THE OLYMPICS AS A CATALYST FOR CHINESE ENVIRONMENTAL REGULATION – A THEORY WITH THREE CASE STUDIES FROM BEIJING

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Abbreviations

BOCOG- Beijing Organizing Committee for the Olympic Games
CCP- Chinese Communist Party
CFC- Chlorofluorocarbon
COD- Chemical Oxygen Demand
EKC- Environmental Kuznets Curve
Environmental Protection Bureau- EPB
GDP- Gross Domestic Product
HFC- Hydrofluorocarbon
HCFC- Hydrochlorofluorocarbon
IOC- International Olympic Committee
MOEC- Ministry of Environment and Construction
OBD- On Board Diagnostics
ODS- Ozone Depleting Substance
PLA- People's Liberation Army
RMB- Renminbi (Chinese Yuan)
SEPA- State Environmental Protection Agency
SOCOG- Sydney Organizing Committee for the Olympic Games
SOE- State owned Enterprises
UNEP- United Nations Environment Program

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1. Introduction

An experience that has been instrumental in focusing my academic interests was my internship in summer 2007 at the Global Village of Beijing. I stayed with a Chinese friend who was visiting her family. Every morning, when I left her house at 7 am to go to work, the commute, by public bus, was a two hour experience, two hours of breathing raspy, dusty air and enough exhaust to give me a headache. When I arrived at work, after coughing as I ran up the three flights of stairs, I began working ~~a~~s hard as possible, thinking that my work may make a difference for the city's eleven million registered residents. Tens of thousands of illegal workers would one day have a better commute home. At the time, the Beijing government, along with many NGOs and other interest groups, were busy cleaning up the city.

I returned the following summer with a new bus ride. I could see progress through the window of the compressed natural gas bus I was riding. The city was cleaner; efforts had noticeably paid off. The skies actually were blue. People filed out of the street exit from the newly built subway stations. The government had performed the majority of the work: it had been a very impressive top-down greening.

All of this starkly contrasted with China during the Maoist era. Although traditional Chinese philosophy promotes maintaining balance with nature, Mao sought to improve national strength through conquering nature. In Mao's eyes, "when the thought of men changes, the earth yields more grain" (Shapiro, 2001, p. 102). The 1966-76 "Cultural Revolution" was a political and ideological campaign initiated by Mao Zedong that was aimed at reviving revolutionary spirit. Phrases like 人定胜天 "Man Must Conquer Nature", would shape Chinese

environmental attitudes for years to come.

While Chinese environmental policy in the 80s and 90s certainly focused on defining China's "environmental responsibility" to the world, the Chinese view point was: responsibility is something that one owes to others. Since China doesn't owe the West anything, but the West owes China for previous economic oppression, Western powers should be held responsible to China. (Shih, 1993, pp. 13) This ties into what Shih Chih-yu calls a Chinese nationalist myth: the West has shamed and humiliated China, and thus is responsible to China. Furthermore, positioning (定位) should determine a person or state's behavior. The wielding of power is righteous when exercised from a proper position. (Shih, 1993, pp. 16) Shih presents the approximation of "duty + burden = power + privilege" to describe the saying, 权利与义务均等. This implies that power and privilege mean more duty, rather than less. Shih's conclusion: The Chinese view on many issues is that the West should answer to China. (Shih, 1993, pp. 14-15) This type of argument, according to Shih, generally has three rationales:

1. "China is a developing state and as such must place priority on economic development."
2. "If the PRC is to address environmental degradation, domestic problems take priority over transnational or global concerns."
3. "It is incumbent upon the advanced industrialized states that polluted and degraded the earth as they developed economically to pay for the lesser-developed states to respond to these global environmental problems." (Kim, 1998, p. 264)

Chinese Environmental Regulation in Beijing Today

I wondered why this decade of Chinese Environmental Regulation, at least in the city of Beijing, contrasted so much with recent history. Has China's position changed? Is China now exercising more environmental responsibility? As environmental think tank head Wu Chuanghua put it, "political will, emerging leadership from business community, [and] increasing awareness on environmental issues" are bound to change China, and China's position. Perhaps the Olympics has changed China's "position" to one of a country that is stronger and more responsible. The World Bank estimates that the economic toll of pollution could stand at between 8 and 23 percent of the Chinese GDP. (Kim, 1998, pp. 265) Thus, a "Green GDP" concept has become a common discussion among Chinese politicians. Political changes like these show the world that China may, after all, be cooperating.

The Olympics

The greening had begun before my initial trip to Beijing. Since 1994, the Olympic Committee has required that host cities strive to host an environmentally-neutral event. Some cities, such as Sydney, Australia, have taken this as a cue that the Olympics should improve the environmental quality of life in the city. Beijing undertook a range of promises to make the city a healthier atmosphere for the athletes that participate, and to ensure that the Olympics was powered by solar and geothermal electricity sources. (UNEP, n.d.)

Many Chinese viewed the Olympics as a defining moment in Chinese environmentalism as a whole. As Olympic Bid Ambassador Yang Lan aptly stated, "The Olympics provide a unique

opportunity to spotlight environmental issues at a national and global level and get people everywhere involved in environmental work" (Wei, 2006). Not only is Beijing meeting its targets for the number of required "Blue Skies Days,"[1] but Chinese media and blogs are proclaiming the "Olympic Spirit" of cleaning up the city. The Olympics has sparked a political, economic, and social transition in China. Politicians admitted the need for environmental reforms and the State Environmental Protection Agency (SEPA) has grown in institutional power. An extreme example of governmental "greenness": apparently a new team of "energy police" was set up to hunt down businesses and schools that fail to meet the national standard for energy efficiency, and threatening to publish their names on television or in newspapers if conditions did not improve. Economically, a huge market has been created for clean technology, renewable and recyclable materials. And socially, the Internet allows for hundreds of thousands of Chinese to express their opinions on this new "Green China." Bloggers are proud to be hosting such an event and proud that government action is finally coming to fruition. Environmental NGOs are increasingly popular volunteer sites and tend to work harmoniously with government agencies.

I think one of the reasons China is making so many environmental changes is the Olympics. Although I see the Olympics as the catalyst for many changes in China as a whole, in this thesis I focus on Beijing. Of course, a caveat is necessary: Beijing does not represent the whole of China. Beijing is decidedly more progressive than many cities in China. Its citizens are likely more politically active and better educated. After all, they reside in the political heart of China, a city with a rich political history; the Tiananmen Square has been the political center of China since it was constructed. Just to name a few well known events, Tiananmen played host to the May

[1] As defined as an Air Pollution Index rating of less than 101

Fourth Movement, was the place where Mao first proclaimed the People's Republic of China, and was the location for both Tiananmen protests. Beijing's citizens are also likely to be better educated than citizens in other cities. After all, it is host to two of China's top universities and eighty-two universities that offer Bachelor's degrees (this excludes institutions that only offer master's degrees). Further, there are 576,000 undergraduate students and 196,000 graduate students on campus at schools in Beijing in 2008 (Beijing Statistical Bureau, 2008). Given the high level of education of many of its residents, it would not be an overstatement to say that Beijing residents may understand environmental issues better (due to education) and exert more pressure on their municipal government, thus promoting environmental regulation in the city.

Despite differences between Beijing and China as a whole, the Olympics did affect the entire country of China's environmental regulation in a positive way. In my analysis, though, I will focus on Beijing, because I wish to understand the effects of the Olympics on the city. I wish to know how the Olympics may have changed the political dynamics in the city. What I find most striking about the environmental measures enacted by the Beijing government is that development theory, primarily the Environmental Kuznets Curve, suggests that Beijing municipal income levels are not high enough for us to expect this level of government commitment. I therefore propose a new model that proves useful in my quest to understand the changes that occurred in Beijing leading up to the Olympics. I then use three case studies to illustrate how these changes occurred. Finally, I illustrate one of the main pillars of my model: that the environmental regulation changes brought about by the Olympics are to a large extent irreversible.

Research Question

I will seek to answer the following three questions:

1. To what extent did the Olympics serve as a catalyst for Chinese environmental regulation in Beijing?
2. Will changes in governmental regulation last?
3. Does this have implications for other international events or developing countries?

A note on environmental indices and statistics

Since this thesis primarily concerns itself with environmental regulation in Beijing, it may seem striking at first that I have chosen not to incorporate environmental regulation indices into my analysis. After all, indices may make comparative statements more clear and may facilitate my placement of Beijing's municipal government and the Chinese government within the context of worldwide environmental regulation. A handful of universities and NGOs have come up with measures of environmental regulation or environmental effort. These indices, however, have two problems in my mind: a) they are rife with missing data, and b) they generally include a measure of democracy. This measure of democracy is sometimes calculated into an index as "political participation" or "civil society," and sometimes even measures a government's responsiveness to or cooperation with the NGO or NGOs conducting the study. In my opinion, many of these estimates are arbitrary and should not be used for comparative purposes, even more so for regression analyses! Furthermore, comparing one country, recognized by many as an outlier in a political economy sense, to others who have scored

higher on such an index is likely to be inconsequential. After all, the extent to which China is democratic is disputed. Although NGO's may give China a low score, Sellers cites China as an example in which local elections showcased small-scale democracy's positive incentives for environmental action. (Sellers, 2004)

Another important issue to note is that of statistics. Numerous sources[2] cite problems such as manipulated statistics and lack of transparency regarding statistics surrounding environmental indicators for the Olympics. While these statistics are controversial, they need to be a part of any thorough analysis of Beijing's progress because in the majority of cases, these are the only statistics we have. For skeptics, I've separated much of these controversial statistics from less disputable facts, such as legislation passed and policies enacted. For example, there's no controversy over whether or not Beijing took roughly half of the personal cars off the road during the Olympics, because a law was enacted that mandated that if these cars drove on certain days, their owners would be captured on camera and billed. I will attempt to build my case mostly off of the policies that were enacted, rather than statistics.

[2] Such as Greenpeace and Time Magazine

2. A theoretical framework in which to view Olympic Changes

The Environmental Kuznets Curve

The Environmental Kuznets Curve (hereafter referred to as the EKC) is broadly defined as the U-shaped relationship between per capita income and environmental quality. In a developing economy, demand for environmental indicators and a healthy lifestyle free of pollutants is low. Health and the environment are not issues at the forefront of peoples' minds nor at the top political system's agenda. At relatively low income levels of society, pollutant emissions increase with income, but after some "turning point", they decrease with income. This is because after attaining a certain level of real GDP, citizens start to demand these environmental improvements. They not only focus on their personal health, but are more concerned with the health of others in their society. This curve will be different for each pollutant.

Review of EKC literature

The EKC was first described by authors Grossman and Krueger, who used regression analysis to explore the relationship between income and emissions. Their conclusion was that a "turning point" occurred at around $8,000 USD, after which emissions tended to decrease. Michael Kahn, author of *Green Cities*, adds to this by describing a developing society's evolution along the EKC. As cities industrialize, he says, pollution becomes worse, but as they move into tertiary and quaternary economic activity[3], pollution becomes less severe. Stated another way, as GDP increases, pollution at first increases; then, once the GDP reaches the "turning point"

[3] Tertiary and Quartenary sectors are the sectors of the economy that deal with the service industry (such as tourism or insurance) and intellectual activities (such as IT, scientific research, etc.), respectively.

described above, pollution decreases. This is often attributed to a move away from industrialization and towards an information society. It is also commonly attributed to technological improvements that help lower abatement costs. But Kahn argues that citizen demand for government environmental protection plays a key role. Consumers demand better environmental conditions as their incomes increase beyond a certain point. To this end, consumers are even willing to alter their consumption choices. (Kahn, 2006, pp. 1-50)

As governments recognize this citizen demand for a better living environment, nations with higher GDP's tend to have governments that promote more environmentally-friendly policies(Hilton & Levinson, 1998). Hilton and Levinson explored the question "Why do governments 'get the lead out' of gasoline when countries grow richer?" and agreed that there is a definitive relationship between income level and regulation, suggesting that citizen demand might be a factor in this relationship. (Hilton & Levinson, 1998)

World Bank Environmental Economist Susmita Dasgupta points out three reasons why richer countries regulate pollution more strictly:

1. Pollution damage receives higher priority after society has completed basic investments in health and education.
2. Higher income societies have more plentiful technical personnel and budgets for monitoring and enforcement activities.
3. Higher income and education empower local communities to enforce higher environmental standards, whatever stance is taken by the national government. (Dasgupta, Laplante, Wang, & Wheeler, 2002)[4]

Dasgupta explains that, due to these factors, countries may be able to achieve a downward shift in the curve. This seems to be occurring in China, and Dasgupta explains that

[4] Dasgupta's third point is addressed on pages 4 and 5

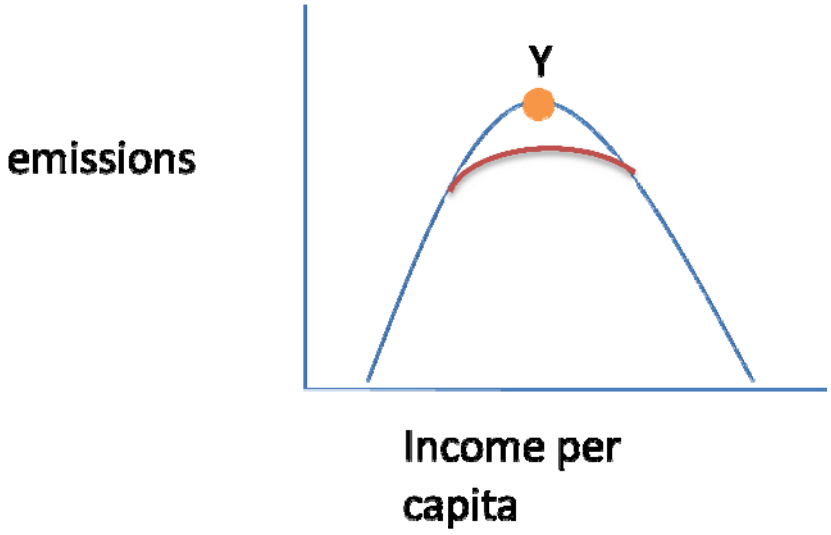
government regulation is most likely the dominant factor in these increases, a conclusion that will be important to my analysis. Dasgupta's also proposes that developing countries could achieve higher GDP while avoiding some or all of the pollution that the Western world emitted to get to the same level. This is sensible for a variety of reasons. First, abatement costs fall as technological innovation progresses on a worldwide scale. Second, international pressure for climate change regulation is much higher than it was at the time when the West did most of its polluting. Third, Dasgupta uses China as an example of a successful case of pigouvian taxes[5]. Dasgupta explains that these countries could tunnel, or leap-frog, the EKC due to these advantages. (Dasgupta et. al, 2002)

Similarly, Copeland and Taylor (2004) show that the inverse U-shape of the EKC may be solely determined by the changing elasticity of income hypothesis.[6] Dasgupta proposes that the EKC is a natural result of a few essential conditions: the marginal utility of consumption is constant or falling, the disutility of pollution is rising, the marginal damage of pollution is increasing, and the marginal cost of abating pollution is rising (Dasgupta et. al, 2002). He explains that the relationship between income and environmental quality will depend on how many parties react to economic growth and its side effects. Parties include citizens, businesses, policymakers, regulators, nongovernmental organizations, etc. These factors can change the shape of a country's curve for a pollutant. The shape of the curve is different for each pollutant, because income elasticity of demand for abatement is different for each pollutant. The red line in Figure 1 demonstrates Dasgupta's "tunnel" theory.

[5] A pigouvian tax is a type of tax that is levied on the market to correct a negative externality. Pigouvian taxes are imposed to counterbalance a negative externality; the tax accomplishes this shifting the marginal private cost curve up by the amount of the tax, so that marginal social cost equals marginal private costs. After this shift, polluting is more costly. Polluters make production choices based on this higher cost of polluting and thus, in theory, reduce output.

[6] Elasticity of income measures the percent change in demand for a good per percent change in income. In this case, our good is environmental improvements. Copeland and Taylor's argument is sensible because the EKC is modeled as a quadratic function of the logarithm of income.

Figure 1: The EKC



It is important to consider where the peak of the curve, Y, occurs. Grossman and Krueger's level of $8000 has vast implications for developing countries, the majority of which have not reached this level; hence many authors try to answer the provocative question: "Does pollution in the developing world have to get worse before it gets better?" In my view, we will never answer this question unless we consider specific pollutants. The EKC for each pollutant is unique. For example, it may require an income elasticity of only a few thousand dollars for citizens to start demanding regulation of a type of water pollution that is deadly if imbibed in small amounts, yet, the same citizen could be relatively unconcerned with carbon dioxide concentrations, which at the moment have no chance of threatening his/her life.

Regulatory monitoring and enforcement works for some pollutants, contributing to the EKC. The reason for this is that relatively few sources are responsible for most of the pollution. (Dasgupta et. al, 2002) Beijing's factory relocation for the Olympics provides an excellent example: the municipal government declared it necessary to move factories away from the urban area to locations outside of the city, including the Caofeidian port, an island 300 kilometers east of

Beijing. This relocation, which includes large pollution sources such as the Capital Iron and Steel Group, should be completed by 2010 under the 'Beijing Municipal Plan For Control of Main Pollutant Emissions During the 11th 5-Year Plan' (see Case Study 1). We will explore the effect of this relocation in our first case study.

Shen and Hashimoto's work uses cross-province data for seven pollutants from China to investigate the relationship between economic growth and environmental quality in China and to assess whether or not the emissions levels of these pollutants follow a Kuznets curve. The pollutants explored were SO_2, Dust Fall, COD[7], Cadmium, Arsenic, Mercury, and Industrial Waste Stock. SO_2, COD, Cadmium, Arsenic, and Mercury all followed the EKC inverted-U shaped distribution[8]; dust fall and Industrial Waste Stock seemed to fit an N-shaped curve[9]. Shen and Hashimoto identified two reasons why China could experience decreases in some of these pollutants: the use of more efficient abatement technologies, and subsidies from developed countries. Shen and Hashimoto's work roughly fits Dasgupta's tunnel theory. (Shen & Hashimoto, 2004)

Shen and Hashimoto's study is not necessarily representative of most pollutants in China. Water pollution, a category which includes five of the above pollutants, has been shown to fit EKCs more closely than other pollutants. There are two reasons for this: First, pollutants that create localized problems, like lead and sulfur, produce a greater urgency of abatement.

[7] COD is a measure of the amount of oxygen needed to breakdown the organic matter in a sample under very strong oxidizing conditions. A COD test measures the amount of organic pollutants in water. Although not used in the United States, COD and the COD test is used in many countries to measure industrial emissions.

[8] An example of an inverted-U shaped curve can be found at the top of p. 9.

[9] This means that, along with a rise in income, emissions or atmospheric pollution rises and falls according to this effect (or according to increases in pollution abatement technology) and then rises again. This would mean that there would be a turning point at an extremely high level of income after which the force of consumption would outweigh any abatement efforts, and therefore pollution would rise with increases in income.

Second, certain pollutants, such as most water pollutants, have a lower abatement cost than other pollutants, like CO2. Thus, pollutants like CO2 may appear to rise monotonically with income, rather than follow an inverted-U distribution. (Shen & Hashimoto, 2004) Energy, land and resource use (jointly termed an "ecological footprint") do not fall with rising income because the problems they create are not localized. As Stern puts it, "local impacts are internalized in a single economy or region and are likely to give rise to environmental policies to correct the externalities on pollutees before such policies are applied to globally externalized problems." (Stern, 2003)

EKC Model Weaknesses

It is important to note that even though the EKC is accepted by many economists and political scientists as a useful theory to analyze the relationship between income and pollution, it raises issues among a handful of academics. Criticisms of the EKC generally concern empirical evidence or lack thereof, and include:

- Missing data for certain pollutants and in certain countries
- Time analysis data is difficult to find because emissions have not been gauged for a long enough period of time. Cross sectional data, which was originally not part of Grossman and Krueger's theory, is usually used as a substitute for the time analysis data.
- EKC literature is econometrically weak. (Stern, 2003)
- EKC was found to hold for some pollutants, such as sulfur dioxide and total suspended particles, but others are seen to increase monotonically with income (carbon emissions).

Pertinent to our topic is that the EKC may not apply to China as neatly as modeled above. Arguably, in an authoritarian regime like China, the link between citizen demand and government action is weaker and less direct than in democracies. On one hand, this may be a

weakness of the EKC model as applied to China. On the other hand, it could mean that an authoritarian government may act on incentives other than citizen demand and thus to some extent insulate the EKC from specific income levels. In other words, an authoritarian regime may choose a top-down "greening" approach, which seems to be the case pertaining to the environmental improvements carried out because of the Olympics.

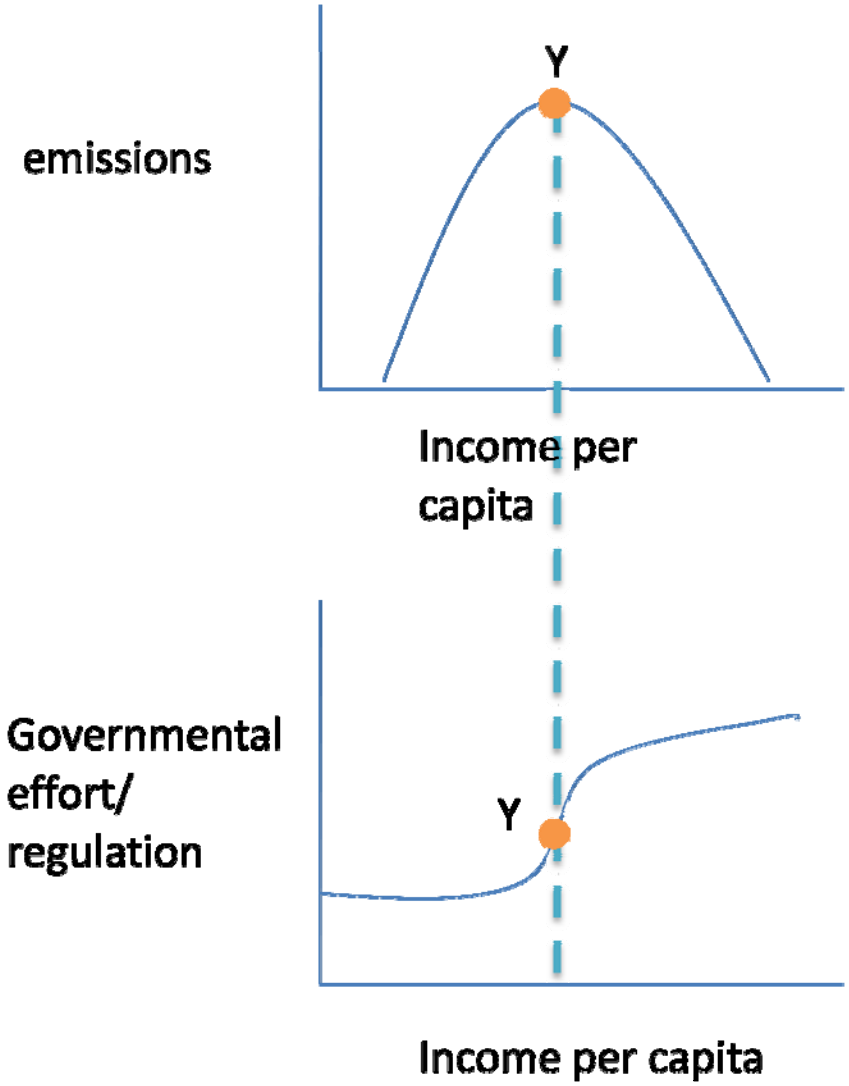
Despite its weaknesses, many studies have shown that the EKC is useful for modeling emissions trajectories. The Kuznets curve shape explains the emission trajectory for some pollutants better than others. The conclusion that we can draw from the literature is that it is difficult to identify a universal "jump" or "tunnel" in the EKC for any one developing country because of this pollutant dependency. However, the "tunnel" theory is still a provocative phenomenon that is occurring in certain cases, and is thus worthy of study.

An Alternative Model Proposed

One main problem exists with both the tunnel theory and the EKC as a whole. As many have pointed out, a gap in the literature exists concerning government regulation's role as a factor in the Environmental Kuznets effect. The literature often attributes a decrease in a pollutant corresponding to a rise in income to a variety of factors, one of them being government regulation. Studies even draw conclusions about the degree of government regulation based on whether or not emissions decreased with income. This type of analysis is common practice when it comes to the EKC, because government regulation is indeed seen as one of the factors contributing to a decrease in emissions.

While I agree in general that government regulation is a main factor in the fall of emissions for certain pollutants, the central flaw of this analysis is that policy outcomes do not always correspond with policy inputs. I think that in order to analyze the issue more thoroughly and to apply our analysis to developing countries, we need to consider government regulation and government effort (policy input) over income per capita growth rather than emissions (policy output). In accordance with this approach, I have created a model that relates these two variables. (see Figure 2)

Figure 2: The EKC and Modified EKC



It is necessary to understand that my model (hereinafter referred to as the Modified EKC) analyzes just one component of the EKC and is *not* a competing model. Rather, it is a complementary model that is more cautious and may be more useful in some cases. The Modified EKC supports the Kuznet's curve's assumption that popular demand makes government regulation rise, but this is often explained as follows: when voters become more affluent, they demand that their government do more for the environment. In the Modified EKC, the relationship between government effort/regulation and income occurs as follows: government regulation is relatively steady and at a minimum level before a country's income per capita grows. As income per capita grows, government effort/regulation increases rapidly, with the most rapid governmental effort/regulation occurring at the "tipping point" of the EKC. Eventually, government effort/regulation starts to level off as emissions decrease.[10] This trajectory can be explained as follows: As disposable income increases, people start to value quality of life and environmental amenities more. Thus, they demand even more from their government to protect the environment, and the government reacts to this demand in the form of environmental regulation, causing emissions to further decrease. (see Figure 2)

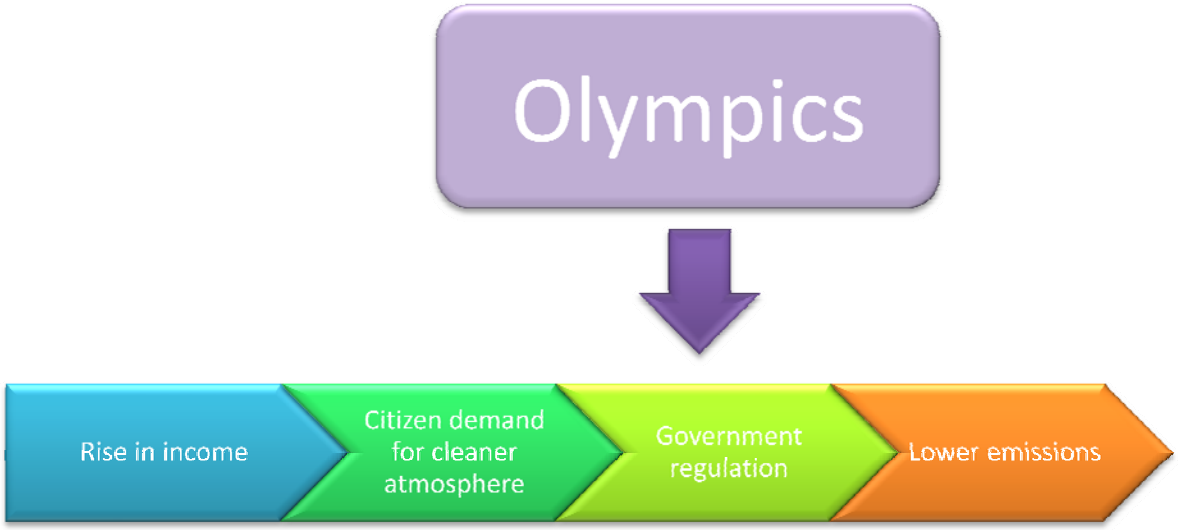
My thesis will evaluate the changes in environmental effort/regulation brought about by the Olympics in the context of this relationship between government effort/regulation and income per capita. In essence, my thesis will attempt to show that Beijing's governmental regulation diverged from the curve before its income per capita on the EKC would predict that it would. (see Figure 3)

[10] This is simply because lower emissions do not necessitate as much government regulation.

I hope to demonstrate in my thesis that my alternative model better explains Beijing's emissions evolution. Below, we observe the EKC and my alternative model. Much of the current literature which shows developing countries not following the EKC attempts to illustrate that there is a tunnel in the Kuznets curve (shown as the red line on the EKC). My analysis will be more cautious in terms of assumptions than the model of the EKC "tunnel" theory, because the Modified EKC *does not* assume that policy inputs can control policy outcomes, especially in developing countries. *Because* I wish to *only* analyse policy inputs, rather than policy outputs, I propose that what has happened in Beijing is shown by the red line on the Modified EKC. My case studies will show what measures Beijing's government went to in addressing the problem of pollution in the city. I will shift the focus from pollution emissions outcomes to government policies. Where these outcomes are present in my analysis, they are only there for my readers' information.

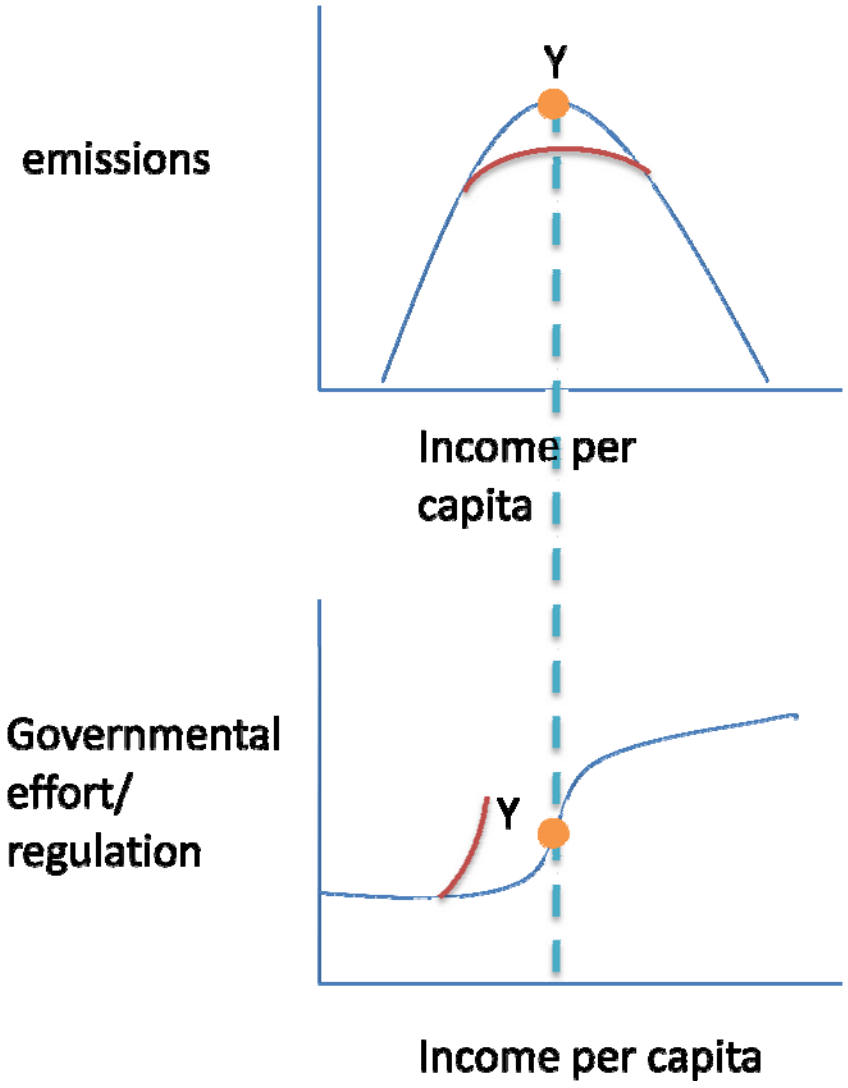
The Beijing Olympics serves as a crucial explanatory variable in my theoretical model. In the EKC model, the mechanism of decreased emissions is caused by income per capita, citizen demand, and other key variables. Because it is clear that many of the environmental reforms were carried out during or because of the Olympics, I see government's direct actions in Beijing's case as, to a certain extent, isolated from these factors.

Figure 3: Flow Chart Relating the Olympics to the Environmental Kuznets Effect in Beijing



In Figure 3, I illustrate the EKC's process of lowering emissions in Beijing, stressing that the Olympics fundamentally changed government regulation, thus speeding up the "greening." Note that in this case, the Olympics becomes a more influential factor than the rise in income and citizen demand for cleaner atmosphere caused by rise in income. Even though income hasn't risen to the point that would predict government regulation, the Olympics means that, to an extent, Beijing can "skip some steps."

Figure 4: The EKC and my model, with Dasgupta's and my own theories represented by red lines



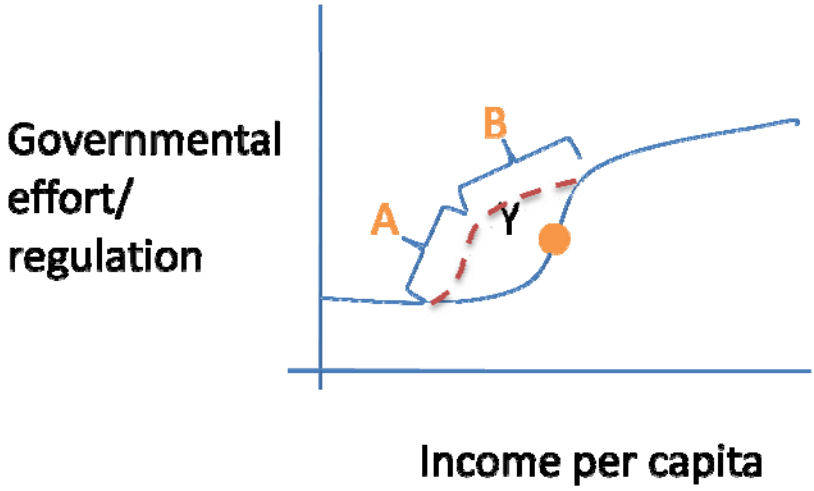
My main assumption above is that government effort/regulation is a main factor in the Environmental Kuznets relationship. Much of the existing literature supports this assumption. However, I do not rule out the possibility that, on the right-hand side of the curve, government effort and regulation may need to continue linearly, rather than increasing at a decreasing rate, to attain the highly unlikely extreme "0-emissions" end of the Kuznets curve, if such a condition

exists. This potential objection to the model is not pertinent to the subject of the thesis and to most analyses because there is no evidence that this end of the EKC can be attained.

Why does this red line exist? Why would Beijing's governmental effort/regulation increase before its income per capita would prescribe? I believe that the Olympics is the reason for this. I propose that:

1. The Olympics was the catalyst for increases in Beijing's environmental regulation and effort before such increases would be expected according to the EKC model (shown as segment A of red dotted line in figure below).
2. These changes brought about by the Olympics will continue, and can be modeled by the path shown below (shown as segment B of dotted line in figure below).

Figure 5: The Modified EKC and this thesis



Chapters three, four, and five will illustrate segment A of the above model using case studies. Chapter six will explore whether or not the changes will last (represented by segment B on the model in Figure 5).

3. Case Study 1: New Industrial Standards and Factory Relocation

Some of the largest measures Beijing took to control air pollution concerned industry: even though Beijing's industry is economically and historically significant, the government sacrificed these interests out of concern for the environment. The Beijing Sustainable Development plan (1998-2007), was a plan that Beijing submitted to the International Olympic Committee (IOC) in 2000 as part of Beijing's Olympic bid. The plan included 20 key projects, and, among others, addressed the issue of industrial standards and factory relocation. It was clear that the plan was one of the factors in the awarding of Beijing's Olympic bid in 2001. (UNEP)

Out of a 2006 list of the 9,509 polluting enterprises that threatened Beijing's air and water, 2,699 were industrial enterprises. (UNEP, 2007) Furthermore, many industrial enterprises accounted for huge portions of the Beijing's Total Suspended Particles (TSP). In the Beijing Sustainable Development plan, the Beijing government identified the largest threats-- a whopping 323 enterprises-- and proceeded to set emissions standards. The Beijing municipal government decided to move all major polluters that did not or could not meet these standards away from the urban area before 2008. Many of the city's big factories were involved in the massive relocation plans. (BOCOG, 2006) Others faced upgrades or temporary shut downs for the months before the Olympics. In total, Beijing planned to move, relocate, or shut down factories that, combined, consumed 13 gigawatts of electricity, which is roughly the equivalent of half of the industrial capacity of the country of Mexico. (Roberts & Tschang, 2008) Included in the over 200 companies to be moved were cement, steel, iron ore, and coal-fired power plants. Winnie Lee, Hong Kong bureau chief for Platts, a company that works with energy and

commodities, agreed that these companies needed to be removed: “If China wants to clean up cities in a very short time -- especially in terms of air pollution -- these are the industries to target” (Roberts & Tschang, 2008). In addition to these measures, Beijing banned construction and forced many enterprises to temporarily close if they weren’t able to meet strict emissions requirements in preparation for the Olympics.

Not only did enterprises, and in some cases entire industries, move out of Beijing (where they pose the most health threats to humans). They also adopted cleaner technology and cleaner processes. Some follow the ‘3R’ approach (Reduce, Reuse and Recycle), claiming to have engrained “Recycling Economy” (循环经济) into their processes in their mission statements. This new trend of recycling programs and environmental compliance spurred another trend: industrial development areas have attracted new sustainable industrial projects. (UNEP, 2007)

New Mechanisms for industrial pollution control

There are two main mechanisms for industrial pollution control in Beijing: the Municipal Bureau for Industrial Development, and the Beijing Environmental Protection Bureau (EPB). The Municipal Bureau for Industrial Development is charged with implementing industrial policies in Beijing. The United Nations Environment Programme (UNEP) sums up its responsibilities as “closing highly polluting enterprises, relocating factories outside the urban perimeter, and adjusting industrial regulations, with a particular focus on new industrial development zones.” (UNEP, 2007)

The EPB served as a monitor and regulator on pollution during the Olympics. It set the standards for boiler pollutant emissions, air pollutant emissions from Construction materials and Metallurgy Industries, air pollutant emissions from oil refineries and the petroleum chemical industry, air pollutant standards for other chemical industries, and water pollutant standards. The EPB issued industrial environmental licenses and cooperated with research institutions in reporting on industrial waste. (UNEP, 2007)

Policies on industrial pollution control

Two pieces of legislation played a key role in industrial pollution control in the years leading up to the Olympics: the Sub-plan for environmental Protection and the Beijing Municipal Plan for Control of Main Pollutant Emissions During the 11th 5-year Plan (2006).

The Sub-plan for environmental protection (2002), part of the Environmental Action Plan for Beijing, details the following concerning prevention and control of industrial pollution.

1. Cut discharge. The following measures were proposed:
    a. Implementing a total discharge quantity control program
    b. Applying of life-cycle control and recycle economy
    c. Changing industrial structure and layout
    d. Improving enterprise-scale industrial management
    e. Promoting advanced technology and replacing outmoded procedures and technology
    f. Closing industries that do not meet standards or pollute on too large a scale
    g. Emphasizing long-term prevention of further air pollutants
2. Implement Recycle Economy. Details of the project:
    a. Enterprises should implement recycle economy in their different processes
    b. 1-2 ecological industrial parks should be built
    c. ISO14000 environmental management systems should be promoted*
    d. Life cycle control and pollution source reduction will be emphasized
    e. An Environmental Impact Assessment will be considered in all relocations of polluting industries.

3. Relocate. Details of the project:
    a. About 200 enterprises will be shut down/ moved by 2008.
    b. Previous factory sites will become commercial or residential areas
    c. More emphasis will be placed on abatement and prevention of dust pollution coming from the metallurgical and cement industries
    d. The Capital Steel & Iron Corporation will cut its steel production by 2 million tons by 2002, and will work on product portfolio optimization as a method to cut back on its pollution.
    e. Small and medium-sized building material production in Fangshan County will be gradually closed down or converted into more high-technology facilities
4. Implement new standards. By 2005, the cement industry will be subject to strict standards. All vertical kilns will be stopped. (Beijing Foreign Affairs Office, n.d.)

*The ISO 14000 environmental management system is a set of environmental management standards.

The 'Beijing Municipal Plan For Control of Main Pollutant Emissions During the 11th 5-Year Plan' was passed by the Municipal Government. The plan is more specific than the above sub-plan. For example, it set specific aims for specific chemical pollutants; these aims for SO2 and COD were 40 per cent and 16 percent respectively. As the UNEP points out, data on whether or not these goals were achieved prior to the Olympics is still unavailable. (UNEP, 2007)

The Beijing government's 11th five year plan was also crucial to industrial reorganization, as it named more plants that needed to be shut down or relocated. It calls for the following measures regarding industry:

1. Relocation of the Shougang group and construction of the Caofeidian New Steelworks;
2. Implementation of the Shunyi Cold Rolled Steel Sheet project*
3. Relocation of Eastern Chemical Works and Coking Plant
4. Restructuring of the construction materials manufacturing industry in Beijing
5. Shutting down of enterprises causing serious environmental pollution. (Natural National Science Foundation, 2005)

*The Shunyi project is a cold rolled Steel sheet project that promotes modernization in the steel industry while at the same time enhancing the industry's competitiveness. (CMWIN, 2007) Cold-rolled steel is a high-tech and high-value added product that is more environmentally friendly than hot-rolled steel, which is malleable and easy to process, but requires heat (thus consuming

energy) and produces air pollution when it is heated. Cold-rolled steel hardens when cold, so it doesn't need to be heated and thus its manufacturing process saves energy and emits fewer pollutants into the atmosphere.

The project will cost around 6,000,000,000 RMB and be completed over a period of 33 months. (CMWIN, 2007) These policies set precedents not only in China, but in the developing countries of Asia as a whole. It is clear that China was thoroughly committed to each of the goals it prescribed for itself even before the Olympics, and thus chose to set stringent policies and almost extreme-sounding standards for industry. It is to be taken as given that these policies are a significant departure from what seemed to be a policy that encouraged heavy industry at any cost in the Beijing of the 1980s and early 1990s.

Industry Restructuring & Relocation

Industry had been crucial to the city of Beijing in the past. Before relocations of industry for the Olympics, industry accounted for more than one third of Beijing's GDP. Even though Beijing is a city that grew and prospered due to heavy industry, the emphasis is being placed on technology in an effort to be greener and reduce air pollution emissions. Many old factories are being converted into strip malls, technology parks, eco-parks, and residential areas.

It is important to point out that some major industrial players moved out of Beijing before the Olympic bid. The moves have been more of a gradual process than a sudden, quick move to deceive the Olympic organizers into thinking that Beijing has good intentions (although that is what is portrayed by the media). From 1998 to 2006 a total of 209 industries relocated, 197 of these firms moved between 2000 and 2006. (UNEP, 2007)

In the below analysis, I will first list some of the enterprises that have been shut down. Then, I examine in more depth what I see as the three cornerstones Beijing's plan: vastly decreasing emissions from boilers, relocating Shougang, and closing the Beijing Coking-Chemical Plant. Other than these two, among the more prominent of the enterprises affected were: (Note: these factories were closed if not otherwise specified)

1. Beijing Second Pharmaceutical Factory
2. Beijing Dye Factory
3. Beijing Coke Plan
4. Other coking plants and organic chemical plants were also targeted by the Environmental Protection Bureau (EPB) in the Southern Suburbs area. (Liu, 2006)
5. Beijing Huaneng Thermal Power Plant: implemented a desulphurization system and is currently working on a nitrogen oxide removal system. (UNEP, 2007) Was not closed.
6. All cement producers in Beijing, as well as over 200 quarries and lime producers
7. Beijing Eastern Chemical Works
8. Beijing Yanshan Petrochemical Group, and 18 other heavy polluters cut production to reduce emissions by 30 percent
9. Beijing Huaer (化儿) Company Ltd., which was purchased by China Petrol for 3.3 billion Yuan, was relocated. (BOCOG, 2006)

Boilers

The Beijing Environmental Protection Bureau (EPB), in charge of reducing air pollution generated by the boilers, identified two different strategies to achieve the task of reducing boiler emissions: conversion to clean energy for the small-scale plants, and complete technical renovation of large-scale plants.

The plan for small-scale boilers was to convert them to cleaner forms of energy, such as solar, geothermal, and natural gas. According to the Beijing Environmental Protection Bureau (EPB), by 2006, 15200 small-scale boilers had been converted and 1,105 small-scale boilers were set to be converted before the end of 2007. The coal fired stoves found in restaurants and homes were also targeted: the EPB sought to convert many of these to electricity. For example,

from 2003 to 2006, the 'Coal to Electricity' demonstration project involved 11,421 families in the areas stretching from Dings SanTiao to BaTiao and from Xisi TouTiao to BaTiao; about 10,000 more homes were set to complete the project by the end of 2007. These plans together required an investment of $38.37 million. (UNEP, 2007)

The plan for large-scale boilers was threefold: (a) to adopt high efficiency dust removal technologies; (b) to control dust in coal storage facilities; and (c) to adopt end-of-pipe desulphurization systems. For example, in the Beijing Shijingshan Industrial Area, the thermal plants at Gaojing and Jingneng began operating a flue gas desulphurization system. This system, planned to be completed by 2007, filters sulfur and nitrogen oxides. Higher efficiency cloth-bag dust removal systems are also part of many companies' upgrade plans. (UNEP, 2007) These strict plans for upgrading or converting boilers show the Beijing government's strong commitment to environmental action, and demonstrate the scope and breadth of environmental reforms that occurred in preparation for the Olympics.

Capital Steel (Shougang)

The Capital Iron and Steel group, also called Shougang, was the city's biggest state-owned enterprise, which once employed one-tenth of Beijing's production workers. (BOCOG, 2006) In 2005, it was announced that the factory should be moved to Caofeidian, an island in Hebei province. The headquarters, research and development, sales and logistical operations would remain in Beijing. Shougang's relocation cost approximately 68 billion renminbi (US$ 8.7 billion). Even after the phase-out had begun, Shougang was still the 7th largest steel producer in China in terms of output. (High, 2007) We can see this in Table 6.

Table 6: Chinese Steel Makers

Rank of Top Chinese Steel-Makers (2007)			
Rank	Group	Output (million tons)	Growth Rate (%)
1	Baoshan Iron and Steel	24.3	7.3
2	Angang Steel Company	23.3	3.4
3	Tangshan Iron & Steel Group	20.8	14.2
4	Wuhan Iron & Steel Group	19.3	11.2
5	Jiangsu Shagang Group	18.5	19.1
6	Maanshan Iron & Steel Group	12.7	31.2
7	Shougang Group	12.4	22.3
8	Jinan Iron & Steel Group	10.8	13.8
9	Laiwu Iron & Steel Group	10.8	7
10	Hunan Iron & Steel Group	9.8	15
Source: China Custeel			

The move was crucial because, at merely 17 kilometers west of Tian'anmen Square, Shougang was simply too close to the Olympic venues. According to the estimates done by the Environmental Protection Bureau (EPB), Capital Steel's relocation alone would decrease 18,000 tons of suspended particles, which accounted for roughly 1/5 of the total suspended particles released by all industry in the year 2002. (Beijing Times, 2005) The effect of the move on Beijing's air was apparent just months after Shougang started to phase out operations. As Beijing resident and salesperson Liu commented, "When I was growing up, the sky was never blue. It was yellow. Things are much better now." (Cha, 2008)

The new plant, set to again be the country's largest steel producer, will have a yearly production capacity of 8.98 million tons of iron, 9.7 million tons of steel, and 9.13 million tons of rolled steel. (High, 2007) Shougang's production in Beijing was cut four million tons in 2007

and another four million tons in 2008. According to a Shougang representative, the new plant in Caofeidian will include two 5500 m3 blast furnaces. Half of the designed capacity of the new plant is set to be operational by 2008. (AsiaPulse News, 2004)

In the announcement to move the factory, Beijing's mayor Chang Jilin explained, "In order to improve Beijing's air pollution situation, the State Council has officially decided on the relocation of Shougang. Although we are setting our deadline for completion of this relocation for 2010, we will strive to complete the relocation in 2008. If the relocation hasn't been completed by 2007, we will cut output in preparation for the Olympic Games. To move Shougang, it will cost at least 50 billion yuan and 80,000 workers will need to be relocated." (Beijing Times, 2005) Later estimates stated that the plan involved the relocation of around 120,000 workers. (UNEP, 2007) Zhu Duanmin, head of Shougang's Council of Affairs, repeatedly exclaimed the slogan "For the long-term interest of Beijing's people, Shougang submits to the general interest" to the media. (Beijing Times, 2005) According to Mayor Chang, the fact that the operation of No 5 blast furnace and No 2 coking oven was halted in 2006 "shows our seriousness about environmental protection." (BOCOG, 2007)

Shougang's transformation is remarkable given its history as one of the founding State-Owned Enterprises (SOE's) in Beijing's heavy industry sector. That such a powerful political entity was moved to a different city illustrates the massive impact of Beijing's Olympics on the city and the city's environmental agenda as a whole. As clearly reflected by the Great Leap Forward, steel was symbol of economic development in China for decades. China's steel industry developed through a system of SOEs, in which an entire community worked to make steel at one large factory. These enterprise/community connections still prevail to an extent.

One interesting thing to note when evaluating energy use in the case of Shougang is that calculations of the energy used to make steel often are larger than expected because they contain energy used for a variety of other functions in the group, some of which do not directly deal with steel production, but with routine tasks in the steel community, supporting/training, or other services the group provides. Furthermore, Shougang has been around for decades and influential in Beijing's municipal government for decades, mostly because of its sheer scale. Since opening in 1979 until 2003, Shougang paid 35.8 billion RMB in tax money to the Beijing Municipal government. Beijing's relationship with Shougang is said to be love-hate, because although the factory is a major polluter, it provides a large number of jobs to Beijing's residents. In 2007, with 135,100 employees, it accounted for one-sixth of Beijing's industrial employment. (Liu, 2006)

One source explains that Beijing loses financially in the case of Shougang, because not only is the city paying in part for the relocation of a taxpaying corporation, it also has to pay retirement allowances to many employees who have retired or are currently in the process of retiring. (Liu, 2006)

According to Shougang's website, the company has introduced pollution reduction technologies that include the most advanced and effective technology from China and other nations at the new site. The website mentions the Siemens-VAI dust removal dry flue gas treatment technology, and explains that this system has high collection efficiency, requires less water, and can reuse dust. Thus, it is water-saving, energy-saving, and environmentally friendly. (Shougang Group, 2009) The plant's development strategy thus envisions a gradual shift from steel production to cleaner services, such as the high-tech industry or real estate and other

service sectors. Robots and silicon chips are included in the list of new high tech products already being manufactured by Shougang. Non-steel sales revenue increased 2.62 percent in 2006, bringing non-steel sales revenue to roughly half of Shougang's overall sales revenue. (AsiaPulse News, 2004)

Beijing Coking-Chemical Plant

Another important measure undertaken by the Chinese government was the closing of the Beijing Coking-Chemical plant in 2006. At its peak, the factory had employed 10,000 workers, and powered most of the city's family cooking. According to one source, the factory, and the smoke that billowed from it, was a proud symbol of economic development to China's leaders. (Cha, 2008) The factory had supplied 710,000 families and 5,000 hotels with gas in the late 1990s. (BOCOG, 2006) The factory had political influence within Beijing's municipal group because of its extensive provision of coal gas to the city's residents. (BOCOG, 2006) Even though natural gas from Shaanxi province became commercially available to Beijing's residents in 1997, the last 6,000 coal gas users did not switch over until July of 2007. The shutdown will save emissions of 2.96 hundred million tons of coal and 4.3 billion cubic meters of exhaust emissions. (BOCOG, 2006)

Like Shougang, the Coking-Chemical plant powered the city for two decades and was thus culturally significant. Its permanent shut down, clearly sparked by the Olympics, again demonstrates the far-reaching effect of the Olympics on the Beijing government's willingness to abate pollution.

The issue of pollution migration

An important question when evaluating this case study is what happens when polluting industries are moved to smaller cities. Migration of heavy industry from wealthier cities to less developed ones has been a major trend in China. (Cha, 2008) This trend is sometimes termed "internal colonization." One example is the city of Tangshan. It is reflected by the comments of the workers in other areas, such as factory worker Ren Yuexiang, who lives less than a mile from a coking plant that relocated out of Beijing, said, "No one cares about us… We are just farmers. In Beijing they are all high class royals." Tangshan, the city in which she lives, has capitalized on relocations and Beijing's newfound environmental consciousness to take advantage of industrial opportunities. Its growth in the past few years has far exceeded the national growth average, as it has become the heart of China's steel industry. Tangshan's GDP is now $50 billion, ranking it 20th in the country.

Tangshan's pollution level has also risen, though, which raises the possibility that pollution is merely being moved from Beijing to other areas. In the words of the head of Shougang's council of affairs Zhu Duanmin, however, "Capital Steel's relocation definitely isn't merely a case of 'Pollution is finding a new home.'" Tangshan's deputy mayor, Xin Zhichun, explained that companies recently moving to Tangshan were required to reduce their pollution levels. In his words, "not a single screw was moved from Beijing to Tangshan," Xin said. "It's a completely new construction. At least a few hundred environmentally friendly, energy-saving and emissions-cutting technologies are being used." (Cha, 2008)

While pollution migration has occurred to some extent, as a steel or other plant is unlikely to be emissions-free, the reduction in pollution may be more substantial than Western Media portrays it to be. The rule of thumb is that new plants are able to integrate new energy saving technologies at less of a cost than old plants. Unfortunately, data on exact reductions in emissions of specific factories in China are unavailable at this point. Worth noting is that Chinese media positively calls the new Shougang factory a "Zero-emissions" project.

Significance

What is significant about this case is that Beijing's government was willing to accept the cost of these relocations. A 2007 quarterly market report about Beijing's industry as a whole explains, "recent concerns for the environment have hindered further growth in industry." (AsiaPac International, 2007) As we see above, politically and historically important plants which supported Beijing during its boom years had to relocate. Additionally, industry, accounting for 1/3 of Beijing's GDP, came out of 2007 badly bruised. Industry grew only 2.2% in 2008, compared with a tertiary sector growth of 11.7% (Beijing Statistical Bureau, 2008). Prominent industries suffered the most. For example, growth in production of steel in Beijing from the year 2007 to 2008 was -37.6% (Beijing Statistical Bureau, 2008.) This shows that the Beijing government is emphasizing industry much less than it has in the past, and possibly less concerned with the loss of profit associated with industry moving to other cities. Many reforms to the industry sector, including those above, were carried out only within the last couple of years, and the most stringent measures were applied only recently. This demonstrates that the Olympics served as the main impetus for this departure from a "business-as-usual" scenario for Beijing's industrial pollution.

4. Case Study 2: Limiting Vehicle Emissions in Beijing

Because vehicle emissions, especially carbon monoxide and nitrogen oxide, are a major source of pollution in Beijing, they are a major threat to not only athletes but also every citizen of Beijing. As Du Shaozhong, Deputy Director of the Environmental Protection Bureau (EPB) explains, "There are 20 percent more air pollutants in the evening than during the daytime… The period around 9 pm is always the time when the density of pollutants in the air start to rise and remain high until about 4 am." Beijing tackled vehicle emissions within the framework of a holistic approach to transportation in the city in which subway lines were expanded and a fleet of environmentally friendly buses, which run on compressed natural gas, was created. The government's vehicle emissions policies affected 19,000 public transport vehicles and 66,000 private vehicles. (Beijing Development and Construction News, 2008) Improved air quality and achievement of 274 blue sky days for the Olympics was credited in part to these policies.[11]

This example also illustrates how Beijing enacted transformative change. We can see through the policies outlined below and the measures taken that, before the Olympics, Beijing may not have been in the position to enact such swift and, in some cases drastic, measures to combat vehicle emissions.

[11]Blue sky days goal for the Olympics was 247 out of 365 days in 2008， so Air quality improved significantly in 2008. While in 2007, only 28 days of the year met the national Level 2 Standard, in 2008, 274 days met this standard.

Policy

The essential policies and plans of the Beijing government that implemented vehicle pollution control for the Olympics include:

- The Sub-plan for environmental protection of the Beijing Municipal Plan (1998)
- The thirteenth Time period: Beijing Air Pollution Control (2007)
- The Olympic Action Plan (2002)

The Sub-plan for Environmental Protection of the Beijing Municipal Plan (1998) details the following measures to control vehicle pollution:

- Emphasize public transportation, such as subway and light rail, and encourage use of cleaner fuels, electricity powered vehicles, and fuel cell vehicles
- Starting January 1, 2003, new light and heavy vehicles will be required to meet standards equivalent to Euro II
- Starting in 2005, all new vehicles will be required to meet Euro III standards.
- New vehicles not in compliance will not be granted licenses
- Fuel should be correspondingly upgraded
- 90% of public buses and 70% of taxies should be converted to cleaner energy by 2007.
- Take measures to put to rest aging automobiles. Automobiles in use in 1992 will be discarded by 2007. Taxies with more than 500,000 km on them will be phased out.
- Guidelines and action regarding motorcycles will be developed.
- Vehicles used for agricultural means will be phased out.
- All vehicles in use will be exhaust tested by the city. * (Beijing Foreign Affairs Office, n.d.)

*Vehicles in Beijing are required to get government check-ups.

The second important piece of legislation was the Municipal government's 13th Time Period Plan on Air Pollution Control (2007), which stipulated that:

- As far as company and individual cars go, we need to emphasize maintenance and care in order to guarantee that mechanisms installed to reduce particles in exhaust are in working order and meet licensing standards.
- The Municipal Quality and Technology Environmental Overseeing Department's plan, to be implemented in 2008, stipulates four phases for the groundwork for this.
- In 2007, the city's public transport organization will replace 2850 public buses and 5000 taxis.

- Vehicles registered before 1999 will not be allowed to obtain official paperwork to transfer to Beijing and operate here.
- Air pollution should meet the national 4th period emissions standards. These standards will be enforced by the Sanitation, Public Transport, Law Enforcement, and Postal departments.
- Completely implement the National 3rd level pollution standards and European On-board Diagnostics system for new automobiles*
- High emissions yellow-tagged vehicles will be checked every quarter, and must meet level 3 standards.
- The City Environmental Protection Bureau and the Urban Settlement Authority should use laser remote sensing vehicle exhaust systems to strengthen roadside enforcement of laws among vehicles. Correspondingly, they should increase punishment of these violations and integrate vehicle exhaust into the Inquiry System Network.
- The traffic control, urban management, municipal management, agriculture, and environmental protection departments all need to take part in monitoring and reporting vehicle emissions
- Improve the quality of petrol. Gas should meet the Stage IV standard. From April 2007 onward, public transport vehicles will use petrol with a sulphur content of less than 50ppm. This regulation will be jointly overseen by the Municipal Quality and Technical and Municipal Commerce and Industry Bureaus.
- Before the end of 2007, volatile organic vapor recovery management systems should be established at tanker filling stations. (EPB, 2007)

*The OBD is a system in which cars self-diagnose and report automobile health statistics to repair mechanics. OBDs have standardized fast digital communication ports, which relay a series of standardized diagnostic trouble codes, or DTCs and real-time data to a mechanic.

The third important policy was the Beijing Olympic Action Plan's third section on Urban Transport Development and Management (2002), which stipulated that:

- Modernization of the road network is crucial; we should do this by constructing rail transport systems, urban road transport systems, inter-city transport systems, and city transport hubs.
- Urban rail transport will focus on subway lines and Beijing Urban Light Rail. By 2008, 148.5 km will be added; by this time, the subway's 202 km of subway should carry roughly 10% of the city's passengers.
- Expand motorways so that the total length of expressways in the city reaches 718 km and the total length of motorways reaches 14,700 km. Expressways will be built on the Fifth Ring Road, Sixth Ring Road, Beijing-Miyun Road, and other first and second grade motorways will be built.

- Bus lanes will be expanded
- Parking facilities will be built in the urban areas, and parking rules will be enforced.
- Traffic control organizations will be set up to manage traffic and limit traffic infractions. (BOCOG, 2003)

The car ban is not mentioned in 11th Five-year plan.

Implementation

For the Olympics, the Beijing government: a) set new standards for vehicle emissions; b) set new limits on vehicle sales; c) built new roads to deal with traffic issues; d) took roughly half of the personal vehicles off the road during the Olympics and one fifth after the Olympics, starting in October 2009, and d) banned yellow-tagged vehicles from the city during the months leading up to as well as during the Olympics. For this case study, I will address each of these measures separately and show how each of them illustrates the Beijing government's commitment to the environment and the impact of the Olympics on the feasibility of these measures.

a) Vehicle emissions standards and Petrol standards

The first step in tackling the problem of vehicle emissions was to set new standards. The legislation for these new standards, outlined below, was all passed and enacted either in the few years preparing to Beijing's bid for the 2008 "green" Olympics, or during the period of preparation for the Olympics. The Beijing government named emission standards for sales of new vehicles according to four phases, which corresponded to Euro emission standards I-IV. Note from Table 7 that Beijing implemented each of the standards two years earlier than the rest of China, with the last phase going into effect in 2008, just in time for the Olympics. As the

table below explains, Beijing implemented standards earlier, presumably because of the Olympics.

Table 7: Implementation of Emission Standards in China and Europe

DATE OF IMPLEMENTATION OF EMISSION STANDARDS IN CHINA AND EUROPE

Standard	Year of implementation (China)	Year of implementation (Beijing)	Year of implementation(Europe, passenger cars)
National First-Phase Emission Standard (Euro I)	2001	1999	1992
National Second-Phase Emission Standard (Euro II)	2005	2003	1996
National Third-Phase Emission Standard (Euro III)	2007	2005	2000
National fourth-Phase Emission Standard (Euro IV)	2010	2008	2005

Source: Environmental Protection Bureau (EPB)

Implementation of this system was strict. According to Feng Yuqiao, the head of the motor vehicle department of the EPB, the Beijing government used 22 laser remote sensing cars to check whether or not vehicles met emissions standards. He explained that these "inspection cars" operated mainly near the Olympic venues and training centers for athletes,

and that they could determine the emission levels of a vehicle in only .7 seconds. (China Daily, 2008)

Petrol emissions standards were also changed according to the framework established by the European model. By 2000, 2003, and 2005, gasoline and diesel fuel sold in Beijing complied with the Euro I, Euro II, and Euro III standards, respectively called the National First Phase, National Second Phase, and National Third Phase standards. Measures to remedy pollution caused by gas stations, storage, and filling were also included in the Municipal Government's phase I plan. Accordingly, in 2001, sealing systems for fuel storage tanks and fuel unloading systems were implemented. By 2007, nearly 100 petrol stations had installed recycling refuel nozzles. Oil storage centers and petroleum refineries were encouraged to install gas recirculation systems. (UNEP, 2007)

Because significant raises in gas taxes are assumed to prevent overconsumption of gas and thus lessen excessive driving, the Beijing government also instituted higher petrol prices within the city, implementing a 16% increase in gas prices in June 2008 and then a further 8% increase in October 2008. Then, even though world gas prices fell in December 2008, after the Olympics, the Beijing government decided to pass a petrol tax that charged 1 yuan per liter of petrol and .8 yuan per litre of diesel, as opposed to previous taxes that were set at .2 yuan per litre of petrol and .1 yuan per liter of diesel. (Jia, 2009)

b) Limiting the issue of registration plates

In order to limit the number of cars on the road, the Beijing government decided to limit the amount of new license plates every year to one-hundred thousand. Guo Jifu, director of the Beijing municipal transport development research center, explained that Beijing is seeing an increase of about 20 percent, or 300,000 new cars a year, and that his research center expected the number of total cars to grow to 5.4 million by 2012, an increase of two million cars. As Guo pointed out, if estimates are correct, "The new cars will need another 60-sq-km parking space, which equals the total area within the Second Ring Road," and will burn at least 1.3 billion liters of petrol per year…" (Gasgoo.com, 2008) According to the Beijing Statistical Bureau website, even with license-plate restrictions, private cars in Beijing rose to 2,480,000 in 2008, increasing 17.1% from 2007. (Beijing Statistical Bureau, 2008)

According to the UNEP, in October 2006, the total number of private cars was 2 million, and 23% of passengers used private cars as their primary transport method. As we can see from the statistics and tables below, the problem of increasing private and government cars was urgently in need of a solution. The Olympics provided an excellent impetus to finally reform Beijing's licensing system.

Table 8: Number of Vehicles in Beijing by Type

NUMBER OF VEHICLES IN BEIJING BY TYPE	
Vehicles	**Total number**
Private cars	2,000,000
Governmental cars	800,000
Buses	18,000

Taxis	65,000
Bicycles	8,000,000

Source: BOCOG

Vehicle breakdown by primary transport method:

- Cycling, walking: 39%
- Bus: 28%
- Taxi and Rail network: 10%
- Car: 23%

Source: BOCOG

Table 9: Private and Government Cars

Private and Government Cars in Beijing, 2006

Year	2001	2002	2003	2004	2005	2006(October)
Number of vehicles in Beijing	1,534,000	1,734,000	2,124,000	2,132,000	2,600,000	2,800,000

Source: BOCOG (UNEP, 2007)

*As the UNEP notes, the figure for private + government cars was above 3 and 3.3 million by the 2008 Olympic games.

Many policies that the Beijing Municipal government enacts not only have momentum to continue in Beijing, but may spread to other cities in Beijing. Xu Changming, Director of Economic Research at the State Information Center, thinks that vehicle license plate restriction is one of these policies. As Xu pointed out, “If Beijing takes the measure first, other Chinese cities will soon follow up.”

c) New Roads

Figure 10: New Road and Bridge Construction for the Olympics

The case for roads and bridges is not as clear. The Beijing government did not build that many roads and bridges; further, many of the new roads and bridges it did build are located near the Olympic Park and other Olympic venues. Clearly, the main purpose of building these roads was to facilitate the Games.

In the lead up to the Olympics, the Beijing government constructed a total of 77 roads and bridges. In Figure 10, the blue and green lines represent roads. Before the Olympics, out of these 77, 31 roads and bridges were under construction and 10 still in the design phase.

Constructing roads could be a positive or negative example for this case, because as UNEP explains, evidence suggests that traffic volumes may simply grow to fit the available space, and thus the problem of pollution-causing congestion may not be solved. It seems that because one of Beijing's other goals is to increase the amount of passengers that ride the subway, this problem effect may not be as acute.(UNEP, 2007) I think that in the context of definitive measures taken to promote subway and bus usage (significantly expanding the subway and decreasing fares, increasing buses and bus stops, etc), and limiting the days that cars can drive, the building of roads and bridges can be seen as a measure that may reduce congestion, and not as an incentive for more cars to drive.

d) Car ban

In anticipation for the Olympic Games, starting in July 2008, the Beijing government removed one-half of the city's daily cars from the roads using a system in which vehicles whose license plates ended in odd and even numbers drove on different days. This reduced traffic by one half.

Although the policy was effective overall in removing most of the targeted cars from the road, some of Beijing's residents, such as ad executive Roy Guo, circumvented this policy by simply buying a second car. Guo brings up the point, though, that this is only an option for the richest of the rich. The policy, in Guo's eyes, has been effective in encouraging car-drivers to

carpool: "Lots of people are planning to share their vehicles…they'll drive one person's car on the odd day and the other's on the even day." (Roberts & Tschang, 2008) The CTR Market Research telephone poll of 2,000 Beijingers found that most people planned to use buses and only 16.7 per cent said they would use private cars during the Games. (Reuters, 2008) During the Olympics, congestion fell 21%, and air pollution dropped 63%. (Masters, 2008) After the Olympics, the government implemented a six-month traffic trial in Beijing, partially reenacting the Olympics car ban. It eliminated thirty-percent of government vehicle driving, and one-fifth of private vehicle driving through license plate restrictions similar to those that occurred during the Olympics for a six month "testing period" after the Olympics. Restricted drivers were exempt from one month of vehicle tax and a year of road maintenance fees. (Pasternack, 2008)

The trial (second ban) was successfully passed for two major reasons. First, car owners and other citizens supported it. Second, it was feasible because it had already been done for the Olympics. The trial was more popular than expected. According to a Greenpeace China poll, 54 percent of car owners want car restrictions to be retained to keep Beijing's air clean. Xinhua's online poll in 2008 found that 56% of 10,000 Beijing residents were in favor of keeping the restrictions. (Spencer, 2008) And a July 2008 poll showed that 96% of people thought that alternating driving days were effective in fighting air pollution and that over 60% of residents thought that the policy "should remain in place after the Olympics". (CRI News, 2008)

The second "test" car ban was feasible because it had already been enacted by the Olympics, setting at least a precedent for the government intervening in the issue of traffic congestion. Clearly, it had staying power because it was effective for the environment and

supported by many Beijing residents. The Environment and Ecology Department of Peking University's Professor Li Dihua's work concerning the traffic restrictions echoes my argument. Li explains, "I think the public should see this policy from the standpoint of a long-term government strategy to improve city planning and the quality of public life." She sees this as a policy that will permanently change China's concept of urbanity. (Qiu, 2008) Clearly, Li's argument implies that this policy will not be retracted and that it will have a long-lasting influence on political dynamics in Beijing. (CRI, 2008) While what will happen after this "test" is unclear, given public pressures, the chances for further car bans are good.

e) Yellow-tagged vehicle ban and Government vehicle Ban

In order to effectively monitor new emissions standards, Beijing implemented the Environmental Vehicle Labeling System in 2001. Official inspection centers issue these environmental labels according to vehicles' compliance with National Phase standards 1-4. On road inspections were carried out regularly at main entrances and throughout the city in 2006, summing to a total of 218 test lines. (UNEP, 2007) Yellow-tagged vehicles are vehicles that fall short of Euro I emission standards, the lowest of the European emission standards. The Beijing Environmental Protection Bureau (EPB) banned these from roads in Beijing during the period of July 1 to September 20, only allowing them to enter the municipality between 7 PM and 8 AM. They were also banned from certain traffic routes in the capital. Trucks carrying crucial items, such as produce or meat, had to apply for certificates from the Beijing government. According to Du, head of the EPB, "Limiting high-emission vehicles is the top priority in dealing with pollution." (China Daily, 2008)

The yellow-tag ban's effect on business was apparent from the start. Yellow-tagged vehicles often serve the purpose of delivering goods to stores. Some retailers, like furniture company Ikea, stocked up on supplies early. (Roberts & Tschang, 2008) Spokesperson Trevor Hale explains, "We've tried to make sure our logistics providers all have those `green' trucks, but we're trying to be flexible…We have a little bit more inventory than we did in the second quarter just in case." Pharmaceuticals were also hit. As GlaxoSmithKline China's Xu Xiaofang explains, "The supply of some raw materials was indeed affected by restrictions during the Olympics… since we were informed about the restriction in advance, we have stored appropriate supplies." (Associated Press, 2008)

It is interesting to view this yellow-tag policy in the context of Beijing's economic development. Clearly, the Olympics served as the primary reason to eliminate trucks which supply vital goods to the city for a few months. Although these trucks have now been allowed back into the city, new trucks will have to conform to the emissions standards listed above. Thus, this is not simply a case of banning trucks for the Olympics and then disregarding their role in polluting afterwards.

Wen Bo, China director for the NGO Pacific Environment said in Jul 2008na, "The measures are only a short-term fix … I think the current Beijing government couldn't have the time and energy to think of long-term solutions for fixing air pollution." (Ramzy, 2008) My analysis suggests otherwise. The Olympics not only set new standards and set rules for limiting the amount of cars in the future. More importantly, it proved to Beijing the enormous impact of the

policies it enacted. It showed Beijing, Beijing's residents, and the world, the power of stringent regulation and a car ban in fighting air pollution.

5. Case Study 3: The Montreal Protocol

The Montreal Protocol, opened for signature in Sept 1987, is an international treaty regarding substances that deplete the Ozone Layer, also called ODSs. CFCs and other ODSs deplete the Ozone layer and may leave humans unprotected from ultraviolet radiation, which can cause skin cancer, eye cataracts, and suppression of the immune system.

China was initially reluctant to sign the Montreal Protocol due to economic concerns and has not yet ratified certain amendments to the protocol, because it has not confirmed that viable methyl bromide (an ozone depleting gas) alternatives exist. China signed onto the Protocol in 1991, which stipulated that it begin to reduce the use of CFCs starting in 1999 (Reuters, 2007). To address the problem of ODS, in June 1991, China created a high level inter-agency task force to work on ozone layer protection. This task force set and enforced guidelines for China and for Beijing. China's environmental protection agency moved to ban the production of all CFCs in 2007.

International Cooperation on this issue

China's ozone work was helped by funding by the UNEP (United Nations Environment Programme) through a multilateral funding program. But more was at stake here than funding. A study on the multilateral fund that was created to financially support the Chinese in their compliance with the protocol revealed two main reasons for signing and complying with the protocol: a) China's desire to appear to the outside world to be responsible and cooperative in

solving global environmental problems, and b) the interest of implementing agencies within China to expand their breadth of responsibility and authority. (Zhao, 2003)

Beijing also hosted the 1999 Eleventh Meeting of the Parties to the Montreal Protocol, which cost China about $2.2 million. In a welcoming speech, Xie Zhenhua, the Minister of SEPA (State Environmental Protection Agency) explained that one of China's incentives was "to demonstrate to the international community what China has achieved in addressing environmental problems, both domestic and international, particularly since the time when the policy of reform and opening to the outside world was adopted." (Zhao, 2003)

China's efforts to be a responsible and co-operative international actor were recognized by Richard Benedick, a principal architect and the chief American negotiator of the Protocol. He argued: "China has also been from the beginning one of the most co-operative and conscientious parties to the Montreal Protocol, notwithstanding the needs of its large and rapidly expanding economy." (Zhao, 2003)

China's Montreal Protocol plans and implementation

China's efforts towards compliance with the treaty were reinforced by the Olympics bid; it wished to appear as a cooperative and reliable international actor. International concerns about China's environment, especially in light of the Olympics, were taken into consideration. (Zhao, 2005) This example shows that a green event like the Olympics located in a powerful city may even be powerful enough to influence a nation's international environmental policy.

a) Country-wide plan

China's country wide plan to address ODS was based on UNEP's time frame for developing countries, shown below:

Table 11: UNEP's ODS Phase-out for Developing Countries including China

ODS	Time	Targets
CFCs, Halons, and Carbon	1 July 1999	At average 1995-97 levels
Tetrachloride	2005	50% reduced
	2007	85% reduced
	2010	Phase-out
Methyl Chloroform	2003	At average1998-2000 levels
	2005	30% reduced
	2010	70% reduced
	2015	Phase-out
methyl bromide	2002	At average 1995-98 levels
	2005	20% reduced
	2015	Phase-out
HCFCs	2016	At 2015 levels
	2040	Phase-out

Source: UNEP Beijing Report

As can be observed on the table of Montreal Protocol phase-outs, China committed to ending the production of chlorofluorocarbons (CFCs) by the end of 2010 and hydro-chlorofluorocarbons (HCFCs) by the end of 2040 under the Montreal Protocol. In 1999, shortly

before the Olympic bid in 2001, the Chinese government's Country Ozone Program was established, with even more stringent phase-out targets.

Table 12: China Ozone Program set up by SEPA, approved in 1999

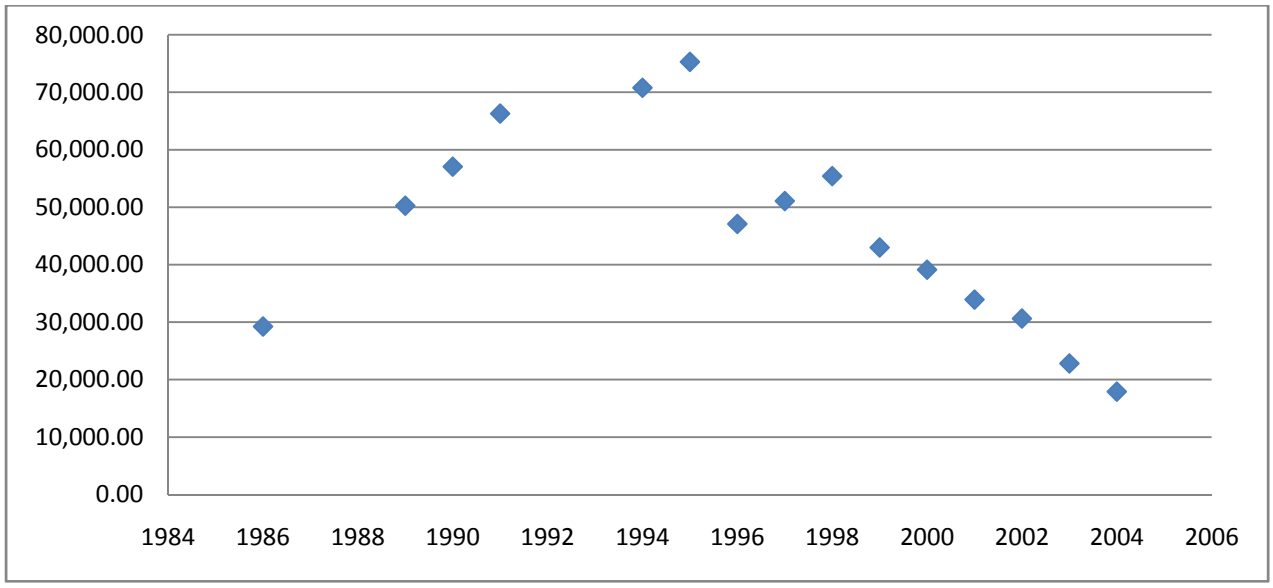
Industries	Time	Phase-out Targets
Halons	2005	Halons 1211 phase-out
	2010	Halons 1301 phase-out
Auto Air-condition	1 Jan.2002	Newly produced automobiles useHFC-134a as refrigerant agent
Foaming Agent	2010	Phase-out
Chemical Industry	2010	Phase-out
	Jan.2006	CFC-113 phased-out
Cleaning Industry	Jan.2004	Carbon Tetrachloride phase-out
	Jan. 2010	TCA phase-out
Tobacco Industry	31 Dec.2006	Phase-out
Refrigerant	2010	CFC-12 and CFC-11 phase-out
	2040	HCFC-22 phase-out

China phased out most ozone depleting chemicals by the 2008 Olympics, two years ahead of the Montreal Protocol's deadline; CFCs and halons were to be banned in developing countries by 2010. (UNEP, 2007) The last of the plants for CFCs and halons, the remaining chemicals for the 2010 deadline, were shut down in 2007. On July 1, China shut down five of the six remaining plants that were not in accordance with the Montreal Protocol (these plants were producing CFCs and halons). (UNEP, 2007) The last six factories that produce CFC agreed

to stop production in 2007 by signing a deal with SEPA (State Environmental Protection Agency). The deal stipulated that the total of 122,000 tons of CFC production capacity be phased out in 2007. Although developing countries are allowed until 2015 to phase out these chemicals, China's plan was to phase them out by 2010. (Xinhua News Agency, 2007) The SEPA stated: "Relevant companies must demolish equipment involved in the production of CFC substances by August 15," explaining that noncompliance would result in punitive measures. (Reuters, 2007) The sixth plant was shut down in 2008, two years before UNEP's deadline for developing countries (see chart below). The shutdown that occurred in 2007 brought China's production of CFCs to just 550 metric tons, down from 55000 metric tons in 1998. The remaining production of CFCs is only allowed in China for producing CFCs in metered-dose inhalers, used in the treatment of diseases such as asthma and COPD. When developed countries shut down plants producing many ozone depleting substances in 1996, China became the largest producer of ODS in the world. Now, India and Korea have surpassed China, with a combined production level of about 15,000 metric tons. (UNEP, 2007)

The government also encouraged many manufacturing industries to stop consuming ODS, especially where alternatives existed. Consumption of ODS in China before can be seen in the chart below.

Figure 12: ODS Consumption, Tons, China



Source: Gerald, 2005

According to Liu Yi, director of the international co-operation centre with the State Environmental Protection Administration, the China-wide end to production of all ODS (and, of course, commitment not to use ODS in the construction of any of the Olympic venues) was a "response to an appeal from the United Nations Environment Programme after Beijing won the bid to host the Games." (China Daily, 2004) As Zhang Lijun, Vice Minister of the State Environmental Protection Agency (SEPA) explained, "The closure of these plants demonstrates China's continued commitment to meet its obligations under this treaty to phase out these chemicals. With the closing of these facilities, industry and consumers both here and in Asia Pacific must realize that there will soon be significant reductions in ozone depleting chemicals and that we should be prepared for the changes that are to come." (UNEP, 2007)

b) Beijing Plan

In Beijing, because of the Olympics, compliance with the Montreal Protocol was expedited. The Olympic Games were also ozone-friendly. As the Olympics website explains, "In the bidding stage for 2008 Olympics Games, the Beijing municipality has committed to accelerate ODS phase-out program to achieve the new State regulation six years ahead of the original timetable." (BOCOG, 2008) The goal was achieved in 2004. Clearly, the Olympics influenced this quickening of environmental compliance for the city of Beijing.

Beijing's plan was comprehensive. Even though Beijing does not produce ODS, consumption was a problem that needed to be addressed. Consumption of ODS in Beijing was 790 tons/year by the end of 2001. UNEP compiled the following list of sectors that consumed ODS in Beijing:

- "Fire-fighting industry, 13 tons/year (fire extinguisher agents).
- Tobacco industry, 33 tons/year (used in the Beijing Cigarette Factory).
- Refrigeration for industry, commerce and household use, 0.68 tons/year(refrigerant agents).
- Cleaning industry, 49.73 tons/year (mainly in the fields of mechanical engineering, electronic industry, precision instruments and dry cleaning; 27.02 tons of CFC-113and 22.71 tons of Methyl Chloroform).
- Insulation/foam industry, 663.2 tons/year(50 tons of CFC-12 and 613.2 tons of CFC-11).
- Car air conditioning. (UNEP, 2007)

Beijing's plan to phase out use of ODS is described in the Chart below.

Table 13: Beijing ODS Program

Sector Target		Phase-out Date		Time in advance
		China	Beijing	
33 tons in Tobacco Sector		31 Dec.2006	31 Dec.2002	4 years
13 tons in Fire-fighting	Halon1211	1 Jan.2005	1 Jan.2002	3 years
	Halon1301	1 Jan.2010	1 Jan.2003	7 years
663.2 tons in Form Sector		1 Jan.2010	31 Dec.2004	6 years
49.73 tons in Cleaning Sector	CFC-113	1 Jan.2006	31 Dec.2004	2 years
	CTC	1 Jan.2004	Phased out	3 years
	TCA	1 Jan.2010	31 Dec.2004	5 years
0.68 tons in Refrigeration for Industry and Commerce		31 Dec.2005	31 Dec.2004	1 years
Auto Air-condition		1 Jan.2002	1 Jan.2002	synchron
Aerosol Sector		31 Dec.1998	31 Dec.1998	synchron

Source: BOCOG

By 2004, all ODS use, except for HCFC (Hydrochlorofluorocarbon) and HFC (Hydrofluorocarbon), both used in the auto air-condition sector, was phased out in Beijing. For many of these chemicals, this was six years ahead of China's Country Program. As far as HCFC and HFC go, HCFC is set to be phased out by the Montreal Protocol by 2040 by developing nations; HFC, although harmful to the ozone layer, was not addressed by the Montreal Protocol. (UNEP, 2007)

Beijing's games also succeeded in being Ozone-friendly. With UNEP's help, the games avoided the use of HCFCs (to be phased out by 2040) and banned the use of other ODS. Refrigerants, air conditioners, fire extinguishing facilities, cleaning, laundry, electronic circuit boards all complied with guidelines. Catering was also ODS free and even sourced from greenhouse sheds that were ODS free. (UNEP, 2007) According to the UNEP OzonAction office, BOCOG's (the Beijing Organizing Committee for the Olympic Games) ozone friendly games were an "achievement and very good news on the eve of the 20th Anniversary of the Montreal Protocol. BOCOG has also won a 20th anniversary public awareness award from the Secretariat of the Vienna Convention for the Protection of the Ozone Layer." (UNEP, 2007)

China's Olympic bid clearly influenced not only the signing of the Montreal Protocol and hosting of the eleventh Montreal Conference, but also the speed with which China complied with the Protocol. This case demonstrates that international events can increase compliance with environmental treaties. As we will see in chapter six, this also shows that an environmental prestige factor is at work here.

6. Towards the Future

Jonathan Lash, the president of the World Resources Institute, once praised the Olympics and the concept of the Green Olympics, but explained that China's clean-up efforts were "extreme but temporary." (Moseman, 2008) Yet many of the measures that the Chinese government took to clean up the Olympics were far from temporary. Three key reasons are at work here: a) Transaction costs prevent a shift back to old facilities and technology, b) Chinese institutions have been permanently altered, and c) International prestige is still a concern for the Chinese government.

Transaction costs prevent a return to the status quo.

As we saw in the first two case studies, many environmental policy changes require new technology, infrastructure, facilities, etc. Enormous transaction costs were associated with these policies, and a transaction cost of un-doing these changes could be correspondingly large. In the auto ban case, for example, Beijing phased out old vehicles and yellow-tag trucks, installed new gas station technology, built new roads, and developed a fleet of emissions-monitoring vehicles. All of these were expensive measures that are unlikely to be reversed, if for no other reason than that it would be too costly.

In the case of the factory move, Beijing's environmental protection measures mostly took the form of technology upgrades, plant relocations (which in many cases were plant upgrades simply because new technology is less costly to implement when building a new plant than when patching up an old one), plant shut downs, and production plans for other goods (high tech, services). Many old plant facilities were converted to recreational centers like

shopping malls. The cost of refusing to continue using technological upgrades, purchase of new technology to produce other goods, and new plants would also make any plan to return to the status quo not only costly, but also extremely unreasonable.

In addition to the case studies, many examples of infrastructure and technology changes in Beijing also illustrate the core idea that transaction costs impede Beijing from returning to the status quo. For example, Beijing implemented new natural-gas run buses and expanded subway lines. It also upgraded pollution-monitoring technology, which would be a wasted investment if it decided to stop monitoring emissions.

Of course, some "leveling off" of standards and technology are expected, and predicted by the Modified EKC, found on p. 21. Even if future infrastructure and technology is less environmentally friendly, or standards fail to rise, Beijing will be better off than before the Olympics.[12]

Path Dependence: deep implications for Chinese regulatory institutions.

Chinese environmental institutions and their role in the government were also changed by the Olympics. According to the theory of Path Dependence, institutions can undergo key transformations, due to historical events, that cause a "lock-in" to a certain path of action. Sometimes the path of action is a set of opportunities, which has been limited by the event.

[12] Although we have no way of knowing about the future of newly installed technology in Beijing, we can infer from Beijing's development path and move into service sectors that the construction of new heavy industry plants within the municipality is highly unlikely.

Path dependence is often used to explain how policy can become so institutionally embedded that it causes an institution to have little choice but to continue it, even if it is inefficient.

Path dependence analysis emphasizes a series of "turning points" and "critical junctures" in history that become embedded in national or institutional policy. The focus of path dependence analysis is to identify events that redirect policy, either by limiting choices that are politically feasible or by expanding an institution or government's options. My analysis suggests that the Olympics may have served as a "critical juncture" in the development of the SEPA (China's environmental watchdog).

According to path dependence analysis, new policies are new "rules of the game." When the rules are changed, the system is changed. Environmental policies like the ones discussed above (the auto ban[13], the new rules for factory emissions, and rules for the Montreal Protocol) will change the way that Chinese institutions operate.

More important to this case are the changes within the institutions themselves. A defining historical juncture is reached when an institution is upgraded or downgraded, or its role in the political system changes. The SEPA (State Environmental Protection Agency) and other environmental institutions, such as the EPB (Environmental Protection Bureau), underwent drastic change in the years leading up to the Olympics. These institutions served Beijing's Olympics by consulting and monitoring, policymaking, and directing the Chinese government's large investment in environmental protection. The institutions were arguably strengthened by these new tasks.

[13] In the case of the auto ban, public pressure reinforces a new "rule of the game"

A more concrete example of the party leadership viewing environmental institutions with growing importance occurred in 2008, just after the Olympics. The Chinese government announced a restructuring of government ministries called the "big-ministries system" (大部委体制). The goal of this new system is to merge smaller organizations in order to increase their efficiency and facilitate execution of policy. The system ensures that policy mandates will be carried out by local-level administrations through a shorter chain of command.

Beijing decided, in addition to making "big ministries," to also make three super-ministries that would have far-reaching power in the government. One of these super ministries was the Ministry of the Environment and Construction (MOEC). The MOEC encompasses the Ministries of Construction, Water Resources, and Land and Natural Resources. When the MOEC was formed, it was conceived as a consolidated authority over pollution. The Chinese government specifically mentioned that its mandate would include addressing the issues of global warming and urbanization.

It is important to note the previous role of the SEPA within the party leadership. Before restructuring, SEPA was one of 29 bureaus, and seen by many authors as below other departments. It did not have regional offices, and did not have the teeth to impose environmental protection on any region in China. Figures 15 and 16 explain the State Council reorganization. Figure 15 is the State Council before Super-Ministry Reforms. The light-blue boxes represent the ministries in this system. The pink box represents SEPA. As we can see, it is not one of the 29 bureaus, and was at the department-level. In Figure 16, "bureaus" have been either relegated or subsumed into a super-ministry. The SEPA was upgraded to become the

MOEC. In this restructuring of the ministries and departments of the State Council, the SEPA became one of five “super-ministries” (indicated in gold) under the state council. "Super ministry" is shorthand for "comprehensive responsibilities super administrative ministry framework". (Qiu, 2008, pp. 1-21) The general purpose of the super ministry reform was to merge departments which share similar functions in order to create greater departments with integrated function. SEPA’s case was different. In the super ministry reform, the SEPA was the only department that was upgraded and would retain its organizational structure and governmental responsibilities. SEPA’s new power is at the cabinet-level. It will enjoy more staff and greater financial support. (Qiu, 2008)

Figure 14: State Council Organization before Super-Ministry Reforms

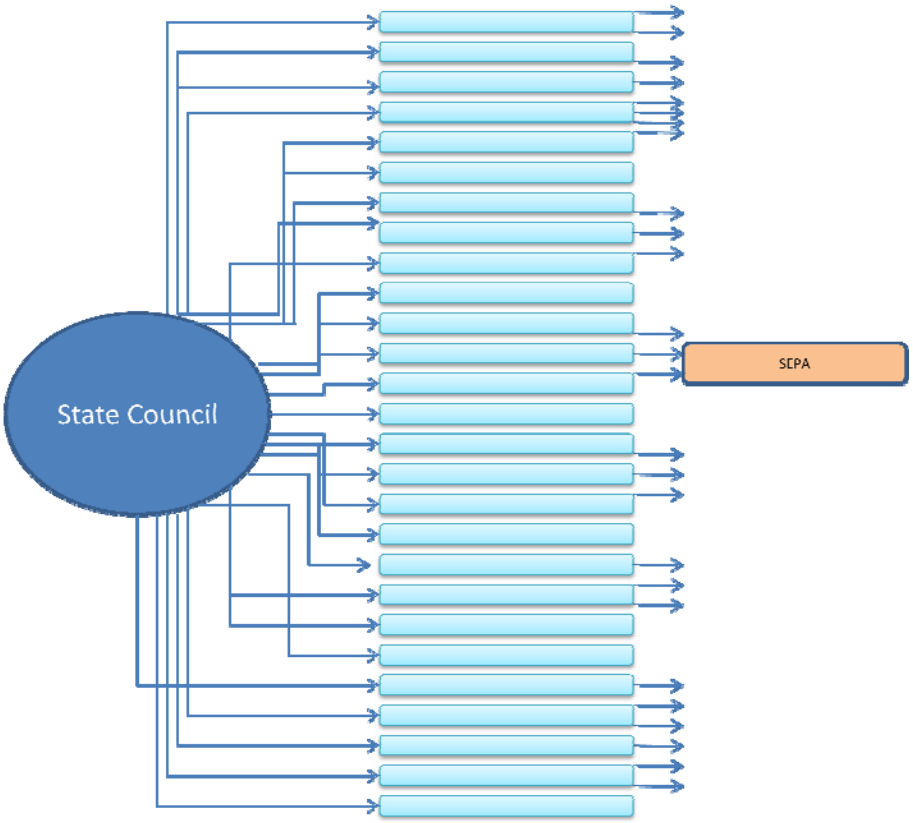
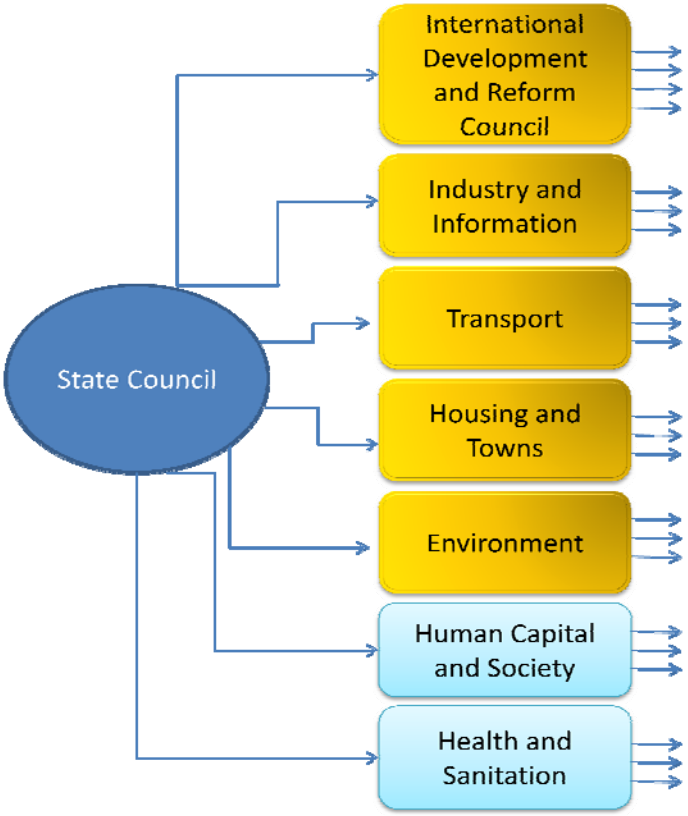


Figure 15: State Council Organization after Super-Ministry Reform



SEPA's upgrade clearly shows the CCP's political will and commitment to solving environmental issues. As James Zimmerman, chairman of the American Chamber of Commerce in China, explained, "SEPA's elevation to ministry level reflects the government's commitment to sustainable development and environmental protection. Its progression from a lower-level bureau under the Ministry of Construction to a ministry within just 10 years is a reflection of the change in thinking and heightened awareness of the need to better manage growth." (China Daily, 2008) His comment was echoed by Wu Xiaoqing, SEPA's deputy chief: "The fact that SEPA was the only administration in the State Council that got promoted this time highlights enormous government support for the environmental protection mission." Wu predicts that SEPA will now have more bite when it comes to policy enforcement. (Clear the Air, 2008)

The MOEC will have regional jurisdiction over land use and waterways, and will thus be a more potent environmental watchdog. It appears that this arrangement will not only increase MOEC's range of jurisdiction, but also make the institution more efficient. As Chang Xiuze, senior researcher at the National Development and Reform Commission's Institute of Macroeconomics said, "Restructuring and streamlining will minimize negative phenomena such as overlapping functions, multiple directives from different units, poor coordination and bureaucratic infighting. Putting various government functions and powers under one department will boost Beijing's ability to provide services to the community and to enforce macro-level control and adjustments [if things go wrong]." (Lam, 2008, pp. 141-166)

MOEC's new power may be constrained by several factors. Mechanisms for cooperation between bureaus are questionable. (Qiu, 2008) It's doubtful whether or not MOEC will have control over China's three powerful oil monopolies. Also, corrupt local officials may still be an insuperable battle for the institution. As Vice Director of SEPA Pan Yue explained, there exist "strong vested interests" often collaborating with local cadres. (Lam, 2008, pp. 141-166) The CCP hopes that the "personnel card" system of compliance—giving ministries like MOEC the power to punish lower-level cadres—will combine with a more powerful agency to ensure results. One example of these principles in action was when, in 2007, the State Council issued a directive which stated that local-level officials who had not achieved environmental goals (such as reducing emissions of certain pollutants by a rate of 2% per year) may not be eligible for promotion in 2008. (Lam, 2008, pp. 141-166)

Even though constraints still exist on MOEC's new power, institutional reform precipitated by the Olympics appears to represent a defining juncture or "critical turning point" in MOEC's institutional timeline. An upgrade to a more financially backed, more authoritative, and larger institution at the cabinet-level is no small change. China's future environmental protection will be invariably altered by this institution's new role.

China's quest for international prestige

Another reason why China is unlikely to undo environmental reforms is international prestige. As Alan M. Wachman from the Fletcher School of International Law and Diplomacy put it, "The Olympic sport in which competition is fiercest, but for which no medals are ever awarded, takes place in the arena of politics… When the games begin, patriotism and the quest for international prestige suffuse the proceedings." (Wachman, 2008) China clearly hoped to, and still hopes to strengthen this image. The Olympics was seen as a way for the CCP to showcase not only China's economic development, modernization, and even social changes; but also China's efficiency in mobilizing resources to execute grand projects. China hoped to parallel its economic growth with environmental prestige. As Xiaofan Li stated, "In order to enhance its prestige in the international community, it is crucial that China pursue an active and positive role in promoting environmental protection. By launching a long-term program to formulate and implement increasingly rigorous environmental policies, China could serve as a model for agriculture-based developing countries with growing populations trying to balance economic growth and environmental concerns." China's wish to become a leader among developing nations in the field of environmental cooperation may motivate it to continue with environmental reforms sparked by the Olympics. (Li, 2006, pp. 76)

The Montreal Protocol case study provides an example of how China is motivated by prestige. In the example, China chose to phase out ODS before the Protocol mandated. Although Beijing's phase-out dates were even earlier than the national phase out dates, China's country plan was earlier than what the Protocol required. This could be because China would like the international environmental prestige that comes with an ambitious country program for the Montreal Protocol.

Another example of China's fervor to be seen as environmentally prestigious is its electric car program. China's BYD Corporation raced to become the world's first producer of a hybrid plug-in car in December 2008, and was met by much acclaim from the Chinese government and the international community. (Balfour, 2008) In the midst of this acclaim, Chinese authorities noticed the opportunity to up their "environmental prestige." By April 2009, they were hatching out a plan to become a world-scale hybrid and all-electric car producer. The Chinese government's plan includes subsidies of $8800 for taxis or government agencies that buy hybrid or all-electric cars in 13 Chinese cities; a plan for the State Electricity Grid to set up electric car charging stations in Beijing, Shanghai, and Tianjin; tax credits for consumers who buy hybrid or all-electric cars; and government research subsidies for electric car designs. China's plan is to raise its annual production capacity from 2,100 hybrid or all-electric cars last year to 500,000 by the end of 2011. (Bradsher, 2009) China's plans and BYD's new car attracted the attention of both Nissan and world-renowned investor Warren Buffet. Buffet said of the car, "I don't know a thing about cell phones or batteries," he admits. "And I don't know how cars work." But, he adds, "Charlie Munger and Dave Sokol are smart guys, and they do understand it.

And there's no question that what's been accomplished since 1995 at BYD is extraordinary.“ (Gunther, 2009)

China’s tarnished international image

International prestige also works as a negative mechanism promoting environmental regulation. Fixing its negative international image could serve as a motivation for future environmental regulation. China’s tarnished international image, resulting from decades of political and social isolation, set the stage for the Olympics as a defining moment and catalyst for change. Author of the *Beijing Consensus* Joshua Cooper Ramo explores China’s image problem in his work *Brand China*. He points to one of the main roots to China’s branding problem- the “China Threat Theory” (中国威胁理论). According to the theory, China’s rise at the start of the 21st century, like Germany’s at the start of the 20th century was angry, emotionally charged, and ridden with a subtle mixture of arrogance and humiliation. (Ramo, 2007, pp. 9) As Paul Wolfowitz put it, China wished to take back “its place in the sun” (Wolfowitz, 1997, pp.7). Admittedly, China’s shaky recent history has been one of periods of cutting edge ambition and innovation as well as power struggles and corruption. Scholar Zheng Bijian coined the phrase “peaceful rise” or “和平崛起”in an attempt to rescue China’s image, but realist John Mearshimer wondered, “Will China rise peacefully?” (Ramo, 2007, pp. 12-25)

The phrase was more controversial than Zheng had intended, and caused foreign politicians and intellectuals to worry even more. After all, a number of questions could be posed:

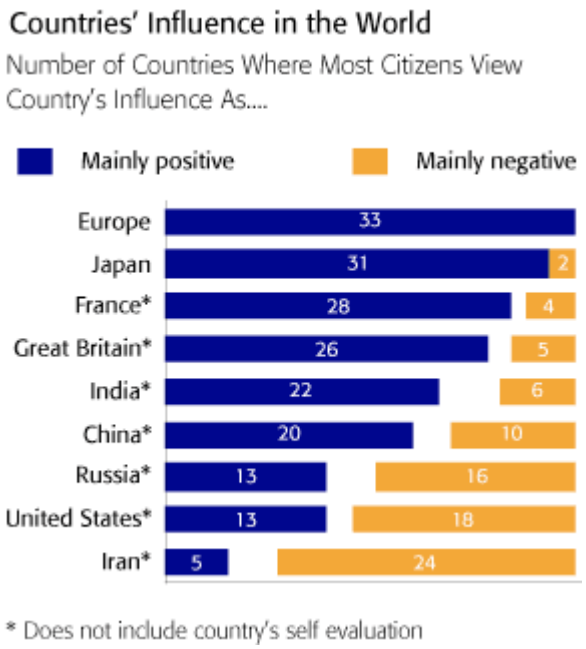
- “How can they claim a peaceful rise while threatening to attack Taiwan?” (Ramo, 2007, pp. 11)
- “Since no nation threatens China, one must wonder: Why this growing investment? Why these continuing large and expanding arms purchases? (Rumsfeld, 2005)
- As Zheng's essay makes clear,” one neo-conservative wrote of the theory, “China's main goal continues to be amassing national power.” (Tonelson, 2005)

The image below shows how China’s image of itself is changing.

As Ramo points out, strange as it may seem, the adjective “peaceful” caused critics to worry that China was becoming more and more untrustworthy. Soon thereafter, the Chinese government decided to rename the concept: “Peaceful Development,” and then later to Deng Xiaoping’s “peace and development” (和平与发展”), and more recently Hu Jintao’s “Harmonious World”(和谐世界) but as Ramo points out, trust had already been eroded. Ramo explains that tactical challenges ranging from the quality of foreign direct investment, to the provision of technological and educational aid, to the success of Chinese businesses in international market are all unarguably rooted in China’s national image. Ramo’s report sheds light on several common misperceptions and stereotypes of China: old-style communist, politically radical, low tech and copied products, not creative in the least, greedy mercantilist companies, naive investors, “sweat-shop cheap” labor, dishonest, but at the same time economically vibrant, and a business “goldmine.” Chinese officials and Chinese views of China can perpetuate these stagnant views. As Ramo points out, although three Chinese films are among the highest grossing foreign films in US history, Chinese tourism often promotes images

of opera, martial arts and tea rather than those of China's new cultural leaders. (Ramo, 2007, pp.12 - 16)

Figure 16: Countries' Influence in the World



Source: Ramo, 2007, pp. 20

Ramo points out that China's image of itself is changing as seen in the chart above, polled from several Chinese cities (shown at left for each survey) shows how closely Chinese citizens associated certain adjectives with China. Notable changes include the ranking of the words "arrogant," "unapproachable," "different" and "tough," which fell dramatically in rank. Adjectives like "gaining in popularity," "prestigious," and "a leader" climbed in ranking. (Ramo, 2007, p. 21)

Another important study, carried out by BBC's *Globescan*, polls citizens of various countries to measure perspectives on the overall influence of other governments in the world. About 20% of those polled saw China's influence as mainly positive, and about ten percent saw China's influence as mainly negative. Although not shown on this chart, citizens of the US and several countries in Europe ranked China's influence as far more negative than the world average. Although China ranks below nations like Japan, Great Britain, and India, it is notable that its influence is globally perceived as better than that of the United States. (The United States' image seems to have been eroded by its recent foreign policy faux pas). (Globescan, 2006)

Ramo advances the concept of reputational capital (名声资本) which he describes as an investment by a government in international conflict aversion. As he points out, a poor or misaligned national image risks confusion, alters the political environment in other countries, and may therefore worsen the severity of what would have been minor confrontations. (Ramo, 2007, p. 27) Among the ways in which a shortage of reputational capital boosts the risks of reform and chances of instability are:

1. Increases costs of economic reform[14]
2. Increases chances of currency and banking crises
3. An inaccurate national image slows process of rural reform
4. Increases international tensions
5. Harms Chinese enterprises (Ramo, 2007, pp. 30)

[14] Image drives foreign investment decisions, determining how much and what type of FDI is available. Thus, a shortage of reputational capital could increase costs of China's economic reform. (Ramo, 2007, pp. 30)

Ramo argues that innovation in China is much more widespread than foreigners perceive it to be. He cites companies like Linktone[15]: they are not "Chinese versions" of anything.

Ramo explains that the demands and opportunities of the vibrant new Chinese playing field-social, economic, and political, is what induced these innovations. (Ramo, 2007, pp. 39)

Ramo is pessimistic towards the implications of this foreign-Chinese divide in views of China. He states that "Frankly, no amount of "image surgery" can help China out of the numerous problems associated with internal and external behavior that is out of step with global norms. (Ramo, 2007, pp. 17) His opinion is that the hope of the 2008 Beijing Olympics reviving China's image is to an extent unfounded: "The only single events that remake national images tend to be bad ones." (Ramo, 2007, pp. 18) My analysis suggests that China's image will be improved, due in no small part to its environmental regulation.

[15] Linktone is a successful Chinese company that provides high-tech media, entertainment, and communications services

Figure 17: How China Sees Itself

5 Cities

Beijing

Shanghai

Guangzhou

Chengdu

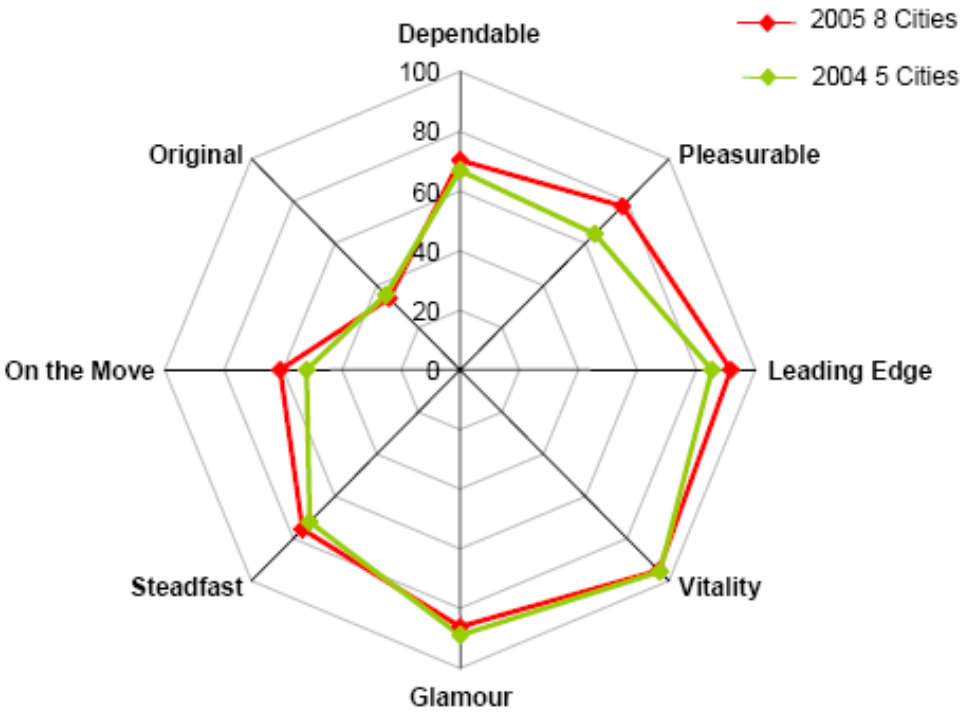
Wuhan

Shenyang

Nanjing

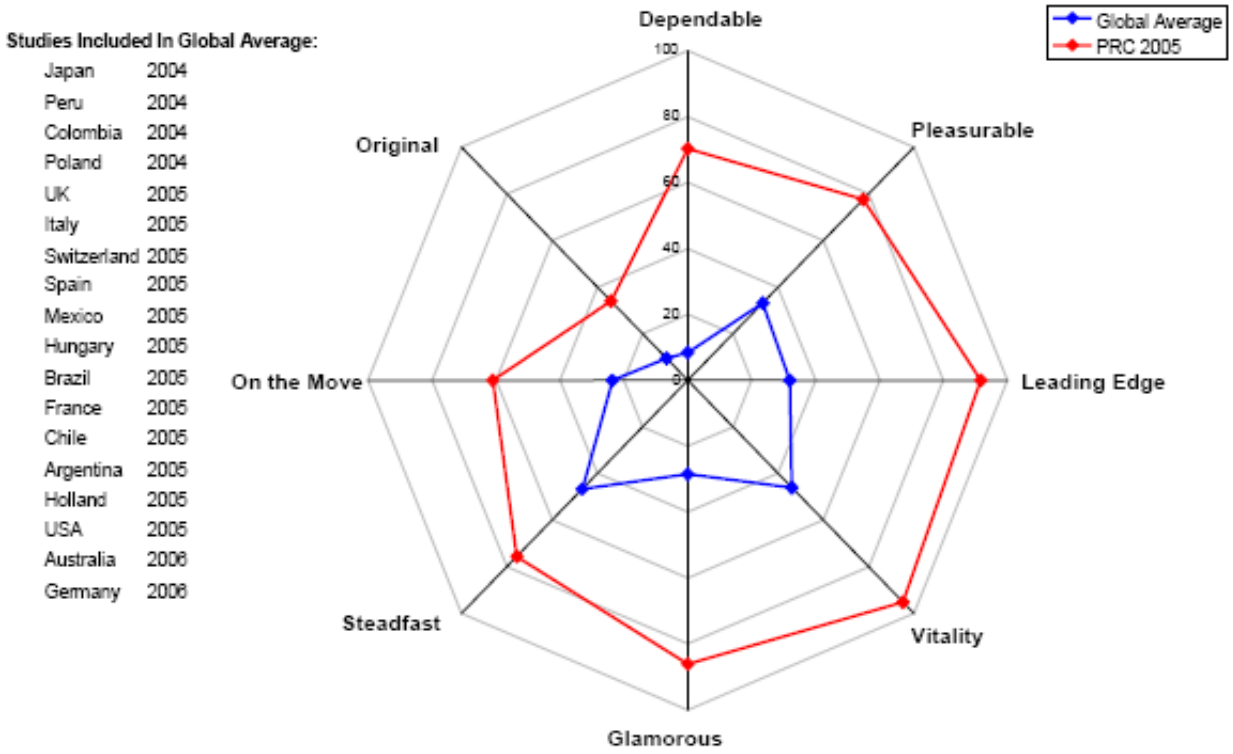
Fuzhou

8 Cities



Global BAV All Adults: China 2004, 2005

Figure 18: How China Sees Itself Is Diverging From the World's View On Average

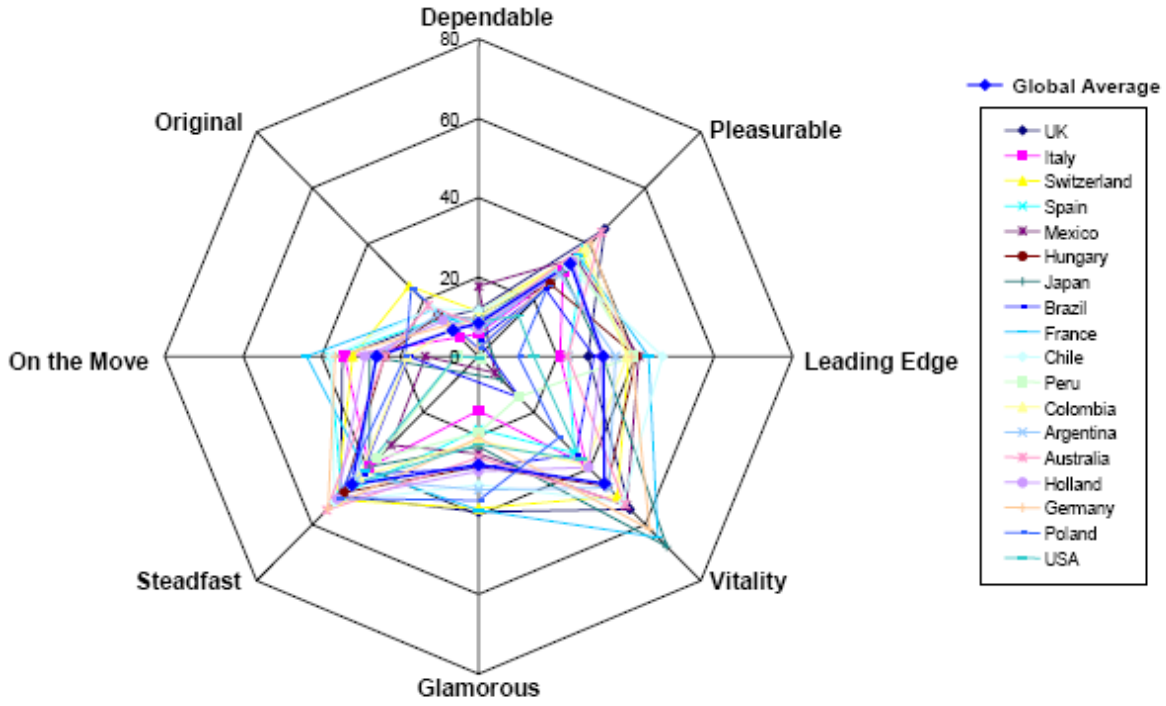


Global BAV All Adults 2004, 2005, 2006

Ramo also introduces a new concept- that of China as "淡" (dan) a character that means light-colored or unity of opposites. Ramo advocates a new national image based upon a dynamic state that is virtually a blank canvas for Chinese, tourists, and others on which to paint their dreams. The Chinese government should play up China's positive qualities, such as an open-minded young generation and an overall feeling of constant newness. (Ramo, 2007, pp. 43) Hu Xin of the PLA (People's Liberation Army) International Affairs Academy, Wang Yiwei of Fudan University, and Shi Yinhong of the People's University of China have all discussed the prospect of "soft power" and China's image and future prospects. Ramo encourages the Chinese government to be consistent in order to dispel foreign misunderstanding and paranoia.

He asks the Chinese government to be cognizant of image implications when analyzing each and every policy. (Ramo, 2007, pp. 19)

Figure 19： How Others See China



Global BAV All Adults: Australia 2006, Italy 2005, Spain 2005, Germany 2005, Holland 2005, Chile 2005, France 2005, Switzerland 2005, Mexico 2005, Argentina 2005, UK 2005, Hungary 2005, USA 2005, Brazil 2005, Japan 2004, Peru 2004, Poland 2004, Colombia 2004

The Chinese-foreign bifurcation in China's image is severe, to say the least, indicating a fundamental problem with China's image. Figure 18 shows how pollsters responded in major cities in China for two years, with the same conclusion as Figure 20: China has become more "pleasurable," "on the move," "leading edge," etcetera. But although Chinese thought that their country was around 70% "dependable" or around 80% pleasurable, world views of China are vastly different. We can see in Figure 20 that the percentages of different adjectives that foreigners thought could be used to describe China. Figure 19 shows the World average versus

the 2005 survey, showcasing the largest disparities in adjectives like “dependable,” “leading edge,” and “glamorous.”

The Olympics as an image booster

When Beijing won the host rights to the Olympics, much more was at stake in terms of environmental protection than air pollution indicators and “blue sky days.” In the context of China’s bruised international image, the Olympics presented a timely opportunity to showcase exactly how powerful Beijing was at enacting environmental reform, and possibly even put its insecurity over national image to rest. As Wang Wei, a senior Beijing Olympic official put it, "Winning the host rights means winning the respect, trust, and favor of the international community." Xinhua News Agency echoed Wei’s pride by explaining that it was "another milestone in China's rising international status and a historical event in the great renaissance of the Chinese nation." (Economy & Segal, 2008, pp. 47-56)

What China may or may not have realized is that the Olympics would leave a legacy of foreign concern over China’s environment. Of course, once international NGOs had strengthened their power within China and the media had started to publish stories (whether accurate or not) about China’s environment, the world’s attention had been captured.

Susan Shen, World Bank international environmental coordinator explains China’s motives for promoting a green Olympics: “Becoming actively involved in environmental issues is all tied in with China wanting to be a leader in the world. As one of the biggest contributors to their own-as well as regional and global—environmental problems, they can’t afford to stay out of these kind of discussions. And with the upcoming Olympics, they really do want to have a seat

at the table in the international arena. They also see themselves as representing the interests of the world's developing countries at international environmental meetings..." As Ong points out, the need for international prestige has long been a key part of China's foreign policy thinking, as its leaders remember all too well China's "century of humiliation" in the 1800s. China's foreign policy also rests on the need for projection of national strength, since much of the ruling Chinese Communist Party's (CCP) legitimacy rests on its commitment to national strength and continued economic growth. (Ong, 2004) Chinese party officials may see the environment as a new realm in which to showcase national strength.

Post-Olympics: No turning back

Clearly, if international prestige is a strong motivator for holding the Olympics, it is a factor that will encourage China to be accountable to the outside world in terms of its environmental regulation. Beijing used the Olympics to show that it had the political will to change its environment. Now that foreign environmental NGOs have become more powerful and international media coverage of China's environmental problems has become more frequent, China knows that the world is watching. It must perform to world standards regarding environmental issues, or face embarrassment on the world stage.

Domestic and international opinion restrains Beijing from retracting the new environmental rules and regulations it set during the Olympics. Ross believes that information published by international NGOs can embarrass China into compliance. (Economy, 2006) According to Jennifer Turner of Environmental Change and Security Project, "In general, China has to see a

local benefit in its international commitments. But at the same time, they want to play with the big boys and be treated as a serious player." (Clay, 2002, pp. A525-A527)

In *China: The Next Environmental Superpower*, Rebecca Clay wonders whether or not China's environmental boom is mainly to curry international favor. Clay cites the following as reasons (1) "Environmental Diplomacy" first became a vital aspect of foreign relations when Wang Zhijia wrote an Internet article about the impact of China's environmental issues on its national security, economy, and foreign trade; (2) Since 1946, China has signed onto 50 agreements, conventions, etc. (Clay, 2002, pp. A525-A527)

Although less studied, issues of domestic prestige also constrain Beijing's government from reneging on its promises. The CCP derives much of its legitimacy from popular support. Just as the literati checked the Emperor's power and claim to legitimacy in ancient China, the public as a whole checks the CCP's power today. Widespread discontent resulting in riots could portend the eventual loss of the mandate of heaven (天命观), a concept that is still prevalent among Chinese thought (consider, for example, the CCP's frantic reaction to the Sichuan earthquake and the dialogue that occurred afterward). While China is not a Western Style democracy, in the words of Hays Gries, "'Chinese popular opinion' is not an oxymoron" (Hays Gries, 2004, p.5). Hays Gries goes on to explain that "Public Opinion arguably regulates Chinese society and politics today." (Hays Gries, 2004, p. 9) Further, as in the international realm, concern for maintaining "face" constrains politicians because they are "众目睽睽", or "in the glare of publicity." (Hays Gries, 2004, p. 9) Thus, although the main reason that the Olympics became a

catalyst for environmental change may have been international prestige, domestic prestige will be a factor that will ensure that policies do not deviate from the path set by the Olympics.

Economic Benefits of Greening

Although quantification of "how much" economic benefit greening as a whole would bring to China and other developing nations are the subject of much controversy, economic benefits also present a "carrot" for the CCP to enact environmental reforms,. According to Lord Nicholas Stern, the worldwide impacts of global warming will be very expensive, and could cause a global recession. Stern argues that damage from global warming could represent 5 to 20% losses in our global economy; thus, he calls for investment of 1% of the world's GDP in mitigating climate change. (Stern, 2007)

Although Stern's report is fascinating, because it is focused on *world* welfare, some might argue that it may not be able to convince China of the economic benefits of Chinese environmental mitigation. Those that take this view might argue that since China is a global exporter, it would make sense for China to choose cheaper, more polluting production methods, and avoid strict environmental standards, to maintain its status as a low cost producer. Although this is seemingly the trend in developing countries for the last twenty years, new arguments question whether it is a route that suits China.

According to the McKinsey report "China's Green Revolution," if China implemented a specific group of green technologies, China could see a 30-40% drop in oil import demand and a 40% drop in coal demand and supply, as well as a 50% decrease in emissions in 2030 compared

to baseline. Incremental capital investment of 150-200 billion euros per year would be needed, of which about one-third would have positive economic returns, one-third would have slight to moderate economic returns, and one-third would have a substantial economic cost. The basic concept behind the McKinsey report is that for certain pollutants, abatement costs are actually negative, meaning that "cleaning up" is profitable, especially in the long run. The report explains that, as in other countries, the main obstacle to success seems to be a lack of upfront investment, which naturally prevents deployment of technologies. (McKinsey & Company, 2009) Economic benefits of greening, if identified by the government, would provide a strong impetus for keeping what environmental regulation changes have been promulgated by the Olympics as well as increasing future investment in green technologies.

Lasting Change and My Modified EKC Model

We have seen in this chapter that Beijing is unlikely to revert back to its pre-Olympic level of environmental regulation; I have proposed four reasons why the environmental regulation will likely continue. This is a crucial aspect of the modified Environmental Kuznets Curve (EKC) model that I have proposed: once countries have reached the "turning point" in my model, which corresponds to the peak of the EKC, backsliding is unlikely. In Beijing's case, income may not have been high enough for people to pressure the government into regulating. Even so, the Olympics was able to catalyze major changes in environmental regulation and effort, which represents a gravitation towards this turning point in my model (segment A of my model, Figure 4). The conclusion that Beijing is unlikely to revert back to its previous level of

regulation supports my model, which suggests that Beijing will continue along a path of higher environmental regulation (represented by segment B of my model).

7. Conclusion

As China is to a certain extent a trendsetter among the developing world, China's cooperation is crucial to the international fight against climate change. Research concerning the Olympics and China's commitment to a greener environment not only sheds light on important "Green" societal phenomena; it also can have implications for the future of China's environment, and perhaps even environmental regulation in many developing countries.

After considering the Beijing government's environmental regulation in the context of the Environmental Kuznets Curve, I have proposed an alternative model for the relationship between government regulation and income. This model, which I will hereafter refer to as the Modified EKC, more clearly describes Beijing's departure from its expected environmental regulation path, which, as I have tried to show, was precipitated by the Olympics. Through three case studies, I have illustrated that the Beijing government did in fact depart from this path. Further, I have detailed why the changes made will likely have a lasting impact on the Beijing government's environmental regulation.

The Modified EKC model that I propose is unique in that it emphasizes the relationship between government regulation and income rather than emissions and income. The model fills what I see as a crucial gap in the existing EKC literature by studying government's role in the Environmental Kuznets relationship; my work suggests that this role can be a powerful one. The Modified ECK is more cautious, and hence in some cases may prove to be more useful, than the EKC because it studies only one component of the Environmental Kuznets relationship. It also fits neatly with newer versions of the EKC that propose a "tunnel" or shortcut effect in

developing countries such as China and India. I illustrate that government can be a key factor in this "tunnel" effect.

My thesis introduces a new variable into the EKC equation, by detailing the effect of an international event on environmental regulation in Beijing. The case studies I have presented suggest that governments may react strongly to such events, responding with dramatic changes in government regulation. We see in all three case studies that the Chinese government took rapid and effective action to improve environmental regulation in Beijing. Because the modified EKC focuses on policy inputs rather than policy outcomes, it is more applicable to Beijing's case than the EKC (Because Beijing is a growing megacity, achieving a decrease in pollutants would be difficult even given great increases in governmental effort). The Beijing government's response to the opportunity to showcase China through the Olympics illustrates the power of international events to catalyze environmental protection in developing countries.

The big question is: Beijing does not represent the whole of China; will the Chinese government continue with reforms in other cities? The true test of commitment to the environment will be what happens at the national level. Institutional changes, like the upgrading of the SEPA (State Environmental Protection Agency) to the MOEC (Ministry of Environment and Construction, a cabinet-level ministry, are promising in this regard. Because of this, and because of the nature of international events, this model holds implications for the city of Tianjin's Olympic bid's effect on Chinese environmental regulation in Tianjin. We may see similar environmental regulation dynamics occurring in association with the Shanghai

World Expo. International events held in other developing countries may also follow these environmental regulation trends.

My model proposes that when a government begins to increase its environmental regulation, thus approaching the "turning point" in both my model and the EKC, the changes it makes tend to have lasting momentum. The Olympics was not the environmental disaster that Elizabeth Economy predicted it would be; nor was it the "band-aid" on the problem that many Western news articles claimed it would be. The Olympics changed Beijing's environment and infrastructure, and even the very structure of environmental regulation in China as a whole. My research finds that four key factors make a Beijing's reversal of this environmental regulation highly unlikely: a) transaction costs, b) path dependence, c) international prestige, and d) economic benefit.

Lastly, my thesis illustrates how governments of the developing world may be motivated by more than the economic gain that comes with environmental regulation. International events could provide one such motivation. In a world where leaders promise "green jobs," corporations and offices "go green" and UN Secretary-General Ban-Ki Moon dreams of a "green New Deal," we can't help but hope that developing countries also catch this green fever. Through the 2008 Olympics, China has demonstrated its leadership in the fight against climate change: while it has the world's most serious environmental problems, my research suggests that it is now persevering against them with immense governmental force.

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