Research on the Relevance of China's Construction Industry, Real Estate Industry and Fixed Assets Investment

Liu Miaomiao*, Chen Fan, Guo Kelan

Civil engineering College, Hunan University of Science and Technology, Xiangtan, Hunan 411201 China

*Corresponding author’s e-mail: 853287812@qq.com

Abstract. The close relationship among construction industry, real estate industry and fixed asset investment is a hot issue of concern to relevant scholars at home and abroad. Based on the statistical data of China Statistical Yearbook 2000-2018 and previous scholars' research, this paper quantitatively describes the relationship among the three. Firstly, the index system among the three is constructed, and the reliability and validity test and factor analysis are performed by SPSS25.0 to ensure the scientificity of the analysis. Then the VAR model is constructed, and the ADF test, J test, second-order differential root test and second-order differential variance decomposition are performed by using EVIEWS9.0. The results show that the fixed assets investment plays a more important role in the promotion of construction industry than the real estate industry; but the development of the construction industry and the real estate industry still depends on its internal forces. Based on the above research, the author puts forward suggestions for enterprise development. This paper provide an important reference for further exploration of enterprise relevance and enterprise management and development.

1. Introduction

Construction industry and real estate industry are important pillar industries of the national economy. Fixed assets investment is a very important indicator. It plays a leading and fundamental role in the national economy and social development. It plays an important role in the operation of the national economy. Impact; plays a very important role in the current development of urbanization in China. Fixed asset investment is part of capital formation, while construction and real estate are its most important industries. The construction industry, real estate industry and fixed asset investment are traditional iron triangle relations, and the relationship between them is very large. Construction, real estate and fixed asset investment are closely related. Relevant scholars based on the "China Statistical Yearbook" to interpret the relationship between construction, real estate and fixed asset investment, clearly pointed out that the three are not completely corresponding, but the three are related to a certain extent, and The correlation is very large. This paper is based on the data of China Statistical Yearbook from 2000 to 2018. The content of the real estate industry listed in the statistical yearbook is mainly focused on real estate development and investment behavior. This paper analyzes the correlation between the three and only considers the statistical yearbook. The content listed in the article.

As early as the early 20th century, American economist Leontief pioneered the input-output model. Since then, relevant scholars have collected relevant statistical data of Guangdong Province in a certain year according to the input-output theory, and analyzed that the forward linkage of the construction industry in the province is from the perspective of direct distribution and complete distribution. The industries with the closest relationship are real estate. Prior to this, some scholars
from Tsinghua University used the input-output table to analyze the years of representative countries in China, and studied the industrial linkages between China's construction industry and other industries, and obtained similar conclusions [5]. From the perspective of departmental analysis, Ding Rong used the input-output model to find that there are 14 departments closely related to the forward linkage of China's construction industry, among which the real estate industry has the greatest correlation, and the sum of their structural proportions is close to the whole. Half of it shows that the construction industry is largely resistant to the real estate industry [6]. Kong et al. used the product oscillating theory combined with the input-output model and found that the price change in the construction industry had the greatest impact on the real estate industry. [7]. In addition, Liu Ying et al. used the grey correlation model to obtain the highest degree of association between the construction industry and the real estate industry, and the construction industry has a greater tolerance to the real estate industry [8].

2. Construction and factor analysis of construction industry, real estate industry and fixed asset investment variable system

2.1. Construction of construction industry, real estate industry and fixed asset investment variable system

(1) The construction industry and the real estate industry are interdependent and closely related. From the statistical analysis of the development of construction industry in recent years [9], the national special and first-class construction general contracting enterprises, the total construction value of the building construction project, the newly signed contract amount, the operating income, the total profit, the receivables, etc. The aspects are ranked first. It can be seen that the construction industry is closely related to the real estate industry, and the progress of the real estate industry can promote the development of the construction industry. Generally speaking, as a developer, the real estate industry acquires land through purchase and contracts to construction companies in the construction industry for construction. After the construction is completed, the real estate industry will conduct inspection and acceptance and the subsequent sales and operation.

(2) Fixed asset investment is theoretically an important part of capital formation, while the construction industry is the most important industry for fixed asset investment, and there is a large positive correlation between the two [10]. In the current economic development and prosperity of the country, the increase in fixed asset investment will greatly promote the construction industry. In recent years, the phenomenon of overheating in the real estate industry has become increasingly prominent, and relevant government departments have taken relevant measures to bring the entire industry back to rationality. Therefore, the development of the construction industry cannot simply rely on the support of the real estate industry. According to the statistics of relevant departments in recent years [9], in 2016, although the construction and construction projects of national special and first-class construction general contracting enterprises in the construction industry, the total output value, new contract amount, operating income, total profit, and receivables It ranks first in terms of other aspects, but the growth rate of total output value of housing construction (4.83%) is much lower than that of power engineering (23.23%), railway engineering (10.59%), and port and waterway engineering (9.51%); The growth rate (12.82%) is much lower than chemical petroleum engineering (35.36%), mining engineering (26.46%), and highway engineering (25.03%); operating income growth rate (6.80%) is also lower than communication engineering (18.33%), railway Project (14.37%) and power engineering (8.78%); total profit growth rate (8.46%) is far lower than communication engineering (39.53%), highway engineering (24.36%) and power engineering (12.83%); The growth rate (12.27%) is also far lower than the port and waterway projects (35.65%), smelting projects (20.96%) and water conservancy and hydropower projects (15.49%). With the implementation of national “Belt and Road” policies in recent years, the construction of such infrastructure as railways, highways, and port coastal projects has continued to increase, and their share in the construction industry has also increased. Therefore, in this case, fixed asset investment plays an important role in the development of the construction industry, and has gradually replaced the impact of the real estate industry on the construction industry, becoming the most
(3) A major driving force behind the real estate industry’s ability to properly complete the capital cycle is the provision of working capital to the real estate industry from fixed assets investment. The real estate industry is such a process of capital circulation from development to finding a suitable construction unit for construction, then to project delivery acceptance, and finally to the household to purchase. The company can continue to proceed to the next project after receiving funds. It can be seen that the increase in fixed asset investment can greatly promote the development of the real estate industry.

Through the analysis of the existing literature and the statistical data of the national statistical yearbook and the statistical analysis of the construction industry, the index system between the construction industry, the real estate industry and the fixed asset investment is constructed, as shown in Figure 1.

![Index system for construction, real estate and fixed asset investment](image_url)

Figure 1. Index system for construction, real estate and fixed asset investment

The data comes from the China Statistical Yearbook 2000-2018, as shown in Table 1.
Table 1. Data table of each industry indicator variable

| Period | J1  | J2  | J3  | J4  | F1  | F2  | F3  | F4  | G1  |
|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1      | 3022.3 | 6066.3 | 36133.0 | 1697.9 | 10143.4 | 2031.7 | 13185.3 | 2613.3 | 24019.3 |
| 2      | 3341.1 | 80714.9 | 1994.3 | 13678.9 | 4515.7 | 45291.7 | 13185.3 | 2613.3 | 24019.3 |
| 3      | 6899.7 | 159406.2 | 2699.9 | 19050.3 | 14769.4 | 18637.1 | 65969.8 | 25068.2 | 17282.4 |
| 4      | 8116.4 | 179673.0 | 2878.2 | 19050.3 | 14769.4 | 18637.1 | 65969.8 | 25068.2 | 17282.4 |
| 5      | 9944.4 | 203992.7 | 32438.9 | 23397.1 | 77354.7 | 29889.1 | 137323.9 |
| 6      | 11911.7 | 223592.0 | 40441.8 | 26696.8 | 65969.8 | 25068.2 | 17282.4 |
| 7      | 15619.8 | 245401.6 | 49358.5 | 44355.2 | 34606.2 | 10476.7 | 57271.2 | 25168.3 |
| 8      | 18983.5 | 277450.2 | 58750.0 | 81868.1 | 44491.3 | 44355.2 | 34606.2 | 10476.7 | 57271.2 |
| 9      | 22070.9 | 316429.3 | 64877.3 | 49358.5 | 34606.2 | 10476.7 | 57271.2 | 25168.3 |
| 10     | 26583.3 | 358736.2 | 70817.0 | 51028.4 | 44491.3 | 10476.7 | 57271.2 | 25168.3 |
| 11     | 33071.5 | 401520.9 | 70817.0 | 51028.4 | 44491.3 | 10476.7 | 57271.2 | 25168.3 |
| 12     | 35270.2 | 423357.3 | 70817.0 | 51028.4 | 44491.3 | 10476.7 | 57271.2 | 25168.3 |
| 13     | 36064.7 | 420784.9 | 70817.0 | 51028.4 | 44491.3 | 10476.7 | 57271.2 | 25168.3 |
| 14     | 37626.8 | 422382.3 | 70817.0 | 51028.4 | 44491.3 | 10476.7 | 57271.2 | 25168.3 |
| 15     | 39765.3 | 419072.3 | 80704.0 | 5529.6 | 44491.3 | 10476.7 | 57271.2 | 25168.3 |

2.2. Factor analysis

Before factor analysis of indicator variables, KMO test and Bartlett spherical test are first used to determine whether factor analysis can be performed between each index variable\(^\text{[12]}\). Analysis using SPSS25.0, Bartlett sphericity test and KMO values are shown in Table 2 and Table 3.

Table 2. Construction Industry KMO and Bartlett Test

| KMO sampling suitability measure. | 0.668 |
|----------------------------------|-------|
| Bartlett's sphericity test       |       |
| Last read chi square             | 113.904 |
| Degree of freedom                | 6     |
| Prominence                       | 0.000 |

Table 3. Real Estate KMO and Bartlett Test

| KMO sampling suitability measure. | 0.761 |
|----------------------------------|-------|
| Bartlett's sphericity test       |       |
| Last read chi square             | 125.365 |
| Degree of freedom                | 6     |
| Prominence                       | 0.000 |

When the probability value corresponding to the P value of the sphericity test is less than the significance level (0.05), it is considered that factor analysis can be performed; when the KMO value is greater than 0.6, it can be considered as factor analysis. Obviously, both are satisfied, so it is suitable for factor analysis.

In this paper, SPSS25.0 is used for factor analysis. The purpose is to verify whether there is information overlap between multivariables, and the reliability and validity of the data, in order to analyze the correlation between the three more scientifically and accurately. Among them, fixed asset investment has only one indicator variable, so only the other two variables are factor analyzed. The results are shown in Table 4.
Table 4. Factor Analysis

| Indicator name | Eigenvalues | Cumulative variance contribution rate |
|----------------|-------------|---------------------------------------|
| J₁             | 3.869       | 96.729                                |
| J₂             | 0.099       | 99.210                                |
| J₃             | 0.025       | 99.825                                |
| J₄             | 0.007       | 100.000                               |
| F₁             | 3.904       | 97.599                                |
| F₂             | 0.066       | 99.250                                |
| F₃             | 0.026       | 99.908                                |
| F₄             | 0.004       | 100.000                               |

According to the analysis results, the indicator data describing each variable belongs to a type of data. When the indicator variable is quantitatively analyzed, each principal component can use the first indicator to describe the variables.

3. Data analysis and establishment of VAR model

Considering the relationship between the indicator variables of selected subjects, this paper uses VAR model to analyze the relationship between variables. The VAR model is used to predict the time series that are closely related to each other and to analyze the dynamic effects of stochastic volatility on the indicator variable system. It is used to estimate the dynamic relationship of the joint endogenous variables, which can explain the different economic shocks to the corresponding variables. Impact [13]. It can construct a model by using each endogenous variable in the system as a function of the hysteresis of all endogenous variables in the system, thereby extending the univariate autoregressive model to a "vector" autoregressive model consisting of multiple time series variables.

In order to prevent false regression, this paper first uses the ADF (Augmented Dickey Fuller) test to test the stability of the variable data. The software is EVIEWS9.0, and the results are shown in Table 5. X₁ represents the added value of the construction industry; X₂ represents the amount of fixed assets investment in the real estate industry; X₃ represents the amount of fixed assets investment in GDP. DX₁, DX₂, and DX₃ are their first-order differences; DDX₁, DDX₂, and DDX₃ are their second-order differences, respectively.

Table 5. ADF stationarity test results

| variable | Inspection form | ADF statistic | 1% threshold | 5% threshold | 10% threshold | P     | conclusion |
|----------|-----------------|---------------|--------------|--------------|---------------|-------|------------|
| X₁       | (0,0,1)         | 2.007661      | -2.75499     | -1.97098     | -1.60369      | 0.9833| unstable   |
| X₂       | (0,0,1)         | -0.07051      | -2.75499     | -1.97098     | -1.60369      | 0.6405| unstable   |
| X₃       | (c,0,0)         | -3.52719      | -4.00443     | -3.0989      | -2.69044      | 0.0235| Stable     |
| DX₁      | (c,0,0)         | -3.60731      | -5.12488     | -3.93336     | -3.42003      | 0.0781| Stable     |
| DX₂      | (0,0,0)         | -1.45218      | -2.75499     | -1.97098     | -1.60369      | 0.1309| unstable   |
| DX₃      | (c,t,0)         | -4.58645      | -4.88643     | -3.82898     | -3.36298      | 0.0158| Stable     |
| DDX₁     | (c,t,2)         | -4.68356      | -5.29538     | -4.00816     | -3.46079      | 0.0212| Stable     |
| DDX₂     | (c,0,0)         | -5.96607      | -4.12199     | -3.14492     | -2.71375      | 0.0006| Stable     |
| DDX₃     | (0,0,3)         | -1.87614      | -2.84725     | -1.9882      | -1.60014      | 0.0612| Stable     |
It can be seen from Table 5 that the index variable selected by the research object and the stability of the first-order difference are not strong, but the second-order difference of the selected index variable is very stable; therefore, the long-term equilibrium relationship test can still be performed. According to the AIC (Akaike Information Criterion) and SC (Schwarz Criterion) information criteria, according to the test results, the optimal lag order of the research object VAR model is 2nd order, and the Johansen test lag period is selected 1st. Data analysis was also performed using EVIEWS 9.0 to obtain the final test results, as shown in Table 6.

Table 6. Johansen test results

| Original hypothesis: the number of cointegration variables | Eigenvalues | Maximum eigenvalue statistic | 5% significance level threshold | P |
|----------------------------------------------------------|-------------|------------------------------|---------------------------------|---|
| None *                                                   | 0.986173    | 81.74834                     | 29.79707                        | 0.0000 |
| At most 1 *                                              | 0.761115    | 26.09363                     | 15.49471                        | 0.0009 |
| At most 2                                                | 0.437538    | 7.480603                     | 3.841466                        | 0.0062 |

It can be seen from Table 6 that the Johansen test shows that there is a long-term cointegration relationship between the construction industry, the real estate industry and the fixed asset investment at a significant level of 0.05, and the standardized cointegration equation is: \( X_1 = 0.4586 X_2 + 0.7509 X_3 \). It can be seen from the cointegration equation that the good and healthy development of the real estate industry and the increase in the amount of investment in fixed assets will promote the development of the construction industry. The fixed assets investment \( (X_2) \) of the real estate industry and the fixed assets investment \( (X_3) \) in GDP will increase by 46% and 75%, respectively. See, the impact of fixed asset investment on the construction industry is greater than the impact of the real estate industry on the construction industry. Based on the current national conditions, the government has taken measures to bring the real estate industry back to rationality. Under the implementation of the “One Belt, One Road” policy, infrastructure construction is increasing. Under this background, the impact of fixed asset investment on the construction industry is growing. It has gradually replaced the impact of the real estate industry on the construction industry and has become the most important factor affecting the construction industry. The analysis is in line with the actual situation.

This paper chooses to perform root test on the second-order difference sequence of each index variable. The results are shown in Table 7. When the root test results are all less than or equal to 1, the variance decomposition is meaningful.

Table 7. Second-order differential root test results of indicator variables

| Root value | Modulus |
|------------|---------|
| -0.215197 - 0.616178i | 0.652675 |
| -0.215197 + 0.616178i | 0.652675 |
| -0.510996 | 0.510996 |

4. Variance Decomposition

Based on the VAR model and the cointegration equation, the two endogenous variables of the construction industry and the real estate industry are subjected to variance decomposition. The results are shown in Tables 8 and 9.
Table 8. Variance decomposition results of the second-order difference of the construction industry (DDX_1)

| period | Standard error | DDX_1     | DDX_2     | DDX_3     |
|--------|----------------|-----------|-----------|-----------|
| 1      | 0.120496       | 65.08061  | 34.91939  | 0.000000  |
| 2      | 0.139961       | 63.50935  | 32.04654  | 4.444111  |
| 3      | 0.145651       | 60.14556  | 33.42582  | 6.428622  |
| 4      | 0.147040       | 59.04694  | 34.62948  | 6.323588  |
| 5      | 0.147408       | 58.78979  | 34.74232  | 6.467887  |
| 6      | 0.147507       | 58.82035  | 34.69859  | 6.481065  |
| 7      | 0.147562       | 58.8263   | 34.67231  | 6.501383  |
| 8      | 0.147586       | 58.80927  | 34.66779  | 6.522943  |
| 9      | 0.147593       | 58.80512  | 34.67244  | 6.522444  |
| 10     | 0.147596       | 58.8028   | 34.67197  | 6.525235  |

Table 9. Variance decomposition results of second-order difference in real estate industry (DDX_2)

| period | Standard error | DDX_1     | DDX_2     | DDX_3     |
|--------|----------------|-----------|-----------|-----------|
| 1      | 0.047813       | 0         | 100       | 0.000000  |
| 2      | 0.054429       | 1.100099  | 86.52705  | 12.37285  |
| 3      | 0.056161       | 6.1308    | 81.28277  | 12.58643  |
| 4      | 0.057223       | 7.983682  | 78.32187  | 13.6945   |
| 5      | 0.057644       | 7.88766   | 77.47966  | 14.63268  |
| 6      | 0.057774       | 7.949003  | 77.48409  | 14.5669   |
| 7      | 0.057836       | 7.937331  | 77.34717  | 14.71549  |
| 8      | 0.057855       | 7.958635  | 77.30873  | 14.73264  |
| 9      | 0.057866       | 7.973197  | 77.28561  | 14.74119  |
| 10     | 0.057871       | 7.971901  | 77.27377  | 14.75433  |

5. Conclusions and Suggestions

5.1. Conclusion
The results of variance decomposition show that the construction industry and the real estate industry are the industries that have the greatest impact on themselves, reaching 58.8% and 77.3% respectively. This shows that fixed asset investment can drive the development of the construction industry and the real estate industry, as well as the construction industry and the real estate industry have an impact on the development of each other, but they can only play a catalytic role. In the end, the development of the industry is still driven by its own internal forces, and the external influences cannot play a decisive role.

5.2. Suggestions
(1) The construction industry enjoys a very important position in China's national economy, has a strong industrial correlation effect, and has a strong ability to drive many related industries. The construction industry should rely on its own internal forces to actively adapt to the new requirements of the industry
in the current urbanization process in China, and effectively transform the development mode of the enterprise itself; increase the soft input of the construction industry, including the introduction, cultivation, management and BIM technology of talents. With the introduction of new technologies and new equipment, the degree of mechanization of enterprises will be increased, the influence of enterprises will be expanded, and the performance of enterprises will be enhanced. Enterprises will vigorously develop new materials and build an environmentally friendly and resource-saving construction development model; adjust the industrial structure and pay attention to the quality of employees. Strengthen cooperation among enterprises and improve core competitiveness; actively develop in-service engineering services, broaden service scope, such as testing, maintenance, reinforcement, transformation, etc. of in-service projects; further open up the enterprise market, actively go abroad and strengthen International exchanges.

(2) The real estate industry is an important part of the urban economy and has a great influence on the development of the urban economy. The fluctuation of real estate prices is related to the national economy and the people's livelihood. The rational, healthy and sustainable development of the real estate industry is very important. Under the current situation, on the one hand, the government should make reasonable expectations for the price of real estate, the government should allocate rationally in various real estate development land, effectively control, prevent overheating and expansion, effectively curb and prevent There has been a malicious rise in housing prices; in addition, the government has reduced its intervention in the real estate market and fully utilized its role in resource allocation. The real estate industry has the advantage of driving a wide range of advantages. Enterprises should continue to play their role in driving other related industries continuously and healthily; enterprises should broaden their service scope, do a good job in property management services, diversify, meticulous, informative, professional Services to strengthen communication with other related industries. Carry out the spirit of the 19th National Congress, the house is used to live, not used for speculation, and the house price is treated reasonably.

References
[1] Gao H. (2011) The relationship and influence of real estate industry, construction industry and fixed asset investment. J. Statistics and Management, 2011(3):46-46.
[2] Gao M, Dai L. (2011) The Triangle Relationship between Real Estate Industry, Construction Industry and Fixed Assets Investment——Interpretation of Related Topics in China Statistical Yearbook. J. China Statistics, 2011(4):39-40.
[3] Leontief W W. (1936) Quantitative Input and Output Relations in the Economic Systems of the United States. J. The Review of Economics and Statistics, 18(3):105-125.
[4] Zhang Y, Wang Y, Lu N, et al. (2015) Metrical Study on the Relatedness of the Construction Industry in Guangdong Province. J. Journal of Engineering Management, 2015(2).
[5] Wu X, Zhang Z. (2005) Input–output analysis of the Chinese construction sector. J. Construction Management and Economics, 23(9):905-912.
[6] Ding Rong. (2015) Study on China's Construction Industry Correlation Effect. D. Chang’an University,2015.
[7] Kong F, Zou H, Xi H. (2018) Research on the Spreading Effect of China’ s Construction Industry Based on Industry Spillover Theory. J. Construction Economy, 2018(9):22-26.
[8] Liu Y, Li Y, Ye Z. (2016) Analysis of the Relationship between Construction Industry and Related Industries Based on Grey Correlation Model. J. Journal of Shenyang Jianzhu University (Social Science), 2016(1):53-57.
[9] Ministry of Housing and Urban-Rural Development Program Finance and Foreign Affairs Division, China Construction Industry Association. Statistical Analysis of Construction Industry Development in 2016 [EB/OL]. (2017-05-23) [2018-04-15]. http://www.mohurd.gov.cn/xyjt/tjzljsytjgb/xjxxtq/wz2017_052321346623070743428.pdf.
[10] Xiong M. (2009) A Study on the Industry Linkage of Beijing Construction Industry——Based on the Input-output Model. D. Huazhong University of Science and Technology, 2009.
[11] Li L, Shao Y. (2018) The Correlation Degree between Engineering Cost Consulting and Investment, Real Estate and Construction Industry. J. Value Engineering, 2018, v.37; No.499(23):77-78.
[12] Liu Y. (2017) Research of Relational governance’s effect on Construction Technology Innovation Network Performance---Based on BIM Project. D. Hunan University of Science and Technology, 2017.
[13] Li L, Shen Z, Zhu H. (2018) Research on the relationship between engineering cost consulting industry, fixed asset investment, real estate industry and construction industry. J. Journal of Shenyang Jianzhu University (Social Science), 2018, 20(05):74-79.
[14] Zhou Y, Liu H, He Y. (2017) Analysis of the Correlation between Real Estate Price Fluctuation and Macroeconomic Time-varying. J. Contemporary Economic Research, 2017(09):90-97.
[15] Man X, Lu X, Yi C. (2017) Real Estate Industry and Urban Economy: An Empirical Study with the Input-output Forms of Beijing from 2000 to 2012. J. Journal of Central University of Finance and Economics, 2017(06):121-130.
[16] Bai Y. (2018) Analysis of Correlation and Spread Effect of Real Estate Industry in Guangdong Province Based on Input-Output Model. J. Journal of Suzhou University, 33(09):39-45.
[17] Chen X. (2018) Analysis of the Relevance of Sichuan Real Estate Industry and Its Related Industries. J. Journal of Chengdu Institute of Public Administration,117(03):58-63.