP generated from the primary sector does have a significant negatively effect on city's mean level of environmental attitudes. This finding indirectly verified the increasing environmental concern among members of "a new class" who hold their job in the service and information sector instead of traditional sector such as agriculture. At the same time, the percentage of the total GDP generated from the primary sector have a significant positively effect on public environmental participation, it suggests that Chinese urban residents in high percentage of the total GDP areas are more willing to participate public environmental behaviors than those in the area with low percentage of the total GDP generated from the primary sector.

In the Chinese resource allocation system, large cities, such as Beijing and Shanghai, can acquire more resources from the central government. Since city type in some degree represents the degree of municipal wealth of each city in urban China. Table 4-7 indicates that city type is positively significant relate to private environmental behaviors while Table 4-8 shows that city type has no significant effect on public environmental behaviors. Therefore, the affluence

hypothesis is only partially supported by this research. This result is inconsistent with common findings in the Western setting (Gelissen, 2003; Franzen and Meyer, 2009). For example, Gelissen (2007) found that wealth measured by GDP per capita is directly related to support for environmental protection. Franzen and Meyer (2009) found that GDP per capita has a positive relationship with public concern for the state of the natural environment. However, how much of this concern or support for environmental protection can be converted into environmental friendly behaviors is still unknown.

Finally, our results do not support the objective problem hypothesis. Some western scholars have argued that areas with severe environmental problems have more support for taking action to solve the problems (Inglehart 1995; Johnson et al. 2005; Marquart-Pyatt 2007). However, in our data, three indicators of objective environmental problems are not significantly related to environmental attitude and private or public environmental behaviors.

However, caution is called for when applying measures of objective environmental problems. Inglehart's hypothesis emphasized the importance of local environmental problems. Here, the objective environmental problems measured mainly use industrial pollution indicators. These industrial pollution indicators were collected based on each city. The city ranking system in China is different from in the U.S. In China, the boundaries of cities include counties, which are comprised of towns and villages. Therefore, cities in China are too large areas to validity represent the local problems that each respondent is experiencing. Industrial pollution indicators belong to regional level of environmental problems in the city. Therefore, they cannot adequately represent the local environmental problems that individuals may confront in their daily life. For example, urban residents might experience chemical pollutions from nearby factories in their living community. As Gelissen (2007) pointed out, it is necessary to seek more valid indicators

of local environmental problems to provide a stricter test of the objective problems hypothesis in the future studies.

To my knowledge, this is the first time that a multi-level analysis of environmental attitude and behaviors in urban China has been conducted. Our findings indicate that the effects of most individual socio-economic and psychological variables follow a similar pattern as in the West. As for municipal level variables, our analysis shows that the affluence hypothesis is partially supported while the objective environmental problems hypothesis does not get obvious support here.

These findings have important implications with regard to both theory and policy. It makes up for the gap in the environmental attitude and behaviors research in the largest developing countries. In addition, through classifying environmentally friendly behaviors into private vs. public behaviors, it allows us systematically to explore the determinants of these two kinds of behaviors. As China becomes more industrialized and urbanized, there is an urgent need for researchers to understand current Chinese environmental concern and help to promote these concerns into environmental friendly behaviors and to provide insights for policy makers.

Despite the significance of our findings, several limitations of these data must be considered. First, in this dataset, private and public environmental behaviors only include five indicators respectively, which only capture the individual's most common environmental behaviors. A more comprehensive and valid measure of private and public environmental behaviors is needed in future research. Second, as mentioned before, our measure of objective environmental problems focuses on regional level environmental problems, instead of local level environmental problems in the specific community. This may help to provide a more stringent test for the

objective problem hypothesis. Also, identifying more comprehensive and valid objective environmental problems in the specific domain will be necessary in future research.

BIBLIOGRAPHY

BIBLIOGRAPHY

- Bamberg, S. (2006). Is a Residential Relocation a Good opportunity to change People's Travel Behavior? Results from a theory-driven intervention Study. *Environment and Behavior*, 38, 820-840.
- Berenguer, J., Corraliza, J. A., & Martin, R. (2005). Rural-urban differences in environment concern, attitudes, and actions. *European Journal of Psychological Assessment*, 21(2), 128-138.
- Blankenau, J., Snowden, M., & Langan, M. (2008). Unstanding environmentalism in a red, agricultural state: The impact of political party identification and place of residence. *Sociological Spectrum*, 28(1), 55-80.
- Blocker, T. J., & Eckberg, D. L. (1989). Environmental Issues as Women's Issues: General Concerns and Local Hazards. *Social Science Quarterly*, 70, 586-593.
- Clark, C. F., Kotchen, M. J., & Moore, M. R. (2003). Internal and external influences on pro-environmental behavior: Participation in a green electricity program. *Journal of Environmental Psychology*, 23, 237-246.
- Cottrell, S. P. (2003). Influence of sociodemographic and environmental attitudes of general responsible environmental behavior among recreational boaters. *Environment and Behavior*, 35, 347-375.
- Davidson, D. J., & Freudenburg, W. R. (1996). Gender and Environmental risk Concerns. *Environment and Behavior*, 28, 302-339.
- Diekmann, A., & Franzen, A. (1999). The Wealth of Nations and Environmental Concern. *Environment and Behavior*, 31(540-549).
- Dietz, T., Kalof, L., & Stern, P. C. (2002). Gender, Values, and Environmentalism. *Social Science Quarterly*, 83, 353-364.
- Diez Roux, A. V. (2002). A glossary for multilevel analysis. *Journal of Epidemiology and Community Health*, 56(8), 588-594.
- Dolnicar, S., & Grün, B. (2009). Environmentally Friendly Behavior: Can Heterogeneity Among Individuals and Contexts/Environments Be Harvested for Improved Sustainable Management? *Environment and Behavior*, 41(5), 693-714.
- Duan, Y., Luo, Y., & Liu, Y. (1993). *Geological Hazards in China*. Beijing: Beijing Architecture and Building Press.
- Dunlap, R. E., & Mertig, A. G. (1995). Global Concern for the Environment: Is Affluence a Prerequisite? *Journal of Social Issues*, 51, 121-137.

Dunlap, R. E., & Van Liere, K. D. (1984). Commitment to the dominant social paradigm and concern for environmental quality. *Social Science Quarterly*, 65(1013-1028).

Dunlap, R. E., Van Liere, 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 post-materialist explanation: Evidence from four cross-national surveys. *Sociological Quarterly*, 49 529-563.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research*. MA: Addison-Welsey.

Frantz, A., & Meyer, R. (2004). Environmental Attitudes in Cross-national perspective: A multilevel analysis of the ISSP 1993 and 2000. *European Sociological Review*, 26(2), 219-234.

Freymer, H. Robert, & Johnson, E. Barbara. (2010). A Cross-cultural Investigation of Factors Influencing Environmental Actions. *Sociological Spectrum* 30(2), 184-195.

Guerin, D., Crete, J., & Mercier, J. (2001). A Multilevel Analysis of the determinants of Recycling Behavior in the European Countries. *Social Science Research*, 30, 195-218.

Haller, M. & Hadler, M. (2008). Dispositions to Act in Favor of the Environment: Fatalism and Readiness to Make Sacrifices in a Cross-National Perspective. *Sociological Forum*, 23 (2), 281-311.

Hayes, B. C. (2001). Gender, Scientific Knowledge, and Attitudes toward the Environment: A Cross-National Analysis. *Political Research Quarterly*, 54(3), 657-671.

Hines, J. M., Hungerford, H. R., & Tomera, A. N. (1987). Analysis and synthesis of research on responsible environmental behavior: A meta-analysis. *Journal of Environmental Education*, 18(2), 1-8.

Hunter, L. M., Hatch, A., & Johnson, A. (2004). Cross-National Gender Variation in Environmental Behaviors. *Social Science Quarterly*, 85(3), 677-694.

Hunter, L. M., Hatch, A., & Johnson, A. (2004). Cross-national gender variation in environmental behaviors." 85: 677-694. *Social Science Quarterly*, 85, 677-694.

Inglehart Ronald.(1990). *Culture Shift in Advanced Industrial Society*. Princeton University Press.

Inglehart, R. (1995). Public Support for Environmental Protection: Objective and Subjective Values in 43 Societies. *Political Science and Politics*, 28, 57-72.

- Johnson, Martin, Paul Brace, and Kevin Arceneaux.(2005). Public Opinion and Dynamic Representation in the American States: The Case of Environmental Attitudes. *Social Science Quarterly* 86:187–108.
- Kaiser, F. G., & Gutscher, H. (2003). The Proposition of a General Version of the Theory of Planned Behavior: Predicting Ecological Behavior. *Applied Social Psychology*, 33(3), 586-603.
- Kaiser, F. G., Hubner, G., & Bogner, F. X. (2005). Contrasting the Theory of Planned Behavior with the Vaule-Belief-Norm Model in Explaining Conservation Behavior. *Journal of Applied Social Psychology*, 35(10), 2150-2170.
- Kasapoğlu, M. A., & Ecevit, M. C. (2002). Attitudes and Behavior toward the Environment: The case of Lake Burdur in Turkey. *Environment and Behavior*, 34(3), 363-377.
- Mobey, C., Vagias, W. M., & Deward, S. L. (2010). Exploring Additional Determinants of Environmentally Responsible Behavior: The Influence of Environmental Literature and Environmental Attitudes. *Environment and Behavior*, 42(4), 420-447.
- Oreg, S., & Katz-Gerro, T. (2006). Predicting proenvironmental Behavior cross-nationally: Value, the Theory of Planned Behavior, and value-belief-norm theory. *Environment and Behavior*, 38(4), 462-483.
- Ostman, R. E., & Parker, J. L. (1987). Impact of education, age, newspapers and television on environmental knowledge, concerns and behaviors. *Journal of Environmental Education*, 19(1), 3-9.
- Raudenbush, S. W., & Bryk, A., S. (2002). *Hierarchical linear models: Applications and data analysis methods*. 2nd edition. Newbury Park: CA: Sage.
- Raudenbush, S. W., Bryk, A., S., & Congdon, R. T. (2005). *HLM-6*. Lincolnwood, IL: Scientific Software International.
- Marguart-Pyatt, S. T. (2007). Concern for the Environment among General Publics: A Cross-national Study. *Society and Natural Resources*, 20, 883-898.
- Marguart-Pyatt, S. T. (2008). Are There Similar sources of Environmental Concern? Comparing Industrialized Countries. *Social Science Quarterly*, 89(5), 1312-1335.
- Schultz, P. W., & Oskamp, S. (1996). Effort as a moderator of the attitude-behavior relationship: General environmental concern and recycling. *Social Science Quarterly*, 59, 375-383.
- Scott, D., & Willits, F. K. (1994). Environmental Attitudes and Behaviors: A Pennsylvania Survey. *Environment and Behavior*, 26(2), 239-260.

- Sherkat, D. E., & Ellison, C. G. (2007). Structuring the religion-environment connection: Identifying religious influences on environmental concern and activism. *Journal of the Scientific Study of Religion*, 46(1), 71-85.
- Stern, P. C. (2000). Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues*, 56, 407-424.
- Stern, P. C., Dietz, T., & Guagnano, G. A. (1995). The New Ecological Paradigm in Social-psychological Context. *Environment and Behavior*, 27(6), 723-743.
- Stern, P. C., Dietz, T., Kalof, L., & Guagnano, G. A. (1995). Values, beliefs, and Proenvironmental action: Attitude formation toward emergent attitude objects. *Journal of Applied Social Psychology*, 25(18), 1611-1634.
- Theodori, G. L., & Luloff, A. E. (2002). Position on Environmental Issues and Engagement in Proenvironmental Behaviors. *Society and Natural Resources*, 15, 471-482.
- Tindall, D. B., Davies, S., & Mauboules, C. (2003). Activism and conservation behavior in an environmental movement: The contradictory effects of gender. *Society and Natural Resources*, 16, 909-932.
- Wang, Y. (2004). Environmental Degradation and Environmental Threats in China. *Environmental Monitoring and Assessment*, 70, 161-169.
- Xiao, C., & Hong, D. (2010). Gender Differences in Environmental Behaviors in China. *Population and Environment*, 32(1), 88-104.
- Xiao, C., & McCright, A. M. (2007). Environmental Concern and Socio-demographic Variables: A Study of Statistical Models. *The Journal of Environmental Education*, 38(2), 3-12.
- Zelezny, L. C., Chua, P.-P., & Aldrich, C. (2000). Elaborating on Gender Differences in Environmentalism. *Journal of Social Issues*, 56(3), 443-457.
- Zeng, Y., Gu, D., Purser, J., Hoenig, H., & Christakis, N. (2010). Associations of Environmental Factors with Elderly Health and Mortality in China. *American Journal of Public Health*, 100(2), 298-304.

Chapter 5 Conclusion and Discussion

5.1 Overview

This dissertation research, comprised of three papers, sets out answer three research questions: 1) Is the measurement of environmental concern in China different from in western societies? 2) How will the selection of particular measures of environmental concern affect their relation to social-demographic variables? 3) What are the effects of individual and community level variables on two types of environmental behaviors?

Using the 2003 General Social Survey (GSS) data and some variables derived from 2003 Urban Statistical Book, I not only try to build a measurement of environmental concern and its links to the respondent's individual social-demographic variables. I also estimate the effects of individual and community level variables, such as, GDP per capita and regional environmental pollution index on environmental attitudes and two kinds of environmental behaviors: private pro-environmental behaviors and public pro-environmental behaviors. This chapter summarizes the findings from these three papers, outlines policy implications and discusses the future research directions.

5.2 Summary of Research Findings

In the first paper of chapter 2, through examining the 2003 GSS data, I proposed a measurement model of environmental concern in China, which includes four dimensions: Economic Environmental Trade off, the NEP, Pro-environmental behaviors, and Perceived Locally Environmental Problems. By exploring the correlation pattern among the constructed four latent factors, I found that Pro-environmental behavior (PEB) factor has a high association with NEP and Economical Trade-off factor, which verifies the previous findings that the measurement of environmental concern put more weights on the NEP scale. From the

perspective of environmental constructionist, traditional and new rising mass media plays an important role in contributing new environmental paradigm worldview for the public.

As I mentioned before, previous research did not take perceived local environmental problem into account in their constructed model. In my measurement model, perceived locally environmental problems factor's relationship with the other factors is contrary to original expectation: it has no significant association with Economic Environmental Trade Off Factor. Why do people not to take a more active action on protecting their local environment where people perceive more locally environmental problems? The answer to this question might require some insights from social psychological perspectives and political systems existing in the Chinese society.

In the second paper, I applied the structural equation model to examine how the selection of particular measure of environmental concern influences social demographic characteristics. The results suggest that more attention should be paid to the selection of particular measure of environmental concern. Compared to the similar studies in developed societies, the findings here has some commonalities as well as differences. For example, regarding the effect of education, the result exhibits that the more educated person generally has more concern for the environment, which is parallel with most previous research. However, in terms of gender, the result here suggests that males have more environmental concern than females in urban China, which is different from some previous research results.

The significant associations between occupation, education and the pro-environmental behaviors factor in U.S and China may reflect the fact that environmental quality is usually treated as a luxury good, and the privilege of upper and middle classes in the Western societies as well as in China. However, does this conclusion suggest that rich and upper class people in

China are more likely or the same as their Western counterparts to conduct pro-environmentally friendly behavior in private field? Since the items used to measure the pro-environmental behavior factor are classified as public environmental behaviors, this question warrants further research. The third paper of chapter 4 provides some insights to this question.

In the third paper, I used HLM to identify how and to what extent individual level and municipal level variables are related to private vs. public environmental behaviors. I find the existence of compositional effects, and it means that both individual level variables and contextual level variables contribute to explain the total variance. Such effects have been examined in the Western literature. As expected, only small portion of variance (5%) can be explained by municipal level variables either in environmental attitudes and public environmental behavior or private environmental behavior. However, several important conclusions arise from the analysis. First, in the individual level variables, most of findings are congruent with previous research in the U.S. and European societies. However, I found that in China, income has no significant association with these two kinds of pro-environmental friendly behaviors. In contrast, several scholars (Clark et al. 2003; Gatersleben et al. 2002) found that people with a high income in western societies are more likely to take part in different pro-environmental friendly activities than people with a low income. The data here demonstrate that rich people in urban China do not show a significantly high level participation than poorer people in different pro-environmental behaviors. Does that indicate that rich people in China feel less social responsibility than their counterparts in the Western society?

In the municipal level, research partially supports the conclusion that although the type of city has no effect on environmental attitudes, private environmental behavior is greatly influenced by the type of city in which the individual lives. It is surprising that GDP per capita

has no effect on environmental attitude and behaviors while % GDP generated from the primary sector has a significant effect two kinds of environmental attitude variables: 1) on environmental attitudes measured by the six item NEP scale and 2) city's mean level of participation in public environmental behaviors. In addition, the results here do not support the objective problem hypothesis. Three indicators of objective environmental problems are not significantly related to either environmental attitudes and private or public environmental behaviors.

5.3 Significance and Limitations of the Study

To my knowledge, this is the first comprehensive study to use a national sample to examine environmental attitudes and pro-environmental behaviors in China. Answers to the raised research questions in this study meet the urgent need for more evidence of knowledge about urban residents' environmental attitudes and behaviors. As mentioned previously, most extant studies in this area have focused on developed countries or areas. There is little research exploring the status of environmental behaviors and attitudes in urban China. As the Chinese society becomes more industrialized and urbanized, there is a need to increase understanding of the construction of environmental concern based on Chinese social background and its social and economic characteristics and further promote these concerns into pro-environmental behaviors.

This research is also designed to advance the existing knowledge about environmental attitudes and behaviors among common Chinese people that has so far received limited attention. The findings of this study may be used as the base for future research on how to improve sustainable life styles among the Chinese people or serve as a reference for studying social and economical factors influencing environmental attitudes and behaviors among urban Chinese residents.

This study has great policy implications for government policy making in the national level and global level. Our results demonstrated that environmental concern is a process of multi-dimension construction. Focusing on one dimension and ignoring the other cannot fully catch the essentials of environmental concern. To increase environmental concern of the public in China, government policy makers need to seek the balance between the economic growths and environmental protection and switch to a more ecological development road. Past experiences show that it is not an easy task to develop programs that promote ecologically and economically sound policy.

Our analysis revealed that education plays an important role in contributing to the rising of environmental concern. Therefore, government and schools should spend more resource in teaching children about the diversity of natures and cultures. A greater appreciation of the diversity of environment should help us realize the consequence of environmental degradation. In addition, since there is gender difference in willingness to engage in public and private environmental behaviors, it suggests that our environmental education programs should have specific purposes. For example, these programs should encourage male groups to participate more in private environmental behaviors and female groups to take part in more public private environmental behaviors. Finally, due to the different effects of public and private environmental behaviors, different education or campaigns should be design to encourage these different kinds of behaviors.

In the global level, concern for environment is not restricted to wealthy nations. It also spreads well in the developing countries such as, China. However, recent global environmental protection effects have been stagnated in part due to the actions of a handful of rich nations. For example, Bush administration refused to sign the Kyoto Protocol. Therefore, it is unfair to blame

developing nations for the lack of progress in protecting the global environment. Only by acknowledging the fact that the citizen's livelihoods in developing countries mainly depend on available natural resources, can effective policies be designed and implemented.

Our analysis also shows that there are no huge differences between China and the developed countries such as the U.S. in terms of measure of environmental concern measured by the six NEP items. The results showed that the decreasing percentage of traditional sector can contribute to the increasing environmental concern and public environmental behaviors due to the formation of "new class". Since the members of new class are mostly well educated and mainly work on service sectors, therefore, whether governments in developed countries or developing countries have obligation to upgrade their industrial sectors and make service sector have more members working in it.

Despite the significance of our findings, there are limitations in this research due to the data availability and data quality. First, with the increasing global environmental issues, such as global warming and global ozone depletion, future research in measure of environmental concern in developing countries like China, should consider how the public perceives these global environmental issues. Second, the classification of private and public environmental behaviors only include five indicators respectively, which only capture the individual's most common environmental behaviors.

Future research might need to identify additional valid items to capture those two kinds of behaviors. For example, individuals purchasing energy efficient products with more cost should be added in private environmental behaviors. Third, it should be noted that our data are limited to urban residents and exclude the residents in rural areas. Therefore, applying the generalized results to the whole China should be careful.

BIBLIOGRAPHY

BIBLIOGRAPHY

Clark, C. F., J.Kotchen, M., & Moore, M. R. (2003). Internal and external influences on pro-environmental behaviors: Participation in a green electricity program. *Journal of Environmental Psychology*, 23, 237-246.

Gatersleben, B., Steg, L., & Vlek, C. (2002). Measurement and Determinants of Environmentally Significant Consumer Behavior. *Environment and Behavior*, 34(3), 335-362.