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Does Comprehensive Geopolitical Risk Deter FDI Outflows: Evidence from China

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ABSTRACT

What is geopolitical risk to multinational enterprises in a world flooded with geopolitical changes? Does such risk impact foreign direct investment flows? To answer these questions, we attempt to develop the concept of comprehensive geopolitical risk by expanding the border of geopolitical risk in the literature to include both implicit and explicit risks that overseas investors face in host countries. We further construct an index by mining big data from a news report database, which we use to examine how comprehensive geopolitical risk impacts FDI outflows from China to 154 host countries between 2003 and 2020. Our findings indicate that comprehensive geopolitical risk does negatively impact FDI outflows, especially in the energy sector. Implicit geopolitical risk also significantly deters FDI outflows.

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Introduction

The past decade has witnessed many remarkable geopolitical events, such as the expansion of NATO, the South China Sea dispute, the China-US trade war, Brexit, the Russia-Ukraine Crisis, and far more implicit geopolitical events, such as the Canada-China-US dispute over the extradition case of Meng Wanzhou (2018-2021), the sudden ban on Chinese apps in India (2021), the Huawei ban in the EU and US (2020), and the Australia-China trade dispute (2021). These geopolitical events should not be ignored for most economic agents in the global market. Indeed, these geopolitical issues generally give rise to explicit or implicit geopolitical risks to firms in the global market and are gradually reshaping the global market environment. In this paper, the specific example we examine is Chinese multinational enterprises.

Triggered by the 'going out' strategy, outward foreign direct investment (FDI) from China has grown considerably since 2001. However, according to the *Statistical Bulletin of China's Outward Foreign Direct Investment*, approximately 30% of Chinese multinational enterprises faced losses in 2019.¹ An increasing number of studies have centred on factors that adversely affect FDI behaviours, mostly examining the macroeconomic risks, international relationships, the business environment in host countries and other institutional factors (Asiedu and Freeman 2009; Li and Vashchilko 2010). In this paper, our analysis focuses instead on geopolitical risk. Specifically, we attempt to answer two questions: What is geopolitical risk? Does geopolitical risk deter FDI outflows? Answering these two questions is important and urgent for multinational enterprises in a global environment flooded with geopolitical changes.

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For the first question, *geopolitical risk* is conventionally considered to be related to wars and other military conflicts. Cases such as the 9/11 attacks, the Iraq War, the Paris terrorist attacks, the Arab Spring, the NATO expansion, and the Russia-Ukraine crisis are cited as typical examples of geopolitical risk in the literature (Caldara and Iacoviello 2022). Nevertheless, many implicit geopolitical events, as mentioned above, are not included in this definition of geopolitical risk or in the measurement of the geopolitical risk index. However, these implicit geopolitical events might threaten international investors or change their investment strategies and thus distort FDI flows. This highlights the gap between existing studies and practice.

Our analysis is a meaningful attempt to consider a broader concept of geopolitical risk, that is, *comprehensive geopolitical risk* (GPR), which includes both the explicit geopolitical conflicts indicated in previous literature and implicit geopolitical frictions observed by the public today. Our measurement of the GPR-related indexes is an important attempt to capture the abovementioned implicit, nonmilitary geopolitical events through big data collected from news reports all over the world. We employ structured query language (SQL) to construct related indexes by searching, screening and counting the number of news reports about kinds of disputes between China and other countries.

Regarding the second question, there is no direct answer in existing studies, and this paper attempts to systematically analyse the impact of GPR on FDI based on relevant theories. Two categories of existing studies on the relationship between risk and investment are closely related to this paper. The first category is studies about the influence of host countries' domestic political risk, such as terrorism, inner wars, armed conflicts, and rent-seeking activities, on FDI (Abadie and Gardeazabal 2008; Bonaime, Gulen, and Ion 2018). The second category is studies about the impacts of geopolitical risk in the financial market. Examples include the impact of the Iraq War on oil prices and stock prices (Wolfers and Zitzewitz 2009), the impact of terrorist attacks on financial markets (Aslam and Kang 2015; Goel, Cagle, and Shawky 2017), the impact of armed conflicts on capital markets (Guidolin and La Ferrara 2010), and the impact of geopolitical risk on stock returns (Pyo 2021). Considering the rapidly changing geopolitical situations in the world today, this article attempts to introduce geopolitical risk into the theoretical framework of risk and investment and explore how comprehensive geopolitical risk, as broadly defined, affects FDI outflows from Chinese multinational enterprises.

Our paper is of interest for three reasons. First, our analyses may provoke a reassessment of the concept of *geopolitical risk* according to different periods and nations. In the Chinese context, we broadly understand *geopolitical risk* as *comprehensive geopolitical risk* to further involve implicit, nonmilitary geopolitical risk to describe what has occurred in practice. Since experts tend to widen the concept of *geopolitics* from geographic factors to other areas according to the ideology and practice in various nations, there is little reason for *geopolitical risk* to be limited to territorial disputes. Our GPR complements this inadequacy in previous literature.

Second, our method of counting news reports with extracted keywords to measure GPR follows previous studies measuring uncertainty or risks, such as Baker, Bloom, and Davis (2016), Azzimonti (2019), and Caldara and Iacoviello (2022), but we employ big data from artificial intelligence. In research on risk or uncertainty, having up-to-date information is important. Most modern economic theories are built on the essential assumption that a decision-making agent is 'rational', but the extent to which the agent can make a rational choice is based on the quality of available information (Cangelosi, Robinson, and Schkade 1968). In other words, if the decision-making agent cannot collect the latest information, he or she may not be able to identify the optimal choice. In our research context, Chinese multinational firms could hardly identify the optimal host country without sufficient, up-to-date information about all potential host countries. With outdated, inaccurate, and subjective information, enterprises cannot maximize their profits or minimize their losses. Nevertheless, the cognitive ability of most individuals is limited, narrowed, and restricted, whereas changes in international geopolitical situations are unlimited, fast, and unexpected. Traditional data limit the extent to which rational decisions can be realized. However, if big data are used to measure geopolitical risk, enterprises could obtain relatively up-to-date, multidimensional information, which

in turn could reduce the mistakes caused by having incomplete information to some extent and improve the degree of rationality.

Third, analyses such as ours highlight the likely utility of news reports with information about geopolitical risk in the world in real time, which can be used to examine whether comprehensive geopolitical risk deters FDI outflows from China. A possible reconciliation of our findings with previous studies on political risks in host countries is that geopolitical risk, as a type of political risk at the international level, has negative effects on FDI outflows. Our empirical evidence further suggests that implicit geopolitical risk also significantly deters FDI flows.

The remainder of this paper is divided into the following sections. The next section discusses how we understand GPR and construct its related indexes between China and the other 154 countries. The third section presents a brief literature review and our hypotheses. The fourth section describes the variables, data sources, and empirical strategy of this study. The fifth section reports the empirical results, including the baseline results, heterogeneous effects and robustness of the analysis. The final section concludes the paper.

Understanding GPR and Constructing Indexes

Geopolitics, Political Risk, Geopolitical Risk and GPR

As witnessed in the development of *geopolitics* in the literature, the meaning of *geopolitics* is extensible without a generally agreed-upon definition. In early studies, *geopolitics* refers to political behaviours related to competition among countries regarding territory, but scholars from different countries and at different times have employed different definitions. At the beginning of the 20th century, Alfred Thayer Mahan, a US commentator, associated *geopolitics* with the sea, and his theoretical framework, *sea power*, focused on serviceable coastlines, growing sea commerce, and nations' inclination to dominate the world by sea (Mahan 1900, 1911). In contrast, Halford Mackinder, a British geopolitician, related *geopolitics* to the land, and his theoretical framework, *heartland theory*, focused on land power and the possibility of a nation ruling Central and Eastern Europe (Mackinder 2004). In 1901, Germany scholar Friedrich Ratzel further developed the concept of *geopolitics* by expanding its meaning, arguing that borders should be considered not static but organic and growing (Ratzel 1901).

In recent studies, many researchers agree that the term *geopolitics* can be used to describe a broader spectrum of international social, political, historical phenomena (GoGwilt 2000). Dalby (2013) and Overland (2015) point out that climate change should be included in the research on geopolitics. Caldara and Iacoviello (2022) state that the term *geopolitics* covers a wide range of geo-events, from financial crises to Brexit. Indeed, geographic distance is not the main reason for cooperation or competition among countries today due to the development of technology and the international division of labour.

While *geopolitics* today is a broad term encompassing different research perspectives, the concept of *geopolitical risk* is still limited to geographic space, which mainly encompasses territorial disputes, wars and conflicts, and terrorism among competitive countries. As mentioned in the introduction, many implicit geopolitical events are not included in existing definitions or the measurement of geopolitical risk. However, we believe that these implicit geopolitical incidents are unignorable new forms of geopolitical risk in this new era since the competition among countries is not limited to military force. It is important to study not only the explicit geopolitical risk in the form of military conflicts, but also the implicit geopolitical risk in other forms, such as disputes in cooperation, technology competition, trade wars, and so forth. For example, although the US and China are geographically distant and they do not have territorial disputes, tensions related to US tariffs on imports from China are currently common geopolitical themes (Singh and Roca 2022). It is not surprising that the US-Sino trade war, as a new form of geopolitical risk, impacts Chinese multinational enterprises and their investment choices.

Political risk is another term closely related to *geopolitical risk*, but with obvious differences. *Political risk* is generally referred to as a sovereign host government that unexpectedly changes the 'rules of games' and results in uncertainty in domestic business activities (Butler and Joaquin 1998). For FDI investors in the global market, typical political risks are monetary or fiscal policy uncertainty, government intervention, inner wars, religious conflicts, rent-seeking activities and other unexpected political changes that mostly affect related firms without nationality-based discrimination. Nonetheless, geopolitical risk would impact FDI based on the relations between the host and the home countries. Geopolitical risk transcends geographic boundaries and affects two or more markets at the international level (Singh and Roca 2022).

Based on the definitions of *geopolitics*, *geopolitical risk* and *political risk*, we broadly understand *geopolitical risk* as *comprehensive geopolitical risk* (GPR). Specifically, GPR refers to risks caused by disputes between two countries (or more) in various fields in competition that thereby cause political and economic damages to both countries or even the whole world. Explicit GPR refers to wars or military attacks as deemed in the previous literature, whereas implicit GPR is associated with disputes in areas other than military affairs. The GPR threat refers to verbal GPR, such as criticism, disapproval, opinions from commentators, and other negative speech about the other country, while the GPR action refers to physical GPR that usually takes the form of nonverbal actions.

Measuring GPR and Its Related Indexes

Based on different understandings of geopolitical risk, previous studies have utilized different databases and approaches to measure geopolitics or geopolitical risk. Cao, Li, and Liu (2019) measured political uncertainty using national election data. Huang et al. (2015) used crisis events as a proxy for political risk. Busse and Hefeker (2007) and Méon and Sekkat (2012) derived data from the PRS' *International Country Risk Guide* (ICRG) to² measure political risk. A recent measurement of the geopolitical risk index constructed by Caldara and Iacoviello (2022) is closely related to our study. Although³ these approaches and databases have gained widespread acceptance, their understandings of political risk and geopolitical risk are inconsistent with those used in our paper, and their data cannot reflect the ongoing development of geopolitical risk in the world today.

Since measuring risks or uncertainty based on news reports is a sophisticated research method, as employed by Baker, Bloom, and Davis (2016), Azzimonti (2019), and Caldara and Iacoviello (2022), we follow this tradition but employ a novel online news database, the *Global Database of Events, Language and Tone* (GDELT)⁴, to construct our indexes. GDELT captures events happening around the world and encodes the text reports from both online and offline new media into its database. Its daily sample size is approximately tens of thousands, and its total sample size is over a quarter billion.

There are mainly five indexes discussed in this paper: the $GPRC_{jt}^*$, the $GPRS_{jt}^*$, the $GPRIM_{jt}^*$, the $GPRA_{jt}^*$ and the $GPRT_{jt}^*$ index.⁵ More specifically, the $GPRC_{jt}^*$ index, as the comprehensive index of all types of GPR, is computed as follows. First, we screen the country of the actors of news event records and kept only those containing actors from two different countries, one of which should be China in our research context. This is because GPR, as risk at the international level, should not contain domestic issues. Second, considering that GPR is defined as 'risk', we exclude positive events by screening the *Goldstein Scale*. The *Goldstein Scale* provided in the database captures the theoretical influence of each event, ranging from -10 to +10 where a negative value represents a negative event and positive values represent a positive event. Third, we select records that contain at least one keyword in the following five categories: war and military, cooperation and communication, policy and reform, crime and justice, and economy and property. The specific terms used in each category, explanations, and typical examples are listed in Table 1. Finally, we count the number of screened records to obtain the original $GPRC_{jt}^*$ index where the subscript j indicates the country, and t indicates the year.⁶

Table 1. Explanations of comprehensive geopolitical risk(GPR).

Groups	Category	Terms for text-searching	Explanations	Examples
Explicit GPR	War and Military	war, military, aggression, espionage, weapon, repression, violence, blockade, occupy, occupation, artillery and tanks, munitions, ceasefire, mass violence, mass expulsion, mass killings, ethnic cleansing.	This sub-type is mainly about traditionally deemed geopolitical risk related to territorial disputes or military conflicts.	Examples include the Iraq War, the Arab Spring, the Russia-Ukraine conflicts in 2022.
Implicit GPR	Cooperation and Communication	relations, international, diplomatic, meeting, negotiation, dispute, mediation	This sub-type is generally about some disputes that negatively affect the cooperation and communication between two countries.	Lithuania's geopolitical risk has been rising due to its diplomatic spat with China over Taiwan in December 2021. ¹
	Policy and Reform	reform, change in leadership, change in institutions, regime, dissent, policy change, political, parties, politicians	This sub-type is associated with the stability of a nation's domestic political environment, which could result in changing strategies towards foreign affairs and impede the normal economic activities.	The Crimean Conflicts in 2014 ² were sparked soon after the 2014 Ukraine presidential election.
	Crime and Justice	assassinate, torture, assault, police, armed force, bombing, rally opposition, complain, lawsuit against, guilty, liable, curfew, forces, emergency, martial law, arrest, detain, legal action, attack, abduct, hijack, hostage	This sub-type mostly refers to social safety and security issues for foreign investors in host countries.	Examples include the Canada-China dispute over the extradition case of Meng Wanzhou. ³
	Economy and Property	corruption, property, economic, economy	This sub-type mostly refers to property safety issues since geopolitical risk sometimes threatens the safety of legal property in foreign countries.	Since the Ukraine-Russia Crisis in 2022, some foreign assets have been 'seized' by the Russia and Western countries.

1. For details, refer to <https://www.euronews.com/2021/11/21/china-downgrades-relations-with-lithuania-over-taiwan-embassy-spat> 2. For details, refer to <https://commonslibrary.parliament.uk/research-briefings/cbp-9476/3>. For details, refer to <https://www.reuters.com/technology/key-events-huawei-cfo-meng-wanzhou-extradition-case-2021-08-11/>.

Furthermore, some studies prefer to aggregate the *Goldstein Scale* when using the GDELT to calculate bilateral political relations (Davis, Fuchs, and Johnson 2019; Li et al. 2021). Along this line, we reconstruct a $GPRS_{jt}^*$ index by aggregating the *Goldstein Scale* of screened records instead of counting the number, as an alternative proxy for comprehensive geopolitical risk. To study implicit geopolitical risk, we further divide the $GPRC_{jt}^*$ into two groups: explicit geopolitical risk ($GPRES_{jt}^*$) and the implicit geopolitical risk ($GPRIM_{jt}^*$). $GPRES_{jt}^*$ is the count of records in the category of *War and Military*, whereas $GPRIM_{jt}^*$ is the count of records in other four categories (see Table 1). Moreover, when discussing the impact of geopolitical risk, many studies focus on the differences between two groups of geopolitical risk: geopolitical risk threat and geopolitical risk action (Caldara and Iacoviello 2022). Following this, we further break the $GPRC_{jt}^*$ index into the geopolitical risk threat index ($GPRT_{jt}^*$) and geopolitical risk action index ($GPRA_{jt}^*$) to examine the differences between these two types of risk. To construct these two indexes, we separate screened events records into these two categories by their *Quadclass* provided in the database. Events with *Quadclass* 1 or 3 are grouped into $GPRT_{jt}^*$, while those with *Quadclass* 2 or 4 are grouped into $GPRA_{jt}^*$.

Literature Review

The question of how risk affects FDI has received ongoing attention in diverse research areas, including finance, international politics, institutional economics, and international economics. Our study is closely related to the literature that attempts to identify a causal impact of geopolitical risk on investment.

The earlier literature focused on a specific type of political or geopolitical risk (i.e. wars, terrorist attacks, government intervention, rent-seeking activities) and its consequence on investment. In these classic settings, risk results in low return of investment by increasing cost and deadweight loss and therefore discourages FDI flows. Specifically, armed conflicts or terrorist attacks can destroy the stock of capital, force international investors to flee to other countries, and lower net FDI inflows (Abadie and Gardeazabal 2003, 2008; Bandyopadhyay, Sandler, and Younas 2014). Governments in host countries may directly seize whole or a portion of foreign investors' assets, as happened during the Russia-Ukraine Crisis in 2022. Although such extreme cases have become rare, sudden changes in government regulations are actually common, which increases firms' unexpected costs (Asiedu and Freeman 2009; Chen et al. 2011). Rent-seeking activities (i.e. corruption, bribery, black markets) adversely affect firms' efficiency and economic prosperity (Krueger 1974). As uncertainty increases after shocks in the macroeconomic environment like Cuban Missile Crisis or the 9/11 attack, the costs of adjustment of labor and capital are also considered to increase (Bloom 2009). With all kinds of costs and losses increasing, it is convincing that the aggregated FDI flows to a country with high geopolitical risk shrink.

Based on the literature mentioned above, we consider that GPR has shared some similar features of traditionally deemed geopolitical risk, and we propose testable Hypothesis 1 as follows:

H1: *Comprehensive geopolitical risk negatively impacts FDI outflows.*

The recent literature has considered how various geopolitical risks affect economic activities through mechanisms other than the cost. Czinkota et al. (2010) mention that the influences of geopolitical risk include declining consumer demand, interrupted supply chains, strict government inspections, and reduced firms' willingness to engage in the international market. Trading is proven to be one of most important mechanisms to transfer the influence of geopolitical risk. Singh and Roca (2022) perform such analysis by examining how Canada's stock volatilizes with respect to China's geopolitical risk since Canada has relied on imported manufacturing goods from its second largest trading partner, China. Investors' sentiment is another widely mentioned mechanism to transfer the consequence of geopolitical risk in the cross-border equity market. Goel, Cagle, and Shawky (2017) examine how terrorist incidents cause physical asset losses and psychological harm and frustrate the international stock market. Similarly, Wang and Young (2020) investigate how investors become scared, depressed, and risk-averse after attacks and thus prefer a less risky portfolio. Some research has been concerned about how oil prices trigger different economic consequences for oil exporting and importing countries through different mechanisms (Su et al. 2019). High or low geopolitical risk increases oil prices, and oil-dependent countries are prone to be more sensitive to geopolitical incidents (Wang, Su, and Umar 2021).

In the context of China, a substantial body of literature has assumed the political property of China's FDI and how geopolitical relations affect the choice of FDI destinations. Later studies along this line find that China's FDI would suffer a relatively high level of geopolitical risk from local authorities. When China's FDI is perceived with political motives, it would face strict scrutiny from some host countries (i.e. the US, Canada, Australia). In particular, Chinese stated-owned investors, as carriers of these political purposes, have been considered threats to host countries' security (Singh 2021). Nevertheless, some research surprisingly finds that China's FDI prefers host countries with a high level of risk. Cuervo-Cazurra et al. (2014) claim that stated-owned investors, as a considerable

portion of China's FDI, have a higher risk tolerance and are more likely to invest in risky projects than private investors. Luo and Tung (2007) explain that FDI flows from emerging countries are driven not only by profitability but also by the political aims of the home government. For example, some of China's FDI entered into the infrastructure or mining sectors in Africa mainly for political aims (Cuervo-Cazurra et al. 2014).

It is reasonable to assume that **implicit geopolitical risk affects FDI through mechanisms including bilateral trading, sentiments, oil prices, and the political property of investors.** For example, UK authorities banned mobile providers in the country from purchasing new 5 G equipment from Huawei (a Chinese Firm), and all such equipment currently in place must be removed from their networks before 2027. This⁷ implicit geopolitical event directly impeded the development of Huawei in the UK market and negatively impacted all FDI outflows from China to the UK market through the mechanism of investors' sentiment. Based on the above, we propose Hypothesis 2 as follows:

H2: *Implicit geopolitical risk negatively impacts FDI outflows.*

Data, Empirical Model and Methodology

Data

The industry-level FDI data of Chinese multinational enterprises are sourced from the *Cross-border Greenfield Investment Database* provided by *fDi Markets*.⁸ We screened projects that originated from China and flowed to another country in the world. This database has been tracking greenfield investment projects all over the world since 2003 and collecting in-depth information on each greenfield investment project, including company names, industries, sales, sourced locations of projects, destinations of projects, amounts of investment, number of employees in each project, types of investment activities and so forth.

Information about the macroeconomy and institutional quality in host countries is collected from the *World Bank's World Development Index (WDI)*.⁹ Other risks in host countries that have been indicated in the literature to distort FDI flows should be controlled in our empirical analysis, and such information is sourced from the *PRS' International Country Risk Guide (ICRG)*. For information on the dynamic political relations between China and the host country, we refer to the United Nations voting data sourced from Bailey, Strezhnev, and Voeten (2017). In addition, we also control the institutional quality of governance in host countries with data derived from the World Bank's *Worldwide Governance Indicators (WGI)*.

Model and Variable Specification

Our panel data for testing the effect of GPR on FDI outflows from China to another country take the following form:

$$dollars_{jht} = \beta_0 + \beta_1 risk_{jt} + \beta_i X_{jt} + \lambda_t + \eta_{jh} + \varepsilon_{jht} \quad (1)$$

where j indicates the country, t indicates the year, and h indicates the industry. The dependent variable $dollars_{jht}$ is the dollars of investment projects, by which we examine how GPR impacts investment amounts outflowing from China into country j in year t in industry h . **We employ Poisson pseudo maximum likelihood regressions (PPMLs) with multiple fixed effects to estimate this equation,**¹⁰ by which any dependent variable without negative values can be properly estimated without an assumed distribution (Correia, Guimarães, and Zylkin 2020). Regressions under this equation all contain both year fixed effects and country-industry fixed effects at a minimum. We also apply robust standard errors to **alleviate** heteroscedasticity.

The key independent variable $risk_{jt}$ stands for GPR, which can be captured by the year-over-year rate of change of the $GPRC_{jt}^*$ index. Specifically, we address the original index in the following way:

$$GPRC_{jt} = \frac{GPRC_{jt}^* - GPRC_{jt-1}^*}{GPRC_{jt-1}^*} \quad (2)$$

where $GPRC_{jt}$ is a proxy for $risk_{jt}$, $GPRC_{jt}^*$ is the original count of records in the current term, and $GPRC_{jt-1}^*$ is the count in the last term. Similarly, when it comes to other related indexes, replacing the $GPRC_{jt}^*$ with the $GPRS_{jt}^*$, $GPRA_{jt}^*$, $GPRT_{jt}^*$, or $GPRIM_{jt}^*$ into Equation (2), we obtain the $GPRS_{jt}$, $GPRA_{jt}$, $GPRT_{jt}$, and $GPRIM_{jt}$ index respectively, as the proxies of $risk_{jt}$.

The vector X_{jt} is the set of control variables, including *lngdp*, *lndeflator*, *Debt*, *XRstab*, *Intlq*, *social_condi*, *invest_pro*, *pve* and *gap_ideal*. The variables *lngdp* and *lndeflator* represent the log of GDP and the log of GDP deflator to capture the macroeconomy of host countries (Azzimonti 2019; Li et al. 2021). The variables *Debt*, *XRstab*, and *Intlq* represent the risks of debt, exchange rate stability and international liquidity to control the host country's financial environment. The variables *social_condi* and *invest_pro* represent the political risks of socioeconomic conditions and investment profile in the host country (Busse and Hefeker 2007). The variable *pve* stands for the quality of governance in the host country to reduce the noise that may affect FDI outflows. The variable *gap_ideal* indicates the dynamic political relations between China and the host country (measured by United Nations voting data) minus the average political relations among alternative countries that have similar levels of economic development (measured by the log of GDP per capital), by which we control the influence of alternative destinations.¹¹ The key coefficient of interest is β_1 , which represents the effect of a one percentage point change in GPR on the dollars of FDI.

Our analysis comprises 154 countries and spans the years 2003 to 2020. In Table 2, we present a summary of the descriptive statistics, as well as the definitions and data sources of all variables used in the following empirical estimations.

Table 2. Descriptive Statistics.

Label	Variable	Source	Obs.	Mean	Std. Dev.	Min	Max
dollars	Dollars of FDI amount	Cross-border Greenfield Investment	3,276	189.700	669.500	0.030	20000.000
number	The number of FDI projects	Cross-border Greenfield Investment	3,276	1.967	2.169	1.000	27.000
GPRC	GPR measured by counting	GDELT	3,276	0.791	3.293	−0.989	61.140
GPRS	GPR measured by Goldstein Scale	GDELT	3,276	0.914	5.075	−0.995	107.400
GPRT	GPR threat	GDELT	2,905	1.262	6.511	−0.965	153.000
GPRA	GPR action	GDELT	3,245	0.698	2.558	−0.964	48.400
GPRIM	Implicit GPR	GDELT	3,220	0.884	4.077	−0.987	109.700
social_condi	Socioeconomic condition	ICRG	3,147	7.096	2.244	0.000	10.960
invest_pro	Investment profile	ICRG	3,147	9.403	1.975	2.500	12.000
XRStab	Exchange rate stability	ICRG	3,147	9.314	1.111	2.167	10.000
Debt	Foreign debt	ICRG	3,147	6.151	1.981	0.000	10.000
Intlq	International liquidity	ICRG	3,147	2.159	1.527	0.000	5.000
pve	Political stability	WDI	3,276	0.064	0.896	−2.974	1.616
lngdp	The log of GDP	WDI	3,225	26.940	1.865	20.120	30.540
lndeflator	The log of GDP deflator	WDI	3,229	4.730	0.411	2.639	9.342
gap_ideal	Dynamic political relations	Bailey, Strezhnev, and Voeten (2017)	3,242	−0.001	0.599	−2.101	1.616

Empirical Results and Discussion

Baseline Results

Table 3 reports the main results from the baseline regressions of the impact of GPR on dollars of investment. In Column (1), the regression includes year fixed effects and industry-country fixed effects. Industries are partitioned according to the *Cross-border Greenfield Investment Database*. In Column (2), the regression further includes all control variables. In Column (3), the regression includes year-by-region fixed effects, where regions are the seven continents to control for possible correlations between changes in the regional effects of FDI over time and geopolitical risk. For example, if GPR changed relatively high and FDI amounts decreased rapidly over time in African regions, estimations without year-by-region fixed effects would attribute all the decline of FDI to changes in GPR and not to secular regional, unrelated reasons (i.e. climate disasters). While Column (3) divided the sample countries into seven groups according to geographic features, Column (4) divided countries into five groups according to their levels of economic_development. In Column (4), the regression includes year-by-eco_level fixed effects to control for possible correlations between shifts in the levels of economic-development of host countries on FDI over time and the fluctuations of geopolitical risk. We partition all countries into five groups (labelled *eco_level*) according to their levels of economic development measured by average GDP per capital from 2003 to 2020. We assume that there exists a year-specific impact for each economic group. For example, if GPR remains stable in the most developed countries group while FDI flow into this group was on a general increasing trend in these countries, it is unreasonable to attribute all the increase of FDI to the relatively low risk. In Column (5), the regression includes year-by-industry fixed effects to permit the

Table 3. Baseline regressions of the impact of GPRC on FDI outflows.

	Dependent variable: dollars				
	(1)	(2)	(3)	(4)	(5)
GPRC	−0.085*** (0.033)	−0.111*** (0.042)	−0.079** (0.031)	−0.079*** (0.029)	−0.080*** (0.024)
Ingdp		0.112 (0.696)	1.711* (0.884)	−0.695 (0.876)	0.155 (0.627)
Indeflator		−0.193 (0.341)	−0.244 (0.340)	−0.568* (0.331)	−0.262 (0.288)
Debt		−0.000 (0.071)	−0.023 (0.070)	0.025 (0.068)	−0.023 (0.065)
XRStab		0.207*** (0.066)	0.118* (0.071)	0.152** (0.069)	0.193*** (0.055)
Intlq		−0.200** (0.093)	−0.283*** (0.081)	−0.200** (0.089)	−0.032 (0.076)
social_condi		−0.057 (0.106)	−0.058 (0.116)	−0.041 (0.098)	−0.014 (0.089)
invest_pro		0.024 (0.078)	0.062 (0.076)	0.005 (0.072)	0.114* (0.061)
gap_ideal		0.342 (0.320)	0.204 (0.337)	0.105 (0.303)	0.056 (0.257)
pve		0.201 (0.253)	0.080 (0.269)	0.019 (0.234)	0.267 (0.241)
Constant	6.352*** (0.052)	3.020 (18.543)	−39.322* (23.894)	27.179 (23.762)	1.169 (16.858)
Year FE	Yes	Yes	Yes	Yes	Yes
Industry-country FE	Yes	Yes	Yes	Yes	Yes
Year × region FE	No	No	Yes	No	No
Year × eco_level FE	No	No	No	Yes	No
Year × industry FE	No	No	No	No	Yes
Observations	2,940	2,791	2,790	2,790	2,782
R-squared	0.637	0.645	0.629	0.686	0.754

Sample period is from 2003 to 2020, for 154 countries. Robust standard errors are shown in parentheses. Significance is denoted as: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

existence of a year-specific influence for each industry. Some industries had experienced soaring in some years for reasons unrelated to geopolitical risk (i.e. a specific technological innovation), and estimations without year-by-industry fixed effects would attribute all the increased FDI to low geopolitical risk.

The estimated coefficients of geopolitical risk using the $GPRC_{it}$ index in Columns (1) and (2) are negative and statistically significant at the 1% level, indicating that GPR is negative for FDI outflow. The results in Columns (3) to (5) with the inclusion of regional trends, economic-level trends, and industry trends further strengthen the main results in Column (2). In general, geopolitical risk does deter the FDI outflows, and the estimated coefficient is negative ($\beta_1 < 0$), which supports Hypothesis 1. Our finding is in line with the research on the negative economic consequences of a specific type of geopolitical risk (i.e. Abadie and Gardeazabal 2003, 2008; Bandyopadhyay, Sandler, and Younas 2014).

To answer whether implicit GPR deters FDI outflows, we use the $GPRIM_{it}$ index to examine Equation (1). Table 4 reports the main results of the impact of implicit GPR on dollars of investment. The coefficients of implicit geopolitical risk estimated by the $GPRIM_{it}$ index in all columns are significantly negative, which supports Hypothesis 2. β_2 , the coefficient on implicit GPR, has a point estimation of -0.103 in Column (2) and is statistically significant at the 1% level. Compared with the coefficient of $GPRC_{it}$, -0.111 , in Column (2) of Table 3, the coefficient of implicit GPR is slightly minor, which might be caused by the exclusion of explicit GPR.

Next, we further adopt the $GPRA_{it}$ and $GPRT_{it}$ index to examine Equation (1) to answer the question of whether GPR actions and GPR threats distort FDI differently, as discussed in the previous literature. The regression results are presented in Table 5, which indicates that both GPRs are

Table 4. Regressions of the impact of GPRIM on FDI outflows.

	Dependent variable: dollars				
	(1)	(2)	(3)	(4)	(5)
GPRIM	-0.067** (0.029)	-0.103*** (0.039)	-0.066** (0.032)	-0.076*** (0.029)	-0.064*** (0.021)
Ingdp		-0.025 (0.704)	1.432 (0.871)	-0.727 (0.877)	0.152 (0.637)
Indeflator		-0.182 (0.353)	-0.273 (0.385)	-0.543 (0.343)	-0.258 (0.308)
Debt		0.008 (0.074)	-0.010 (0.072)	0.010 (0.071)	-0.036 (0.067)
XRStab		0.206*** (0.068)	0.113 (0.073)	0.150** (0.071)	0.188*** (0.056)
Intliq		-0.204** (0.094)	-0.290*** (0.082)	-0.196** (0.090)	-0.033 (0.077)
social_condi		-0.051 (0.108)	-0.052 (0.119)	-0.035 (0.100)	0.006 (0.089)
invest_pro		0.027 (0.078)	0.065 (0.077)	0.009 (0.074)	0.105* (0.061)
gap_ideal		0.319 (0.330)	0.202 (0.349)	0.014 (0.316)	0.017 (0.264)
pve		0.215 (0.257)	0.082 (0.274)	0.037 (0.238)	0.272 (0.244)
Constant	6.359*** (0.053)	6.612 (18.744)	-31.711 (23.579)	28.027 (23.823)	1.343 (17.099)
Year FE	Yes	Yes	Yes	Yes	Yes
Industry-country FE	Yes	Yes	Yes	Yes	Yes
Year \times region FE	No	No	Yes	No	No
Year \times eco_level FE	No	No	No	Yes	No
Year \times industry FE	No	No	No	No	Yes
Observations	2,887	2,738	2,737	2,737	2,729
R-squared	0.637	0.647	0.693	0.687	0.758

Sample period 2003 to 2020, for 154 countries. Robust standard errors in parentheses. Significance shown as: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 5. Regressions of the impact of GPRA and GPRT on FDI outflows.

	Dependent variable: dollars			
	(1)	(2)	(3)	(4)
GPRA	−0.085*** (0.031)	−0.105*** (0.039)		
GPRT			−0.040* (0.024)	−0.060** (0.030)
Ingdp		0.078 (0.703)		0.251 (0.741)
Indeflator		−0.180 (0.355)		0.023 (0.337)
Debt		−0.008 (0.071)		0.058 (0.083)
XRStab		0.209*** (0.067)		0.193*** (0.071)
Intliq		−0.200** (0.095)		−0.204** (0.095)
social_condi		−0.049 (0.107)		−0.053 (0.110)
invest_pro		0.027 (0.078)		−0.055 (0.084)
gap_ideal		0.326 (0.321)		0.364 (0.345)
pve		0.211 (0.257)		0.050 (0.269)
Constant	6.358*** (0.052)	3.838 (18.669)	6.372*** (0.055)	−1.431 (19.783)
Year FE	Yes	Yes	Yes	Yes
Industry-country FE	Yes	Yes	Yes	Yes
Observations	2,911	2,764	2,620	2,501
R-squared	0.638	0.645	0.644	0.651

estimated to significantly and adversely impact FDI in our research context. Comparing the results of the $GPRA_{jt}$ index in Columns (1) and (2) of Table 5 with those of the $GPRT_{jt}$ index in Columns (3) and (4), we find that the coefficients of GPR actions are larger than those of threats, and that the significance level of GPR actions is higher than that of GPR threats. Our results indicate that the negative effects of GPR are mainly derived from actions, but we cannot deny the influence of threats on FDI outflows. Our finding is in line with research done by Bouoiyour et al. (2019).

Robustness

In this section, we conduct robustness checks, and all of the following regressions include a full set of control variables used in the baseline regressions. The first concern about the main findings is that by focusing on a single measure of geopolitical risk, we may obtain a biased result regarding its relation with GPR. In view of this, we complemented the estimations made with the $GPRS_{jt}^*$ index. We estimated Equation (1) using the $GPRS_{jt}$ index, and the estimation results are reported in Column (1) of Table 6. The estimated coefficient of $GPRS_{jt}$ is negative and significant at the 5% level, which is consistent with the main findings of the baseline regressions with the $GPRC_{jt}$ index in general.

The second concern about the main results might be their dependence on the sample. First, the raw data show that the quantity of news reports about the United States every year is far greater than that about other countries, which should not be interpreted to mean that the US-China comprehensive geopolitical risk is the highest over time. This may simply be because GDELT is organized by US companies and organizations that are most concerned with the US or because readers around the world are mostly interested in events about the US. To address this problem, we also run our estimations after excluding the US from the sample, and the results are reported in Column (2) of Table 6. Finally, the GDELT is separated into two subdatabases,

Table 6. Robustness.

	(1) dollars	(2) dollars	(3) dollars	(4) number	(5) Avg. dollar
GPRS	−0.089** (0.038)				
GPRC		−0.116*** (0.045)	−0.108*** (0.039)	−0.010** (0.004)	−0.121** (0.048)
Ingdp	0.140 (0.694)	0.728 (0.716)	0.067 (0.691)	0.180 (0.221)	0.058 (0.750)
Indeflator	−0.198 (0.341)	−0.159 (0.345)	−0.248 (0.364)	−0.181** (0.082)	0.141 (0.314)
Debt	−0.003 (0.070)	−0.024 (0.071)	−0.005 (0.072)	0.027 (0.018)	−0.066 (0.068)
XRStab	0.206*** (0.067)	0.190*** (0.067)	0.216*** (0.081)	0.016 (0.019)	0.209*** (0.061)
Intliq	−0.195** (0.093)	−0.153 (0.095)	−0.190** (0.092)	−0.049** (0.024)	−0.140 (0.088)
social_condi	−0.059 (0.106)	−0.116 (0.110)	−0.017 (0.107)	0.105*** (0.026)	−0.125 (0.119)
invest_pro	0.023 (0.078)	0.015 (0.078)	0.035 (0.081)	−0.003 (0.019)	0.186** (0.076)
gap_ideal	0.325 (0.320)	0.336 (0.318)	0.407 (0.347)	0.144 (0.088)	0.796** (0.333)
pve	0.193 (0.252)	0.087 (0.264)	0.173 (0.263)	0.082 (0.073)	0.283 (0.262)
Constant	2.316 (18.518)	−12.890 (18.837)	3.998 (18.275)	−4.200 (5.984)	1.833 (19.537)
Year FE	Yes	Yes	Yes	Yes	Yes
Industry-country FE	Yes	Yes	Yes	Yes	Yes
Observations	2,791	2,597	2,563	2,791	2,791
R-squared	0.645	0.658	0.647	0.252	0.687

Sample period is from 2003 to 2020, for 154 countries. Robust standard errors are shown in parentheses. Significance is denoted as: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

and the frequencies in these two subdatabases are different, which may influence the estimation results. To address this concern, we ran our estimations after excluding 2015 from the baseline sample and provide the results in Column (3) of Table 6. Our main finding still holds despite the smaller sample size without the US or without the 2015 data.

The third concern about the main findings is that by focusing on a single measure of FDI outflows, we may obtain a biased result. To address this issue, we change the dependent variable in Equation (1) into $number_{jht}$, the number of FDI projects from China to the host country j in year t in industry h , by which we examine how the GPR impacts the number of projects. We employ PPML with multiple fixed effects to estimate Equation (1), by which the count-dependent variable can be addressed naturally. The key coefficient, β_2 , represents the effect of a one percentage point change in GPR on the number of FDI projects. The result is presented in Column (4) of Table 6, and the estimated coefficient of $GPRC_{jt}$ is negative and significant at the 5% level. Moreover, we change the dependent variable in Equation (1) into avg_dollar_{jht} , the mean value of investment amount, and its regression result is reported in Column (5) of Table 6. The estimated coefficient of $GPRC_{jt}$ is negative and significant at the 5% level. It is evident that our main findings still hold with changed forms of dependent variables.

Heterogeneous Effects

In this subsection, we consider the possibility that geopolitical risk has heterogeneous effects on the FDI outflows derived from a particular set of industries. [The latest studies are particularly interested in the influences of geopolitical risk in the energy sector \(Bouoiyour et al. 2019; Plakandaras, Gupta, and Wong 2019; Qin et al. 2020\).](#) Geopolitical risk is caused by competition in various fields among countries, but different sectors are not equally important. In some key sectors that are closely related

to national economic security, competition among nations tends to be stronger, which in turn increases the probability of geopolitical conflicts. Accordingly, FDI outflows in some industries are assumed to be more sensitive than others to fluctuations in geopolitical risk.

We classify the sample into five sectors: *science, manufacture, energy, construction, and business service*, which account for 31.04%, 26.21%, 16.80%, 18.80% and 7.14% of the total FDI outflows amount, respectively.¹² Interaction terms between $sector_{jht}$ and $risk_{jt}$ ($risk_{jt} \times sector_{jht}$), are introduced into the baseline regression model to examine how the difference in industries impacts the marginal effect of geopolitical risk on FDI outflows.

$$OFDI_{jht} = \beta_0 + \beta_1 risk_{jt} + \beta_4 sector_{jht} + \beta_5 risk_{jt} \times sector_{jht} + \beta_1 X_{jt} + \lambda_t + \eta_{jh} + \varepsilon_{jht} \quad (3)$$

In Equation (3), the partial effect ($\frac{\partial OFDI_{jht}}{\partial risk_{jt}} = \beta_1 + \beta_5 sector_{jht}$) implies that β_1 and β_5 are parameters of interest. The results show that the coefficients of $risk_{jt}$ and β_1 in all columns of Table 7 are negative and significant, further supporting our baseline finding that rising GPR adversely affects FDI outflows. The estimated coefficients of the interaction terms, β_5 , in different sectors vary widely.

Compared with other sectors, the estimated coefficient on the interaction term between GPR and energy ($GPRC \times energy$) is -2.087 and significant at the 10% level, reported in Column (2) of

Table 7. Heterogeneous effects.

	Dependent variable: dollars				
	(1)	(2)	(3)	(4)	(5)
GPRC	-0.117** (0.046)	-0.074*** (0.028)	-0.105*** (0.025)	-0.099** (0.042)	-0.089*** (0.031)
GPRC \times science	0.062 (0.051)				
GPRC \times energy		-0.287* (0.167)			
GPRC \times construct			0.024 (0.090)		
GPRC \times manufacture				0.014 (0.052)	
GPRC \times business service					-0.010 (0.055)
Ingdp	0.961 (0.952)	0.822 (0.896)	0.885 (0.955)	0.975 (0.931)	0.857 (0.952)
Indeflator	-0.500 (0.321)	-0.441 (0.309)	-0.627* (0.343)	-0.576* (0.321)	-0.438 (0.321)
Debt	-0.033 (0.088)	-0.064 (0.088)	-0.032 (0.088)	-0.047 (0.086)	-0.031 (0.086)
XRStab	0.148** (0.068)	0.155** (0.063)	0.140* (0.072)	0.142** (0.068)	0.149** (0.070)
Intliq	-0.206** (0.091)	-0.197** (0.087)	-0.209** (0.091)	-0.199** (0.090)	-0.199** (0.092)
social_condi	0.057 (0.141)	0.070 (0.139)	0.068 (0.140)	0.057 (0.140)	0.052 (0.137)
invest_pro	-0.014 (0.077)	-0.013 (0.072)	-0.027 (0.080)	-0.007 (0.076)	-0.007 (0.076)
gap_ideal	-0.024 (0.390)	-0.027 (0.370)	-0.027 (0.395)	-0.048 (0.385)	0.071 (0.385)
pve	-0.084 (0.322)	-0.005 (0.273)	-0.092 (0.335)	-0.119 (0.319)	-0.029 (0.315)
Constant	-18.668 (25.124)	-15.306 (23.701)	-16.056 (25.098)	-18.511 (24.529)	-16.081 (25.148)
Year FE	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Year \times region FE	Yes	Yes	Yes	Yes	Yes
Observations	3,065	3,065	3,065	3,065	3,065
R-squared	0.326	0.355	0.369	0.336	0.357

Sample period is from 2003 to 2020, for 154 countries. Robust standard errors are shown in parentheses. Significance is denoted as: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 7. This means that the energy sector reinforces the adverse impacts of GPR on FDI outflows, in line with the findings of the latest studies (Bouoiyour et al. 2019; Plakandaras, Gupta, and Wong 2019; Qin et al. 2020). This is mainly because energy is an important sector that a vast majority of sovereign nations are concerned about and that frequently generates border disputes among sovereign nations (Overland 2015). Throughout world history, energy issues have triggered countless geopolitical frictions, armed conflicts, local wars, and even world wars. Thus, it is clear that countries are extremely sensitive to boundary changes in energy. Accordingly, the negative impact of GPR on FDI is strengthened when enterprises invest in the energy sector.

Nevertheless, the estimated coefficients of other sectors are insignificant. For the science sector, as reported in Column (1) of Table 7, the estimated coefficient of the interaction term between GPR and science ($GPRC \times science$) is unexpectedly insignificant. Although there are many famous geopolitical events in science or technology, we could not find evidence that the negative impact of GPR on FDI is stronger in science sector. The positive externalities of FDI in the science sector, such as increases in firm innovation, benefit the economic development of host countries, which counteract the adverse impacts of political risk on FDI (Maliar, Maliar, and Sebastián 2008).

Positive externalities also exist in manufacturing and construct sectors, since FDI in the manufacturing sector probably decreases unemployment by demanding a relatively large quantity of labour, whereas FDI in the construction sector is inclined to improve the infrastructure in host countries. Similarly, FDI in the business service sector is more likely to be sourced from local suppliers, and the positive externalities of FDI may spill over through backwards or forward linkages to local firms. FDI in the business service sector is also inclined to hire local employees, through which skills are transferred to other sectors in the host country (Orlic, Hashi, and Hisarciklilar 2018).

Conclusions

This paper develops the concept of *comprehensive geopolitical risk* by expanding the meaning of *geopolitical risk* from existing literature to include both implicit and explicit GPR faced by investors in the international market. In the context of China, who is rarely involved in armed conflicts (explicit GPR) with another nation, it is rational to consider implicit GPR and estimate its economic costs. This offsets the inadequate recognition of geopolitical risk in past literature, which has long neglected nonmilitary and other implicit risks.

Correspondingly, we construct GPR-related indexes ($GPRC_{jt}^*$, $GPRS_{jt}^*$, $GRIM_{jt}^*$, GPR_{jt}^* , $GPRT_{jt}^*$) by extracting big data on news reports about various events to quantify the *comprehensive geopolitical risk* in 154 overseas countries that Chinese multinational enterprises invested in between 2003 and 2020. Differing from the index measured by traditional databases, our indexes cover most countries in the world. Our analysis circumvents the common problem in many empirical studies of being event specific. These studies subjectively select several well-known explicit geopolitical events, such as the Iraq War and the 9/11 attack, and examine their consequences over a relatively short period of time, but seldom examine how numerous implicit geopolitical events impact normal economic activities over a long period of time.

Our study examines GPR and its impacts on FDI flows and yields three main findings. First, similar to other political risks discussed in the literature under the institutional economic framework, GPR adversely affects FDI outflows from China to other countries. Although both GPR action and GPR threat generate significantly adverse effects on FDI outflows, the former tends to be more impactful than the latter. Second, we find that implicit GPR also significantly deters FDI outflows. Third, FDI outflows in the energy sector are more sensitive than those in other sectors to marginal changes in GPR.

One limitation of our analysis is that the big data identified by artificial intelligence and machine recognition are not completely pure, and the measurement results may be biased, even though we try to filter the noise by adding screening conditions.

Notes

1. Data is sourced from Outward Foreign Direct Investment(2019), see its official website <http://hzs.mofcom.gov.cn/article/date/202009/20200903001523.shtml>.
2. For more information about PRS' International Country Risk Guide (ICRG), refer to <https://www.prsgroup.com/explore-our-products/international-country-risk-guide/>.
3. Caldara and Iacoviello (2022) examined 11 primary newspapers by text searches, counted the number of occurrences geopolitical-related words to construct their index. There are, however, some differences between our measurement and the one measured by Caldara and Iacoviello (2022). For one thing, the definition of geopolitical risk used in their GPR index is different from ours. For another, GPR in this paper focuses on China and its partners all over the world. Nonetheless, their index is relatively suitable for research of developed and emerging countries.
4. For details, refer to <https://www.gdeltproject.org/about.html>.
5. Many thanks for Biao Li's technological supports. The $GPRC_{it}^*$, $GPRS_{it}^*$, and $GPRIM_{it}^*$ indexes are open to the public and available at: <https://public.tableau.com/app/profile/lu.and.liu.2023/viz/ComprehensiveGeopoliticalRiskIndexes/ComprehensiveGeopoliticalRiskIndexes>. Please use the Chrome or Safari to open it. Please cite these indexes under the citation of this paper.
6. Seasonally or monthly index is also possible, but since other variables in the following analysis are yearly, we use yearly index in this paper.
7. For details, refer to <https://www.bbc.com/news/technology-53403793>.
8. For details, refer to <https://www.fdimarkets.com/about/>.
9. For details, refer to <https://databank.worldbank.org/source/world-development-indicators>.
10. Many thanks for the anonymous reviewer' suggestions.
11. Many thanks for the anonymous reviewer' suggestions.
12. (1) *Science* includes physical sciences, life sciences, environmental technology, ICT & electronics; (2) *Manufacture* refers to industrial, creative industries, consumer goods, wood, apparel & related products, transportation & warehousing, transport equipment; (3) *Energy* refers energy; (4) *Construction* refers to Construction; and (5) *Business Service* includes tourism, retail trade, professional services, financial services, agribusiness as labelled in the database.

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