2020

36th IARIW General Conference

The Measurement and Its Inequality of Innovation Capability in China: A Provincial-Level Analysis

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In recent years, both the central government and local governments have pursued ambitious innovation policies intending to foster economic growth with high quality in China. The question is whether these policies accrue 100% to our benefit. While emphasizing and highlighting the irreplaceable role of innovation in economic development, we must recognize the main contradiction in China at present, that is, what we now face is the contradiction between unbalanced and inadequate development and the people's ever-growing needs for a better life. The innovation capability is closely related to "unbalanced and inadequate development." The productivity among regions is not fully and equally developed, and the human and material endowments for innovation are closing to and accumulating in economically developed regions, which further triggering and expanding the imbalance of innovation development among regions.

Much attention has been focused on the relation between innovation and productivity. Both Schumpeter's Technical Innovation Theory and Romer's Theory of Endogenous Growth emphasize that innovation/technological progress is the key factor to maintain economic growth. A series of follow-up studies also set the objective function based on efficiency maximization. However, relatively little attention has been paid to the inequality of innovation capability. The main objective of this study is to fill the gap of research on inequality innovation capability, and try to contribute in the following aspects:

Firstly, based on the dual consideration of the connotation of innovation connotation and the feasibility of actual measurement, Research and Development (R&D) capital is proposed to examine China's innovation capability more scientifically and rationally.

Secondly, based on the dual consideration of the characteristics of innovation capability and the attributes of measurement methods, the Concentration Index (CI) is used to measure the unequal innovation capability related to the economic level, expanding the traditional inequality indexes (e.g., Gini coefficient).

Thirdly, based on the dual consideration of inequality measurement and policy-oriented demand, using the dynamic decomposition method proposed by Allanson et al. (2010). The change of provincial innovation capacity inequality is decomposed into "regional economic growth effect"

and "the cumulative effect of innovation capability," and the latter is further decomposed into "distribution effect of innovation capability" and "the scale factor of innovation capability."

Besides, the time series of this study is from 1978 to 2016, trying to explore the development of innovation capability during the nearly 40 years of Reform and Opening-Up in China. The results show that:

(1) In the nearly 40 years of Reform and Opening-up, China's innovation capability has been gradually improved, and the regional agglomeration effect has been remarkable. The innovation capability of Jiangsu, Guangdong, Beijing, Shanghai, Shandong, and Zhejiang are far ahead of other regions, and the gap has a trend of further expansion.

(2) From the results of the measurement of inequality, the one-dimensional inequality indexes, such as the Gini coefficient, show a downward trend in the early stage. But they have remained at a high level since 2000 and have rebounded in recent years, indicating that the inequality of provincial innovation capability in China is still high without significant releasing. The provincial innovation capability related to economy shows "pro-rich" inequality, that is, the economically developed areas have accumulated higher innovation capability. Since 1996, the "pro-rich" inequality has shown a rapid growth trend. The degree of correlation between the distribution and the level of provincial economic development has gradually increased. The concentration index is directly close to the Gini coefficient, which reflects the convergence of R&D capital accumulation and economic level in each province.

(3) From the results of dynamic decomposition, the contribution of regional economic growth effect to inequality has been turned negative, which indicates that the improvement of the regional economy, especially the location of regions with poor innovation capability, is conducive to reducing the inequality of innovation capability. The cumulative effect of innovation capability is more prominent to the aggravation of inequality. Although the distribution effect is weakened (consistent with the trend of Gini coefficient), its scale effect is significantly enhanced, especially in economically developed regions. A certain amount of R&D capital has been accumulated in the early period, and the mechanism of "best choice" promotes all kinds of innovation elements. It gradually forms a more superior and more competitive innovation environment, thereby expanding the scale of innovative products in the region and generating economies of scale. However, in the less developed regions, due to the poor market demand and profit drivers, the cumulative disadvantages of innovation are formed. If the corresponding measures are not taken, the innovation and disadvantaged areas will be placed in an even more vulnerable situation for a long time.

Our findings will have great significance in building an innovative country, especially for how to effectively narrow the regional innovation gap and regional innovation capability to promote coordinated development.