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# Convergence and transitional dynamics of China's industrial output: A county-level study using a new framework of distribution dynamics analysis

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## ABSTRACT

Many scholars have argued that the huge increase in regional inequality in China can be attributed greatly to the disparity in industrialization. This paper contributes to the literature by providing empirical evidence on the transitional dynamics of industrial output by employing a new framework of distribution dynamics analysis, namely, the mobility probability plot (MPP), and a county-level database made up of counties and county-level cities. The new framework can address several inadequacies of the traditional display tools used in the distribution dynamics literature. Stochastic kernel analyses are performed for the nation, the economic zones, and the provinces individually so as to provide an in-depth understanding of the evolution and convergence of industrial output. This study fills the gap in the literature and provides information on mobility of the county-level units, which can greatly aid the policy making process.

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## 1. Introduction

China has experienced dramatic economic growth since the initiation of economic reforms in 1978. The gross domestic product (GDP) of China increased from 365 billion yuan in 1978 to 51.89 trillion yuan in 2012, while GDP per capita in China increased from 381 yuan to 38,420 yuan (State Statistical Bureau, 2013). In that period, GDP per capita increased at an annual real rate of 8.8%, while the annual growth rate of GDP was 9.9%. The real growth rate of the primary sector in this period was 4.6%, a figure dwarfed by the growth rates of the secondary sector (11.5%) and the tertiary sector (10.9%).<sup>1</sup> The annual growth rate of GDP is very close to the growth rate of the secondary sector in that period, thus hinting there was a possible link between the two. It is widely postulated that industrialization has strongly promoted economic growth, for example, Yu (2012) claims that the impressive economic growth can be attributed mainly to the successes in structural transformation and industrial upgrading.

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<sup>1</sup> All the economic activities in China can be categorized into three strata of industries, namely, the primary industry, which refers to agriculture, forestry, animal husbandry and fishery and services in support of these industries; the secondary industry, which refers to mining and quarrying, manufacturing, production and supply of electricity, water and gas, and construction; and the tertiary industry, which refers to all other economic activities not included in the primary or secondary industries (State Statistical Bureau, 2013).

However, regional inequality in China also increased dramatically in that period. Basically, the increase in inequality can mainly be attributed to the extremely unbalanced industrial development in the country. Cheong and Wu (2012a) proved that the percentage contribution of inequality amongst the county-level units to overall regional inequality had increased gradually over time and had exceeded 60% in 2007. In another paper, Cheong and Wu (2014) showed that the secondary sector contributed more than 50% to overall inequality in 2010. These findings show that the inequality in industrial outputs amongst the county-level units is the crux of the problem of regional inequality in China. This finding is also demonstrated by Huang, Kuo, and Kao (2003) who showed that the disparity in industrial output (value-added) is the largest contributor to regional inequality. Given that an increase in inequality in China can exert adverse impacts on the well-being of the people (Klasen, 2009), the progress of poverty reduction (Fosu, 2009; Rupasingha & Goetz, 2007; Zhuang, 2008), the economic growth (Alesina & Perotti, 1996; Alesina & Rodrik, 1994; Deininger & Squire, 1998; Huang, Lin, & Yeh, 2009; Persson & Tabellini, 1994), and even social stability (Cheong & Wu, 2015). Therefore, it calls for a thorough examination of the disparity, evolution, and convergence of industrialization in China. However, most of the studies on inequality in industrial output have been based on provincial-level data, and thus the policy implications derived from these studies are valid for formulating policies at the provincial-level only. Hence, many scholars argue that it is necessary to include county-level or prefectural-level data in research (Akhmat & Bochun, 2010; Herrmann-Pillath, Kirchert, & Pan, 2002a, 2002b; Li & Wei, 2010; Wei, 1999, 2002; Wei & Fan, 2000; Wei & Kim, 2002; Wei & Ye, 2004, 2009; Yu & Wei, 2007), but because of the difficulty in data preparation, most of the studies are still confined to the use of provincial-level data. Even though a few studies have been conducted using county-level or prefectural-level data, they are plagued by the problems of a short time span (for only a particular year) and limited coverage (only for a few provinces).

Given that situation, the existing literature cannot provide policy makers with relevant county-level information on industrialization when looking at mitigating regional inequality. In the absence of this material, this study aims to fill the gap in the literature by examining the inequality of industrial output through performing county-level transitional dynamics analysis. The database used in this study is made up of counties and county-level cities in China and includes more than 20,000 county-level data from 1997 to 2010. To the best of the authors' knowledge, this is the most comprehensive research ever undertaken at the county level for investigating disparity and convergence of industrial output in China by using distribution analysis. Stochastic kernel analyses are carried out for the nation, the economic zones<sup>2</sup>, and the provinces individually so as to provide an in-depth understanding of the evolution and convergence of industrial output in China. Moreover, this paper also proposes a new analytical framework for interpreting mobility probability, which can be used in conjunction with a contour map or three-dimensional plot. The proposed new framework offers additional insights and greatly enhances the traditional distribution dynamics analysis (Quah, 1993a, 1993b, 1996a, 1996b, 1996c, 1997). By adopting the new framework, this study can also provide a comparison of the transitional dynamics of the four economic zones. This will reveal the effectiveness of regional development campaigns in mitigating regional inequality. Finally, this paper evaluates the possibility of convergence in industrial output for every individual province. The findings foster better understanding of the role of industrialization and provide relevant information for formulation of regional industrial policies in alleviating intra-provincial regional disparity.

The remainder of the article is organized as follows: Section 2 presents the literature review; Section 3 presents the data preparation procedure; Section 4 provides a discussion of the methodology and proposes a new framework of presentation for distribution dynamics analysis; empirical results are presented in Section 5; finally, conclusions and perspectives for future researches are provided in Section 6.

## 2. Literature review

Kuznets (1955) suggests that industrialization will lead to an increase in inequality in the early stages of economic development. His argument is widely accepted, and many researchers suggest that industrialization in China has exacerbated regional inequality (Golley, 2002; Kanbur & Zhang, 2005; Pradhan, 2009; Rozelle, 1994, 1996; Tsui, 2007, 1996; Wei, 1998; Yang, 2002). It is notable that in the early stage of economic reforms, the township and village enterprise (TVE) sector played a prominent role in industrialization in rural China, and many researchers found that the unequal development in that sector had led to an increase in regional inequality (Wan, 2004; Yao, 1997; Zhang, 1999). These studies all confirm that industrialization in China is positively correlated with inequality.

However, other researchers have focused on the study of inequality in industrial output and its impact on overall regional inequality. Huang et al. (2003) performed a decomposition of the Gini coefficient by using provincial data from 1991 to 2001, and they found that the inequality in the secondary industry sector was the primary contributor to the inequality in total regional economic development. This finding was supported by that of Cheong and Wu (2014), who showed that the inequality in the secondary industry sector was the principal contributor to regional inequality at all the spatial levels (namely, the provincial, economic zonal, inland-and-coastal, and national levels) during the period from 1997 to 2010. The authors even showed that national inequality in China could be lowered by half if industrialization was distributed evenly.

Although the importance of understanding inequality in industrial output is well established, no research has been conducted on the distribution dynamics of industrial output at the county level. In fact, many researchers have employed a distribution dynamics approach in studying convergence and evolution of different economic characteristics in China (He & Zhang, 2007; He, 2010;

<sup>2</sup> Before 2006, China was divided into three economic zones, namely, the eastern, central and western zones. The eastern zone is also termed as the 'coastal' region. The 'inland' region (some refer to it as the 'interior' region) is comprised of the central and western zones. However, in the Eleventh Five-Year Plan, the Chinese government started to divide China into four economic zones, namely, the eastern, central, western and the newly added northeastern zones.

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