Growth Sources of Green Economy and Energy consumption in China: New Evidence Accounting for Heterogeneous Regimes

Guanchun Liu,[a] Yuanyuan Liu,[b] and Chien-Chiang Lee[c]

Since the reform and opening up in 1978, China has experienced rapid growth for nearly three decades with an average rate 10%, and especially the amount of energy consumption has been rising dramatically. However, China has entered a 'new normal' stage since 2012, at which the growth rate continuously drops and the relative importance of the tertiary industry keeps increasing. Under this new background, it is essential to reestimate the growth sources of green economy in China, and especially investigate whether the importance of energy consumption varies across industries and years.

In this paper, we propose an extended Solow growth model accounting for regime heterogeneity, which is incorporated via a finite mixture model that permits multiple growth regimes and regime switch over time. The framework decomposes growth into two components, namely, green total factor productivity and factor endowment. In particular, we classify Chinese provinces on the basis of the similarity of the conditional distribution of real GDP. More importantly, the number of multiple green growth regimes is endogenously determined and regime-specific output elasticities for production factors are estimated.

Based on a panel data of three industries for 29 Chinese provinces over 2000–2015, our empirical analysis proceeds with four main questions: (i) investigating whether the same industry across provinces follows a universal green growth path; (ii) estimating the green growth sources of different industries; (iii) assessing the importance of energy consumption across industries, and (iv) exploring the decomposition bias in traditional methods that do not account for regime heterogeneity.

The empirical results show that a finite mixture model with three regimes is best to describe the green production technology of each industry for Chinese provinces. Specifically, some provinces switch their regimes over time, while the others maintain the same regime. Furthermore, when accounting for regime heterogeneity in the Solow decomposition framework, we observe that the contribution rate of factor endowment (green total factor productivity) is overestimated (underestimated) in traditional methods. With respect to the role of energy consumption, it is overestimated in traditional methods for the primary and tertiary industries, but underestimated for the secondary industry. More importantly, the reliance of China's over economy as well as the secondary and tertiary industries on energy consumption tends to decline during the period 2000–2015.

Our work is related to a number of different literatures. First, this paper contributes to the researches on the growth sources of China's green economy. We extend the data sample to 2015 that includes the 'new normal' stage after 2012, whereas most similar studies generally examine the question before 2000 and especially ignore energy consumption in the production function. Second, this paper connects to the studies on accounting for regime heterogeneity. Differing from traditional works, we overcome the issue using a finite mixture model based on the similarity of the conditional

a Lingnan College, Sun Yat-sen University, Guangzhou 510275, China. Email: liuguanchun1@126.com.

b School of Economics, Fudan University, Shanghai 200433, China. Email: liuyuanyuan123@126.com.

c Corresponding author. Research Center of the Central China for Economic and Social Development, Nanchang University. School of Economics and Management, Nanchang University, Nanchang 330031, China. E-mail: cclee6101@gmail.com.

distribution of real GDP. Third, this paper relates to the empirical literature that applies the latent class models or finite mixture models. We permit Chinese provinces to switch regime over time, while most previous researches assume a constant growth regime for each economy.