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中国粮食产量变化的时空格局与影响因素

Spatial-temporal characteristics and influencing factors of grain yield change in China

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中文摘要:

基于1990—2011年分省面板数据,应用均值、标准差与区位基尼系数揭示了中国粮食产量的阶段特征与主导类型,进而利用空间面板计量经济模型探讨了中国粮食产量变化的影响因素。结果表明:中国粮食产量变化可分为3个阶段,主要年份各粮食主导类型包含的省份存在较大差异;土地投入的影响由强转弱,劳动力依次表现为正显著、不显著与负显著,不同类型的资本投入存在迥异的影响效应;粮食产量同时受到农业结构调整、非农产业发展等宏观背景以及空间随机误差溢出效应的影响;不同主导类型的粮食产量变化机制存在差异,体现要素边际报酬递减、规模效应、政府调控等内在规律与外在因素的综合作用。该文揭示了全国及各主导类型的粮食产量波动原因及其作用规律,有助于确定各区域粮食增产的主要制约因素与提升途径,该研究为中央制定差别化的粮食生产支持政策提供参考。

英文摘要:

Abstract: Despite high attention to the stability and increase of grain production and market supply by Chinese government, grain yield in China has been undergoing a great fluctuation during the past decades, which could be a big challenge to national food security. This paper thus analyzes the spatial-temporal characteristics and influence factors of grain yield change in China since 1990 from the aspect of evolution stages and main types. Statistical indicators and spatial econometric models for panel data are introduced, which are supported by Geodata, ArcGIS, and Matlab software. It shows that the growing process of Chinese grain yield has three stages, namely stage 1990-1998, 1998-2003, and 2003-2011 respectively. Meanwhile, provinces in China can be categorized into three sets according to different supply-demand relationships, which are provinces with surplus grain (PGSG), provinces with balanced grain supply and demand (PBGSD), and provinces with insufficient grain supply (PIGS). The three separate types vary every year, with different provinces included each other. Roughly speaking, the grain production status of eastern provinces, central provinces, western provinces, and northeastern provinces is decreased, weakened, enhanced and strengthened respectively. In 2011, the PGSG, the PBGSD, and the PIGS distribute mainly at North, Middle, and South China respectively. Among all the factors that influence grain yield, the land factor has a significant positive impact, changing from strong to weak. It indicates grain production in China is increasingly dependent upon factors that contribute to per unit yield, such as technical progress, capital investment, etc. The labor factor brings an effect from positive significant to insignificant then negative significant, reflecting the change of agricultural surplus labor, rural labor structure, etc. The impact of different types of capital input varies as follows. Definitely, agricultural infrastructure investment, represented by irrigation facilities, has a strong positive effect. As a kind of labor saving capital investment, the total power of agricultural machinery brings about 'positive to negative and positive again' effect; the chemical fertilizer input, as a representative of agricultural materials, follows the law of diminishing returns to scale. Besides agricultural production factors, agricultural structure adjustment, non-agricultural industry development, and random error factors of neighboring provinces also influence the actual yield. As to the three separate types, the driving mechanism of grain yield change differs significantly, including the impact of agricultural production factors and that of macro environment. It is the mutual result of both internal law such as diminishing marginal returns and scale effect and external factors such as government regulation. Taking into account the above different driving mechanism, it will be meaningful to promote the regional division of grain production among the PGSG, the PBGSD, and the PIGS, to protect a large-scale arable land resource with a special priority to the project of arable land consolidation and protection in PGSG, to change the focal point of financial support and land consolidation to improve the efficiency of agricultural infrastructure, to solve the scarcity of agricultural labor by measures such as the cognizance of agricultural producers, and to promote agricultural mechanization with an emphasis to plain agricultural area, and which in all will help stabilize and increase grain yield in China.

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