Research on the Relationship Between Volatility and Regional Economies of Scale in Cloud Computing

Jun-hao Qiao(✉) and Xin Tang

Zhengzhou Technical College, Zhengzhou 450121, China
qiaojunhao55@yeah.net

Abstract. There is a certain correlation between the regional education scale and the local economy, but the factors considered in the existing analysis of the relationship between regional education and economic fluctuations are not comprehensive. Moreover, the data used in the analysis process is relatively old and cannot reflect the current relationship between education and the economy. So this paper studies the simulation method of the coordination relationship between regional education scale fluctuation and economic fluctuation based on cloud computing. This study extracts the characteristics of regional education scale fluctuations and economic fluctuations in advance, and then uses cloud computing technology to establish a comprehensive analysis model, and uses the model to simulate the coordination between the two. Experimental test results: compared with the two traditional coordination relationship simulation methods, the simulation method of this study is not affected by the fluctuation of education scale and economic fluctuation. Considering the fluctuation coordination relationship from many aspects, the simulation results are more close to the expected value in the near future.

Keywords: Cloud computing · Regional education scale fluctuation · Economic fluctuation coordination · Relationship simulation

1 Introduction

In the huge education system, the relationship between education and economic development is the most close. Regional economy provides material security and financial support for education and promotes the development of vocational education. Vocational education indirectly promotes economic growth by cultivating labor force and improving labor productivity. There is a complex two-way interactive relationship between education and regional economy. In the past, researches on the relationship between vocational education and regional economy were mostly single-dimensional [1, 2].

The development of higher education and economic development both promote and restrict each other. For a country or region, the development of higher education can promote short-term economic growth and long-term development, while being restricted by the stage and level of local economic development. If higher education lags behind

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the level of economic development, the long-term economic development and social progress will lose the fundamental basis of human resources; if higher education is too far ahead of the level of economic development, it will also cause a waste of social resources and bring about the quality of higher education Decline and difficulties in finding employment for college graduates. Therefore, for a country or region, the development level of higher education should be basically adapted to the level of economic development. This adaptation is the coordination referred to in this article.

In order to solve the relationship between multi-level education and regional economy, this study proposes a coordination relationship simulation method based on cloud computing. Cloud computing is a new network computing mode, which can provide various services to various network applications. It has the technical characteristics of rapid scalability, high scalability, quality assurance, security, storage and calculation of massive data [3, 4]. Therefore, the mechanism and technical characteristics of cloud computing are fully utilized to simulate the tonal relationship between regional education scale fluctuation and economic fluctuation.

2 Simulation of Coordination Relationship Between Regional Education Scale Fluctuation and Economic Fluctuation Based on Cloud Computing

2.1 Extract the Fluctuation Characteristics of Regional Education Scale

There are many forms of higher education, such as graduate education, general college education, adult college education, network college education, higher education self-study examination and so on. The statistical indicators related to the number of students mainly include the number of students enrolled, the number of students in school and the number of graduates. This paper chooses the number of students who are receiving graduate education and general college education to describe the scale of China's higher education. The index data of this paper are all selected from the statistical literature of Chinese government departments, and the specific data are shown in Table 1.

Table 1. Scale of higher education in China (2010–2019)

Particular year	Total number of students in school (10000 students)	Gross enrollment rate (%)
2015	3647	40.00
2016	3699	42.70
2017	3799	45.70
2018	3833	48.10
2019	4002	51.60

According to the statistics in Table 1, the scale of higher education in China has been on the rise in the past 5 years, but there are still great differences among different

regions in terms of the scale of education. First, the influence of political factors on the scale of China's higher education has been great. According to the differences of the main role, the development of higher education in the world can be divided into two models: national regulation and university autonomy. The development of higher education in China is controlled by the state, which is characterized by nationalism and government dominance. In this model, the change of the scale of higher education is strongly influenced by political factors. The scale of higher education is often a kind of government action under the guidance of nationalism. When the political situation is turbulent, the change of the scale of higher education fluctuates greatly; when the political situation is stable, the change of the scale of higher education fluctuates little. Compared with the political situation, the policy of higher education has a more direct impact on the change of the scale of higher education, the direction and degree of its change. Both the political situation and the higher education policy are deeply influenced by the political leaders. Major changes in the scale of higher education often begin with speeches or instructions from political leaders, followed by government policies to follow through on leaders' intentions, and then implemented by universities. In this process, the influence of political factors is not only direct, but also mandatory, and often causes the problem of policy expansion. Because the promotion of subordinates "is often based on political correctness, mainly closely followed the level of the higher level to the decision," so that "the upper good, the lower will be very good" situation from time to time [5, 6].

Second, the influence of economic factors on the scale change of China's higher education is growing. Before the reform and opening up, the influence of economic factors on the scale change of China's higher education, though existing, is not strong. The correlation analysis between China's GDP since 1952 and the scale of higher education shows that the Pearson correlation coefficient between 1952 and 1977 is −0.142. The reason why the absolute value of the correlation coefficient is small, and negative, mainly because the correlation between the two is only low, and there are more reverse changes [7]. During this period, the scale of higher education has changed three times. The first appeared in 1963–1966, and the second in 1969–1970, when the economy grew significantly, but the size of higher education shrank dramatically. The third was in 1976, when the size of the economy declined, but the size of higher education increased [8]. After the reform and opening up, economic factors on the scale of China's higher education has become increasingly large, the relationship between the two become close. From 1978 to 2010, the correlation coefficient between China's GDP and the size of higher education was 0.977. The reason why the correlation coefficient is so high, mainly because the two highly correlated, highly convergent direction of change [9]. To a large extent, this is due to the strategic shift of China's work focus since the reform and opening up, focusing on economic construction as the central task, strengthening the connection between economic work and other work, and increasing the impact of economic work on other work. With regard to higher education, the cost-sharing system is adopted to expand the scale of higher education, the structural adjustment of higher education is carried out on the basis of the theory of scale efficiency, the expansion of enrollment in colleges and universities is adopted to stimulate consumption, expand domestic demand, and absorb private capital to develop higher education [10]. Such new measures closely

link the economy with higher education, and make the impact of economic factors on the scale change of higher education increasingly strong.

Third, the role of higher education itself in the change of higher education scale in China needs to be strengthened. The influence of political and economic factors on the scale change of higher education is external and belongs to external pressure, while the influence of higher education itself on the scale change is internal and belongs to internal logic. For example, it is a kind of internal logic that the scale of higher education will be restrained after a long period of time. After the founding of the People's Republic of China, the scale of higher education continued to rise in 1960, particularly in 1958–1960, long after the rise that took up to 10 years of decline. Since 1971, the scale of higher education in China has risen back to 132% in 1972, which is the result of the release of the expansion potential of colleges and universities for a decade. Facts show that the internal logic is powerful, and it plays a significant role in the basic trend of the scale change of higher education. Only by following the internal logic, can the scale change of higher education be regular and the alienation of higher education be avoided. Yet, as Clark Kerr puts it, "much of the history of higher education has been written by confrontation between internal logic and external pressure." The influence of internal logic is not always smooth sailing, but often met with resistance from external pressure. The history of China's higher education is such that the internal logic not only to resist external pressure, but often at a disadvantage. As the main body of internal logic, facing the interference of government power and the temptation of market interests, colleges and universities often lack the conditions and willingness to confront.

2.2 Extracting Characteristics of Economic Fluctuations

It is shown that overcapacity is not only a possible result of economic fluctuation, but also a reaction to economic fluctuation. Here, a simple theoretical explanation of the mechanism of overcapacity affecting economic fluctuation is provided, and a corresponding test hypothesis is proposed. Overcapacity in China is generally divided into three types: cyclical overcapacity, institutional overcapacity and structural overcapacity. Since China is primarily a demand-driven economy, cyclical and structural excesses can be attributed to demand shocks, while the institutional excesses are attributed to the implementation of supply-side vertical industrial policies [11]. Excess production capacity in some industries, on the one hand, will lead to the loss of enterprises, the decline in capacity utilization rate and unemployment of workers, and then produce economic fluctuations; on the other hand, it will lead to mismatch of resources, environmental pollution, lack of innovation, and further aggravate economic fluctuations. These two aspects represent the direct mechanism and indirect mechanism of excess production capacity affecting economic fluctuations, which can be summarized as quantitative effect and factor distortion effect.

First, the quantitative effect of excess capacity on economic volatility. The so-called quantity effect actually refers to the effect of economic fluctuations caused by enterprises' quantity adjustment under non-price conditions [12]. As Kornai points out, quantitative adjustment plays a very important role in all economic systems. Because the policy stimulation and the demand impact, some industries present the overcapacity, inevitably causes the capacity utilization rate the drop. The change of capacity utilization rate

reflects the process of quantity adjustment. The driving effect of capacity utilization on economic fluctuations has long been observed by economists, but it was not until the 1990s that the dynamic general equilibrium framework was gradually used to analyze the intrinsic relationship between the two [13]. Firstly, the excess production capacity leads to the unsalable products and the decline of profit, which urges the enterprises to make adjustment decisions, including instantaneous adjustment, short-term adjustment and long-term adjustment. Because of the lack of innovation in domestic enterprises, instantaneous and short-term adjustment methods are very single, that is, reducing capacity utilization. Its essence is to reduce the input of variable cost factors, so as to reduce output, resulting in economic volatility. A lot of researches show that the main reason of China's economic cycle change is the fluctuation of fixed asset investment and investment income. In addition, the herd behavior of enterprise investment has further enhanced the impact of overcapacity on economic fluctuations. Secondly, the influence of productivity utilization on the elasticity of factor output [14]. In reality, because higher capacity utilization speeds up capital depreciation, output elasticity changes in the same direction as labor input and in the opposite direction as capital stock. Therefore, overcapacity will cause economic fluctuation by changing the elasticity of factor output. Thirdly, the impact of capacity utilization on scale return. Many scholars have proved that there is a close relationship between capacity utilization and scale return. For example, changes in short-term capacity utilization may lead to increasing returns to scale that only exist during the demand expansion phase. Therefore, the change of capacity utilization rate can amplify the extent of economic fluctuation by influencing the scale return. According to calculations, it can be found that due to market, system, policy and other factors, China's excess capacity is increasingly affecting the scope, severity and duration of the recession, leading to a continuous recession. Increased investment, an ongoing stimulus, may rebound the economy in the short term, but in the long run, it will lead to further declines in capacity utilization and an increase in overcapacity, plunging the economy into a deeper depression [7].

Second, overcapacity distorts the factors that affect economic volatility. Factor distortion refers to the deviation or deviation between the factor market price and the opportunity cost caused by the imperfection of the market, which leads to the non-optimal allocation of factors [15]. The factor distortion effect is one of the important transmission mechanisms of economic fluctuation caused by overcapacity, which actually reflects the adjustment result of enterprises in the existing price system. Many important documents show that China's overcapacity, especially institutional overcapacity, is largely the result of the distortions in factor markets caused by policy subsidies. But different from the Western countries, due to the imperfection of the market mechanism, China's "self-healing" mechanism of excess capacity will become invalid, instead, it will make the factor market more distorted, so that the excess capacity will not be cured for a long time. The fundamental reason for this dilemma lies in the dual system during the transition period. Some key industries are subject to soft budget constraints, and these industries are often the hardest hit areas of overcapacity. The specific mechanisms by which excess production capacity affects economic fluctuations through the distortion effect of factors are as follows:

The first is product price distortion. The essence of overcapacity is that the production capacity exceeds the potential demand, which will inevitably lead to market stagnation and product price decline. However, because the surplus industries are pillar industries or motivated by government competition, "quantitative" catch-up development, social stability and so on, governments at all levels will often prevent enterprises from withdrawing through a series of policy measures such as tax incentives, financial subsidies, government procurement and so on, resulting in the softening of the budget constraint of enterprises, which makes the demand function of enterprises shift from a downward inclination to a level without price elasticity. As a result, soft budget constraints impede or even distort the signal transmission of product price changes caused by overcapacity, and incumbents rarely make instantaneous or short-term adjustments to market changes in a timely manner, possibly leading to long-term capacity expansion and the continued entry of new firms. Kornai generalizes this situation as product price has no effect on investment decision, and thinks that if investment is important and beneficial from the non-price point of view, its profitability can be guaranteed, so it will induce investment. Thus, in the case of distorted product prices, excess capacity will reduce the economic downturn brought about by structural shifts in the short term, and even stimulate economic growth, but will lead to deeper adjustments and recessions in the long run. Next is the factor of production price distortion. On the contrary, the government's "father-love behavior" further aggravates the distortion of factor prices, such as financing support. Government intervention makes it easier for surplus enterprises to obtain credit funds from banks at lower cost, thus forming the "ratchet effect" of "passing over surplus credit". On the one hand, the distortion of the price of important factors of production and the dual-track system have "crowding out" the investment of other industries, on the other hand, they also affect the output through the change of the marginal output of factors, which causes the economic fluctuation.

By definition, the distortion of factor allocation is actually the result of price distortion. Because of soft budget constraints and dual-track system, China's overcapacity has caused price distortion, which will inevitably lead to factor mismatch.In order to show the difference between configuration distortion and price distortion, technical distortion needs to be understood, that is, the change in total factor productivity caused by factor mismatch. Based on the literature review, it is found that almost all the studies support the conclusion that factor configuration distortions inhibit TFP. Endogenous growth theory holds that total factor productivity is an important factor of economic growth. The RBC theory further emphasizes the impact of TFP shocks on economic fluctuations. Taken together, overcapacity can lead to economic volatility through distortions in factor allocation.

Based on the above discussion, this paper proposes the following two hypotheses: Hypothesis 1: There are direct mechanism and indirect mechanism of excess capacity affecting economic fluctuations. Hypothesis 2: Overcapacity also leads to economic volatility indirectly through the distortion effect of factors including price distortion and allocation distortion. Therefore, the econometric model of hypothesis one is established.

$$T_t = SeH_tL_tC_t \tag{1}$$

In the formula, t represents the total output of phase T_t; S represents technological progress and other institutional or difficult to observe factors; H_t represents the capacity

utilization rate of phase t, which is the core index to measure the degree of excess; L_t and C_t represent the capital stock and labor input of phase L_t respectively. At the same time, the econometric test model of Hypothesis 2 was established. Hypothesis two holds that overcapacity can affect economic fluctuation through factor distortion. In order to test this hypothesis, the mediating effect model was introduced and analyzed.

$$f_t = \varphi_0 + \varphi_1 y + \alpha F + \omega_1 \tag{2}$$

$$d_t = \varepsilon_0 + \varepsilon_1 y + \beta F + \omega_2 \tag{3}$$

$$f_t = \lambda_0 + \lambda_1 y + \lambda_2 y + \pi\theta F + \omega_3 \tag{4}$$

In the formula: f_t represents economic fluctuation; d_t represents distortion degree of factor market; y represents change of capacity utilization rate; t represents time; ω_1, ω_2, ω_3 represents random error; F represents control variable. Through the above calculation process, the characteristics of economic fluctuation are extracted.

2.3 Coordination Relationship Simulation Based on Cloud Computing

Cloud computing is the development direction of the next generation infrastructure, with the characteristics of traditional computing, but also with new technology advantages. Therefore, according to the hierarchical view of organizational ability, the low-level ability of enterprise and education will affect the high-level ability, so as to improve the performance and students' examination results. This study believes that the application of cloud computing will enable enterprises and education to have low-level capabilities, that is, cloud computing infrastructure capabilities, and through the promotion of high-level capabilities of enterprises and education, that is, organizational agility, improve performance and students' ability, and achieve coordinated relationship modeling. The relationship between education and regional economy is intertwined and complex. If vocational education and regional economy are regarded as two different overall systems, they will present a "Circular" relationship logic. If the entire education and regional economic system is further analyzed, it will be found that there are two relationships between the elements, namely "inter subjectivity logic" and "hierarchical coupling logic", because of their interaction. Among them, "inter subjectivity logic" refers to the interactive relationship between subjects in the linkage between education and regional economy, and "hierarchical coupling logic" refers to the "level type" interaction relationship formed between education and regional economy. First, it simulates the "circular logic" of the linkage between education and regional economy. Education and regional economy, as two subsystems of the social system, have different functions and structures, which make the interaction between them intertwined and complex. If these two systems are analyzed as a whole, the two systems mainly present a "ring" linkage relationship mediated by capital, as shown in Fig. 1.

Second, the "inter subjectivity logic" of the linkage between education and regional economy. The linkage between education and regional economy involves the government, enterprises and schools. In the relationship formed by the "three main bodies"

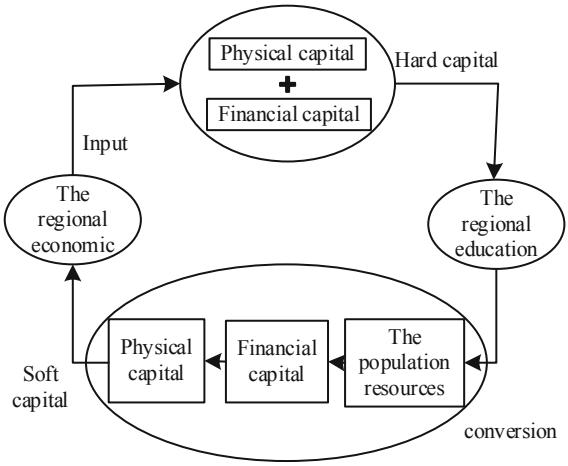


Fig. 1. Simulation diagram of circular logical relationship

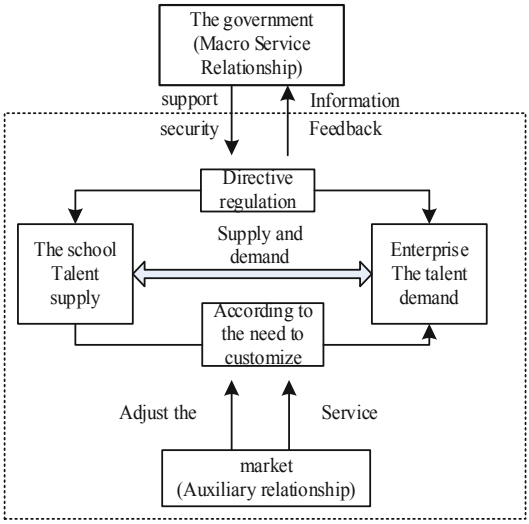
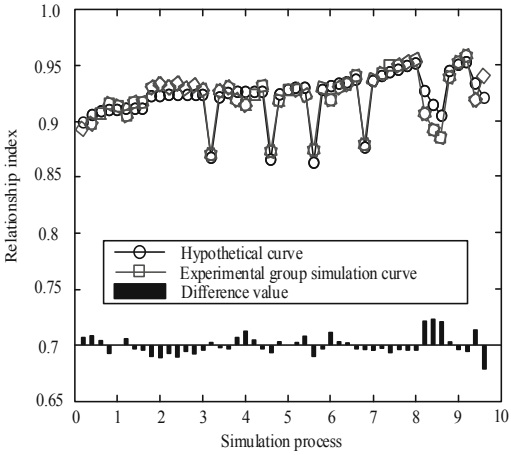


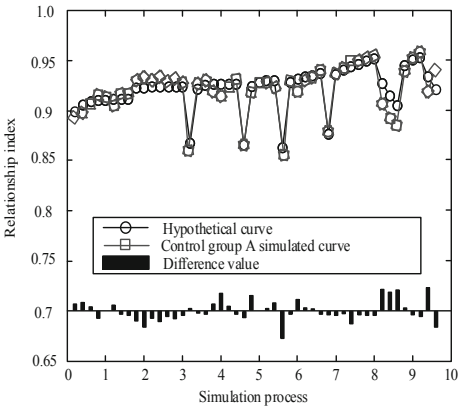
Fig. 2. Inter agent logic simulation diagram of linkage

of the government, enterprises and schools, talents, as an "invisible hand", are always intertwined with the relations among the main bodies, as shown in Fig. 2 below.

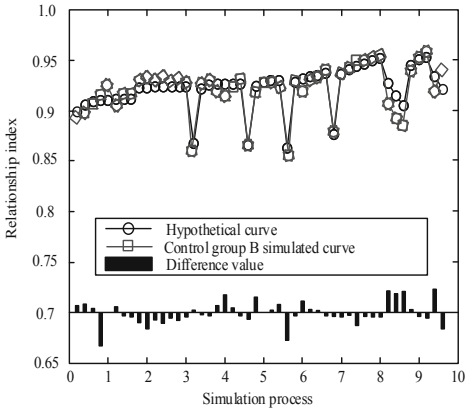
Through the above analysis and research, based on the concept and principle of cloud computing, the coordination relationship between regional education scale fluctuation and economic fluctuation is simulated.



(a) Experimental group

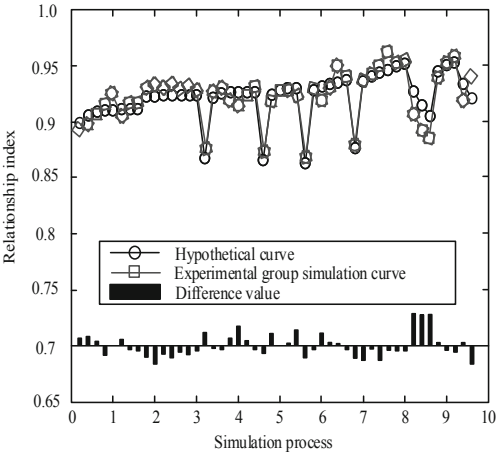


(b) Control group A

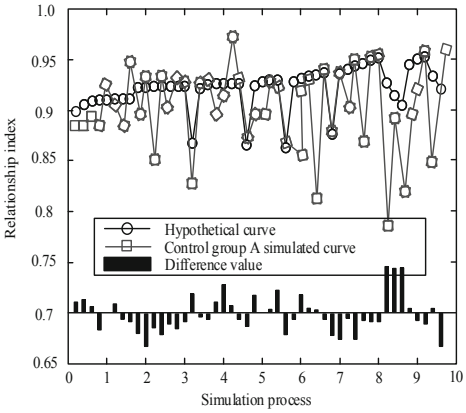


(c) Control group B

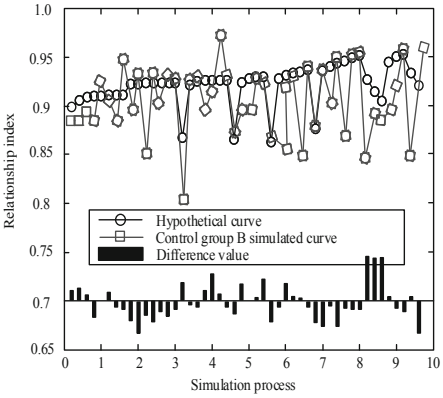
Fig. 3. Contrast effect under weak fluctuation



(a) Experimental group



(b) Control group A



(c) Control group B

Fig. 4. Contrast effect under strong fluctuation

3 Experimental Study

In order to verify whether the simulation method of this study is feasible, a comparative test experiment is proposed. The coordination relationship simulation method of this study is taken as the experimental group, and the two traditional simulation methods are taken as the control group. Taking the current situation of education and economic fluctuation in area a as an example, the coordination relationship between the two test groups is analyzed. It is known that the fluctuation of education scale and economy in area a is small, so the coordination relationship between them is easy to capture. Figure 3 shows the relationship simulation effect curve of three test groups.

According to the simulation results of the three methods in Fig. 3, the three test groups have good simulation effect in the face of weak fluctuations. Then, taking region B as the test object, it is known that the regional education scale and economic fluctuations exist violent and frequent phenomenon. Figure 4 shows the simulation effect of three test groups on the coordination relationship.

According to the test results shown in Fig. 4, in the face of strong fluctuations in education scale and economy, there is a strong correlation between the simulation effect curve of the experimental group and the hypothetical relationship curve, while the correlation between the simulation effect of the coordination relationship of the two control groups and the hypothesis curve is weak. Therefore, the simulation method based on cloud computing is better.

4 Conclusion

Although the proposed simulation method has achieved good research results, there are still some shortcomings. In the future, cloud computing can be optimized to further strengthen the coordination relationship simulation, and provide more perfect coordination relationship simulation technology for regional education and economic development.

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