The Influence of Population Quality Competitiveness to Regional Innovation: the China Case

(DRAFT VERSION!)

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1. Introduction

Nowadays the world economy is changing from the industrial economy to the knowledge-based economy, and the modern international competition has been turned into the competition of science, knowledge and intellectuals, which is, in fact, the competition of human, especially of talents. Among all the factors that influence the productivity, human resource is the most active one, and it is the most valuable resource compared with other sorts of resources, playing a leading role in the activities of a nation's innovation.

After more than 20 years of reform and opening up and development of China's economy has made rapid development. But China is still a developing country; the characteristics of the human resources such as the size, structure, utilization, mobility, quality and so on need to be further rationalized and increased substantially. From an international viewpoint, labor adjustment of the industrial structure and accelerating the pace of the transfer, and constantly improve skills of workers, and continuously improve the quality of national life, and international competition is becoming increasingly fierce. The face of the new challenges, we have the human resources only by constantly expanding its scale, adjusting the structure, open up markets, enhance knowledge and labor skills, and improve people's quality of life, to enhance quality of the Chinese people's competitiveness, to enhance our national ability to innovate.

This article is based on the population data of the "China Statistical Yearbook 2007", and gives an overview of the features of China's population and an exploration of the relationship between human capital and regional innovation from a perspective of population qualities.

2. Overview of China's Population Qualities

(1) Historical Development

Based on the data from five national population census in history, there is a clear increasing trend in the population quality of China. Figure 1~4 has displayed a variety of changing characteristics of China's population ever since 1953. (1) Age structure: strengthened labor force and less burden; (2) Education level: educational quality also

increasing; (3) Higher average life expectancy: healthier population; (4) Increasing proportion of urban population indicates better living conditions.

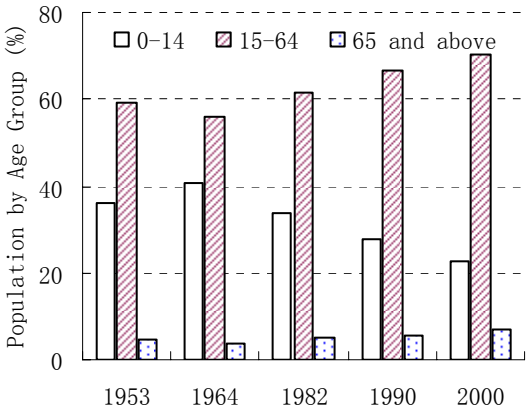

Figure 1 Population age structure: 1953~2000

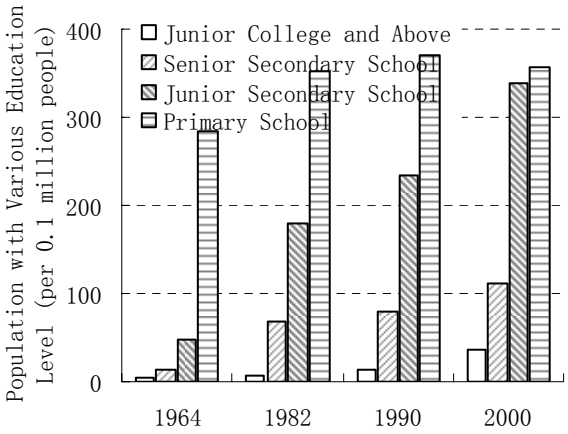

Figure 2 Education level structure: 1964~2000

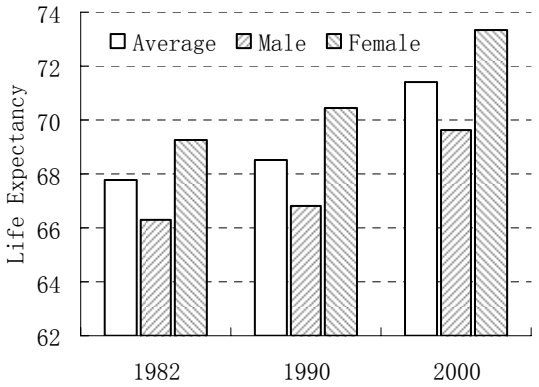

Figure 3 Gender and life structure: 1953~2000

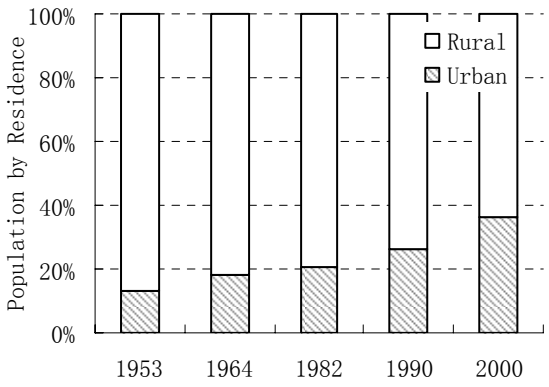

Figure 4 Region structure: 1964~2000

(2) Regional Distribution

We examine five aspects here: gross quantity of human resource, growth rate, health quality, educational quality and living standard. Figure 5 is an overview of China's population qualities distributed in the 31 regions. The width of the thermometers is proportional to the number of people in each region; the height is proportional to the growth rate; the "degree of temperature" has indicated the proportion of urban people in a region.

The two boxplots denote the distributions of people with higher education and life expectancy respectively. The contour lines have shown the 2D density based the two variables. Obviously all the 31 regions in China are clustered from the viewpoint of population qualities: eastern regions are more developed and with better population qualities, while the middle and western regions are less developed and with weaker population qualities consequently. Figure 6 is a perspective plot corresponding to the contour lines in Figure 5, which might help us to see the clustered characteristic more clearly.

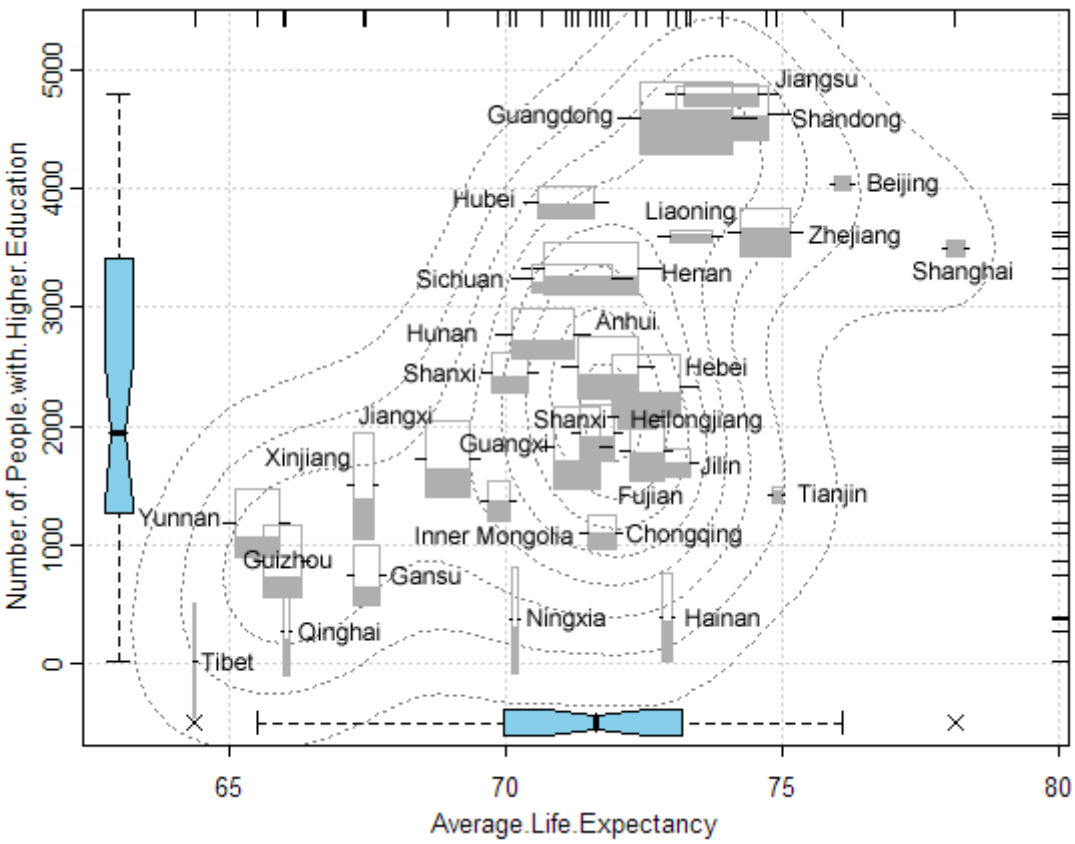

Figure 5 Overview of population qualities in 31 regions: gross quantity of human resource, growth rate, health quality, educational quality and living standard

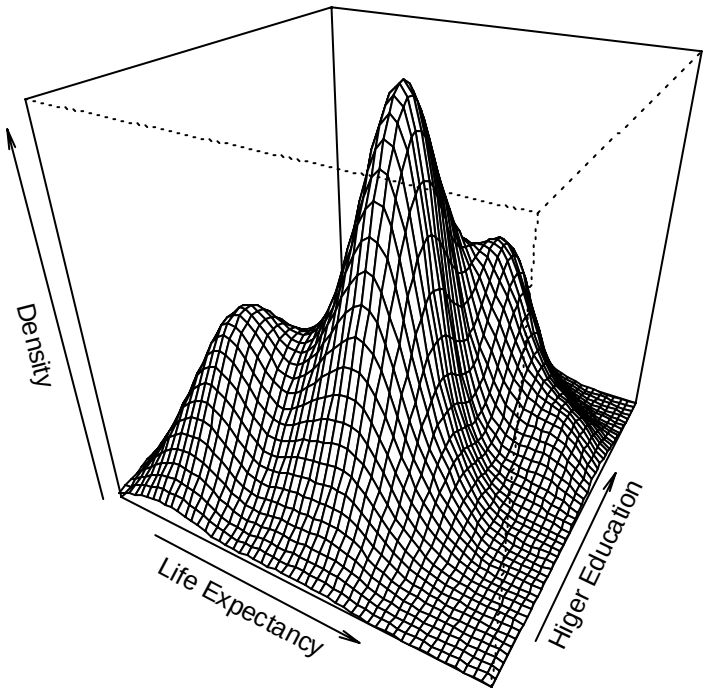

Figure 6 The joint distribution of life expectancy and higher education

3. Population Qualities and Regional Innovation

(1) Indicators of Innovation

Patent is the most common indicator to evaluate the output of innovation, e.g. Griliches (1990) and Acs et al (1989) have justified that it is reasonable to use the patent data to make research on the output of innovation.

Here we may check the relationship between GDP per capita, the average transaction value in technical market and the number of patents (accepted and granted respectively).

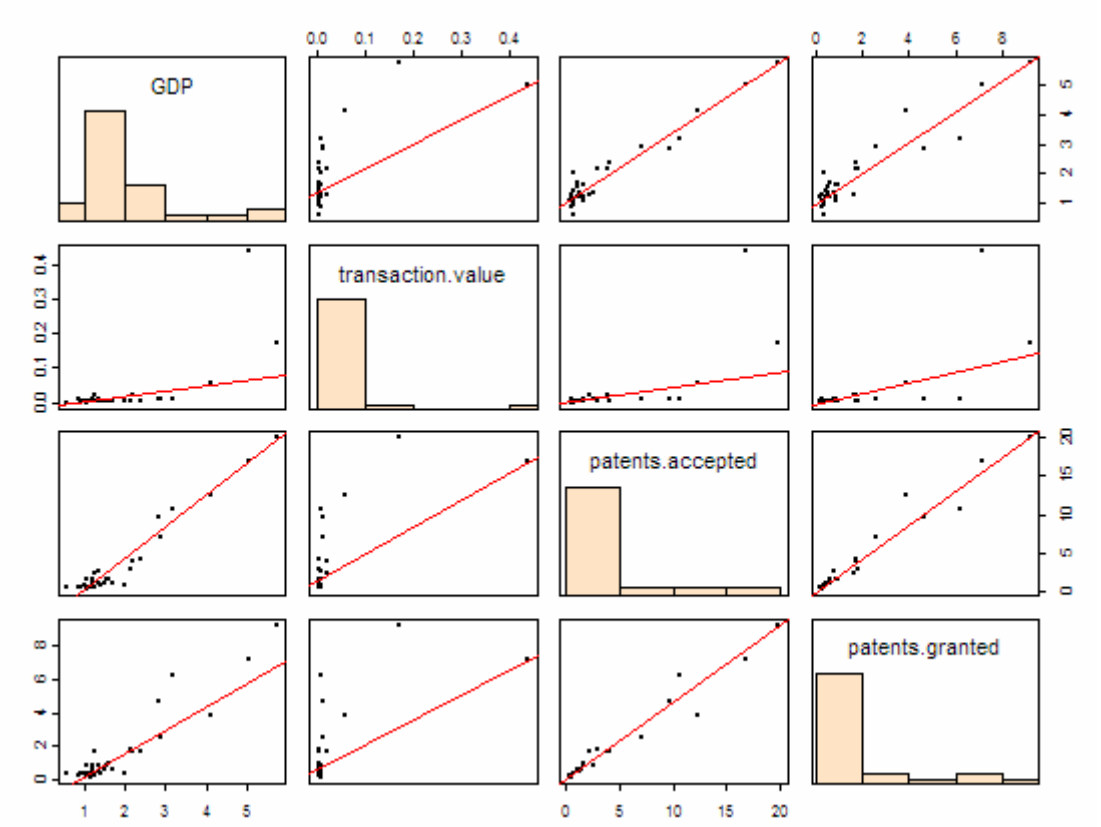

Figure 7 The relationship between GDP per capita, the average transaction value in technical market and the number of patents per capita

Apparently the number of patents has a strong influence on the economy, so does the average transaction value in technical market.

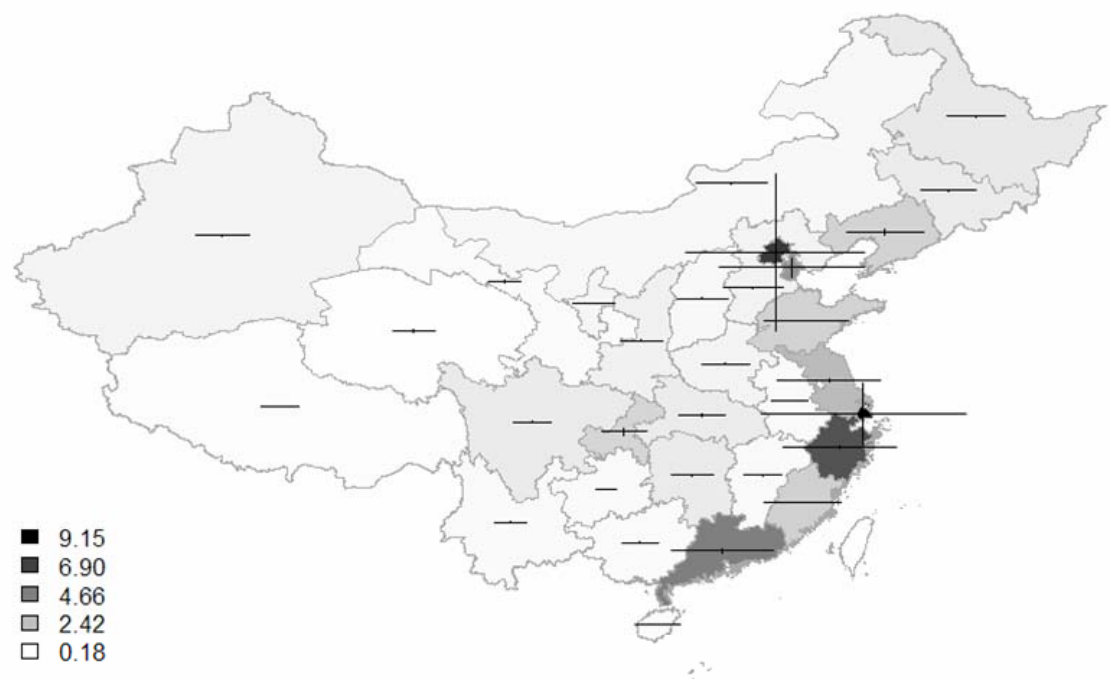

Figure 8 Regional distribution of innovation output of China's 31 regions

Figure 8 displays the regional distribution of innovation output denoted by the number of patents. It is clear that Beijing, Tianjin, Shanghai, Guangdong and Zhejiang are strong in the innovation output. And again, there is a phenomenon of clustering geometrically. The horizontal and vertical lines in the graph are proportional to GDP per capita and the average transaction value in technical market respectively.

(2) Influence of Population Qualities on Innovation

In this section we consider five indicators of population qualities: (1) Living condition, denoted by the proportion of urban people (2) Health quality, denoted by life expectancy (3) Population mobility: computed from the sampling survey data (4) Educational quality, denoted by the proportion of people with higher education (5) Employment situation, denoted by the registered unemployment rate in urban areas. Figure 9 shows the influence of these indicators on the innovation output.

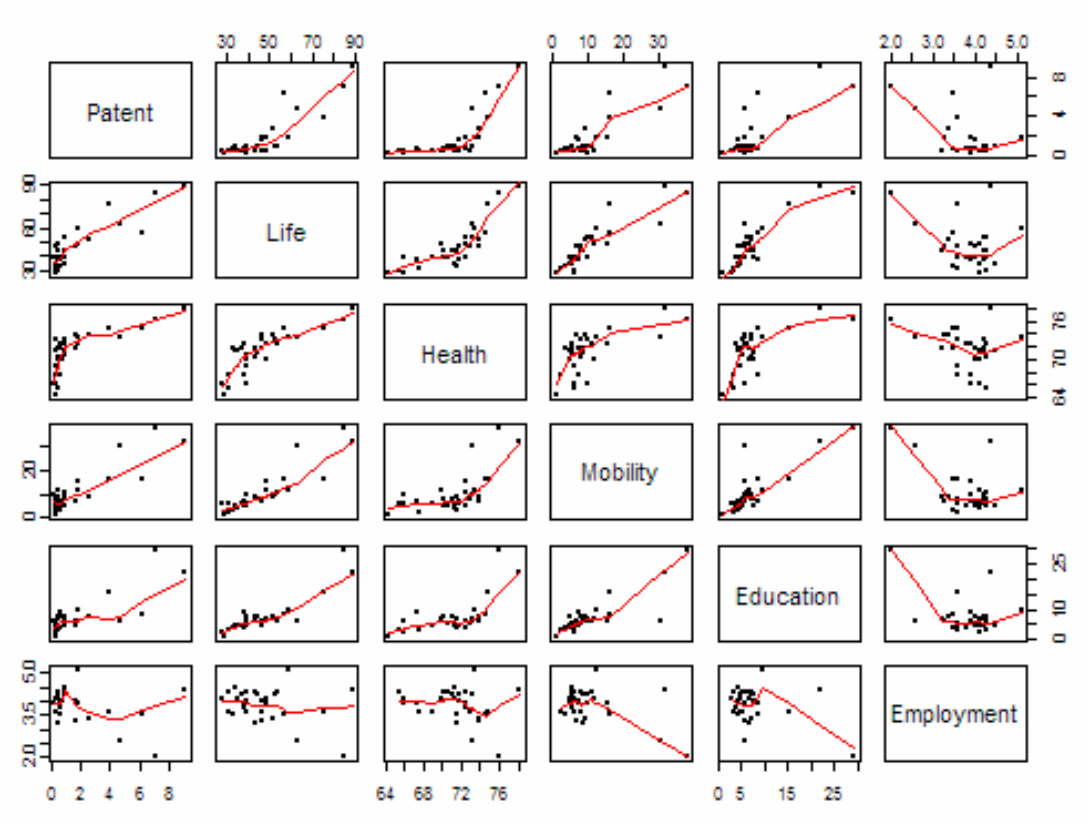

Figure 9 Relationship of population qualities and innovation output

Multiple regression:

Table 1 Multiple regression on the innovation output against population qualities

	Coefficient	Standard error	t	Pr(>|t|)
Intercept	-16.0396	7.65277	-2.096	0.0468
Proportion of urban people	-0.00124	0.04618	-0.027	0.9788
Life expectancy	0.21005	0.1165	1.803	0.084
Proportion of floating population	0.16287	0.05692	2.861	0.0086
Proportion of people with higher education	0.05962	0.0695	0.858	0.3995
Registered unemployment rate	0.15628	0.38655	0.404	0.6896

Next we examine how the population qualities influence the innovation output from the perspective of "Classification and Regression Tree" (CART, Breiman et al 1984), which can both reveal the importance of independent variables to the response and the path of the influence.

In order to make a more thorough research, we define the response variable "innovation output" in four situations in Table 2:

Table 2 Different definitions of the response variable in the regression tree

	number of patents	output value of new products
averaged by all the people	(1)	(2)

averaged by employed people	(3)	(4)

The result of (1) & (2):

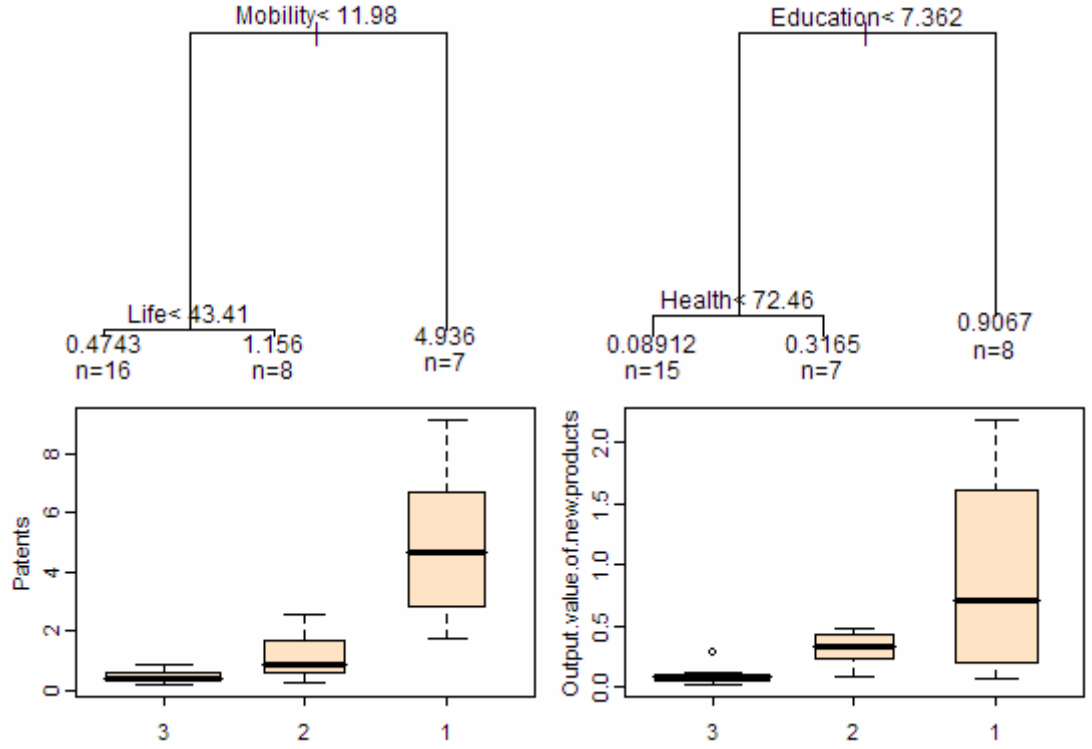

Figure 10 Regression tree from model (1) and (2)

The result of (3) and (4):

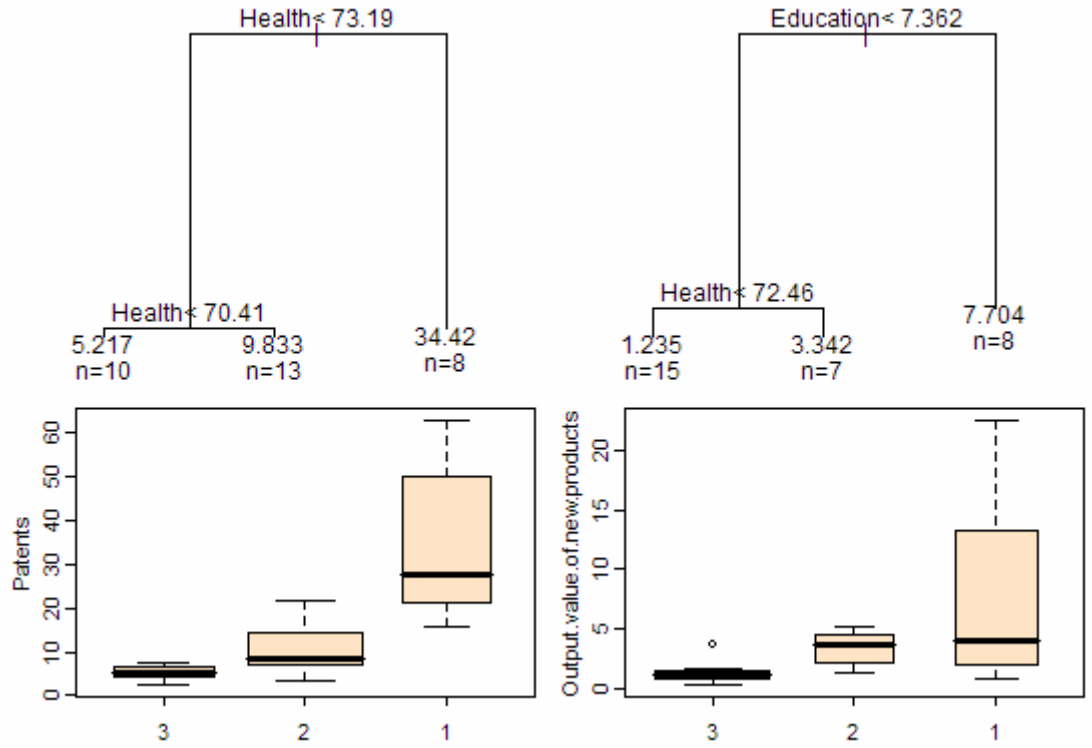

Figure 11 Regress tree from model (3) and (4)

The regression trees also clustered all the 31 regions into 3 groups.

4. Conclusions

1. Spatial clustering of population qualities.

2. From the perspective of patents as the indicator of innovation output, we discovered that the mobility of population is the most important factor in regional innovation.

3. From another perspective of the "output value of new products", the educational level plays the most critical role in regional innovation.

4. The other two factors "health quality" and "living condition" can discriminate regions with middle and low levels of innovation.

Reference

Breiman, Friedman, Olshen, and Stone. (1984) *Classification and Regression Trees* [M]. Wadsworth.

Griliches, Z. *Patent statistics as economic indicators: a survey*. [J] Journal of Economic Literature, 1990, 28 (12): 1661-1707.

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