How Climate Change Policy Affects the Economic Development in China

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Abstract. Climate change has become a global problem. China has also experienced obvious climate warming in recent decades, especially in arid areas, which has led to higher risks of wildfires and personal safety. Moreover, dry land absorbs more sunlight, converts soil moisture into water vapor, and takes heat away from the surface, thus making the temperature higher. These may hinder economic growth to a great extent. The Chinese government is aware of the existing problems in a timely manner and has actively taken measures to participate in international cooperation and issue relevant laws. China will continue to put into practice the vision of innovative, coordinated, green, open and inclusive development The Chinese government is committed to achieving sustainable development. In the short term, it is difficult to fundamentally change climate change caused by industrial production habits and energy use. But in the long term, with the transformation of the energy structure and the transformation of the mode of economic development, we believe that the negative impact of the climate problem on the economy will be gradually solved. This paper mainly explores the impact of climate change on China's economy, and how China takes measures to deal with these problems, and studies the effects of these policies and measures. Finally, we come to the conclusion that these measures may not be effective in the short term, but they are still very necessary, and they will play a role in the medium and long term.

Keywords: climate change policy, local government in China, renewable energy strategy, sustainable development.

1. Introduction

With the progress of technology comes the destruction of the environment. These harm to the environment causes the changes in climate. China has become a major emitter of carbon dioxide in the contemporary world. Population increase and urbanization have had a significant impact on climate change. China's economic activities and accompanying rapid industrialization are also major causes of climate change and pollution. Due to the hierarchical nature of China's government, traditional climate policy development and implementation are often organized through multilayered, top-down approaches. China's top-down government structure and vertical accountability plan have already significantly increased the country's pollution levels [1-3]. In this passage the first section will explore the causes and consequences of climate changes. Furthermore, our second section will introduce the policies about protecting environment and our suggestions. Then we analyse the effect of these policies in short-run and long-run. The last part is the conclusion, following with the references.

2. The Effect of Climate Change in China

2.1 Climate Change in China

B The Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) states that an increase in the concentrations of greenhouse gases (GHGs), such as carbon dioxide (CO2), methane (CH4), and nitrous oxide, is likely to blame for the majority of the global warming that has

been observed over the past 50 years (N2O) [4]. In relation to global warming, China's climate has changed significantly during the past century as well. such as glaciers, precipitation, harsh weather, and temperature increases. These phenomena have a significant impact on people's lives [5].

2.2 Causes of Climate Change

Since the reform and opening up, environmental issues have emerged in tandem with the economy's rapid growth. China has significantly increased its carbon emissions in the contemporary era, which is important for the United Nations Framework Convention on Climate Change. If China does nothing, its carbon emissions between 2004 and 2030 may quadruple those of other member nations, according to the International Energy Agency. Jost Wübbeke Overindulgent economic activity and the country's brisk urban and population growth are the primary causes of China's pollution and climate problems [2]. In this section of the essay, the main cause of climate change can be attributed to China's deplorable environmental situation [6].

2.3 The Consequences of Climate Change

A variety of unforeseen repercussions will result from the numerous climate changes. The fact that heat waves are occurring more frequently and with greater frequency, especially in dry locations, is one of the major effects of global warming since it increases the risk of wildfires. Droughts can have a greater negative influence on people's lives because they can cause already high temperatures to rise further because drier soils absorb more sunlight, which turns soil moisture into water vapour and conducts heat away from the surface. These can significantly impede economic growth. In China, the frequency of heat-related deaths has increased fourfold since 1990. Additionally, this number has grown to 26,800 individuals in 2019[7]. So, the rise of the mean annual air temperature not only will affect the development of China, but also causes problems on people’s safety.

Ecosystems were mostly affected by the change in precipitation. Resource levels will also be altered over the long term, either directly through changes in soil hydrodynamics or indirectly through the effects of soil water on the availability of other resources, as more extreme precipitation patterns represent permanent changes in terrestrial ecosystems rather than transitory changes (for example, those associated with disturbances) [8, 9]. Long-term modifications to these resources, whether they influence availability, timing, or both. Through physiological responses to the existing biota, population-level adaptability, and altered community structure, it can gradually change ecosystems in a hierarchical way. The majority of environmental changes are unpredictable and subtle, so it may be challenging to undo them once they have occurred.[10]

3. Government Policy

3.1 Policy on Steel and Coal Industries

According to the World Resources Institute, with more than one fifth of the world's glasshouse gases (GHG) emissions in 2011, China became one of the main sources of global warming [11].

In fact, since 1992, China has already started to take part in international conversations over the environment. China was also one of the first countries to sign on as a participant in the United Nations Framework Convention on Climate Change. However, China should meanwhile balance the loss from economic opportunities if China sticked to its environmental -friendly visions [5]. Taking into consideration the development status of the nation back to 1992, as a developing nation, China was trying to find a balance between economic development and environmental protection, and has therefore announced its general position in this regard that countries should act according to their specific needs, requirement and development status, with some common but some others differentiated responsibilities based on each country’s capabilities and conditions. The differentiated responsibilities that the developed and developing countries should undertake were manifested again at the 15th Conference of the Parties (COP15) in Copenhagen [12].

While other developing countries insisted on the priority of their country's development, during the conference, China agreed to cut its carbon intensity by 40 to 45 percent compared to its 2005 level in 2020. China was one of the few developing countries which were willing to shoulder such significant amount of environmental protection responsibilities [13]. In addition, China also vowed to expand its forest cover by 40 million hectares by 2020 compared to 2005 levels and to raise its forest stock by 1.3 billion cubic metres by 2020 compared to 2005 levels.

Following the carbon emission targets, industries' research and development, production, and manufacture should also enter a "greener" mode. The original Chinese economic model was built solely on the purpose of profit maximization, however, at a sacrifice of the environment and sustainability. The existing proportion of GDP contribution from manufacturing and heavy industries that emit significant pollutant stayed high in the current Chinese economy [1]. In order to respond to the call for energy saving and carbon emission reduction, the Chinese government has also begun managing overcapacity and pollutant emissions in various industries. For example, we've already seen significant reductions of capacity in the steel and coal industries. A decrease of 100 to 150 million metric tons (13 percent of present capacity) in annual crude steel capacity by 2020 was reported earlier this year [14,15]. Over the next three to five years, coal production will decrease by 500 million metric tons, or 9 percent of the existing capacity. Local governments are being required to provide information in order to construct capacity reduction strategies, and consequences have been outlined for noncompliance. As a consequence, steel output decreased by 1.5% during the first half of 2016 while coal production decreased by 8.5%. These trends have contributed to China's so-called "new normal" economic growth.

In terms of China's energy sector, the country's global energy consumption, which is mostly supported by fossil fuels, mandates the implementation of inter fuel substitution and a growth in the use of low-carbon technologies. Because of this, China must continue to reduce its reliance on coal and increase the use of other forms of energy. These activities contribute to China's goal of improving energy security and independence, in addition to cutting CO2 emissions; at the same time, they tackle health concerns that are induced by air pollution [15].

3.2 Policy on pollution control

Except the greenhouse effect, pollution which produced by the firms also has numerous negative impacts on the environment. And the thing that is most easily affected by the pollution is ecosystem. Chinese government firstly realized the importance of pollution was in 1970 and till 1979 people's environmental awareness were in enlightening stage. From 1979 to 1993, Chinese government started to set up some relative laws [16]. In 1982, the Chinese government set up the first edition of Interim Measures for collecting Pollutant Discharge Fees which is the China's first law deal with pollution. This policy used for 21 years and was abolished in 2003. That's because in 2003, the State Council of the People's Republic of China published the Regulations on the Administration of the collection and use of Pollutant Discharge Fees. Furthermore, after 14 years 'improvement the new policy was published in 2017 --Regulations of the People's Republic of China for the Implementation of the Environmental Protection Tax Law. This policy was set up to help the implement of Environmental Protection Tax Law of the People's Republic of China. All of these policies focused on reducing the emission of pollution.

Nowadays, Chins is relying on this new policy to control the emission of pollution. This policy limits the discharge capacity for every kind of firms and every kind of industrial pollution. When the government discharge more amount than the limited, they have to pay for the extra tax [17]. And for the firms that can recycle the pollution or use eco-friendly materials, the government will pay subsidies for them. So, China is using tax and subsidies to control the pollution.

However, we consider that the tax and subsidies couldn't fundamentally solve the problem of pollution. For example, some firms have a very low-price elasticity of demand and when the government put extra tax on them, they may transfer them to the consumers. This may not help a lot on reducing pollution but rise the cost of living for people. And that in some rural areas the

government can't monitor the emission of pollution of firms effectively, that makes them very hard to put extra tax. In our opinion, the Chinese government have to give more subsidies to the firms which innovate the eco-friendly materials. This not only can help reduce the pollution, but also help the growth of economy. What's more, the government can set up their own research department to innovate the new energy.

In conclusion, from 1970 to 2018 the Chinese government focused on improving the tax system for pollution. However, to eventually solve this problem we think the government should transfer to the innovation of new eco-friendly materials [18-20].

3.3 Policy on Imported Garbage

The garbage problem is a environmental problem cannot be neglected around the world. In China, how to deal with garbage is an environmental problem that cannot be ignored. In 2017, Chinese government designed the policy named Implementation plan on prohibiting foreign garbage from entering China and promoting the reform of solid waste import management system. This decree prohibits other countries from transporting waste products into China, thus is also China's great progress in environmental protection.

In the early stage of reform and opening up, due to the backwardness of the economy, China opened up to introduce garbage from European and American countries. Under the background that the environment protection laws were not perfect, and some local government neglected the environment problems in order to achieve economic improvement, large amount of imported garbage has been introduced into China. From 1990 to 1997, the garbage imported quantity per years increased from 1 million tons to 11 million tons, and this number increased into 33 million tons in 2005[21].

The slant of a large amount of foreign garbage can cause great damage to the environment. A lot of artificial products, especially the plastic, are dramatically made negative effect to the earth's environment. They take tens of thousands of years to decompose in the natural world. They have serious adverse effects on the ecological environment. These non-degradable wastes have seriously eroded the land and they destroyed the soil structure and the soil quality which make negative impact on agriculture [22]. Waste batteries contain virus and toxic substances which will cause serious harm to organisms, cause death of animals and plants, and even endanger the health of nearby residents.

Banning the import of foreign garbage is a major achievement in China's environmental protection. It greatly alleviates the deterioration of domestic environment due to garbage, and provide the people a environment that will not be poisoned by harmful substances spread abroad. Although there are still a lot of foreign garbage smuggled into China, the quantity has dropped significantly compared with the past. Nowadays, the Chinese designed policy to deal with problem brought by the imported garbage and treat the environment. In order to solve this problem thoroughly, we think that the government should continue to deal with the problem of garbage pollution.

4. The Effect of Policy on Economic

4.1 Long Run Effects

For solving environmental issue, the center government and local government has done something not only solve the environmental problem but also promote the economy. According to research in the past decade, the central government in China made strict policy at the beginning, in order to reduce the carbon emission. The central government gave some index to the local government and would collect the data of each province. For the reason to check is they have followed the policy completely [23]. (Translating a Global Issue into Local Priority, page 380~383)

According to the table below, China industry structure has developed improve a lot from past decades. From the table, we can see that from 2016 to 2030 in the future, Chinese government will focus more on electrical and electronic machinery which is highly energy preserve without using coal. At the same time, the major industries in China are not require in heavy energy, such as coal and oil.

Those industry such as automobile and electric machinery require less coal than plastic products [24,25]. (China's renewable energy strategy and industrial adjustment policy, page1392)

According to figure 2 and 3, China government put huge amount investment to wind and solar power, until 2018 there were more 18426 wind power and 189967 kilowatt of solar power production. These behaviors have changed is not only transport the energy all over the country but also promote the environmental conditions in the major cities those electric produce from solar and wind can be used around 72% among the cities.

Industry	CP	CP rank	EP	EP rank
Textile, Wearing Apparel and Accessories	9.66	5	6.39	5
Paper Products and Printing	4.64	7	3.87	7
Processing of Petroleum, Coking and Nuclear Fuel	1.30	9	2.22	8
Raw Chemical Materials and Chemical Products	1.40	8	1.67	9
Rubber and Plastics Products	9.55	6	6.14	6
Non-metallic Mineral Products	1.00	10	1.33	10
Basic Metals	0.71	11	1.11	11
Metal Products	10.88	4	6.83	4
General Purpose Machinery and Special Machinery	12.07	3	12.64	3
Automobiles and Transport Equipments	23.63	2	18.37	2
Electrical and Electronic Machinery	43.14	1	24.39	1

Note: CP mean value compared with EP mean rank.

Figure 1. The industry that requiring new energy

Year	Installation capacity of grid-connected wind power (MW)	Specific gravity of wind power installed (%)	Wind power generation(100 million kWh)	Proportion of wind power generation (%)
2005	106	0.20	16	0.07
2006	207	0.33	28	0.09
2007	420	0.58	57	0.17
2008	839	1.06	131	0.38
2009	1760	2.01	276	0.75
2010	2958	3.06	404	1.17
2011	4623	4.35	741	1.57
2012	6083	5.31	1004	2.02
2013	7652	6.08	1383	2.57
2014	9657	7.04	1598	2.85
2015	13075	8.57	1856	3.45
2016	14747	8.93	2409	3.99
2017	16400	9.19	3046	4.72
2018	18426	9.70	3660	5.23

Figure 2. Installation capacity and generation capacity of wind power Grid-connected

	Installed capacity of power generation	Solar energy	Proportion	Power generation	Solar energy	Proportion
Unit	10000 kW	10000 kW	%	100 million KWH	100 million KWH	%
2010	96641	26	0.03	42278	1	0.003
2011	106253	212	0.20	47306	6	0.01
2012	114676	341	0.30	49865	36	0.07
2013	125768	1589	1.26	53721	84	0.16
2014	137018	2486	1.81	56045	235	0.42
2015	152527	4218	2.77	57399	395	0.69
2016	165051	7631	4.62	60228	665	1.10
2017	178418	13042	7.31	64529	1178	1.83
2018	189967	17463	9.19	69940	1775	2.54

Figure 3. Installation capacity and power generation capacity of solar power generation.

More water is found in the west and less in the east, which describes China's water resources. Utilizing new energy sources significantly improves the situation. Large hydropower plants with installed capacities of 300,000 kilowatt or more generate 72% of the installed capacity and the yearly power output. Of this, super large hydropower stations with installed capacities of 1 million kilowatt or more account for more than 50% of the total installed capacity and annual power generation. In China, small hydropower plants make up 92.1% of the total number of plants. These stations are dispersed throughout China and are useful tools for addressing regional power and energy issues. By 2020, conventional hydropower plants will have an installed capacity of 340 million kilowatts, and their annual power generation capacity will be 1250 billion kilowatts [26]. Data indicated that the largest growth occurred between 2009 and 2016, indicating that the government invested more money during this time. (China's renewable energy strategy and industrial adjustment policy, page 1387)

Rank	Alternatives
1	Hydro
2	Nuclear
3	Wind
4	Geothermal
5	Solar PV
6	Gas
7	Oil
8	Biomass
9	Coal

Figure 4. The ranking of energy sources

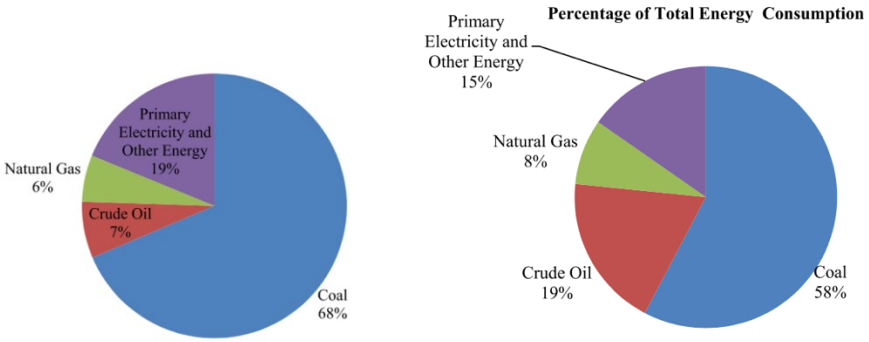

Figure 5. Percentage of total energy production and consumption in 2019.

The result of constructing of new energy is obvious, according to table 6, coal is the lowest ranking of the list of energy resources. The new energy, such as wind and hydro are on the top of the list. It is easily to be seen that in the past decade the achievement of energy innovation effect [27]. (China's renewable energy strategy and industrial adjustment policy, page 1393 and 1383) Some government sponsored research will release High-Tec resource consuming methods. In this manner, those documents which can be sold world widely will cover the money spend by the government. It will benefit the government in the long run.

4.2 Short Run Effects

In the short run, the carbon consumption cannot prevent due to the growth of economic, because of the producing of the industry and human's daily life are highly based on the usage of fuel, which will lead to a lot of carbon emission. Thus, forcing those factories to stop producing will slow down the economic and add pressure to the local government. Therefore, the central government putting the focuses on the growth of financial conditions and taxes of each local government, the mitigating of climate change will cut down the tax they will pay to the central government. At the same time, the lower of environmental governance will reduce the tourist industry. But it can be easily solved by usage of new energy [28,29]. (Climate-change policy/ why has so little been achieved, page 221~224)

5. Conclusion

Short-term, the existing reduction in consumption cannot prevent the expansion of the economy from causing a substantial increase in carbon emissions since industrial production and everyday human existence is strongly dependent on the use of fuel. Therefore, forcing these enterprises to cease production would impede economic growth and increase pressure on the local authorities. In the long term, the federal government and local government have taken action not just to fix the environmental issue but also to stimulate the economy in order to address it. The government will profit in the long term.

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