ADBI Working Paper Series

ENVIRONMENTAL GOVERNANCE AND ENVIRONMENTAL PERFORMANCE

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No. 936
March 2019

Asian Development Bank Institute

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Suggested citation:

Chang, C.-P., M. Dong, and J. Liu. 2019. Environmental Governance and Environmental Performance. ADBI Working Paper 936. Tokyo: Asian Development Bank Institute. Available: https://www.adb.org/publications/environmental-governance-and-environmental-performance

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Abstract

Along with the continuous development of the global economy, environmental deterioration has been widely recognized as a pressing issue nowadays, bringing environmental governance to the forefront of human survival. Asia, the largest continent in world in terms of both landmass size and population, has long been facing the exhaustive challenge of environmental pollution. We empirically prove that the level of environmental governance, proxied by government expenditure on environmental protection as a share of gross domestic product (GDP), exerts significant impacts on environmental conditions among Asian countries. For Asian countries, basically three main conclusions can be drawn that may be useful for improving the condition of environmental quality: (i) the authority should increase the share of government expenditure on environmental protection, since it contributes significantly to the reduction of CO_2 emissions and the promotion of energy efficiency; (ii) the government should make an effort to control the overheating economic growth, since excessive economic growth is detrimental to the environment, and increasing GDP per capita leads to increasing CO_2 emissions, decreasing energy efficiency, and decreasing comprehensive environmental performance; and (iii) although foreign direct investment has no impact on CO_2 emissions and Environmental Performance Index, it exerts a significantly negative impact on energy intensity and thus promotes an effect on energy efficiency; therefore, we recommend that the government should implement relevant policies to attract more foreign investment.

Keywords: environmental performance, environmental governance, government expenditure

JEL Classification: H11, Q56, Q58

Contents

1. INTRODUCTION

Human demand on raw materials has continuously increased since the beginning of the Industrial Revolution, leading to an inevitable depletion of natural resources. As Karl Marx stated in his book *Capital*, the entire development of both civilization and industry has always been destructive to the forests, and by contrast, the effect of cultivation and production on the forests can be considered negligible. The environmental problem sourced from this predicament has gained momentum and finally resulted in a series of environmental pollution incidents. For instance, the most notorious air pollution incident, the Great Smog, happened in London in the winter of 1952. Large amounts of soot, dust, ash, and exhaust accumulated at that time and hung like a vast pall over London; the pollutant load of noxious gases, such as sulfur dioxide (SO_2) and suspended particulate matters (SPMs), surged to 300% of their normal value; and approximately 12,000 people died because of respiratory disease. The environmental problem has obviously become a conspicuous and widespread problem in the world today, and its ever-intensifying negative effect not only severely hinders the global economic growth, but also damages human health and destroys the ecosystem.

The concept of environmental protection didn't step into the limelight until 1962, when Rachel Carson, a famous American marine biologist and author, published the book *Silent Spring*. This book illustrated the environmental contamination caused by a kind of highly toxic pesticide named dichlorodiphenyltrichloroethane (DDT), and the American government launched an investigation targeting highly toxic pesticides as a result of the warnings in the book. Subsequently, the American government established the Environmental Protection Agency (EPA), which is in charge of enforcing federal laws involving the environment, and the states sequentially formulated relevant policies and laws on forbidding the production and application of highly toxic pesticides. Thus, this book is of epoch-making significance against the social background of conquering nature at that time. In addition, these environmental measures taken by the American government triggered chain reactions among some western European nations, promoting the development of large-scale civil environmental movements. There appeared many nongovernment environmental research institutions and community organizations, represented by the Club of Rome, established in 1968, and Greenpeace, established in 1971, and these nongovernment organizations (NGOs) utilized their increasing power to pressure the national governments to take corresponding actions and resolve environmental issues. People in increasing numbers came to realize that it is in everybody's self-interest to deal with the environmental problems, and the public started criticizing enterprises that stubbornly chase high profits at the expense of environmental pollution and the apathetic governments that take a position of willful blindness toward environmental deterioration. In 1969, the American government struggled to promulgate the National Environmental Policy Act (NEPA) and formulated a corresponding environmental governance system. That was when the national governments' function of environmental governance was put on the agenda.

On 5 June 1972, the United Nations held the first session of the United Nations Conference on the Human Environment in Stockholm, Sweden. The well-known United Nations Declaration on the Human Environment was proposed at the meeting, which indicated that environmental protection had formally gained increasing awareness among countries all over the world. Environmental pollution has taken its toll on human beings and forced them to suffer heavy losses due to their destructive exploitation of natural resources, and humans have begun to rethink their position in the meantime.

In fact, as most developing countries and emerging industrializing countries have experienced during their economic takeoff phases, environmental deterioration and irreversible resource depletion have already become among the most critical challenges that have stifled long-term sustainable economic development and endangered fundamental social stability.

Looking at the evolution of international environmental protection, the development of environmental protection awareness can be approximately divided into the following three stages. The first stage ranges from the early 1960s to the 1970s, that is, from the time that human society started to realize the existence of the environmental pollution problem to the time that national governments actually implemented relevant environmental policies. During this period, the state and the government regarded the environmental problem simply as a sort of technical problem and tried to resolve the problem through pollution control. The second stage of environmental governance covers the period from the early 1980s to the early 1990s, during which the authorities began to recognize the interrelationship between the economy and the environment, and started to apply economic stimulation as a major measure of environmental governance. In the third stage of environmental governance and protection, most national governments saw the environmental problem as a sort of development problem and tried to enact efficient policies to coordinate the relation between environmental protection and economic development. And the state intended to decentralize its decision-making authority in environmental policies to various stakeholders, institutions, and organizations. No matter in which stage of environmental governance, we believe that political institutions are always involved and have played an unneglectable role in the process of environmental governance.

Focusing principally on the relationship between environmental governance and environmental performance in Asia, Section 2 looks at the history of environmental governance and presents a literature review on the relationship between government expenditure and environmental performance. Section 3 briefly reviews the environmental conditions in Asia and analyzes the evolution of environmental governance in representative Asian countries. Next, we discuss the data and empirical results in Section 4. Finally, Section 5 presents the conclusions drawn.

2. BASIC DESCRIPTION OF ENVIRONMENTAL GOVERNANCE

This section first introduces the basic definition of environmental governance, then briefly looks through the whole evolution of environmental governance since the 1960s, and finally reviews the relevant literature on the relationship between environmental performance and environmental governance, which can be proxied by government expenditure on environmental protection.

2.1 Definition of Environmental Governance

Objectively speaking, environmental pollution is closely bound up with humans' production activities and living behaviors, and human activity inevitably results in environmental degradation. Long before the Industrial Revolution, the impact of human activity on the ecological environment was still considered to be limited and partial, and most pollution issues were still within the range that could be resolved and accommodated by the environment itself. Therefore, the self-adjustment function of the environment acted as the main measure for solving the problem of environmental

pollution, while anthropogenic governance and protection only served as assistances. Equipped with advanced machines and developed technologies, human society has enjoyed an unprecedented galloping progress ever since the beginning of the Industrial Revolution. Nevertheless, massive environmental pollution problems have occurred at the same time, and the adverse impact of human activity on the ecological environment has kept deepening and spreading over the whole world during the last few decades. The increasingly acute conflict between the environment and human society has gone beyond the capacity of the environment, and further endangered the existence and development of mankind.

Following economic theory, the law of value is an essential element in governing human behavior, and people are likely to pursue the maximization of benefits, that is, people prefer to generate greater profit at lower cost. Moreover, people won't subjectively or proactively consider the negative externalities of their behaviors, indicating that enterprises tend to dump waste materials directly into the environment because of the low treatment costs. That was the main reason for calling on the state government to take responsibility for environmental governance in the early 1960s. In recent years, environmental governance has become a rapidly growing field in both academia and business due to its significant implications for conservation practice. Paavola (2007) thinks that a broad and deep understanding of environmental governance is necessary for handling conflicts over environmental resources.

Against the background of global environmental change, environmental conservation is facing complex, nonlinear, and cross-scale challenges (Rockström et al. 2009), and it is of great importance to have a clear recognition of environmental governance (Chapin et al. 2010). Armitage, de Loë, and Plummer (2012) distinguish environmental management from environmental governance, where the former consists of a set of operational decisions aimed at achieving certain conservation outcomes while the latter covers a wider range of both responsibilities and actors. Oakerson (1992) proposes that environmental governance involves broad processes through which societies make decisions related to the environment or may exert certain impacts on the environment. Lemos and Agrawal (2006) define environmental governance as a set of regulatory processes, mechanisms, and organizations through which political actors resolve environmental problems and impact environmental outcomes, and they further emphasize that governance is not a synonym for government. Environmental governance, especially in today's world, is a much broader concept covering the environment-related actions of the state and other actors, such as businesses, communities, and nongovernment organizations (NGOs).

2.2 The Evolution of Environmental Governance

The ecological environment possesses characteristics of nonrivalrous consumption and nonexcludability, which are the typical features of public goods.[1] Environmental pollution is regarded as an inevitable by-product generated from human economic and social activities, and environmental governance is thus an essential function and responsibility of both national and local governments. Looking back at and reviewing the history of environmental governance, it has experienced three main eras, namely the centralized "command-and-control" regulation, the intervention of a market-oriented economic approach, and the hybrid partnerships among the state and other actors.

[1] Nonrivalrous indicates that its consumption by individuals does not reduce the amount that is available to be consumed by other individuals, and nonexcludability refers to the fact that no individual can be effectively excluded from consuming it (Gravelle and Rees 1992).

The first generation of environmental governance was dominated by the national government with its mandatory policy measures, and this phase roughly ran from the 1960s until the end of the 1970s. Western countries, including, in particular, the United States, attempted to resolve environmental problems via formulating relevant environmental laws and regulations, which forced environmental polluters to internalize their environmental costs. The national governments designed, formulated, and implemented relevant laws and regulations according to specific environmental standards, and enterprises were forced to adopt clean technologies to control pollutant emissions in accordance with corresponding emission standards. For example, the American government promulgated the Clean Air Act in 1963, which marked its first attempt to adopt a "command-and-control" approach to resolving the pollution problem. The Clean Air Act proposed strict air quality standards for six kinds of air pollutants in accordance with the standards set by the Environmental Protection Agency (EPA), and the legislation required states and territories to formulate specific solutions to meet the standards. The "command-and-control" approach made extraordinary contributions to environmental protection during the 1960s and 1970s. This mandatory policy instrument was frequently used by developed countries, such as the United States, Canada, Japan, and some western European countries, in the early stage of environmental governance. The conventional "command-and-control" regulation can improve environmental protection performance in a relatively short period and has a remarkable promoting effect on the environment, yet its deficiency is obvious as well. The "command-and-control" approach is generally regarded as a short-term emergency measure and has been criticized for its lack of flexibility and the huge cost hiding behind the implementation process. The success of such regulation is at the expense of large social and environmental costs, such as social costs related to resolving the problem of compliance and enforcement, and environmental costs in regulating and provisioning ecosystem services (Armitage, de Loë, and Plummer 2012; MA 2005). Moreover, the effective implementation of "command-and-control" regulation requires a higher level of government regulation, which may indirectly increase the government's administrative expenses.

After the initial stage of the successful construction of the state-dominated environmental governance pattern in the 1960s and 1970s, more and more stakeholders began to criticize the failure of government to prevent environmental risks and resolve environmental degradation (Jänicke 1986; Bulkeley and Mol 2003). Just like market failure in the business field, there also exists government failure in the governance process, and people gradually realized that government alone may fail to resolve the environmental problem. Moreover, corporations' abilities to respond to environmental governance are relatively weak at the beginning of "command-and-control" regulation. Faced with severe environmental problems and enormous social pressure, most corporations can only be regulated passively and struggle to meet the emission standards at high costs. Nevertheless, corporations have gained more and more speaking rights in the process of environmental governance over time, and they have made alliances against the government, requesting the government to consider the huge cost of pollutant treatment and emission control. The tremendous and increasing environmental costs also exert a certain negative impact on the competitiveness and economic development of a country, which has increasingly aroused public concern and brought about considerable pressure on government regulation. In the mid-1980s, the environmental governance pattern changed in accordance with the market economic system, and market mechanism measures were brought into the process of environmental protection, which is the most striking feature of the second generation of environmental governance. This kind of market-oriented approach is called "environmental-economic means," and includes a series of measures,

such as environmental fees, taxes, subsidies, preferential credit, and differential tax rate, among which emission trading is one of the most effective environmental-economic policy instruments. Emission trading is a form of the so-called "cap and trade" system. Generally speaking, an overall limit (or ceiling) of pollutant emissions is set by the state (government or other authorities), since regulated polluters must hold a permit that is equal to or higher than the amount of pollutants that are actually emitted during a certain time period. The participants can thus sell or buy the emission permit according to their real demand. For example, a participant could choose to adopt clean technology to reduce its own emissions and sell the excess permit to other polluters. This approach successfully redistributes pollutant emissions by establishing the legal right to trade emission permits, and contributes to achieving the goal of total emission control. Compared with the conventional "command-and-control" approach, environmental-economic means basically possessing the following advantages: (i) it is more cost-effective due to its flexibility in terms of implementation, which allows polluters and stakeholders to make the choice that maximizes their own interests and benefits; (ii) it provides certain incentives for the innovation of clean technology and environmental management, mainly because its potential profit mechanism leads people to believe that environmental protection can be profitable; (iii) since environmental-economic refers to source control mechanisms of environmental governance, it is favorable to the prevention of environmental pollution and degradation.

In the 1990s, environmental governance gradually stepped into its third generation. As stated by Armitage, de Loë, and Plummer (2012), government is not the most significant source of decision-making authority on environmental issues, at least in today's complex environmental conditions. Stewart (2001) also argues that the optimal structure of environmental governance develops over time, and environmental protection strategies must change with the change of circumstances (Esty 2001). More and more new actors are participating in the process of decision-making on environmental protection, such as private actors and nonstate organizations. Bache and Flinders (2004) propose that multilevel governance is also an important aspect of environmental governance, and nonstate actors ought to play a crucial role in the decision-making process on various governance levels, which further emphasizes the significance of stronger decentralization in the process of policy formulation and implementation (Jordan 1999; Papadopoulos 2007; Kluvánková-Oravská et al. 2009). Lemos and Agrawal (2006) conclude that cross-scale governance, market instruments, and individual incentives are the most important themes of environmental governance. Currently, the involvement of stakeholders, businesses, institutions, markets, the public, and nongovernment organizations in policy making is the main idea and theme of environmental governance (Bulkeley and Mol 2003), and hybrid partnerships among various actors in decision-making have become the most obvious feature of the third generation of environmental governance.

2.3 Literature Review on the Relationship between Environmental Governance and Environmental Performance

As explained before, environmental protection is generally regarded as a public good, which is widely considered to be the responsibility of the government. And there is a strand of research that linked environmental performance with environmental governance, proxied by government expenditure on environmental protection.

López and Galinato (2007) classify government expenditure into two categories, namely expenditure on public goods and expenditure on private goods. The former includes expenditure on pure public goods as well as expenditure to mitigate the impact of market failure, while the latter refers to expenditure that cannot be justified on these grounds. For example, expenditure on public goods includes environmental protection, health and social transfers, research and development (R&D), and subsidies to households through education; expenditure on private goods includes subsidies on energy consumption, fossil fuel production, and government grants to corporations. Pearce and Palmer (2001) propose that government expenditure on environmental protection generates certain improvements for social welfare. The European Commission (2012) states in its "Report on public finances in EMU" that increasing environmental protection expenditure contributes to dealing with market failures related to negative environmental externalities. Antweiler, Copeland, and Taylor (2001) argue that the reallocation of government expenditure on public goods and private goods can influence environmental pollution in a similar way to the impact of trade on the environment. In addition, López, Galinato, and Islam (2011) state that government spending on public goods may have a certain impact on the environment through three different channels, namely the scale effect, the composition effect, and the technical effect. Based on the research of López, Galinato, and Islam (2011), López and Palacios (2014) propose two more channels to illustrate how the scale and composition of government expenditure may influence the environment. They point out that increasing government expenditure on public transportation has a certain substitution effect on private transportation, while the former has less energy demand and fewer pollutant emissions than the latter. Another channel indicates that a higher level of investment in research and development contributes to the promotion of energy-efficient and energy-saving appliances.

Based on a panel data set of 21 European countries covering the period 1995–2006, López and Palacios (2010) find that both government expenditure and energy tax have significantly negative influences on air pollution, regardless of the composition of government expenditure on public goods. Before long, motivated by increasing government expenditure aimed at stimulating economies during the recent economic crisis, López, Galinato, and Islam (2011) model and examine the impact of both the level and composition of government spending on the environment, and they conclude that a higher proportion of government spending on public goods than total government spending significantly helps to alleviate water and air pollution, yet an increase in total government spending with an unchanged composition does not reduce emissions. Employing government expenditure as a proxy of government size, Carlsson and Lundström (2001) state that the size of government has a regulation effect on environmental problems, since environmental protection is a public good and needs certain political interventions. They construct a sample of 77 countries covering the period 1977–1996 and find that higher economic freedom can significantly contribute to the promotion of environmental quality if the government is small, while it will exacerbate air pollution when the size of the government is large. Based on a panel data set of 42 countries ranging from 1971 to 1996, Bernauer and Koubi (2013) apply the proportion of government spending to GDP as a measure of government size and empirically find that a higher proportion of government spending to GDP significantly increases SO_2 emissions, which is mainly attributed to the negative consequences of large governments, such as bureaucratic inefficiency and special interest group influence.

Some studies in this field suggest that the influence of government expenditure on environmental performance may be moderated by other factors, such as national income level and democracy level. Halkos and Paizanos (2013) use the generalized method of moments (GMM) method on a sample of 77 countries between 1980 and 2000, and they find that government expenditure alone has a direct and negative influence on per capita SO_2 emissions, while only an insignificant impact on CO_2 emissions is found in the sample countries. Their results also indicate that the relationship between government expenditure and air pollution is influenced by incorporating the level of national income, that is, government expenditure contributes to decreasing SO_2 emissions if the national income is low, and vice versa: The impact of government expenditure on CO_2 emissions is significantly negative regardless of the level of national income. Galinato and Islam (2017) find a countervailing effect of a shift in government expenditure towards public goods, indicating that an increased income level leads to severer pollution yet increased environmental regulation helps alleviate environmental problems. They also state that a larger scale of government expenditure on public goods significantly lowers the level of NO_2 and O_3 emissions for countries with a higher democracy level.

In a similar vein, Ercolano and Romano (2018) study a similar case at European level and find that government expenditure on environmental protection is positively associated with a better environmental performance. Huang (2018) utilizes a sample of 30 provinces in the PRC between 2008 to 2013 and examines the impact of environmental protection expenditure on SO_2 emissions. The estimations indicate that government expenditure on environmental protection is significantly conducive to the reduction of SO_2 emissions. Moreover, Gholipour and Farzanegan (2018) examine the impact of environmental protection expenditure on air pollution at different levels of governance quality based on panel data of 14 Middle East and North Africa (MENA) countries during the period 1996–2015. And they find that government expenditure on environmental protection alone cannot significantly promote environmental quality, and its effect is found to rely on the quality of governance.

3. ENVIRONMENTAL PERFORMANCE AND ENVIRONMENTAL GOVERNANCE IN ASIA

This section attempts to present a brief overview of the basic environmental conditions of countries all around Asia from three different perspectives: (i) the greenhouse effect, measured by the level of national carbon dioxide (CO_2) emission; (ii) energy utilization, represented by the level of energy intensity; and (iii) comprehensive environmental performance, proxied by the environmental performance index (EPI).

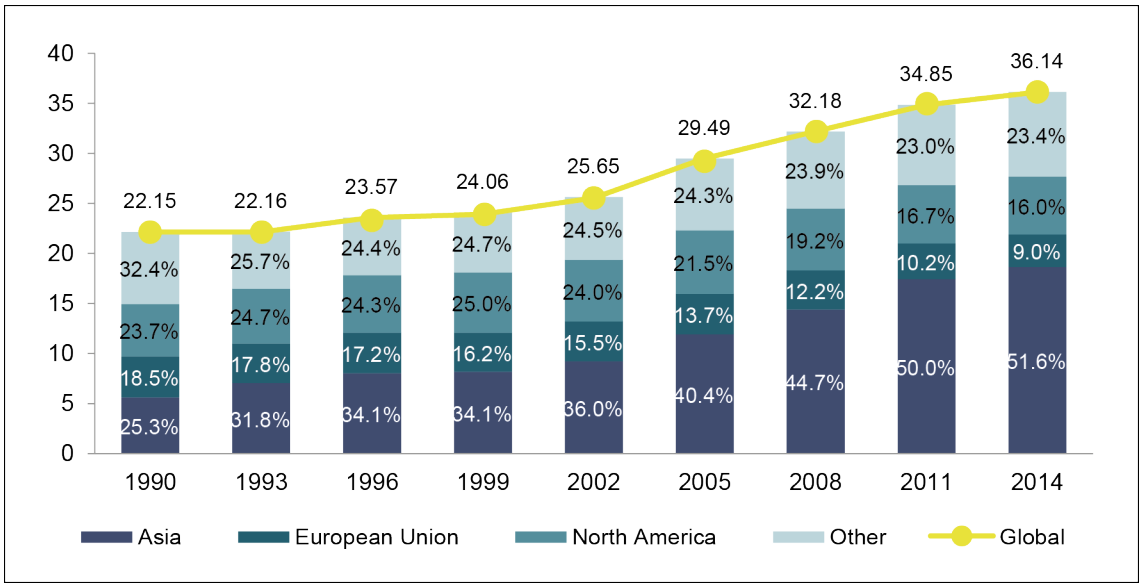
3.1 Greenhouse Effect in Asia

Human beings have been keen to aggressively exploit natural resources ever since the Industrial Revolution, which brought the direct consequence that exhaust gases and waste materials have been unscrupulously released into the environment. The increase in CO_2 in the atmosphere resulting from the burning of fossil fuels, such as coal and oil, is creating a so-called “greenhouse effect” and consequently raising the world’s average temperature. Although the greenhouse effect has been part of the earth’s workings since its earliest days, a runaway greenhouse effect may in turn make the earth a hostile environment for living things due to its soaring temperatures. Recent statistics reveal that the average global temperature has increased by 0.6 degrees centigrade since meteorological observation records began. Global warming and climate change have

already resulted in alarming shifts all over the world, bringing about natural disasters such as melting glaciers and rising sea levels.

CO_2 is generally considered to be the main type of greenhouse gas, and the primary source of CO_2 emission is the utilization of fossil fuel,[2] which can be emitted from human-induced influences on forest or other land use. CO_2 emission is directly connected with the production and lives of human beings, and is also an effective indicator measuring the degree of climate change. Global CO_2 emission grew by 3.7% in 2014 and reached a historic high of 36.14 gigatons. Seen from the entire evolution of CO_2 emission (Figure 1), it can be found that global CO_2 emission grew moderately throughout the 1990s and enjoyed a faster growth from 2002, and the growth rate of Asian CO_2 emission presents a similar path to that of global CO_2 emission. Global CO_2 emission increased from 22.15 gigatons to 36.14 gigatons during the period 1990–2014, with Asian countries contributing the most while the European Union and North American countries gradually reduced their weight.[3] Amazingly, the share of Asian CO_2 emission has more than doubled in the past two decades, from 25.3% in 1990 to 51.6% in 2014. In contrast, the European Union successfully reduced its share of CO_2 emission by half during the same period, from 18.5% in 1990 to 9.0% in 2014.

Figure 1: The Evolution of CO_2 Emission from 1990 to 2014



Note: The unit of CO_2 emission is the gigaton.

Source: Authors' calculations based on data provided by WDI database.

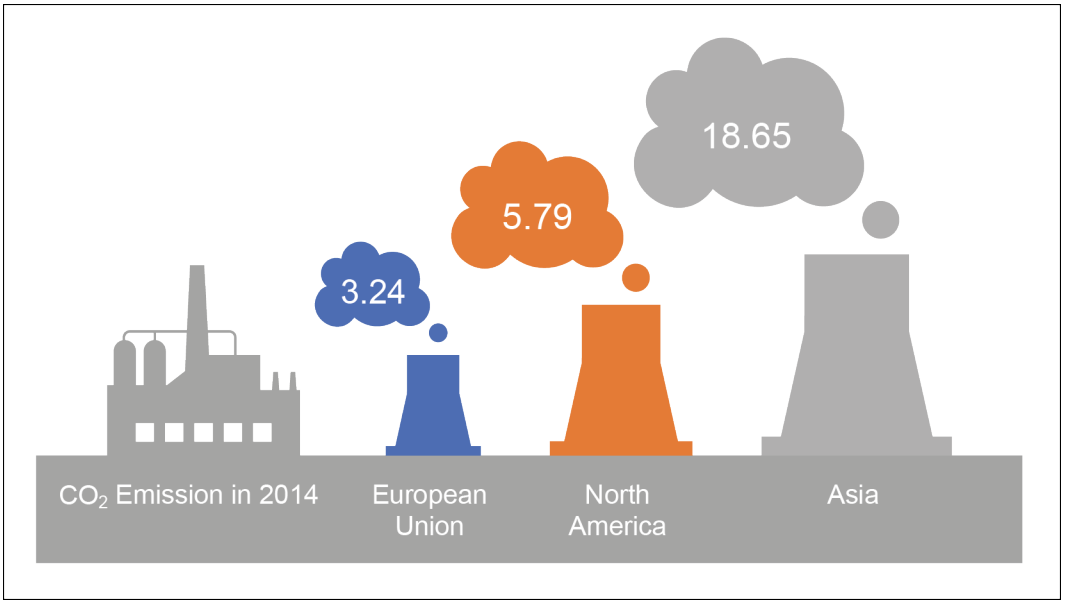
[2] The data source for CO_2 emissions is the World Development Indicators Database provided by the World Bank, and the available data range for CO_2 emission covers the period 1960 to 2014.

[3] Data for the European Union contain CO_2 emissions of all 28 member states, which are calculated manually; data for North America are sourced directly from the World Development Indicators database, excluding low- and middle-income countries.

In recent years, it has become more and more apparent that the differences between developed continents (represented by Europe and North America) and developing continents (such as Asia) not only lie in the aspects of economic and social development, but also exist in the condition of environmental pollution. Taking CO_2 emission as an example, the CO_2 emission of Asian countries was 18.65 gigatons in 2014, which was almost six times that of the European Union and approximately 3.2 times that of North American countries, as shown in Figure 2.

This phenomenon apparently fits the well-known Environmental Kuznets Curve (EKC) theory, which proposes the existence of an inverted U-shaped relation between economic development and environmental quality, that is, the level of CO_2 emission increases with rapid economic development in developing countries (most of which are located in Asia), and the level of CO_2 emission decreases with steady economic development in developed countries (most of which are located in Europe and North America).

Figure 2: CO_2 Emission of Different Regions in 2014



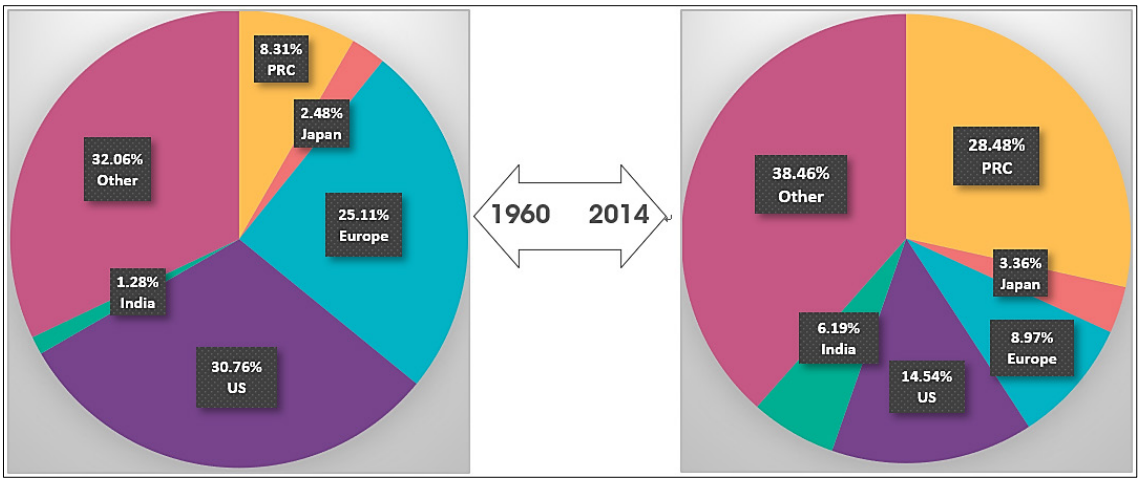
Note: The unit of CO_2 emission is the gigaton.

Source: Authors' calculation based on data provided by WDI database.

If further analysis on regional contributions to global CO_2 emission is conducted (Figure 3), it becomes obvious that developed countries, such as European Union members and the United States, have achieved demonstrable success in reducing greenhouse gas emission. The United States was the biggest emitter of CO_2 in 1960, accounting for 30.76% of the total, and although the United States was still the top carbon dioxide emitter across the world in 2014, its share fell to only 14.54%. Similarly, the European Union successfully lowered its share of CO_2 emission as well, from 25.11% in 1960 to 8.97% in 2014. The Asian countries, by contrast, present an ever-increasing trend in CO_2 emission, with the PRC being the typical representative of unchecked greenhouse gas emission. During the period 1960 to 2014, the PRC suffered a quadruple increase of CO_2 emission and jumped to become the biggest CO_2 emitter across the world, accounting for 28.48% of the total. Another representative is India, whose condition is similar to that of the PRC, both in economic development and in the evolution of greenhouse gas emission, which suffered an incredible fivefold

expansion in CO_2 emission, from 1.28% in 1960 to 6.19% in 2014, while Japan, one of the most developed countries in Asia, barely maintained a relatively moderate growth rate of CO_2 emission (from 2.48% in 1960 to 3.36% in 2014) compared to other countries in Asia. The evolution of CO_2 emission in Europe, North America, and Japan again provides sound evidence supporting the existence of an EKC relationship between economic development and CO_2 emission.

Figure 3: Regional Shares of CO_2 Emission in 1960 and 2014



Source: Authors' calculations based on data provided by WDI database.

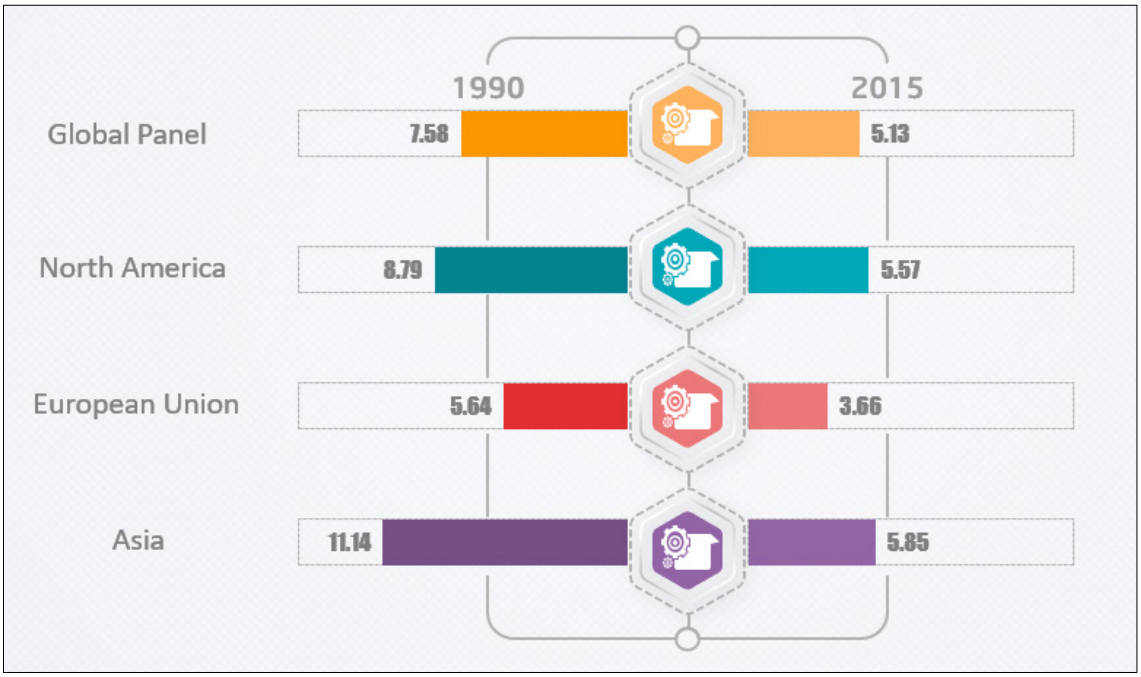
3.2 Energy Utilization in Asia

Generally speaking, there is a very close relationship between energy and the environment. On the one hand, the original natural environment is influenced and a huge amount of exhaust and pollutants are generated during the process of energy acquisition and utilization, and the natural environment, on which people rely for their very existence, would be polluted and eventually destroyed if these wastes were left mishandled. On the other hand, the development of both energy and the economy does give a tremendous boost in terms of improving environmental conservation; an ever-increasing energy consumption is accompanied by a strengthening economic force, which in turn provides sufficient financial and technological support to accelerate environmental governance and pollution control.

Although energy is of great significance to the generation of industrial development and social wealth, it produces considerable pressures on the environment as well: for example, greenhouse gas and air pollutant emissions generated from the combustion of fossil fuel, oil spills during the production process, and nuclear waste that is seriously detrimental to human health. Energy intensity is a widely adopted variable assessing the level of energy efficiency,[4] that is, lower energy intensity shows that less energy is used to produce one unit of economic output and thus represents higher energy efficiency, and vice versa.

[4] Energy intensity is calculated as the amount of energy consumed per unit of GDP output, of which the unit is the megajoule (MJ)/$2010 PPP GDP, and data are sourced from the World Development Indicators Database, and the data range of energy intensity analyzed in this section covers the period 1990 to 2015.

Figure 4: A Comparison of Energy Intensity: 1990 and 2015

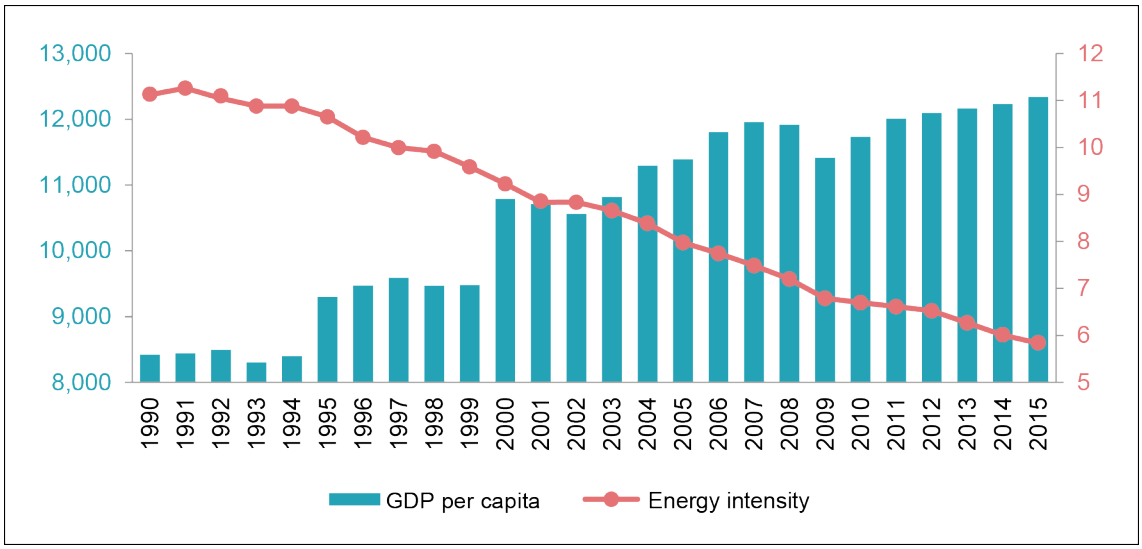


Source: Authors' calculations based on data provided by WDI database.

Making a rough comparison between energy intensity in 1990 and 2015, as shown in Figure 4, energy intensities in all regions were successfully improved. The global energy intensity decreased from 7.58 to 5.13, with a 32.3% deduction in total, and Asia achieved the most successful energy intensity improvement during this period, with its energy intensity decreasing from 11.14 to 5.85, and a 47.5% reduction in total.

On the one hand, this implies an ascending awareness of energy conservation; the energy situation of developed countries has been effectively improved ever since the establishment of the International Energy Agency, an intergovernmental organization set up by the Organisation for Economic Co-operation and Development (OECD) in 1974. Serving as a global energy authority, the IEA suggests that governments should formulate policies that would improve energy reliability, affordability, and sustainability, encouraging member states to improve their energy efficiency and offset the negative impact of energy production. On the other hand, the sustained economic growth not only improves the quality of human life, it also brings sufficient capital input for technological improvement of energy efficiency and environmental governance, which is evidenced by the relationship between economic development and energy intensity in Asia (Figure 5).

Figure 5: The Evolution of Economic Development and Energy Intensity in Asia



Note: GDP per capita is in the form of constant 2010 US$.

Source: Authors' calculations based on data provided by WDI database.

For further detailed analysis on relevant issues, we divide our sample into five subgroups:[5] East Asia, Southeast Asia, South Asia, West Asia, and Central Asia.[6] Among Asian countries, Central Asia had the highest average energy intensity of 14.43 during the 1990s, which was almost three times that of Southeast Asia and 1.5 times that of East Asia. Although energy efficiency in Central Asia has effectively been improved in recent decades, the energy intensity of Central Asia still represents a dark side of Asian energy conservation. It is intriguing that if we follow the thoughts concluded from the relationship between economic development and energy intensity in Asia (Figure 5), we should come up with the idea that highly developed economies usually go with a relatively lower energy intensity. While the regional data in Table 1 show that East Asia, where the most developed Asian economies can be found, has the second-highest average energy intensity, South Asia, in which all countries are developing countries, possesses the lowest average energy intensity. This phenomenon indicates that the energy intensity of Asia is not fully determined by the level of economic development, which more or less contradicts the evolution presented

[5] Our sample countries comprise 21 Asian economies in total, and taking into consideration data availability, our sample contains several representative countries in each regional category: three countries in East Asia, i.e., the PRC, Japan, and Mongolia; six countries in Southeast Asia, i.e., Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Viet Nam; four countries in South Asia, i.e., Bangladesh, India, Pakistan, and Sri Lanka; seven countries in West Asia, i.e., Armenia, Azerbaijan, Iran, Israel, Lebanon, Turkey, and Yemen; and one country in Central Asia, i.e., Kazakhstan.

[6] The country classification of East Asia is referenced from Miller (2008) and Holcombe (2011). The classification of Southeast Asia is based on the list of member states in the Association of Southeast Asian Nations (ASEAN) (see details at https://asean.org/asean/asean-member-states/). The classification of South Asia refers to the list of member states of the South Asian Association for Regional Cooperation (SAARC) (see details at http://saarc-sec.org/about-saarc). For Central Asia, the country classification is referenced from https://www.britannica.com/place/Central-Asia. In addition, since the definition of West Asia is admittedly relatively vague, we follow the classification of both the OECD and the United Nations Industrial Development Organization (UNIDO) (see details in Angus (2003) and the *International Yearbook of Industrial Statistics 2011* published by UNIDO in 2011).

in Figure 5, and further indicates that there must exist other factors influencing the level of Asian energy intensity.

Table 1: The Evolution of Average Energy Intensity in Asian Countries

Region	1990–1999	2000–2009	2010–2015
East Asia	10.63	7.68	6.37
Southeast Asia	5.22	4.93	4.34
South Asia	5.11	4.45	3.79
West Asia	7.40	5.57	5.12
Central Asia	14.43	8.87	8.26

Source: Authors' calculations based on data provided by WDI database.

3.3 Comprehensive Environmental Performance in Asia

This section adopts the Environmental Performance Index (EPI) to comprehensively measure national environmental performance[7]. The EPI is widely adopted as an effective indicator of environmental trends, and it serves as a national measurement of how close countries are to environmental policy goals. This indicator suits the objective of this chapter perfectly, which is to find the interlink between the environment and environmental governance. Taking the 2016 version of the EPI as an example, it comprises two subindicators, namely the Environmental Health Index (EHI) and the Ecosystem Vitality Index (EVI), with the score of each accounting for 50% of the total EPI. Under this basic framework, the EHI reflects the risk of possible environmental pollution to humans, which is comprehensively measured by the level of health impacts, air quality, water, and sanitation, while the EVI assesses the vitality of the whole ecosystem of the country, which is evaluated from several perspectives related to environmental governance and species conservation, including water resources, agriculture, forest cover, fish stock, biodiversity and habitat, and climate and energy.

The 2018 EPI reveals that countries with the highest environmental quality are generally located in Europe. In particular, Switzerland, France, and Denmark are the top three, and most countries with the worst environmental performance are located in Africa and Asia, with the Democratic Republic of Congo, Bangladesh, and Burundi making up the bottom three. Undoubtedly, Europe and North America achieve greater environmental performance accompanied by the advanced and stable development of both their economy and their society. South America and Asia, which mainly comprise developing countries with increasingly rapid economic growth but immature governance mechanisms, maintain the second-tier level of environmental performance across the world. And the third tier of environmental performance is composed of countries in Africa, most of which still suffer from unsettled and volatile political situations as well as relatively backward economic development. Roughly judging from the regional distribution of the EPI level across the world, environmental performance is considered to have a close connection with both economic development and political situation, which is in line with the general view taken by most scholars. Furthermore, in the case of Asia, it is quite unexpected that the environmental performance of West Asia is much better than that of

[7] Yale University and Columbia University jointly calculate the EPI score in collaboration with the World Economic Forum; the data period covers the years 2000 to 2018. The group has continuously revised the compilation of the EPI, and different versions of the EPI contain different shares of policy categories as well as subindicators.

East and Southeast Asia, while the worst environmental performance is found in South Asia and Central Asia.

3.4 Environmental Governance in Representative Asian Countries

This section presents a simple but clear retrospect on the path of the environmental governance of Asian countries, represented by Japan and the PRC. These two countries have experienced different path of economic growth, environmental pollution and environmental governance.

Japan, as one of the few developed countries in Asia, also experienced severe environmental pollution in the early 1960s; yet, as shown in the ranking of the latest released EPI, the environmental quality of Japan is at the forefront of Asian countries. The improvement in the environmental quality of Japan is more or less obvious, which makes its process of environmental governance worth learning. The environmental pollution problem of Japan arose right after World War II, approximately from the mid-1950s to the mid-1970s, when Japan was in the postwar period and its economy was enjoying a blistering catch-up growth. The Japanese government energetically developed heavy industries, such as the steel, electricity, and petrochemical industries, which consumed a huge amount of natural resources and further resulted in several typical environmental pollution incidents. Suffering the directly adverse impact of environmental pollution, the local residents spontaneously organized campaigns against environmental pollution, and finally evolved into a national protest campaign. Benefiting from the unremitting effort of the public, the Japanese government eventually enacted an official environmental protection act in 1968, namely the Atmospheric Pollution Prevention Law. Later on, the government gradually formulated a series of environmental policies aimed at fighting against various kinds of environmental pollution, including laws and acts on air, water, and ocean pollution, energy conservation, and resource recycling. Nowadays, the environmental quality of Japan has enjoyed a comprehensive improvement compared to a half century ago, which has mainly benefited from the ever-improving environmental legislation system and through the government and authorities being focused on environmental governance.

The Japanese government has released four types of environment-related laws to help enhance the rigors of environmental governance. The first is the basic law that is related to environmental conservation and the control of environmental pollution[8]. These basic laws draft a set of broad principles and general provisions for industries, organizations, and enterprises as well as citizens. The second type is the general laws specialized in specific aspects of environmental conservation[9]. These laws have meticulous provisions and stipulations and put forward corresponding measures on environmental governance and pollution prevention. The third type of laws is the comprehensive laws on environmental protection, aimed at supervising and regulating relevant behaviors of environmental governance. Furthermore, although the last of these does not directly belong to environmental laws, its content is closely associated with environmental protection, such as the Law on Rationalization of Energy Utilization enacted in 1979. As well as a relatively complete legal system relating

[8] For example, the Basic Law on Environmental Pollution Control and the Basic Law on Pollution Countermeasures released in 1967, and the Environmental Basic Law enacted in 1993.

[9] This type of law is represented by the Law on Air Pollution Control and the Noise Control Ordinance implemented in 1993.

to environmental governance, the Japanese government has established various specialized political institutions relating to environmental governance. The Japanese central government set up the Environment Agency in 1972 and the Lower House of Parliament voted to upgrade the Environment Agency to a ministry in 2001. The Ministry of the Environment of Japan (MOEJ) is responsible for formulating environmental policies and supervising environmental governance, and comprises seven branches: the department of environmental policy; the department of global environment; the department of waste management and recycling; the department of air and transportation; the department of water, soil, and ground environment; the department of health and chemicals; and the department of nature and parks.

Another representative country is the PRC, which is the biggest developing country and now the second-largest economy in the world. From an overall perspective, the environmental situation has still been grim for the PRC in recent years, with environmental problems such as sustained hazy weather, soil contamination, overgrazing, desertification, garbage disposal, and serious destruction of biodiversity having plagued the future development of the PRC. The idea of the PRC's environmental governance was first proposed in 1973; subsequently, the Environment Law of the PRC was decreed in 1979, and marked the formation of the legislative framework for environmental governance in the PRC. In 1983, an environmental protection policy was published by the Chinese government as a basic national policy. The National People's Congress and its Standing Committee have already formulated and implemented nine laws involving environmental protection and 15 laws on the protection of natural resources since the foundation of New PRC. The national government has enacted or modified environmental protection laws on several aspects, including the prevention, treatment, and control of water pollution, air pollution, environmental noise pollution, solid waste pollution, marine environmental pollution, and radioactive contamination: for example, the Law on the Prevention and Control of Pollution from Environmental Noise released in 1996; the Law on the Prevention and Control of Environmental Pollution Caused by Solid Waste promulgated in 2005; the "Law on Prevention and Control of Water Pollution" implemented in 2008, the Law on the Prevention and Control of Atmospheric Pollution revised in 2015; the Environmental Impact Assessment Law revised in 2016; and the Marine Environment Protection Law revised and promulgated in 2017. The government has implemented laws on aspects closely correlated with environmental protection, such as laws on the regulation and supervision of cleaner production, agriculture, animal husbandry, and renewable energy resources, including specifically the Law on Desert Prevention and Transformation formulated in 2001; the Renewable Energy Law of the PRC adopted in 2005; the Energy Conservation Law implemented in 2008; the Regulations for the Administration of the Recovery and Disposal of Waste Electric and Electronic Products enacted in 2011; the Regulations on Urban Drainage and Sewage Treatment implemented in 2014; and the Law of the PRC on Conserving Energy revised and implemented in 2016. In addition, the PRC has actively participated in international cooperation and has signed more than 50 international treaties related to environmental protection, represented by the United Nations Convention to Combat Desertification and the United Nations Convention on Biological Diversity.

The construction of the PRC's political institutions relating to environmental governance started from the 1970s, and experienced a winding course from scratch. In 1974, the State Council officially organized the Leading Team of Environmental Protection, aimed at organizing the environmental conservation effort of local areas and helping to finalize national plans for environmental protection. In 1982, the Ministry of Urban and Rural Development and Environmental Protection was established, with one internal department called the Environmental Protection Bureau being reshuffled into the

National Environmental Protection Agency in 1984 and taking over the responsibility for regulating and supervising the national environmental governance and protection. Later on, the National Environmental Protection Agency was upgraded to a higher administrative level in 1998, and was renamed the State Environmental Protection Administration. And in 2008, the State Environmental Protection Administration was again upgraded to a higher administrative level, namely the Ministry of Environmental Protection, being an integral department directly under the governance of the State Council. The evolution of the PRC's political institutions relating to environmental protection reflects an increasing national recognition of environmental governance; however, the PRC's capability in terms of environmental governance remains limited.

Comparing the environmental governance of the PRC with that of Japan, we find that there are certainly several similarities between them: For example, both countries have established specialized political institutions that have taken the responsibility for environmental protection, regulation, and governance; moreover, both countries have formulated a series of correlative environmental laws to set environmental standards, clarify the rewards and punishments related to corresponding environmental outcomes, and constrain the behavior of industries, enterprises, and citizens. It is worth noting that the environmental governance in Japan and the PRC started at very similar times, yet it seems that Japan has successfully achieved a remarkable amount in that regard, while the PRC's environmental deterioration still remains extraordinarily disturbing. The reason for this may lie in the inequalities in the allocation of power within the PRC's political system. In other words, the Ministry of the Environment of Japan is a fully independent political institution with absolute power in terms of integrated environmental governance. In contrast, the Ministry of Environmental Protection of the PRC is directly affiliated to the authority of the State Council; thus, the Ministry of Environmental Protection of the PRC needs to maintain more independence and authority to rule on the formulation of environmental laws and environmental policies.

4. RELATIONSHIP BETWEEN ENVIRONMENTAL GOVERNANCE AND ENVIRONMENTAL PERFORMANCE IN THE CONTEXT OF ASIA

4.1 Data Description

Limited by availability and the quality of the data, we construct an unbalanced panel data set of 18 Asian countries in total from 2005 to 2014 and 26 European countries covering the period 2008–2013[10]. In the empirical estimation, we mainly focus on the relationship between government expenditure on environmental protection and three representative factors of environmental quality, which have all been introduced before. Among them, government expenditure on environmental protection (*Expenditure*) is presented as the percentage of GDP, while three environmental variables are the CO_2 emission, energy intensity, and EPI, respectively. We further introduce a series of control variables that may exert a certain influence on environmental governance, including GDP per capita,

[10] The 18 Asian countries are Afghanistan, Azerbaijan, Bahrain, Bangladesh, the PRC, Georgia, Iran, Israel, Jordan, the Kyrgyz Republic, Lebanon, Nepal, Oman, Pakistan, the Philippines, Qatar, Thailand, and Turkey; the 26 European countries are Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Italy, Latvia, Lithuania, Luxembourg, Malta, Norway, Poland, Portugal, Romania, the Slovak Republic, Slovenia, Spain, Sweden, and the United Kingdom. The data of Asian and European countries are sourced from the International Monetary Fund and Eurostat, respectively.

population size, level of urbanization, industry structure, FDI, and trade openness. Here, we will briefly define these control variables.

(1) GDP per capita (*GDP*): We introduce GDP per capita as one of the major control variables following the EKC theory, which demonstrates the close correlation between economic development and environmental quality. The unit of *GDP* is constant 2010 US$.

(2) Population (*Population*): This is proxied by the national population size. The significant relationship between demography and the environment has aroused interest among scholars for more than 200 years, when Malthus (1798) first proposed that unrestrained population growth would be restricted by limited natural resources. Most scholars have agreed with the conclusion that increasing population size is significantly correlated with environmental pollution such as CO_2 emission (Dietz and Rosa 1997; Cramer 1998).

(3) Urbanization rate (*Urbanization*): This is measured as the proportion of urban population to total population. There are inconsistent conclusions on the effect of urbanization rate on environmental performance. For example, Panayotou (1997) stated that an increasing degree of urbanization is accompanied by rising consumption of fossil fuels and thus poorer environmental quality, while Poumanyvong and Kaneko (2010) found that an ascending level of urbanization lowers energy use in the low-income group, yet it exacerbates the energy use in upper-middle-income groups.

(4) Industry structure (*Industry*): This is measured as the ratio of industrial sector value added to GDP. It is widely argued that the level of industrialization is a crucial determinant of environment performance, and Cherniwchan (2012) empirically demonstrated that the increasing ratio of industrial output to total output is significantly correlated with the rising level of emission per capita.

(5) Foreign direct investment (*FDI*): This is proxied by the net inflows of foreign direct investments as a share of GDP. The effect of FDI on environmental pollution is a controversial issue: Some scholars support the “pollution heaven hypothesis” proposed by Walter and Ugelow (1979), arguing that greater foreign investments would be detrimental to the environment of investee countries (Baumol et al. 1988; Cole 2004); and some other scholars agree with the “pollution halo hypothesis,” which states that foreign direct investments toward developing countries would promote the enhancement of energy efficiency and thus benefit the environmental conservation of investee countries (Letchumanan and Kodama 2000; Eskeland and Harrison 2003).

(6) Trade openness (*Openness*): This is calculated as the sum of export and import of goods and services measured as a share of GDP. The evidence from relevant studies on the relation between trade openness and environmental quality is mixed: Scholars like Antweiler, Copeland, and Taylor (2001), Baek, Cho, and Koo (2009), and Boulatoff and Jenkins (2010) found that trade openness is linked with decreasing environmental pollution and waste emission, while a number of researchers support the argument that trade openness would worsen environmental quality (Kellenberg 2009; Managi and Kumar 2009). Other scholars like Le, Chang, and Park (2016) state that the impact of trade openness on the environment differs according to the income level of countries.

Table 2a: Descriptive Statistics and Data Sources for Asian Sample

Variables	Obs	Mean	Std. Dev.	Min.	Max.	Source
CO_2 emission	180	7.483	10.902	0.053	62.824	World Development Indicators
Energy intensity	180	5.601	2.273	1.268	11.293	World Development Indicators
EPI	163	53.782	12.244	21.57	82.176	EPI released by Yale University
Expenditure	160	0.343	0.400	0	2.444	International Monetary Fund
GDP	180	10,561.63	16,117.71	389.416	72,671	World Development Indicators
Population	180	1.14e+08	3.01e+08	864,863	1.36e+09	World Development Indicators
Urbanization	180	58.360	24.649	15.183	99.159	World Development Indicators
Industry	178	14.976	6.935	4	32.452	World Development Indicators
FDI	180	4.491	4.897	–0.423	33.795	World Development Indicators
Openness	180	0.736	0.445	0	1.905	World Development Indicators

Source: Author's calculations.

Tables 2a and 2b present the descriptive statistics and the data sources of the variables, respectively, for the Asian and European samples utilized in the empirical estimation.

Table 2b: Descriptive Statistics and Data Sources for European Sample

Variables	Obs	Mean	Std. Dev.	Min.	Max.	Source
CO_2 emission	156	7.568	3.588	3.376	22.386	World Development Indicators
Energy intensity	156	4.564	1.169	2.635	7.964	World Development Indicators
EPI	156	73.887	11.864	47.7	90.73	EPI released by Yale University
Expenditure	156	1.654	1.031	0	4.772	Eurostat
GDP	156	33,159.39	23,549.73	6,709.53	108,577	World Development Indicators
Population	156	1.83e+07	2.36e+07	409,379	8.20e+07	World Development Indicators
Urbanization	156	72.522	12.329	49.764	97.776	World Development Indicators
Industry	156	13.889	4.614	3.844	24.831	World Development Indicators
FDI	156	9.750	31.849	–43.463	252.308	World Development Indicators
Openness	156	13.889	4.614	3.844	24.831	World Development Indicators

Source: Author's calculations.

4.2 Empirical Investigation

Firstly, we conduct panel fixed-effect regression to investigate the relationship between CO_2 emission and environmental governance, proxied by the ratio of government expenditure on environmental protection to GDP, and the results are displayed in Table 3. Quite unexpectedly, the estimation results present entirely different implications for Asian countries and European countries. For Asian countries, the variable *Expenditure* has a significantly negative influence on CO_2 emission at the 10% level, indicating that a greater scale of government expenditure on environmental protection contributes significantly to the reduction of CO_2 emission in Asian countries. Moreover, *GDP* has a significantly positive and relatively large impact on CO_2 emission, implying that CO_2 emission increases along with the development of the Asian economy, and this finding further provides evidence that most Asian countries are located in the left half of the EKC, where environmental pollution increases along with rising GDP per capita. For European countries, the variables *Expenditure* and *GDP* only have insignificant impacts on CO_2 emission, while *Urbanization*, *Industry*, and *Openness* exert significant influence on CO_2 emission. Specifically, *Urbanization* and *Openness* are proved to have significantly negative influences on CO_2 emission, indicating that both the promotion of urbanization level and greater trade openness benefit the reduction of CO_2 emission in Europe. *Industry* has a significantly positive effect on CO_2 emission, representing a greater share of industrial value added, which implies that accelerated industrial activities aggravate the pressure on CO_2 emission and further worsen the environmental quality in European countries.

The results show that only CO_2 emissions in Asian countries are significantly affected by the government expenditure on environmental protection. A relatively reasonable explanation for this phenomenon is that most Asian countries rely on the national government to a great extent with the issue of environmental protection; the major governance instruments of Asian countries are still mandatory regulations and legislations set by the state, while most European countries have already adopted and developed a hybrid partnership pattern in relation to environmental governance, where the state or the government is no longer the most crucial source of decision-making in the field of environmental protection (Armitage, de Loë, and Plummer 2012), and government expenditure on environmental protection may present partially environmental governance actions only taken by the state. Thus, for European countries, the influence of environmental expenditure on CO_2 emission can be insignificant or negligible, but for Asian countries whose decision-making authority largely belongs to its state government, environmental expenditure tends to have a significantly negative impact on CO_2 emission.

Table 3: Estimation Results of CO_2 Emission and Environmental Governance

Variables	Asia	Europe
Expenditure	–0.288*	0.008
	(0.164)	(0.007)
GDP	7.086*	–2.816
	(3.693)	(2.870)
GDP^2	–0.386*	0.186
	(0.233)	(0.146)
Population	–0.369	–0.133
	(0.632)	(0.271)
Urbanization	–1.813	–2.943***
	(1.898)	(0.871)
Industry	–0.441	0.394***
	(0.516)	(0.099)
FDI	–0.025	0.001
	(0.087)	(0.001)
Openness	–0.313	–0.366***
	(0.529)	(0.093)
Constant	–15.970	24.841
	(16.760)	(16.141)
Observation	140	156
R^2	0.099	0.509
F	1.56	15.81

Notes: The values in parentheses denote the standard errors. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Turning the focus onto how government expenditure on environmental protection influences the level of energy intensity, Table 4 presents the basic estimation results generated from the panel fixed-effect model for both Asian and European samples. Much like the results shown in Table 3, there is a significantly negative influence of *Expenditure* on energy intensity, and a significantly positive impact of *GDP* on energy intensity for the Asian sample, which indicates that government expenditure on environmental protection can significantly enhance energy efficiency while the economic development may be detrimental to energy utilization, which again provides evidence for the argument that most Asian countries are located in the left half of the EKC. In the case of energy intensity, the variable *FDI* is significantly negative for the Asian sample, implying that a large scale of foreign direct investment helps to promote energy efficiency and lower energy intensity. As far as the European sample is concerned, the variable *GDP* has a considerable negative impact on energy intensity, thereby indicating that the economic development in European economies benefits the reduction of energy intensity and thus the improvement of energy efficiency. Such a negative relationship also reflects the argument that European countries, most of which are developed countries, are located in the right half of the EKC, where environmental quality improves along with the development of the economy. Similar to the results for CO_2 emission, *Urbanization*, *Openness*, and *Industry* present significant impacts on energy intensity as well, with the first two negatively affecting energy intensity and the last one affecting it positively. These results indicate that a higher level of urbanization, greater trade openness, and a lower share of industrial value added contribute to the perfection of energy intensity in Europe.

Table 4: Estimation Results of Energy Intensity and Environmental Governance

Variables	Asia	Europe
Expenditure	–0.095***	0.005
	(0.031)	(0.005)
GDP	4.034***	–4.235**
	(0.707)	(2.077)
GDP^2	–0.246***	0.201*
	(0.045)	(0.106)
Population	–0.199	0.254
	(0.121)	(0.196)
Urbanization	–0.461	–1.237*
	(0.363)	(0.631)
Industry	0.010	0.254***
	(0.099)	(0.720)
FDI	–0.036**	0.001
	(0.017)	(0.001)
Openness	–0.132	–0.134***
	(0.101)	(0.067)
Constant	–9.312***	24.290**
	(3.209)	(11.684)
Observation	140	156
R^2	0.285	0.412
F	8.92	10.68

Notes: Same as Table 3.

Finally, we attempt to figure out the relationship between environmental governance and comprehensive environmental performance, proxied by the Environmental Performance Index (EPI), and Table 5 displays the corresponding results for both Asian and European countries. Surprisingly, government expenditure on environmental protection has no impact on the EPI level, either for Asian or European countries. The potential reason for this unexpected phenomenon could be that the EPI is a composite indicator containing both the performance of environmental health and the level of ecosystem vitality, which may result in an insignificant or negligible relationship between the EPI and government expenditure on environmental protection. Other variables present similar results to the foregoing analysis: To be specific, *GDP* is significantly negatively correlated with the EPI, indicating that continuous economic development is harmful to the comprehensive environmental performance in Asia and further demonstrates Asia's left-of-center location in the EKC. For European countries, *Urbanization* and *Openness* are significantly positively correlated with the EPI, implying that the development of urbanization of trade openness contributes to the promotion of comprehensive environmental performance. Nevertheless, the negative impact of foreign direct investment on environmental quality is again proved by the significantly negative relationship between *FDI* and the EPI.

Table 5: Estimation Results of EPI and Environmental Governance

Variables	Asia	Europe
Expenditure	-0.002	-0.011
	(0.068)	(0.012)
GDP	-3.558*	0.193
	(1.973)	(5.178)
GDP^2	0.209*	-0.018
	(0.118)	(0.263)
Population	0.150	0.538
	(0.296)	(0.488)
Urbanization	-0.350	7.713***
	(0.779)	(1.572)
Industry	0.093	-0.669***
	(0.242)	(0.179)
FDI	0.036	-0.001
	(0.038)	(0.001)
Openness	0.134	1.703***
	(0.247)	(0.168)
Constant	17.374**	-35.522
	(8.075)	(29.119)
Observation	140	156
R^2	0.070	0.635
F	0.94	26.5

Notes: Same as Table 3.

4.3 Conclusion

With the interaction between humans and the environment existing throughout the entire development of society, humans' devastating influence on the environment has continued to escalate in the last few centuries. There is no doubt that environmental pollution has become an extremely severe problem in today's world, and the authorities and all stakeholders are believed to have the responsibility to take strong and effective measures to deal with this problem. Looking back through the history of environmental governance, although the actions of modes, policy instruments, and even the actors involved have changed over the last few decades, people have never stopped pursuing a better ecological environment.

Asia, the largest continent in the world in terms of both landmass size and population, has long been facing the exhaustive challenge of environmental pollution. Most Asian countries are developing countries and emerging economies, and rapid economic development has been accompanied by growing environmental problems for decades. From the perspective of environmental governance, there are both well-governed countries, such as Singapore and Japan, and poorly governed countries, such as India, in Asia. Through analyzing the basic environmental conditions in Asia from different perspectives, such as CO_2 emission, energy intensity, and comprehensive environmental performance, we find that West Asia generally has the best environmental quality among all parts of Asia, while the environmental performance in South Asia and Central Asia is much worse than in East and Southeast

Asia. Based on the current reality that environmental conditions differ a lot from country to country, we further investigate whether the quality of environmental governance contributes to creating such a difference.

We empirically demonstrate the significant impacts of governments' environmental expenditure on environmental quality for Asian countries, while the impact is insignificant for European countries. We highlight several conclusions for Asian countries as follows: (i) a greater scale of government expenditure on environmental protection contributes to a reduction of CO_2 emission and the promotion of energy efficiency; (ii) excessive economic growth is detrimental to the environment, and increasing GDP per capita leads to increasing CO_2 emission, decreasing energy efficiency, and decreasing comprehensive environmental performance; (iii) although FDI has no impact on CO_2 emission and the EPI, it exerts a significantly negative impact on energy intensity and thus has an effect on energy efficiency. For European countries, all estimations present similar conclusions, that is, a higher level of urbanization, greater trade openness, and a lower proportion of industrial value added are beneficial for the environment through lowering CO_2 emission, improving energy efficiency, and promoting environmental quality.

Compared with developed economies such as those in the European area, most Asian economies are still located in the left half of the Environmental Kuznets Curve, which indicates that rapid economic development of these developing and emerging countries would seriously exacerbate the environmental pollution problem. It is imperative that Asian emerging economies balance the pros and cons of both economic development and environmental conservation. Empirical estimation shows that foreign direct investment benefits the energy intensity in Asian countries and does not exert a detrimental effect on CO_2 emission and environmental quality, suggesting that Asian economies should implement relevant policies to attract more foreign investment. Although the level of urbanization, industrial value added, and trade openness don't have any significant impact on the environment in Asia, we observe from the case of Europe that these indicators may still exert a certain influence along with the development of the economy. Hence, we recommend that policymakers of Asian countries should lay a certain emphasis on these factors, especially for the share of industrial value added, whose enhancement may be potentially and significantly destructive to the environment.

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