Chapter 2
A Study on Coordination Relationship of Construction Industry and Economic Growth in Shaanxi Province

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Abstract In this paper, construction industry, serving as the pillar industry of national economy, has played a great role in promoting the economic growth. Therefore, it is essential to study the coordination between construction industry and economic growth. This paper takes the actual situation of construction industry and economic growth of Shaanxi Province as an example, selects the data from 2001 to 2010, by using coordination formula to analyze correlation and coordination between construction industry and economic growth. Results show that the coordination between construction industry and economic growth is at a high level, but it also slightly fluctuates. In order to enhance the coordination between construction industry and economic growth, sustainable economic growth should be maintained, technological progress and innovation in construction should be strengthened and construction growth mode should be transformed.

Keywords Coordination · Construction industry · Economic growth · Shaanxi

2.1 Introduction

With the rapid development of national economy, construction industry, serving as the pillar industry of national economy, has played a great role in promoting the economic growth. The rapid development of the construction industry has important significance in strengthening the urban and rural infrastructure construction, advancing the process of urbanization, building a harmonious society and improving the whole social production efficiency (Sharma 2010).

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There are different views about the relationship between construction and economical growth. Some scholars believe that construction and economical growth promote each other; in short time, the economic growth is the cause of construction industry growth causes. In the long-term, the construction industry is caused by economic growth (Tse and Raftery 2001; Chan 2001; Wigren and Wilhelmsson 2007; Lewis; Ozkan et al. 2011; Jiang and Jiang 2007; Lu 2003). However, other scholars point out, in the highly developed areas, the importance of the construction industry is in the weak; but in the less developed areas, construction industry has an important role in promoting the economic growth and dweller income, which provide a theoretical basis for the construction industry of the underdeveloped areas (Pietroforte et al. 2000). Therefore, we should objectively and accurately describe the relationship between construction industry and economic growth.

At present, the domestic and foreign scholars on the interactive relationship of the construction industry and economic growth mostly concentrates in the construction industry on the economical growth influence and contribution, but it is rare for coordinate development of the building industry and economic growth. This article is based on this perspective, taking the actual situation of construction industry and economic growth of Shaanxi Province as an example, selects the data from 2001 to 2010, by using coordination formula to analyze correlation and coordination between construction industry and economic growth. Compared with the existing research, this paper uses synergistic effect to measure the coordination degree, which can avoid judging the coordination degree by using synchrony of the development of the construction industry and economic growth. In addition, using multiple indicators to measure the building industry and economic growth can avoid the possible deviation of single index.

2.2 The Current Situation of Construction Industry and Economic Growth in Shaanxi Province

In recent years, with the rapid development of China's economy, Shaanxi economy development is rapid and construction industry, serving as the pillar industry of national economy develops continuously. As we can see from Fig. 2.1, during 2001–2010, the trends of GDP and the construction industry in Shaanxi are on rise. It can be seen from Fig. 2.2 that there are two obvious peaks in 2003 and 2007 and it has an obvious decline after 2008. With the improvement in the level of openness and market-oriented, construction and economical growth in Shaanxi have a rapid development. In 2001, after China joining in the WTO, the construction industry in Shaanxi province has a rapid development process; in 2003, the construction industry created a peak and promoted the economic development of Shaanxi province. In 2008, the world economy came into the end of the valley because of the American loan crisis, which affected our economy. The construction industry of Shaanxi province started to decline and economy also had an obvious trend of decline.

Fig. 2.1 The trends of GDP
and construction output value
of Shaanxi Province
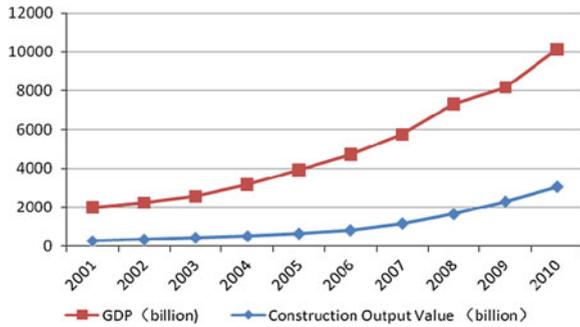
Fig. 2.2 The trends of GDP
growth rate and construction
growth rate of Shaanxi
province
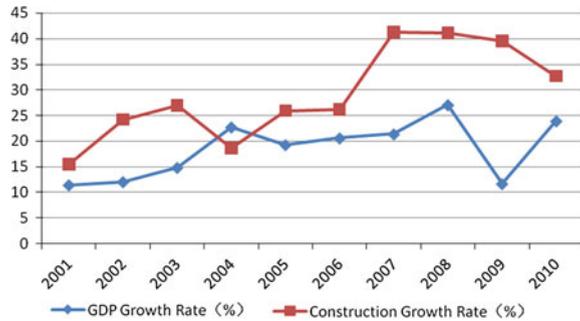
At the same time, we can also see from Fig. 2.2, the construction growth rate was significantly higher than the GDP growth rate, but the construction growth rate is not very consistent with GDP growth rate. Changes in GDP growth slightly lagged behind the growth of the construction industry, especially after the 2003. Therefore, the both have a stronger correlation. So it has a great practical significance in studying coordination between construction and economic growth.

2.3 An Empirical Analysis on Coordination Relationship of Construction Industry and Economic Growth in Shaanxi Province

2.3.1 Calculation Method of Coordination of Construction and Economic Growth of Shaanxi Province

From the perspective of synergetic, coordination generally refers to internal elements of the system or system "harmony" with the proper relationship (Huang et al. 2000). Because the system is in dynamic change, the relationship of the internal elements of the system or the system itself is constantly adjusted. The coordination degree is quantitative indicators, which is to measure the status

of good and bad coordination of the internal elements of the system or the system itself (Zheng and Liu 2001). Therefore, we can build the coordination of construction and economic growth indicators to reflect their development coordination degree. The main ideas and the steps are as follows.

1. According to the above main component analysis result, we can establish the systematic evaluation model among them.

$$f(\mathrm{x}) = \sum_{i=1}^{m} ax_i, \quad g(\mathrm{y}) = \sum_{j=1}^{n} by_j \tag{2.1}$$

Among them, f(x) is the comprehensive development level of construction, g(y) is the comprehensive development level of economic growth. x_i, y_j are evaluation index, a_i, b_j are the weight of evaluation index.

2. To investigate the relative development level of construction (X′) compared with economic growth (X) and the relative status of economic growth Y′) compared with the development of construction (Y), X is regressed on Y to get X′, Y is regressed on X to get Y′.
3. The model of static coordination degree (Chen et al. 2007; Li et al. 2003) is as follows.

$$U(i,j) = \frac{\min\{u(i/j),\, u(j/i)\}}{\max\{u(i/j),\, u(j/i)\}} \tag{2.2}$$

where U(i, j) is the static coordination degree between X and Y, u(i/j) is the adaptability of construction to economic growth, u(j/i) is the adaptability of economic growth to construction. The formulation of u(i/j) and u(j/i) are as follows:

$$U(i/j) = \exp\left[-\frac{(X - X')^2}{s_i^2}\right] \tag{2.3}$$

$$U(j/i) = \exp\left[-\frac{(Y - Y')^2}{s_j^2}\right] \tag{2.4}$$

where S_i^2 is the standard deviation of X, S_j^2 is the standard deviation of Y.

In order to directly reflect the coordination degree of development of the construction industry and economic growth of Shaanxi Province, this paper refers to the relevant articles (Liu et al. 2006) and combines with the development characteristics of the construction industry and economic growth, coordination level is divided, as shown in Table 2.1.

Table 2.1 Type classification in the construction industry and economic growth

Coordination degree	Classification	Comparison between $f(x)$ and $g(y)$	Basic type of development
0.90–1.00	Quality coordinated development	$f(x) > g(y)$	Economic growth lag of quality coordinated development
		$f(x) = g(y)$	The synchronous type of quality coordinated development
		$f(x) < g(y)$	Construction lag of quality coordinated development
0.8–0.89	Good coordinated development	$f(x) > g(y)$	Economic growth lag of good coordinated development
		$f(x) = g(y)$	The synchronous type of quality coordinated development
		$f(x) < g(y)$	Construction lag of quality coordinated development
0.7–0.79	Intermediate coordinated development	$f(x) > g(y)$	Economic growth lag of intermediate coordinated development
		$f(x) = g(y)$	The synchronous type of intermediate coordinated development
		$f(x) < g(y)$	Construction lag of intermediate coordinated development
0.6–0.69	Primary coordinated development	$f(x) > g(y)$	Economic growth lag of primary coordinated development
		$f(x) = g(y)$	The synchronous type of primary coordinated development
		$f(x) < g(y)$	Construction lag of primary coordinated development
0.5–0.59	Reluctant coordinated development	$f(x) > g(y)$	Economic growth lag of reluctant coordinated development
		$f(x) = g(y)$	The synchronous type of reluctant coordinated development
		$f(x) < g(y)$	Construction lag of reluctant coordinated development
0.3–0.49	Mild disorder development	$f(x) > g(y)$	Economic growth lag of mild disorder development
		$f(x) = g(y)$	The synchronous type of mild disorder development
		$f(x) < g(y)$	Construction lag of mild disorder development
0.2–0.29	Moderate offset development	$f(x) > g(y)$	Economic growth lag of moderate offset development
		$f(x) = g(y)$	The synchronous type of moderate offset development
		$f(x) < g(y)$	Construction lag of moderate offset development
0–0.19	Serious imbalance development	$f(x) > g(y)$	Economic growth lag of serious imbalance development
		$f(x) = g(y)$	The synchronous type of serious imbalance development
		$f(x) < g(y)$	Construction lag of serious imbalance development

2.3.2 Data Sources and Indicator System

Drawing lessons from the existing indicator systems of coordinative degree (Niu and Lin 2011) and following the principles of typicality, availability, and systematic analysis, the article develops an indicator system consisting of such subsystem as construction industry and economic growth to measure the coordinative degree of Shaanxi.

Considering the industrial scale, technology level, industrial benefits, social benefits, construction representative indicators consist of the construction output value (million), construction company assets (million), construction annual average personnel (million), the number of construction companies, the rate of technical equipment (yuan/capita), power equipment (yuan/capita), the average wage of construction workers (yuan/capita), construction area (m^2/capita), the contribution rate (%).

Considering economic scale, economic structure and economic benefits, economic growth indicators consist of total GDP (billion), total investment in fixed assets (billion), local revenues (billion), total imports and exports (million), percentage of GDP of the added value of primary industry (%), percentage of GDP of the added value of secondary industry (%), percentage of GDP of the added value of tertiary industry (%), GDP growth rate (%), consumer price index.

The original data sources of construction industry and economic growth from 2001 to 2010 in this article are from the Statistical Yearbooks of China and Statistical Yearbook of Shaanxi Province. Because of different units of measurement indicators, we standardize the data and eliminate the influence of dimension, magnitude, and positive and negative orientation.

2.3.3 Coordination of the Construction Industry and Economic Growth

The index values of the construction industry and economic growth are calculated by regression analysis, and the coordination degrees of the construction industry and economic growth are calculated by the formulas (2.2)–(2.4). The results are given in Table 2.2.

First, it is negative during 2001–2006, which indicates that the construction development level of Shaanxi Province in this period is lower than the average level of development; while it is positive during 2007–2010, which indicates that the construction development level of Shaanxi Province in this period is lower than the average level of development. There are some reasons for accounting for this phenomenon. On the one hand, the government policy support increases the construction investment of Shaanxi Province; on the other hand, the growth way of construction industry improves the development of construction. Economic growth of Shaanxi Province in general is increased year by year, while during 2001–2005

Table 2.2 The evaluation results of coordination of the construction industry and economic growth in Shaanxi province

Years	Construction comprehensive development index f(x)	Economic growth development index g(y)	The adaptability of construction to economic growth	The adaptability of economic growth to construction	Coordination degree	Coordination evaluation of the construction industry and economic growth
2001	−0.8691	−1.0332	0.947	0.805	0.850	Economic growth lag of good coordinated development
2002	−0.6281	−0.7991	0.998	0.987	0.989	Economic growth lag of quality coordinated development
2003	−0.5499	−0.6818	0.992	1.000	0.992	Economic growth lag of quality coordinated development
2004	−0.3195	−0.6541	0.986	0.999	0.987	Economic growth lag of quality coordinated development
2005	−0.5803	−0.2705	0.994	0.974	0.980	Construction lag of quality coordinated development
2006	−0.4547	0.0685	0.986	0.990	0.996	Construction lag of quality coordinated development
2007	0.0482	0.2011	0.998	0.997	0.999	Construction lag of quality coordinated development
2008	0.8551	0.4300	0.891	0.999	0.892	Economic growth lag of good coordinated development
2009	1.2840	1.1997	0.975	0.998	0.977	Economic growth lag of quality coordinated development
2010	1.2143	1.5394	0.999	0.907	0.908	Construction lag of quality coordinated development

it is negative, which indicates that in recent years it is in the low level; during 2006–2010 it is positive, which indicates that it is in the higher levels in this period. Because in recent years, Shaanxi Province, firmly grasp the great western development, the national macro-control and other development opportunities.

Compared integrated development index of the construction industry f(x) with integrated development index of economic growth development index g(y), the coordination degree is obviously divided into four stages. The first phase is from 2001 to 2004, an economic growth retarded, which means economic development has lagged behind the development of the construction industry. This is mainly due to establish the construction industry as one of the pillar industries of Shaanxi Province. As a result, the construction industry developed rapidly. The second phase is from 2005 to 2007, which belongs to a construction lag. This indicates that the construction industry development has lagged behind the trend of economic growth. This is mainly because the construction industry of Shaanxi Province has a long cycle and the growth is slower. The third phase is from 2008 to 2009, which is also economic growth retarded. This is mainly because the financial crisis of 2008 has a greater impact on the economy of Shaanxi Province, which caused the economic growth to decline. The fourth stage is 2010, which belongs to a construction lag. Because the country takes measures on the real estate industry in the early 2010 to limit the demand for the purchase of speculative investment and support user demand. However, the real estate industry is closely related to the construction industry and fluctuations in the real estate industry affect the construction industry, so this development of construction industry in 2010 is relatively slow. At the same time, it can be seen that the level of coordination of the construction industry and economic growth has been in a volatile state, which also shows the construction development of Shaanxi Province is not sound.

2.4 Conclusion and Suggestions

The coordination of construction and economic growth determines the mutual adaptation and the interaction relationship of the construction industry and economic growth in terms of size, structure, and the pace of development. How to coordinate the relationship between the construction industry and economic growth is the foundation of developing construction industry and economic growth. This article uses the coordination in order to analysis construction industry and economic growth of Shaanxi province. We conclude the construction industry and economic growth in Shaanxi province have a stronger correlation, but it has significant fluctuations. The coordination degree of construction and economic growth of Shaanxi province is more than 0.85, which shows that the both have a strong coordination and the development speed is relatively modest. However, we also see that the coordination degrees of the construction industry and economic growth have a large fluctuation, which shows that the improvement space is larger.

From the trend of development, promoting the coordination of construction industry and economic growth is still an urgent task. This demands to maintain a stable economic growth and avoid changes radically. We should closely monitor the operation situation of economy, consider the situation and timely take corresponding measures. What's more, sustainable economic growth should be maintained, technological progress and innovation in construction should be strengthened and construction growth mode should be transformed. We look forward to the construction and economic growth from disorder to order and develop toward the benign direction of sustainable development.

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