

# Dataset of Geo-economic Relations between the United States and Northeast Asian Nations Based on Flow Data (2000–2016)

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**Abstract:** Geo-economic research is of great significance for understanding the geographical pattern of the United States and Northeast Asia. Adhering to the spatial connection strength model and the static potential energy formula from physics, this paper constructs a geo-economic relationship tightness model and geo-economic streaming potential model. We calculate the geo-economic relationship tightness among Northeast Asian nations and the geo-economic streaming potential between the United States and the respective Northeast Asian nations. The variables of interest include data on investment, trade, air cargo capacity, liner transportation capacity, the number of days needed to establish enterprises, and the turnover time of importers. This paper describes the overall geo-economic development patterns and evolution from two datasets focused on trade and investment. The results data and process data were included in these datasets. The results dataset includes: (1) the trade tightness between Northeast Asian nations (2000–2016); (2) the investment tightness between Northeast Asian nations (2004–2016); (3) the trade streaming potential between the United States and Northeast Asian nations (2004–2016); (4) the investment streaming potential between the United States and Northeast Asian nations (2004–2016); and (5) the geo-economic streaming potential between the United States and Northeast Asian nations (2004–2016). The dataset was archived in .xlsx format, with a data size of 44.5 KB.

**Keywords:** geo-relations; geo-economics; flow data; Northeast Asia

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## Dataset Availability Statement:

The dataset supporting this paper was published and is accessible through the *Digital Journal of Global Change Data Repository* at: <https://doi.org/10.3974/geodb.2021.03.02.V1> or <https://cstr.escience.org.cn/CSTR:20146.11.2021.03.02.V1>.

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## 1 Introduction

Geo-economics is a product of the logic of geo-political conflict being replaced with the logic of geo-economic competition under globalization<sup>[1]</sup>, and is a new theory explaining international relations. Since the 1970s, global trade and capital flows have accelerated, and economic factors and relations have become increasingly dominant across international affairs. Globalization and regional integration are driving this process, along with the imminent emergence of the geo-economic era. In this era, economic factors represent not only geo-strategic goals of nations around the world but also an important means for nations to achieve their geo-political goals<sup>[2]</sup>. Since Luttwak first proposed the concept of geo-economics in 1990<sup>[3]</sup>, domestic and foreign scholars have explored many avenues including the origin, development process, and theoretical application and extensions of geo-economics<sup>[4–6]</sup>. The emergence of geo-economics has also led scholars to redefine the core concept of ‘power’ within geo-politics and international relations<sup>[7,8]</sup>.

One important aspect of geo-economic research is to describe the evolution of geo-economic relations between nations across time and space. Flow data can not only reflect the scale of the geo-economic flow between nations but also highlight the changes in flow direction. This dataset mainly consists of data on trade and investment across Northeast Asian nations, and describes the geo-economic relationship between them.

## 2 Metadata of the Dataset

The metadata of the Geo-economic relation dataset between US and Northeast Asia nations (2000–2016)<sup>[9]</sup> is summarized in Table 1. It includes the dataset full name, short name, authors, year of the dataset, data format, data size, data publisher, and data sharing policy, etc.

## 3 Method

### 3.1 Research Areas

Geo-security relations across Northeast Asia face constant threats and challenges, while geo-economic relations have steadily grown, and bilateral trade and investment quotas have increased continuously. Even with a reduction in political friction, economic and political development is not coordinated. It is also an issue within Northeast Asia’s geo-economic relations, which makes Northeast Asia a representative case for geo-economics. The dataset used in this study includes the United States, Japan, South Korea, Mongolia, China, Russia and North Korea.

### 3.2 Data Sources

The data sources are as follows: trade data come from the United Nations Trade and Development Database<sup>1</sup>; investment data are taken from China’s Foreign Investment Statistics Bulletin (2003–2016) on the website of the Ministry of Commerce of the People’s Republic of China<sup>2</sup>, the US Bureau of Business Analysis<sup>3</sup>, and the official website of the Organization for Economic Cooperation and Development<sup>4</sup>; the air cargo capacity, liner transportation capacity index, the number of days required to establish a business, and the

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<sup>1</sup> UN Comtrade, <https://comtrade.un.org/db/default.aspx>.

<sup>2</sup> Ministry of Commerce of the People’s Republic of China. <http://www.mofcom.gov.cn>.

<sup>3</sup> US Bureau of Business Analysis. <https://www.bea.gov/>.

<sup>4</sup> OECD. <http://stats.oecd.org/>.

turnover time of imported goods are all sourced from the World Bank database<sup>5</sup>. (Three indicators—the liner transportation capacity index, the number of days required to establish a business, and the turnover time of imported goods—are not included in the statistics for North Korea. To replace these, the dataset uses the corresponding data of the ‘least developed nations’ defined by the World Bank.) In order to ensure uniformity across the dataset, only trade data from the time period 2000–2016 were used in this study, while investment data were selected between 2004–2016. The final comparison of geo-economic relations incorporates complete data between 2004–2016. As the size and units differ across the dataset, SPSS19.0 is used to standardize the data before eliminating the influence of dimensions.

**Table 1** Metadata summary of the Geo-economic relation dataset between US and Northeast Asia nations (2000–2016)

| Items                               | Description  |
|-------------------------------------|--|
| Dataset full name                   | Geo-economic relation dataset between US and Northeast Asia nations (2000–2016)  |
| Dataset short name                  | Geo-economic_US_NE_Asia  |
| Authors                             | Ma, T., School of Economics and Management, Hangzhou Normal University; Institute for Global Innovation and Development, East China Normal University; mateng0119@163.com.<br>Li, Y. J., School of Economics and Management, Hangzhou Normal University; liyjie199712@163.com.<br>Ge, Y. J., Faculty of Geographical Science, Beijing Normal University; Academy of Plateau Science and Sustainability; geyj@bnu.edu.cn.   |
| Geographical region                 | United States, Japan, South Korea, Mongolia, China, Russia, North Korea  |
| Year                                | 2000–2016  |
| Data format                         | .xlsx Data size 44.5 KB  |
| Data files                          | Raw data of investment, trade, air cargo capacity, liner transport capacity index, the number of days needed to start a business, and the turnover time of imported goods across Northeast Asian nations (2000–2016); trade tightness between Northeast Asian nations (2000–2016); investment tightness between Northeast Asian nations (2004–2016); trade, investment, and geo-economic streaming potential between the United States and Northeast Asian nations (2004–2016)   |
| Foundations                         | National Natural Science Foundation of China (41871128, 41661033, 41701133); Major Programme of the National Social Science Foundation of China (16ZDA041); Strategic Priority Research Program of the Chinese Academy of Sciences (XDA20100311)   |
| Data publisher                      | Global Change Research Data Publishing & Repository, <a href="http://www.geodoi.ac.cn">http://www.geodoi.ac.cn</a>   |
| Address                             | No. 11A, Datun Road, Chaoyang District, Beijing 100101, China  |
| Data sharing policy                 | <b>Data</b> from the Global Change Research Data Publishing & Repository includes metadata, datasets (in the <i>Digital Journal of Global Change Data Repository</i> ), and publications (in the <i>Journal of Global Change Data &amp; Discovery</i> ). <b>Data</b> sharing policy includes: (1) <b>Data</b> are openly available and can be free downloaded via the Internet; (2) End users are encouraged to use <b>Data</b> subject to citation; (3) Users, who are by definition also value-added service providers, are welcome to redistribute <b>Data</b> subject to written permission from the GCdataPR Editorial Office and the issuance of a <b>Data</b> redistribution license; and (4) If <b>Data</b> are used to compile new datasets, the ‘ten per cent principal’ should be followed such that <b>Data</b> records utilized should not surpass 10% of the new dataset contents, while sources should be clearly noted in suitable places in the new dataset <sup>[10]</sup> |
| Communication and searchable system | DOI, CSTR, Crossref, DCI, CSCD, CNKI, SciEngine, WDS/ISC, GEOSS  |

### 3.3 Algorithms

#### 3.3.1 The Construction of a Geo-economic Relations Tightness Model

The spatial connection strength model has previously been used in geography research, and it can comprehensively and objectively describe the spatial connection strength of the research object<sup>[11]</sup>. Here, the spatial linkage strength model is used to measure the tightness of trade and investment linkages among Northeast Asian nations. The equation is:

<sup>5</sup> World Bank database. <http://www.shihang.org/>.

$$T_{ij} = \frac{P_i \times P_j}{D_{ij}^2} \quad (1)$$

where  $T_{ij}$  is the strength of the trade (or investment) relationship between the two nations;  $P_i$  and  $P_j$  represent the mutual exports (or investment) between nation  $i$  and nation  $j$ , respectively; and  $D_{ij}$  is the spherical distance between the two nations.

### 3.3.2 Construction of the Geo-economic Streaming Potential Model

Here, we use the static potential energy formula from physics to analyze the geo-economics streaming potential within trade and investments.

(1) At the trade level, the equation is:

$$GeoT_{ij} = \sqrt{\frac{EXP_{ij}^2 \times EXP_{ji} \times CT_{ij}}{r \times (EXP_{ij} + EXP_{ji})}} \quad (2)$$

where  $GeoT_{ij}$  (Geo-trade) represents the trade flow between  $i$  and  $j$ ;  $EXP_{ij}$  is the total export volume of nation  $i$  to nation  $j$ ; whereas  $EXP_{ji}$  is the total export volume of nation  $j$  to nation  $i$ ;  $CT_{ij}$  is the trade flow channel index of the nation; and  $r$  is the spherical distance between  $i$  and  $j$ . The size of the trade flow channel index  $CT_{ij}$  is mainly dependent on the transportation capacity and convenience of goods. This article defines the trade flow channel index as being related to its transportation volume and turnaround time. The equation is:

$$CT_{ij} = \frac{AF_i + LF_i}{IT_j} \times \frac{EXP_{ij}}{EXP_{ji}} \quad (3)$$

where  $AF_i$  is the air cargo capacity of nation  $i$ ;  $LF_i$  is the liner transportation capacity of nation  $i$ ;  $IT_j$  is the turnaround time of nation  $j$ 's imports; and  $EXP_{ij}/EXP_{ji}$  is the proportion of nation  $i$ 's exports to nation  $j$  compared to nation  $i$ 's total exports that year.

(2) At the investment level, the equation is:

$$GeoI_{ij} = \sqrt{\frac{FDI_{ij}^2 \times FDI_{ji} \times CI_{ij}}{r \times (FDI_{ij} + FDI_{ji})}} \quad (4)$$

where  $GeoI_{ij}$  (Geo-investment) represents the investment flow of  $i$  and  $j$ ;  $FDI_{ij}$  is the amount of foreign direct investment from nation  $i$  to nation  $j$ ;  $FDI_{ji}$  is the amount of foreign direct investment from nation  $j$  to nation  $i$ ;  $CI_{ij}$  is the investment flow channel index from nation  $j$  to nation  $i$ ; and  $r$  is the spherical distance between  $i$  and  $j$ . The degree of market openness of a nation has a channel restrictive effect on investment. The market openness of target nation  $j$  is divided into five categories on a Likert scale comprising 'very open', 'relatively open', 'normal', 'relatively closed', and 'very closed'. We take the five points from the United States, and compare the other nations with the United States in turn and assign them a score according to an expert scoring method. Here, we draw on relevant research for scoring<sup>[12]</sup> and assign Japan and South Korea four points each, Mongolia and China three points, Russia two points, and North Korea one point, according to the moment when each nation joined the World Trade Organization (WTO) which could have led to changes in the value. At the same time, the factor of the time required to establish a business in the target nation has been used by some scholars to indicate the factors of investment thresholds and obstacles<sup>[13]</sup>. From this, the investment flow channel index ( $CI_{ij}$ ) equation is:

$$CI_{ij} = \frac{S_j}{BR_j} \quad (5)$$

where  $S_j$  is the Likert scale score of the market openness of target nation  $j$ , and  $BR_j$  is the number of days required to start a business in target nation  $j$ .

(3) The geo-economic streaming potential model is:

$$GeoE_{ij} = GeoT_{ij} \times GeoI_{ij} \quad (6)$$

where  $GeoE_{ij}$  (Geo-economic relation) is the geo-economic flow of the two nations  $i$  and  $j$ , which is used to reflect the geo-economic relationship between the two nations. The higher the score the stronger the geo-economic relationship is, the lower the score, the weaker the relationship.

## 4 Data Results

### 4.1 Data Composition

This dataset has a national spatial resolution and covers the United States, Japan, South Korea, Mongolia, China, Russia, and North Korea, including the results and processing data. The results data consist of:

- (1) the trade tightness between Northeast Asian nations (2000–2016);
- (2) the investment tightness between Northeast Asian nations (2004–2016);
- (3) the trade streaming potential between the United States and Northeast Asian nations (2004–2016);
- (4) the investment streaming potential between the United States and Northeast Asian nations (2004–2016); and
- (5) the geo-economic streaming potential between the United States and Northeast Asian nations (2004–2016).

The processing data in the attachment contains the raw data of investment, trade, air cargo capacity, liner transport capacity index, the number of days needed to start a business, and the turnover time of imported goods downloaded from the United Nations Trade and Development Database, China's Foreign Investment Statistics Bulletin (2003–2016), the US Bureau of Business Analysis, the official website of the Organization for Economic Cooperation and Development, and the World Bank database.

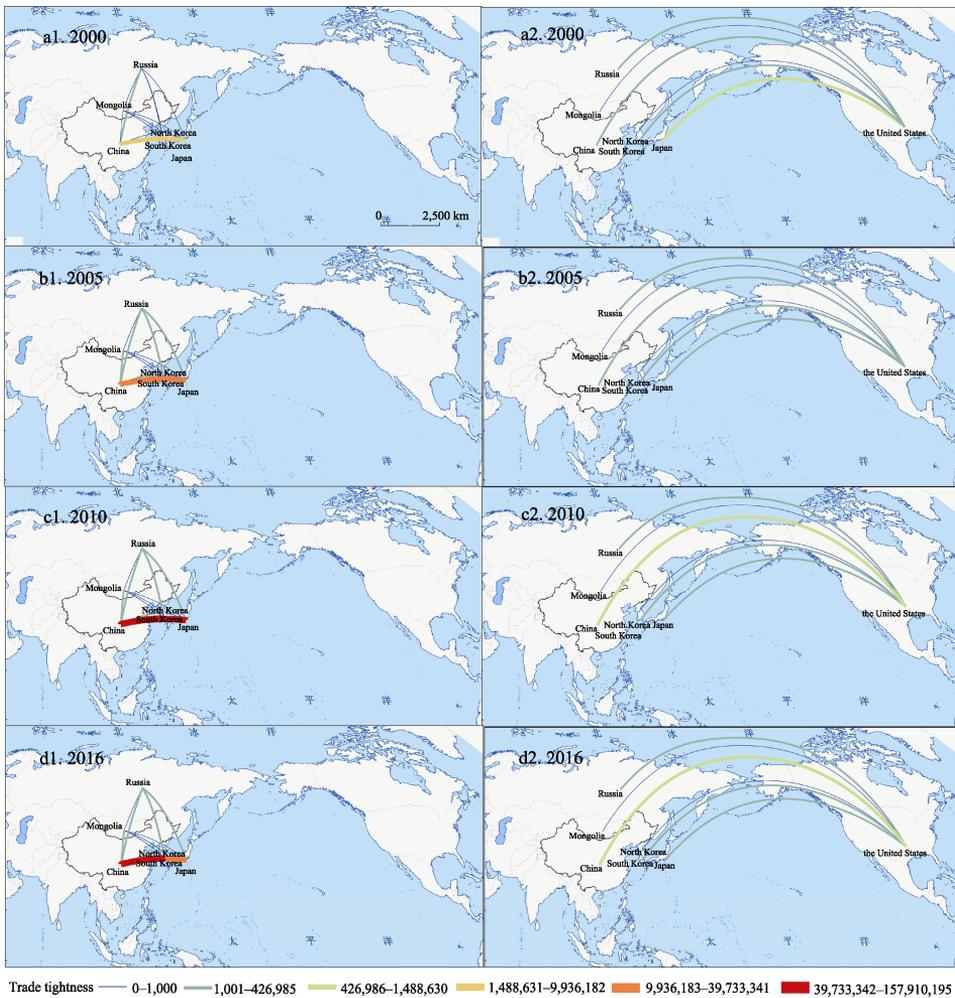
### 4.2 Data Results

#### 4.2.1 Geo-economic Tightness

In terms of trade, from 2000 to 2016 the level of trade tightness between the United States and Russia, compared to other nations in Northeast Asia, continuously improved. After 2010, the degree of trade tightness between China and the United States was significantly higher than that between the United States and other Northeast Asian nations, while Mongolia and North Korea were in a low static state compared to other nations.

In terms of investment, in 2004 the scale of investment flows across Northeast Asian nations was generally low, but this situation began to change in 2008. The investment flows from the United States, Japan, Russia, South Korea and China increased significantly. This shows that an investment flow network with the United States as the core was gradually forming. By 2012, this core position of the United States was further consolidated, especially considering the improved investment tightness with China, and the investment tightness between China, Japan and South Korea also significantly increased. During this period, China gradually formed another core. In 2016, the central position of the United States in the investment flow network in Northeast Asia was even stronger, and the

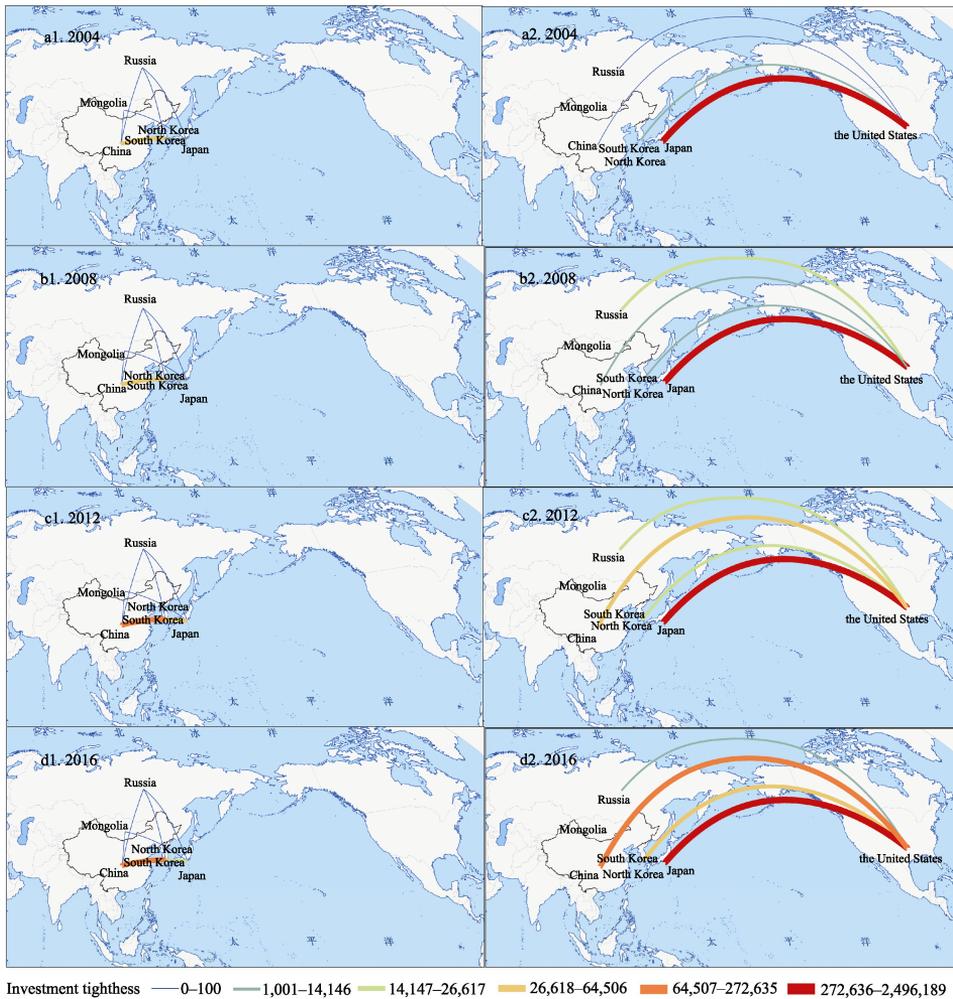
investment tightness between China and other nations had greatly improved. In this way, China and the United States formed a dual center pattern in the investment flow network.



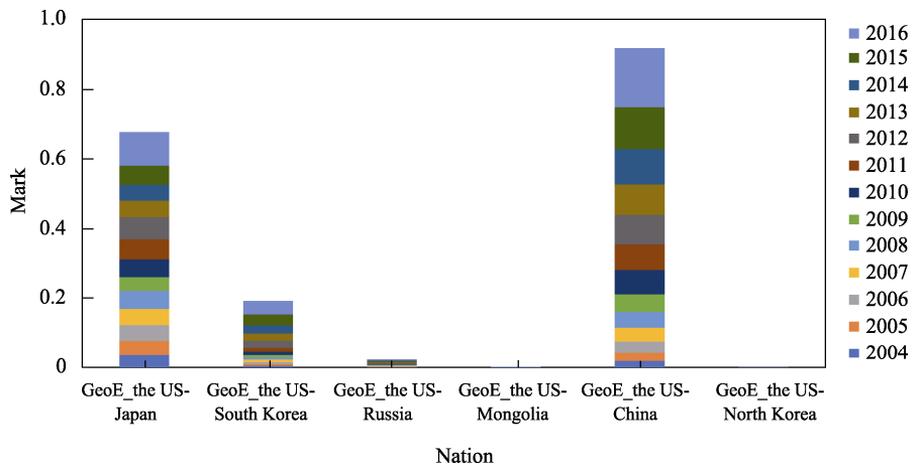
**Figure 1** Spatio-temporal evolution of the trade tightness between the United States and Northeast Asian nations during 2000–2016

#### 4.2.2 Geo-economic Streaming Potential

The United States and Northeast Asian nations had low overall scores on geo-economic streaming potential, but this continued to rise, especially after 2009. The strength of the United States–China currents began to surpass that of the United States–Japan currents around 2008 and continued to rise, becoming the most important bilateral current in Northeast Asia. In terms of economic relations, the United States–South Korea rising geo-economic streaming potential followed closely behind; the remaining geo-economic trends between United States–Russia, United States–Mongolia and United States–North Korea rose every year, but remained in a low and static state. Compared with United States–China, United States–Japan, and United States–South Korea, the strength of the geo-economic flow of United States–Russia, United States–Mongolia and United States–North Korea remained weak, which was consistent with the performance of trade and investment flows.



**Figure 2** Spatio-temporal evolution of the investment tightness between the US and Northeast Asian nations during 2004-2016



**Figure 3** Geo-economic streaming potential between the US and Northeast Asian nations during 2004-2016

## 5 Conclusion

This dataset uses flow data, introduces the spatial connection strength model and static potential energy formula, and evaluates geo-economic relations from the two perspectives of trade and investment. The improved geo-economic flow potential model based on the static potential energy formula can describe the strength and dynamic changes of ‘flow’ within geo-economics well, and the channel index in the model is also an important factor to modify the spatial distance across a geo-economy. In evaluating geo-economic flow, the product of trade and investment flow is also selected because there is no relevant method or associated research to determine the weight of investment and trade in geo-economic relations. Calculating the product makes the two mutually weighted, thus achieving the effect of comprehensive evaluation of geo-economic relations.

At present, the model used in this dataset can only analyze the geo-economic relationship between two nations, while there are still some deficiencies in the study of trilateral or multilateral relations. At the same time, although the quantitative model was verified through its usage, its potential for universal applicability needs to be further tested, and the weight of investment and trade also needs to be further studied.

### Author Contributions

Ge, Y. J. and Ma, T. designed the overall dataset development; Ma, T. collected the statistical data; Ma, T. designed the model; Li, Y. J. wrote the paper.

### Conflicts of Interest

The authors declare no conflicts of interest.

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