



Natural gas consumption and economic development in China and Japan: An empirical examination of the Asian context[☆]



Fumitaka Furuoka^{*}

Asia-Europe Institute, University of Malaya, 50603 Kuala Lumpur, Malaysia

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ABSTRACT

This paper examined the relationship between natural gas consumption and economic development in two largest natural gas consumers in Asia, namely, China and Japan for the period of 1980–2012. It used the autoregressive distributed lags (ARDL) method for the empirical analysis. The findings revealed some similarities in the natural gas consumption and economic development nexus in China and Japan. Thus, a cointegration relationship between natural gas consumption and economic development was found to exist both in China and Japan. However, there was an important difference in the findings. In the case of China, the findings indicated the existence of a unidirectional causality from natural gas consumption to economic development, which was in line with the growth hypothesis. In Japan, there was a bidirectional causality between natural gas consumption and economic development, which supported the feedback hypothesis.

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1. Introduction

Natural gas has been seen as a promising alternative energy source of the future. As its consumption is rapidly expanding, natural gas has become a new focus of the global energy market [1,2]. There are three main reasons to consider natural gas as a desirable alternative energy source. First of all, it tends to produce fewer carbon dioxide emissions than other fossil fuels, such as coal and oil. Secondly, natural gas is a less controversial energy source than nuclear energy. Thirdly, there is a change in the perception concerning the availability of natural gas [3]. In a sense, natural gas

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^{*}Tel.: +60 3 7967 4645; fax: +60 3 7954 0799.

E-mail addresses: fumitaka@um.edu.my, fumitakamy@gmail.com

could be seen as a “bridge” in the transition period from a carbon-intensive energy system to a sustainable and environmentally friendly one [4]. Therefore, there is little wonder why many countries, including China and Japan, are moving toward increasing their consumptions of natural gas. As this trend is gaining momentum, the global natural gas consumption is rapidly expanding [3,5,6] and the annual growth is expected to exceed 10 percent between 2007 and 2035 [6].

Against such a backdrop, researchers have shown a considerable interest toward examining the relationship between natural gas consumption and economic development. However, the findings from previous studies are not conclusive [6] and a systematic empirical inquires on the gas–development nexus are lacking [2]. Therefore, this paper chooses China and Japan, to examine the relationship between natural gas consumption and economic development for the period of 1980–2012. For the purpose of

empirical analysis, the paper uses the autoregressive distributed lags (ARDL) method [7].

China and Japan were selected as case studies mainly because these countries are among the world's major consumers of natural gas. According to the EIA [8], China is the fourth largest natural gas consumers in the world. In 2012, it consumed 5.1 trillion cubic feet of natural gas and its share of the world natural gas consumption was 4.3 percent. Japan as the fifth largest natural gas consumer utilized 4.6 trillion cubic feet of natural gas in 2012, and its global share was 3.8 percent [8].² Furthermore, China and Japan are the dominant consumers of natural gas in Asia. The Asian region has emerged as one of the largest and fast growing markets for natural gas. The region's share in the global natural gas consumption was 10.4 percent in 2000; it increased to 12.1 percent in 2005, before reaching 16.3 percent in 2010 [8]. In 2012, Asian countries jointly utilized approximately 21 trillion cubic feet of natural gas or 17.5 percent of the global share; China's share was 24.6 percent while Japan's share was 21.9 percent. In other words, the two countries accounted for approximately half of Asia's total consumption of natural gas.

Besides their massive natural gas consumptions, there are other specific reasons as to why China and Japan are interesting cases for an empirical analysis of the natural gas consumption and economic development nexus. Firstly, the consumption of natural gas in these countries has been growing. Fig. 1 offers a graphical representation of the gas consumption patterns in China and Japan for the period of 1980–2012. As seen in the figure, in Japan, the increase in natural gas consumption proceeded in a steady way throughout the 1980s, 1990s and 2000s. Following the nuclear plant accident in 2011, Japan's consumption of natural gas expanded rapidly from 3.84 trillion cubic feet in 2010, to 4.46 trillion cubic feet in 2011, and to 4.66 trillion cubic feet in 2012. In China, the pattern was different. In the 1980s and 1990s, there was almost no increase in natural gas consumption. During the 2000s, the consumption of this energy source increased four times and reached 5.18 trillion cubic feet in 2012 [8].

Secondly, China and Japan are both economic superpowers. China emerged as the “world's factory” in the 1980s and since then the country's status and role in the world economy has been rapidly expanding [9]. According to the World Bank [10], China is the world's second largest economic power in terms of national income; in 2013, its Gross Domestic Product (GDP) amounted to US\$9240 billion. Japan emerged as a regional economic power in the 1960s. Despite a prolonged economic slowdown since the 1990s, the country still plays a leading economic role in Asia through engaging in the international trade, investment and foreign aid activities [11]. At the same time, Japan remains the world's third largest economic power and its GDP amounted to US \$4919 billion in 2013 [10].³ One of the aims of the current comparative study is to explore whether there have been similarities in the relationship between natural gas consumption and economic development in China and Japan.

Thirdly, there were discrepancies in the relationships between natural gas consumption and economic development in China and Japan. The gas consumption and economic development nexus in China and Japan is graphically represented in Fig. 2(a) and (b), respectively. As can be seen in Fig. 2(b), Japan's consumption of natural gas tended to increase more or less proportionally to the level of the country's national income. By contrast, China

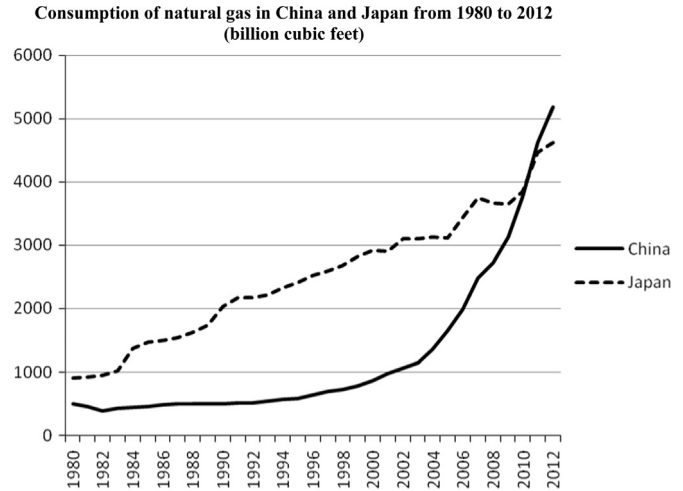


Fig. 1. Consumption of natural gas in China and Japan from 1980 to 2012 (billion cubic feet). Source: EIA [8].

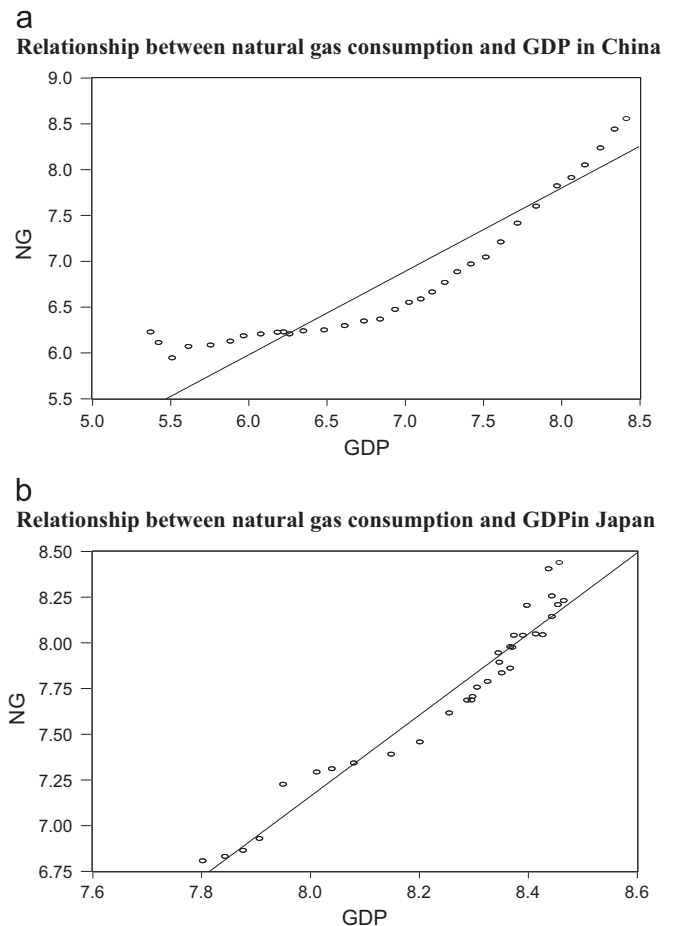


Fig. 2. (a) Relationship between natural gas consumption and GDP in China. Source: EIA [8] and World Bank [10]. (b) Relationship between natural gas consumption and GDP in Japan. Source: EIA [8] and World Bank [10].

experienced under-consumption of natural gas until the beginning of the 2000s, after which the country's utilization of natural gas grew very rapidly. Therefore, the present study aims to explore the differences in the relationships between economic development and natural gas consumption in China and Japan.

In sum, the main objective of the current study is to empirically examine the gas–development nexus in China and Japan. This

² According to the Energy Information Authority [8], the world consumption of natural gas amounted to 120 trillion cubic feet in 2012, and the top five largest consumers were the United States, Russia, Iran, China and Japan.

³ According to the World Bank [10], the world GDP amounted to US\$75,612 billion in 2013, and the top five economic powers were the United States, China, Japan, Germany and France.

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