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Big Data-Based Assessment of Political Risk along the Belt and Road

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Abstract: Political risk assessment has become increasingly important in recent years, especially with the launch of the Belt and Road Initiative (BRI) and with Covid-19 still ravaging the world. This study aims to assess systematically the political risk of BRI countries during the period from 2013 to 2019 based on three big data sets, the Global Database of Events, Language, and Tone (GDELT), China Global Investment Tracker (CGIT), and Armed Conflict Location & Event Data Project (ACLED). It is found that to properly quantify the political risks for BRI countries, the type of events, "Material Conflict", and a variable characterizing the degree of cooperation/conflicts of the events, the Goldstein Scale, are of critical importance. Based on the chosen type of events and variable, we design a normalized variable to assess political risk of any country in any year so that comparison among different countries can be meaningly made. By decomposing political risk into two components, domestic and international, and examining the spatiotemporal evolution of political risk along the Belt and Road, we find that the sum of the number of BRI countries with the extremely high level and the high level of domestic, international, and (overall) political risk all reached the peak in 2015, and decreased thereafter, and that often the level of domestic political risk along the Belt and Road was higher than the international political risk. It is also found that a strong positive correlation exists between political risk and China's total investments and construction contracts along the Belt and Road during this period. The implications of this positive correlation are discussed. The analysis presented here may help to promote the sustainable development of BRI, and be extended to examine the risks associated with foreign investments other than BRI projects.

Keywords: political risk; assessment; big data; GDELT; Belt and Road Initiative (BRI); China

Citation: Sun, X.; Gao, J.; Liu, B.; Wang, Z. Big Data-Based Assessment of Political Risk along the Belt and Road. *Sustainability* **2021**, *13*, 3935. https://doi.org/10.3390/su13073935

Academic Editors: Anna Visvizi, Federico Martellozzo and Miltiadis D. Lytras

Received: 28 January 2021
Accepted: 30 March 2021
Published: 2 April 2021

1. Introduction

Being a critical issue of business environment, risk assessment has been a hot research topic in recent decades. Especially with the launch of the Belt and Road Initiative (BRI) in 2013 by the Chinese President Xi Jinping, a subset of the issue, political risk assessment, has become increasingly important [1–5]. BRI is also known as One Belt One Road (OBOR), aiming to increase cooperation among participating countries [6]. As of Jan 2020, 138 countries and 30 international organizations have signed BRI cooperation agreements with China [7]. China's accumulated direct investment to BRI countries has reached USD 117.31 billion during the period from 2013 to 2019 [8], accounting for 11.60% of gross flow of China's outward foreign direct investment.

Since the launch of BRI, much research has been done to properly interpret BRI [9–12], carry out case studies of international projects instigated by BRI [13,14], study China's outward foreign direct investment to BRI countries [15–17], and study the influence of BRI on concerned countries or regions [18–25]. However, research into the political risk

facing the many countries along the Belt and Road, especially China, has not gained sufficient attention. Understandably, political risks may impact on the sustainability of BRI and cause substantial loss of investment [26,27], and thus constitute a major challenge for any country which has investments abroad. As an example, Teheran-Qom-Esfahan high-speed railway project was terminated indefinitely as a result of the sanction on Iran's nuclear program in 2013 (from the USA, Europe, and the UN), which led to a tremendous economic loss of up to EUR 8.4 billion investment from China [28]. While many countries and regions around the world are still recovering from the global financial crisis of 2008 and adjusting to changed international investment patterns, the outbreak of COVID-19, which began in early 2020 and has intensified in recent months, has tremendously exacerbated the risk of instability. Indeed, tensions, mass protests, social unrest, economic collapse, and humanitarian crises have been reported in many countries and regions around the globe [29,30], and the global GDP growth has been forecasted to drop 4.4% in 2020 [31]. These issues may have a tremendous adverse effect on the sustainability of BRI. Therefore, systematic study of political risk along the Belt and Road has not only been important, but also pressing. Since a main component of BRI can be regarded as overseas investments and cooperation in this world, thus, systematic study of political risks for BRI countries may also shed light on general overseas investments. However, quantifying political risks is a difficult issue, as political risks have many manifestations, such as social unrest, civil disturbance, riots, political instability, terrorism, and even wars [32–34]. This difficulty motivates us to explore a big data-based assessment of political risk for BRI.

There is a vast literature on the assessment of political risk. While most research in the field focused on conceptual thinking [35,36], developing some rating indices [37,38], and quantifying risks based on small data [5,39–42], major efforts have yet to be made to use big data for assessment of political risk. Recently, an important and illuminating step has been taken from a research group based on big data using spatial statistical analysis [43]. The big data they have used is called the Global Database of Events, Language, and Tone (GDELT), one of the most comprehensive data set regarding news report in the world. GDELT has many advantages to make it valuable for analyzing political risk. In particular, GDELT has been covering almost all news about the events occurring in the world since 1979, in over 100 languages. By now, the number of events covered has exceeded 600 million, and the database is updated every 15 min. Each event has two actors, such as country A and country B (for example, the Nagorno-Karabakh Conflict between Azerbaijan and Armenia which started in 1988 and recurred recently). One of the most important and interesting attributes of the GDELT event data is that each event is assigned a number, called Goldstein Scale, which is in the range of -10 and 10 and quantifies the degree of conflict or cooperation between the two actors of the event. In Zhang et al.'s work [43], they basically used the number and location of four types of events, assault, protest, coerce, fight, as the proxy of political instability, social unrest, lack of democracy, and external conflict, to assess political risk of BRI countries. While enlightening, they produced some intriguing results, such as the level of political risk in Russia (particularly in Moscow and North Caucasus) is almost as high as that in Syria in recent years (more precisely, from Oct 2013 to May 2018). Is the political risk in Russia really this high, or the observation is due to some factors, such as Russia has been active in world affairs in recent years, and is thus rich in news?

To resolve the above and other issues, we will consider systematically how to assess political risk by using GDELT and other big data. More concretely, we aim to assess systematically the political risk along the Belt and Road during the period from 2013 to 2019, based on big data comprising GDELT, the China Global Investment Tracker (CGIT), and the Armed Conflict Location & Event Data Project (ACLED). We will focus on two important questions: (i) How can political risk of BRI countries be properly assessed? (ii) Are China's BRI investments and construction contracts largely in BRI countries with low levels of political risk? If not, what are the general characteristics of political risks associated with China's BRI investments and construction contracts?

In making efforts to answer the above questions, we made six contributions: (1) In trying to resolve why political risk measured by the number of events for "Protest", "Coerce", "Assault" and "Fight" in Russia is so high, we find that the basic reason is that the number of the type of events that are chosen for evaluating risks may be correlated with the total number of events that is covered by GDELT for a country, and the number of events can vary substantially for a country over time and among different countries around the globe in a fixed (short) time interval. For example, when international affairs are concerned, the more active a country is, the more news reports the country will get. In GDELT, the number of events is roughly proportional to the number of news reports. Realizing this, one can readily understand why Russia has the large number of events belonging to "Protest", "Coerce", "Assault" and "Fight"—this is because Russia has been very active in world affairs in recent years; in fact, Russia has the largest number of events among all the BRI countries. (2) Aiming to represent more pertinently and more comprehensively the events that may directly affect foreign investment, we select a new class of events called "Material Conflict" coded in GDELT, which consists of "Exhibit Force Posture", "Reduce Relations", "Coerce", "Assault", "Fight" and "Use Unconventional Mass Violence". (3) To facilitate comparison among countries that may have vast differences in national capabilities, geographical characteristics, cultural background, etc., we design a normalized quantify, the ratio between the sum of the Goldstein Scale of "Material Conflict" events and the sum of the Goldstein Scale of all the events. Clearly, using the Goldstein Scale of the events is more advantageous than directly using the number of events, since an event with the Goldstein Scale of -10 amounts to 10 events with the Goldstein Scale of -1. (4) To assess which type of political risk a BRI country is facing, we study domestic and international political risk which are two components of the political risk. (5) We examine the spatiotemporal evolution of political risk along the Belt and Road during the period from 2013 to 2019. (6) We find a strong positive correlation between the political risk and China's investments and construction contracts along the BRI during the period from 2013 to 2019. While this is quite the opposite of the ideal case that investment goes to countries or regions with as low political risk as possible, it nevertheless corroborates a general saying that chances are often associated with risks.

The remainder of the paper is organized as follows. Section 2 contains the literature review. Section 3 explains the data and methods. Section 4 presents the assessment results about the political risk along the BRI, and examines the correlation between the political risk and China's total investment and construction contracts in a period from 2013 to 2019. Sections 5 and 6 contain the conclusions and discussions, respectively.

2. Literature Review

Since multiple risks are involved in investments by multinational firms and international projects [44], in recent years, study on the correlation between the political risk and foreign investments [4,40,45–50] and the relevance of political risk to multinational firms [51–53] and international projects [37,54,55] are gaining increasing attention. These studies are especially important for the study of China's investments in BRI countries [56]. While much research on BRI has been done, including interpretation of BRI [9–12], case studies of international project [13,14], analyses of various risks (e.g., environmental risk, energy investment risk, investment risk etc.) [5,57,58], China's outward foreign direct investment to BRI countries [15–17], the influence of BRI on concerned countries or regions [18–25], and energy efficiency and environmental quality along BRI [59–61], recently, attention has also been paid to the analysis of political risk along the Belt and Road [3,5,43]. In particular, Morris [3] has provided three dimensions for the analyses of political risk, including geopolitical level, country level, and project level, and has called for a comprehensive understanding of political risk along the Belt and Road. Hussain et al. [5] considered political risk as part of challenges that China has to consider for its investment in a host country . To assess the risks facing China's investment to BRI countries, they employed the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method and proposed an

indicator system. Zhang et al. [43] combined big data sets and spatial methods to analyze political risk of BRI countries and China's investment and construction projects.

While interesting, existing studies on big data-based assessment of political risk along the Belt and Road are limited. In fact, as many countries and regions along the BRI are unstable and vulnerable, such as Yemen, Iraq, and Afghanistan, which have been struggling with social unrest, political conflicts, terrorism and even wars, China's foreign investment towards these BRI countries surely needs serious consideration, especially the factors that could impact greatly on the business environment along the Belt and Road and the sustainability of BRI. Indeed, many overseas projects by China have not been successful. For example, the Myitsone Dam in Myanmar, which is one of China's largest electricity infrastructure projects, was terminated by Myanmar's former military government [62]. As another example, the Hambantota Port project in Sri Lanka also highlighted the importance of political risk study [63].

Although the study of the political risk along the Belt and Road is important, relevant literature however is limited, therefore, in this section, we will take a review of the general studies on political risk that may not target BRI. This general literature is quite rich, and may be divided into two lines. One line has focused on conceptual discussion of political risk [35,64], which can be classified into two clusters [35,36,65]. One cluster has emphasized government interferences with business operations in different scenarios. Robock [66] has considered "government in power and its operating agencies" as one of groups which could generate political risk, such as confiscating certain properties of international operations. Similarly, Butler and Joaquin [67] indicated political risk is unexpected changes on the "rules of game" of business operate by sovereign host government, and this government action may cause more uncertain investment consequences. Besides the element of causing political risk, government intervention in business is regarded as one of the most serious political risk effects as well [1,68]. The other cluster has considered political events as generators of political risk in international business. Adverse outcomes may arise from political events, such as wide-scale strikes, bombings, riots, violence, changes in government [35,65,66]. As political risk may affect the outcome of foreign direct investments, Clark [40] has considered "the probability of politically motivated change". Likewise, Khattab et al. [36] proposed political risk to be regarded as the probability that a political event will occur, which may cause loss for companies and other investors. Consequentially, if political risk is considered as the probability that political events will result in loss of investment, the degree of political risk will be determined by the "size" of this probability [56].

The other line of research on political risk has focused on empirical analyses of political risk. Along this line, much effort has been made to develop proper indicators for political risk. As examples, Hussain et al. [5] proposed an indicator system for environment risk based on the "Technique for Order Preference by Similarity to Ideal Solution" (TOPIS) method, which contains four sub-indices for political risk. Chang et al. [55], based on a comprehensive review of literature, identified nine categories of political risks which contain a total of 29 political risk factors and three political risk consequences. Furthermore, efforts have also been made to develop several rating indices to address political risk through multifarious variables, such as International Country Risk Guide (ICRG) model [37], and the Fragile States Index (FSI) [38]. ICRG model, launched online by the Political Risk Services (PRS) group, has built a political risk rating system comprising 12 components of political risk with different ranges of values, as a means of assessing political stability in 166 countries [37]. These 12 components of the ICRG model, including the government instability, internal and external conflict, corruption and ethnic tension, law and order, democratic accountability of government, and quality of bureaucracy, were used by Busse and Hefeker [39] to examine their effects on foreign direct investment. Another rating index, FSI, uses a three-layer system to define "Political Indicator", where the 2nd layer uses by 4 groups of variables and the 3rd layer contains 12 detailed indicators to rank countries around the world [38]. Clark [40] proposed assessing political risk as a

cost in capital budgets, to value impacts of political risk on consequences of foreign direct investment. Butler and Joaquin [67] developed a model to isolate diversifiable and non-diversifiable sources of political risk, and analyzed the effects of political risk on returns and cost of capital. In contrast to developing a model, Howell and Chaddick [49] evaluated three political risk assessment models, the Economist Method, Business Environment Risk Intelligence (BERI), and Political Risk Services, with actual losses.

While literature on the assessment of political risk is rich, major efforts have yet to be made to assess political risk based on big data. Recently, an important and illuminating step has been taken by a research group based on big data using spatial statistical analysis [43]. The significance of this work is that it showed the potential of associating political events reported in mass media with risk. This potential lines well with many earlier studies showing that political events are often associated with political risk [1,50,65,69]. As event data can now be readily generated through machine-reading from texts, such as news reports, intelligence reports, press conferences, etc., we can hope that factors relevant to political risks will be more comprehensively identified in the future. Along this line, however, it is important to be reminded of a complexity emphasized by Clark [40] that the evolution of political risk may be involved in reaction to countless events.

Therefore, systematic assessment of political risks along the Belt and Road on China's foreign investment using big data has become increasingly important.

3. Data and Methods

3.1. Data

GDELT is the major data to be used here. It includes more than 600 million distinct events across all countries, during the period from 1979 to the present, covering 20 categories and over 300 subcategories. GDELT events are drawn from a wide variety of news media, both in English and non-English, from across the world, ranging from local to international sources in nearly every country, based on the Conflict and Mediation Event Observations (CAMEO) event coding ontology [70,71]. Each event has two actors (Actor1 and Actor2), such as country A and country B (for example, the Nagorno-Karabakh Conflict between Azerbaijan and Armenia which started in 1988 and recurred recently). One of the most important and interesting attributes of the GDELT event data is that each event is assigned a set of attributes, including the interval-level Goldstein conflict-cooperation scale value [72], called Goldstein Scale, which is in the range of −10 and 10 and quantifies the degree of conflicts or cooperations between the two actors of the event. GDELT can be downloaded from https://www.gdeltproject.org/ (accessed on 16 September 2020). To compute political risks using GDELT for countries along the Belt and Road during the period from 2013 to 2019, we use the computing platform provided by the Center for Geodata and Analysis, Faculty of Geographical Science, Beijing Normal University. We use the MATLAB-R2019b and Python to identify the time, Actor1, Actor2, types of events, number, and Goldstein Scale for the events covered by GDELT, and then compute variables of interest.

CGIT is used here for the purpose of examining the correlation between the political risk of the BRI countries and China's investments and construction contracts, covering 52 BRI countries. CGIT is the only open data set covering China's global investment and construction contracts comprehensively, and has covered 3400 large transactions and 300 troubled transactions [73]. These transactions are in the areas of energy, transportation, real estate, and other industries, and contain information about Chinese parent company, host country, and sector to which the investment or project belongs.

Besides, we shall also use a database called ACLED to better determine the risks a BRI country faces. ACLED is a conflict data set which records information of internal political conflict events with dates, geographical locations, types, actors, fatalities, etc. [74], which has recorded in real-time, covering almost a million unique events in over 150 countries during a period from 1997 to 2020. As only in 2018 and 2019 ACLED covers all BRI countries, we consider a country to have fatalities of more than 10,000 caused by armed conflicts

during the period from 2018 to 2019 to be war-torn. By this criterion, Afghanistan, Yemen, Syria and Iraq are war-torn. Investments to them, and to Syria (which is not covered by CGIT), will not be considered in the correlation analysis of this study.

While 138 countries signed BRI cooperation agreements with China as of January 2020 [7], we select the initial 63 countries along the Belt and Road since the launch of BRI in 2013 that have news reports covered by GDELT, so that their spatial evolution of political risks in the whole period from 2013 to 2019 can be examined. According to the official website of BRI (https://www.yidaiyilu.gov.cn/jcsjpc.htm (accessed on 16 September 2020)), these 63 countries belong to 6 major regions: Northeast Asia, Southeast Asia, South Asia, West Asia and North Africa, Central and Eastern Europe, and Central Asia. They are listed in Table 1. The country codes referred to here follow those of GDELT.

Table 1. Regions and corresponding countries along the Belt and Road.

Regions	Countries (Country Codes)
Northeast Asia	Mongolia (MNG), Russia (RUS)
Southeast Asia	Singapore (SGP), Indonesia (IDN), Malaysia (MYS), Thailand (THA), Vietnam (VNM), Philippines (PHL), Cambodia (KHM), Myanmar (MMR), Laos (LAO), Brunei (BRN)
South Asia	India (IND), Pakistan (PAK), Sri Lanka, (LKA), Bangladesh (BGD), Nepal (NPL), Maldives (MDV), Bhutan (BTN)
West Asia and North Africa	United Arab Emirates (ARE), Kuwait (KWT), Turkey (TUR), Qatar (QAT), Oman (OMN), Lebanon (LBN), Saudi Arabia (SAU), Bahrain (BHR), Israel (ISR), Yemen (YEM), Egypt (EGY), Iran (IRN), Jordan (JOR), Syria (SYR), Iraq (IRQ), Afghanistan (AFG), Palestine (PLE), Azerbaijan (AZE), Georgia (GEO), Armenia (ARM), Bahrain (BHR)
Central and Eastern Europe	Poland (POL), Albania (ALB), Estonia (EST), Lithuania (LTU), Slovenia (SVN), Bulgaria (BGR), Czech (CZE), Hungary (HUN), Macedonia (MKD), Serbia (SRB), Romania (ROU), Slovakia (SVK), Croatia (HRV), Latvia (LVA), Ukraine (UKR), Belarus (BLR), Moldova (MDA), Greece (GRC), Cyprus (CYP)
Central Asia	Kazakhstan (KAZ), Kyrgyzstan (KGZ), Turkmenistan (TKM), Tajikistan (TJK), Uzbekistan (UZB)

3.2. Methods

3.2.1. Choosing the Proper Type of Events—"Material Conflict"

We believe choosing pertinent types of events to evaluate political risk is of critical importance. While Zhang et al. used four types of events: "Protest", "Coerce", "Assault", and "Fight" [43], we will show in the Results Section that the type "Protest" is inappropriate to be included for evaluating political risk—the simplest reason one can immediately think of is that the nature of a protest in a democratic country or a non-democratic country is completely different, and thus including "Protest" will make comparison among BRI countries that are full of democratic and non-democratic countries impossible. Besides the remaining three types of events used by Zhang et al. [43], namely, "Coerce", "Assault", and "Fight", we will also include "Exhibit Force Posture", "Reduce Relations", and "Use Unconventional Mass Violence". These six types of events constitute one of the Quadclasses, "Material Conflict", in GDELT. The other three Quadclasses are "Verbal Cooperation", "Verbal Conflict", and "Material Cooperation" [71]. "Material Conflict" contains six groups of events, "Exhibit Force Posture", "Reduce Relations", "Coerce", "Assault", "Fight" and "Use Unconventional Mass Violence". The major characteristics of these 6 groups are summarized in Table 2.

Table 2. The Specific elements of "Material Conflict" covered by GDELT.

Exhibit Force Posture	Reduce Relations	Coerce	Assault	Fight	Use Unconventional Mass Violence
Demonstrate military or police power	Reduce relations	Coerce	Use unconventional violence	Use conventional military force	Use unconventional mass violence
Increase police alert status	Reduce or break diplomatic relations	Seize or damage property	Abduct/hijack /take hostage	Impose blockade /restrict movement	Engage in mass expulsion
Increase military alert status	Reduce or stop material aid	Impose administrative sanctions	Physically assault	Occupy territory	Engage in mass killings
Mobilize or increase police power	Impose embargo/ boycott/sanctions	Arrest/detain/charge with legal action	Conduct suicide/ car/other non-military bombing	Fight with small arms and light weapons	Engage in ethnic cleansing
Mobilize or increase armed forces	Halt negotiations	Expel or deport individuals	Use as human shield	Fight with artillery and tanks	Use weapons of mass destruction
Mobilize or increase cyber-forces	Halt mediation	Use tactics of violent repression	Attempt to assassinate	Employ aerial weapons	
	Expel or withdraw	Attack cybernetically	Assassinate	Violate ceasefire	

3.2.2. Choosing the Proper Variable—Goldstein Scale

Choosing the proper variable to assess political risk is also important. Zhang et al. [43] directly used the number of events to measure political risk. While this seems to be a viable choice, it is far from optimal, since different events have different degrees of importance. As we will show in the Results Section, using this variable could lead to hard to interpret results, such as the level of political risk in Russia (particularly in Moscow and North Caucasus) to be almost as high as that in Syria in recent years (more precisely, from Oct 2013 to May 2018). Recognizing this, here we choose Goldstein Scale of an event as the basis of our analysis. As we mentioned, Goldstein Scale is in the range of -10 and 10 and quantifies the degree of conflicts or cooperations between the two actors of the event—the score of -10 and 10 represent the strongest conflict and cooperation. Clearly, using the Goldstein Scale of the events is more advantageous than directly using the number of events, since an event with the Goldstein Scale of -10 amounts to 10 events with the Goldstein Scale of -1.

3.2.3. Designing the Proper Measure for Assessing Political Risk

Based on the chosen type of events and variable, we design a normalized variable to assess the political risks of any country in any year so that comparison among different countries can be meaningly made. Without normalization (which is the case when the number of events is directly used for evaluating risks), comparison among countries with vast differences in national capabilities, activities in international affairs, geographical characteristics, cultural background, etc., is essentially impossible. Our normalized variable is the ratio between the sum of the absolute value of the Goldstein Scale of "Material Conflict" events representing political risk and the sum of the absolute value of the Goldstein Scale of all the events:

$$PR_t^i = \frac{|GS(M)_{it}|}{GS_{it}^{(+)} + |GS_{it}^{(-)}|} \qquad (i = 1, 2, \ldots, 63; t = 2013, \ldots, 2019) \tag{1}$$

In the formula, t is the specific year belonging to the period from 2013 to 2019, and i is a BRI country. PR_t^i is an abbreviation of the level of political risk for BRI country i and year t. $GS(M)_{it}$ is the sum of Goldstein Scale of "Material Conflict" events for BRI country i and year t. $GS_{it}^{(+)}$ is the sum of the Goldstein Scale values of all the events with positive Goldstein Scale for BRI country i and year t, and $GS_{it}^{(-)}$ is the sum of the Goldstein Scale values of all the events with negative Goldstein Scale for BRI country i and year t. There are 63 BRI countries so that i is in the range from 1 to 63. We neglect three BRI countries,

Georgia (GEO), Romania (ROU), and Slovenia (SVN), as they have too small number of events during the period from 2013 to 2019. In fact, they are in the exponential cut-off range in terms of number of events collected by GDELT, as is clearly shown in Figure 1. In our actual analysis, we will focus on the political risk of the remaining 60 BRI countries (that is, i will run from 1 to 60 in contrast with the specification in Equation (1).

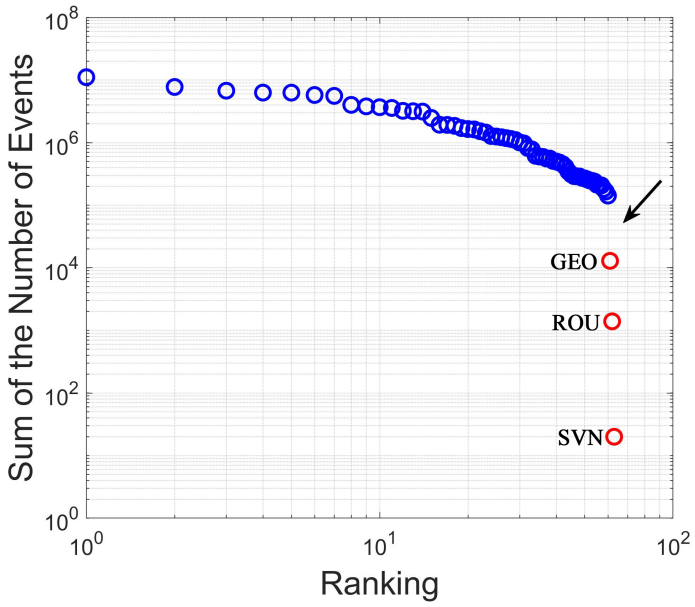

Figure 1. Sum of the number of events covered by GDELT vs. the ranking (in log-log scale) for BRI countries during a period from 2013 to 2019, where the countries are ordered according to the descending sum of number of events. Red dots are BRI countries with the sum of the number of events less than 13,000, which are Georgia (GEO), Romania (ROU), and Slovenia (SVN) respectively.

It is often thought that political risk may be better considered from external and internal perspectives [56], since countless events associated with political risk can be classified into international and national levels [40]. This is implemented by checking the actors of the events. Based on this rationale, we will also consider political risk in two components, international and domestic political risk. We hope such an approach can help better assess which type of political risk a BRI country is facing.

4. Results

4.1. The Type of Events "Protest" Is Inappropriate to Be Included for Assessing Political Risk

As we mentioned, the nature of protest in a democratic country is entirely different from that in a non-democratic country, since protest has become a mode of public participation, a regular and even desired feature of politics in established democracies [75]. Considering that BRI countries are full of democratic and non-democratic countries, including events of protest when evaluating political risk therefore will make comparison among BRI countries impossible. This realization can be better appreciated by the following two straightforward analyses. First, India has the largest number of "Protest" events covered by GDELT among BRI countries during the period from 2013 to 2019, as is presented in Figure 2. Thus, including this type of event may lead one to mis-conclude India (and other, especially democratic countries with a lot of protests) to be in turbulent and even risky situations.

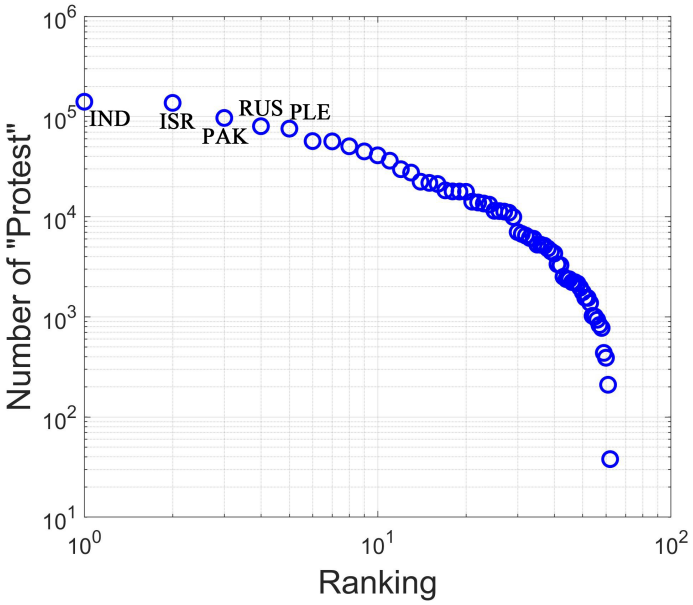

Figure 2. Number of "Protest" covered by GDELT vs. the ranking (in log-log scale) for BRI countries during a period from 2013 to 2019, where the countries are ordered according to the descending number of "Protest". The top5 countries are India (IND), Israel (ISR), Pakistan (PAK), Russia (RUS), and Palestine (PLE).

Second and more relevant to general overseas investments, we find that there is no correlation between the "Protest" and China's investments during the period from 2013 to 2019, as is shown in Figure 3. This highlights that the event type "Protest" is not correlated with China's investments at all. Please note that even if we measure political risk by Equation (1), the correlation between the "Protest" and China's investments during the period from 2013 to 2019 is still basically zero.

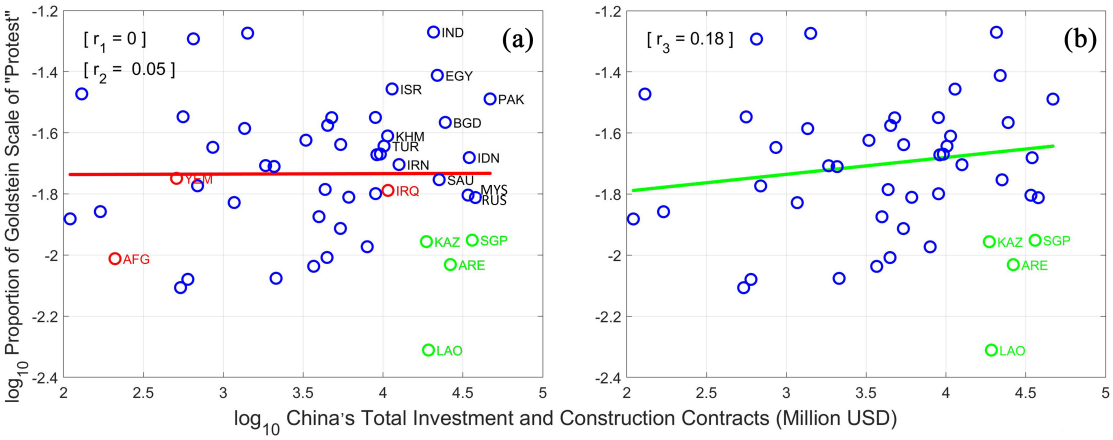

Figure 3. Scatter-plots between the proportion of Goldstein Scale of "Protest" and China's total investments and construction contracts for BRI countries during the period of 2013–2019, where (**a**) shows that the correlation coefficient for all BRI countries is only $r_2 = 0.05$ ($p = 0.736$), while the coefficient is decreased to $r_1 = 0$ ($p = 0.977$) when the war-torn countries, Yemen (YEM), Afghanistan (AFG), and Iraq (IRQ) (which were denoted by red), were excluded. The red regression line refers to $r_1 = 0$. The correlation coefficient was increased to $r_3 = 0.18$ ($p = 0.264$) but still almost zero, when four more countries, the United Arab Emirates (ARE), Lao (LAO), Singapore (SGP), and Kazakhstan (KAZ), which were denoted by green, were also removed; this is shown in (**b**) , with the green regression line referring to $r_3 = 0.18$.

4.2. Using the Number of Events for Assessing Political Risk Is in Appropriate

We mentioned that using the number of events for evaluating political risk may not be appropriate. The basic reason is that the number of the type of events that are chosen for evaluating risks may be correlated with the total number of events that is covered by GDELT for a country, and the number of events can vary substantially for a country over time and among different countries around the globe in a fixed (short) time interval. If this is the case, then a country with a large number of events covered by GDELT may be mis-classified as having high risks. To appreciate the idea, we show, in Figure 4, the total number of events BRI countries have and scatter plots between the number of the four types of events used by Zhang et al. [43] and the total number of events of the BRI countries. We observed that the number of events in Russia from Oct 2013 to May 2018 is the largest among all the BRI countries, reaching 8,554,758. The underlying reason must be that Russia has been very active in world affairs in recent years, and thus must have had huge number of events reported in the news media, which in turn have been collected by GDELT. In general, we can conclude that the more active a country is, the more events the country will generate, and the more news reports it will get.

More importantly, Figure 4b showed that the number of the four types of events chosen by Zhang et al. [43] to evaluate risks is strongly correlated with the total number of events (in log-log scale). These analyses clearly indicate that directly using the number of the four types of events shown in Figure 4 is not optimal for evaluating risks. In fact, one can readily see that even if one uses other types of events to assess political risks, directly using the number of events will still be far from optimal for evaluating risks.

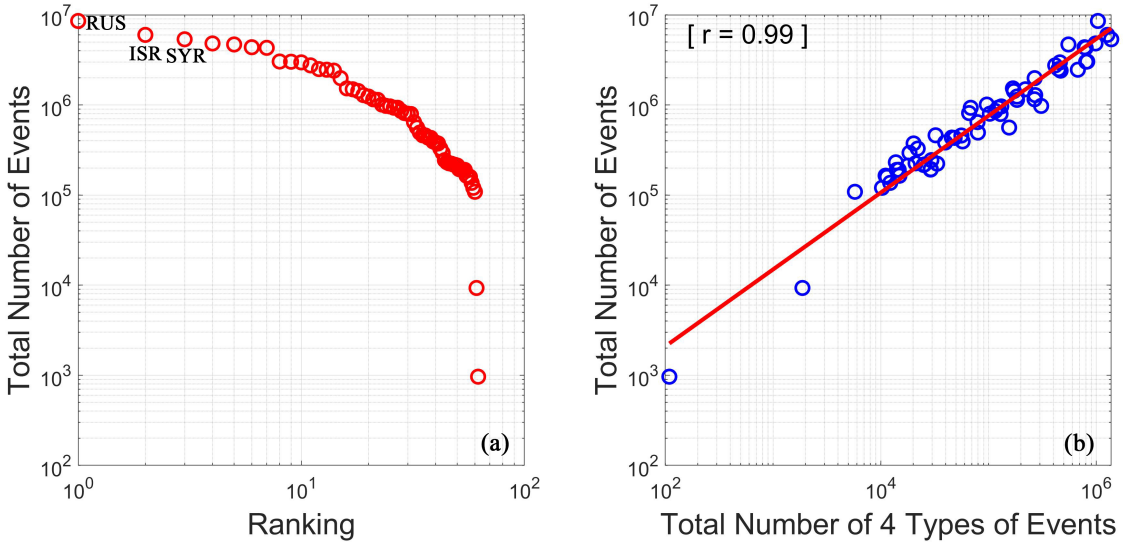

Figure 4. (**a**) Ranked total number of events covered by GDELT during the period from Oct 2013 to May 2018 for BRI countries, where the countries are ordered according to the descending total number of events, with the top3 countries being Russia (RUS), Israel (ISR), and Syria (SYR); and (**b**) scatter plots between the total number of events and total number of 4 types of events (in log-log scale), including "Coerce", "Assault", "Fight" and "Protest", with the correlation coefficient r being as large as 0.99 and the p-value being less than 10^{-6}.

4.3. Spatiotemporal Evolution of Political Risk along the Belt and Road

We first discuss the temporal evolution of the political risk along the Belt and Road, then examine its two components, domestic and international political risk, and finally study the spatial evolution.

By computing the political risk defined in Equation (1) and the Probability Density Function (PDF) of the political risk during the period from 2013 to 2019, Figure 5 shows that the PDF of political risk, where a mean of 0.25 is indicated by a red vertical line. The PDF suggests us to define political risk in 4 levels. Concretely, the interval $0.2 < PR \leq 0.3$, which contains a large probability when the political risk falls within this interval, is defined

as the moderate level of political risk for BRI countries during the period from 2013 to 2019. The interval $PR \leq 0.2$, which also contains a large probability similar to that for the interval $0.2 < PR \leq 0.3$, is defined as the negligible level of political risk. Two other intervals, $0.3 < PR \leq 0.4$ and $PR > 0.4$, both above average but containing much smaller probabilities than other two levels, are defined as high and extremely high level of political risk, respectively. This ensures that most countries along the Belt and Road are peaceful. Therefore, we find it appropriate to divide the political risk into 4 levels, including $PR > 0.4$, $0.3 < PR \leq 0.4$, $0.2 < PR \leq 0.3$, and $PR \leq 0.2$. These 4 levels are called *Level* 4, *Level* 3, *Level* 2, *Level* 1, which represents extremely high, high, moderate, and negligible level of political risk, respectively. This classification will also be used when discussing domestic and international political risk below.

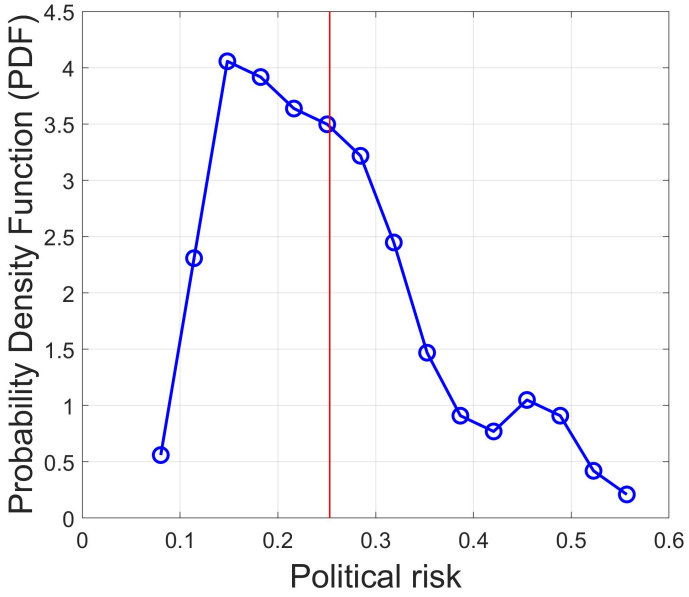

Figure 5. Probability Density Function (PDF) of political risk along the Belt and Road during the period from 2013 to 2019, where the mean value of 0.25 is indicated by the vertical red line.

It is instructive to examine the temporal evolution of the number of BRI countries at different risk levels from 2013 to 2019. This is depicted in Figure 6. For the extremely high level of (overall) political risk, the number of BRI countries is 7, 9, 9, 8, 6, 6, and 5, from 2013 to 2019, respectively. For the high level of political risk, the number of BRI countries is 7, 8, 14, 12, 9, 9, and 9, from 2013 to 2019, respectively. These numbers sum to 14, 17, 23, 20, 15, 15, and 14, from 2013 to 2019, respectively. Therefore, the sum of the number of BRI countries with the extremely high and the high level of (overall) political risk reaches the peak in 2015, and decreases thereafter.

For domestic political risk, the number of BRI countries with the extremely high level is 9, 11, 12, 12, 8, 6, and 7, from 2013 to 2019, respectively, and the number of BRI countries with the high level is 7, 11, 16, 15, 12, 13, and 14, from 2013 to 2019, respectively. These numbers sum to 16, 22, 28, 27, 20, 19, and 21, from 2013 to 2019, respectively. For international political risk, the number of BRI countries with the extremely high level is 4, 8, 8, 5, 5, 5, and 3, from 2013 to 2019, severally, and the number of BRI countries with the high level is 6, 4, 7, 8, 5, 6, and 5, from 2013 to 2019, severally. These numbers sum to 10, 12, 15, 13, 10, 11, and 8, from 2013 to 2019, severally. It is thus clear that the sum of the number of BRI countries with the extremely high and the high level of political risk either for domestic or for international political risk increases to the maximum in 2015, and falls from then on. This is similar to the temporal evolution of the sum of the number of BRI countries with the extremely high and the high level of (overall) political risk.

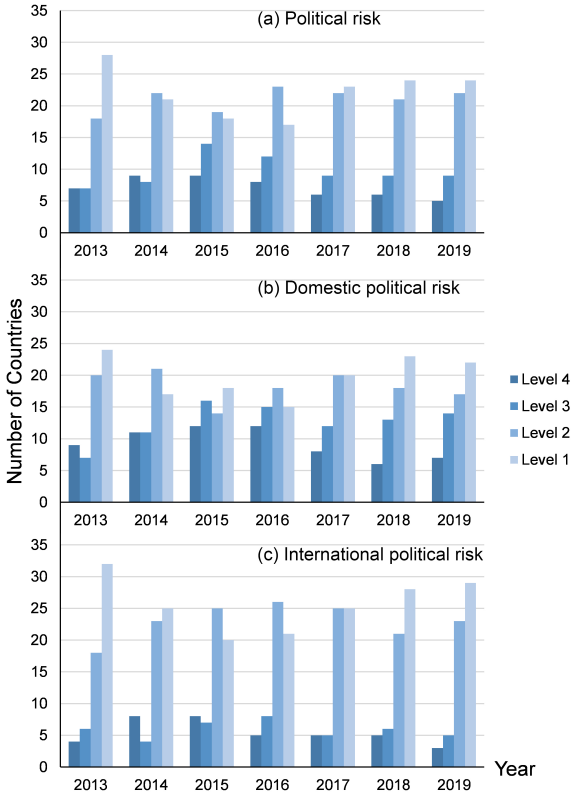

Figure 6. The temporal evolution of (**a**) political risk, (**b**) domestic political risk, and (**c**) international political risk along the Belt and Road from 2013 to 2019.

As the above discussions on the temporal evolution of the sum of the number of BRI countries with the extremely high and the high level of political risk all show that the number reaches maximum in 2015 for domestic, international, and (overall) political risk, it is instructive to explore the spatial evolution of political risk along the Belt and Road by focusing on 2013, 2015, 2017 and 2019. We first study the (overall) political risk along the Belt and Road, then analyze domestic and international political risk.

The spatial evolution of the political risk along the Belt and Road is shown in Figure 7. We find that Syria, Iraq, Yemen and Palestine exhibited the extremely high level of political risk in all these four years. They are followed by Afghanistan, Lebanon, and Israel, which exhibited the extremely high level of political risk in at least two of these four years. It should be emphasized that the nature of risks these countries faced was quite different. For example, Syria's risk has been mainly caused by the continued Syrian Civil War and attacks from the Islamic State of Iraq and the Syria (ISIS, a terrorist organization designated by the United Nations). The spillover of Syrian Civil War into Lebanon (2011–2017) impacted Lebanon greatly. In Iraq, the ISIS is also the main cause of risks, which even caused the Iraqi Civil War (2014–2017) with the Iraqi Forces. In contrast, Yemen has been struggling with the Yemeni Crisis (2011–present) and the Yemeni Civil War (2014–present). In fact, when the Yemeni Civil War erupted, Saudi Arabia made an armed intervention in Yemen. As for Afghanistan from 2001 to the present, there have been many wars and attacks, such as the assaults by Taliban and the Kabul attack. Palestine has been mainly struggling with the ongoing Israeli-Palestinian conflict.

For the high level of political risk, we find that Pakistan and India of South Asia, and Myanmar of Southeast Asia showed this level in all these four years, and the political risk of Pakistan even reached the extremely high level of political risk in 2013. Saudi Arabia, Egypt, Turkey, and Ukraine showed the high level of political risk in at least two of these four years. The high level of political risk exhibited by them were also mainly caused by religious conflicts, terrorist organizations, and complex relationships between them, including other

countries' interventions. For example, the loggerheads between Saudi Arabia and Iran and the Egyptian Crisis (2011–2014) were significant causes of the high level of political risk in this region. The Internal Conflict in Myanmar since 1948 has been the longest ongoing civil war in the world, which causes a series of insurgencies. For Pakistan and India, the India-Pakistan border skirmishes (2016–2018) and the India-Pakistan standoff in 2019 were the causes of the turbulent situations.

Please note that some sudden changes in the levels of political risk occurred in the following countries, with causes readily identifiable. In 2015, the level of political risk in Central and Eastern Europe was higher than in other times. This was caused by the European Refugee Crisis which was thought to have started in 2014 and reached the peak of crisis in 2015. Moreover, the Russo-Ukrainian War since 2014, which has been a protracted conflict between Russia and Ukraine mainly in the Ukraine regions of Crimea and Donbas, has caused a high level of political risk in Ukraine. Involved in this war, Poland made military responses, while Turkey encountered military actions by Russia. In Bangladesh around the same time, the political risk level not only became higher in 2015, but reached the extremely high level. This was a manifestation of the Bangladesh political crisis in 2015, a political turmoil between the Awami League (AL) and the Bangladesh Nationalist Party (BNP), a terrorist organization considered by AL. The crisis had led to many violent and even fatal attacks on the public. As in Philippines, the high level of political risk in 2017 was mainly due to an armed conflict between Philippine government security forces and the ISIS (more precisely, the Battle of Marawi).

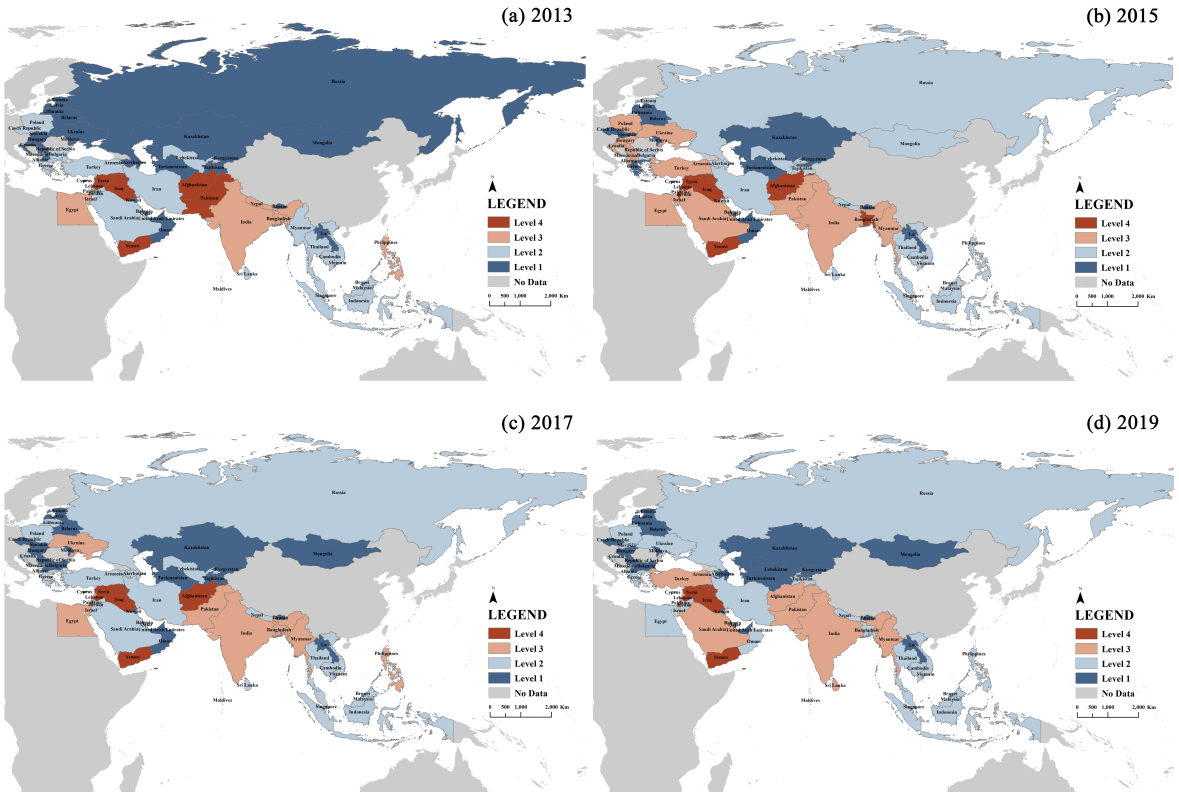

Figure 7. The spatial evolution of the political risk along the Belt and Road.

Next, let us decompose political risk into domestic and international components. The spatial evolution of domestic political risk along the Belt and Road is presented in Figure 8. We find that the extremely high level of domestic political risk showed in Syria, Iraq, Afghanistan, and Yemen in all these four years. They are followed by Myanmar, Palestine, Lebanon, Israel, Egypt, and Pakistan, which showed the extremely high level of domestic political risk in at least two of these four years. The high level of domestic

political risk often exhibited in Iran, India, Myanmar, Philippines, Bangladesh, Turkey, and Saudi Arabia in at least two of these four years. Besides, sudden changes in the level of domestic political risk also appeared in 2015, with the political risk in Russia and many BRI countries of Central and Eastern Europe increasing to the high level. Major causes of domestic political risk in these BRI countries are thought to include conflicts due to religions, terrorism, civil wars and conflicts, actions by anti-government forces, social unrest, and the refugee problem. Besides, it is important to realize that some of the causes for the high level of domestic political risk are due to interplay between domestic and international events, such as the European Refugee Crisis.

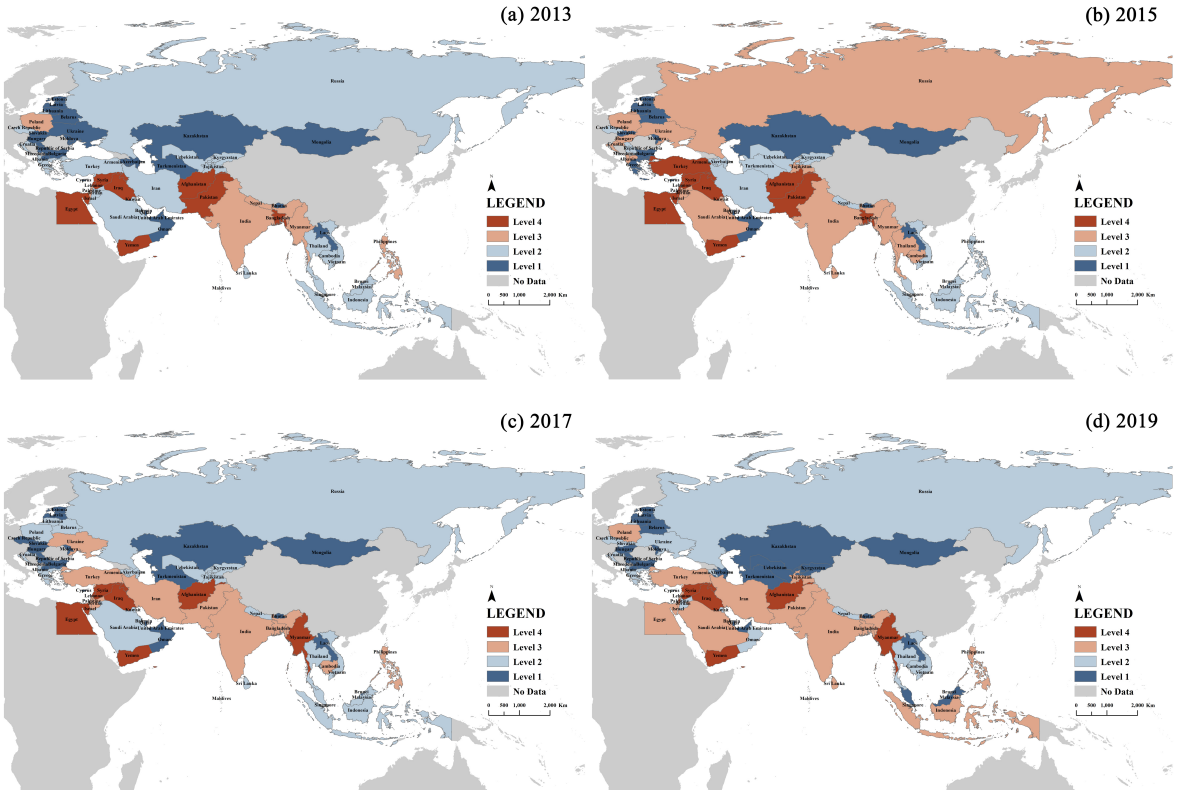

Figure 8. The spatial evolution of domestic political risk along the Belt and Road.

The spatial evolution of international political risk along the Belt and Road is presented in Figure 9. Comparing with the domestic political risk along the Belt and Road shown in Figure 8, we find that the color becomes much lighter, meaning that overall the international political risk along the Belt and Road is much lower than the domestic political risk. While the extremely high level of domestic political risk showed in four countries, Syria, Iraq, Afghanistan, and Yemen, in all these four years, we find only one country, Yemen, reached the extremely high level of international political risk in all these four years. Besides Yemen, Iraq, Syria, Palestine, Israel, and Lebanon also exhibited the extremely high level of international political risk in at least two of these four years. The lesser level of international political risk, the high level, was found in Saudi Arabia and Afghanistan in at least two of these four years, followed by Pakistan, India, Turkey, Ukraine, and Bangladesh, which showed this level in only one of these four years.

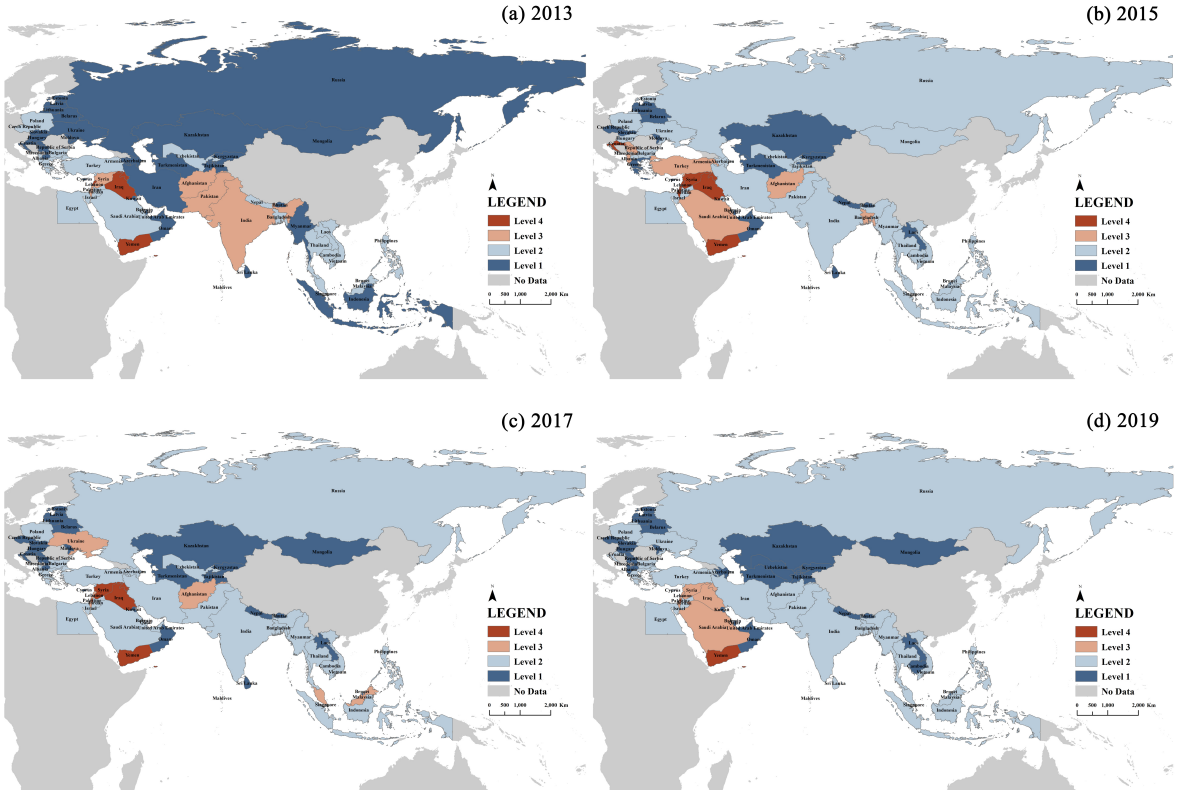

Figure 9. The spatial evolution of international political risk along the Belt and Road.

4.4. The Correlation between Political Risk and China'S Foreign Investments and Construction Contracts

To examine the correlation between political risk and China's total investments and construction contracts for BRI countries during the period from 2013 to 2019, it is instructive to construct scatter plots between political risk and China's total investments and construction contracts for BRI countries during this period. This is shown in Figure 10. We find in Figure 10a that the correlation coefficient for all BRI countries is only $r_2 = 0.16$ ($p = 0.28$); it is increased to $r_1 = 0.33$ ($p = 0.026$) when the war-torn countries, Yemen, Afghanistan, and Iraq (which were denoted by red), were excluded. The correlation coefficient is further increased to $r_3 = 0.58$ ($p < 10^{-6}$) when four more countries, the United Arab Emirates, Lao, Singapore, and Kazakhstan, which were denoted by green, were also removed; this is shown in Figure 10b. Since the correlation coefficient is quite positive, by large, we can say that political risk and China's total investments and construction contracts for BRI countries during the period from 2013 to 2019 are strongly positively correlated. With investment, one certainly wishes substantial reward. The positive correlation between risk and investment thus highlights that reward and risk are highly entangled. As this is not ideal, we can ask, is there any way for us to break the "curse" of always accompanying investment with risk? The answer lies in excluding the four countries the United Arab Emirates, Lao, Singapore, and Kazakhstan. The risk levels in these four countries are rather low. However, China's investments and construction contracts in these four countries are quite heavy. One can readily perceive that if the number of such countries, i.e., low risk countries with substantial investments from China increases (for example, China's investments to low-risk countries such as Cyprus, Brunei, Moldova, Oman, Turkmenistan, and Belarus greatly increases), then the correlation between political risk and China's total investments and construction contracts for BRI countries may not only weaken, but becomes negative altogether. This would be the ideal case. Unfortunately, along the Belt and Road, the correlation between political risk and China's total investments and construction

contracts will basically remain positive, since there are a lot of high-risk countries but with heavy investments from China, including Pakistan, Indonesia, Malaysia, Bangladesh, Saudi Arabia, Egypt, India, Russia, Iran, Israel, Cambodia, and Turkey.

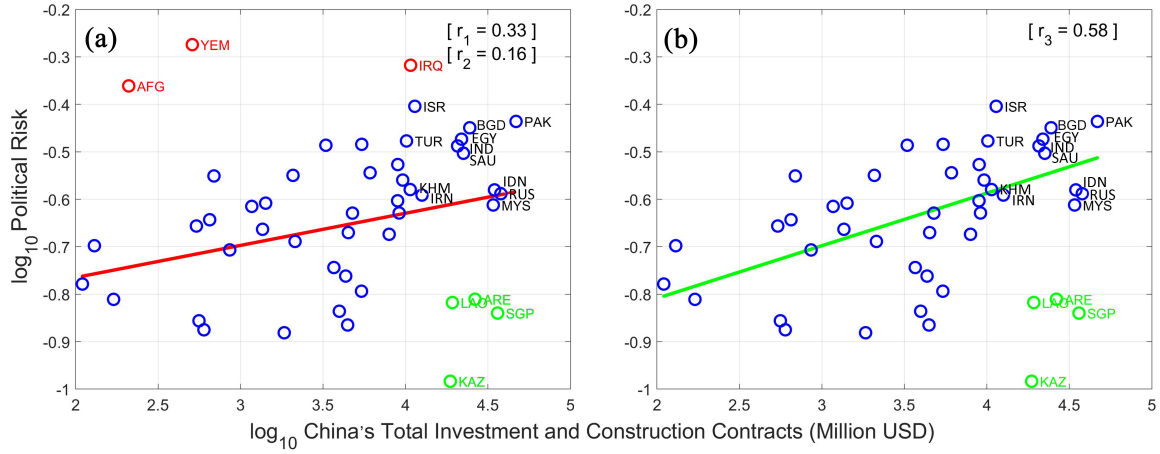

Figure 10. Scatter-plots between political risk and China's total investment and construction contracts for BRI countries during the period of 2013–2019, where (**a**) shows that the correlation coefficient for all BRI countries is only $r_2 = 0.16$ ($p = 0.28$), while the coefficient is increased to $r_1 = 0.33$ ($p = 0.026$) when the war-torn countries, Yemen (YEM), Afghanistan (AFG), and Iraq (IRQ) (which were denoted by red), were excluded. The red regression line refers to $r_1 = 0.33$. The correlation coefficient was further increased to $r_3 = 0.58$ ($p < 10^{-6}$) when four more countries, the United Arab Emirates (ARE), Lao (LAO), Singapore (SGP), and Kazakhstan (KAZ), which were denoted by green, were also removed; this is shown in (**b**), with the green regression line referring to $r_3 = 0.58$.

5. Conclusions

We aimed to gain insights into two important questions, (i) How can political risk of BRI countries be properly assessed? and (ii) Are China's BRI investments and construction contracts largely in BRI countries with low levels of the political risk? If not, what are the general characteristics of political risks associated with China's investments and construction contracts? In trying to resolve these two questions, we used a few big data sets, including GDELT, CGIT, and ACLED, to systematically assess the political risk along the Belt and Road during the period from 2013 to 2019. We made several findings: (1) the type of events, "Protest", is inappropriate to be included for assessing political risk, because the nature of protest in a democratic country is entirely different from that in a non-democratic country; (2) choosing the type of events, "Material Conflict", which includes "Exhibit Force Posture", "Reduce Relations", "Coerce", "Assault", "Fight" and "Use Unconventional Mass Violence", is more appropriate for evaluating the political risk; (3) using the number of events for assessing political risk is also inappropriate, since the number of the type of events that are chosen for evaluating risks may be correlated with the total number of events that is covered by GDELT for a country, and the number can vary substantially for a country over time and among different countries around the globe in a fixed (short) time interval; (4) using the Goldstein Scale of events is more advantageous than directly using the number of events, because an event with the Goldstein Scale of -10 amounts to 10 events with the Goldstein Scale of -1; (5) it is of importance to design a normalized variable to assess the political risks of any BRI country in any period of time, to facilitate comparison among different countries; (6) it is beneficial to decompose political risk into two components, domestic and international political risk, and then to assess which type of political risk a BRI country is facing.

By examining the spatiotemporal evolution of political risk along the Belt and Road during the period from 2013 to 2019, we observed that the sum of the number of BRI countries with the extremely high level and the high level for domestic, international, and (overall) political risk all reached the peak in 2015, and decreased thereafter, and that

overall the international political risk along the Belt and Road was much lower than the domestic political risk.

We found a strong positive correlation between political risk and China's total investments and construction contracts for BRI countries during the period from 2013 to 2019. While this is quite the opposite of the ideal case that investment goes to countries or regions with as low political risk as possible, it nevertheless suggests that if we want to achieve the ideal case, it would be necessary for China to choose to invest in countries and regions with low or even negligible political risks along the Belt and Road.

6. Discussions

While various kinds of traditional economic data will remain critical for assessing risks, it has become increasingly clear that big data, including massive media reports, offer an unprecedented opportunity to help to evaluate, manage and control risks. Yet, the challenge for achieving this goal is also enormous. To better know the potential of this viewpoint, in this paper, we tried to provide a new approach to assess political risk along the Belt and Road using GDELT. We showed that the "Material Conflict" types of events can represent pertinently and comprehensively the events that may directly affect foreign investment. Furthermore, we showed that the contribution of events in this category to risk is better quantified by the summation of the Goldstein Scale rather than by the number of events. These provisions, while simple, enable reasonable comparison among BRI countries. Clearly, the usefulness of these insights may not be confined only with BRI projects, but extended to general overseas investments.

Before pondering the potential future research topics, let us first discuss the caveats of the present study. There are quite a number. First, GDELT has under-reported a lot of interesting events, including those related to risks, in remote regions of the globe [76]. Unfortunately, this limitation is not a unique trait of GDELT. Rather, it is shared by all big databases based on news reports, and it does not appear that there is any way this limitation will go away soon. Second, it is very difficult to track future evolutions of an event or a cluster of events covered in GDELT, and thus it is not easy to evaluate long-time impacts of a specific event or a cluster of events. Third, this study only focuses on the national-level analyses of political risk. Fortunately, the last problem can be readily solved, since GDELT has provided geo-coordinates for each event, and thus in principle allows one to look into political risk associated with specific locations. The difficulties one may envision with a localized study is whether data for a chosen interested region may be large enough for meaningful statistical analysis.

Let us now ponder interesting future research topics that may be solved by analyzing GDELT. First, clearly it is interesting and worthwhile to extend the current study to assess risks associated with general overseas investments rather than just BRI projects. Second, it appears interesting and feasible to carry out a coupled study of politics and economics. Third, it may be useful to further divide the events chosen here for assessing political risk into a few different categories, then evaluate risks for each category, and finally synthesize the risks into a single risk index. Third, it may be interesting to use the risks along the BRI countries computed here as a reference to further study the spatial correlation of political risk among different countries, in the sense that many BRI countries may be bundled together due to a single event, such as the India-Pakistan border skirmishes (2016–2018).

Finally, we emphasize that the political risk identified here may not be equated to the actual risk a foreign investment may face. The risk identified here is better considered as the nominal risk. Part of this risk will be absorbed by a country because of its national collective power including the level of its economic development, research and development capability of its science and technology, government capacity, and resilience of its citizens. This calls for a completely new scheme to determine the actual risk by studying how the collective power of a nation affects the nominal political risk for a country identified here.

Author Contributions: Conceptualization, X.S. and J.G.; methodology, X.S. and J.G.; software, X.S. and B.L.; formal analysis, X.S.; data curation, X.S. and B.L.; writing–original draft preparation, X.S. and Z.W.; writing–review and editing, X.S., J.G. and Z.W.; visualization, X.S. and Z.W.; supervision, J.G. All authors have read and agreed to the published version of the manuscript.

Funding: This research was supported by the National Natural Science Foundation of China under Grant Nos. 71661002 and 41671532 and by the Fundamental Research Funds for the Central Universities under Grant No. 310432101. It is also supported by the National Key Research and Development Program of China, grant number 2020AAA0103402. One of the authors (JG) also benefited tremendously from participating the long program on culture analytics organized by the Institute for Pure and Applied Mathematics (IPAM) at UCLA, which was supported by the National Science Foundation.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data available in a publicly accessible repository.

Acknowledgments: We would like to thank the high-performance computing supported from the Center for Geodata and Analysis, Faculty of Geographical Science, Beijing Normal University [https://gda.bnu.edu.cn/] (accessed on 16 September 2020). We would like to thank anonymous reviewers for their valuable comments and suggestions for improving this paper.

Conflicts of Interest: The authors declare no conflict of interest.

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