

Article

Spatio-Temporal Changes and Their Reasons to the Geopolitical Influence of China and the US in South Asia

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Abstract: The current international society has entered an era of large-scale power transfer. Government interests have gradually transferred from national strength to national influence. As such, how to quantitatively present the fuzzy geopolitical influence (*i.e.*, geo-influence) has attracted greater attention from scholars. The proposed concept of geo-influence conforms to this trend of power structure change in international relations, and provides a reference for national sustainable development on the international stage. This study sets up an index system and a mathematical model of geopolitical influence, and explores the spatio-temporal changes of the geo-influence of China and the United States (US) in South Asia over the past decade. Three primary results are found as follows: (1) In general, the geo-influence of China and the US in South Asia increased between 2003 and 2012. In terms of growth rate, the geo-influence of China in South Asia grew much faster than that of the US; (2) The overall strength and geo-influence show non-linear relationships. Strong national overall strength does not necessarily mean that one country has the strongest geo-influence; (3) National geo-influence is inversely proportional to the friction of distance. The larger the friction of distance is, the smaller national geo-potential is, and *vice versa*.

Keywords: geopolitical influence; spatio-temporal changes; China; the US; South Asia

1. Introduction

1.1. Current Challenges: The Necessity and Importance of the Research

The current international society has entered an era of large-scale shifts in power, which tend to be less transformable and forcible, but more intangible [1]. Government interests have gradually transferred from national strength to national influence. As such, how to present the fuzzy national influence in a quantitative way and offer a new perspective to the study of national diplomatic capacity have attracted significant attention from scholars. The proposed concept of geopolitical influence (geo-influence) conforms to this trend of changing power structures in international relations, and will become an important indicator to measure national international image. Geo-influence is an overall reflection of national overseas communication and coordination capacity. Therefore, study of geo-influence can help describe real national diplomatic capacity, analyze the advantages and disadvantages of national overseas capacity, and provide reference for national sustainable development on the international stage.

1.2. Literature Review

Reviewing the literature on South Asian geopolitics, we found that most scholars concentrated on the South Asian geopolitical security, the spatial patterns of the geopolitical environment [2], geopolitical structure, security dilemma, and interest relationships [3]. There were also some studies that investigated the rise of China and India. Many scholars conducted a comparative study of China and India with regard to the aspects of politics, economy, military, science and technology, education and culture [4–6]. “Prescription research” was the ultimate goal, concerning South Asian policy and decision-making processes, security strategies and foreign policies [7–9].

The current studies on national influence primarily stem from the perspective of political economy [10], national and ethnic culture [11,12], national image [13] and international communication [14]. Fu Mengzi [15] considers that national influence is real and tangible. It is, however, a fuzzy concept and difficult to quantitatively analyze, because the analysis of national influence must consider many factors, such as strength, power, domestic and international interaction, policy and effectiveness.

Reviewing the existing literature, studies of South Asia mainly focus on geopolitical security, geopolitical policies and the comparative study of China and India in a qualitative way. Few studies have investigated the national geo-influence in South Asia analyzed by a quantitative method. The current studies of national influence consider politics, economy, culture, national image and international communication. Studies from the perspective of geography and quantitative research are rare. Therefore, combining geography, international relations and political science perspectives, this paper proposes the following questions: what spatio-temporal changes took place in the geo-influence of China and the US in South Asia from 2003 -2012, and what were the reasons for these changes?

1.3. Core Concept

The term “geopolitics” is composed of Greek roots: *Ge or Gaia*, the goddess of the earth, and *polis*, the city-state of classical Greece [16]. *Ge* represented humankind’s terrestrial home in all its variety

and abundance, while the *politike* was the control and organization of it by humankind. Therefore, “geopolitics” implies the political relationships based on the spatial or geographical location. Thus, we can understand that geopolitics contains two levels of meanings: one is the location, namely the graphical space, in which the political actors lie; the other is the relationships that different political actors form [17]. Influence is the ability to change people or affairs. In general, influence refers to the ability to change people’s thoughts and actions in an acceptable way. Based on the concepts above, in this paper, geopolitical influence is defined as an ability of one country to affect other countries and regions due to the interrelation and interaction of hard power, soft power and interdependent power, given a certain geographical area with a spatial distance constraint [18]. In other words, geo-influence refers to the capability coming from the size and comprehensive power of geo-bodies.

1.4. Outline

This paper is comprised of five sections. The first section proposes research questions and core concepts. The second section introduces study object and method. The paper considers South Asia as its study area, and constructs a mathematical model of national geo-influence by setting up an index system. The third section presents study results that compare the overall strengths of China, the US and South Asian countries, and explores the spatio-temporal changes of the geo-influence of China and the US in South Asia. The following section is the discussion of these results, where the reasons leading to the changes are analyzed. Finally, conclusions and future work are presented.

2. Study Object and Method

2.1. Study Object

South Asia lies in the middle of Southeast and Southwest Asia, and generally refers to the southern area of the Himalayas, west of the Pamirs, and east of the China-Burma border. It includes seven countries, namely Pakistan, India, Nepal, Bhutan, Bangladesh, Sri Lanka and the Maldives. At present, there are mainly three kinds of views about the definition of the South Asian range. The first view is that South Asia includes seven countries, namely Pakistan, India, Nepal, Bhutan, Bangladesh, Sri Lanka and Maldives. The second view is South Asia should involve Afghanistan in addition to the seven countries above. The third view is South Asia has eight countries including Burma. This paper adopts the first view (Figure 1). This area comprises approximately 4.46 million km², with a total population of over 1.6 billion in 2012 (Table 1). Geographically, South Asia lies in the center of Eurasia’s outer edge of the crescent, guarding the water transportation arteries from Asia and Oceania to Europe and Africa, near the oil-producing region of the Persian Gulf, and overlooking the vital East-West oil passage. The region is located in an important strategic position, directly affecting the security of China’s energy channel [19]. In addition, its location in South Asia is directly related to the border security of China’s southwest region, including Xinjiang and Tibet’s stability and development [20]. Considering the points above, this paper takes South Asia as the study area and focuses on the spatio-temporal changes in the geo-influence of China and the US in South Asia over the past decade. As for time series, the paper takes 2003 as a starting point and 2012 as an end point. Once every two

years, the values of geo-influence of China and the US in South Asia are calculated, which generally reflects the dynamic changes in the region.

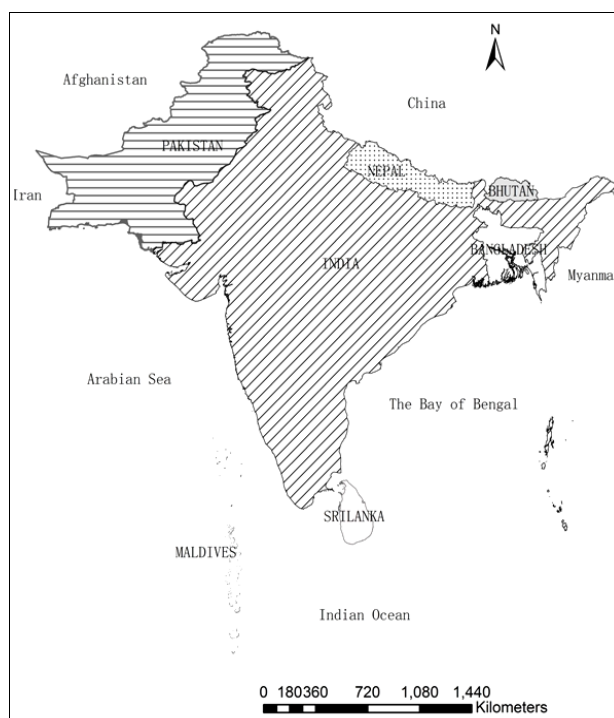


Figure 1. Location of South Asian countries.

Table 1. Country profiles of the seven South Asian countries in 2012 [21].

	Capital	Area/ Million km ²	Population/ Million People	GDP/ Billion Dollars	Proportion of GDP	GDP Growth/%	GDP per Capita/ Dollars
India (IN)	New Delhi	3.2873	1236.6867	1858.74	81.43%	7.2	1592
Pakistan (PK)	Islamabad	0.7961	179.1601	225.14	9.86%	4.0	1256.7
Nepal (NP)	Kathmandu	0.1434	27.4744	18.963	0.83%	4.9	690.6
Bhutan (BT)	Thimphu	0.0384	0.7418	1.780	0.08%	9.4	2398.9
Bangladesh (BD)	Dhaka	0.1302	154.6954	116.355	5.10%	6.2	752.2
Sri Lanka (LK)	Colombo	0.0627	20.328	59.423	2.60%	6.4	2923.2
Maldives (MV)	Male	0.0003	0.3384	2.222	0.10%	3.4	6566.6
Total		4.4584	1619.425	2282.623			

2.2. Study Method

2.2.1. Index System

Indicators in the index system of geo-influence are selected using experiential judgment and logical reasoning. Hard power, soft power, and interdependent power are considered in the index system (Table 2). By highlighting the dominant factors and an operational principle, hard power indicators involve basic strength, economic strength, military strength and technological strength, taking Cline's comprehensive national strength equation as a reference [22]. Soft power consists of normative power,

assimilation and influence [23], selecting policy and system, national image and cultural exchange as the indicators. Interdependent power indicators are international trade and direct foreign investment with reference to the *Power Interdependence* written by Keohane and Nye [24].

Table 2. The index system of geopolitical influence.

Evaluation Index	Primary Indicators	Secondary Indicators
Hard power	basic strength $A1$	Population (billion, area (km ²))
	economic strength $A2$	GDP (billion dollars)
	military strength $A3$	military expenditure (billion dollars)
	technological strength $A4$	R & D expenditure, high-tech exports (billion dollars)
Soft power	policy and system $B1$	the average of public sector management and institutions cluster (1 = low to 6 = high)
		the average of policies for social inclusion/equity cluster (1 = low to 6 = high)
		peacekeeping activities (frequency), official development assistance (million dollars)
	cultural exchange $B3$	movie and television culture exports (billion dollars) foreign students (million people)
Independent power	national trade $C1$	volume of import and export trade (billion dollars)
	direct investment $C2$	foreign direct investment (billion dollars)

2.2.2. Model Construction

Potential and potential differences are important reasons and key drivers for spatial interaction and the form of various “forces”. Geo- influence is affected by the locations of nations and regions, as well as potential difference. Thus, with reference to the location potential model [25,26], we construct a national geo-influence model as follows:

$$P_i = (H_j + S_j + M_j) e^{-r_{ij}} \quad (1)$$

where P_i represents the national geo-influence in another country or region such as i ; H_j represents hard power, S_j represents soft power, M_j represents interdependent power coming from unequal interdependence among countries, “e” is the base of natural logarithms and r_{ij} represents the friction of distance from one country to another country or region. This equation shows that the geo-influence is affected by two factors: the power of one country and the friction of distance.

Referring to Cline’s national evaluation framework, we set different index weights for basic strength A_{1j} , economic strength A_{2j} , military strength A_{3j} and technological strength A_{4j} respectively. Setting weight takes the discriminant method of two-two indicators comparison. Using professional knowledge and rational experience, we can judge the comparative advantages and relative importance of two-two indicators. The formula is as follows

$$H_j = 0.2A_{1j} + 0.4A_{2j} + 0.3A_{3j} + 0.1A_{4j} \quad (2)$$

where A_{1j} describes population and area in one country, A_{2j} is GDP, A_{3j} describes military expenditures, and A_{4j} covers R & D expenditures and high-tech exports. Soft power is made up of policy and system B_{1j} , national image B_{2j} and cultural exchange B_{3j}

$$S_j = B_{1j} + B_{2j} + B_{3j} \quad (3)$$

where B_{1j} describes the average of public sector management and institutions cluster, and the average of policies for social inclusion/equity cluster; B_{2j} describes peacekeeping activities and official development assistance; and B_{3j} describes movie and television culture exports, foreign students.

Interdependent power is determined by the importance of trade between two counties as well as the asymmetric interdependent level in bilateral trade relations [27]. Accordingly, the formula of independent power is:

$$M_j = \varphi_j(1 - \varphi_{ji} \%) + I_{ji} \quad (4)$$

where M_j represents the country i with the power in the asymmetric interdependence; φ_j represents the country's total trade; φ_{ji} represents the trade volume between the two countries that accounts for the proportion of the total trade in one country; and I_{ji} represents the total amount of investment of country i in country j .

The friction of distance considers both physical distance and diplomatic distance. Physical distance refers to the real distance expressed by the centroid distance between two countries. Diplomatic distance refers to the friendly relations between countries, which is expressed in numeric form from 1–9, where “9” represents the most hostile relations, and “1” represents the friendliest relations.

Due to the different physical meanings of indicators in the geo-influence index system, original data are handled in a dimensionless way. Dimensionless processing is that each variable value subtracts the minimum value, and divides the difference of maximum and minimum. After standardizing the original data, comprehensive strengths are calculated. Then, considering the friction of distance, we can obtain the values of national geo-influence in a specific country or region. To demonstrate how the values were determined, we take an example of the geo-influence of China and the US in India in 2012. After handling the original data and using the formulae above, we determine the values of Chinese and American hard power, soft power, interdependent power and friction of distance. Finally, the values of geo-influence of China and the US in India were calculated (Table 3). It should be noted that sometimes diplomatic distance can overcome the physical distance and play a greater role. As Table 3 shows, the friction of distance between the US and India is shorter than that between China and India owing to the friendlier and closer diplomatic relations between the US and India.

Table 3. The values of geo-influence of China and the US in India in 2012.

	Hard Power	Soft Power	Interdependent Power	Comprehensive Power	Friction of Distance	Geo-Influence
CN-IN	13.34	3.33	4.45	21.12	0.43	9.03
US-IN	16.91	4.23	5.64	26.78	0.39	10.35

2.2.3. Data Sources

Data reflecting basic strength, economic strength, military strength, policy and system, national image, cultural exchange, international trade, and foreign investment are selected. The data sources are authoritative databases, official websites, and related statistical yearbooks, which include the South Asia Archive, the World Bank open databases (www.worldbank.org.cn), Ministry of

Foreign Affairs of the People's Republic of China websites (http://www.fmprc.gov.cn/mfa_chn), Ministry of Commerce of China websites (<http://www.mofcom.gov.cn/>), National Bureau of Statistics of China websites (www.stats.gov.cn/tjsj/ndsj), U.S. Department of Commerce websites (<http://www.commerce.gov/>), United States Census Bureau websites (<http://www.census.gov/>), U.S. Bureau of Economic Analysis websites (<http://www.bea.gov/>), Chinese Institute of higher education (<http://www.mofcom.gov.cn/>), foreign student education management branch (www.cafsa.org.cn/index.php?mid=6&tid=603), United Nations peacekeeping websites (www.un.org/zh/peacekeeping), UNESCO site, China foreign aid White Paper, and China's Defense White Paper.

3. Results

3.1. Comparison of Overall Strength in 2012

This study aims to describe the relationship between the gap of national strength and geo-influence, and if a larger gap of national strength indicates a greater geo-influence. To test these ideas, this paper compares the gap of all strengths among China, the US and the countries in South Asia.

The ratio of overall strength between China and the seven countries of South Asia in 2012 were India (30.35), Pakistan (146.18), Bangladesh (413.03), Sri Lanka (814.28), Nepal (5701.27), Bhutan (7575.17) and the Maldives (38,455.99) in ascending order. The ratio of overall strength between the US and the seven countries of South Asia were India (70.67), Pakistan (293.72), Bangladesh (879.21), Sri Lanka (2095.99), Bhutan (11,992.08), Nepal (20,562.59) and the Maldives (40,883.03) (Table 4). It should be noted that military data of Bhutan is missing. If we considered the military factor, the gap of comprehensive strength between America and Bhutan should be larger than that between America and Nepal. The gap sequence of comprehensive strength among China, the US and South Asian countries was similar. The results showed that both China and the US had the smallest gap of overall strength with India, and the largest gap with the Maldives.

Table 4. The strength comparison among China, the US and South Asian countries in 2012.

	Basic Strength (A ₁)	Economic Strength (A ₂)	Military Strength (A ₃)	Hard Power (H)	Policy System (B ₁)	National Image (B ₂)	Cultural Exchange (B ₃)	Soft Power (S)	Trade Strength (C)	Comprehensive Strength
CN-IN	3.23	4.51	3.72	11.46	1.06	2.45	10.43	13.94	4.95	30.35
US-IN	3.08	7.84	15.26	26.18	1.48	10.64	26.05	38.17	6.33	70.67
CN-PK	12.45	33.79	23.67	69.92	1.50	3.26	15.26	20.02	56.24	146.18
US-PK	11.87	59.38	94.29	165.54	1.91	16.30	38.15	56.36	71.83	293.72
CN-BD	73.73	64.58	106.59	244.91	1.25	4.27	18.75	24.27	143.85	413.03
US-BD	70.26	112.86	437.15	620.27	1.94	25.15	48.13	75.22	183.72	879.21
CN-LK	153.11	140.75	352.63	646.49	1.25	5.03	19.25	25.53	142.26	814.28
US-LK	145.89	247.34	1446.15	1839.38	1.64	25.15	48.13	74.92	181.69	2095.99
CN-NP	66.95	419.20	4673.15	5159.30	1.25	4.46	17.93	23.64	518.33	5701.27
US-NP	63.79	752.64	19,164.98	19,981.41	1.75	22.30	44.83	68.88	512.31	20,562.59
CN-BT	250.00	4895.52	-	5145.52	1.15	6.32	20.46	27.93	2401.71	7575.17
US-BT	238.21	8602.57	-	8840.78	1.25	31.60	51.15	84.00	3067.30	11,992.08
CN-MV	32,000.0	4354.75	-	36,354.75	1.36	7.21	23.78	32.35	2068.89	38,456.00
US-MV	30,491.33	7652.31	-	38,143.64	1.64	36.05	59.45	97.14	2642.25	40,883.03

Comparing hard power, the gap between China and India was the narrowest, while the gap between China and the Maldives was the widest; the same trend is shown with regard to the US. From the data, it could be seen that the hard power of the US was much stronger than that of China. In terms of soft power, the gaps between China and India, and between the US and India were the smallest with values of 13.94 and 38.17 respectively. Meanwhile, both China and the US had the largest gap with the Maldives. The same situation occurred in the comparison of national image and cultural exchange. When comparing national policy and systems, the gaps among China, the US and the seven countries of South Asia were narrow and ranged between 1.06 and 1.94. Regarding trade strength, the gaps between China and India (4.95) and the US and India (56.24) were the smallest.

3.2. Spatio-Temporal Changes in the Geo-Influence of China and the US in South Asian Countries over the Past Decade

From the horizontal data, the geo-influence of China was the largest in Pakistan (8.93) and the smallest in Sri Lanka (5.15) and the Maldives (5.15) in 2003. Similar results were shown for the US. In 2012, the geo-influence of China in Pakistan was the largest and the smallest in India and Sri Lanka. Meanwhile, the geo-influence of the US was shown to be the largest in India and the smallest in the Maldives (Figure 2). Without considering India, we found that the geo-influence of China in other South Asian countries was larger than that of the US. The geo-influence of the US in India was 1.32 higher than that of China, yet the geo-influence of China in Pakistan was 5.03 higher than that of the US. In 2012, the ranking of geo-influences of China in South Asian countries was Pakistan (14.88), Nepal (12.18), Bhutan (11.59), Bangladesh (11.03), Maldives (9.49), India (9.03), Sri Lanka (9.03) in descending order. Meanwhile, the ranking of geo-influences of the US in South Asian countries was India (10.35), Pakistan (9.85), Bangladesh (9.37), Nepal (8.91), Bhutan (8.65), Sri Lanka (7.52), and the Maldives (7.44).

From the longitudinal data, the geo-influence of China in South Asian countries was slowly rising from 2003–2012. The geo-influence of China in Pakistan increased from 8.93 in 2003 to 14.88 in 2012, and in India rose up from 5.69 in 2003 to 9.03 in 2012. The geo-influence of China in the Maldives increased from 5.15 in 2003 to 9.49 in 2012. Meanwhile, the geo-influence of the US in India also increased from 7.48 in 2003 to 10.35 in 2012, and in the Maldives it rose from 6.90 in 2003 to 7.44 in 2012. However, the geo-influence of the US in Pakistan fell slightly from 10.10 in 2003 to 9.85 in 2012 (Figure 3).

Overall, the geo-influence of China and the US in South Asian countries rose slowly with slight fluctuations between 2003 and 2012. The geo-influence of China in South Asian countries showed an increasing trend. Between 2003 and 2007, the geo-influence of China in South Asian slowly increased by 10%–38%. While during 2007–2012, the geo-influence of China increased rapidly by 15%–48%. The geo-influence of the US in South Asian countries slowly improved with small fluctuations. In 2003, the geo-influence of the US in South Asia was higher than that of China. Yet, there were two periods with low values in 2007 and 2011, when the geo-influence of the US declined; lastly in 2009, the geo-influence of the US began to increase again, and continued to rise in 2012 (Figure 4).

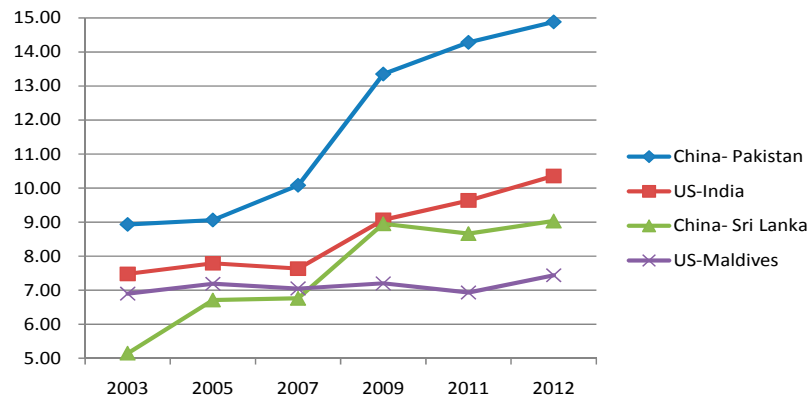


Figure 2. The largest and smallest countries in terms of the geopolitical influence of China and the US in South Asia.

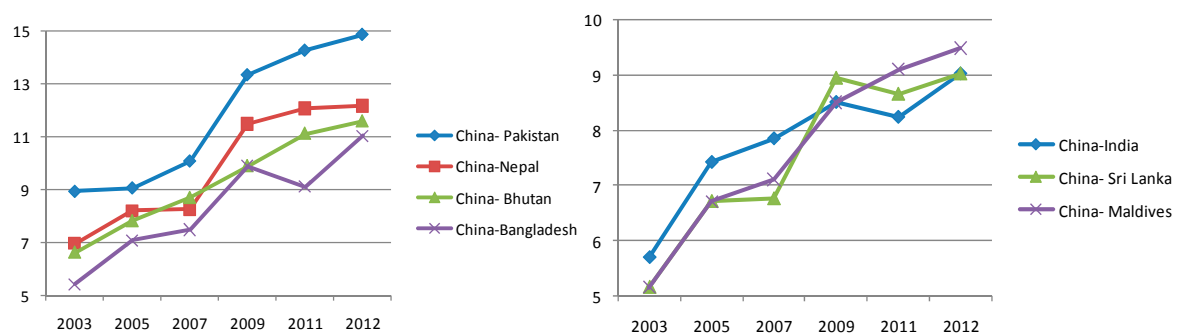


Figure 3. The changes of China's geopolitical influence in South Asian countries over the past decade.

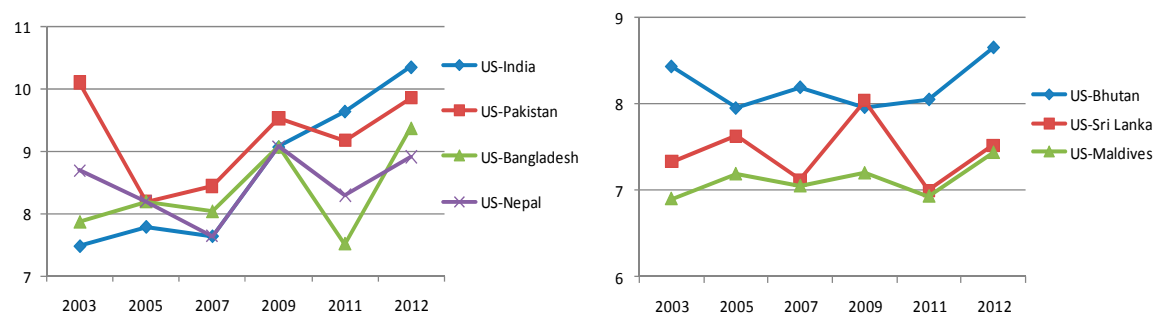


Figure 4. The changes of geopolitical influence of the US in South Asian countries over the past decade.

3.3. Spatio-Temporal Changes of Geo-Influence of China and the US in South Asian Region over the Past Decade

The geo-influence of China in the South Asian region showed a rising trend, from 7.31 in 2003 to 11.59 in 2012, at a growth rate of 58.55%. The geo-influence of the US in the South Asian region also showed a slowly increasing trend with slight fluctuations from 7.86 in 2003 to 8.31 in 2012 at a growth rate of 5.73% (Figure 5).

From 2003–2012, the growth rate of geo-influence of China in South Asian region was significantly faster than that of the US. In terms of hard power, China increased significantly from 8.0 in 2003 to 13.34 in 2012, at a growth rate of 66.75%. Conversely, the US edged slowly down from 17.33 in 2003 to 16.91 in 2012, at a decline rate of 2.42%. Regarding soft power, China rose from 2.0 in 2003 to 3.33 in 2012, up 66.5%. The US declined slightly from 4.33 in 2003 to 4.23 in 2012, down to 2.31%. Regarding the interdependent power, China increased from 2.67 in 2003 to 4.45 in 2012, up 66.67%. The US changed with small fluctuations, decreasing slightly from 5.78 in 2003 to 5.61 in 2007, but rising to 6.03 in 2009, and then down to 5.64 in 2012. Regarding comprehensive strength, China rose from 12.67 in 2003 to 21.12 in 2012, which was a rise of 66.7%. The change in the US was not significant, only decreasing from 27.44 in 2003 to 26.77 in 2012, down 2.44% (Table 5). From 2003–2012, regardless of hard power, soft power, interdependent power, or comprehensive strength, China increased by 66%; conversely, the US declined by approximately 2.3%–2.4%.

Table 5. The geopolitical influence of China and the US in the South Asian region over the past decade.

	Hard Power		Soft Power		Independent Power		Comprehensive Strength		Geo-Influence		Rising Ratio	
	CN	US	CN	US	CN	US	CN	US	CN	US	CN	US
2003	8.00	17.33	2.00	4.33	2.67	5.78	12.67	27.44	7.31	7.86		
2005	9.92	17.17	2.48	4.29	3.31	5.72	15.71	27.18	8.62	7.79	17.97%	−0.95%
2007	10.50	16.83	2.63	4.21	3.50	5.61	16.63	26.65	10.08	7.26	16.96%	−6.73%
2009	13.22	18.08	3.31	4.52	4.41	6.03	20.94	28.63	12.08	7.42	19.79%	2.19%
2011	12.80	15.74	3.20	3.93	4.27	4.27	20.26	24.92	11.12	7.73	−7.93%	4.20%
2012	13.34	16.91	3.33	4.23	4.45	5.64	21.12	26.77	11.59	8.31	4.22%	7.44%

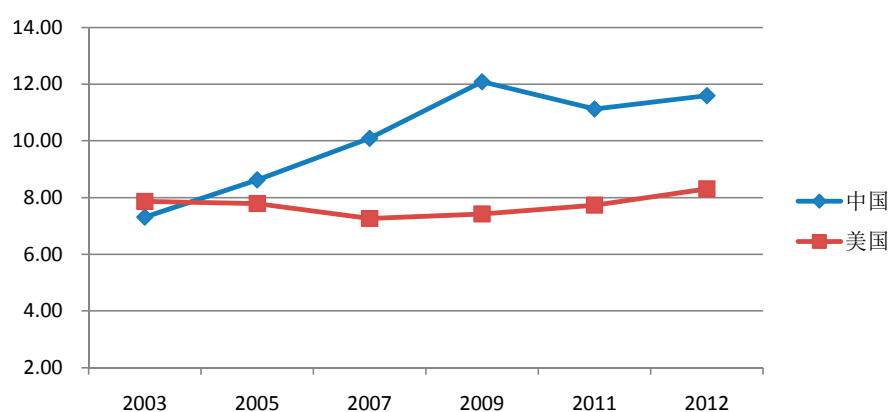


Figure 5. The geopolitical influence of China and the US in the South Asian region over the past decade.

4. Discussion

4.1. Comparison of Overall Strength

Since the Soviet Union collapsed, the US has been the world's sole superpower. In 2012, the GDP of the US was 16244.6 billion dollars, while China's GDP was 8227.1 billion dollars, accounting for 50.65% of the US's GDP. Indian GDP was 1858.74 billion dollars, accounting for 11.44%. The Maldives GDP was 2.22 billion dollars, accounting for only 0.137% of the US's. Besides, the Maldives is the smallest country in South Asia with a small land area (300 km²), population (0.39 million in 2012) and GDP (2.22 billion dollars). These data explain why the gap of overall strength was the smallest when comparing US, China and India, but was the largest when comparing the US, China and the Maldives. Furthermore, these data indicate that the geopolitical weight of a state including its land area, population, economy and military is still an important indicator of overall strength.

It is worth noting that the gap of soft power is much smaller compared to hard power. The gaps of soft power among China, the US and South Asian countries are in the range of 13–97, which demonstrates that hard power is still the primary indicator to measure overall strength. The gap of soft power between China and India is the smallest, which is likely due to three reasons. First, South Asian countries in their policy and systems are similar to the US, but significantly different from China. Bhutan has a parliamentary constitutional monarchy; the other six countries in South Asia are democratic republics, among which India, Bangladesh, Nepal are parliamentary republics, and Pakistan, Sri Lanka, Maldives are presidential republics. The second reason is related to the national international image. China, the US and India are important members in peacekeeping activities and international aid. In the international arena, these countries take international responsibility in global or regional areas. Third, the gaps of cultural exchange between China and India, and between the US and India are narrow. Film and TV cultural export in India has long ranked second in the world, just after the US. The data released by the USA Film Association showed that Indian film production reached 1600 films in 2012, and box-office revenues attained 1.4 billion dollars, ranking the sixth in the international box office list.

4.2. Spatial Analysis

Through analysis, it could be found that the geo-influence of China in Pakistan was large, but has been relatively small in India over the past decade. The geo-influence of the US in India was comparatively high and varied in Pakistan. Reasons for these results are complex. We find that the relationship between the US and India has developed favorably in the twenty-first century, from natural allies to strategic partnerships [28]. Militarily, security diplomacy between the US and India entered into a new period. The two countries not only conducted a number of joint military exercises but also signed the “10 Year Defense Cooperation Framework Agreement” in June 2005 [29]. To establish an alliance with India, the US signed a nuclear cooperation agreement with India. In economics, the trade between the US and India has grown steadily since the 1990s. Exports from India to the US have increased rapidly. At present, the US is India's largest trade and investment partner. With improvement in the investment environment in India, the capital investment of the US in India

will rise significantly, particularly in business processing and outsourcing services. In contrast, strategic cooperative partnerships between China and India are characterized by narrow scopes and channels. Political mutual trust between China and India has encountered some new challenges. For a long time, many problems have affected the relationship between China and India, such as boundary demarcation, the Tibet issue, border military facilities, and the loyal partnership between China and Pakistan [30]. Regarding economic cooperation, the process of regional economic integration between China and India has been rather slow. All of these indicators suggest that the political, economic and diplomatic relations between the US and India, and between China and India, profoundly determine the geo-influences. This is because economic relationships impact the amount of foreign trade and mutual investment, thus leading to the changes of interdependent power. Similarly, political and diplomatic activities affect the relations between two countries, and may result in variations of friction of distance. Therefore, the above-mentioned facts support the study's results that the geo-influence of the US in India is high, but the geo-influence of China in India is relatively low.

China and Pakistan established diplomatic relations on May 21, 1951. Established for over 60 years, the relationship between China and Pakistan has gone beyond normal bilateral relations with wide regional and international influence. Politically, China and Pakistan are all-weather strategic cooperative partners [31]. China always supports Pakistan's core interests, including national sovereignty and territorial integrity, economic prosperity and national stability [32]. Militarily, all-round military cooperation has been consistently observed with high-level military exchange mechanisms for defense and security consultation of joint exercises, counter-terrorism cooperation, mutual personnel training, mission technical cooperation, and weapons R&D and production cooperation. Economically, the two countries have conducted many multi-aspect exchanges and cooperation in economy, business and culture. Furthermore, these two countries have established an effective, practical and flexible framework to promote pragmatic cooperation. Thus, bilateral economic and trade cooperation has constantly improved. In 2012, the bilateral trade volume between China and Pakistan reached 12.4 billion dollars, rising by 17.6% per year. China's investments in Pakistan including infrastructure, energy, mineral and other aspects increased steadily. In May 2013, Premier Li Keqiang proposed to build the Palestinian Economic Corridor, which would provide a strong driving force for economic development and cooperation between China and Pakistan. For the foreseeable future, the geo-influence of China in Pakistan will continue to increase.

In 2003, the geo-influence of the US in Pakistan (10.10) was higher than that of China (8.93), but then gradually decreased. After 2009, the geo-influence of the US in Pakistan improved but was lower than that of China. The US has been an ever long-term ally of Pakistan as well as the primary exporter and source of investment for Pakistan. Nevertheless, since the American subprime crisis happened in 2006, American investors have continued to withdraw the capital from Pakistan. Pakistan slipped into a debt crisis, severely curtailing economic development. On the contrary, the Chinese government has been increasing economic aid to Pakistan. These back-and-forth actions have led to the changes in geo-influence.

4.3. Time Analysis

From the figures, we can see that the geo-influence of China and the US in South Asia were slowly increasing with slight fluctuations from 2003–2012, which indicated that Chinese and American overall influences were gradually rising. There are two reasons for this: one is the continuing rise of China's economic strength, foreign trade and investment. Since 2000, China's economy has developed rapidly. In 2003, China's GDP was 1288.4 billion dollars, and in 2010, China's GDP rocketed to 5878.6 billion dollars, exceeding that of Japan and making China the second largest economy in the world. China's foreign trade increased from 851.21 billion dollars in 2003 to 3866.76 billion dollars in 2012, making it first in the world. The total amount of foreign direct investment increased from 2.9 billion dollars in 2003 to 87.8 billion dollars in 2012, making China one of the top three foreign investment countries for the first time. Concurrently, the GDP of the US also grew from 2003–2007, but then decreased in 2009. The American subprime crisis in 2006 caused the financial crisis of 2008, and resulted in a new economic recession and weak growth. This led to a decrease in American dominance in world affairs. Second, China constructed a vision of harmonious world, and committed to “win-win” cooperation. For its neighbors, China has enacted the foreign policies of friendship and partnership and continues to promote the diplomacy of an amicable, secure and prosperous neighborhood, which has achieved positive results. Furthermore, with sustained and healthy development, China's development model is considered to be a positive and effective example by many developing countries. These countries are attracted to this model and thus learn from China.

From this analysis, it can be seen that among the indicators of geo-influence, hard power and particularly economic strength plays a dominant role. Hard power as a type of material force is the basis of soft power and is the cornerstone of national geo-influence. Nevertheless, hard power is not equal to geo-influence. Soft power should not be ignored because it has increasingly played a prominent role in strengthening geo-influence in recent years.

4.4. Relationship between Overall Strength and Geo-Influence

Through data analysis, the results show that the changes in overall strength and geo-influence are not following the same direction. They do not present a positive correlation. Strong overall strength does not mean that one country has strong geo-influence. Similarly, a larger gap of national strength does not necessarily indicate greater geo-influence. From 2003–2012, the comprehensive strength of the US was higher than that of China, but the geo-influences of China and the US in South Asia were variable. In 2003, the geo-influence of the US was larger than that of China. After 2005, although China's overall strength was still lower than that of the US, the geo-influence of China in South Asia was higher than that of the US.

It is no doubt that national overall strength is an important indicator to determine geo-influence. In most cases, it does do, but some unexpected conditions such as paroxysmal crisis and conflict events usually alter the geo-influence. There is a good case for stating this situation. For example, the GDP of the US has been ranked first place in the world for many decades. After the end of Cold War, the US held the center stage of the world as the sole superpower, and its geo-influence was very high. No other country could match it. Yet, since the outbreak of economic crisis in 2008, the US has been in a

prolonged economic slump. Therefore, a strategy of shrinking was taken, and all aspects of the country began to retract including withdrawing troops from Iraq, and pulling back overseas investments. Therefore, the geo-influence of the US started to decline. Conversely, China's economy maintains a good momentum of growth despite global economic slowdown. Its foreign trade and investments are continuing to grow. In recent years, the geo-influence of China has kept rising particularly in developing countries and regions.

4.5. Geo-Influence and Friction of Distance

National geo-influence is inversely proportional to the friction of distance. The larger the friction of distance is, the smaller geo-influence is, and *vice versa*. Although the friction of distance cannot determine geo-influence directly, it can strengthen or weaken it. This is because the friction of distance consists of both physical and diplomatic distances. Short physical distances can better maintain geo-influence, while large physical distances can reduce geo-influence. This demonstrates that geo-influence is restricted by location and physical distance, showing the spatial attenuating tendency. Diplomatic distance refers to the degree of friendliness between countries. A long diplomatic distance indicates that relationships are not favorable, while a short diplomatic distance indicates that relationships are close. The former can decrease the geo-influence, while the latter can increase the geo-influence.

In South Asia, the geo-influence of China in Pakistan, Nepal and Bhutan are high, but relatively low in the Maldives and Sri Lanka. One of the reasons for these phenomena is long physical distances. Among the seven countries in South Asia, India, Pakistan, Nepal and Bhutan share borders with China, and thus, physical distances are short. Sri Lanka and the Maldives are island countries, which are far from China. Additionally, the geo-influence of China in Pakistan is higher than that of the US, while the geo-influence of the US in India is higher than that of China. These phenomena can be explained by smaller diplomatic distances.

5. Conclusions and Future Work

This paper sets up an evaluation system and a mathematical model of national geo-influence, and explores the spatio-temporal changes in geo-influence of China and the US in South Asia. The primary conclusions are described as follows.

(1) Overall, the geo-influences of China and the US in South Asia have risen from 2003–2012. The geo-influence of China in South Asia has consistently increased, while the geo-influence of the US in South Asia has slowly improved with small fluctuations. In terms of growth rate, the geo-influence of China in South Asia grew much faster than that of the US. In 2012, the geo-influence of China in Pakistan was the largest, but that in Sri Lanka was the smallest. The geo-influence of the US in India was the largest but was the smallest in the Maldives. The geo-influence of China in South Asian countries except for India was larger than that of the US. From these results, it can be seen that the geo-influence of China and the US in South Asia is not a zero-sum game. Both of them have increased in the past decade. This conclusion differs from the existing literature, which argues that influences of China and the US are conflicting and irreconcilable. However, fact tells the true story. The geopolitics, economy and culture can explain the result described from various aspects.

(2) Changes in overall strength and geo-influence did not occur in the same direction, and have a non-linear relationship. Strong national overall strength does not necessarily mean that one country has a strong geo-influence. From 2003–2012, the overall strength of the US was higher than that of China, but changes in the geo-influence of China and the US in South Asia have fluctuated significantly. This result is not intuitive, and most people assume that overall strength equals geo-influence. Yet, in addition to overall strength, some unexpected situations should be considered during the research of geo-influence, for instance economic crises, military conflicts, and changes in foreign policies.

(3) National geo-influence is inversely proportional to the friction of distance. The larger the friction of distance is, the smaller the national geo-potential is, and *vice versa*. Friction of distance can strengthen or weaken geo-influence, though it cannot determine it. The geo-influence of China in the Maldives and Sri Lanka is relatively lower, partly due to the long physical distance between the countries. The geo-influence of China in Pakistan is comparatively higher, which can be largely attributed to the smaller diplomatic distance between the two countries. The current literature studies national influence from the perspective of national image, ethnic culture and international communication without considering the distance [10–14]. From this study, however, we know that distance, particularly diplomatic distance, plays a vital role in geo-influence. Good diplomatic relations can improve geo-influence, as shown by the relationship between China and Pakistan. Therefore, this study can supplement and improve current literature.

Although this paper measures the geo-influence of China and the US in South Asia using a quantitative method, the results generally reflect the reality. However, there are still some aspects to improve. For example, only key and representative indicators are considered in the index system without considering the comprehensiveness of selected elements. Additionally, the paper does not set weights for hard power, soft power and interdependent power. The aim of this paper is to promote the academic study of geo-influence and inspire scholars to explore more scientific and rational approaches to measure national geo-influence.

There are some issues on geo-influence valuable to further research. First, which distances (e.g., centroid distance, boundary distance, time distance, or friction of distance) are more scientific to measure national geo-influence? Second, what criterion should be used to measure geo-influence? Third, how should geopolitical relations and structure be incorporated into the study of geo-influence?

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Author Contributions

Shufang Wang played an important role in the conception of the study, establishing the index system and model, drafting and revising the manuscript. Yuan Cao performed the data processing and analyses. Yuejing Ge contributed to the conception of the study, and played a vital role in interpreting of the results and approved the final version.

Conflicts of Interest

The authors declare no conflicts of interest.

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