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Energy productivity and Chinese local officials' promotions: Evidence from provincial governors

Xiude Chen [a], Quande Qin [b,c,d,*], Y.-M. Wei [c,d]

[a] School of Management, Guangdong University of Technology, Guangzhou 510520, China
[b] Department of Management Science, Shenzhen University, Shenzhen 518060, China
[c] Center for Energy and Environmental Policy Research, Beijing Institute of Technology, Beijing 100081, China
[d] School of Management and Economics, Beijing Institute of Technology, Beijing 100081, China

HIGHLIGHTS

- The data of position changes for China's provincial governors during 1978–2012 are utilized.
- Energy productivity has a positive impact on provincial governors' promotion in China.
- Political incentive is an important driver of the improvement in China's energy productivity.
- The correlation between energy productivity and local officials' promotions was evolved.

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ABSTRACT

Improving energy productivity is one of the most cost-effective ways to achieve a sustainable development target. The existing literature has shown some factors that have driven the improvement in China's energy productivity. However, these studies do little to tackle the role of Chinese local officials. Political promotions can be seen as the most important career incentive for Chinese local officials. Hence, we intend to study whether energy productivity affects Chinese local officials' promotions in this paper. The data of position changes for the 31 provincial governors during 1978-2012 are utilized. We adopted probit models to empirically examine the correlation between provincial governors' political promotions and energy productivity. The empirical results demonstrate that (1) energy productivity has a significantly positive impact on provincial governors' political promotions in China, meaning that the provincial governors have the momentum to improve energy productivity; and (2) the effect of energy productivity on provincial governors' political promotions has evolved, dynamically changing along with the transformation of the economic growth mode and the adjustment of the local officials' promotion mechanism. The results are helpful in understanding the drivers of the improvement in China's energy productivity and provide insightful implications for conducting energy policy in China.

1. Introduction

Since the implementation of the reform and opening-up policies, China's economic reforms have resulted in spectacular growth. The gross domestic product (GDP) has increased from 364.52 billion RMB in 1978 to 51.93 trillion RMB in 2012, with an average annual growth of 9.97%.[1] Meanwhile, China's energy consumption is also exhibiting a rapid growth trend. According to the "China Statistical Yearbook 1981–2013", China's total energy consumption was 57,144 ten-thousand tons of standard coal in 1978 but reached to 361,732 ten-thousand tons of standard coal in 2012. Based on the data in BP's "Statistical Review of World Energy 2011", China consumed 20.3% of the world's energy, exceeding the 19% rate of the US, and became the world's largest consumer of energy (BP, 2011). It is expected that China's energy demand will increase in the future, putting enormous strain on China's economy and the environment. Under these circumstances, it is imperative for China to improve its energy efficiency. Energy efficiency growth has at least two beneficial effects on social and economic development. First, it contributes to reducing carbon dioxide emissions without necessarily increasing energy consumption. Second, it provides national energy security benefits

* Corresponding author at: Department of Management Science, Shenzhen University, Shenzhen 518060, China.
E-mail addresses: vinkchen@sina.com (X. Chen), qinquande@gmail.com (Q. Qin), wei@bit.edu.cn (Y.-M. Wei).

[1] Data is from the "China Statistical Yearbook (1981–2013)".

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during the process of economic growth.

Energy productivity, the inverse of energy intensity, is defined as the ratio of output divided by energy consumption (Patterson, 1996; Han et al., 2007; Miketa and Mulder, 2005; Dimitropoulos, 2007). Generally, energy productivity can be seen as a useful indicator for understanding the energy efficiency of an industry or an economy (Patterson, 1996; Hu and Wang, 2006; Chang and Hu, 2010). For all governments, improving energy productivity is an import way to maximize the economic welfare extracted from the energy system. Perhaps, nowhere else in the world is the issue more salient than in China. China has experienced a steady increase in energy productivity from the onset of economic reform in late 1970 s (Han et al., 2007; Chang and Hu, 2010). Data from the China Center for Economic Research (CCER) database demonstrates that the average energy consumption elasticity during 1978–2012 was approximately 0.56, which was less than 1 and further decreased to approximately 0.5 in the most recent ten years. What is driving the increase in China's energy productivity? In previous studies, the decomposition approach was widely employed. Some factors that have affected China's energy productivity have been found. These factors include sectoral adjustments, energy prices, technological progress, energy efficiency, structural shifts, the energy consumption structure, foreign direct investment and energy use technology (Sinton and Levine, 1994; Patterson, 1996; Garbaccio et al., 1999; Fisher-Vanden et al., 2004; Fisher-Vanden et al., 2006; Hang and Tu, 2007; Liao et al., 2007; Fan et al., 2007; Ma and Stern, 2008; Chai et al., 2009; Feng et al., 2009; Chang and Hu, 2010; Wang, 2011; Elliott et al., 2013; Lin and Du, 2014). The abovementioned literature has important implications for our understanding of the dynamic evolution of China's energy productivity.

Many empirical results demonstrated that the political incentives for local officials constitute a major key to understanding economic performance in China (Bo, 1996; Zhou, 2004; Li and Zhou, 2005; Zhang and Gao, 2008). Like politicians elsewhere, Chinese local officials care most about their political future. Zhuravskaya (2000) and Bardhan (2006) suggested that local official governance has brought about differences in economic development among Russia, India and China since the 1990s. Su et al., (2012) and Zhang and Gao (2008) found that China's success in economic development was due to local officials competing for economic growth. It had long been assumed that local GDP growth was the main yardstick for the central government for appraising local officials' performance (Chen et al., 2005; Li and Zhou, 2005). China has a regionally decentralized authoritarian system, which is characterized as a combination of political centralization and economic regional decentralization (Xu, 2011; Wan et al., 2015). Actually, local officials hold the ultimate right to choose the mode of economic growth (Li and Zhou, 2005). In this paper, we want to examine whether local officials have the incentive to improve energy productivity.

It is assumed that local officials' promotion incentives have been playing a vital role in Chinese economic development. To encourage Chinese local officials to focus on energy productivity, the central government should take it as an assessment indicator. In fact, the Chinese government has enacted or amended a number of laws and regulations focused on energy saving and emission reduction since the reform and opening-up, such as the "Provisional Regulations on the Control of Energy Conservation (1986)" and "Comprehensive Work Program of Energy Saving and Emission Reduction (2007)". From a policy point of view, energy conservation work conducted by local government officials should be integrated into the assessment of the local officials' political performance alongside output growth. If energy productivity became an important criterion for official promotion, career-minded officials would try to excel in tournament-like competitions. The incentive for local officials is crucial for improving energy productivity. Does energy performance really affect the political promotions of Chinese local officials? To the best of our knowledge, there exist few studies in the literature that examined the question. In this paper, we collected data of position changes for the 31 provincial governors during 1978–2012 and utilized a probit model to study whether energy productivity does matter for provincial governors' political promotions. This paper focuses on the effects of energy productivity on the likelihood of the promotion of local officials. This paper argues that energy productivity has a stronger impact on the likelihood of promotion of provincial governors. Performance in energy productivity correlated positively with the probability of promotion during local officials' tenure, and the correlation has gradually evolved.

The remainder of this paper is organized as follows. Section 2 explains the probit method. Section 3 introduces the variables and data. In Section 4, we present the empirical results and analysis. The conclusions are drawn in Section 5.

2. Probit method

A probit model is employed to handle a regression problem where the dependent variable can take only two values (Ai and Norton, 2003). The purpose of the model is to estimate the probability that an observation with particular characteristics will fall into a specific category. In this paper, the probit model is utilized to examine whether the performance of energy productivity during an official's tenure affects the official's promotion.

Assume the central government assesses local officials based on a series of factors x_i and obtains a score y_i^*. Whether a local official should be promoted depends entirely on the relative size of y_i^*. Further assume there is a linear functional relationship between the y_i^* and x_i as formula (1) describes:

$$y_i^* = x_i\beta + \varepsilon_i \tag{1}$$

where ε_i represents an independent and identically distributed random error term. β represents the coefficient of assessment factors x_i. y_i^* could not be directly observed, but we could use the appointment and removal of local officials as an indirect reflection indicator.

Assume y_i represents the appointment and removal results of local officials, which is a dummy variable. When a local official obtains a promotion, y_i is equal to 1; otherwise, y_i is equal to 0. Let us further assume there is assessment score threshold γ that determines whether a local official should obtain a promotion; then,

$$y_i = \begin{cases} 1 & if y^* > \gamma \\ 0 & if y^* \le \gamma \end{cases} \tag{2}$$

Thus, we can employ the probit model to analyze the relationship between the assessment indicator x_i and local officials' promotions y_i. In formula (2), if x_i includes a constant component, γ could be arbitrary. The specific probit model can be set as follows:

$$y_i = \mathrm{I}(x_i\beta > \gamma) \tag{3}$$

where $I(\bullet)$ is the indicator function.

We can determine the relationship between various assessment factors and local officials' promotions according to estimation of the parameter β and its significance. For example, if the estimated parameter of energy productivity is significantly positive, that indicates that the energy productivity has a significant positive impact on the probability of local officials' promotions. However, the estimated parameter β of the probit model can