PROBLEMY EKOROZWOJU – PROBLEMS OF SUSTAINABLE DEVELOPMENT
2016, vol. 11, no 1, 59-64

Tax Payment, Social Contribution for Pollution Prevention and Happiness

Płacenie podatków, społeczny wkład ograniczanie zanieczyszczeń i poczucie satysfakcji

Jing Xu, Jianjun Li

Southwestern University of Finance and Economics
Chengdu, 611130, China
E-mails: xuj@swufe.edu.cn, lijj@swufe.edu.cn

Abstract

Using data from the China part of the World Value Survey (WVS), this paper empirically studies the impact of air pollution on happiness, and further, the citizens' willingness to pay (WTP) for pollution prevention and its determinants. The result confirms that air pollution significantly worsens happiness. Regarding he WTP, it is differentiated in the form of tax and social contribution. Contrary to the expectation that the air pollution level affects the WTP, the concern on the environment plays a bigger role in increasing the WTP. Besides, the WTP are shown significantly influenced by tax compliance incentives, trust in the government or environmental organizations, attitudes toward environmental protection responsibilities and the family income, which sheds light on effective environmental policy making and implementation.

Key words: air pollution, happiness, willingness to pay, world value survey

Streszczenie

W artykule, wykorzystując dane odnoszące się do Chin w ramach bazy World Value Survey (WVS), omówiono badania empiryczne odnoszące się wpływu zanieczyszczeń powietrza na poczucie satysfakcji obywateli, a także ich gotowości do zapłaty za zanieczyszczenia powietrza i ich determinanty. Otrzymane rezultaty potwierdzają, że zanieczyszczenia powietrza znacząco pogarszają poczucie satysfakcji. Biorąc pod uwagę gotowość do zapłaty, odpowiedź jest uzależniona od formy podatku i społecznego zaangażowania. Przeciwnie do oczekiwań, że zanieczyszczenia powietrza wpływają bezpośrednio gotowość do zapłaty, okazało się, że ważniejsza jest troska o środowisko. Ponadto, na gotowość do zapłaty wpływają sensowne podatki, zaufanie do rządu, organizacji ekologicznych, świadomość odpowiedzialności za środowisko, a także osiągany dochód, co zarazem pozwala ocenić efektywność polityki środowiskowej i jej wdrażania.

Słowa kluczowe: zanieczyszczenia powietrza, pomyślność, gotowość do zapłaty, world value survey

1. Introduction

Pollutants come with economic activities. In 2013, China produces GDP amounted to 56885 billion yuan (9170 billion US dollars). At the same time, it emits 20 million tons of SO_2, 13 million tons of dust, 66936 billion square meter of industrial waste gas (Table 1). Moreover, in 2013, the fine particular pollution prevails in China, most cities are experiencing the haze problem more than 50 days of the whole year. In the report *Toward an Environmentally Sustainable Future: Country Environmental Analysis of the People's Republic of China* published by Asian Development Bank, among 500 big cities in China, only 1% can achieve the air quality standard recommended by the World Health Organization. The environmental degradation has become so serious that in the most polluted cities rank worldwide, Chinese cities occupy 7 of the top 10.

Table 1. Air pollution in China (2006-2013), data source：China Environment Yearbook

Pollution	2006	2007	2008	2009	2010	2011	2012	2013
SO_2 (in millions of tons)	25.9	24.7	23.2	22.1	21.8	22.2	21.2	20.4
Dust (in millions of tons)	10.9	9.9	9.0	8.5	8.5	12.8	12.3	12.8
Industrial waste gas (in billion square meter)	33099	38817	40387	43606	51917	67451	63552	66936

Despite the remarkable economic achievements realized, the pollution generates serious negative consequences. Evaluated by the World Bank (2007), the economic cost caused by the air pollution is estimated equivalent to 1.2% of GDP in China by the measure of illness, and as high as 3.8% by the measure of willingness to pay. Through health risks, the air pollution accounts for the fourth highest risk factor (after food security, high blood pressure and smoking) responsible for health hazards and the death rate. According to a report published on *The Lancet* in 2012, outdoor air pollution leads to the death of 1.2 million people in China.

In September of 2013, China releases the *Plan of Action for the Prevention of Air Pollution*, which emphasizes the significance and urgency of air pollution abatement, and establishes environmental targets, policy instruments and detailed strategies. No matter the action is to be carried out by the government or other agencies, the improvement of air quality requires a good deal of financial input, which is originated from the general public. Hence, studying the effect of air pollution on the personal welfare, the willingness to pay (WTP) for the pollution prevention, and economic social factors that affect the WTP, is essential for green taxation designs, public policy making, and environmental management.

In recent years, more and more research is conducted on personal subjective welfare, which is commonly measured by the response to *happiness* or *life satisfaction* (Frey and Stutzer, 2005; Dolan et al., 2008; MacKerron, 2012). Regarding the relationship between environmental quality and happiness, the existed literature explores the matter in various dimensions of air pollution, climate, noise and water quality as in Cuñado and Pérez Gracia (2013). As for the air pollution, Welsch (2006) discovers that air pollution significantly worsens personal welfare using data from 10 European countries. Rehdanz and Maddison (2008), Ferreira and Moro (2010), and Luechinger (2009, 2010) find similar results of negative correlation with focus on noise, PM_{10} and SO_2 with data from Germany, Ireland and European countries, respectively. Mackerron and Mourato (2009) match the subjects being interviewed in London and the air pollution concentration of their neighborhood using geography information system, and conclude that no matter measured or perceptive air pollution significantly reduces their life satisfaction. Such matching method is also employed in Levinson (2012) with data from the United States. Menz and Welsch (2012) study the preference and WTP of air quality involving age structures, with panel data of 25 OECD countries from 1990 to 2004, they demonstrate that people are willing to pay 100-188 dollars for exchange of a reduction of 1μg/m^3 of PM_{10}. Together with the acceleration of the aging problem, the WTP will double in 2030.

However, such research targeting China is scarce. Smyth et al. (2008) analyze data from 30 Chinese cities and find the more SO_2-polluted the area is, the lower the citizen's subjective satisfaction becomes. Yang and Yang (2011) take into consideration the effect of environmental satisfaction as well as job satisfaction and psychological elements such as extraversion, neuroticism, conscientiousness, etc. on personal well-being, and find, among others, environmental satisfaction is positively correlated with well-being.

Previous literature has revealed the negative relationship between pollution and happiness. Some estimates the value of pollution through the marginal substitution of pollution and personal income. It is evident that pollution results in loss of personal well-being, hence paying for pollution abatement, as long as the amount paid is smaller than the gain from pollution reduction, is a rational choice for enhancing the social welfare. Nevertheless, such common action encounters certain difficulties due to institutional reasons, transaction costs, free rider problems, etc. Hence, this paper aims to firstly test the welfare effect of air pollution, and further, to examine the WTP for environmental quality improvement and its determinants. Comparing to existed literature, our research is different in several ways. First, concerning WTP for pollution reduction, this paper involves a new dataset, innovatively separates and considers both tax payment and social contribution, hence provides evidence for effective and feasible environmental policy choices. Second, this paper emphasizes on the direct subjective WTP instead of indirect evaluation, through income for instance, which reflects a more practical value for promoting pollution abatement at both personal and community level. Lastly, current research on pollution control is more on the macro and policy dimension, this paper, basing on the micro data, provides micro foundation for public environmental policy making.

2. The data and model

2.1. The data description

The data is extracted from the Chinese part of the World Value Survey (WVS), which is a micro database based on a multi-national survey program, and widely used in sociology, political science, econom-

ics, etc. WVS conducted 5 surveys in China, because of the variable inconsistency and the aim of this paper, we adopt the data surveyed in 2007. The variables we use are explained in detail as follows.

Happiness and WTP for pollution prevention

Happiness, as one of the dependent variables, is introduced in the WVS with the question *would you say you are happy or not*. The value is defined for very happy, rather happy, not very happy, not at all happy as 1 to 4, and 77% of the respondents are self-evaluated as happy.

Regarding the WTP for environmental quality improvement, there are two questions in the WVS. One is *I would agree to an increase in taxes if the extra money were used to prevent environmental pollution,* and translates to the variable *taxfenvi*. The value 1 to 4 is given to answers of *strongly disagree, disagree, agree and strongly agree*, with higher values associated with higher willingness of tax payment. The other question asked is *I would give part of my income if I were certain that the money would be used to prevent environmental pollution*, corresponding to the variable *payfenvi* with values 1, 2, 3 and 4 representing *strongly disagree, disagree, agree and strongly agree* as before. The personal payment, as contrary to the official and compulsory payment with tax, reflects more of a social contribution. The two variables demonstrate different payment preferences for pollution control, with mean 2.88 and 3.01, respectively. Besides, 75% of respondents choose agree or strongly agree, while the percentage for giving up personal income is 83%. The general people have relatively high WTP. Besides, reflecting an obligatory and voluntary cost bearing for pollution prevention, the tax mechanism seems less favorable than the personal payment.

Air pollution

Air pollution index, as a key variable in this study of its effect on happiness and WTP, has two dimensions of measurement: objective pollution record, often represented in terms of the density of SO_2, NO_2, PM_{10} and $PM_{2.5}$, and subjective pollution perception of the person being interviewed. Since the objective pollution level is only recorded on the municipal and sometimes the county level, the air pollution density could differ greatly even in one city. Besides, the record demonstrates only the absolute value of pollution level, while the personal assessment involves both the objective air pollution and the relative satisfaction comparing to for instance the environmental quality in neighboring districts. Hence this paper employs personal perception on local air pollution, which is more comprehensive, influential and direct to individuals, as in Mackerron and Mourato (2009). In detail, the index is classified to *not serious at all, not very serious, somewhat serious, very serious* based on the personal valuation of the neighborhood, and is defined as 1, 2, 3 and 4. Among all respondents, 32% regards the air pollution as somewhat serious or very serious.

Other variables

The estimation also introduces various demographic variables, including gender, age, marital status, with child or not. Besides, the education is expressed with 0, 6, 9, 12, 16 and 19 years of schooling corresponding to *no formal education, primary school, secondary school, high school, university, master and above*. Regarding health status, two dummy variables of good health (healthg) and fair health (healthf) are set contrary to poor health. Income is represented by the family income, which is classified to 10 groups with integer value from the lowest 1 to highest 10.

The survey also includes other relevant variables concerning environment or tax attitude. *Looking after the environment is important* is defined as 1 in envimp variable, 0 otherwise. As *envimp* measures the concern on environment, another variable *govresp* represents the responsibility of environmental protection, corresponding to the reply of *the government should reduce environmental pollution but it should not cost me any money*. The value varies from 1 to 4, with different grades from disagree to agree. The attitude towards environmental organization and the government is also essential for different types of payment for pollution prevention, may be also expressed with emphasis on trust in the markets. Whether one trusts environmental organizations and whether one trusts the government are captured by *trustenv* and *trustgov*, with different trust degree from 1 to 4. Lastly, regarding the tax payment for environmental protection, the tax compliance attitude plays a role. We use *avoidtax* to measure incentives on tax evasion, with integer value 1 representing that cheating on tax is not justifiable and value 10 that cheating on tax if have a chance. Those variables reflect personal attitude, social trust, and sense of responsibility which influence the WTP in return.

2.2 The estimation model

The estimation aims to first test the effect of air pollution on personal happiness, represented in (1) as follows. Furthermore, the determinants of WTP are studied. Specifically, the WTP are in forms of tax and personal income, corresponding to equation (2) and (3), respectively.

$$happiness_i = c + \alpha_1 airp_i + \alpha_2 gender_i + \alpha_3 age_i + \alpha_4 age^2_i + \alpha_5 married_i + \alpha_6 child_i + \alpha_7 edu_i + \alpha_8 healthf_i + \alpha_9 healthg_i + \alpha_{10} income_i + \varepsilon_i \quad (1)$$

$$taxfenvi_i = \beta_1 gender_i + \beta_2 age_i + \beta_3 married_i + \beta_4 child_i + \beta_5 edu_i + \beta_6 income_i + \beta_7 healthf_i + \beta_8 healthg_i + \beta_9 airp_i + \beta_{10} envimp_i + \beta_{11} trustenvi_i + \beta_{12} avoidtax_i + \beta_{13} govresp_i + \varepsilon_i \quad (2)$$

$$payfenvi_i = \gamma_1 gender_i + \gamma_2 age_i + \gamma_3 married_i + \gamma_4 child_i + \gamma_5 edu_i + \gamma_6 income_i + \gamma_7 healthf_i + \gamma_8 healthg_i + \gamma_9 airp_i + \gamma_{10} envimp_i + \gamma_{11} trustgov_i + \gamma_{12} avoidtax_i + \gamma_{13} govresp_i + \varepsilon_i \quad (3)$$

In the model, α , β , γ are coefficients; c and ε represent the constant and the error term. Since the dependent variables are binary and ordinal variables, the estimation is processed with OLS, Probit and Order-probit model. The use of the model is justified in Ferreira and Moro (2010) where they find that the regression result is similar using OLS, Probit and Order-probit model if the dependent variables are ordinal. Besides, Maddison and Rehdanz (2008), Cuñado and Pérez Gracia (2013), and Ferreira et al. (2013) all study the matter with linear probability model and OLS estimation.

3. The regression result: pollution, happiness and WTP

3.1 Pollution and happiness

Table 2 demonstrates the regression results from model (1). The sign, coefficient and significance of both OLS and Probit estimation is consistent, showing that the air pollution does worsen the personal happiness significantly.

As for other variables, happiness represents a U-shape relationship with respect to age. Besides, conforming to common knowledge and previous literature, education, health and income all exhibit a positive effect on personal happiness. The variable gender turns out to be insignificant, consistent with Louis and Zhao (2002), Smyth et al. (2008), Cuñado and Pérez Gracia (2013), that female and male do not show evident differences in their happiness perceptions.

Table 2. The effect of air pollution on subjective happiness

	Dependent variable: happiness			
	OLS		Probit	
	coefficient	t	coefficient	z
airp	-0.0195**	-2.06	-0.0186*	-1.81
gender	-0.0214	-1.08	-0.0285	-1.32
age	-0.0101*	-1.82	-0.0096	-1.56
age^2	0.0001**	2.50	0.0001**	2.21
married	0.0772**	2.23	0.0830**	2.07
child	-0.0121	-0.27	-0.0140	-0.29
edu	0.0110***	5.24	0.0115***	5.10
healthf	0.2156***	6.62	0.1223***	4.68
healthg	0.4143***	13.50	0.3753***	11.39
income	0.0363***	6.73	0.0398***	6.58
c	0.3689***	3.18	-	-
R^2/Pseudo R^2	0.2225		0.2111	

*p<0.1,**p<0.05,***p<0.01

3.2. The willingness to pay tax for pollution prevention

Air pollution worsens subjective happiness as proven, thereby improving the environmental quality enhances personal and social welfare. Environmental protection requires financing, and the following regressions estimate the factors that influence the WTP for pollution reduction. Table 3 concentrates on the tax payment willingness, and the result is robust between OLS and Order-probit models.

The personal perception of air pollution does not show significance on the willingness to pay, in other words, who regards the air pollution is more severe will not necessarily pay more tax in order to reduce the pollution. Instead, variable envimp is significant at 1% level, that who cares more about the environment is willing to devote more in tax payment in exchange of a better environment. How much one would be willing to accept a raise in tax for pollution prevention, does not depend much on how polluted the air quality is, but hinges on the sense of environmental damage, the preference of clean air, thereby a higher demand for a greener environment.

Besides, the judgment on the responsibility of environmental protection (govresp) negatively affects the WTP, that is, a person tends to oppose a tax raise if he deems pollution abatement a government's obligation instead of a social action. Since the payment for pollution reduction is in the form of tax collection, whether the person trusts the government or not plays a role. Improving environmental quality is a public service that conforms to a general preference, and using tax is a common way to finance environmental management. In this process that the public exchanges the tax revenue for environmental service from the government, the faith that one holds towards whether and how efficiently the government will reduce the air pollution is pivotal in how much one is willing to pay. Therefore, building credibility of the government and gaining trust from the public are the basis for collecting tax and implementing the pollution abatement strategy. Concerning the tax payment, the variable avoidtax, representing the tendency that one evades the general tax and the lack of social responsibility, is negatively correlated with the willingness to pay tax for environmental protection in specific. Factors influencing the WTP also include the household income, where people with higher income are relatively less sensitive in money

Table 3. Determinants of the tax payment for pollution prevention

	Dependent variable: payfenvi			
	OLS		Order-probit	
	coefficient	t	coefficient	z
gender	0.0211	0.54	0.0411	0.59
age	0.0019	1.03	0.0033	1.03
married	0.0655	0.96	0.1218	1.00
child	-0.0633	-0.78	-0.1184	-0.82
edu	-0.0001	-0.02	-0.0001	-0.01
income	0.0398***	3.72	0.0716***	3.76
healthf	-0.0551	-0.80	-0.1020	-0.84
healthg	-0.0498	-0.77	-0.0913	-0.80
airp	-0.0102	-0.53	-0.0187	-0.55
envimp	0.2584***	5.89	0.4621***	5.89
trustgov	0.0968***	3.47	0.1763***	3.55
avoidtax	-0.0183*	-1.73	-0.0322*	-1.73
govresp	-0.1884***	-7.37	-0.3258***	-7.12
C	2.7221***	16.17		
R^2/Pseudo R^2	0.1118		0.0579	

*p<0.1,**p<0.05,***p<0.01

and more desirous of a pleasant environment, thereby more willing to pay for pollution abatement.

4. The social willingness to pay for pollution prevention

Different from previous estimation with willingness to pay tax for pollution prevention, the following part focuses on the determinants of WTP in the form of personal income, which we refer as a social contribution, contrasting to the obligatory taxation. The regression was run with OLS and Order-probit models, where the results do not differ much.

Similar with the regression result from Table 3, we find that the WTP is more related to the consciousness of environmental protection (envimp) instead of the air pollution level (aip). Hence, arousing the public concern on pollution prevention is an important step toward environmental governance. Besides, how one regards the pollution control as more of a social responsibility instead of government's job (govresp), more incentives of tax compliance (avoidtax) and family income (income), all encourage people to devote more in the finance of environmental protection. As we consider a social payment of WTP, whether one trusts environmental organization for their endeavors in environmental protection (trustenvi) should not be ignored. Environmental organizations, as a leading body working on environmental quality improvement other than the government, turn out to significantly affect the WTP (at 1% level) through how efficiently they use the donations and how satisfactory their environmental work is carried out.

Table 4. Determinants of the social payment for pollution prevention

	Dependent variable: payfenvi			
	OLS		Order-probit	
	coefficient	t	coefficient	z
gender	0.0228	0.60	0.0633	0.80
age	0.0010	0.56	0.0019	0.51
married	-0.0055	-0.08	-0.0089	-0.06
child	-0.0117	-0.15	-0.0275	-0.17
edu	-0.0053	-1.25	-0.0112	-1.27
income	0.0434***	4.21	0.0928***	4.30
healthf	-0.0300	-0.42	-0.0766	-0.52
healthg	-0.0549	-0.82	-0.1316	-0.94
airp	0.0155	0.84	0.0325	0.84
envimp	0.3053***	6.95	0.6290***	6.76
trustenvi	0.1396***	5.01	0.2905***	4.98
avoidtax	-0.0255***	-2.52	-0.0511**	-2.46
govresp	-0.1778***	-6.93	-0.3616***	-6.75
C	2.7197	16.23		
R^2/Pseudo R^2	0.1614		0.0945	

*p<0.1,**p<0.05,***p<0.01

5. Conclusion

The environmental problem has become a heated and tough issue in China. Curbing air pollution and protecting the environment needs a great deal of finances, which are directly or indirectly borne by the general public. Hence, understanding the impact of air pollution on personal welfare, the WTP for pollution prevention, and the social economic determinants of WTP, merits great value in environmental policy making. This paper analyzes the problem from a micro level using data from the WVS in China, and proves that air pollution significantly reduces personal happiness. Regarding the WTP, two dimensions are considered, the tax payment and the social contribution. The social payment is revealed slightly higher than the WTP in the form of tax, suggesting a preference of non-obligatory payment instead of a raise in tax to fund environmental services. Moreover, the factors influencing the WTP are similar, which include family income, trust in government or the environmental organization, tax compliance incentives, and the way regarding environmental protection responsibilities. However, the severity of air pollution level does not affect the WTP; instead, the concern on the environment plays a bigger role.

Given a high demand for pollution reduction and enhanced social welfare, the government, as well as environmental organizations, should take active measures. The policy implications for the government to gain support from the public and to effectively implement environmental policies involve a reasonable and transparent tax collection and usage, public consciousness of environmental protection, and improvement of social accountability. As people with higher income are more willing and capable to pay, the tax can be designed progressively. Besides, curbing pollution is not only the government's job. The finances used for environmental protection is gathered from the public, thereby the government should arouse the consensus of the environmental urgency and personal duty and social responsibility, hence lessen the free-rider problem and increase the WTP.

References

1. CUÑADO J., PÉREZ GRACIA F., 2013, Environment and Happiness: New Evidence for Spain, in: *Social Indicators Research*, vol. 112, no 3, p. 549-567.
2. DOLAN P., PEASGOOD T., WHITE M., 2008, Do We Really Know What Makes Us Happy? A Review of the Economic Literature on the Factors Associated with Subjective Well-being, in: *Journal of Economic Psychology*, vol. 29, no 1, p. 94-122.
3. FREY B. S., STUTZER A., 2005, Happiness Research: State and Prospects, in: *Review of Social Economy*, vol. 62, no 2, p. 207-228.
4. FERREIRA S., AKAY A., BRERETON F., CUÑADO J., MARTINSSON P., MORO M., NINGAL T. F., 2013, Life Satisfaction and Air Quality in Europe, in: *Ecological Economics*, vol. 88, no 4, p. 1-10.

5. FERREIRA S., MORO M., 2010, On the Use of Subjective Well-being Data for Environmental Valuation, in: *Environmental and Resource Economics*, vol. 46, no 3, p. 249-273.
6. LEVINSON A., 2012, Valuing Public Goods Using Happiness Data: the Case of Air Quality, in: *Journal of Public Economics*, vol. 96, no 9, p. 869-880.
7. LOUIS V. V., ZHAO S., 2002, Effects of Family Structure, Family SES, and Adulthood Experiences on Life Satisfaction, in: *Journal of Family Issues*, vol. 23, p. 986-1005.
8. LUECHINGER S., 2009, Valuing Air Quality Using the Life Satisfaction Approach, in: *The Economic Journal*, vol. 119, no 536, p. 482-515.
9. LUECHINGER S., 2010, Life Satisfaction and Transboundary Air Pollution, in: *Economics Letters*, vol. 107, no 1, p. 4-6.
10. MACKERRON G., 2012, Happiness Economics from 35000 Feet, in: *Journal of Economics Surveys*, vol. 26, no 4, p. 705-735.
11. MACKERRON G., MOURATO S., 2009, Life Satisfaction and Air Quality in London, in: *Ecological Economics*, vol. 68, no 5, p. 1441-1453.
12. MENZ T., WELSCH H., 2012, Life-cycle and Cohort Effects in the Valuation of Air Quality: Evidence from Subjective Well-being Data, in: *Land Economics*, vol. 88, no 2, p. 300-325.
13. REHDANZ K., MADDISON D., 2008, Local Environmental Quality and Life-satisfaction in Germany, in: *Ecological Economics*, vol. 64, no 4, p. 787-797.
14. SMYTH R., MISHRA V., QIAN X., 2008, The Environment and Well-being in Urban China, in: *Ecological Economics*, vol. 68, no 1, p. 547-555.
15. WELSCH H., 2006, Environment and Happiness: Valuation of Air Pollution Using Life Satisfaction Data, in: Ecological Economics, vol. 58, no 4, p. 801-813.
16. WORLD BANK, 2007, Cost of Pollution in China: Economic Estimates of Physical Damages, Conference edition. Washington D.C.
17. YANG Y., YANG W., 2011, Environment and Personal Well-being in Urban China, in: *Chinese Journal of Population, Resources and Environment*, vol. 9, no 4, p. 77-81.