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The Spatio-Temporal Evolution of Geo-Economic Relationships between China and ASEAN Countries: Competition or Cooperation?

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Abstract: In the last 30 years, China's economic power has experienced great changes and has brought about a profound impact on the world economy. This led us to ask a question: do changes in China's economic power shift the geo-economic relationships between China and its neighboring countries? To answer this question, we researched the evolution of geo-economic relationships between China and the Association of Southeast Asian Nations (ASEAN) countries. Using the Euclidean distance method, we explored the changes in these geo-economic relationships between China and ASEAN countries from 1980 to 2014. Our findings resulted in five conclusions: (1) Over time, geo-economic relationships between China and ASEAN countries remained relatively stable. (2) Geographically, the main geo-economic relationships between China and continental ASEAN countries were complementary, while the main geo-economic relationships between China and island ASEAN countries were competitive. (3) Geopolitics and geo-culture were attributed to the changes in geo-economic relationships. (4) The evolution of geo-economic relationships was characterized by path dependence. (5) Geo-economic relationships between China and ASEAN countries could be classified into four types: game type, with high cooperation and competition; complementary type, with high cooperation and low competition; fight type, with low cooperation and high competition; and loose type, with low cooperation and competition. Our findings contribute to improving the understanding of geo-economic relationships.

Keywords: geo-economic relationships; competition and cooperation; patterns and characteristics; China; ASEAN countries

1. Introduction

In the context of globalization and economic integration, geo-economic research is becoming increasingly important. Since the end of the Cold War, with rapid economic development in China, India and other emerging countries, the space and structure of international power have undergone profound changes. The world is entering a new era of geopolitics and geo-economics [1]. Many scholars turn their attention to geo-economics and geo-economic relationships. Wigell defined geo-economics as the geostrategic use of economic power and constructed two typologies: strategic frame (competitive or cooperative) and economic power (as goal or means) [2,3]. A strategic frame leads to two different views of geo-economic relationships. Some scholars discuss geo-economics as a form of statecraft and take states as agents of economic power [4,5]. They believe the reason for developing geo-economics

is to gain economic interest, control resources and improve political influence through competition with other countries, arguing that there are competitive relationships between geo-economic actors. However, other scholars believe that the dependency of countries on the fluid global circulation of resources, goods, data, people and finance has risen, and that economic complementarities and cooperation amongst countries seem clear [6]. The major regional economic powers, such as Brazil, Russia, India, China and South Africa (BRICS), are inclined to maintain cooperation during economic development [7]. The cooperative geo-economic relationships for BRICS countries are significant [2]. These new economic powers resort to a series of diplomatic, political and economic policies to facilitate economic development, which focus on commodity circulation and economic cooperation. From our perspective, the competitive and cooperative geo-economic relationships are relative. Sometimes geo-economic competition and cooperation co-exist between countries. In some industries, there are competitive relationships, while in other industries there are cooperative relationships. Similarly, in some years, the competitive geo-economic relationships between countries are more obvious. In other years, the cooperative geo-economic relationships are more prominent. Therefore, competition and cooperation are not separate. Geo-economic relationships are constantly changing, and the relationships of competition and cooperation can be altered. For a regional power, do changes in economic strength shift geo-economic relationships with neighboring countries? How does the geo-economic relationship evolve?

Regarding geo-economic relationships, some studies on North America and Europe have been conducted. The geo-economic relationships between the U.S. and Canada, as well as the U.S. and Mexico, have been extensively studied. The geo-economic relationship between the U.S. and Canada is dependent on integration and asymmetry [8], while the geo-economic relationship between the U.S. and Mexico depends on cross-border cooperation [9,10]. Scholars have also researched the geo-economic relationships between the European Union (EU) and other countries. Smith suggested that the relationships between Europe and other countries were influenced by mutual interdependence of geo-economics and geopolitics; and the cooperative relationships of cities and regions between Europe and the outside world needed to be strengthened [11,12]. Although previous studies have mostly focused on North America and Europe, with the rise of China, geo-economic research on China and its neighboring countries is gaining importance. The current research focuses on China's geo-economic strategy, export policy, industrial cooperation, regional financial and monetary markets, overseas foreign direct investment, transnational regional economic cooperation, geo-economic cooperative effects, policy coordination, facility connectivity, unimpeded trade, financial integration, and people-to-people bonds [13–19]. However, research on the geo-economic relationships between China and the surrounding countries is limited.

Since its economic expansion 30 years ago, China's economic power has experienced a noteworthy change. Currently, China is the world's largest trading nation and an important regional power. Its geo-economic influence is also increasingly prominent. In such a scenario, do the changes of China's economic power shift the geo-economic relationships between China and its neighboring countries? Do they change competitive or cooperative relationships with China's economic strength?

These questions prompted our research into the spatial-temporal evolution of geo-economic relationships between China and its neighbors. Compared with Central Asia, South Asia and Northeast Asia, the Association of Southeast Asian Nations (ASEAN) plays the most important role in China's economic development. Since the establishment of the China–ASEAN strategic partnership in 2003, economic and trade cooperation have experienced a decade of remarkable achievements. According to statistics from the Ministry of Commerce of China, the bilateral trade volume between China and ASEAN countries rose sharply from 782 billion dollars in 2003 to 4721.6 billion dollars in 2015. By the end of 2015, China had been the largest trading partner of ASEAN countries for six consecutive years, and ASEAN countries had been China's third largest trading partner for four consecutive years. Furthermore, the Chinese government regarded the Silk Road Economic Belt and 21st-Century Maritime Silk Road policy (referred to as "The Belt and Road") as a major national development

strategy in 2013. As a result, ASEAN countries became a key region of Maritime Silk Road cooperation. In this context, it is vital to take ASEAN countries as an example to discuss the changes of geo-economic relationships between China and its neighboring countries.

The structure of this paper is as follows: Section 1 asks if the changes in China's economic power shift the geo-economic relationships between China and its neighboring countries. Section 2 introduces the research area and method. Section 3 provides the results, describing the geo-economic relationships between China and ASEAN countries from 1980 to 2014. Section 4 discusses the analysis of spatial-temporal patterns and characteristics, reclassifies geo-economic relationships and provides corresponding countermeasures. Section 5 is a summary of major conclusions and future works.

2. Materials and Methods

2.1. Research Area

The research areas were mainland China and ASEAN countries. ASEAN nations include Myanmar, Thailand, Cambodia, Laos, Vietnam, Indonesia, Malaysia, the Philippines, Singapore and Brunei. The total area of ASEAN countries is about 4.479 million km², with a population of 618 million (2014 data). ASEAN countries have a very important geopolitical position, being located south of China, north of Australia, west of the Pacific Ocean and east of the Indian Ocean (Figure 1). They connect three continents (Asia, Africa and Oceania) and are thus in a high-traffic area. For northeast Asian countries, the Malacca Strait is the shortest sea route to Europe or Africa.
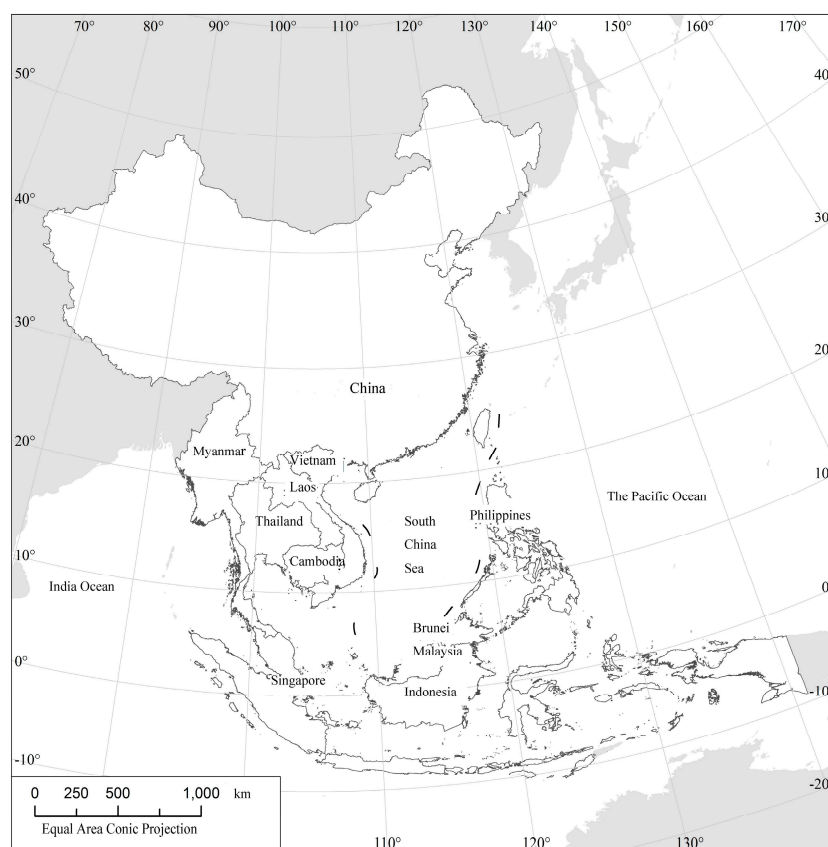
**Figure 1.** Geographic location of China and Association of Southeast Asian Nations (ASEAN).

2.2. Concept

The differences in natural conditions and economic production lead to the competitive or complementary geo-economic relationships. Competitive geo-economic relationships are caused

by geographical and industrial similarities between countries or regions, including the types of resources and the market structure. During economic development, under competitive relationships, participants are likely to compete for resources, manpower, capital and market. Conversely, complementary geo-economic relationships are formed from differences in geographical and industrial factors [20]. In economic development, the actors can learn from each other and attain individual advantages for mutual benefit and the development of the region as a whole. The aim of the evaluation of geo-economic relationships is to determine whether there is a competitive or complementary relationship between two countries in order to enact corresponding economic strategies. Since competition and complementarity are affected by geographical and industrial differences, we use Euclidean distance as a way to measure the differences between countries. Large distances indicate large differences, inferring a complementary geo-economic relationship between countries. Smaller distances indicate smaller differences, which corresponds to a competitive geo-economic relationship.

2.3. Research Method

Through economic indicators, the Euclidean distance (*ED*) can quantitatively measure differences in resources, products, and efficiency between countries. Since Wen designed the index system and measurement methods of geo-economic relationships [21], the Euclidean distance has been used by many scholars to measure the geo-economic relationships between regions or countries [22–33]. Research on the measurement of geo-economic relationships has enriched existing theoretical achievements of geo-economics, clarified research ideas, and provided a reference for follow-up studies. However, there are also a few shortcomings of using Euclidean distance. First, the Euclidean distance only considers the main relationships between countries at the macro level; it cannot measure the competitive or cooperative relationships in specific industries. Second, indicators are limited, and only key indicators are selected to reflect the competition and cooperation of geo-economics. Third, Euclidean distance analysis reflects the competitive or cooperative relationships between regions or countries at a specific year and does not reflect the continuous changes in geo-economic relationships within a certain period of time. Nevertheless, the Euclidean distance method is still recognized by scholars and has proven to be a scientific and effective way to measure geo-economic relationships between regions or countries.
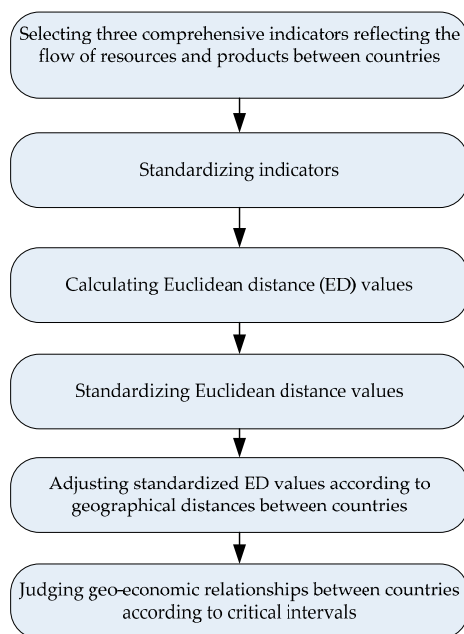

Figure 2. Method to measure geo-economic relationships.

The method to measure geo-economic relationships is as follows (Figure 2): First, we selected three comprehensive indicators that reflected the differences in resources and products between countries and standardizes them. Second, Euclidean distance (*ED*) values were calculated and standardized. Third, the standardized *ED* values were adjusted according to geographical distances between countries, namely geographic location weight multiplied by standardized *ED*. Finally, the geo-economic relationships between China and ASEAN countries in a certain year could be judged according to the critical intervals of *ED*. We measured the geo-economic relationships every five years, from 1980 to 2014, for a total of eight periods.

2.2.1. Selection of Evaluating Indicators

The measurement and analysis of geo-economic relationships draw on the theory of regional economic competitiveness. Regional economic competitiveness refers to the ability of a region to compete with other regions for market share and resources, or a region's optimal allocation of resources relative to other similar regions [34]. From an economic point of view, the core of regional competitiveness is the ability to compete for market share and allocate resources. This ability is reflected in three aspects: the attraction of resources and capital, the efficiency of processing and conversion, and the output capability of products and services [25]. Based on this viewpoint, we designed a theoretical framework to measure national geo-economic relationships (Figure 3).
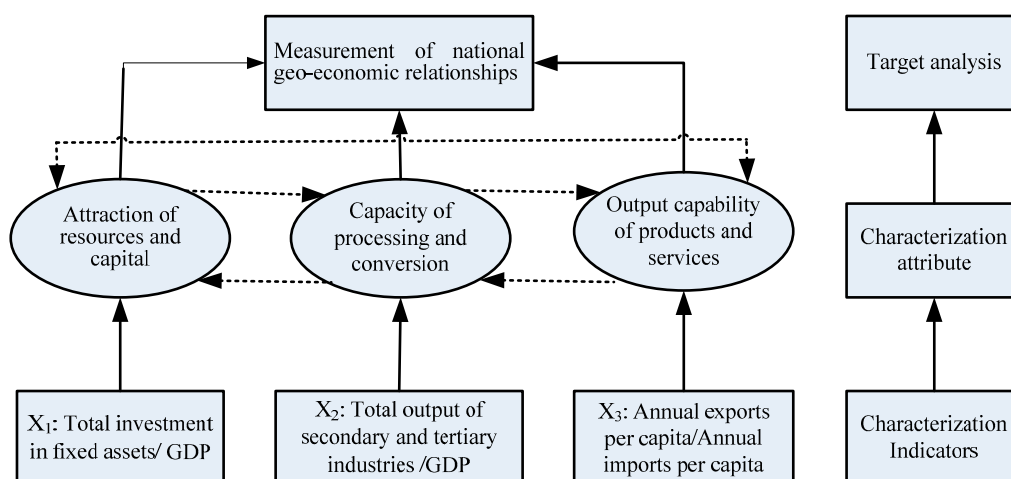
Figure 3. Theoretical frame for the measurement of national geo-economic relationships.

Specific indicators are selected by scholars to reflect the flow of resource, product and capital. Xu used material resources, human resources, capital flow, products flow, and transport accessibility to reveal the circulation of resources and products, as well as regional competitiveness [27]. Xie and Yan selected four indicators: capital investment, income, industrial output, and market scale [33]. Yet most scholars tended to select investment in fixed assets, the output of secondary and tertiary industries, and annual exports and imports per capita. Research shows that these three indicators can comprehensively reflect geo-economic relationships between countries [29,32]. Competitiveness and complementarities are reflected in the flow of resources and products between countries. In general, raw material, labor force, capital, and products flow from low-efficiency areas to high-efficiency areas, and from resource-rich to resource-poor countries or regions [21]. Thus, we selected three comprehensive indicators (X_1, X_2, X_3) to reflect the flow of resources and products.

X_1 = Total investment in fixed assets/gross domestic product (GDP)
X_2 = Total output of secondary and tertiary industries/GDP
X_3 = Total annual exports per capita/total annual imports per capita

X_1 reflects national investment efficiency or shortage of capital. If the value of X_1 is large, it is possible that investment efficiency is low, or that the country is abundant in capital. When the value of X_1 is small, it indicates that investment efficiency is high or the country has a shortage of capital. X_2 reflects labor efficiency. To some extent, the development levels of secondary and tertiary industries reflect national economic and social development and thus mirror the degree of industrialization and labor efficiency. If the value of X_2 is large, it is possible that labor efficiency is high. Conversely, if X_2 is small, labor efficiency is low. X_3 reflects the outward flow of resources and products. If the value of X_3 is large, it is possible that the country has a product surplus with a higher possibility of export; conversely, if X_3 is small, it indicates that the country will import resources and products. The above indicators are relative numbers because absolute numbers cannot reflect the flow, and it is more reasonable to use relative numbers. Furthermore, we analyzed the correlation between the three variables. Spearman's correlation test showed that the significant levels between variables were above 0.05, which indicated the variables were independent. There was no correlation between X_1 and X_2, X_1 and X_3, or between X_2 and X_3 (Table 1).

Table 1. Correlation between variables.

Indicators	X_1	X_2	X_3
X_1	1.000	0.213 (0.072)	−0.025 (0.837)
X_2	0.213 (0.072)	1.000	0.385 (0.097)
X_3	−0.025 (0.837)	0.385 (0.097)	1.000

In the box, the above numbers indicate correlation coefficient. The numbers in brackets indicate the significance level with a two-tailed test.

2.2.2. Standardization of Indicators

The values of X_1, X_2, and X_3 were calculated according to the formula shown in Figure 3. The three values were then standardized in SPSS 19.0 software. The formula to standardize indicators is as follows:

$$X'_{ij} = (X_{ij} - \overline{X_j})/S(X_j) \tag{1}$$

where X'_{ij} is the standardized value, X_{ij} is the original value of indicator j of country i, $\overline{X_j}$ is the average value of indicator j, and $S(X_j)$ is the standard deviation of indicator j.

2.2.3. Calculation of *ED* Values

If the *ED* of country a and country b is denoted as ED_{ab}, then the formula is:

$$ED_{ab} = \sqrt{\sum_{j=1}^{n} (X'_{aj} - X'_{bj})^2} \tag{2}$$

2.2.4. Standardization of *ED* Values

In order to compare the *ED* values of different countries, *ED* values must be standardized:

$$ED' = (ED_i - \overline{ED_i})/S(ED_i) \tag{3}$$

2.2.5. The Assignment of Geographical Location Weight

The distances between countries have an impact on the flow of resources and products and thus play a role in enhancing or impairing the competition or cooperation between countries. Therefore,

standardized *ED* values were adjusted according to the geographical distances between countries. Geographical location weight is represented by *W*. The shorter the distance between countries, the larger the value of *W*; the longer the distance, the smaller the value of *W*. The values of *W* were determined by expert evaluation and the analytic hierarchy process. First, the values of *W* were rated by geopolitical research experts from Beijing Normal University, Yunnan Normal University, East China Normal University, Geographical Institute of Chinese Academy of Sciences, Academy of Social Sciences and China Foreign Affairs University. Second, multi-factor analysis was used to determine the final geographical location weight. Last, we set the values of *W* as follows: Laos, Myanmar and Vietnam share borders with China, with *W* set to 1. Thailand and Cambodia are adjacent to China, with *W* set to 0.9. Philippines, Brunei, Malaysia, Singapore and Indonesia are maritime neighbors, with *W* set to 0.8. The adjusted distance can be presented as *WD*, which means the distances covering geographical location weight:

$$WD = W \times ED' \tag{4}$$

2.2.6. Determination of Geo-Economic Relationships

Geo-economic relationships are measured by the critical intervals of *ED*. When the value of *WD* is large, it means that there are strong complementarities with weak competitiveness between countries. When the value of *WD* is small, it indicates that there is strong competitiveness with weak complementarities. In this paper, four critical intervals were set up in Table 2.

Table 2. Critical intervals of geo-economic relationship types.

Relationship Types	Range
Strongly Competitive	$WD < -0.5$
Generally Competitive	$-0.5 \leq WD < 0$
Generally Complementary	$0 < WD < 0.5$
Strongly Complementary	$WD \geq 0.5$

2.3. Data Selection and Resources

Before 1978, geo-economic development between China and ASEAN countries was slow due to low economic development, inward-looking development strategies, and other non-economic factors. The scale of trade was small, and economic benefits were subordinate to politics. Since reform in 1978, economic and trade exchanges between China and ASEAN countries have strengthened. Trade volume and investment have gradually increased. Because the evolution of geo-economic relationships between countries is a gradual, dynamic process, we measured geo-economic relationships every five years from 1980 to 2014, over a total of eight periods. This reflected the overall changes of geo-economic relationships between China and ASEAN countries over the past 35 years. Data for 1980, 1985, 1990, 1995, 2000, 2005, 2010, and 2014 were downloaded from the World Bank database [35], including total investment in fixed assets, GDP, the output of secondary and tertiary industries, population, total export, and total import.

3. Results

3.1. Geo-Economic Relationships between China and ASEAN Countries in the 1980s

In 1980, ASEAN included five countries: Malaysia, Indonesia, Thailand, the Philippines and Singapore. Thus, we first measured geo-economic relationships between China and the above five countries. Brunei joined the ASEAN organization in 1984; therefore, the measurement of geo-economic relationships involved Brunei starting in 1985. The geo-economic relationships between China and ASEAN countries are shown in (Tables 3 and 4). The ranking of competition between China and ASEAN countries in descending order were the Philippines, Thailand, Malaysia, Indonesia,

and Singapore in 1980, while the ranking changed to be Malaysia, Thailand, Indonesia, the Philippines, Singapore, and Brunei in 1985 (Table 5).

In the early 1980s, from the perspective of investment efficiency and capital, China, Thailand, Indonesia, Malaysia, and the Philippines were in capital shortage. The capital of Singapore was abundant ($X_1 = 0.395$). Thus, China and Singapore were complementary in capital. Meanwhile, China had competition with Thailand, Indonesia, Malaysia and the Philippines for foreign direct investment. In terms of industrialization level and labor efficiency, Singapore was the highest ($X_2 = 0.948$), followed by Malaysia, Thailand, Indonesia, the Philippines. China was comparatively lowest ($X_2 = 0.701$). As for the outward flow of resources and products, Indonesia ($X_3 = 2.022$) and Malaysia ($X_3 = 1.198$) were more likely to export resources and products.

In the mid-1980s, the capital of Singapore was still abundant ($X_1 = 0.408$), while the Philippines ($X_1 = 0.165$) and Brunei ($X_1 = 0.184$) were in capital shortage and urgently needed foreign investment. With regard to industrialization level and labor efficiency, Singapore ($X_2 = 0.953$) and Brunei ($X_2 = 0.988$) were the highest. China, Indonesia and the Philippines were relatively low. As for the outward flow of resources and products, Brunei ($X_3 = 4.833$), Indonesia ($X_3 = 1.812$), and Malaysia ($X_3 = 1.255$) were more likely to export resources and products.

The data showed that in the 1980s, China urgently needed a lot of foreign investment. At that time, its industrialization level and labor efficiency were comparatively low. However, the index of X_3 for China was in the middle-upper position, and the possibility of exports existed.

Table 3. The results of geo-economic relationships between China and ASEAN countries in 1980.

Country	X_1	X_2	X_3	X_1'	X_2'	X_3'	ED	ED'	W	WD	Ranks of Competition
China	0.291	0.701	0.908	0.832	0.438	−0.258					
Thailand	0.278	0.768	0.706	0.751	0.596	−0.349	0.905	−0.708	1.0	−0.708	1
Indonesia	0.216	0.760	2.022	0.358	0.579	0.241	2.632	0.732	0.8	0.586	4
Malaysia	0.299	0.774	1.198	0.888	0.611	−0.129	1.041	−0.595	0.8	−0.476	3
Philippines	0.272	0.749	0.692	0.716	0.552	−0.355	0.770	−0.821	0.8	−0.656	2
Singapore	0.395	0.948	0.807	1.495	1.026	−0.303	3.423	1.391	0.8	1.113	5

Table 4. The results of geo-economic relationships between China and ASEAN countries in 1985.

Country	X_1	X_2	X_3	X_1'	X_2'	X_3'	ED	ED'	W	WD	Ranks of Competition
China	0.296	0.719	0.647	0.408	−1.104	−0.623					
Thailand	0.272	0.842	0.771	0.114	0.096	−0.540	1.24	−0.60	1.0	−0.603	2
Indonesia	0.227	0.768	1.812	−0.438	−0.626	0.159	1.25	−0.60	0.8	−0.477	3
Malaysia	0.287	0.801	1.255	0.298	−0.304	−0.215	0.91	−0.88	0.8	−0.704	1
Philippines	0.165	0.754	0.844	−1.198	−0.763	−0.491	1.65	−0.26	0.8	−0.211	4
Singapore	0.408	0.953	0.868	1.781	1.180	−0.475	2.67	0.58	0.8	0.468	5
Brunei	0.184	0.988	4.833	−0.965	1.521	2.187	4.08	1.76	0.8	1.407	6

Table 5. The types of geo-economic relationships between China and ASEAN countries in the 1980s.

Type	Range	Country	
		1980	**1985**
Strongly Competitive	WD < −0.5	The Philippines, Thailand	Malaysia, Thailand
Generally Competitive	−0.5 ≤ WD < 0	Malaysia	Indonesia, the Philippines
Generally Complementary	0 < WD < 0.5		Singapore
Strongly Complementary	WD ≥ 0.5	Indonesia, Singapore	Brunei

3.2. Geo-Economic Relationships between China and ASEAN Countries in the 1990s

Vietnam joined the ASEAN organization in 1995. Therefore, the measurement of geo-economic relationships included Vietnam starting in 1995. The geo-economic relationships between China and ASEAN countries are shown in (Tables 6 and 7). The ranking of competition between China and

ASEAN countries in descending order were Indonesia, the Philippines, Malaysia, Singapore, Thailand, and Brunei in 1990, while the ranking changed to be Indonesia, Malaysia, Singapore, Brunei, Thailand, Vietnam, and the Philippines in 1995 (Table 8).

In the early 1990s, regarding investment efficiency and capital, Thailand (X_1 = 0.404), Malaysia (X_1 = 0.330), and Singapore (X_1 = 0.317) had abundant capital, while Brunei (X_1 = 0.187), the Philippines (X_1 = 0.231), and China (X_1 = 0.257) were in capital shortage. China, Thailand, Malaysia and Singapore were complementary in capital. In terms of industrialization level and labor efficiency, Singapore (X_2 = 0.950) and Brunei (X_2 = 0.990) were the highest, while China (X_2 = 0.733) and the Philippines (X_2 = 0.781) were relatively low. Concerning the outward flow of resources and products, Brunei (X_3 = 2.211), Indonesia (X_3 = 1.176), and China (X_3 = 1.164) were more likely to export.

In 1995, corresponding to investment efficiency and capital, Malaysia (X_1 = 0.436) and Thailand (X_1 = 0.411) had abundant capital, while the Philippines, Vietnam, and Indonesia were in capital shortage. The index of X_1 for China was 0.342, indicating China's investment efficiency was higher and it still needed foreign investment. In terms of industrialization level and labor efficiency, Brunei (X_2 = 0.988), Singapore (X_2 = 0.931), and Thailand (X_2 = 0.905) were relatively high. The index of X_2 for China improved from 0.733 in 1990 to 0.803 in 1995, showing the industrialization level and labor efficiency of China gradually increased. With regard to the outward flow of resources and products, China (X_3 = 1.126), Indonesia (X_3 = 1.118) and Brunei (X_3 = 1.149) were more likely to export.

This data demonstrated that in the 1990s, China still needed large amounts of foreign investment. Its industrialization level and labor efficiency steadily improved. The possibility of China's exports increased.

Table 6. The results of geo-economic relationships between China and ASEAN countries in 1990.

Country	X_1	X_2	X_3	X_1'	X_2'	X_3'	ED	ED′	W	WD	Ranks of Competition
China	0.257	0.733	1.164	−0.420	−1.327	0.108					
Thailand	0.404	0.875	0.698	1.637	0.220	−0.768	2.719	0.606	1.0	0.606	5
Indonesia	0.283	0.806	1.176	−0.052	−0.531	0.130	0.877	−1.190	0.8	−0.952	1
Malaysia	0.330	0.848	1.007	0.607	−0.075	−0.188	1.646	−0.440	0.8	−0.352	3
Philippines	0.231	0.781	0.622	−0.786	−0.803	−0.911	1.202	−0.873	0.8	−0.698	2
Singapore	0.317	0.950	0.868	0.421	1.041	−0.449	2.574	0.465	0.8	0.372	4
Brunei	0.187	0.990	2.211	−1.407	1.475	2.077	3.564	1.430	0.8	1.144	6

Table 7. The results of geo-economic relationships between China and ASEAN countries in 1995.

Country	X_1	X_2	X_3	X_1'	X_2'	X_3'	ED	ED′	W	WD	Ranks of Competition
China	0.342	0.803	1.126	0.145	−0.604	0.977					
Thailand	0.411	0.905	0.797	1.074	0.588	−0.597	2.182	0.219	1.0	0.219	5
Vietnam	0.254	0.728	0.668	−1.031	−1.486	−1.215	2.640	0.882	1.2	1.058	7
Indonesia	0.284	0.829	1.118	−0.626	−0.308	0.936	0.828	−1.739	0.8	−1.392	1
Malaysia	0.436	0.871	0.951	1.413	0.184	0.140	1.711	−0.462	0.8	−0.370	2
Philippines	0.222	0.784	0.618	−1.464	−0.835	−1.457	2.927	1.297	0.8	1.038	6
Singapore	0.331	0.931	0.950	0.008	0.895	0.133	1.726	−0.440	0.8	−0.352	3
Brunei	0.367	0.988	1.149	0.481	1.567	1.084	2.199	0.244	0.8	0.195	4

Table 8. The types of geo-economic relationships between China and ASEAN countries in the 1990s.

Type	Range	Country	
		1990	**1995**
Strongly Competitive	WD < −0.5	Indonesia, the Philippines	Indonesia
Generally Competitive	−0.5 ≤ WD<0	Malaysia	Malaysia, Singapore
Generally Complementary	0 < WD < 0.5	Singapore	Brunei, Thailand
Strongly Complementary	WD ≥ 0.5	Thailand, Brunei	Vietnam, the Philippines

3.3. Geo-Economic Relationships between China and ASEAN Countries in the 2000s

　　Laos and Myanmar joined the ASEAN organization in 1997, and Cambodia joined in 1999. Therefore, there were 10 geo-economic relationships between China and ASEAN countries starting in 2000. The geo-economic relationships between China and ASEAN countries are shown in (Tables 9 and 10). The ranking of competition between China and ASEAN countries in descending order were Vietnam, Malaysia, Thailand, the Philippines, Indonesia, Cambodia, Laos, Singapore, Myanmar, and Brunei in 2000. The ranking changed to be Vietnam, Thailand, Indonesia, Malaysia, the Philippines, Myanmar, Laos, Singapore, Cambodia, and Brunei in 2005 (Table 11).

Table 9. The results of geo-economic relationships between China and ASEAN countries in 2000.

Country	X_1	X_2	X_3	X_1'	X_2'	X_3'	ED	ED'	W	WD	Ranks of Competition
China	0.339	0.853	1.107	1.649	0.352	−0.148					
Myanmar	0.101	0.550	0.686	−1.507	−1.529	−0.672	3.710	1.077	1.2	1.303	9
Thailand	0.220	0.910	1.115	0.071	0.706	−0.138	1.620	−0.784	1.0	−0.784	3
Cambodia	0.183	0.590	0.716	−0.420	−1.281	−0.634	2.680	0.161	1.0	0.161	6
Laos	0.139	0.544	0.617	−1.003	−1.566	−0.758	3.330	0.738	1.2	0.886	8
Vietnam	0.256	0.773	0.926	0.549	−0.144	−0.373	1.230	−1.130	1.2	−1.356	1
Indonesia	0.199	0.844	1.500	−0.207	0.296	0.340	1.920	−0.514	0.8	−0.411	5
Malaysia	0.253	0.914	1.198	0.509	0.731	−0.035	1.210	−1.149	0.8	−0.919	2
Philippines	0.221	0.860	1.074	0.084	0.396	−0.189	1.570	−0.830	0.8	−0.664	4
Singapore	0.320	0.931	1.024	1.397	0.836	−0.251	3.560	0.939	0.8	0.751	7
Brunei	0.130	0.990	3.526	−1.122	1.203	2.859	4.180	1.491	0.8	1.193	10

Table 10. The results of geo-economic relationships between China and ASEAN countries in 2005.

Country	X_1	X_2	X_3	X_1'	X_2'	X_3'	ED	ED'	W	WD	Ranks of Competition
China	0.399	0.883	1.155	2.094	0.439	−0.201					
Myanmar	0.269	0.580	1.979	0.328	−1.656	0.619	2.859	0.184	1.2	0.221	6
Thailand	0.289	0.897	0.939	0.600	0.535	−0.416	1.512	−1.130	1.0	−1.130	2
Cambodia	0.189	0.641	0.787	−0.758	−1.234	−0.568	3.326	0.639	1.0	0.639	9
Laos	0.231	0.602	0.627	−0.188	−1.504	−0.727	3.042	0.362	1.2	0.435	7
Vietnam	0.313	0.807	0.883	0.926	−0.087	−0.472	1.309	−1.327	1.2	−1.592	1
Indonesia	0.236	0.869	1.149	−0.120	0.342	−0.207	2.216	−0.443	0.8	−0.355	3
Malaysia	0.223	0.917	1.239	−0.296	0.674	−0.118	2.403	−0.261	0.8	−0.209	4
Philippines	0.199	0.873	0.834	−0.622	0.369	−0.521	2.736	0.064	0.8	0.051	5
Singapore	0.231	0.955	1.148	−0.188	0.936	−0.208	3.235	0.607	0.8	0.486	8
Brunei	0.114	0.991	4.191	−1.777	1.185	2.821	4.967	2.239	0.8	1.791	10

Table 11. The types of geo-economic relationships between China and ASEAN countries in the 2000s.

Type	Range	Country	
		2000	**2005**
Strongly Competitive	WD < −0.5	Vietnam, Malaysia, Thailand, the Philippines	Vietnam, Thailand
Generally Competitive	−0.5 ≤ WD < 0	Indonesia	Indonesia, Malaysia
Generally Complementary	0 < WD < 0.5	Cambodia	The Philippines, Myanmar, Laos, Singapore
Strongly Complementary	WD ≥ 0.5	Laos, Singapore, Myanmar, Brunei	Cambodia, Brunei

　　In the early 21st century, from the perspective of investment efficiency and capital, China (X_1 = 0.339) and Singapore (X_1 = 0.320) had abundant capital, while Brunei (X_1 = 0.130), Laos (X_1 = 0.139), and Cambodia (X_1 = 0.183) were in capital shortage. Compared with ASEAN countries, China's capital was the most in 2000, indicating that China had a certain amount of capital accumulation, and its ability to invest abroad was enhanced after development over 20 years. Regarding industrialization level and labor efficiency, Brunei (X_2 = 0.990) and Singapore (X_2 = 0.931) were high, followed by the Philippines and China, while Cambodia (X_2 = 0.590) and Laos (X_2 = 0.544) were the lowest. With regard to the outward flow of resources and products, Brunei (X_3 = 3.526) and

Indonesia (X_3 = 1.5000) were more likely to export, while the possibility of export for Laos (X_3 = 0.617), Myanmar (X_3 = 0.686), and Cambodia (X_3 = 0.716) was the least.

In 2005, for investment efficiency and capital, China (X_1 = 0.399) and Vietnam (X_1 = 0.313) were relatively abundant, while Brunei (X_1 = 0.114), Cambodia (X_1 = 0.189), and the Philippines (X_1 = 0.199) were in capital shortage. The index of capital for China ranked first, indicating that China's capital accumulation rose and its ability to invest abroad improved. In terms of industrialization level and labor efficiency, the indexes for Brunei (X_2 = 0.991), Singapore (X_2 = 0.955), and Malaysia (X_2 = 0.917) were high, while they were low for Myanmar and Cambodia. China (X_2 = 0.883) was at a mid-upper level. Regarding the outward flow of resources and products, the index for Brunei (X_3 = 4.191) was the highest, and thus Brunei was most likely to export. Laos had the smallest surplus of resources and products (X_3 = 0.627), and also had the lowest possibility of export.

The data in the 2000s illustrates that China's capital accumulation steadily increased, and the possibility of investing abroad improved. China's industrialization level, labor efficiency, and the export of resources and products also rose.

3.4. Geo-Economic Relationships between China and ASEAN Countries in the 2010s

The geo-economic relationships between China and ASEAN countries for the 2010s are shown in (Tables 12 and 13). Comparison of geo-economic relationships in 2010 and 2014 showed that Vietnam, Thailand and Indonesia always maintained a strong competitive relationship with China, while Laos maintained a generally complementary relationship. Singapore shifted the relationships from generally complementary in 2010 to strongly complementary in 2014 (Table 14).

In 2010, concerning investment efficiency and capital, the situation was similar to that in 2005. China (X_1 = 0.399) still ranked first, while Brunei, Myanmar and Cambodia were in capital shortage. Regarding industrialization level and labor efficiency, Singapore (X_2 = 0.955), Brunei (X_2 = 0.991) and China (X_2 = 0.883) were relatively high, while Laos, Cambodia and Myanmar were low. As for the outward flow of resources and products, the index for Brunei (X_3 = 4.191) was still the highest. China was in the middle-upper situation.

In 2014, the index of investment efficiency and capital for Brunei (X_1 = 1.428) was the highest. Meanwhile, the index for China rose to 0.794. Myanmar was still in capital shortage. For industrialization level and labor efficiency, most countries improved slightly. China (X_2 = 0.908) was at a middle-upper level. The outward flow of resources and products in China (X_3 = 1.195) ranked second, indicating its surplus and its likelihood to export.

The data in the 2010s reveals that China maintained the same upward trend as in the 2000s for investment efficiency and capital, industrialization level and labor efficiency, and the outward flow of resources and products.

Table 12. The results of geo-economic relationships between China and ASEAN countries in 2010.

Country	X_1	X_2	X_3	X_1'	X_2'	X_3'	ED	ED'	W	WD	Ranks of Competition
China	0.399	0.883	1.155	2.314	0.634	−0.223					
Myanmar	0.179	0.651	1.820	−0.849	−1.280	0.655	3.800	0.808	1.2	0.970	8
Thailand	0.289	0.897	0.939	−0.052	0.422	−0.316	2.380	−0.654	1.0	−0.654	3
Cambodia	0.189	0.641	0.787	−1.048	−1.650	−0.697	4.090	1.110	1.0	1.110	9
Laos	0.231	0.602	0.627	−0.099	−1.401	−0.582	3.180	0.168	1.2	0.201	7
Vietnam	0.313	0.807	0.883	0.873	−0.069	−0.578	1.640	−1.410	1.2	−1.692	1
Indonesia	0.236	0.869	1.149	0.686	0.105	−0.181	1.710	−1.337	0.8	−1.070	2
Malaysia	0.223	0.917	1.239	−0.310	0.574	−0.126	2.630	−0.398	0.8	−0.318	4
Philippines	0.199	0.873	0.834	−0.544	0.430	−0.540	2.880	−0.133	0.8	−0.107	5
Singapore	0.231	0.955	1.148	0.112	0.937	−0.220	3.220	0.215	0.8	0.172	6
Brunei	0.114	0.991	4.191	−1.083	1.300	2.806	4.600	1.631	0.8	1.305	10

Table 13. The results of geo-economic relationships between China and ASEAN countries in 2014.

| Country	X$_1$	X$_2$	X$_3$	X$_1'$	X$_2'$	X$_3'$	ED	ED$'$	W	WD	Ranks of Competition
China	0.794	0.908	1.195	1.019	0.552	0.036					
Myanmar	0.117	0.651	0.845	−0.756	−1.518	−0.503	2.779	0.927	1.2	1.112	9
Thailand	0.259	0.884	0.998	−0.384	0.359	−0.267	1.448	−0.926	1.0	−0.926	1
Cambodia	0.221	0.661	0.800	−0.483	−1.437	−0.572	2.566	0.630	1.0	0.630	8
Laos	0.353	0.684	0.803	−0.137	−1.252	−0.568	2.226	0.157	1.2	0.189	6
Vietnam	0.238	0.819	1.008	−0.439	−0.165	−0.252	1.649	−0.616	1.2	−0.792	4
Indonesia	0.326	0.841	0.989	−0.208	0.012	−0.281	1.377	−1.025	0.8	−0.820	2
Malaysia	0.264	0.909	1.121	−0.371	0.560	−0.078	1.394	−1.001	0.8	−0.801	3
Philippines	0.205	0.887	0.921	−0.525	0.383	−0.386	1.609	−0.702	0.8	−0.561	5
Singapore	0.254	1.000	1.119	−0.397	1.293	−0.081	2.662	0.764	0.8	0.611	7
Brunei	1.428	0.990	3.088	2.681	1.212	2.953	3.421	1.821	0.8	1.457	10

Table 14. Types of geo-economic relationships between China and ASEAN countries in the 2010s.

Type	Range	Country	
		2010	**2014**
Strongly Competitive	WD < −0.5	Vietnam, Indonesia, Thailand	Thailand, Indonesia, Malaysia, the Philippines, Vietnam
Generally Competitive	−0.5 ≤ WD<0	Malaysia, the Philippines	–
Generally Complementary	0 < WD < 0.5	Laos, Singapore	Laos
Strongly Complementary	WD ≥ 0.5	Myanmar, Brunei, Cambodia	Singapore, Cambodia, Myanmar, Brunei

4. Discussion

4.1. The Temporal Pattern of Evolution of Geo-Economic Relationships

ASEAN countries have maintained relatively stable geo-economic relationships with China (Figure 4). Over the past 35 years, Indonesia, Malaysia, the Philippines, Thailand and Vietnam had competitive geo-economic relationships with China in general. Malaysia and China always had a competitive geo-economic relationship, but the competition intensity fluctuated, increasing in the last 10 years. The geo-economic relationship between China and Thailand also changed greatly. It was competitive in the 1980s, complementary in the 1990s, and competitive again in the 2000s and 2010s. Indonesia remained in a competitive geo-economic relationship with China over the 30 years, except in 1980. The geo-economic relationship between China and the Philippines was generally competitive, with the exception of a complementary relationship in 1995 and 2005. After 2010, the competitive relationship between China and the Philippines intensified. Since 2000, Vietnam maintained a competitive relationship with China. In the 2000s, the competitive relationships were strengthened and subsequently weakened.
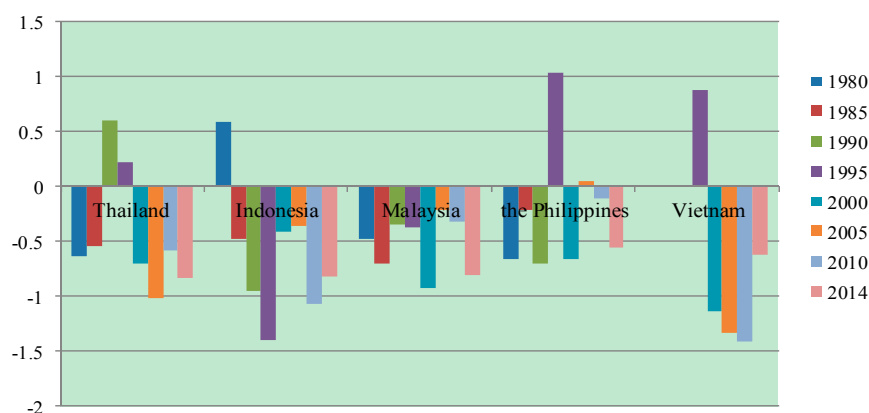
Figure 4. Competitive geo-economic relationships between China and ASEAN countries. Value > 0: Complementary type, the larger the value, the stronger the complementary relationship; Value < 0: Competitive type, the smaller the value, the stronger the competitive relationship.

In the same period, Singapore, Brunei, Myanmar, Cambodia and Laos maintained complementary geo-economic relationships with China in general (Figure 5). In 2005, the complementary value between Brunei and China was the highest. The complementary geo-economic relationship between China and Cambodia continuously strengthened, while the complementary geo-economic relationship between China and Laos weakened. Singapore had a complementary geo-economic relationship with China, except in 1995, and it followed a weakening trend.
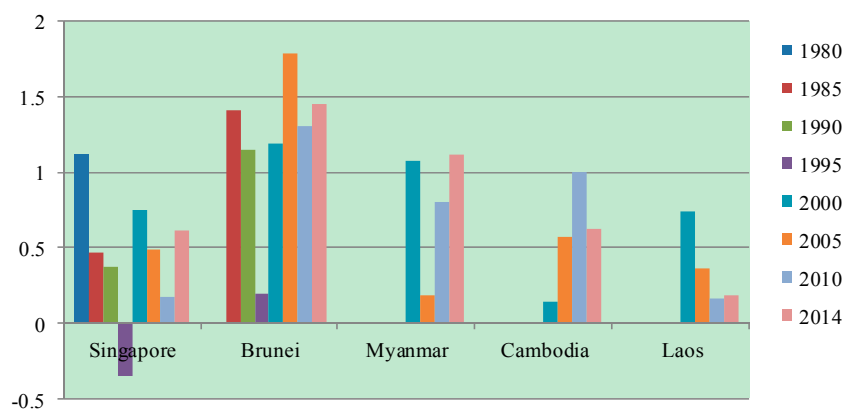
Figure 5. Complementary geo-economic relationships between China and ASEAN countries.

Although the geo-economic relationships were generally steady, there were still changes between competitive and complementary types in some ASEAN countries (Table 15). In the 1980s, the geo-economic relationship between China and Indonesia changed from a complementary relationship into a competitive one. In the 1990s, the geo-economic relationship between China and Singapore also changed from a complementary relationship into a competitive one. Conversely, the geo-economic relationship of China and the Philippines changed from a competitive relationship into complementary one. In the 2000s, the geo-economic relationship between China and the Philippines changed again, from complementary to competitive. Therefore, the greatest changes in geo-economic relationships were between China and the Philippines.

Table 15. Changes in geo-economic relationships over the past 35 years.

Time Range	Type	Country
1980s (1980–1989)	Competitive Complementary Changing from Complementary into Competitive	Thailand, the Philippines, Malaysia Singapore, Brunei Indonesia
1990s (1990–1999)	Competitive Complementary Changing from Competitive into Complementary Changing from Complementary into Competitive	Indonesia, Malaysia Brunei, Thailand, Vietnam The Philippines Singapore
2000s (2000–2009)	Competitive Complementary Changing from Competitive into Complementary	Vietnam, Thailand, Malaysia, Indonesia Laos, Singapore, Cambodia, Brunei, Myanmar The Philippines
2010s (2010–2019)	Competitive Complementary	Vietnam, Thailand, Indonesia, the Philippines, Malaysia Laos, Singapore, Cambodia, Brunei, Myanmar

4.2. The Spatial Pattern of Evolution of Geo-Economic Relationships

4.2.1. China-ASEAN Geo-Economic Relationships from the Perspective of Geographical Location

We divided ASEAN countries into continental and island countries to analyze the effect of location on geo-economic relationships.

- The Geo-Economic Relationships between China and Continental ASEAN Countries

The continental ASEAN countries generally refer to Myanmar, Thailand, Cambodia, Laos and Vietnam. Over the past 35 years, the continental ASEAN countries have maintained steady geo-economic relationships with China (Table 16). Myanmar, Cambodia and Laos maintained complementary geo-economic relationships with China, while Thailand and Vietnam maintained competitive geo-economic relationships with China. The geo-economic complementary relationships between China and Cambodia and Myanmar were stronger than between China and Laos. The competitive relationship between China and Thailand was stronger than between China and Vietnam.

Table 16. Geo-economic relationships between China and continental ASEAN countries.

Country	Year	Type of Geo-Economic Relationship	General Relationship
Myanmar	2000	Strongly Complementary	Strongly Complementary Relationship
	2005	Generally Complementary	
	2010	Strongly Complementary	
	2014	Strongly Complementary	
Thailand	1980	Strongly Competitive	Strongly Competitive Relationship
	1985	Strongly Competitive	
	1990	Strongly Complementary	
	1995	Generally Complementary	
	2000	Strongly Competitive	
	2005	Strongly Competitive	
	2010	Strongly Competitive	
	2014	Strongly Competitive	
Cambodia	2000	Generally Complementary	Strongly Complementary Relationship
	2005	Strongly Complementary	
	2010	Strongly Complementary	
	2014	Strongly Complementary	
Laos	2000	Strongly Complementary	Generally Complementary Relationship
	2005	Generally Complementary	
	2010	Generally Complementary	
	2014	Generally Complementary	
Vietnam	1995	Strongly Complementary	Strongly Competitive Relationship
	2000	Strongly Competitive	
	2005	Strongly Competitive	
	2010	Strongly Competitive	
	2014	Strongly Competitive	

- Geo-Economic Relationships between China and Island ASEAN Countries

Island ASEAN countries include Indonesia, Malaysia, the Philippines, Singapore, and Brunei. Changes in geo-economic relationships between China and island ASEAN countries were greater than between China and continental ASEAN countries over the past 35 years (Table 17). The geo-economic relationships between China and Indonesia changed from being strongly complementary to generally competitive, and then changed back to strongly competitive; in general, the relationship was competitive. The geo-economic relationship between China and Malaysia changed from being generally competitive to strongly competitive. The geo-economic relationships between China and the Philippines fluctuated, following four types: strongly competitive, generally competitive, strongly complementary and generally complementary. A competitive relationship between China and the Philippines occurred more frequently than a complementary relationship over 35 years. Therefore, it was generally a competitive relationship. The geo-economic relationship between China and Singapore was mainly complementary. The geo-economic relationship between China and Brunei was relatively stable and strongly complementary, except in 1995, when it was generally complementary. Overall,

the Philippines, Malaysia and Indonesia maintained competitive geo-economic relationships with China, while Singapore and Brunei had complementary geo-economic relationships with China.

Table 17. Geo-economic relationships between China and island ASEAN countries.

Country	Year	Type of Geo-Economic Relationship	General Relationship
Indonesia	1980	Strongly Complementary	Competitive Relationship
	1985	Generally Competitive	
	1990	Strongly Competitive	
	1995	Strongly Competitive	
	2000	Generally Competitive	
	2005	Generally Competitive	
	2010	Strongly Competitive	
	2014	Strongly Competitive	
Malaysia	1980	Generally Competitive	Competitive Relationship in General
	1985	Strongly Competitive	
	1990	Generally Competitive	
	1995	Generally Competitive	
	2000	Strongly Competitive	
	2005	Generally Competitive	
	2010	Generally Competitive	
	2014	Strongly Competitive	
The Philippines	1980	Strongly Competitive	Competitive Relationship
	1985	Generally Competitive	
	1990	Strongly Competitive	
	1995	Strongly Complementary	
	2000	Strongly Competitive	
	2005	Generally Complementary	
	2010	Generally Competitive	
	2014	Strongly Competitive	
Singapore	1980	Strongly Complementary	Complementary Relationship in General
	1985	Generally Complementary	
	1990	Generally Complementary	
	1995	Generally Competitive	
	2000	Strongly Complementary	
	2005	Generally Complementary	
	2010	Generally Complementary	
	2014	Strongly Complementary	
Brunei	1985	Strongly Complementary	Strongly Complementary Relationship
	1990	Strongly Complementary	
	1995	Generally Complementary	
	2000	Strongly Complementary	
	2005	Strongly Complementary	
	2010	Strongly Complementary	
	2014	Strongly Complementary	

4.2.2. China-ASEAN Geo-Economic Relationships from the Perspective of Spatial Proximity

The geographic location of a country has a significant impact on its economic behavior and development. Geographical proximity often means lower transportation costs, which tends to promote economic cooperation and generate a spatial proximity effect, namely, the influence of various economic activities decreasing as spatial distance increases. China and continental ASEAN countries are highly complementary in inter-industry trade. China imported agricultural products and primary goods from continental ASEAN countries and exported machinery, electronic products, metals and related products. China and island ASEAN countries are highly complementary in intra-industry trade, and both sides tried to form an industrial division to actualize complementary advantages and extend the industrial chain. The main import and export commodities were mechanical and electrical products, electrical components, and high-tech products.

4.3. The Attribute Patterns of Evolution of Geo-Economic Relationships

4.3.1. China-ASEAN Political Relationships

The political relationships between China and ASEAN countries have gradually improved. Since the establishment of ASEAN, the political relationships have gone through five stages: a stagnation period (1967–1978), a recovery period (1979–1990), a warming period (1991–2000), a leaping period (2001–2010), and a deepening period (2011–present) [36]. With the favorable development of political relationships among countries, geo-economic cooperation between China and ASEAN countries has continuously strengthened.

4.3.2. Intervention of Great Powers and ASEAN's Balanced Diplomacy

As ASEAN countries' strategic positions becomes increasingly important and economic development continues, the world's major powers concerning the ASEAN market and regional leadership have launched fierce competition. In this context, ASEAN countries have adopted a balance of power strategy, which has had a negative impact on the geopolitical and economic relationships between China and ASEAN countries. To obtain developmental resources, some ASEAN countries (Thailand, Myanmar and Vietnam) interact with larger powers (the US, China, Japan and India). This increases the randomness and uncertainty of cooperation and weakens ASEAN countries' economic dependence on China.

4.3.3. Close Genetic Relationship

ASEAN countries are the home to overseas Chinese with the world's largest and most concentrated population. More than 73% of the world's overseas Chinese population lives in ASEAN countries [37]. At the beginning of the 21st century, the number of overseas Chinese in Southeast Asia reached 25.26 million, accounting for 4.82% of the total population [38]. The cultures in these two regions are becoming intertwined. They have a close affinity and share similar customs and practices. The non-native ASEAN population has a pivotal position in local economic development and plays a vital role in geo-economic cooperation between China and ASEAN countries.

4.4. Path Dependency of Evolution of Geo-Economic Relationships

Due to the fixed locations of national geography, the existence of resource endowment, the slowness to improve the economic development level and adjust the structure of industries, the evolution of geo-economic relationships is characterized by path dependence, as shown in geo-economic relationships between China and ASEAN countries over the past 35 years. From 1980 to 2014, the geo-economic relationships between China and Thailand, Vietnam, Malaysia, Indonesia and the Philippines were competitive in general. During this period, the relationships changed occasionally, but only slightly. Meanwhile, the geo-economic relationships between China and Singapore, Brunei, Myanmar, Cambodia and Laos remained complementary.
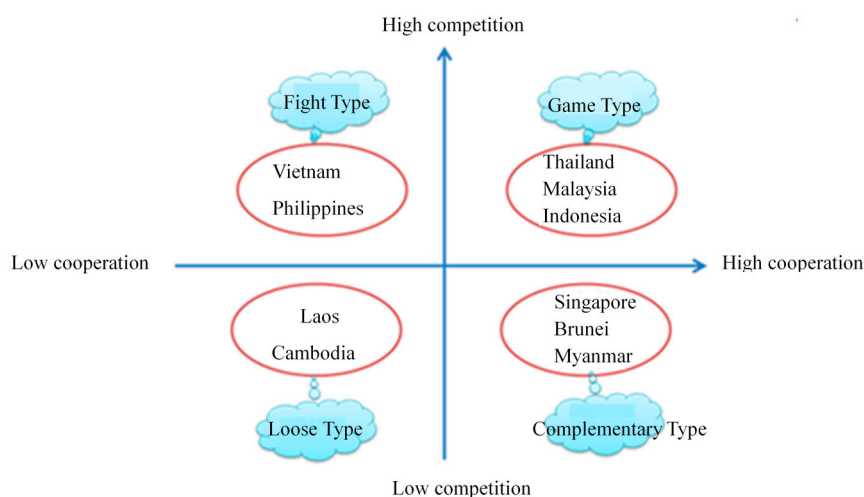
4.5. Classification and Suggestions about Geo-Economic Relationships

According to the measurement of geo-economic relationships between China and ASEAN countries, we classified geo-economic relationships into four types to reflect competition and cooperation more clearly and fully: (1) game type, with high cooperation and competition, such as with Thailand, Malaysia and Indonesia; (2) complementary type, with high cooperation and low competition, such as with Singapore, Brunei and Myanmar; (3) fight type, with low cooperation and high competition, such as with Vietnam and the Philippines; and (4) loose type, with low cooperation and competition, such as with Laos and Cambodia (Figure 6).

In the past, geo-economic relationships were divided into competition and cooperation. The method to separate competition from cooperation cannot fully reflect the similarity or difference of

resource endowment, economic factors, industrial structure, product structure, and market structure between countries. The advantage of this classification is that it can reflect the competitive and cooperative relationships of geo-economics more clearly and comprehensively. Simultaneously, the overall geo-economic relationships have been refined and summarized, which is conducive to the formulation of targeted geo-economic strategies to promote the prosperity and development of bilateral economies.

Figure 6. Classification of geo-economic relationships between China and ASEAN countries.

Based on the above classification, China's government can follow appropriate strategies to promote sustainable development of geo-economics between China and ASEAN countries. For countries with a game type relationship (Malaysia, Indonesia and Thailand), from the perspective of economic factors and trading flow, and based on market mechanisms, the government can take measures to promote the free flow of economic factors, and facilitate trade and investment. At present, import clearance in China takes 24 days, and export clearance takes 21 days. China's customs clearance efficiency ranks 98th in the world, lower than Cambodia, Myanmar and Laos. Meanwhile, Singapore's customs clearance efficiency is the highest, ranking first in the world. Export clearance takes only six days, and import clearance takes only four days. Therefore, China needs to reduce the number of customs clearance days required for import and export, improve the customs clearance mechanism, optimize the customs clearance process and environment, and strengthen coordination and management. Furthermore, China should improve the overall quality of customs officers and the operational skills of business operators. The measures will increase China's customs clearance efficiency and create better conditions for the continued growth of China-ASEAN trade.

For countries with complementary type relationships (Singapore, Brunei and Myanmar), from the perspective of geo-culture and people-to-people bonds, and based on the transmission mechanism, the government can take measures to promote cultural exchange and enhance the sense of kinship for the overseas Chinese population living in ASEAN countries. China should continue to encourage students from ASEAN countries to come to China for learning and exchange by providing government scholarships. Singapore currently has only one Confucius Institute and two Confucius classrooms. Myanmar has three Confucius classrooms and no Confucius Institute. Brunei has not yet opened a Confucius Institute or Confucius classroom. Confucius Institutes and classrooms can enhance China's soft power and promote traditional Chinese culture, as well as facilitate cultural communication and mutual understanding among nations. Therefore, it is recommended to establish Confucius Institutes in Myanmar and Brunei, and increase the number of Confucius classrooms in these three countries. Through the exchange of geo-culture, geo-economic cooperation between China and Singapore, Myanmar and Brunei can be further strengthened.

For the countries with game type relationships (the Philippines and Vietnam), from the perspective of geo-politics and policy communication, and based on the negotiation mechanism, the government can take measures to enhance strategic mutual trust and improve cooperation. In the past few years, the conflicts between China and Vietnam have been fierce in the South China Sea, leading to a decrease in trade, investment and other economic cooperation. Both sides should continue to increase their strategic mutual trust, suspend disputes, and jointly develop oil and gas resources in the South China Sea, in conformity with the Declaration on the Conduct of Parties in the South China Sea. At the same time, the Chinese government should take measures to reduce or eliminate the "China threat" theory of the Philippines and Vietnam through bilateral or multilateral diplomacy. It is wise for governments to be aware that geo-economic development is not a zero-sum game, but is mutually beneficial. By the implementation of the 21st Century Maritime Silk Road strategy, China will be closely associated with the interests of the Philippines and Vietnam by continuously strengthening the complementarity and mutual benefit of geo-economic cooperation.

For countries with loose type relationships (Cambodia and Laos), from the perspective of geographic location and facilities connections, and based on the location selection mechanism, the government can take measures to strengthen infrastructure construction and improve traffic accessibility. Cambodia and Laos are traditionally agricultural countries, and infrastructure construction is lagging behind. For these two countries, China should actively implement the facilities connectivity strategy. In the construction of transport infrastructure, they should strengthen infrastructure planning, match technical standards, jointly promote the construction of main roads, and form a network of infrastructure to connect bilateral regions. They have to identify the key channels, nodes and projects of transport infrastructure construction for Cambodia and Laos, give priority to construct traffic networks in inaccessible areas, smooth traffic bottlenecks, and enhance road accessibility. Lastly, we recommend building high-speed rail networks between core node cities in Cambodia and Laos to speed up the economic flow.

5. Conclusions

Using the Euclidean distance method, we measured the geo-economic relationships between China and ASEAN countries from 1980 to 2014, and summarized the patterns and characteristics. These findings implement existing knowledge to make an important contribution to the international literature by providing a better understanding of the evolution of geo-economic relationships.

We drew the following main conclusions:

Over time, geo-economic relationships between China and ASEAN countries remained relatively stable. Over the past 35 years, Thailand, the Philippines, Malaysia, Indonesia and Vietnam generally maintained a competitive geo-economic relationship with China. Singapore, Brunei, Myanmar, Cambodia and Laos generally had a complementary geo-economic relationship with China. Malaysia and China always maintained a competitive geo-economic relationship, and the trend of competition increased over the last 10 years. Since 2000, Vietnam has maintained a competitive relationship with China, while Brunei has had a strong complementary relationship. The complementary geo-economic relationship between China and Cambodia continuously strengthened, while the complementary geo-economic relationship between China and Laos weakened.

Spatially, the main geo-economic relationships between China and continental ASEAN countries were complementary, while the main geo-economic relationships between China and island ASEAN countries were competitive. From 1980 to 2014, changes in geo-economic relationships between China and island ASEAN countries were greater than between China and continental ASEAN countries. Existing literature tends to regard the ten ASEAN countries as a whole and discuss the competition or cooperation in one industry [39–41]. In our study, we divided ASEAN countries into mainland and island ASEAN countries. The geo-economic relationships between China and these two types of ASEAN countries were analyzed to understand the impact of geographical location on geo-economic competition and cooperation. The results show that geographical location and distance between

countries play a role in the formation of geo-economic relationships, but it is not the only decisive factor. Geographical location, national resource endowments, economic level, geopolitics, and geo-culture jointly determine the geo-economic relationships between countries.

From the perspective of geopolitics and geo-culture, we analyzed the possible reasons attributed to changes in geo-economic relationships. From a geopolitical point of view, friendly development of political relations between China and ASEAN countries promotes geo-economic cooperation. Yet, the intervention of great powers and the balanced diplomacy of ASEAN countries weaken geo-economic cooperation. Geo-culturally, close genetic relationships between the Chinese population at home and overseas in Southeast Asia play an essential role in geo-economic cooperation.

The evolution of geo-economic relationships is characterized by path dependence. Due to the fixed location of national geography, the existence of resource endowment, and the slowness to improve the economic development level and adjust the structure of industries, the geo-economic relationships between China and ASEAN countries has remained relatively stable over the past 35 years. Even when there were some changes in geo-economic relationships between China and ASEAN countries, the changes were not significant. Some scholars attribute the stability of geo-economic relationships to common cultural values. They consider that similar geo-cultures form similar consumption preferences as well as business ideas and methods [42].

Finally, we classified geo-economic relationships between China and ASEAN countries into four types: (1) game type, with high cooperation and competition, such as with Thailand, Malaysia and Indonesia; (2) complementary type, with high cooperation and low competition, such as with Singapore, Brunei and Myanmar; (3) fight type, with low cooperation and high competition, such as with Vietnam and the Philippines; and (4) loose type, with low cooperation and competition, such as with Laos and Cambodia. For each type of geo-economic relationship, combined with China's politics, economy and foreign policy, this paper put forth countermeasures and suggestions.

For future work, we suggest exploring the reasons and mechanisms for the formation of geo-economic relationships, as well as influence factors, paths and effects combined with geographical location, politics, economy, culture and diplomacy.

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