Spatial-Temporal Evolution and Correlation Effect of FDI from China, Japan and South Korea to ASEAN

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Abstract. The economy of East Asia is related to the overall development of Asia and even the whole world. Use ArcGIS to analyze the spatial-temporal evolution and the time series from 2004 to 2018 to construct the correlation effect model of FDI from China, Japan and South Korea to ASEAN to analyze the correlation effect of cumulative impulse response and variance decomposition. The results show that FDI from China, Japan and the South Korea in ASEAN increased significantly, and the investment location choice of the three countries in the ASEAN was relatively stable and had similarities and differences. The FDI from China and Japan to ASEAN mainly focuses on cooperation and synergy for a long time, while there is competition between Japan and South Korea, and the FDI from Japan to ASEAN has a deep influence on China and South Korea. The FDI from China, Japan and South Korea to ASEAN is not a zero-sum game. It is also known as the investment cooperation mode that multiple parties make investment in the same region over time, in different industries in the same period and in different locations.

1. Introduction
The great changes that the world has not seen in a century are accelerating, and the COVID-19 epidemic has affected more than 200 countries and regions. The world economy has suffered a severe setback, investment and trade have declined significantly, anti-globalization and trade protectionism have intensified, and China's trade and investment with East Asian countries are facing major risks and challenge. The leaders of the G20 summit in particular, President Xi Jinping of PRC stressed that the ASEAN and China, Japan and South Korea (10+3) are neighbours, there are all kinds, the complementary advantages of the industrial chain and division of labour system, to make efforts to restore economic development, promote regional economic integration, to play a “10 + 3” countries are highly complementary [1]. Close economic and trade exchanges, complete industrial structure and benefit the advantages of the depth of fusion, to further promote the investment, open markets to each other, as soon as possible to restore the East Asian economic growth. Over the past 40 years and more since reform and opening up, China's economy has been developing steadily and China has been deeply involved in investment and industrial distribution in East Asia. Now, how should be rational to participate in the game, the ASEAN investment competition and cooperation, and balance the FDI from Japan and South Korea to build various complementary advantages of East Asian industry network? Based on the dialectical perspective and development, visual analysis of China, Japan and South Korea direct investment to ASEAN, Spatial-Temporal evolution characteristics, quantitative analysis of correlation effect of FDI from China, Japan and South Korea to ASEAN should be analysed.
Throughout the domestic and international research progress, existing on the multinational direct investment in the same area correlation effect theory and the empirical study is less. The research on spatial-temporal evolution and the correlation effect of the FDI from China, Japan and South Korea to ASEAN is little. The research for China, Japan and South Korea cooperation with ASEAN in the majority is qualitative analysis framework mechanism[2]. There is a need for geospatial analysis and empirical research. Using the basic principle of international investment and regional economics, combining with the game theory thinking, based on the perspective of dialectical development, research on the spatial-temporal evolution and correlation effect of the FDI from China, Japan and South Korea to ASEAN. Explain the spatial-temporal evolution characteristics and correlation effect of associated and causes boost rational to participate in the direct investment in ASEAN, and discuss the new mode of China, Japan and South Korea-ASEAN investment cooperation.

2. Methods and Data

2.1 Methods

2.1.1. Spatial geographic model. Geographic information system (GIS) is a computer system for collecting, storing, processing, managing, analyzing, displaying and applying geospatial information [3]. Through the combination of geographical information and trade data, ARCGIS visualizes the temporal and spatial evolution characteristics and correlation effect of associated and causes boost rational to participate in the direct investment in ASEAN, and discuss the new mode of China, Japan and South Korea-ASEAN investment cooperation.

2.1.2. Vector autoregression mode. The vector autoregression model, which is widely used in macroeconomic research, is used to evaluate the investment correlation effect, and the dynamic correlation of time series of multiple variables in the system is investigated based on the principle of unstructured mathematical statistics. The vector autoregression model, VAR(p) is composed of n vectors, and the lag order is p. The form of VAR(p) is:

\[ Y_t = A_0 + \sum_{i=1}^{p} A_i Y_{t-i} + BX_t + \mathcal{E}_t \]  

Among them, i=1, 2... p. \( Y_t \) is the endogenous variable vector, \( A_0, A_i \) and B are the corresponding coefficient matrices, \( Y_{t-i} \) is the core explanatory variable, the i order lag variable of \( Y_t \), \( X_t \) is the control variable, and \( \mathcal{E}_t \) is the random perturbation term that conforms to the classical hypothesis. The VAR model contains too many parameters, and the economic significance is difficult to explain. Therefore, it focuses on analyzing the results of variance decomposition of impulse response function and system variables.

2.2. Research Data

The sample intervals of FDI flows from China, Japan, South Korea, the European Union and the United States to ASEAN were selected from the time series of 15 years from 2004 to 2018, with data from ASEAN Statistical Yearbook (2012, 2014, 2018), ASEAN FDI Database, Japan Trade Recovery Agency (JETRO) database and Korea Exim Bank database.

3. Spatial – Temporal Evolution Characteristics of the FDI in ASEAN

3.1 Overview of Major Countries (Regions) Investing in ASEAN

Since the beginning of this century, ASEAN has become increasingly diversified in terms of international investment sources and industry segmentation. In 2003, ASEAN announced the construction of a key economic community, which promoted foreign investment. After the global financial crisis, direct investment into ASEAN declined, but in 2010, it began to receive steady increase of direct investment[4]. ASEAN to accept the world's major economies in 2004-2018 direct investment flow as a whole, fluctuated upward trend (Figure 1.), but countries (regions) performance differentiation is obvious, the EU to ASEAN investment but more volatile, Japan and the United States of the ASEAN direct investment size and greater volatility, and China and South Korea's direct
investment to ASEAN steadily rising, other than the above countries (areas) of the ASEAN investment is small. With the continuous development of China's economy, China-ASEAN Free Trade Area was established in 2010, which greatly promoted China's direct investment in ASEAN[5]. At the same time, Japan and South Korea's direct investment industry in ASEAN and its subdivision direction have changed, not only limited to the use of ASEAN labour costs and natural resources and energy[6,7]. As can be seen from the proportion of direct investment from major economies accepted by ASEAN (Figure 2), investment from China, Japan and The South Korea in ASEAN has always occupied an important position and gradually surpassed the EU to become the most important source of investment for ASEAN after the outbreak of the global financial crisis in 2008. Since the establishment of the ASEAN Community in 2015, the economic restructuring and industrial restructuring within ASEAN have been carried out in an orderly way, and the liberalization of intra-regional trade, investment and labour force has been actively promoted. Currently, ASEAN has become the fifth largest economy in the world and the third largest in Asia, participating in the global value chain and regional production network[8].

![Figure 1. 2004-2018 FDI in ASEAN from world’s major economies](image1)

![Figure 2. 2004-2018 the proportion of FDI from major economies in ASEAN](image2)

3.2. The Spatial Distribution of FDI from China, Japan and Korea to ASEAN

By using ArcGIS software, the geographic coordinates of capitals of various countries are taken as nodes, and the weight of total bilateral trade is taken as the weight, without considering the flow direction of trade, the geographic spatial structure chart of FDI from China, Japan and Korea to ASEAN network is constructed by selecting four time sections in 2004, 2009, 2014 and 2018(shown in Figure 3).
In 2004, China, Japan and The South Korea had obvious differences in investment in the ten ASEAN countries, but there were also similarities. Japan invested the most in ASEAN, followed by China, and then the South Korea. China's direct investment in Singapore is the largest among the ten ASEAN countries, followed by Indonesia, and its investment in other countries is relatively low. Japan invested most in Singapore and Thailand, followed by Malaysia and Vietnam. South Korea invests more in Vietnam and Indonesia among the ten ASEAN countries. In 2009, Japan was still the biggest investor among the three, but South Korea outpaced China. Chinese investment in Singapore remains high, while increasing investment in Myanmar and Vietnam; Japan invests most in Thailand, followed by Indonesia and the Philippines, followed by Malaysia and Vietnam. South Korea has invested the most in Vietnam and Singapore, while increasing its investments in Thailand, Myanmar and Cambodia. It is worth noting that the investment of Japan and South Korea in Thailand has increased significantly, while the investment in Vietnam and Indonesia is still high, while the investment of China and South Korea in Singapore is still high but the investment in Japan is significantly reduced. In 2014, the total investment of China, Japan and the South Korea in ASEAN increased significantly, with little change in the spatial pattern of investment. China's investment in ASEAN countries has increased, and its investment in Singapore is the largest. Japan invests most in Singapore, followed by Indonesia, then Vietnam, Thailand and Malaysia. South Korea's top destination for investment was Vietnam, and investment elsewhere rose. In 2018, investment from Japan and the South Korea in ASEAN increased further, while investment from China fell back. The spatial pattern of investment was relatively stable. China has invested more in Singapore than other countries. Japan invested most in Thailand and Singapore, followed by Vietnam and Malaysia. South Korea has invested heavily in Vietnam and Singapore.

From 2004 to 2018, the direct investment of China, Japan and the South Korea in ASEAN increased significantly, and the investment location choice of the three countries in the ASEAN countries was relatively stable and had similarities and differences. Japan's investment in ASEAN is always large, with a significant growth trend. Japan's investment in Thailand, Singapore and Indonesia is always large, followed by its investment in Malaysia and Vietnam, namely, Japan prefers ASEAN6. Among ASEAN countries, China's investment in Singapore has always been the largest and its investment growth in other countries has been relatively balanced. South Korea's investment is smaller than That of China and Japan, but steadily increasing, and its investment in Vietnam and Singapore is always large.
4. The Empirical Analysis of the Correlation Effect Model of FDI from China, Japan and South Korea to ASEAN

4.1. Model Construction and Validation

4.1.1. Variable selection. When studying the correlation effect of FDI from China, Japan and South Korea to ASEAN, we take into account the large scale of FDI in ASEAN by the United States and the European Union. China (cn), Japan (jp), Korea (kr), The European Union (eu) and the United States (us) are determined to construct the model of direct investment flows to ASEAN as the scale of direct investment by each country (region) to ASEAN. The VAR model is added to the EU direct investment flow (eu) and the US direct investment flow (us) as control variables in order to reduce the influence of the US and EU direct investment in ASEAN on the model system of correlation effect of China, Japan and South Korea's investment in ASEAN.

4.1.2. Variable stationarity test. Considering the possibility of heteroscedastics and multicollinearity, the endogenous variables were treated with natural logarithms, that is, lncn, lnjp and lnkr respectively represent the FDI scale of China, Japan and South Korea in ASEAN, and eu and us respectively represent the FDI scale of EU and the United States in ASEAN. ADF test was performed on the
stationarity of time series with the help of Stata15 software. Under the significance of 5%, all the five variables were non-stationary time series. After the first score check, dlnnc, dlnjp, dlnkr, deu and dus were stable under the significance of 1%.

4.1.3. Construction of correlation effect model. A vector autoregressive model was constructed by using the stationary time series after first-order checking, in which dlnnc, dlnjp and dlnkr were endogenous variables and deu and dus were control variables. According to AIC and SC information criteria, the minimum lag order was finally determined as second order after several attempts, and the VAR(2) model of correlation effect should be established. Before the establishment of the model, the system stability test was carried out on the estimation model system. All characteristic roots fell within the unit circle, indicating that the system stability of the correlation effect model was stable, that is, there was a long-term stable relationship between the three core variables. The subsequent Granger causality test, impulse response function and variance decomposition are all based on this stable correlation effect VAR(2) model.

4.1.4. Granger causality test. Granger causality test is not a causal relationship in the real sense, but it can be used to describe the dynamic correlation between variables and is a necessary condition for the existence of causal relationship between variables. The result of Granger causality test show that the Japanese and Korean direct investment to ASEAN is Granger cause of the scale of Chinese FDI to ASEAN, China and South Korea are granger cause of Japan's direct investment to ASEAN, while the FDI from China and Japan in ASEAN isn’t through the granger causality test for Korea by single variable, but the results strongly refused to China and Japan are not the Granger reason of South Korea, China and Japan have a certain effect on South Korea's investment in ASEAN, and most of the inspection results significantly stronger. It can be interpreted as follows, The correlation effect of the FDI from China, Japan and South Korea to ASEAN is very significant, the investment layout and strategic considerations of the three countries in ASEAN have a comprehensive impact on all parties, and the investment industrial network in East Asia is closely related, so it is necessary to conduct impulse response function and variance decomposition analysis on the investment correlation effect.

4.2. Results Analysis

4.2.1. Analysis of impulse response function. The impulse response function is used to investigate the dynamic response of an endogenous variable in the system to the impact caused by the error term. In other words, after a standard deviation impact occurs in the random error term, the current and future values of the endogenous variable in the system are simulated. The direct investment correlation effect of different countries on the same region was investigated, that is, the cumulative response of the macroeconomic system in a period of time in the future, and the orthogonal cumulative impulse response function (lag period 8, confidence interval 95%) of the direct investment correlation effect of China, Japan and South Korea on ASEAN was constructed by comprehensively considering the sample interval.

According to all the impulse response results (Figure 4), a preliminary analysis and interpretation is made, Chinese and Japanese direct investment in ASEAN orthogonal cumulative impulse response preliminary estimation results (Figure 4(a), 4(b)), found that the current Japanese direct investment in ASEAN one standard deviation, the Chinese direct investment ASEAN to the positive effects in the long run, and peak at the first period, although in the fourth period before and after the negative, but then till tend to be more positive and stable convergence at the 8th period. The trend of Japan's influence by China's investment in ASEAN is similar to the former, but to a lesser extent. On the whole, it has a positive impact on Japan's direct investment in ASEAN, namely, synergistic effect. This shows that although there is a certain degree of competition between China and Japan in direct investment in ASEAN, the long-term cooperation synergy is the main effect. First of all, China and Japan invest in ASEAN or have many similar industrial choices to form a competitive effect, but they invest in and manufacture complementary commodities in the same industry, thus playing a promoting role. Secondly, the two sides will invest in the upstream and downstream industries in ASEAN to
promote vertical industrial division at home and abroad. Third, the investment of China and Japan in ASEAN countries appears the space industry cluster, realizes the scale economy to promote the investment of both sides; Fourthly, the author believes that the national investment decision conforms to the rational subject hypothesis in economics, and seeks the optimal solution of investment in the dynamic game process for the consideration of domestic industrial structure upgrading and comprehensive strategy. Japan and China have similar and different investment motivations in ASEAN. Japan's and China's direct investment is based on market size, resource endowment (natural resources and human resources) and domestic marginal industry transfer, while China's investment in ASEAN is based on scientific and technological knowledge. China and Japan in the wholesale and retail, manufacturing, energy resources industry and finance and insurance services are high investment, which Japan has focused on manufacturing (raw materials processing, information communication and mechanical transportation equipment manufacturing) investment, financial insurance services and other services, while China focuses on real estate and infrastructure construction, investment form the upstream and downstream industry chain, the two countries to promote investment cooperation.

The initial measured results of orthogonal cumulative impulse response of direct investment from China and South Korea in ASEAN (Figure 4(c), Figure 4(d)) show that the impact of one standard deviation of China's investment in ASEAN in the current period will have a negative impact on South Korea's investment in ASEAN, but the fluctuation is not large. However, China is less affected by the influence of South Korea, which is mainly affected in a negative way. In the third and fourth stages, it appears in a positive way, and then tends to converge steadily until the 8th stage. It indicates that the investment behaviours of China and South Korea in ASEAN have a weak influence on each other. Investment competition and cooperation coexist, but competition is mainly inhibited at present. First of all, China and South Korea have the same industrial choices in their investment in ASEAN, and both sides invest in and manufacture alternative commodities in the same industry, thus inhibiting the effect. Second, South Korea's investment in ASEAN forms industrial competition with China, crowding out Chinese investment; Third, China and South Korea have overlapping investment in ASEAN countries and areas, and there is competition in the spatial layout. Specifically, South Korea's investment in ASEAN countries is mainly market-oriented and resource-oriented, while South Korea's investment is mainly concentrated in the manufacturing industry, coal, oil and gas (energy industry) and financial services industry. South Korea and China have advantages over ASEAN countries in textile manufacturing, rubber and plastics, leather bags, shoes and other low-technology manufacturing industries, thus inhibiting China's investment in ASEAN. In addition, South Korea lacks some domestic energy resources, and invests more in ASEAN in energy industries, thus competing with China's investment in ASEAN natural resources, which inhibits China's investment in ASEAN.

Japan and South Korea in ASEAN direct investment orthogonal cumulative impulse response of the preliminary estimation results (Figure 4(f), Figure 4(e)), found that the current to Japan’s direct investment one standard deviation, as a whole will be South Korea's direct investment in asean has negative effects in the long-term trend, and after the shock peak at first period, although at South Korea's direct investment to ASEAN cumulative impulse response in the fourth period before and after appear weak positive, but then until 8th tend to be negative to the stable convergence; On the other hand, Japan's direct investment is influenced by South Korea's direct investment in ASEAN with a similar trend, but to a lesser extent. On the whole, Japan's direct investment in ASEAN has a negative trend in the long run, reaching a peak in the second period after the impact, and then tending to a negative and stable convergence until the 8th period. It indicates that the mutual restraining competition effect is the main factor in the investment of Japan and South Korea in ASEAN, and its mechanism is similar to that of South Korea and China. The development of South Korea's foreign trade and investment is greatly influenced by Japan. To a certain extent, it can be regarded as a student of Japan. Japan and South Korea have industrial competition and regional competition in their investment in ASEAN. Japan always have advanced technology and management advantages in Asia, and South Korea's rapid economic rise and with the development of domestic industrial upgrading, more to ASEAN regional investors especially in high technology manufacturing electronic
components manufacturing and modern services such as financial insurance investment, and Japan form the stronger industrial competition.

Figure 4. Impulse response function curve of correlation effect

4.2.2. Variance decomposition analysis. The variance decomposition of the VAR model is used to measure the individual contribution (influence degree) of the disturbance term of each equation in the model system to the prediction error. It is now used to analyse the relative importance of the dynamic correlation change of China, Japan and South Korea to ASEAN direct investment. Among the correlation effect of China, Japan and South Korea's investment in ASEAN, Japan has always been the most affected by its own investment, while China and South Korea have also been the most affected by Japan's direct investment in ASEAN and their long-term structure is relatively stable. South Korea's influence on China and Japan's direct investment in ASEAN is very weak, but South Korea's contribution to China's and Japan's influence is more balanced. According to the variance decomposition results of the correlation effect VAR model (Table 1), a preliminary analysis and interpretation is made:

China's direct investment in ASEAN is most affected by Japan, followed by its own, and least affected by South Korea. To be specific, in the first phase, China's direct investment in ASEAN is only influenced by itself; in the second phase, Japan's direct investment in ASEAN is the most influential; in the third phase, it peaks and then tends to be stable, that is, China is the most affected by Japan's direct investment in ASEAN and the least affected by South Korea's direct investment in ASEAN. Due to the late start of China's investment in ASEAN, no matter in multinational companies or in the industrial dimension, a perfect structure has not been formed, the investment consistency is weak, and the scale economy and industrial chain division of labour and cooperation have not yet been realized. Japan began to invest in ASEAN as early as the 1950s, and has an in-depth understanding of local market potential, technological level, industrial development and government regulation. Combined with the analysis results of cumulative impulse response function, based on the correlation between upstream and downstream industries and strategic policy considerations, Japanese investment has a significant driving effect on China's investment in ASEAN and a significant long-term impact. At the same time, with the improvement of China's comprehensive economic strength, the amount and speed of China's investment in ASEAN will increase. Considering the domestic industrial development and production capacity advantages, its investment in ASEAN will be influenced to some extent. However, South Korea's direct investment in ASEAN is relatively small compared with That of China and Japan, which has a weak restraining effect on China's direct investment in ASEAN.

The biggest contribution to Japan's investment influence in ASEAN is always its own, but China's influence on Japan is high in the short term and tends to be stable after that, while Japan is weakly influenced by South Korea. To be specific, in the first phase, Japan's direct investment in ASEAN is
mainly influenced by itself; in the second phase, China's direct investment in ASEAN increases; in the third phase, it reaches a peak, and then tends to be stable. In other words, Japan's direct investment in ASEAN is most influenced by itself, and the influence of Korea's direct investment in ASEAN is the weakest. It can be interpreted that Japan's investment decision on ASEAN is mainly based on its own consideration of economic and industrial structure development, and has certain investment inertia. Meanwhile, its investment is significantly influenced by the driving effect of China in the short term. First of all, Japan, as an Asian developed economy, has obvious advantages in investing in ASEAN in high-tech industries. Meanwhile, due to the maturity and perfection of its industrial structure, the distribution of marginal industries and excess capital in China will not change dramatically in the short term. Secondly, Japan has been investing in ASEAN for a long time and has the investment foundation and advantages in the old FIVE ASEAN countries. Japanese domestic multinational companies will continue to follow up the investment based on the consideration of existing ASEAN industrial advantages and market share maintenance. Third, the industrial layout of China's investment in ASEAN is complementary and synergistic with that of Japan. With the improvement of China's investment status in ASEAN, China's investment influences Japan's investment in ASEAN to some extent in the short term, which is consistent with the analysis results of the impulse response function of the model.

The first two periods have the greatest influence on South Korea's investment in ASEAN, and the long-term influence of Japan's investment in ASEAN is greatest, followed by its own and China. To be specific, in the first and second phases, South Korea's direct investment in ASEAN is greatly influenced by itself; in the third phase, Japan's direct investment in ASEAN has the greatest influence; in the sixth phase, it peaks and then tends to be stable. In other words, South Korea is most affected by Japan's direct investment in ASEAN and is similarly affected by itself and China's direct investment in ASEAN. Different from China and Japan, South Korea's investment in ASEAN is more evenly affected by the three countries, mainly because of the large amount and amount of Chinese and Japanese investment in ASEAN. In the early stage, South Korea's investment in ASEAN was mainly based on its own considerations of industrial and economic development. After Japan's investment gradually increased its influence. Due to the similarities and historical factors in the economic and industrial structure between Japan and South Korea, South Korea's investment choice was deeply influenced by Japan. Combined with the analysis of cumulative impulse response function, the investment between Korea and China in ASEAN has a competitive effect, and Japan has an obvious inhibitory effect on the investment in Korea.

Table 1. Variance decomposition of VAR model

| period | dln cn | dln jp | dln kr | dln cn | dln jp | dln kr | dln cn | dln jp | dln kr | dln cn | dln jp | dln kr |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 1      | 1      | 0      | 0      | 0.046  | 0.954  | 0      | 0.386  | 0.142  | 0.472  |
| 2      | 0.231  | 0.721  | 0.048  | 0.411  | 0.540  | 0.049  | 0.343  | 0.231  | 0.426  |
| 3      | 0.132  | 0.835  | 0.034  | 0.250  | 0.722  | 0.028  | 0.262  | 0.376  | 0.362  |
| 4      | 0.211  | 0.727  | 0.062  | 0.159  | 0.813  | 0.028  | 0.269  | 0.411  | 0.319  |
| 5      | 0.209  | 0.732  | 0.059  | 0.192  | 0.781  | 0.027  | 0.214  | 0.531  | 0.254  |
| 6      | 0.176  | 0.763  | 0.060  | 0.186  | 0.789  | 0.025  | 0.200  | 0.564  | 0.236  |
| 7      | 0.188  | 0.754  | 0.058  | 0.165  | 0.812  | 0.023  | 0.225  | 0.539  | 0.236  |
| 8      | 0.187  | 0.757  | 0.056  | 0.174  | 0.804  | 0.023  | 0.217  | 0.556  | 0.227  |

5. Conclusions
Through a comprehensive review of the development status, temporal-spatial evolution characteristics and correlation effect of FDI from China, Japan and South Korea to ASEAN from 2004 to 2018, the conclusion can be drawn.

1. The direct investment of China, Japan and the South Korea in ASEAN increased significantly, and the investment location choice of the three countries in the ASEAN countries was relatively stable
and had similarities and differences. Japan's investment in ASEAN is always large, with a significant growth trend. Japan's investment prefers ASEAN6. Among ASEAN countries, China's investment in Singapore has always been the largest and its investment growth in other countries has been relatively balanced. South Korea's investment is smaller than that of China and Japan, but steadily increasing, and its investment in Vietnam and Singapore is always large.

2. The direct investment of China, Japan and South Korea in ASEAN has a long-term and stable correlation effect. The investment of the three countries in ASEAN has both synergistic and competitive effects. Although China and Japan have competition in direct investment in ASEAN, in the long run, they mainly promote cooperation. The two sides invest in or form upstream and downstream related industries and economies of scale, with synergies. The investment of Japan and South Korea in ASEAN has the effect of restraining competition, and Japan has a strong influence on South Korea. However, China and South Korea's investment in ASEAN has a competitive effect, but has little impact on both sides.

3. China, Japan and South Korea have different influences on their investment in ASEAN. Based on historical reality and investment inertia, Japan's direct investment in ASEAN has the highest influence on itself, and Japan has a high influence on China and South Korea, while South Korea has a weak influence on China and Japan's investment in ASEAN.

4. Based on the research on the correlation effect of ASEAN direct investment between China, Japan and South Korea, it is believed that the direct investment of multiple countries in the same region is not a zero-sum game. The investment motivation, industrial selection and advantages (factor endowment, technology, location and competitive advantage) of the investment home country are the basis of cooperation. The continuation of investment in the same region over time, and the location selection of different industries and differentiation in the same period are all the manifestations of investment cooperation.

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