



The uneven development of wind power in China: Determinants and the role of supporting policies



Fang Xia^a, Feng Song^{b,*}

^a Research Institute for Global Value Chains, University of International Business and Economics, China

^b School of Economics, Renmin University of China, China

ARTICLE INFO

Article history:

Received 15 February 2016

Received in revised form 5 August 2017

Accepted 8 August 2017

Available online 18 August 2017

JEL classification:

Q42

Q48

R11

Keywords:

Wind power

Agglomeration effect

Feed-in-tariff policy

ABSTRACT

We apply a partial adjustment model to investigate the driving factors of the regional disparity of China's wind power development. We have three major findings. First, similar to many industries, wind power shows an agglomeration effect, that is, existing installed capacity attracts new addition of capacity. Second, demand factors including both local demand, indicated by variables in the local economy, and demand outside the region, indicated by transmission capacity, do not significantly affect the location choice of wind power farms. Lastly, governmental supporting measures have heterogeneous effects on different regions. They are most effective in wind resource rich regions but have little impact in other regions.

© 2017 Elsevier B.V. All rights reserved.

1. Introduction

To reduce the reliance on fossil fuel based energy and increase energy independence, the Chinese government has promoted renewable energy including wind power in recent years. China has rich wind resources, as the technical potential for wind energy exceeds 5500 GW per year (China Meteorological Administration, 2014). Driven by the declining cost as well as the supportive policies, wind power capacity in China has grown substantially since the early 2000s and now ranks first in the world, with 76,241 installed wind turbines and cumulative capacity reaching 115 GW in 2014.

Meanwhile, China's wind power development shows dramatic regional disparity. Although almost all provinces have hosted investments in the wind power industry since 2010, capacity heavily concentrates in the western and northern part of China. Fig. 1 illustrates the provincial distribution of the cumulative installed wind power capacity in 2015. Six provinces (Inner Mongolia, Xinjiang, Hebei, Gansu, Liaoning and Heilongjiang) account for over half the wind power capacity.

He and Kammen (2014) estimate that wind capacity potential varies greatly at the provincial level, from <1 GW to near 600 GW, and that wind conditions are notably favorable over extensive regions of northern China (Inner Mongolia, Heilongjiang, Jilin, and Liaoning) and in parts of the west (Tibet, Xinjiang, Qinghai, and Gansu). However, the

vast variation of regional wind power development cannot be fully explained by the uneven distribution of wind resources across regions. Even in wind resource rich provinces, the actual installed capacity relative to the potential capacity varies greatly. As shown in Table 1, Guangxi and Shaanxi have similar wind power potential but the installed capacity in Shaanxi is more than three times that of Guangxi. The ratio of exploited wind resources relative to potential wind resources ranges from 0 to 375%. Even for the top ten wind rich provinces, this ratio ranges from 0.39% to 5.56%. What factors drive the uneven distribution of wind power development?

In this paper, we investigate the drivers of the large spatial and temporal variation in wind power development in China, which is important for better evaluating wind power potential and for optimizing the industrial distribution. We apply Chow's (1967) partial adjustment model to analyze Chinese county-level wind power data from 2004 to 2011. It assumes there exists an equilibrium or desirable wind power capacity level in a region, which is determined by a number of factors affecting the relative profitability of wind farms. The speed of converging to the equilibrium is determined by the gap between existing capacity and equilibrium capacity. By taking this approach, we are able to both study regional distribution of wind power development and evaluate the effect of governmental supporting policies in a consistent way.

China's wind power development has attracted academic interest in recent years. Early literature discusses the barriers to obtaining a good return on an investment in wind capacity (Cyranoski, 2009; Han et al., 2009; Liu and Kokko, 2010). A few studies analyze the effect of

* Corresponding author.

E-mail address: songfeng@ruc.edu.cn (F. Song).

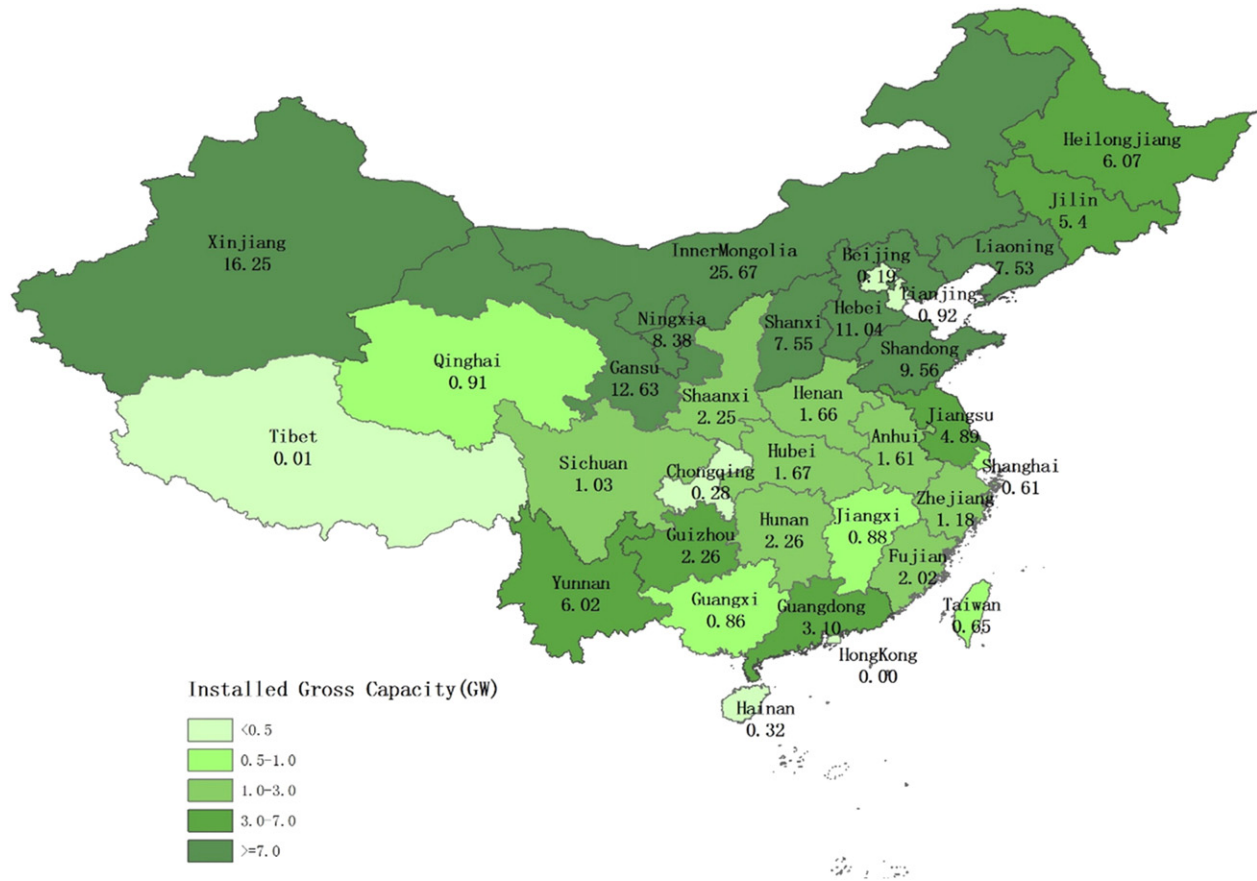


Fig. 1. Provincial installed capacity of wind power in 2015 (in GW).

supportive policies on wind power industry development. [Hu et al. \(2013\)](#) review China's feed-in-tariff policy and compare it with that of several European countries. [Zhang et al. \(2013\)](#) analyze how political and institutional factors have determined the relative successes and failures of China's wind power policy over the period 2005–2011. Several papers ([Qiu and Anadon, 2012](#); [Qiu et al., 2013](#)) investigate what factors contribute to the continuing decline in the cost of wind power in China. Recently, several studies have explored the cause of a large gap between the installed wind capacity and the actual generation of wind power ([Zhao et al., 2012](#); [Fang et al., 2012](#); [Zhao et al., 2013](#); [Liu, 2013](#)). Most existing literature focusing on China consists of case studies and exploratory analyses, with very few empirical investigations.

Studies on other countries' wind power development are also closely related to our paper. Several papers analyze the effect of Renewable Portfolio Standards (RPS) on wind power development in the United States ([Adelaja and Hailu, 2007](#); [Menz and Vachon, 2006](#)). Employing a panel Tobit model and a county-level wind power dataset, [Hitaj \(2013\)](#) analyzes the drivers of wind power development in the United States and concludes that governmental policies, such as production incentives, play a significant role in wind power development, both by providing financial support and by improving physical and procedural access. [Schmidt et al. \(2013\)](#) compares the effects of the fixed and premium based feed-in tariffs on the choice of wind turbine locations in Austria.

This paper builds on the existing literature by providing a quantitative analysis of the determinants of wind power development in China. To our knowledge, this is the first paper to analyze the large spatial and temporal variation of China's wind development using county-level data. In addition, we evaluate how governmental policies contribute to the (uneven) development of China's wind power industry. Although it has been argued that policies have played a significant role in

accelerating the development of wind power in China ([Zhao et al., 2012](#); [Hu et al., 2013](#)), few studies have empirically evaluated its effect. These are the literature gaps we attempt to fill in this paper.

2. Wind power supporting policies in China

The dramatic development of China's wind energy sector since the early 2000s has been largely driven by government policies as wind power in China is not cost competitive with conventional power such as coal-fire power or hydropower ([International Renewable Energy Agency, 2012](#); [Liu et al., 2015](#)). The Renewable Energy Law approved in 2005 serves as the principal framework for development of renewable energy, and numerous regulations and policies have been issued in connection with this law. We summarize three important policies that arguably stimulate the rapid development of wind power in China.

2.1. Mandatory access to grid

Due to the fact that most renewable energy technologies are uncompetitive with conventional energy technologies, grid companies tend to resist the introduction of intermittent renewable energy sources such as wind power, which was a dramatic obstacles for early renewable energy investment. The Renewable Energy Law explicitly requires grid companies to purchase the full amount of renewable energy produced by registered producers. The provision of mandatory access to grid is expected to reduce the transaction cost and raise financial credibility of renewable energy projects, and thus promote the development of renewable energy.

Download English Version:

<https://daneshyari.com/en/article/5063575>

Download Persian Version:

<https://daneshyari.com/article/5063575>

[Daneshyari.com](https://daneshyari.com)