



Decoupling China's Carbon Emissions Increase from Economic Growth: An Economic Analysis and Policy Implications

ZHONGXIANG ZHANG *

University of Groningen, Groningen, The Netherlands

Summary. — As the world's second largest carbon emitter, China has long been criticized as a “free-rider” benefiting from other countries' efforts to reduce greenhouse gas emissions but not taking responsibility for its own emissions. China has been singled out as one of the major targets at the subsequent negotiations after the Kyoto meeting. By analyzing the historical contributions of interfuel switching, energy conservation, economic growth and population expansion to China's CO₂ emissions during 1980–97, this article clearly demonstrates that the above criticism is unjustified. Moreover, given the fact that the role of China is an issue of perennial concern at the international climate change negotiations, the article envisions some efforts and commitments that could be expected from China until its per capita income catches up with the level of middle-developed countries. By emphasizing the win-win strategies, these efforts and commitments are unlikely to jeopardize China's economic development and, at the same time, would give the country more leverage at the international climate change negotiations subsequent to the Buenos Aires meeting. © 2000 Elsevier Science Ltd. All rights reserved.

Key words — China, energy, carbon dioxide emissions, CGE model, environmental policy, climate change

1. INTRODUCTION

China is the world's most populous country and largest coal producer and consumer. At present, it contributes 13.5% of global carbon dioxide (CO₂) emissions, which makes it the world's second largest emitter of CO₂, after the United States, according to the World Energy Council (see Table 1). China's share in global CO₂ emissions is expected to increase and is likely to exceed that of the United States by 2020, if the current trend of economic development in China continues (World Bank, 1994; Energy Information Administration, 1999). In the face of a potentially serious global climate change problem, Annex I countries¹ finally committed themselves to legally binding emissions targets and timetables for reducing their greenhouse gas emissions in December 1997, at a meeting in Kyoto, Japan. Under the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC), these industrialized countries together must reduce their emissions of six greenhouse gases by at least 5% below 1990 levels over the commitment period 2008–2012, with the

European Union (EU), the United States and Japan required to reduce their emissions of such gases by 8%, 7% and 6% respectively (UNFCCC, 1997). The Protocol will become effective once it is ratified by at least 55 parties whose CO₂ emissions represent at least 55% of the total from Annex I countries in the year 1990.

Since China has made no concrete commitments, it has been criticized as a “free-rider” benefiting from other countries' efforts to abate greenhouse gas emissions but not taking responsibilities of its own. This article is devoted to examining whether the above criticism holds up by analyzing the historical contributions of interfuel switching, energy conservation, economic growth and population

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Table 1. *Shares of global CO₂ emissions and world population, 1996^a*

	Share of global CO ₂ emissions (%)	Share of the world population (%)
USA	25.0	4.7
EU-15	14.7	6.5
China	13.5	21.5
CIS Republics	10.2	5.0
Japan	5.6	2.2
India	3.6	16.3
Canada	2.1	0.5
Australia	1.3	0.3

^a Source: Jefferson (1997).

expansion to China's CO₂ emissions during 1980–97. Such an analysis clearly indicates that China has made a significant contribution to reducing global CO₂ emissions, although none of these carbon savings has resulted from conscious domestic climate mitigation policies. Moreover, given the fact that the role of China is an issue of perennial concern at the international climate change negotiations, the article envisions some plausible strategies that China might take subsequent to the Buenos Aires meeting.

2. HISTORICAL EVOLUTION OF CO₂ EMISSIONS IN CHINA

With more than 1.2 billion people, China is home to about 21.5% of the world's population (see Table 1) and has a large and rapidly growing economy, making the country an important player on the world's stage. Since launching its open-door policy and economic reform in late 1978, China has experienced spectacular economic growth, with its gross domestic product (GDP) increasing at the average annual rate of about 10% over 1978–97. Along with the rapid economic development, energy consumption rose from 571.4 million tons of coal equivalent (Mtce) in 1978 to 1440.0 Mtce in 1997. Currently, China consumes almost 1,400 million tons of coal a year, leading the world in both production and consumption of coal. As indicated in Figure 1, coal has accounted for about 75% of the total energy consumption over the past years. This share has remained stable after having increased from 70% in 1976, indicating that coal has fuelled much of China's economic

growth over the past two decades. Although China surpassed Russia to become the world's second largest energy producer and user in 1993, China's current per capita energy consumption of 1.165 tons of coal equivalent (tce) is about half the world's average, or only about 1/12th of that of the United States (see Table 3).

Accompanying the growth in fossil fuel use, China's CO₂ emissions have grown rapidly. The corresponding CO₂ emissions from fossil fuels in China over 1980–97 have been calculated based on fossil fuel consumption and by using the CO₂ emission coefficients given in Table 2 that are measured in tons of carbon per ton of coal equivalent (tC/tce) and are generally considered suitable for China. As shown in Table 3, the total CO₂ emissions in China rose from 358.60 million tons of carbon (MtC) in 1980 to 847.25 MtC in 1997, with an average annual growth rate of 5.2%. China thus ranks as the world's second largest CO₂ emitter only behind the United States. But on a per capita basis, China's CO₂ emissions of 0.685 tC in 1997 (see Table 3) were very low, only about half the world average.

The breakdown of CO₂ emissions by fuel is shown in Figure 2. Because of the coal-dominant structure of Chinese energy consumption, it is not surprising that coal predominates, accounting for 81.3% of the total emissions in 1997. This share has remained almost unchanged over the past two decades.

3. THE CONTRIBUTIONS OF CO₂ EMISSIONS IN CHINA

Let us now examine the contributions of interfuel switching, energy conservation, economic growth and population expansion to China's CO₂ emissions over the past 17 years.

CO₂ emissions can be decomposed as follows:²

$$C = \left(\frac{C}{FEC} \right) \cdot \left(\frac{FEC}{TEC} \right) \cdot \left(\frac{TEC}{GDP} \right) \cdot \left(\frac{GDP}{POP} \right) \cdot POP,$$

where C is the amount of CO₂ emissions, FEC is the total carbon-based fossil fuel consumption, TEC is the total commercial energy consumption, GDP is the gross domestic product, and POP is the population.

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