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Abstract

Background: The main social contradictions in China have changed: the core concept is high quality development. Health care investment improves the health of residents and promotes regional economic growth.

Aims: To analyse the direct and indirect economic effects of health expenditure during 2012–2018 and to test whether China's investment in health care meets the requirements for high quality development.

Method: We selected spatial panel data reflecting the input and output of health resources. We used the knowledge production function and a model of spatial economics to conduct empirical analysis of 31 provinces to show the effects of health expenditure on economic growth.

Results: Economic development (LnGDP) was the dependent variable; explanatory variables included health financial input (LnHI), health personnel input (LnHR), health assets (LnCW) and health insurance expenditure (LnHIE). The regression coefficients for indirect, direct and total effects of LnHI were 0.4346, 0.0623 and 0.4970 respectively (all statistically significant). The direct effect coefficient of LnHR (0.3343) was statistically significant. The regression coefficients for the indirect and total effects were –0.6779 and –0.3436, respectively. The direct, indirect and total effect regression coefficients for LnCW and LnHIE were all statistically significant.

Conclusion: Both LnHI and LnHIE positively promote economic growth within provinces and in

neighbouring provinces, i.e. there are direct and indirect positive effects from investing in health care. Increasing the input of health care personnel can promote the economic growth of a province but not that of neighbouring provinces. Overall planning and coordinated development will facilitate high quality development and economic advancement.

Keywords: development; health expenditure; health economics health investment; China

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Introduction

Socialism with Chinese characteristics has entered a new era and the main social contradictions in China have changed (1). The core concept for development in this new era is high quality development, which is required to meet the growing needs of the people for a better life. For example, to mitigate the difficulty and expense incurred in seeing doctors and to satisfy the demand for high quality medical services, the quality and benefits of development must be vigorously improved. In 2018, China's total health expenditure reached 5.91 trillion yuan, compared to 1.75 trillion yuan in 2009, a 3.37-fold increase. From 2009 to 2018, total health expenditure per capita increased from 1314.26 yuan to 4237.0 yuan, a 3.22-fold increase (Table 1). Studies in other countries have shown that health care investment not only improves the health of residents but also promotes regional economic growth (2,3). Thus, we examined the economic impact of allocating health care resources in 31 provinces (cities) in China from the perspective of spatial correlation. We empirically analysed whether there is any spillover from the input of public health care resources.

Literature review

Overview

The relevant literature on the relationship between health care spending and economic growth can be classified into 2 competing claims: that health care spending promotes economic growth and that it hinders economic growth.

Public health care expenditure promotes economic growth

Health care spending can stimulate economic growth, according to Mushkin's hypothesis that health is a determinant of economic growth (4). According to this hypothesis, health is a type of capital. Thus, investment in health care can increase income levels and facilitate economic growth. Since health care is a core component of human capital investment, the accumulation of human capital is the main factor of the endogenous growth model. To accumulate human capital, innovative strategies (innovation) and health care policies are especially important. In this context, it is essential to form appropriate health care policies for both sustainable growth and the overall health of the population. Several prominent economists (Kleiman, Newhouse and Pueyo, among others) have offered theoretical and empirical evidence that shows that public health expenditure promotes economic growth (5–7). Wang, Naidu et al., Hatam et al., Aboubacar et al. and Wang et al. have pointed out that public health expenditure plays a certain role in promoting economic growth (8–12). Atilgan et al. estimated that a 1% increase in per-capita health expenditure leads to a 0.434% increase in the per-capita gross domestic product (GDP) (13). Aghion et al. found that investment in health care had a significant and positive impact on economic growth from 1940 to 1980, although they noted that this relationship tended to weaken after 1960 (14).

Health care investment hinders economic growth

In contrast, Barro constructed an endogenous growth model that showed that consumer expenditure hinders economic growth, whereas productive public expenditure plays a role in promoting it (15). According to this view, health care expenditure is only a consumer good and not an investment good. Thus, because of budget limitations, health is a reason for reducing expenditure in the public and private sectors. Many scholars have conducted similar studies. Finkelstein, Hall and Jones, Mehrara et al., Awaworyi et al. and Afawubo et al. used an array of research objects, methods and data and found that increasing investment in health care does not make a significant contribution to economic growth, and indeed may hinder or slow down economic growth in the long-term (16–20).

Summing up

In summary, scholars have not reached a consensus on the relationship between public health expenditure and economic growth. Most research relies exclusively on time-series or

cross-sectional data and empirical research, use of spatial panel models is rare. From the perspective of high quality development, on the one hand, we must take into account the characteristics of public goods invested in health care resources and consider the spatial relevance and heterogeneity of these resources. From the perspective of high-quality allocation, on the other hand, we must adopt new methods to study the input of health care resources and then reform the supply side and allocate these resources more efficiently.

In this study, we used an improved knowledge production function to consider health expenditure in 31 provinces in China. We combined this with an advanced spatial panel model to measure and estimate provincial spillover from health expenditure input (i.e. the indirect economic effects on neighbouring provinces) and whether health care investment promotes economic growth.

Model setting and measurement methods

Spatial Durbin model

The spatial Durbin model (SDM) considers the spatial autocorrelation of dependent variables and residuals. The model states that independent variables have spatial interactions with dependent variables:

where Y is the dependent variable; X is the explanatory variable; W1, W2 is the spatial weight matrix of n×n; ρ and λ are the spatial autoregressive coefficients; β is the regression coefficient; and ε is the random disturbance term. When W2 = 0, the SDM model can be simplified to a spatial lag model (SLM), where ρ indicates whether there is a significant spatial correlation between the units; when W1 = 0, the SDM model can be simplified to a spatial error model (SEM), where λ represents the error term and whether there is a significant spatial correlation.

Modelling ideas and variable description

According to the core idea of the endogenous economic growth model proposed by Lucas, we introduced health-related human capital (mainly determined by the variables of health care input) into the economic growth model.

The ordinary least squares model of health investment and economic growth in this study is as follows:

where: LnA is the constant term, i an t denote the region and time respectively, and the error term ε represents other factors that were observed to affect economic growth in the 31 provinces and cities. The description of the health variables in this study is shown in Table 2 .

We considered the impact of local health care input on economic growth; we also considered the impact of health care input on the economic growth of neighbouring provinces and cities according to the regional economic development level. The following SDM was thus adopted:

where: ui represents the regional effect, ωt represents the effect of time; both the SLM and the SEM in this study use the maximum likelihood (ML). We introduced n×n according to the determinant (1–ρW), such that the lag term is treated as an endogenous variable. The original equations of the 2 models are converted into:

For this purpose, we propose a 2-stage test based on Elhorst to judge which model to select, the SEM, the SLM or the SDM (21).

Data sources

The data were derived from the China Health Statistics Yearbook, the China Statistical Yearbook, and relevant statistical data calculated by provincial and municipal statistical bureau websites (https://data.cnki.net/area/yearbook/single/n2012090077?z=d09; http://www.

stats.gov.cn/tjsj/ndsj/; http://www.nhc.gov.cn/wjw/tjnj/list.shtml).

Results

Empirical analysis

MATLAB software regression result analysis

First, we used the Matlab space measurement package provided by Elhorst to perform a maximum likelihood estimation (LM) and a robust LM test on the panel data without considering spatial effects (21).

Both the LM test and the robust LM test in models 1–4 were significant at the 1% level (Table 3), rejecting the null hypotheses (i.e. that there was no dependent variable spatial effect and no

residual term spatial effect). Only the robust LM tests in models 1 and 4 rejected the null hypothesis that there were no spatial effects of residual terms. Therefore, we inferred that the model should include the spatial lag term, although further tests are needed to determine whether the autocorrelation residual term should be included. In addition, the likelihood ratio test results of the space fixed effect and time fixed effect were 256.3517 ($P < 0.005$) and 186.5465 (P