3rd International Conference

on Public Policy (ICPP3)

June 28-30, 2017 – Singapore

Panel T16 P17 Session 2

Sustainable Development and Policy Intervention in Asia

Title of the paper

What Makes a Government Spend More on the Environment? The Case of Hong Kong

Author(s)

Jingyuan, XU, City University of Hong Kong, Hong Kong, China

Jingyxu3-c@my.cityu.edu.hk

Date of presentation

June 16, 2017

What makes a government spend more on the Environment? The case of Hong Kong

Jingyuan XU, City University of Hong Kong

Prepared for ICPP 3 - SINGAPORE 2017.

Abstract

Hong Kong, an industrial city in tropic, has long been plagued with the problems of severe environment pollution and scarce natural resources. The past 30 years have seen success and struggle of a flourishing economy and growing population as well increasing need for environmental protection. Governmental environmental spending trend signifies this need and struggle. This essay utilizes the longitudinal data over 30 years to examine the Hong Kong government environmental spending patterns, trends and causes. The results show that Hong Kong's environmental spending is much more influenced by the residential and commercial environmental problems rather than traditional manufacturing pollution in the past decades.

Keywords: Environmental funding, Public financing, Pressure-state-response (PRS) framework, environment governance

1. Introduction

Hong Kong, once a fishing village with a population of only 5,000 has now turned to a metropolis with over 7 million urban dwellers at present. Since early 1950s, the rise of labor-intensive manufacturing industries had brought Hong Kong the well-known decades of "economic miracles", as

well as soaring population, environmental degradation and great challenges to the nature resource of this lonely island. Pollution resulted from manufacturing and industrial threatened the quality of water, air and land. Scarcity of water and energy resources has perplexed Hong Kong during its heyday of economic development. Even after its industrial stagnation, all these problems of resources shortage and environmental pollution have not been improved. After many manufacturing industrial production sites being moved out of Hong Kong into south China since the early 1990s, the environmental situation in Hong Kong was still severe. (Lee, 2011) According to the latest statistics calculated by UNEP, the EVI (Environmental Vulnerability Index) of Hong Kong is still ranked as "vulnerably". (UNEP, 2013)

Environmental governance has been ignored for a long period in Hong Kong. Under a western Weberian-type bureaucracy, the colonial government favored a low tax rate and minimal government interference in order to strengthen Hong Kong's role as a key trading post in the Asia-Pacific region. During British colonial time (before the year of 1997), only the areas of education, public housing, social service and health care, which have been termed as "the four pillars" of public service by governor MacLehose in the 1970s, have enjoyed the top priority in government's policy agenda. (Lee, 2011) Colonial government lacked both capacity and motivation to expand public service. Environmental issue, from then on, has longtime been a marginalized policy area for Hong Kong's government.

However, in recent years, large-scale and fast-speed consumption of natural resources has urged the city to pay attention to environmental pollution governance and natural resource management. Both of the government and normal citizens are inevitable to look into worsen environmental problems. Faced with the degraded environmental and rapid consumption of natural resources, citizens began to express their dissatisfaction and worries. A survey with over 2,000 is believed as an increasingly importance policy areas for Hong Kong, randomly sampled Hong Kong residents (aged 18 or above) showed that environmental protection becoming the second importance in 2007, while whose performance is one of the lowest scores. (See Fig. 1) In the same year, Green Power made a survey about Hong Kong citizens' satisfaction on trees conservation. The result revealed that over 70% of citizens expressed

their worries that trees conservation in Hong Kong is unqualified. (Green power, 2015) Under this circumstance, Hong Kong's chief executive officer and legislators also began to pay increasing attention into the environmental issue in these years. Environmental protection has generally become a heated topic been frequently mentioned in policy addresses, council meetings and proposals.

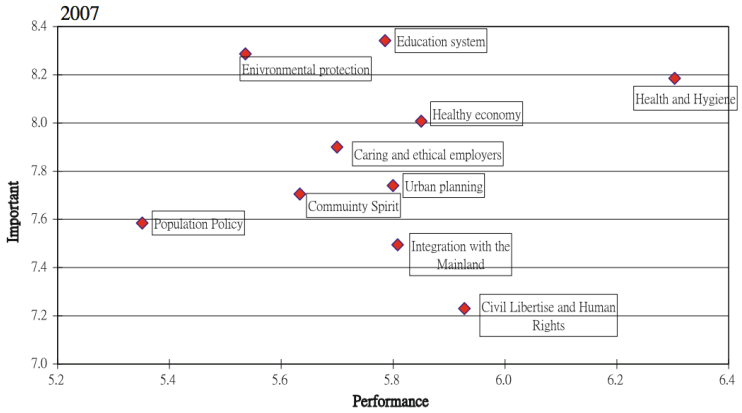

Fig.1 Importance versus Performance of priority areas in Hong Kong in 2007 (Tso, 2011)

While, even the government has frequently claimed to devote more efforts into environmental governance in the last couple of years, environmental funding in Hong Kong has still been keeping in a pretty low level in the total public expenditure, with the percentage of less than 3%. (See Fig. 2) In this trend, the ambitions of Hong Kong government in environmental improvement would be far from achievement.

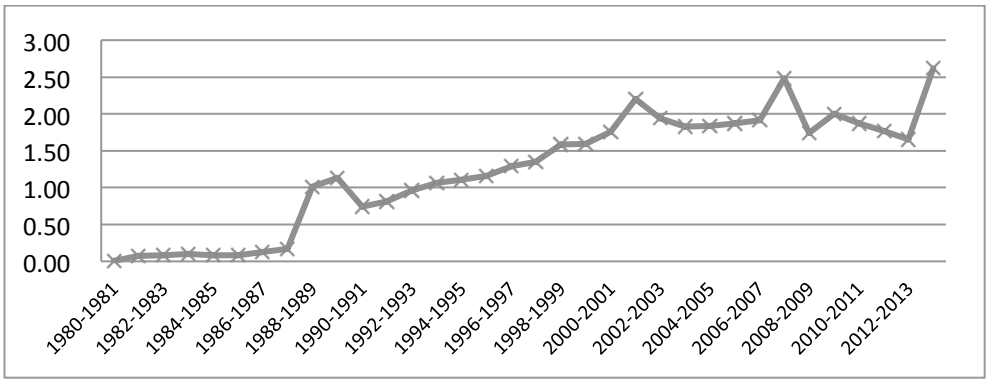

Fig. 2 The percentage of environmental spending in the total expenditure in Hong Kong

2. Framework

Hong Kong is facing with the pressing environmental threat, while only little proportion of the public expenditure has been devoted into environmental protection service. Here comes the question: what are the factors influencing the government's environmental funding in Hong Kong? If we fail to find out the answer of this question, it will be impossible for us to discover the critical node that connecting the environmental concerns and the government's strategy. Also, it shall be even more difficult to improve the environmental consciousness of government and their devotion into this typical issue in practical.

Little literature can directly answer this question: what are the factors influencing the environmental funding, while some theoretical frameworks can provide some clues. One dominant explanation of environmental funding is provided by the analytical **framework of pressure-state-response (PSR)**, which based on a concept of causality: human activities exert pressures on the environment and society responds to these changes through environmental, general economic and sectorial policies. (OECD, 1993, 1997). Government's environmental spending is a result of institutional policies and actions in response to the natural resource depletion and consumption that occur during a production process that utilizes natural resources and other forms of capitals (Wang 2011; Olewiler, 2006).

Figure 3 provides an overview of this theory framework. Consistent with this framework, environmental spending should be associated with the pressure and demands on the environment created by the production process. Some existing studies have supported this theory. The pressure-state-response theory has been applied to assess the eutrophication in estuaries, sea coastal zone and forest management in European countries. The appealing for the improvements on protection efforts has been raised in met with increasing and substantive environmental pressure or a deteriorating environmental state. (Whitall, 2007; Wolfslehner, 2008; Pirrone, 2005)

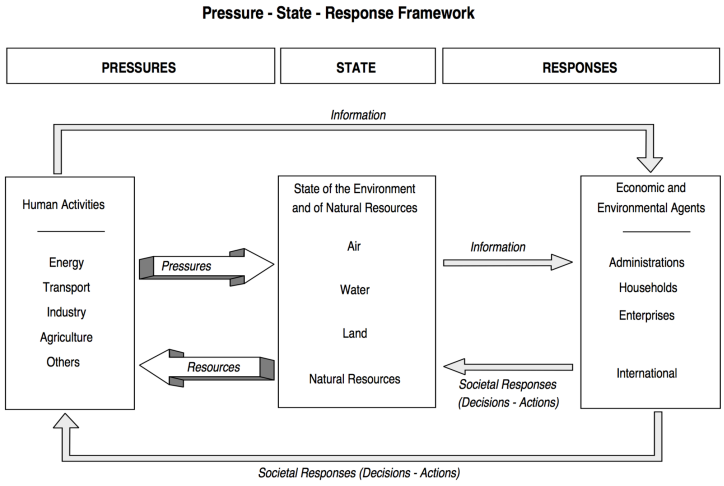

Fig. 3: An overview of Pressure-State-Response framework

Based on this PSR theory, variables in the research shall be consistence with the three indicators in the graph, and to be clarified as follows.

Indicators of environmental pressures

These indicators describe pressures from human activities exerted on the environment, including the quality and quantity of natural resources. (OECD, 1993) Two more specific categories can be distinguished. The first one is proximate pressure, which includes emissions or consumption of natural resources, like water use and electricity consumption in this research. The other one is indirect pressure reflecting human activities that lead to proximate environmental pressures, like manufacturing employment and the number of vehicles. Among all mentioned pressures from human activities, urbanization and industrialization have usually been taken regard as the most influential, or most destructive threat to natural resources and environment. (Hettige, 1996; Markowitz, 2013; Maung, 2015) Natural resources have been damaged or abused in the process of urbanization, and pollutants have been unscrupulously released into the air and water during the industrial development. Both of the two process of urban development accompany with the sacrifice of the natural resources, leading to the serious pressure on environment.

Indicators of environmental conditions

This indicator relates to the quality of the environment and the quality and quantity of natural resources. While in practice, the distinction between environmental conditions and the pressures may be ambiguous and the measurement of environmental conditions can turn out to be difficult or very costly. (OECD, 1993) Therefore, in this research, the researcher substitutes the measurement of environmental pressures for the measurement of environmental conditions.

Indicators of societal responses

Societal response indicators are measurements that show to what degree society is responding to environmental changes and concerns. The report of OCED provides a relatively broad definition of societal response, which refer to individual and collective actions to mitigate, adapt to or prevent human-induced negative impacts on the environment and to halt or reverse environmental damage already inflicted. As this research specifically focuses on the environmental spending issue, only one indicator will be used to measure the societal, or the government's, response, which is the proportion of environmental spending in the total public expenditure.

Thus, this research is based on a simplified logic of the PSR framework. Applying the Hong Kong's case into this framework, this study attempts to figure out the answer for what are the factors influencing the environmental funding in Hong Kong. Or more specific, what are the major external pressures caused by industrial or unban development that may affect Hong Kong's environmental funding most.

3. Method

This study analyzes the case of Hong Kong with the longitudinal data of over thirty years. Referring to the environmental governance services provided by the government, environmental preservation is mostly a policy area reaching to various departments, though environmental protection agency (EPA) takes the major responsibility since the British colonial time. Table 1 has shown the thirteen heads that have ever existed contributing to the policy area of environmental protection in the past decades. (Hong Kong Budget, 2016)

Table 1: Heads and departments contributing to environmental protection

	Head #	Head
1	22	Agriculture, Fisheries and Conservation Department
2	33	Civil Engineering and Development Department
3	43	Civil Engineering Department
4	39	Drainage Services Department
5	42	Electrical and Mechanical Services Department
6	44	Environmental Protection Department
7	48	Government Laboratory
8	65	Government Secretariat: Planning, Environment and Lands Bureau and Works Bureau
9	60	Highways Department
10	100	Marine Department
11	137	Government Secretariat: Environment Bureau
12	154	Government Secretariat: Environment and Food Bureau
13	158	Government Secretariat: Environment, Transport and Works Bureau (Environment and Transport Branch)

3.1. Data

This study draws on multiple data sources. Indicator of environmental pressure, like data on usage of water and land, population and manufacturing development was collected from Hong Kong Yearbooks. This data source has recorded the all-sided conditions of various industrials and fields' development in that certain year, including economy, employment, healthy, environment, public order and many others. Meanwhile, the yearbook also summarizes the calendar of big events in Hong Kong that year. In its Appendix, detailed statistics like population, economic growth, environmental situation and so in that typical year has been well recorded.

As for the indicator of societal response, this research mainly focuses the environmental spending of Hong Kong, and funding data come from the Estimates of Revenue and Expenditure, which can also be regarded as the annual budget of Hong Kong government. Compare to Annual Report, Estimates are more targeted and narrowed-scope, which is only focusing on the money earned, operated and spent by the government. Each year in late February, the financial secretary of Hong Kong will release

the budget for next year, which is followed by the publishing of Estimate of Revenue and Expenditure. From it, people can easily achieve detailed data of spending by different departments or government heads. Except for the estimates of next year, the content also includes actual spending in past years and revised estimates data in this year.

3.2. Measurement

A measure of the societal responses was constructed by using the proportion of environmental spending (ES) in total government spending. Measures were also developed for indicator of environmental pressures based on the PSR framework, includes population, industrial and residential outputs, water and land uses, etc. The selection of these variables is consistent with the concept of environmental pressure defined by OECD as human interaction with the environment (OECD, 1993). A description of these variables is presented in Table 2.

Table 2: Variables and data sources

Measurement	Definition	Data Source
Societal response		
ES/Total	Proportion of environmental spending in total government spending (1980-2016)	Hong Kong Budget
Environmental pressure		
Population	Population (1980-2016)	Hong Kong Yearbook
Population growth	Average annual population growth (1980 - 2016)	Hong Kong Yearbook
Electricity use	Annual Electricity Consumption (1980-2016)	Hong Kong Yearbook
Residential electricity use	Annual residential Electricity Consumption (1980-2016)	Hong Kong Yearbook
Commericial electricity use	Annual commercial Electricity Consumption (1980-2016)	Hong Kong Yearbook
Industrial electriciy use	Annual industrial Electricity Consumption (1980-2016)	Hong Kong Yearbook
Manufacturing employment	Percent change of employment in manufacturing (1980-2016)	Hong Kong Yearbook
Vehicle number	Licensed Motor Vehicles number (1982-2016)	Hong Kong Yearbook
Land Size	Square kilometers (1980-2016)	Hong Kong Yearbook
Farm Land Size	Average acres of land in farms from (1989-2016)	Hong Kong Yearbook
Water Use	Million gallons of water used from (1980-2016)	Hong Kong Yearbook
Seawater	Million gallons of water used from (1980-2016)	Hong Kong Yearbook
GDP	Annual Gross Domestic Product from (1980 - 2016)	Hong Kong Yearbook

4. Findings and discussions

4.1. Spending trend

Figure 4 displays the amount of money spent on environment of Hong Kong since 1980-2014, with the overall trend appearing to be increase. As can be seen, before 1997, there existed a relatively steady rise from 1980. However, a different trend emerged since the handover event in 1997, which revealed a trend of significant fluctuations in the next twenty years.

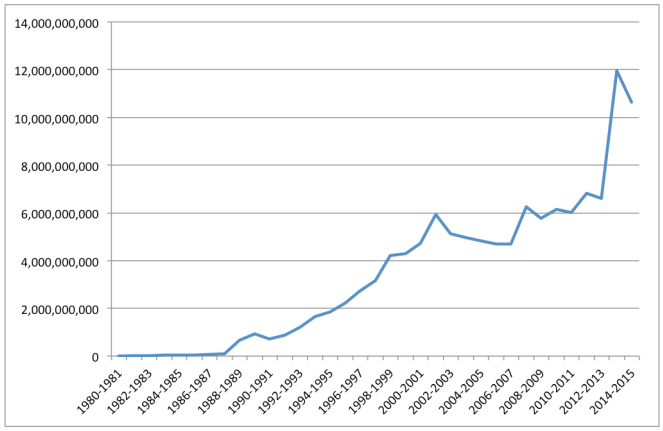

Fig. 4: Total Environmental Spending of Hong Kong government from 1980-2014

Digging in to the data, we can compare the environment spending on the department level. Three major spending objects are noticeable: environmental protection agency, drainage service department and marine department, which occupy over 75% of environmental spending. Table 3 has summarized the top five spending objects on the department level.

Table 3: Top five departments as the objects of environment spending

	Head	%
	Environmental Protection Agency	49.78%
	Drainage Services Department	16.29%
	Marine Department	9.79 %
	Agriculture, Fisheries and Conservation Department	6.10 %
	Highways Department	5.36 %

Analyzed from the program level, data also demonstrate the major spending objects of environmental affairs. Hong Kong government spends most of its funding on waste management (24.14%), sewage service (21.58%) and air pollution governance (10.17%). These Big Three take over 50% of Hong Kong's total environmental spending. Table 4 has summarized the top ten spending objects on the program level.

Table 4: Top ten programs as the objects of environment spending

No.	Department	Program	Proportion
44	Environmental Protection Agency	Waste (Facilities)	24.14%
39	Drainage Services Department	Sewage Services	21.58%
44	Environmental Protection Agency	Air	10.17%
22	Agriculture, Fisheries and Conservation Department	Nature Conservation and Country Parks	7.44%
33	Civil Engineering and Development Department	Management of Construction and Demolition Materials	7.42%
100	Marine Department	Port services	5.39%
60	Highways Department	Capital Projects	4.82%
44	Environmental Protection Agency	Water	3.85%
42	Electrical and Mechanical Services Department	Energy Efficiency and Conservation, and Alternative Energy	1.86%
42	Electrical and Mechanical Services Department	Energy Supply; Electrical, Gas and Nuclear Safety	1.77%

4.2 What influences environmental funding: a bivariate analysis

As elaborated upon in the framework, environmental spending should be associated with the pressure and demands on the environment. In the analysis in Table 5, the relationship between these variables of environmental pressure and the proportion of environmental spending in total public expenditure is examined.

Table 5: What influences environmental funding: a bivariate analysis

	Spending percentage 1980-2015
Environemntal pressure	
Population	0.9436
Electricity use	0.9462
Residential electricity use	0.9427
Commericial electricity use	0.9462
Industrial electriciy use	-0.497
Manufacturing employment	-0.9343
Vehicle number	0.9235
Land Size	0.9226
Farm Land Size	-0.8771
Water Use	0.8682
Seawater	0.9286
GDP	0.9186

Note: 1. Presented are Pearson Correlation Coefficients,

2. Coefficients shown in table 5 are all with $p < .01$ for two-tailed t tests. (See Appendix 1)

In this research, the variables of environmental pressure consist of population, electricity use (residential, commercial and industrial), manufacturing employment, vehicle number, land size (and farmland), water use (fresh water and sea water) and GDP. The results indicate that with the increase of population, electricity use (residential and commercial), vehicle number water consumption and GDP, the government will spend more on the environmental protection. In brief, the funding appears to respond to environmental pressure created by economic activities, showing a result consistent with the PSR framework.

Interestingly, there are also some negative correlations among these variables. The result shows that environmental spending has a negative relationship with manufacturing employment and industrial electricity consumption, which contracted to the assumptions of PSR framework. Pressure-State-Response Framework suggests that manufacturing or industrial development shall lead to more spending on environment because of the accompanying pollution and environmental degradation. While for the Hong Kong's case in this research, the result shows the opposite.

Why does it happen ? This noticeable point has somewhat provided an insightful angle of view for researcher under the PSR framework. The theoretical framework assumes that environmental funding

shall be positively related to the external pressure, but fails to clarify the source of these pressures. Industrial and manufacturing development shall be one, while environmental pressure may also come from many other sources according to different societies. For those cities or countries in their post-industrial time, like Hong Kong, industrial or manufacturing developments are no longer their pillar industrial anymore, and more pollution may come from commercial activities and residential lives, like vehicle emission or residential waste. In this way, industrial pollutions are not the major concerns in the environmental governance affairs and would not be devoted into huge amount of funding to govern. In contrast, more spending will be put onto combating the residential and commercial pollution. That might be the reason why environmental spending has a positive relationship with vehicle number and commercial or residential electricity use. And that can also provide explains for the result that industrial and manufacturing affairs have a negative affect on environmental spending.

From the above, even the broad result is consistent with the assumption that environmental spending increases with the economic growth, the growth may not necessarily result from industrial development. The sources of environmental pressure have generally been switched from industrial to residential and some other aspects. Hong Kong, a typical case of cities in their post-industrial time, has provided some supplement thoughts to the traditional Pressure-State-Response framework.

5. Conclusion

To sum up, in spite of facing with the threat of environmental pollution and the problem of resources shortage, Hong Kong's environmental spending still occupies a tiny part of government's public expenditure, with about only 3%. Delightedly, the past three decades have witnessed a substantial increase in spending on the environment in Hong Kong, especially after it's entering into the 21st century.

Reviewing the existing data on environmental spending of Hong Kong, the researcher has figured out the main sectors responsible for the environmental affairs are Environmental Protection Agency (EPA), Marine Department and Drainage Service Department, with their most amount of funding on governance. As for the major spending programs are air pollution control, waste management and sewage service. Referring to the data analysis, it can be preliminary concluded that, compared to pollution from industrial development and manufacturing, Hong Kong, after entering the post-industrial era, paying more on governing the pollution caused by the residential or commercial activities.

Referring to the pressure-states-response model as assumed in this research, the case of Hong Kong has supplemented this theory to a certain extent. In PRS model, it suggested that the industrial development might result in the environmental pressure, which will finally lead to the response from government, in this research, the increase of environmental spending. However, according to our finding, the assumption is not a necessity but depending on different social situations. For a country undergoing its industrialization, it might work. Because the major pollution comes from the industrial or manufacturing, and it shall be positively increase the environmental spending on governing. However, for a post-industrial city or country, including Hong Kong, there would exist a negative correlation relationship between the development of manufacturing and environmental expenditure. For Hong Kong such a post-industrial metropolis, its industrial manufacturing has declined and the pollutions from these industries are no longer the major concerns of the government. Instead, residential and commercial related issues such as sewage treatment, and control of air pollution caused by auto emissions and electricity generation are more likely the major pollution source and to be caught attention from the government. All of these have urged the government to adjust its preset and switch its attention.

This point provides certain enlightening significance for most countries or cites in their post-industrial period, or even in the midst of the industrialization process. Industrial pollution is not the only source

of environmental pollution. After rapid development of industrial development and entering into its stagnation or slow-paced process, governments can not simply cut its spending on the environment protection, on the contrary, attentions shall be switched to other pollution sources, such as residential and commercial pollution, including car emissions, pollution caused by electricity generation, and sewage and waste treatment. All of these mentioned will keep up consuming, if not increase, governments' funding on environmental issue.

Back to the case of Hong Kong in this research, variables like number of registered vehicles number, water consumption, population and GDP have more positive influential to government's spending on environmental, while manufacturing employment and industrial electricity consumption negatively. As can been imagined, due to the ascension of vehicle number, air pollution may boost government spending on the environment. Also, with the increase of water consumption results in government's pressure on wastewater or sewage treatment accordingly. This situation also conforms to the spending pattern part in the analysis, as air pollution control and wastewater treatment are two major programs in Hong Kong's environment spending or used in.

In general, Hong Kong government cannot treat any environmental problem lightly, even after it entered into the post-industrial era of seeming triumph. There is still long way off, and in future, Hong Kong shall put more effort on the pollution control of residential and commercial aspects, and improvement of environmental awareness of its entre people.

Reference:

Asian Development Bank (2009). *Environmental Performance Assessment. Prepared by GMS Environment Operations Center*. GMS Environment Operations Center Publication, Bangkok, Thailand.

Clark, T.N., Inglehart, R. (1998). The new political culture: changing dynamics of support for the welfare state and other policies in postindustrial societies. In: Clark, T.N., Hoffmann-Martinot, V. (Eds.), *The New Political Culture.* Westview Press, Boulder.

Elliott, E., Seldon, B.J., Regens, J.L.(1997). Political and economic determinants of individuals' support for environmental spending. *Journal of Environmental Management* 51, 15-27.

EVI UNEP: *classification of EVI for countries:* http://islands.unep.ch/EVI%20Country%20Classification.pdf

Hettige, Hemamala, et al. (1996), Determinants of pollution abatement in developing countries: evidence from South and Southeast Asia. *World Development* 24(12): 1891-1904.

Konisky, D.M., Milyo, J., Richardson Jr., L.E. (2008). Environmental policy attitudes: issues, geographical scale, and political trust. *Social Science Quarterly* 89 (5), 1066-1085.

Lee, Eliza WY. (2011), Chapter 12 History and Context of Public Administration in Hong Kong, *Thailand, Philippines, Malaysia, Hong Kong, and Macao*: 245(8)

Markowitz, Gerald, and David Rosner. (2013) *Deceit and denial: The deadly politics of industrial pollution*. Univ of California Press,

Maung, Min, Craig Wilson, and Xiaobo Tang. (2015) Political connections and industrial pollution: Evidence based on state ownership and environmental levies in China. *Journal of Business Ethics*: 1-11.

OECD (1993). *Core Set of Indicators for Environmental Performance Reviews*. In: OECD Environmental Monographs No. 83. OECD, Paris.

(1997). OECD *Environmental Performance Review: A practical Introduction* OECD/GD (97)35. Paris.

Olewiler, N., (2006). Environmental sustainability for urban areas: the role of natural capital Indicators. *Cities* 23 (3), 184-195.

Rosdil, D., (1998). R*ethinking Local Policy Analysis: the Challenge of Culture to Political Economy* Paper presented at the annual meeting of the Midwest political Science Association, Chicago.

Sharp, E.B., (2005). *Morality Politics in American Cities.* University Press of Kansas, Lawrence.

Tso, Geoffrey KF, Kelvin KW Yau, and C. Y. Yang. (2011), Sustainable Development Index in Hong Kong: Approach, Method and Findings. *Social indicators research* 101(1): 93-108.

Xiao, C., Riley, E.D., (2007). Validating a comprehensive model of environmental concern cross-nationally: a U.S. Canadian comparison. *Social Science Quarterly* 88 (2), 71-93

Appendix 1

```
. pwcorr, star(0.01) sig
```

	env_per	GDP	PPL	fresh_~r	seawater	farmland	vehicle
env_per	1.0000						
GDP	0.9186*	1.0000					
	0.0000						
PPL	0.9436*	0.9742*	1.0000				
	0.0000	0.0000					
fresh_water	0.8682*	0.8097*	0.8476*	1.0000			
	0.0000	0.0000	0.0000				
seawater	0.9286*	0.9437*	0.9863*	0.7956*	1.0000		
	0.0000	0.0000	0.0000	0.0000			
farmland	-0.8771*	-0.8929*	-0.9718*	-0.8173*	-0.9791*	1.0000	
	0.0000	0.0000	0.0000	0.0000	0.0000		
vehicle	0.9235*	0.9932*	0.9730*	0.8160*	0.9396*	-0.9105*	1.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
elec	0.9462*	0.9404*	0.9752*	0.9119*	0.9642*	-0.9760*	0.9497*
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
manu_empl	-0.9343*	-0.9431*	-0.9731*	-0.8527*	-0.9693*	0.9462*	-0.9503*
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
resi	0.9427*	0.9781*	0.9914*	0.8742*	0.9724*	-0.9630*	0.9830*
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
comm	0.9462*	0.9620*	0.9938*	0.8514*	0.9913*	-0.9873*	0.9655*
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
indus	-0.4970*	-0.6637*	-0.6563*	-0.1899	-0.7233*	0.9755*	-0.7475*
	0.0028	0.0000	0.0000	0.2673	0.0000	0.0000	0.0000
land	0.9226*	0.9368*	0.9744*	0.7807*	0.9867*	-0.9497*	0.9392*
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000