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ANALYSIS

The Environment and Well-Being in Urban China

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ABSTRACT

We examine the relationship between atmospheric pollution, measured as sulphur dioxide emissions, environmental disasters, traffic congestion, access to parkland and well-being in urban China, using a large survey administered across 30 cities in 2003. We find that in cities with high levels of atmospheric pollution, environmental disasters and traffic congestion Chinese citizens report significantly lower levels of well-being ceteris paribus while in cities with greater access to parkland Chinese citizens report significantly higher levels of well-being ceteris paribus.

1. Introduction

China's pollution problems are well-known. According to the World Bank, China has 16 of the world's 20 most polluted cities, with four of the worst in the main coal producing province of Shanxi. In 2005, only 31% of Chinese cities met national air quality standards and more than 75% of water in rivers in China's urban areas cannot be used for drinking or fishing (Economy, 2007). The World Bank (2007) estimates that only 1% of China's urban population of 560 million breathe air considered safe in the European Union. The World Bank (2007) estimates that the health costs of air and water pollution amount to 4.3% of Gross Domestic Product (GDP) and the non-health impacts to 1.5% of GDP, making the total cost of air and water pollution in China, 5.8% of GDP.

Recently there has been a surge of interest in economics in studying subjective well-being (see Frey and Stutzer 2002; Dolan et al., 2008 for reviews). This interest has emerged in the wake of several decades of research by psychologists on the topic (see Diener et al., 1999). While economists were initially sceptical about the value of using subjective well-being as a measure of utility, as Kahneman et al. (1997) note the use of direct scientific measurement of utility represents a return to the origins of Classical economics. Most economic models assume that utility equates with consumption, such that income is the best measure of well-being. The use of self-reported measures of utility has the advantage that it can assist to clarify the relationship between income and a host of indicators including personal traits, socially developed characteristics, beliefs, how we spend our time and overall life satisfaction.

Economists have primarily been concerned with examining the correlation between (absolute and relative) income or unemployment and subjective well-being. A consensus exists that the unemployed report lower well-being than those in employment ceteris paribus (Clark and Oswald, 1994). How-

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ever, there continues to be much debate about the relationship between income and subjective well-being with several recent studies examining the relationship between relative income and subjective well-being with a range of alternative comparators (see Clark et al., 2008 for a review of the literature on the relationship between income and subjective well-being). Compared with the large literature examining the relationship between income and well-being, little research has examined the relationship between the environment and subjective well-being. This study adds to this paucity of literature through examining the correlation between environmental variables and subjective well-being using a survey of 8890 individuals in 30 Chinese cities, collected in September, 2003.

This research is important for two reasons. First, the speed at which China can effectively address its environment problems requires knowledge about people's preferences. This, in turn, depends on the relationship between environmental surroundings and subjective well-being. In China, there are two competing aspects of this issue that the central government is attempting to balance. On the one hand, China has a nascent environmental movement at the citizen level. Since the mid-1990s about 3000 environment oriented non-government organizations (NGOs) have been established in China. These organizations, such as the well-known 'Friends of Nature' and 'Global Village of Beijing', primarily focus on education, raising awareness and hands-on environmental activism (Martens, 2006). The Chinese central government provides tacit support for this movement as a means of scrutinizing environmental protection at the local level, although criticism of the central government is not permitted (Larson, 2007; Martens, 2006; Mol and Carter, 2006). As Economy (2007) notes, while the Chinese central government has enunciated a much greater commitment to environmental protection in recent times, such commitments mean little in practice if lower levels of government refuse to enforce central directives or regulations as has been the case. In this respect, the central government sees environmental NGOs as a means to put pressure on lower levels of government.

However, at the same time, the Chinese central government is worried about the potential for environmental concerns to manifest themselves in the form of widespread political and social unrest. For this reason environmental protection, along with reducing corruption and rural–urban income inequalities, is a cornerstone of Hu Jintao's commitment to more balanced growth. The deterioration in the environment resulted in 51,000 pollution disputes in 2005, amounting to 140 per day (Zhang, 2007). Citizen complaints about the environment, expressed on official hotlines and in letters to local officials are increasing at 30% per annum and were expected to top 450,000 in 2007 (Economy, 2007). There are also an increasing number of political demonstrations complaining about the environment. Economy (2007) mentioned one such demonstration in 2005 when 30,000 to 40,000 people in Zhejiang province vandalised 13 chemical plants as part of a protest about air pollution. Knowledge of the relationship between pollution and other environmental variables and subjective well-being is useful for the central government in balancing support for environmental NGOs with a need to avoid social and political unrest.

The second reason research on the correlation between environmental surroundings and subjective well-being is important is that the results help to strengthen the foundations of the ecological economics literature on the detrimental effects of economic growth (Ferrer-i-Carbonell and Gowdy, 2007). This is particularly apposite for a country such as China which has been described as 'choking on its own success' (Kahn and Yardley, 2007). The literature on sustainability suggests that social welfare rather than per capita income should be the focus of government policy (Gowdy, 2004, 2005). In 2004, for the first and only time, the Chinese government reported figures for Green GDP, which adjusted GDP to reflect the cost of pollution. The figures, however, were sobering, with the pollution-adjusted growth rates in several provinces being close to zero. The idea of reporting Green GDP in China has since been shelved because of strong opposition from local government officials (Kahn and Yardley, 2007). Local officials were opposed to Green GDP as a concept from the start because lower adjusted growth rates reduce their prospects for promotion (Economy, 2006). A better knowledge of the relationship between environmental surroundings and well-being in urban China has the potential to put broader notions of social welfare, such as Green GDP, back on the policy-making agenda.

2. The Chinese context

Since economic reforms commenced in the late 1970s China has had one of the highest rates of growth in the world, but this has also generated massive environmental problems. For two decades through the 1980s and 1990s China's Collective Township and Village Enterprises (CTVEs) were the driving force behind China's high growth rate. However, most CTVEs had no wastewater or hazardous waste treatment facilities. Through the 1980s and 1990s CTVEs were responsible for 50% of industrial wastewater and air pollutants (WHO, 2001). China is the largest coal producer in the world. Coal contributes 90% of China's sulphur dioxide emissions and about 70% of China's total dust, nitrogen oxide and carbon dioxide emissions (Zhang, 2007). China has twice the sulphur dioxide emissions of the United States with some estimates suggesting that in the future China's sulphur dioxide emissions will be up to five times their current level. Motor vehicle emissions are also becoming an important source of ambient air pollution. By 2020 China is expected to have 130 million cars and by 2040–2050 China will have more cars than the United States (Economy, 2007). Walsh (2000) estimates that motor vehicles contribute between 45 and 60% of the NO_x emissions and 85% of the carbon monoxide emissions in Chinese cities. As a result, some have argued that urban air pollution in Chinese cities is shifting from a predominantly coal-burning type to a coal-vehicle mixed type (see Deng, 2006 and references cited there in).

According to World Bank estimates from the 1990s, the number of annual pollution-related premature deaths in China from a mixture of outdoor air pollution in large cities, indoor air pollution from inhaling fumes from coal-burning stoves and cooking oil as well as cancers and diarrhoea from drinking polluted water, were about 400,000 (Toy, 2007). In a preliminary version of the World Bank's (2007) most recent study on pollution in China, it estimated that the annual number of premature pollution-related deaths in China are as high as 750,000. While this figure was censored from the final

version of the World Bank (2007) report, it was openly discussed at the conference launching the World Bank study and has been reported in the media (see e.g. Kahn and Yardley, 2007; Toy, 2007). China's air pollution is also held responsible for an increase in the prevalence of asthma in Chinese cities. According to official figures, throughout the 1990s the prevalence of asthma among urban children increased 64%. More recent data is not available, nor is data available for adults, although Chinese doctors have estimated that the number of asthma cases they treated increased 40% over the period 2000 to 2005 (Watts, 2006).

3. Related literature

As discussed above there is a vast literature in economics and psychology on subjective well-being. As a subset of this literature there are a growing number of studies for transitional economies. There are studies of which variables are correlated with well-being in Russia (see e.g. Eggers et al., 2006; Frijters and Van Praag, 1998; Frijters et al., 2006; Graham et al., 2004 among others); the former Soviet Republics (Namazie and Sanfey, 2001) and Central and Eastern Europe (see e.g. Andren and Martinsson, 2006; Hayo and Seifert, 2003; Hayo, 2007; Lelkes, 2006; Sanfey and Teksoz, 2007). Other studies have examined the subjective well-being of former East Germans and West Germans following reunification (see e.g. Frijters et al., 2004).

Correlation between well-being and other variables is a significant issue on the research agendas of economists and psychologists studying China's rapid modernisation, though to date, studies in the English language literature have been confined either to clinical samples (e.g. Yan and Sellick, 2004); age-specific samples, such as adolescents (e.g. Edwards set al., 2005); specific occupations (e.g. Law et al., 2008); the elderly (e.g. Chen, 2003), rural residents (Knight et al., 2007) or off farm migrants (Knight and Gunatilaka, 2007). Cheung and Leung (2004) who examined subjective well-being of residents in Beijing is the only study to consider this issue for urban residents. There are no studies of subjective well-being among urban residents for cities other than Beijing. Moreover, one feature of all of these studies for transitional economies, including China, is that few consider the relationship between the environment and subjective well-being. Of those studies which do consider environmental factors, Frijters and Van Praag (1998) find that climate is correlated with people's standard of living in Russia and that people dislike cold winters and hot summers. Knight et al. (2007), in their study of rural China, find that people living in hilly and mountainous terrains report lower levels of well-being ceteris paribus.

There are few studies by economists of the relationship between the environment and subjective well-being. Some studies have found a positive correlation between climatic variables and subjective well-being (in addition to Frijters and Van Praag, 1998 see Rehdanz and Maddison, 2005; Brereton et al., 2008). Studies have found a negative correlation between air and noise pollution and subjective well-being (Di Tella and MacCulloch, 2008; Van Praag and Baarsma, 2005; Welsch, 2002, 2006; Rehdanz and Maddison, 2008). In addition to climatic conditions, Brereton et al. (2008) examine the relationship between environmental surroundings proxied by indicators such as proximity to a major road, airport, a landfill or hazardous waste facility, and subjective well-being. Ferrer-i-Carbonell and Gowdy (2007) examine how environmental attitudes are correlated with subjective well-being. In short, existing studies that have considered the relationship between environmental surroundings and subjective well-being have been primarily restricted to developed countries. There are no studies that have focused on the relationship between environmental variables and well-being in a developing country such as China.

4. Empirical approach

4.1. *The model*

We employ a specification where we express subjective well-being (SWB) as a function of: (i) variables capturing the environmental surroundings of the individual (ES), (ii) attitudes to the environment (EA); (iii) personal characteristics (P) and (iv) attitudes to other political and socio-economic issues (OA). This relationship can be expressed as follows where ε is the error term, reflecting unobserved random factors.

$$\mathrm{SWB} = f(\mathrm{ES}, \mathrm{EA}, \mathrm{P}, \mathrm{OA}, \varepsilon) \quad (1)$$

To measure subjective well-being we use respondents' answers to the question: 'How satisfied do you feel with your life these days?' Respondents can answer on a scale of 1 to 5 where 1 denotes 'very unsatisfied' and 5 denotes 'very satisfied'. Overall, 2.6% were 'very unsatisfied', 13.4% were 'unsatisfied', 41.9% were 'neither satisfied nor unsatisfied', 39.3% were 'satisfied' and 2.8% were 'very satisfied'. The mean satisfaction rating for respondents to the survey was 3.26 (SD=0.82). To measure environmental surroundings we employ variables for atmospheric pollution, measured in terms of sulphur dioxide emissions, the number of environmental disasters, traffic congestion and the area of parkland per capita in the city in which the respondent lives. To measure environmental attitudes we used two variables denoting whether environmental protection is a social problem of major interest to the respondent (environment awareness) and the respondent's perception of changes in the environmental consciousness in the neighbourhood in which he or she lives in the two years prior to the survey (neighbourhood environment). For personal characteristics of the respondents we use commonly employed controls; namely, age, age squared, education, employment status, gender, occupation and marital status.

We control for the individual's attitudes on a range of other socio-economic and political issues other than the environment. Specifically, we control for whether the individual is pro-market and whether the individual considers each of income inequality, social protection, reunification of Mainland China and Taiwan and the Severe Acute Respiratory Syndrome (SARS) epidemic is a social problem of major interest. SARS is a relevant issue because the survey we use was administered in late 2003 soon after the height of the outbreak of the epidemic in China. Table 1 contains a complete list of explanatory variables and descriptive statistics for each variable.

To estimate Eq. (1) we use an ordered probit model. This means that subjective well-being is assumed to be a categorical

Table 1 – Description of variables

Variable	Definition	Descriptive statistics
Environmental attitudes		
Environment awareness	Response to the question: Is environmental protection a social problem of major interest to you? A dummy variable set equal to 1 if the respondent answered 'yes'; zero otherwise.	28.5% of respondents considered environmental protection a social problem of major interest to them.
Neighbourhood environment	Response to the question: Over the last two years, what changes in environmental consciousness have you observed in the neighbourhood in which you live? Responses depicted on an ordinal scale from 1= 'considerable fall' to 5='significant improvement'.	1=1.3%; 2=7.7%; 3=24.2%; 4=56.5%; 5=10.3%. Mean perceived change rating=3.66 (SD=0.81).
Attitudes on other socio-economic and political issues		
Pro-market	A dummy variable set equal to 1 if the respondent favours further market reforms; zero otherwise.	96.8% of respondents were pro-market.
Income inequality	A dummy variable set equal to 1 if income inequality is a social problem of major interest to the respondent; zero otherwise.	29.5% of respondents considered income inequality a social problem of major interest to them.
Social protection	A dummy variable set equal to 1 if social protection is a social problem of major interest to the respondent; zero otherwise.	50.5% of respondents considered social protection a social problem of major interest to them.
National reunification	A dummy variable set equal to 1 if reunification between the Mainland and Taiwan is a social problem of major interest to the respondent; zero otherwise.	9.9% of respondents considered national reunification a social problem of major interest to them.
SARS	A dummy variable set equal to 1 if SARS is a social problem of major interest to the respondent; zero otherwise.	26.2% of respondents considered SARS a social problem of major interest to them.
Personal characteristics		
Gender	A dummy variable set equal to 1 if the respondent is male.	51.2% female.
Age	The age of the respondent.	Mean=39.11 (SD=13.90) in a range of 18–88.
Marital status	A vector of dummy variables for marital status of the respondent	Single=25.6%, married=69.4%, divorced and not

Table 1 (*continued*)

Variable	Definition	Descriptive statistics
Personal characteristics		
Marital status	(single, married, divorced and not remarried, divorced and remarried, widowed and not remarried, widowed and remarried).	remarried=1.9%, divorced and remarried=0.5%, widowed and not remarried=2.4%, widowed and remarried=0.2%.
Education	A vector of dummy variables representing the highest education of respondent (junior secondary school and below; senior secondary school; polytechnic school; three year higher degree; four year undergraduate; and postgraduate degree.	Junior secondary school and below=20.9%; senior secondary school=28.5%; polytechnic school=11.4%; three year higher degree=22.9%; four year undergraduate=14.8%; and postgraduate degree=1.5%.
Occupation	A vector of dummy variables for occupation of respondent (senior professional; middle professional; lower professional; technical; semi-skilled; manual; retired; not in labour force).	Senior professional=0.5%; middle professional=9.3%; lower professional=25.8%; technical=14.1%; semi-skilled=13.6%; manual=3.6%; retired=15.9%; not in labour force=8.4%.
Unemployed	A dummy variable set equal to 1 if the respondent is unemployed, or laid-off (xiagang).	8.8% of respondents were unemployed or laid-off (xiagang).
Income	An ordered variable representing monthly household income over 20 categories from 1 (≤260 RMB) to 20 (>20,000 RMB).	Median=9 (RMB2001-2250).
Environmental surroundings		
Pollution	SO_2 emissions (tons per capita) in 2003 in the province/municipality/ autonomous region in which the respondent lives.	Mean=0.012; SD=0.006; Min.=0.0003; Max.=0.0327.
Disaster	Number of environmental disasters in 2003 in the province/ municipality/ autonomous region in which the respondent lives.	Mean=58.8; SD=75.5; Min.=0; Max.=358
Congestion	Total passenger traffic (vehicles) per capita in 2003 in the city where the respondent lives.	Mean=2.08; SD=1.85; Min.=.05; Max.=11.8
Parks	Green area per capita in 2003 in the city where the respondent lives.	Mean=5.334; SD=2.009; Min.=1.6; Max.=10.1

variable; that the answer to the subjective well-being question provides an ordinal (and not cardinal) ranking and that ordinal interpersonal comparability is assumed (Ferrer-i-Carbonell and Frijters, 2004).

4.2. *The data*

Our data were collected by China Mainland Marketing Research Company (CMMRC), a private firm under the direct supervision of China's State Statistical Bureau, which conducted face-to-face interviews with approximately 10,000 individuals in 30 Chinese cities in September, 2003. These 30 cities are the provincial capitals of 21 of the 22 provinces (all provincial capitals except Fuzhou in Fujian); the four municipalities directly under the control of the central government (Beijing, Shanghai, Chongqing and Tianjin) and the capitals of the five autonomous regions of China.[1] There were 8890 valid responses containing questions of interest to us in this study. On average there were 297 valid responses per city ranging from a minimum of 94 in Changsha to a maximum of 520 in Harbin. The major cities, such as Beijing, Chongqing and Shanghai, each had around 500 valid responses in the dataset.

The CMMRC survey asks respondents a number of questions relating to attitudes on a range of social and economic issues as well as background characteristics of the respondent such as age, education, gender, income, marital status and occupation. CMMRC employs multi-stage stratified random sampling to ensure a representative sample in terms of age, gender and income. The respondents were interviewed in person in shopping districts of each city by a trained CMMRC interviewer. In each city there were four individuals conducting the survey in four different shopping districts. All responses were checked for accuracy three times prior to being entered into the database; initially by a supervisor on location, then by a supervisor for the city and finally at the CMMRC offices in Beijing. All respondents who participated in the survey were aged 18 years or above and had an urban household registration.

From Table 1, the mean age of respondents in the sample was 39.1 years, 51.2% were female, 69.4% were married and the median household income of respondents was 2001 RMB to 2250 RMB per month. Of the respondents, 16.3% had a four year higher degree or better, 11.4% had completed a polytechnic level education and 28.4% had completed senior middle school. In terms of occupation, 35.6% of respondents were in professional occupations, 31.3% were manual, semi-skilled or technical workers, 15.9% were retired, 8.8% were unemployed and 8.4% were not in the labour force.

Overall, with the exception of the education profile, the characteristics of the sample are fairly representative of the urban population as a whole. In 2003, average household income of urban employees in the 35 provincial capitals and separate planning cities was 1800 RMB, the mean age of urban residents was 37 years and 75% were married (NBS, 2004a). In 2003, 49.62% of the urban population was female (NBS, 2004c). In 2003 the official urban unemployment rate was 4% (NBS, 2004a); however, Giles et al. (2005) suggested that the real unemployment rate for those with an urban household registration, once laid-off (xiagang) workers were taken into account, was about 11% in 2002. Knight and Xue (2006) estimated a similar figure for the end of the 1990s. The retirement age for blue collar workers in urban areas is 55 for women and 60 for men. In 2002 9.8% of the urban population were aged 60 years or older and 14.4% were aged 55 years or older (NBS, 2003). In order to reduce the surplus labour problem in SOEs, some enterprises have introduced semi-retirement (neitui) at ages younger than the official retirement age, with semi-retired workers receiving 50–70% of their position wage with no bonuses (Smyth et al., 2004). It is conceivable that some of the respondents in the sample who are designated as retired are semi-retired.

According to the statistics from the communiqué of the First National Economic Census in 2004, of the urban workforce, 42.0% had completed junior secondary school or less, 33.6% had completed senior secondary school and 24.4% had a three year college education or higher (NBS, 2005a,b). This means that in our sample, those with a junior middle school education or less are under-represented and those with a tertiary degree are over-represented relative to the urban population as a whole. One explanation for the education profile of our sample is that the survey was conducted in large cities where the educational level is much higher than in other urban areas. Previous studies which have interviewed respondents in large Chinese cities have also found better educated individuals to be disproportionately represented relative to the urban population as a whole. For example, in a survey of employees in manufacturing enterprises in Nanjing, Shanghai and Tianjin in 1994–1995, Zhu (1997) found that 73.3% of respondents had tertiary qualifications.

This peculiarity with respect to educational level also seems to reflect respondents in street surveys more generally. Holbrook et al. (2003) found that the educational levels of respondents are skewed — respondents with a lower education level are generally reluctant to respond to street surveys as they believe they may have more to lose. Studies comparing the education levels of respondents in various surveys have also found fewer low-education respondents in telephone samples than in face-to-face samples (see e.g. Greenfield et al., 2000; Groves, 1977).

The data on each of the environmental variables – atmospheric pollution measured in terms of sulphur dioxide emissions, environmental disasters, access to parkland and traffic congestion – are for 2003, the year of the survey. These variables are from the on-line version of the *China Statistical Yearbook 2004* (NBS, 2004a) and *China City Statistical Yearbook 2004* (NBS, 2004b) and are matched to the city, province or autonomous region in which the individual lives. According to the *China Statistical Yearbook 2004* (NBS, 2004a), environmental disasters "refer to

[1] The cities sampled were Beijing, Tianjin, Shijiazhuang, Taiyuan, Huhehaote, Shenyang, Changchun, Harbin, Shanghai, Nanjing, Hangzhou, Hefei, Nanchang, Jinan, Zhenzhou, Wuhan, Changsha, Guangzhou, Nanning, Haikou, Chongqing, Chengdu, Guizhou, Kunming, Lhasa, Xian, Lanzhou, Xining, Yinchuan, Wulumuqi. In addition to these 30 cities, Fuzhou and Xiamen, both in Fujian, were also sampled in the survey. However, in the data provided by CMMRC both were given the same code, which was a provincial code for Fujian, so were not able to distinguish between these cities. As a result, the data for these two cities had to be dropped from the analysis.

sudden accidents, due to economic or social activities that are contrary to environment protection laws or due to unforeseen factors or natural disasters, that lead to environment pollution, destruction of protected wild animals, plants or nature reserves, damage to human health, economic and property losses, and other negative impacts on the society".

5. Results

Table 2 reports the results for Eq. (1) with and without city dummy variables. Specification I reports the results without city dummy variables. Specification II reports the results with city dummy variables. The dummy variables for each city *X* were defined such that Dum_*X*=1 if City=*X*, 0 otherwise with Shanxi the reference category. Including the city dummy variables addresses the fact that city differences exist; for example, cities differ with respect to factors such as public services, housing, climate and the labour market to name a few. Dummy variables for the cities help to capture those differences, meaning that the results with the city dummy variables are more robust. For this reason in the discussion we concentrate on the results from Specification II for those variables where the specifications give different results. There are two such cases. CONGESTION and PARKS are statistically insignificant in Specification I, but statistically significant in Specification II.

The results from Specification II suggest that in cities with higher levels of atmospheric pollution, more environmental disasters and greater traffic congestion respondents report lower levels of well-being ceteris paribus, while in cities with greater access to parkland respondents report higher levels of well-being ceteris paribus. Because the dependent variable is categorical in nature, the explanatory variables represent the probability of moving from one category to another in the dependent variable. The dependent variable takes the value of 1 for 'very unsatisfied' and 5 for 'very satisfied' and in-between we have categories 2, 3 and 4 representing increasing levels of satisfaction. In Specification II, the coefficient for atmospheric pollution is −15.58. This indicates that a 1% increase in the level of atmospheric pollution in the province increases the probability of a respondent classifying himself or herself in a lower well-being category compared to the one which he or has reported (say from 5 to 4, 4 to 3, 3 to 2 or 2 to 1) by 15.58% ceteris paribus. Similar interpretations hold for the other variables. A 1% increase in traffic congestion will increase the probability of moving to a lower well-being category by 0.05%; a 1% increase in environmental disasters will increase the probability of moving to a lower well-being category by 0.02%, whereas a 1% increase in parkland will increase the probability of moving to a higher well-being category by 0.5%. Thus, from a policy perspective, lowering atmospheric pollution, measured as sulphur dioxide emissions, has a much more pronounced effect than changing any of the other environmental variables on the probability that Chinese urban resident will report a higher category of well-being.

Of the environmental attitude variables, there is no statistically significant relationship between environmental awareness and well-being. The variable measuring perceptions of environmental consciousness in the neighbourhood, however, is statistically significant with a positive coefficient.

Table 2 – The environment and well-being in urban China

	I	II
Pollution	−9.086***	−15.58***
	(−4.668)	(−3.442)
Disaster	−0.005***	−0.0244***
	(−2.881)	(−7.574)
Congestion	−0.0002	−0.0547***
	(−0.280)	(−6.998)
Parks	−0.005	0.499***
	(−0.760)	(−6.955)
Environment awareness	0.0131	0.0402
	(0.490)	(−1.476)
Neighbourhood environment	0.207***	0.202***
	(14.48)	(−13.88)
Gender	−0.0009	−0.00378
	(−0.0393)	(−0.156)
Age	−0.0205***	−0.0198***
	(−3.117)	(−2.984)
$(Age)^2$ (×100)	0.0326***	0.0326***
	(4.462)	(−4.426)
Education [a]		
Senior secondary school	−0.0432	−0.0274
	(−1.239)	(−0.781)
Polytechnic school	−0.0112	−0.0121
	(−0.249)	(−0.267)
Three year higher education	−0.0559	−0.0568
	(−1.361)	(−1.369)
Four year undergraduate and above	−0.0045	−0.0125
	(−0.0959)	(−0.260)
Income	0.0642***	0.0692***
	(19.04)	(−19.00)
Unemployed	−0.353***	−0.346***
	(−6.697)	(−6.527)
Marital status [b]		
Single	0.0381	0.0339
	(0.413)	−0.364
Married	0.0688	0.0286
	(0.820)	(−0.338)
Divorced and remarried	−0.203	−0.255
	(−1.098)	(−1.367)
Widowed and not remarried	−0.0933	−0.124
	(−0.820)	(−1.082)
Widowed and remarried	0.363	0.343
	(1.218)	(−1.141)
Pro-market	−0.0371*	−0.0569***
	(−1.736)	(−2.609)
Income inequality	−0.190***	−0.157***
	(−7.213)	(−5.866)
Social protection	−0.085***	−0.0430*
	(−3.447)	(−1.689)
National reunification	0.164***	0.165***
	(4.066)	(−4.061)
SARS	0.129***	0.0822***
	(4.615)	(−2.837)
Occupation dummies [c]	Yes	Yes
City dummies [d]	No	Yes
Number of observations	8890	8890
Log likelihood	−10,045.907	−9868.3313
Pseudo R^2	0.0587	0.0754

Notes: ***(*) denotes statistical significance at the 1%(10%) level.
[a] Reference category is junior secondary school and below.
[b] Reference category is divorced and not remarried.
[c] Reference category is not in the workforce.
[d] Reference category is Shanxi.

The results for the neighbourhood environmental consciousness variable reflect the public goods aspect of environmental activism (Hardin, 1982). Improving the environment requires collective action and an improvement in environmental consciousness in the respondent's neighbourhood will result in a better environment for the individual. For example, if local factories reduce pollution emissions because of an improvement in environmental consciousness in the neighbourhood, this will improve the quality of the air the respondent breathes, having a positive effect on subjective well-being.

The results for the other control variables in Table 2 are generally consistent with expectations and findings from previous studies. Of the personal characteristics of the respondent we find that household income has a positive effect on subjective well-being, while being unemployed has a negative effect on subjective well-being. We find a non-linear u-shaped relationship between age and subjective well-being However, education, gender and marital status are statistically insignificant. Of the social attitude variables, people who considered social protection and income inequality important as well as those who were pro-market report lower levels of well-being ceteris paribus, while those who considered national reunification and SARS important reported higher levels of subjective well-being ceteris paribus.

The results for attitudes to income inequality and social protection could reflect concern about widening income disparities and large numbers of low income individuals, including sizeable numbers of laid-off workers, who have been the losers of the market reforms. However, it is likely that such attitudes will differ between different segments of the urban population and more detailed study is needed before firm conclusions can be drawn about these attitudes and subjective well-being. The results for pro-market attitudes differ from a study by Graham and Pettinato (2001) which found that having pro-market attitudes are associated with higher subjective well-being in Latin America and Russia. Comparing China and Russia the different results could lie in the speed of the reform. China's 'gradual approach' to market reforms has been much slower than Russia's 'big bang' reforms. Thus, individuals who support further marketization in China might have lower subjective well-being because they are frustrated with the relatively slow pace of the reforms.

6. Conclusion

In this paper we have examined the relationship between environmental variables and subjective well-being in urban China. The approach is in the tradition of a growing literature on the economics of happiness that use self-reported measures of utility to obtain insights into how people think and feel about their lives. The approach is consistent with the view that economists should move beyond the traditional assumption that interpersonal comparisons of utility should be avoided and that well-being can be measured in terms of consumption and income alone. There are parallels with the ecological economics literature on the limits of growth, although with few exceptions there has been little research on the relationship between atmospheric pollution or other environmental variables and self-reported measures of utility.

The main finding is that in cities with high atmospheric pollution, environmental disasters and traffic congestion urban residents report lower levels of well-being while in cities with greater access to parkland, respondents report higher levels of well-being controlling for the respondent's attitudes towards the environment and other social and political issues and the personal traits of the respondent. From a policy perspective, for a 1% change in atmospheric pollution there is a much higher probability that an individual will move up or down one category of well-being on the five point scale than for a 1% change in other environmental variable. Hence, our results suggest that reducing atmospheric pollution will generate the biggest gains in terms of improving well-being in urban China. This finding adds to the results from previous studies that have examined the relationship between the environment on subjective well-being – primarily employing data for developed countries – for a large developing country with a sizeable population base and serious pollution problems.

In light of the findings the question then becomes what is the best method to stem atmospheric pollution? As environmental scholars such as Economy (2007) have noted, it is difficult for the central government to impose 'top down' directives to reduce atmospheric pollution problems or other environmental problems. In this respect, an important implication of the results is people report higher life satisfaction if they believe there is an increase in the will in the local community to improve environmental protection, ceteris paribus. This finding lends support to the view that the Chinese central government should further relax restrictions on environmental NGOs. While environmental issues are sanctioned as a topic for public debate in China, there are limits, particularly where there are links with related issues such as ethnic tensions and human rights, which remain under strict control. The dividing line, however, between those environmental topics which can and cannot be discussed is constantly shifting (Martens, 2006). Relaxing the strict control over environmental NGOs would not only act as a pressure group at the local level for environmental change, but would have a positive effect on well-being, given that our findings suggest the latter is positively correlated with environmental consciousness.

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