

## Measuring Geopolitical Risk<sup>†</sup>

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*We present a news-based measure of adverse geopolitical events and associated risks. The geopolitical risk (GPR) index spikes around the two world wars, at the beginning of the Korean War, during the Cuban Missile Crisis, and after 9/11. Higher geopolitical risk foreshadows lower investment and employment and is associated with higher disaster probability and larger downside risks. The adverse consequences of the GPR index are driven by both the threat and the realization of adverse geopolitical events. We complement our aggregate measures with industry- and firm-level indicators of geopolitical risk. Investment drops more in industries that are exposed to aggregate geopolitical risk. Higher firm-level geopolitical risk is associated with lower firm-level investment. (JEL C43, E32, F51, F52, G31, H56, N40)*

Entrepreneurs, market participants, and central bank officials view geopolitical risks as key determinants of investment decisions and stock market dynamics. The Bank of England includes geopolitical risk, together with economic and policy uncertainty, among an “uncertainty trinity” that could have significant adverse economic effects (Carney 2016). In recent years, the European Central Bank, the International Monetary Fund, and the World Bank have routinely highlighted and monitored the risks to the outlook posed by geopolitical tensions.<sup>1</sup> In a 2017 Gallup survey of more than 1,000 investors, 75 percent of respondents expressed worries about the economic impact of the various military and diplomatic conflicts happening around the world.<sup>2</sup>

From the standpoint of many economic models, adverse geopolitical events and threats can impact macroeconomic variables through several channels, such as loss of human life, destruction of capital stock, higher military spending, or increased

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<sup>1</sup>These institutions keep track of geopolitical risks using our index presented here.

<sup>2</sup>See <http://www.businesswire.com/news/home/20170613005348/en/>.

precautionary behavior. However, the importance of geopolitical factors in shaping macroeconomic outcomes has not been the subject of systematic empirical analysis. The main limitation has been the lack of an indicator that is consistent over time, and that measures real-time geopolitical tensions as perceived by the press, the public, global investors, and policymakers. This is the perspective we adopt here. We construct newspaper-based indices of geopolitical risk (GPR), daily and monthly, global and country-specific, and examine their evolution since 1900. Using aggregate macroeconomic data, we then show that higher GPR increases the probability of an economic disaster and predicts lower investment and employment. Using firm-level data, we document that the adverse implications of geopolitical risk are stronger for firms in more exposed industries, and that high firm-level GPR is associated with lower firm-level investment.

The construction of our index consists of definition, measurement, and validation. Section I presents definition and measurement. We define geopolitical risk as the threat, realization, and escalation of adverse events associated with wars, terrorism, and any tensions among states and political actors that affect the peaceful course of international relations.<sup>3</sup> In the measurement step, we draw on Saiz and Simonsohn (2013) and Baker, Bloom, and Davis (2016), and construct the GPR index with an algorithm that computes the share of articles mentioning adverse geopolitical events in leading newspapers published in the United States, the United Kingdom, and Canada. These newspapers cover geopolitical events of global interest, often implying an involvement of the United States. That said, while the GPR index can be viewed either as a measure that is relevant for major companies, investors, and policymakers, or as a measure that is mostly relevant from a North American and British perspective, our validation analysis shows that our index can be further sliced into separate country-specific components, likely reflecting the different geographic imprint of major geopolitical events.

We plot the recent index, dating back to 1985, in Figure 1. The three largest spikes are recorded during the Gulf War, after 9/11, and during the 2003 invasion of Iraq. More recently, the index spikes after the Paris terrorist attacks and during the 2017–2018 North Korea crisis. We also construct the daily GPR index (Figure 2) as well as the historical GPR index, dating back to 1900, which spikes at the beginning of the two world wars, as well as around D-Day, the Korean War, and the Cuban Missile Crisis (Figure 3). Elevated readings of the index reflect the realization or escalation of *current* adverse events, as well as expectations and threats about *future* adverse geopolitical events. To quantify these two components, we construct the geopolitical acts index and the geopolitical threats index, shown in Figure 4.

In Section II we present a variety of checks that verify the plausibility of the GPR index and compare the index with related economic and geopolitical indicators. In addition to performing a formal audit of a sample of 7,000 newspaper articles, we verify that our automated index is highly correlated with a narrative counterpart constructed by manually scoring the 44,000 front pages of the *New York Times* published from 1900 through 2019. Moreover, we show that spikes in our index and its components highlight well-known historical episodes associated with

<sup>3</sup>The term “risk” is a bit of a misnomer, since it includes both the threat and the realization of adverse events. Section I explains the rationale for our naming convention.

wars, terrorism, or international crises. Based on these exercises and other robustness checks, we conclude that the GPR index is meaningful and accurate.

In Sections III and IV, we look at the macroeconomic effects of geopolitical risk. For the United States, using vector autoregressive (VAR) models for the period 1985 to 2019, we find that a shock to geopolitical risk induces persistent declines in investment, employment, and stock prices, with the decline in activity due to both the threat and the realization of adverse geopolitical events. In addition, using cross-country data and country-specific indices spanning 120 years, we find that higher values of the GPR index are associated with (i) higher probability of economic disasters, (ii) lower expected GDP growth, and (iii) higher downside risks to GDP growth.

In Section V, we provide further evidence on the implications of geopolitical risk using industry and firm-level data. The aggregate GPR index correlates well with listed firms' own perceptions of geopolitical risks, which we construct from mentions of geopolitical risks in 135,000 firms' earnings calls, inspired by Hassan et al. (2019). We study the dynamic effect of industry- and firm-specific geopolitical risk on firm-level investment. Industries that are positively exposed to geopolitical risks suffer a decline in investment that is larger than the aggregate effect. Idiosyncratic geopolitical risk—constructed using the transcripts of firms' earnings calls, and purged of aggregate and industry-specific components—is associated with lower investment at the firm level, with effects that accumulate and persist over time.

Our paper makes three contributions. First, we develop a new measure of adverse geopolitical events. Around some key dates, the GPR index shares some of its spikes with the military spending news variable of Ramey (2011), with indicators of the human cost of conflicts, with the economic policy uncertainty (EPU) index of Baker, Bloom, and Davis (2016), and with financial volatility. However, the GPR index also captures important information about geopolitical events that is not reflected in these indicators. Second, we distinguish the threats of adverse geopolitical events from their actual realization.<sup>4</sup> We do so because our methodology pinpoints the timing of different types of geopolitical events, thus allowing measurement of their effects.<sup>5</sup> Third, we present new systematic evidence on the role of adverse geopolitical events in business fluctuations, using quarterly VARs, cross-country historical data, and firm-level data.

## I. Construction of the GPR Indices

The construction of GPR indices involves definition, measurement, and validation. We first describe the definitions of geopolitics and geopolitical risk adopted in our paper. We then discuss how we measure geopolitical risk and describe the key features of the resulting indices.

<sup>4</sup>A growing literature studies the distinction between expectations and realizations of macroeconomic and financial phenomena. Bloom (2009) controls for the level of the stock market when identifying shocks to financial uncertainty. Berger, Dew-Becker, and Giglio (2019) find that expectations about future volatility are not contractionary after controlling for current volatility.

<sup>5</sup>Ludvigson, Ma, and Ng (2021) and Caldara et al. (2016) study the relationship between economic uncertainty and the business cycle by controlling for financial and economic activity when identifying uncertainty shocks. Our emphasis on geopolitical risk also links our paper to the literature on disaster risk. See for instance Barro (2006); Gourio (2008); Berkman, Jacobsen, and Lee (2011); Pindyck and Wang (2013); and Nakamura et al. (2013).

### A. Definition of Geopolitical Risk

Formally, geopolitics is the study of how geography affects politics and the relations among states (Foster 2006 and Dijkink 2009). By contrast, the popular usage of the term geopolitics is more complex and contested, ranging from narrow to broad definitions of what constitutes geography and who the relevant political actors are. In *A Dictionary of Human Geography*, Rogers, Castree, and Kitchin (2013) state that the media often refer to geopolitical concerns to describe the impact of international crises and international violence. This is the perspective we adopt here.

We define geopolitical risk as the threat, realization, and escalation of adverse events associated with wars, terrorism, and any tensions among states and political actors that affect the peaceful course of international relations.

Two considerations about our definition are in order. First, our definition of geopolitical builds on the historical usage of the term—to describe the practice of states to control and compete for territory (Flint 2016). However, in line with recent assessments of modern international relations, our definition also includes power struggles that do not involve acts of violence and competition over territories, such as the Cuban Missile Crisis or recent tensions between the United States and Iran, or the United States and North Korea. Our definition also includes terrorism. In recent decades, terrorist acts have generated political tensions among states and, in some instances, have led to full-fledged wars.

Second, our definition of geopolitical risk captures—with a slight abuse of the word “risk”—a wide range of adverse geopolitical events, from their threat, to their realization, to their escalation. This choice is dictated by journalistic practices and measurement considerations. Regarding journalistic practices, in naming our index, we followed a tradition in the media that refers to geopolitical risks as a catchall phrase to describe the effects of international crises and violence, actual or perceived (Rogers, Castree, and Kitchin 2013). Regarding measurement considerations, our extensive reading of news coverage on wars, terrorism, and international crises over the past 120 years revealed that the threat, realization, and escalation of international violence are often intertwined, so that a headline measure that abstracts from one of these components may not capture the range of events that could be of interest to researchers. That said, we break the headline index into separate “acts” and “threats” components, so that interested researchers can choose their preferred components for downstream empirical applications.

### B. Measurement

Our sample is the text contained in about 25 million news articles published in the print edition of leading English-language newspapers from 1900 through the present, corresponding to about 30,000 and 10,000 articles per month in the recent and historical sample, respectively. We construct the GPR index by counting, each month, the share of articles discussing adverse geopolitical events and associated threats. The recent GPR index starts in 1985 and is based on automated text-searches on the electronic archives of 10 newspapers: the *Chicago Tribune*, the *Daily Telegraph*, the *Financial Times*, the *Globe and Mail*, the *Guardian*, the *Los Angeles Times*, the *New York Times*, *USA Today*, the *Wall Street Journal*, and the

*Washington Post*. The choice of six newspapers from the US, three from the United Kingdom, and one from Canada reflects our intention to capture events that have global dimension and repercussions.<sup>6</sup> The index counts, each month, the number of articles discussing rising geopolitical risks, divided by the total number of published articles. By the same token, the historical GPR index, dating back to 1900, is based on searches of the historical archives of the *Chicago Tribune*, the *New York Times*, and the *Washington Post*.

To construct our outcome of interest, we use a dictionary-based method, specifying a dictionary of words whose occurrence in newspaper articles is associated with coverage of geopolitical events and threats. Such a method organizes prior information about how features of a text (e.g., the occurrence in newspaper articles of the words “war” and “threat” within close proximity) map into the outcome of interest (e.g., news coverage of geopolitical risks). The use of supervised or unsupervised algorithms or prespecified dictionaries is less applicable to our case as the outcome of interest is not directly observed and there are no readily available data to train a supervised model.<sup>7</sup>

How do we specify the information that guides the construction of the dictionary? First, we build directly on the definition of geopolitical risk adopted in this paper, selecting words that closely align with our definition. Second, we use information from two geopolitical textbooks and from the Corpus of Historical American English to isolate themes that are more likely to be associated with geopolitical events (such as “war [on] terror” or “nuclear weapon”) or words that are more likely to be used in conjunction with war-related words (such as “declare”). Third, we organize the search around high-frequency words and their synonyms that are more likely to appear in newspapers on days of high geopolitical tensions (see Tables A.1 and A.2 in the online Appendix). For instance, the word “crisis” has a relative term frequency of 0.25 percent on days of high geopolitical tensions compared to 0.04 percent on an average day. Words very likely to appear in newspapers on days of high geopolitical tensions include “terror,” “blockade,” “invasion,” “troops,” and “war.”

Our goal is to provide an index that can highlight distinct aspects of geopolitical risk, and that can be sliced conceptually and geographically. Doing so exclusively with one-word searches would likely lead to misclassification and measurement error. These considerations lead to our search query, which specifies two words or phrases whose joint occurrence likely indicates adverse geopolitical events. The query is described in Table 1, and is organized in eight categories (see panel A). Each category is captured by a search query comprising two sets of words, the first set containing topic words (e.g., “war,” “nuclear,” or “terrorism”), the second set containing “threat” words for categories 1 through 5 and “act” words for categories 6 through 8. For six of our categories, we run proximity searches (e.g., searching for “terrorist” and “risk” appearing within two words of each other). For two categories, we search for either two words appearing in the same article (“weapons” and “blockade”) or for one bigram and one word appearing in the same article (“nuclear

<sup>6</sup>These newspapers have high circulation throughout the sample, consistent coverage of international political events, and digital archives that span a long period. In Section II we verify that an index that excludes non-US newspapers is very similar to the benchmark index.

<sup>7</sup>See Gentzkow, Kelly, and Taddy (2019) for a detailed comparison of methods for text analysis.

TABLE 1—SEARCH QUERY FOR THE GPR INDEX

Category	Search query	Peak (month)	Contribution to index percent		
			Full sample	1900–1959	1960–2019
<i>Panel A. Search categories and search queries</i>					
Threats					
1. War threats	War_words N/2 Threat_words	Germany invades Czech. (September 1938)	13.5	17.9	9.2
2. Peace threats	Peace_words N/2	Iran crisis of 1946 (April 1946)	3.5	4.3	2.7
3. Military buildup	Peace_disruption_words Military_words AND buildup_words	Cuban Missile Crisis (October 1962)	23.5	21.3	25.8
4. Nuclear threats	Nuclear_bigrams AND Threat_words	Nuclear ban negotiations (August 1963)	10.1	4.2	16.0
5. Terrorist threats	Terrorism_words N/2 Threat_words	9/11 (October 2001)	2.7	0.3	5.0
Acts					
6. Beginning of war	War_words N/2 War_begin_words	WWII begins (September 1939)	18.8	26.8	10.7
7. Escalation of war	Actors_words N/2 Actors_fight_words	D-Day (June 1944)	19.6	23.9	15.3
8. Terrorist acts	Terrorism_words N/2 Terrorism_act_words	9/11 (September 2001)	8.3	1.3	15.2
<i>Panel B. Search words</i>					
Topic sets					
War_words	<b>war OR conflict</b> OR hostilities OR revolution* OR insurrection OR uprising OR revolt OR coup OR geopolitical				
Peace_words	<b>peace</b> OR truce OR armistice OR treaty OR parley				
Military_words	<b>military OR troops</b> OR missile* OR “arms” OR weapon* OR bomb* OR warhead*				
Nuclear_bigrams	<b>“nuclear war”</b> OR “atomic war” OR “nuclear missile” OR “nuclear bomb” OR “atomic bomb” OR “h-bomb” OR “hydrogen bomb” OR “nuclear test” OR “nuclear weapon”				
Terrorism_words	<b>terror</b> * OR guerrilla* OR hostage*				
Actor_words	<b>allie* OR enem* OR insurgen*</b> OR foe* OR army OR navy OR aerial OR troops OR rebels				
Threat/act sets					
Threat_words	<b>threat*</b> OR <b>warn*</b> OR <b>fear*</b> OR <b>risk*</b> OR <b>concern*</b> OR danger* OR doubt* OR crisis OR troubl* OR disput* OR tension* OR imminen* OR inevitable OR footing OR menace* OR brink OR scare OR peril*				
Peace_disruption_words	<b>threat*</b> OR menace* OR reject* OR peril* OR boycott* OR disrupt*				
Buildup_words	<b>buildup*</b> OR <b>build-up*</b> OR <b>sanction*</b> OR blockad* OR embargo OR quarantine OR ultimatum OR mobiliz*				
War_begin_words	<b>begin*</b> OR <b>start*</b> OR <b>declar*</b> OR begun OR began OR outbreak OR “broke out” OR breakout OR proclamation OR launch*				
Actor_fight_words	<b>advance*</b> OR <b>attack*</b> OR <b>strike*</b> OR drive* OR shell* OR offensive OR invasion OR invad* OR clash* OR raid* OR launch*				
Terrorism_act_words	<b>attack</b> OR act OR bomb* OR kill* OR strike* OR hijack*				
<i>Panel C. Excluded words</i>					
Exclusion words	movie* OR film* OR museum* OR anniversar* OR obituar* OR memorial* OR arts OR book OR books OR memoir* OR “price war” OR game OR story OR history OR veteran* OR tribute* OR sport OR music OR racing OR cancer OR “real estate” OR mafia OR trial OR tax				

Notes: In panel A, the contribution to the index is the percent of articles in each category satisfying the condition for inclusion in the GPR index, as a share of all articles satisfying that condition. In panel B, “core words” for each category are highlighted in bold. The truncation character (\*) denotes a search including all possible endings of a word, e.g. “threat\*” includes “threat” or “threats” or “threatening.

war” AND “threat”). We do plenty of robustness analysis around this search strategy (discussed in Section II) and verify that, in our application, this approach yields better outcomes relative to a search using bigrams only, as in Hassan et al. (2019), or using Boolean operators only, as in Baker, Bloom, and Davis (2016), who search “economic” and “policy” and “uncertainty” terms.

Panel B of Table 1 describes the sets of words constituting our dictionary. For each category, we started from a minimal set of “core words,” denoted in red. For instance, for category 1 the two core words are “war” and “conflict.” For category 2, the core word is “peace.” For category 3, the core words are “military” and “troops.” Core words that indicate threats are “threat,” “warn,” “fear,” “risk,” and “concern.” These sets of words are the most common words used in news coverage to discuss war-related threats. As shown in Section II, exclusive reliance on these core words, while resulting in an index that shares a similar contour to our final index, would lead to searches that fail to capture several articles that discuss geopolitical events and risks. For this reason, we add words that are used throughout our historical sample to cover multiple episodes. For instance, news coverage of military buildups, embargoes, and sanctions (such as during the Cold War, the Cuban Missile Crisis, or the run-up to the Gulf War) relies on words that are not included in the core set. Threats to peace are often referred to as “disruptions” of peace, a word that is not used to directly indicate war threats. For the nuclear threats category, we use bigrams to reduce the possibility that articles related to civilian usage of nuclear technologies would slip into our search. Finally, the bottom panel lists “excluded words” that our audit revealed to be more frequently associated with false positives. Articles that mention these words cover a diverse set of topics, such as movies and books, sport events, war anniversaries, and obituaries of famous generals and politicians. The excluded words do not affect the spikes in our index. Nonetheless, accounting for these words mitigates spurious trends and reduces the share of false positive articles in the index (see Table A.3 in the online Appendix).

### C. The Recent GPR Index

Figure 1 presents the GPR index from 1985 through 2020 based on ten newspapers. The index is characterized by several spikes corresponding to key adverse geopolitical events. The first spike is recorded in April 1986 and corresponds to the terrorist escalation that led to the US bombing of Libya. The second spike happens around the Iraq invasion of Kuwait and the subsequent Gulf War. The index surges at the beginning of 1993, during a period of escalating tensions between the United States and Iraq. It then trends downwards until 2001 when it surges after the 9/11 events, before spiking again during the 2003 invasion of Iraq. In recent years, the index is high during the 2011 military intervention in Libya, around the 2014 Russian annexation of the Crimea peninsula, and after the 2015 Paris terrorist attacks. The index displays a break in its mean after 2001. The 9/11 terrorist attacks saw a shift in news coverage of geopolitical events, driven by increased reporting on terrorist threats and on the war on terror.<sup>8</sup>

<sup>8</sup>We perform a supremum Wald test for structural break at an unknown date using symmetric trimming of 15 percent. We reject the null of no break in the log of the GPR index ( $p$ -value of  $< 0.001$ ) and find a break in September

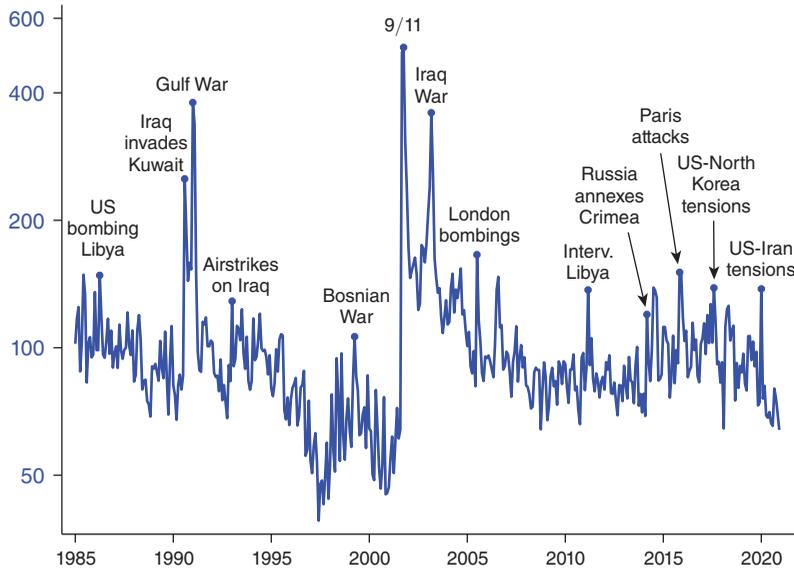


FIGURE 1. RECENT GPR INDEX FROM 1985

Notes: Recent GPR index from 1985 through 2020. Index is normalized to 100 throughout the 1985–2019 period.

Figure 2 shows the GPR index at daily frequency. The daily index is noisier than its monthly counterpart but provides a detailed view of a larger set of episodes, including those that may seem to be missed by the monthly index. For instance, in August 1991, the daily index captures the escalation of ethnic violence in the former Yugoslavia, and the attempted coup in the Soviet Union. In March 1999, the index spikes at the beginning of the North Atlantic Treaty Organization (NATO) air strikes in Kosovo. These events have a low bearing on the monthly index, as the associated news coverage was short-lived.

The daily GPR index illustrates how the unfolding of geopolitical tensions can add up to elevated values in its monthly counterpart. In a first scenario, a protracted buildup in tensions leads to a defining event causing a big spike in the index, as in the case of the Gulf War. In a second scenario, one climactic event causes a large spike in daily geopolitical risk and is followed by readings that are persistently higher than the average, as in the aftermath of the 9/11 terrorist attacks. In a third scenario, slow-moving geopolitical tensions persistently remain in the news cycle, averaging out to elevated values in the monthly GPR. Examples include the Syrian Civil War and the 2017–2018 North Korea crisis. In all these scenarios, spikes in the daily index correctly point to when tensions materialized, thus bolstering evidence of the informative content that the index produces at daily frequencies. That said, it is possible that our index may not appropriately measure episodes that slowly unfold over multiple years, such as the fall of communism in the Soviet Union and Eastern Europe, and are recognized as geopolitical risks only with the benefit of hindsight.

2001. Higher news coverage of geopolitical risks after 9/11 may indicate either an increase in actual risks of wars and terrorism, or an increase in the public perception of these risks. An important question for future research would be to study the relative importance of perceived versus actual geopolitical risks for economic outcomes.

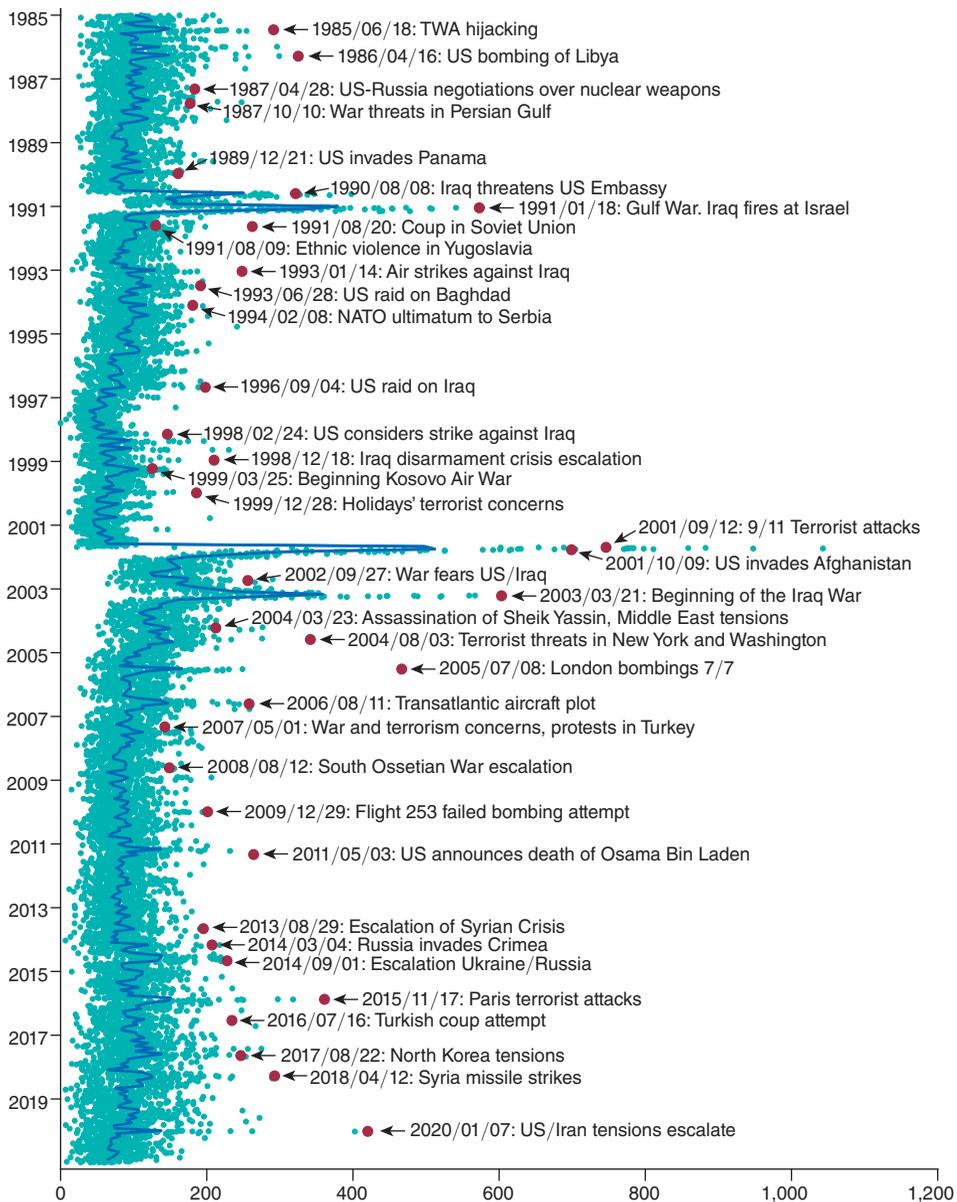


FIGURE 2. DAILY GEOPOLITICAL RISK

Notes: Timeline of the daily GPR index from 1985 through end-2020. The solid blue line plots the monthly index. The green dots show the daily observations, including descriptions of the events reported by the newspapers on selected days featuring spikes in the index (shown by the large red dots). Index is normalized to 100 in the 1985–2019 period.

D. The Historical GPR Index

Figure 3 displays the historical GPR index from 1900 onward. The historical index closely mimics the recent index during the period 1985 to 2020 when their coverage overlaps, with a correlation of 0.95. The historical GPR index is higher,

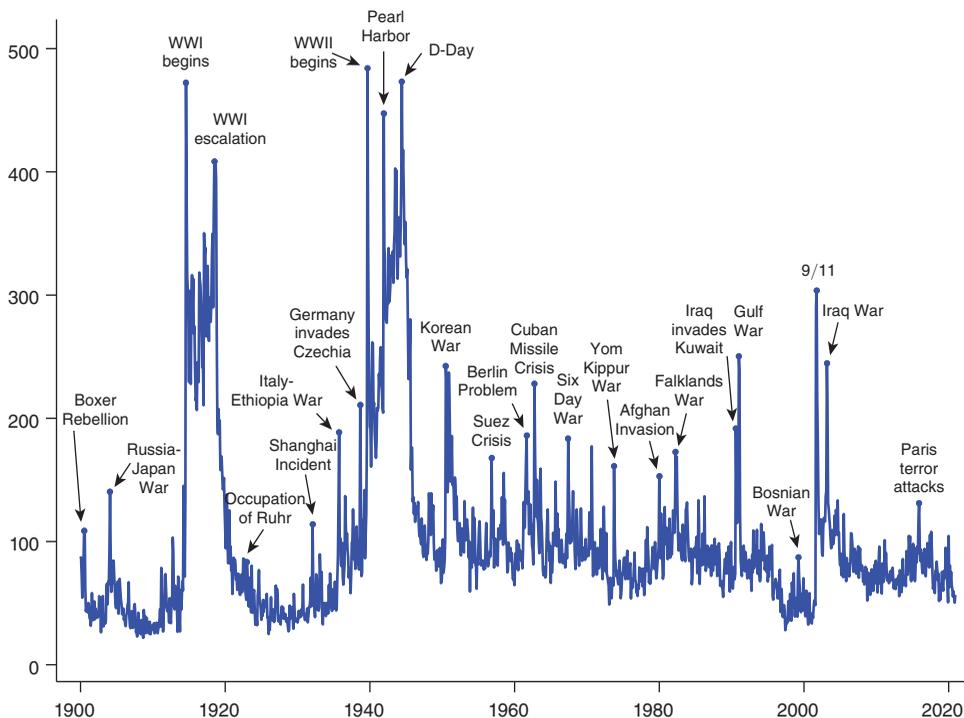


FIGURE 3. HISTORICAL GPR INDEX FROM 1900

Notes: Historical GPR Index from January 1900 through December 2020. Index is normalized to 100 throughout the 1900–2019 period.

on average, during the first half of the twentieth century (see summary statistics in Table A.3 in the online Appendix).

Perhaps unsurprisingly, the highest readings of the index coincide with the two world wars. The index spikes at the onset of World War I and World War II and remains persistently high during each war. The index declines rapidly at the end of World War II only to rise again during the Korean War. The second half of the twentieth century witnessed several geopolitical threats and crises. For instance, the index spikes during the Suez Crisis, the Cuban Missile Crisis, the Six-Day War, and the Falklands War. The index stays at relatively high levels from the 1950s through the mid-1980s, a time when the threat of nuclear war and geopolitical tensions between countries were more prevalent than actual wars. As discussed, since the 2000s, terrorism, the Iraq War, and rising bilateral tensions dominate the index.

### *E. Geopolitical Threats and Geopolitical Acts*

Throughout history, the realization of adverse geopolitical events has often been the catalyst for increased fears about future adverse events. For instance, terrorist attacks may increase the threat of future attacks or of a war. Our search query and the resulting GPR index capture both the realization of adverse geopolitical events (a terrorist attack or the outbreak of a war), and threats about the future adverse events.

We construct two components of the GPR index, the geopolitical threats (GPT) and the geopolitical acts (GPA) indices. The GPT index searches articles including phrases related to threats and military buildups (categories 1 through 5 in Table 1), while the GPA index searches phrases referring to the realization or the escalation of adverse events (categories 6 through 8 in Table 1). Figure 4 plots the two indices since 1900. The GPT and GPA indices have a correlation of 0.59 over the full sample, and of 0.45 from 1985 onward. Even if some spikes in the two indices coincide, there is also independent variation that is better highlighted when examining particular historical episodes. The beginning of World War I appears largely unexpected. Throughout the war, the GPA index remains elevated while the GPT index remains subdued, although a spike in threats when the US severs diplomatic relations with Germany in February 1917 is followed by the American entry into World War I two months later. The buildup to World War II sees the GPT index rise amid news coverage of the risk of war, for instance during the annexation of Czechoslovakia by Nazi Germany, whereas the GPA index spikes at the beginning of the war, after Pearl Harbor, and around D-Day. By contrast, the 1960s witnessed international crises captured by spikes in the GPT index that did not lead to wars such as the Berlin Crisis and the Cuban Missile Crisis. The GPT index surges in 1990 in the run-up Gulf war. The GPA index spikes after 9/11 and at the beginning of the Gulf War. Finally, the GPT index is high relative to its historical average during the recent tensions between the US and North Korea and Iran.

## II. Validation of the Index

This section presents three exercises aimed at ensuring the validity of our indices. First, we verify that the GPR indices provide a plausible quantification of the historical and geographical evolution of geopolitical risks. Second, we compare the indices with similar economic and geopolitical data. Third, we summarize the audit process and additional accuracy checks.

### A. Plausibility

*Largest Spikes in the Historical Index.*—Our first plausibility test relies on the logic that jumps in the index must capture the most important geopolitical risks of the past 120 years, in the way these risks were perceived by the contemporaries.<sup>9</sup> We calculate surprises in the index and in its two main subcomponents as the residuals of a regression of the relevant monthly indices on three of their own lags.

Table 4 illustrates that the relative magnitude of the historical jumps in the index is reasonable. The largest shocks capture well-known episodes of sizable increases in the risk associated with wars, terrorism, or international crises. The five largest shocks are the beginning of both world wars, 9/11, Pearl Harbor, and the onset of the Korean War. Some of these events illustrate examples of shocks to both the threat and act components of the index. Other shocks, such as the Cuban Missile

<sup>9</sup>One example of a possible discrepancy between contemporaries' perception of risks and ex post perception is given by the Cuban Missile Crisis. With hindsight, it is reasonable to claim that the dangers posed by the crisis were far greater than the contemporaries understood. See for instance Sherwin (2012).

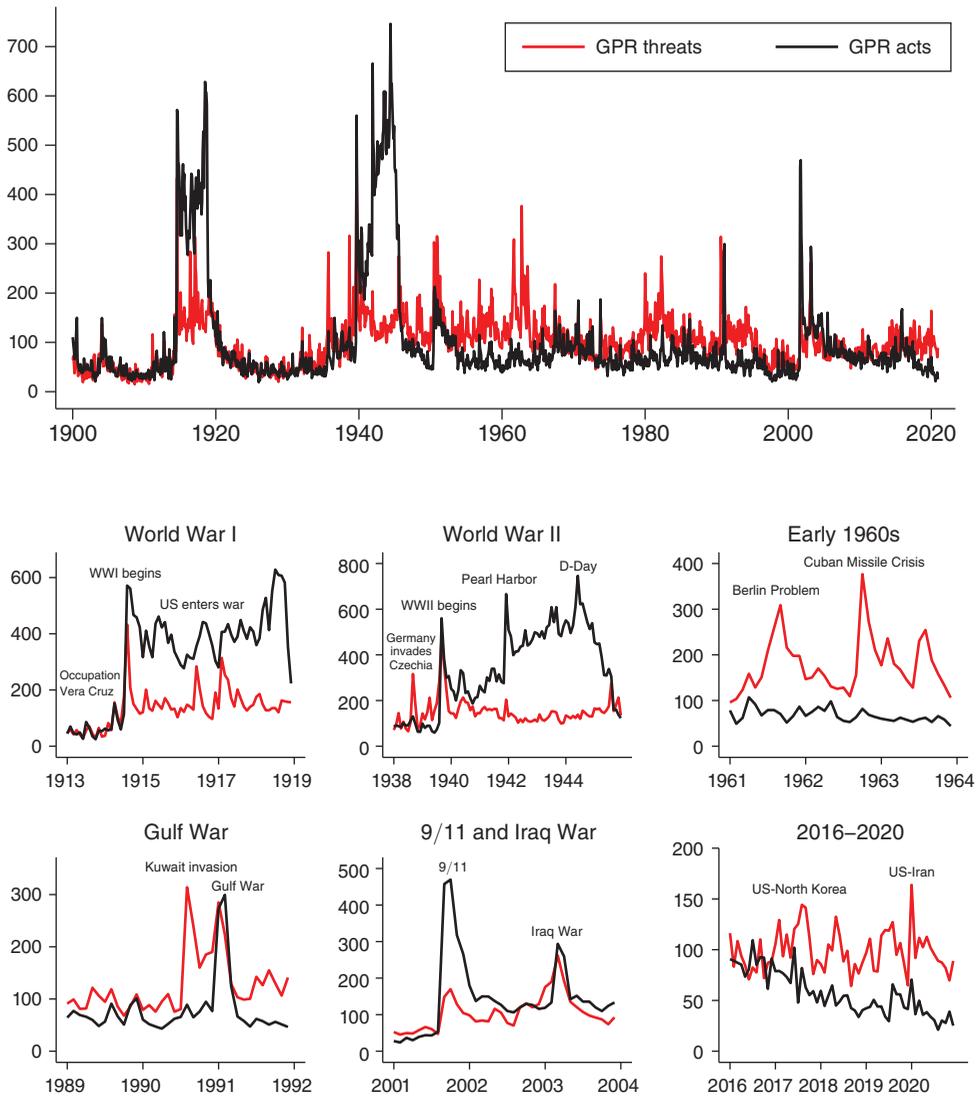


FIGURE 4. GEOPOLITICAL THREATS AND GEOPOLITICAL ACTS

Notes: Geopolitical threats (GPT) and the geopolitical acts (GPA) indices. The GPT index is constructed by searching articles in categories 1 to 5 in Table 1. The GPA index is constructed by searching articles in categories 6 to 8 in Table 1. Both indices are normalized to 100 in the 1900–2019 period.

Crisis or the Gulf War, weigh more heavily on either component, showcasing the independent role played by threats and acts in the construction of the index. For example, the Cuban Missile Crisis ranks fourth among the largest threats within the past 120 years despite its official duration of only 13 days and the lack of public attention that it garnered within its first week.

*Comparison with a Narrative GPR Index.*—Traditionally, a newspaper’s front page gives the reader a summary of the most important news event of the day in order of importance, with editors always ready to break out big headlines for the

TABLE 2—LARGEST GEOPOLITICAL SHOCKS SINCE 1900

Month	Rank	GPR	Shock	Event
<i>Panel A. Shocks to the GPR index</i>				
1914:4	15	145.2	84.5	Occupation of Vera Cruz
1914:8	1	472.3	341.5	WWI begins
1916:6	14	318.3	93.2	WWI escalation
1917:2	6	350.2	141.9	US severs Germany relations
1938:9	11	210.7	109.9	Germany occupies Czechia
1939:9	2	484.2	318.6	WWII begins
1941:12	3	447.5	245.7	Pearl Harbor
1944:6	12	473.2	107.9	D-Day
1950:7	5	242.4	143.5	Korean War
1962:10	8	228.1	121.2	Cuban Missile Crisis
1973:10	13	161.1	94.3	Yom Kippur War
1990:8	9	191.9	115.5	Iraq invades Kuwait
1991:1	7	250.4	126.4	Gulf War
2001:9	4	289.9	238.2	9/11
2003:3	10	244.6	110.2	Iraq War
Month	Rank	GPR threats	Shock	Event
<i>Panel B. Shocks to the threats component of the GPR index</i>				
1914:8	1	432.6	279.2	WWI begins
1938:9	5	316.1	217.1	Germany occupies Czechia
1939:9	2	480.0	246.8	WWII begins
1962:10	3	376.6	234.0	Cuban Missile Crisis
1990:8	4	314.1	225.7	Iraq invades Kuwait
Month	Rank	GPR acts	Shock	Event
<i>Panel C. Shocks to the acts component of the GPR index</i>				
1914:8	2	571.5	456.9	WWI begins
1939:9	1	560.0	463.0	WWII begins
1941:12	4	665.7	391.5	Pearl Harbor
1991:1	5	273.1	196.9	Gulf War
2001:9	3	457.5	403.4	9/11

*Notes:* The table lists the largest shocks to the GPR index (and its components) in the 1900–2019 sample. For this table, the shocks are constructed as the residuals of a regression of the level of the relevant monthly index against its first three lags.

most important stories. As a second check for the plausibility of the index, we compare it with a “narrative” index of adverse geopolitical events that we constructed by reading and scoring the headlines of 44,000 front pages of the print edition of the *New York Times* from 1900 through 2019.<sup>10</sup>

Together with a team of research assistants, we read all headlines above the fold of the front page of the *New York Times*, and assign to each day a score of a 0, 1, 2, or 5 depending on whether no headline features rising or existing geopolitical tensions (score: 0); one headline, but not the lead headline, features GPR (score: 1); the lead headline, but not a banner headline, features GPR (score: 2); the banner headline features GPR (score: 5).<sup>11</sup> The resulting narrative index places heavy weight on the

<sup>10</sup>The front page of the *New York Times* has changed dramatically over time. A typical front page in 1900 had four times as much text as today, as well as more articles. Early on, the subject in the front page was mostly domestic and international politics. Today, the front page covers a larger variety of topics including finance, family, technology, and medicine. See Rosenthal (2004). That said, the front page and its headlines have always directed the reader to the most important issues of the day.

<sup>11</sup>The weights are chosen to be roughly proportional to the space taken by the headline across the page.

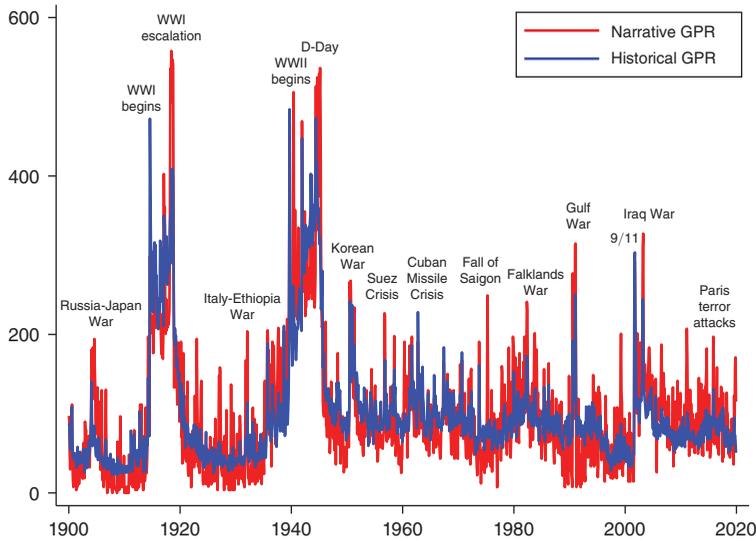


FIGURE 5. NARRATIVE GPR INDEX

Notes: The narrative GPR index is constructed by reading all daily front pages of the *New York Times* since 1900 and scoring them as 0, 1, 2, or 5 depending on the intensity of news about adverse geopolitical events. Both indices are normalized to 100 in the 1900–2019 period.

importance of the article, as reflected by its placement in the newspaper, and adequately captures the tone of the event. Additionally, the narrative index, not relying on a preset list of words, is unlikely to be affected by changes in language over time.

The narrative index is plotted in Figure 5 alongside our automated one. The two indices share very similar long-run trends and display a very high correlation of 0.86, sharing very similar spikes during the world wars and in the wake of the Korean War, the Gulf War, and 9/11. This positive correlation bolsters our confidence that the automated index is an accurate measure of geopolitical risks. We consider the automated index to be a better benchmark relative to the narrative for three main reasons. First, the automatic index enhances transparency and replicability. Second, the narrative index relies only on the front page articles of one newspaper thereby rendering scaling up and maintenance costly. Third, the narrative index may suffer more from mismeasurement due to limited front-page space (e.g., major concurrent events crowd out front-page space so other relevant events are pushed elsewhere in the newspaper) and ambiguity of historical records (thereby requiring difficult judgment calls).

*Country-Specific Measures of Geopolitical Risk.*—We construct country-specific measures of geopolitical risk by counting joint occurrences in newspapers of geopolitical terms and the name of the country (or its capital or main city) in question. For instance, the GPR index for Japan is the share of articles that meet the criterion for inclusion in the GPR index and that contain the words “Japan” or “Tokyo.” The geographical disaggregation permits a more granular assessment of the index, quantifying exposure of countries to global risks and highlighting geopolitical episodes that, while relevant for individual countries or regions, receive little weight in the aggregate index. Importantly, the resulting indices, being constructed using three

US newspapers, capture the US perspective on risks posed by, or involving, the country in question.

Figure 6 plots country-specific GPR indices for selected countries. Most countries share exposure to common geopolitical events, most notably the two world wars and, more recently, the Gulf War and Iraq War. That said, a few spikes are isolated to specific countries or regions. After World War II, the United Kingdom was involved in several international crises, ranging from the dispute with Egypt over the Suez Canal to the war against Argentina for control over the Falkland Islands. Germany faced a major crisis that culminated in the construction of the Berlin Wall in 1961. Japan, Russia, and China were opposed in regional wars in the first half of the twentieth century. Mexico and Korea were each embroiled in two major wars that saw the direct involvement of the United States.

### B. Comparison with Related Economic and Geopolitical Data

*Comparison with News about Military Spending.*—The top panel of Figure 7 compares the historical GPR index with Ramey's (2011) measure of news about US military expenditures constructed from historical records. Ramey's series reports the present discounted value of expected changes in defense expenditures constructed, akin to our measure, using news from *Business Week* and other newspaper sources. The two measures are clearly related, with a correlation of 0.29 over the period 1900:II to 2016:IV. The GPR index is above its historical mean in 15 out of the 16 instances in which the military spending news variable is larger than 5 percent of GDP. The two measures also display independent variation driven by spikes in the GPR index unrelated to US military spending (see Figure A.1 in the online Appendix), such as during both world wars, throughout the Korean War, and in the years following 9/11.

*Comparison with War Deaths.*—Our index assumes that the propensity to discuss a phenomenon in newspapers can be seen as an ordinal measure of the intensity of that phenomenon, and is monotonically increasing in the phenomenon itself. Figure 7 shows that the GPR index is positively correlated with worldwide deaths from conflicts, a cardinal, albeit crude, measure of the risks posed by armed conflicts. The correlation coefficient between the two measures is 0.82. War deaths correlate more with GPR acts (0.83) than with GPR threats (0.46). The GPR index and deaths from conflict surge together during the two world wars, but their correlation weakens after the 1950s. Of note, the level of the GPR index has been higher almost every year since the end of World War II compared to any year during the interwar period, whereas deaths have stayed at relatively low levels. It is no surprise that the level of the index appears permanently higher after the world wars made humanity more attentive to the risks posed by armed conflicts.

*Comparison with Proxies for Uncertainty and Granger Causality Tests.*—Figure 8 compares the recent GPR index with two popular measures of uncertainty: the old VIX (a measure of stock market volatility based on the options on the Standard and Poor's 100 stock index) and the news-based EPU index of Baker, Bloom, and Davis (2016). There are two periods where all three indices rise simultaneously: in 1990–1991, around the time of the Gulf War, and in 2001, after the 9/11 terrorist

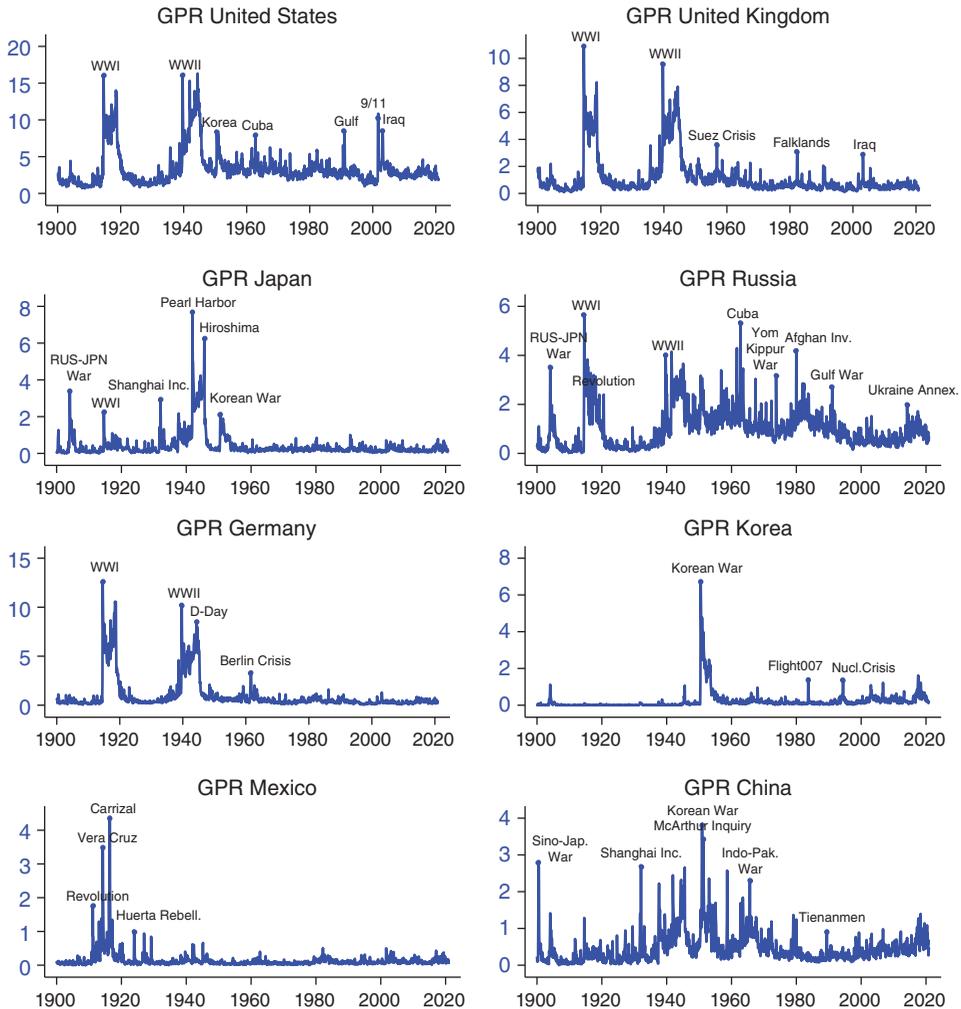


FIGURE 6. COUNTRY-SPECIFIC GEOPOLITICAL RISK

*Note:* For each country, the country-specific GPR index measures share of articles simultaneously mentioning geopolitical risks together with the name of the country (or its capital or main city) in question.

attacks. However, in both cases it seems plausible to argue that the causation runs from geopolitical events to stock market volatility and policy uncertainty. The three indices also exhibit sizable independent variation. The GPR index does not move during periods of economic and financial distress or around presidential elections, periods characterized by elevated policy uncertainty. By contrast, rises in the EPU index and VIX do not coincide with the Russian annexation of Crimea or with terrorist events other than 9/11. In sum, the graphical evidence indicates that, compared to the VIX and the EPU index, the GPR index appear to capture—because of its own nature—events that (i) are less likely to have an economic origin, and (ii) could give rise to heightened financial volatility and policy uncertainty.<sup>12</sup>

<sup>12</sup>In online Appendix B.10, we compare the GPR index to other quantitative proxies: International Crisis Behavior (ICB) database, the national security EPU subindex, and the US external conflict rating index.

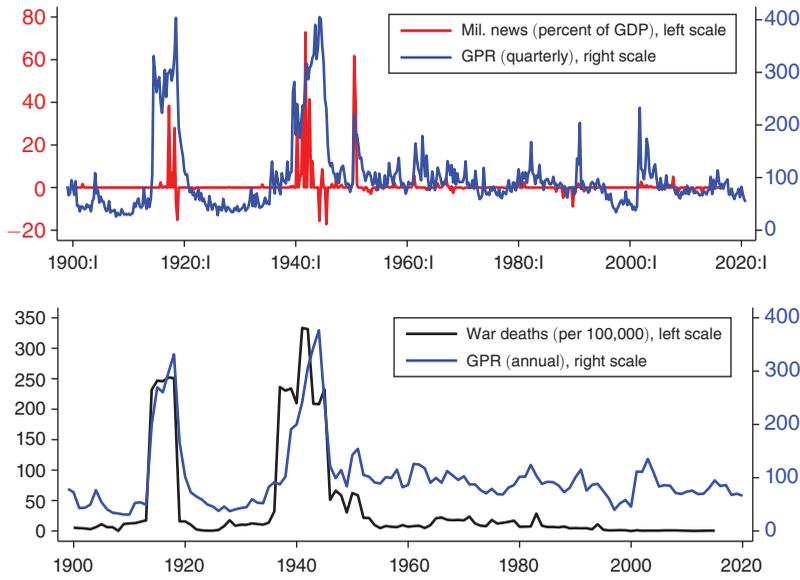


FIGURE 7. COMPARISONS WITH MILITARY SPENDING NEWS AND WAR DEATHS

Notes: In the top panel, comparison of quarterly GPR index with the expected military spending news variable from Ramey (2011), updated in Ramey and Zubairy (2018). In the bottom panel, comparison of the annual historical GPR index with worldwide military and civilian death rate from conflicts and terrorism (see online Appendix B.4 for data sources).

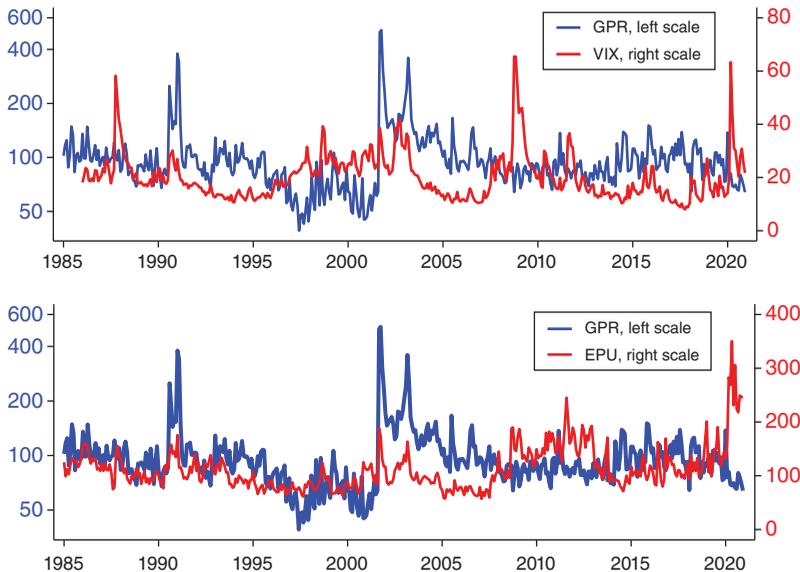


FIGURE 8. COMPARISON WITH FINANCIAL AND ECONOMIC UNCERTAINTY MEASURES

Note: Comparison of the GPR index (plotted on a log scale) with financial volatility as measured by the Chicago Board Options Exchange's Volatility Index (old VIX, also known as VXO) and with the economic policy uncertainty (EPU) index constructed by Baker, Bloom, and Davis (2016).

Online Appendix B.5 shows that the GPR index is not Granger caused by news related to recent developments in the United States. We regress the log of the GPR index on macroeconomic variables (change in US industrial production, private employment, and the log of the West Texas Intermediate (WTI) price of oil deflated by the US consumer price index), financial variables (real returns on the S&P 500 index and the two-year Treasury yield), and proxies for uncertainty (the VIX and the log of the EPU index). Macroeconomic, financial, and uncertainty developments do not Granger cause the GPR index.

### C. Additional Checks

*Audit.*—We evaluate the GPR index against alternatives based on different search queries and we perform an extensive human audit of newspaper articles likely discussing geopolitical risks.

In the first exercise, we use the narrative index—constructed using the *New York Times* front pages as discussed in Section IIA—as a reference point for assessing the accuracy of the benchmark index. Specifically, we compare the benchmark index with three alternatives based on slight modifications of the search query of Table 1. The alternative indices (i) do not remove the “excluded words” from the query; (ii) are based on a smaller set of “core words”; (iii) use the Boolean operator “AND” for all search categories (as opposed to a search of terms within two words from each other). We find that the GPR index exhibits a higher correlation with the narrative index than the three alternative indices (see online Appendix Table A.3 for details). Additionally, for each index, we randomly sample a large number of articles, read each of them, and manually code them as either discussing high or rising geopolitical tensions or not. We find the GPR index has a lower type I error rate relative to all alternatives.<sup>13</sup>

In the second exercise, we follow the approach of Baker, Bloom, and Davis (2016) and evaluate the GPR index through a human audit that further confirms the validity of the article selection process. The GPR index has a correlation of 0.93—at an annual frequency—with a “human” GPR index that is constructed by manually reading and coding a sample of more than 7,000 newspaper articles (see online Appendix B.6 for additional details).<sup>14</sup>

*Are Results Sensitive to the Use of Different Newspapers?*—The recent and historical GPR indices rely on ten and three newspapers, respectively. This choice avoids reliance on one particular news source and provides a robust and stable account of geopolitical risks. We find that the exact number of newspapers has only a modest effect on the index (see also online Appendix A.2). The correlation between the historical index and the recent index is 0.95 for the period in which the two indices overlap. Additionally, the correlation between non-US and US newspapers’ GPR is 0.88, thus suggesting that the global nature of most geopolitical events receives similar coverage across US and non-US newspapers. Finally, the Cronbach alpha, a

<sup>13</sup>The GPR index trends slightly downward from 1900 onward, a plausible feature given the two world wars and the Korean War in the early part of the sample.

<sup>14</sup>Saiz and Simonsohn (2013) list a number of formal conditions that must hold to obtain useful document frequency-based proxies for variables and concepts that are otherwise elusive to measure, such as ours. In online Appendix B.9, we show that our index satisfies the Saiz and Simonsohn (2013) conditions.

measure of internal consistency across indices based on the ten individual newspapers, is 0.96, a number that indicates an excellent degree of reliability of our measure.

*Does War Language Change over Time?*—The construction of our index relies on an extensive analysis of the most common words and sentences used in newspapers over time to describe risks of war and risks to peace, and acts of war and terror. We offer a detailed description of this analysis in online Appendix B.7, where we confirm that we neither ignore nor over-rely on words used relatively more often in some historical periods. First, we verify that we do not omit any crucial, war-related words that are used *relatively* frequently in newspapers during selected episodes of elevated geopolitical tensions. In particular, words such as terrorism, blockade, invasion, war, crisis, troops, and threat, among others, have odds of appearing in newspapers on days of high geopolitical risk that are at least five times higher relative to any average day (see online Appendix Table A.1). Second, we analyze term frequency for the words and word combinations used to construct the index and study their evolution over time. Online Appendix Tables A.4 and A.5 confirm that our query includes both words that are more frequent in the early part of the twentieth century, such as “menace” or “peril,” and words that are more frequent in recent decades, such as “risk” or “tension.”

As a final consideration, we recognize that newspapers appear to have devoted increasingly more space to arts, history, sports, and entertainment, often borrowing some of their language from warfare and military terminology. For this reason, our search ignores the articles containing the “excluded words” of Table 1. Without these words, the index would have a slight upward trend throughout the historical period, and slightly higher measurement error (see online Appendix Table A.3).

*Does Media Attention Measure the Underlying Risk?*—An implicit hypothesis of our analysis is that the propensity to mention geopolitical risks in newspapers is representative of such propensity in the wider population. While a formal test of this hypothesis would be beyond the scope of this paper, our online Appendix provides evidence that the GPR index is not unduly affected by issues related to how the media reports the news. First, we show that the index is not prone to spurious fluctuations when geopolitical events could be crowded out by unpredictable or predictable newsworthy events—from natural disasters to inflation to Olympic Games to presidential elections (see Figure A.4 and Table A.6 in the online Appendix). Second, we verify that our index is not impacted by the political orientation of the newspapers used in the analysis (see online Appendix Figure A.3). Finally, we show that there is a high correlation between occurrence and extent of murders, hijackings, and nuclear tests on the one hand, and the media coverage of these events on the other. This correlation suggests that, even if these events share with geopolitical news an alarmist message that may sell more newspapers, their occurrence is in line with the media coverage (see online Appendix Figure A.4).

### III. VAR Evidence on the Effects of Geopolitical Risk

In this section, we present our investigation of the relationship between the GPR index and aggregate economic activity in the United States using VAR models for the period 1985 to 2019.

### A. Aggregate Economic Effects

We examine the macroeconomic consequences of innovations to geopolitical risk using a structural VAR model (details and robustness analysis are in online Appendix C). Our main specification, which we estimate using two lags and quarterly data from 1986:I through 2019:IV, consists of eight variables: (i) the log of the GPR index; (ii) the VIX; (iii) the log of real business fixed investment per capita; (iv) the log of private hours per capita; (v) the log of the S&P 500 index; (vi) the log of the WTI price of oil; (vii) the yield on two-year US Treasuries; (viii) the Chicago Federal Reserve's National Financial Conditions Index (NFCI).<sup>15</sup>

We identify a GPR shock by using a Cholesky decomposition of the covariance matrix of the VAR reduced-form residuals, ordering the GPR index first. The ordering implies that any contemporaneous correlation between economic variables and the GPR index reflects the effect of the GPR index on the economic variables, rather than the other way around. The characteristics of the GPR index discussed in the previous two sections lend support to this assumption. We explore robustness to alternative identification assumptions and VAR specifications in the online Appendix.

The solid lines in Figure 9 show the median impulse responses to a two standard deviation shock to the GPR index.<sup>16</sup> The size of the shock reflects the average of the innovations in the right 10 percent tail of the GPR shock distribution. The GPR index rises persistently and remains elevated for nearly two years. High geopolitical risk is followed by a short-lived increase in financial uncertainty as measured by the VIX, by a decline in stock prices and oil prices, and by a modest decrease in the two-year yield. Fixed investment gradually declines, bottoming out at negative 1.5 percent after about one year, before slowly reverting to trend. Labor market conditions deteriorate, with hours declining 0.6 percent one year after the shock. The decline in investment and hours in the wake of a GPR shock is broadly consistent both with models that emphasize the contractionary effects of future negative news about the future—as in Beaudry and Portier (2006) and Jaimovich and Rebelo (2009)—and with models where recessions are driven by shocks with a negative first moment and a positive second moment—such as Bloom et al. (2018).<sup>17</sup>

### B. Acts and Threats

Next, we evaluate the difference between innovations in the two broad components of the GPR index, the GPA index (geopolitical acts) and the GPT index (geopolitical threats). We modify the benchmark VAR by replacing the GPR index with the GPA and GPT indices, using a Cholesky ordering with the GPA and GPT indices ordered first and second, respectively. This ordering captures a specific configuration of shocks such that “GPA shocks” can prompt a contemporaneous comovement

<sup>15</sup>The stock market index and oil prices are divided by the Consumer Price Index for All Urban Consumers.

<sup>16</sup>Figure A.6 in the online Appendix plots the estimated shocks to the GPR index and to its components both for the VAR specification of this subsection and the VAR specification of Section IIIB.

<sup>17</sup>When we add GDP to the VAR, we find that GDP drops 0.3 percent over the first year in response to a two standard deviation geopolitical risk shock (see online Appendix Figure A.7).

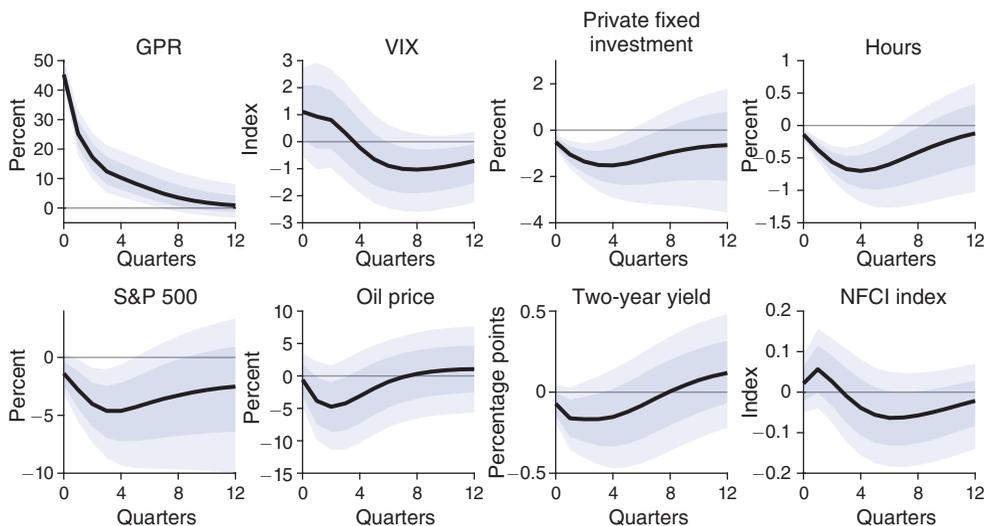


FIGURE 9. THE IMPACT OF INCREASED GEOPOLITICAL RISK

*Notes:* The black solid line depicts the median impulse response of the specified variable to a two standard deviation increase in the GPR index. The dark and light shaded bands represent the 68 percent and 90 percent pointwise credible sets, respectively.

in acts and threats, whereas “GPT shocks” capture threats that do not immediately materialize, leaving acts unchanged within the month.<sup>18</sup>

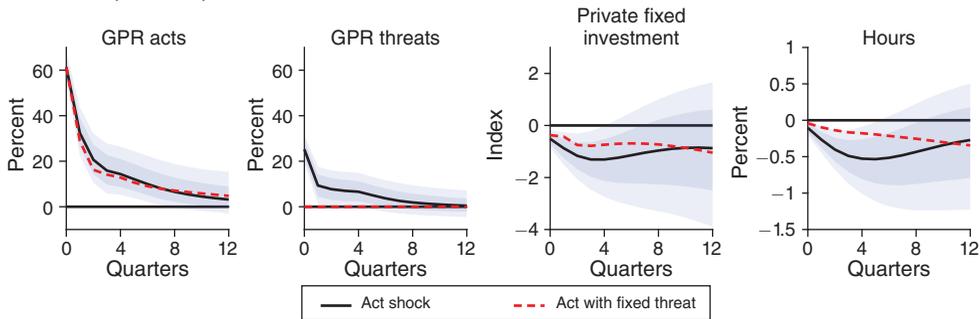
The solid lines in Figure 10 plot the median responses to the GPA and GPT shocks. A shock to acts leads to a sharp and significant increase in threats, whereas shocks to threats lead to a small and short-lived increase in acts. GPA and GPT shocks induce similar declines on investment and hours, though the effects of GPA shocks are more persistent.

To better quantify the role of acts and threats in affecting macroeconomic variables, we construct a counterfactual set of impulse responses for the two VAR shocks in which threats are held constant in response to act shocks, and vice versa. Specifically, in response to the GPA and GPT shocks, we select a sequence of GPT and GPA shocks that hold GPT and GPA constant, respectively. The dashed lines in Figure 10 illustrate that both acts and threats in isolation produce contractionary effects. Were threats to remain unchanged in response to an acts shock, the response of investment and hours would be smaller, thus supporting the notion that unrealized threats about future events could have contractionary effects. This result is corroborated by the decline in activity associated with increases in threats, keeping acts unchanged.

The contractionary consequences of the threats of adverse events support the insights of theoretical models where agents form expectations using a worst case

<sup>18</sup> An alternative identification scheme in which “threats” are ordered before “acts” would have the unpalatable property that both GPT and GPA shocks move the GPA on impact, thus making it difficult to isolate historical events when the threat component of the index moves substantially without a contemporaneous movement in acts, such as the Cuban Missile Crisis or the recent United States-North Korea and United States-Iran tensions.

Panel A. Impulse responses to a GPA shock



Panel B. Impulse responses to a GPT shock

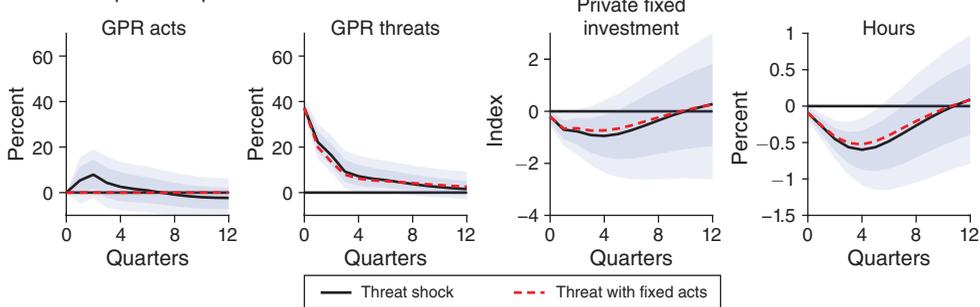


FIGURE 10. THE IMPACT OF INCREASED GEOPOLITICAL RISK: ACTS VERSUS THREATS

*Notes:* The black line depicts the median impulse response of the specified variable to a two standard deviations exogenous increase in the GPA index (panel A) and in the GPT index (panel B). The red dashed line depicts the outcome of a counterfactual simulation that keeps GPT (panel A) and GPA (panel B) constant. The dark and light shaded bands represent the 68 percent and 90 percent pointwise credible sets, respectively.

probability, as in Ilut and Schneider (2014), or models where the threat of adverse events leads agents to reassess macroeconomic tail risks, as in Kozlowski, Veldkamp, and Venkateswaran (2018). Of course, these findings may well depend on the country and the period that are studied in our VAR. With the notable exception of 9/11, most adverse geopolitical events in the sample did not directly hit the United States. By contrast, it is well known that countries experiencing adverse geopolitical events, wars in particular, on their soil suffer very large drops in economic activity, as documented by Barro (2006) and Glick and Taylor (2010). We return to this theme in the next section.

#### IV. Tail Effects of Geopolitical Risk

In this section, we quantify the relationship between geopolitical risk (a noneconomic risk) and risks to economic activity. We first show that high geopolitical risk is associated with a higher probability of economic disasters. We then show, using quantile regressions, that elevated geopolitical risk is associated with lower expected GDP growth and higher downside risks to GDP growth. We exploit variation in geopolitical risks and economic activity over time and across nations, using annual data for 26 countries for the period 1900 to 2019. We measure geopolitical

risk using both the historical GPR index and the country-specific indices described above. The main advantage of using the country-specific indices is to exploit episodes of higher geopolitical risk that are important for individual countries but that receive a low weight in the aggregate index. For instance, country-specific geopolitical risk is extraordinarily high for Korea in the 1950s, for Chile in 1973, and for Argentina and Peru in 1982, all of which are episodes that saw foreign involvements and that contributed to geopolitical tensions in Asia and South America.

### A. Effects on Disaster Probability

We model the occurrence of disaster  $D_{i,t}$  in country  $i$  in year  $t$  as given by

$$(1) \quad D_{i,t} = \alpha_i + \beta GPR_t + \gamma GPRC_{i,t} + \delta \Delta GDP_{i,t-1} + controls + u_{i,t},$$

where  $D_{i,t}$  is a zero or one dummy for an economic disaster,  $\alpha_i$  is a country-fixed effect,  $GPR$  is the “global” GPR index,  $GPRC$  is the country-specific index, and  $\Delta GDP$  is real GDP growth. To measure  $D_{i,t}$ , we use the disaster dummy constructed in Nakamura et al. (2013) using an approach that generates endogenous estimates of the timing and length of an economic disaster. We update their estimation with data through 2019.<sup>19</sup>

The first five columns of Table 3 show results from different specifications of equation (1). All models are estimated using a linear probability specification to simplify the interpretation of the coefficients, but the results are largely unchanged when using a logistic specification. The simplest specification in column 1 has no country-fixed effects and does not control for country-specific risk. The coefficient on global GPR is economically large. It indicates that a one standard deviation increase in global geopolitical risk increases the probability of disaster by 18 percentage points.<sup>20</sup> Column 2 adds country fixed effects as well as country-specific GPR. After controlling for global factors, a one standard deviation rise in country-specific GPR increases the disaster probability by 9 percentage points. Column 3 illustrates the important role played by the two world wars in driving the relationship between the (global) GPR and disaster probability. When the world war dummies are added to the specification, the coefficients on both (global) GPR index and war dummies are positive but not statistically significant, while the impact of country-specific GPR remains large and significant. While many economic disasters of the twentieth century took place during the two world wars, geopolitical risks and the associated economic consequences materialized through history and across countries.

Column 4 replaces GPR with a variable measuring spikes in the index with nearly unchanged results. Column 5 controls for US military spending news and allows for a common shift in the disaster probability across three subsamples, as in Nakamura

<sup>19</sup>We use the codes in Nakamura et al. (2013) to extend the estimation of the disaster events through 2019. Our procedure reproduces their disaster dates almost exactly, with a tetrachoric correlation coefficient between our disaster dummy and theirs of 0.99. China and Russia are not part of their sample, but we include them for their role in the geopolitical events of the period. We define disaster years in China as the periods 1940–1946 and 1960–1968. We define disaster years in Russia as the periods 1914–1920, 1941–1945, and 1990–1995.

<sup>20</sup>The share of disaster events in the sample is 17 percent. Sample average GDP growth is 2.9 percent in the nondisaster state,  $-0.2$  percent in the disaster state.

TABLE 3—GEOPOLITICAL RISK AND ECONOMIC DISASTERS

	Disaster (1)	Disaster (2)	Disaster (3)	Disaster (4)	Disaster (5)	Onset (6)	Ending (7)
GDP growth $t-1$	-0.0071 (0.0030)	-0.0062 (0.0030)	-0.0056 (0.0030)	-0.0065 (0.0032)	-0.0056 (0.0026)	-0.0009 (0.0010)	0.0012 (0.0010)
GPR	0.1753 (0.0223)	0.1144 (0.0241)	0.0337 (0.0469)		0.1001 (0.0236)	0.0180 (0.0237)	-0.0175 (0.0094)
Country GPR		0.0940 (0.0160)	0.0842 (0.0170)		0.0794 (0.0175)	0.0664 (0.0295)	-0.0090 (0.0105)
Dummy WWI/WWII			0.3328 (0.1761)				
GPR spikes				0.1692 (0.0246)			
Country GPR spikes				0.0821 (0.0122)			
Dummy pre-1946					0.2437 (0.0490)		
Dummy 1946–1972					0.1152 (0.0467)		
Constant	0.2309 (0.0252)	0.2289 (0.0273)	0.1947 (0.0341)	0.1762 (0.0302)	0.1112 (0.0320)	0.0401 (0.0185)	0.1180 (0.0130)
Observations	3,056	3,056	3,056	3,056	3,056	2,447	609
$R^2$	0.20	0.20	0.21	0.18	0.26	0.13	0.02
Countries	26	26	26	26	26	26	26
Country fixed effects	No	Yes	Yes	Yes	Yes	Yes	Yes

*Notes:* Standard errors in parentheses are clustered by country and year. The table shows the effects of global and country-specific geopolitical risk on the probability of economic disaster in a panel of countries from 1900 through 2019. GDP growth is expressed in percent. GPR is standardized. Country GPR is standardized by country. Country GPR is the number of GPR articles mentioning the country divided by total number of newspaper articles. The GPR spikes variable equals GPR in the ten observations with the highest value of the GPR relative to a 20-year lagged moving average, and zero otherwise. The country GPR spikes variable equals country GPR when country GPR is larger than two standard deviations relative to a 20-year lagged moving average, and zero otherwise. The war dummy equals one in the years 1914–1918 and 1939–1945. See online Appendix D for the list of countries. Disaster episode data were constructed using updated GDP and consumption per capita data from Barro and Ursúa (2012) and the methodology described in Nakamura et al. (2013).

et al. (2013): one before 1946, one for the period 1946 to 1972, and one for the period since 1973. The association of geopolitical risk with occurrence of disaster is only slightly attenuated. Finally, in columns 6 and 7 we follow the approach in Bazzi and Blattman (2014), replacing the disaster dummy with a dummy equal to one either at the onset or at the end of a disaster, and zero otherwise.<sup>21</sup> Column 6 shows that disasters are more likely to start, rather than occur and persist, at times of high geopolitical risk. A one standard deviation increase in country-specific geopolitical risk brings the probability of disaster onset from its historical mean of about 2.2 percent to 9 percent, an increase of 6.8 percentage points. Column 7 shows that high geopolitical risk also reduces the probability of the ending of a disaster, though the effects are smaller and more imprecise.

<sup>21</sup>The onset disaster dummy is one when  $D_{i,t} - D_{i,t-1} = 1$  and  $D_{i,t-1} = 0$ , zero in nondisaster years, and missing when both  $D_{i,t} = 1$  and  $D_{i,t-1} = 1$ . The ending of a disaster dummy treats all disaster years as zero, the year of the ending of a disaster as one, and all other years as missing.

The evidence in this subsection supports the idea that, historically, changes in geopolitical risk are associated with substantial variations in the probability of large declines in economic activity. Many economic disasters of the twentieth century took place during the world wars, the two global events in our sample. However, our estimates also demonstrate that regional and country-specific geopolitical events were associated with major economic crises.

### B. *Quantile Effects of Geopolitical Risk*

Throughout history, wars have at times destroyed human and physical capital, shifted resources from productive to less productive uses, and diverted international trade. At other times, wars have enabled larger labor force participation, better technological diffusion, and larger infrastructure spending (see Stein and Russett 1980). We use cross-country data and quantile regressions to evaluate how geopolitical risk is associated with the distribution of future economic growth. Suppose for instance that conflict is followed in some cases by faster, in some cases by slower growth, like in the United States and Germany during World War II, respectively. If that is the case, geopolitical risks may be associated with different outcomes at the low and high ends of the GDP growth distribution. To test this hypothesis, we run quantile regressions of the following form:

$$(2) \quad Q_{\tau}(\Delta y_{i,t+1} | x_{i,t}) = \alpha_{\tau} + \beta_{\tau} GPRC_{i,t}.$$

Above, we estimate the best linear predictor of the quantile  $\tau$  of variable  $\Delta y_{i,t+1}$  one year ahead, conditional on values of country-specific geopolitical risk, denoted by  $GPRC_{i,t}$  (the regressions also control for global geopolitical risk). As dependent variables, we consider GDP growth, total factor productivity (TFP) growth, and military spending as a share of GDP. We estimate equation (2) at different quantiles.

Table 4 shows the results. The ordinary least squares (OLS) estimates show that a rise in country-specific GPR predicts lower expected GDP growth, lower expected TFP growth, and higher expected military spending. The median effects (row labeled q50) have the same sign as the OLS estimates, though they are slightly smaller in magnitude, suggesting that the effects of GPR are somewhat larger during a crisis. The rows labeled q10 and q90 estimate equation (2) at the tenth and ninetieth quantiles. In line with the findings from the disaster risk regressions, a rise in the GPR index increases the probability of particularly adverse economic outcomes. The left tail of the GDP distribution, measured by the tenth quantile coefficient, shows a decline that is four times larger than the OLS effect, whereas the right tail of the distribution, measured by the ninetieth quantile, slightly increases. The conditional distributions of one-year-ahead TFP growth displays higher uncertainty, with both positive and negative tail events becoming more likely. Finally, the right tail of military spending moves disproportionately: elevated GPR predicts a risk of a large military buildup.

### V. *Geopolitical Risk and Firm-Level Investment*

In our last step, we provide evidence on the effects of geopolitical risk on investment using firm-level data. There are two questions that we are interested in. First,

TABLE 4—QUANTILE REGRESSION EFFECTS OF COUNTRY-SPECIFIC GEOPOLITICAL RISK

	GDP growth (t+1) (1)	TFP growth (t+1) (2)	Military exp. (t+1) (3)
OLS	−0.35 (0.22)	−0.22 (0.27)	2.15 (0.39)
Quantile			
q50	−0.24 (0.22)	−0.04 (0.14)	0.63 (0.19)
q10	−1.44 (0.63)	−1.86 (0.45)	0.16 (0.03)
q90	0.30 (0.30)	1.53 (0.55)	7.08 (0.55)
Observations	3,082	2,261	2,681
Countries	26	19	26

*Notes:* Standard errors, in parentheses, are bootstrapped using 500 replications. The table shows quantile regression effects of geopolitical risk in a panel of countries from 1900 through 2019. In each specification, the right-hand side variable is country-specific GPR in year  $t$  (standardized by country). The dependent variables are GDP growth, TFP growth, and military expenditures in year  $t+1$ , respectively. GDP growth and TFP growth are expressed in percent units. Military expenditures are expressed as a share of GDP. The OLS coefficients are reported in the top row. The quantile coefficients report the effects at the fiftieth, tenth, and ninetieth percentile of the distribution of the dependent variable. All regressions include an intercept and control for global geopolitical risk. Real GDP per capita data are from Barro and Ursúa (2012), extended through 2019 using the World Bank World Development Indicators. TFP data are from Bergeaud, Cetté, and Lecat (2016). Military expenditures are taken from Roser and Nagdy (2013).

do firms in industries more exposed to aggregate geopolitical risks experience a larger decline in investment? Second, are idiosyncratic geopolitical events at the level of the firm associated with fluctuations in investment?

### A. Measuring Geopolitical Risk across Firms and Industries

It is useful to think of firm-level geopolitical risk as embedding three components:

$$(3) \quad GPR_{i,t} = GPR_t + GPR_t \Lambda_k + Z_{i,t}$$

where the subscripts  $i$  and  $k$  denote firms and industries, respectively. The first component in equation (3) is aggregate GPR. The second component interacts aggregate GPR with industry exposure  $\Lambda_k$ , capturing the idea that some industries may be disproportionately affected by aggregate geopolitical risks. For instance, defense or petroleum companies may be particularly affected by geopolitical tensions in the Middle East, while airlines may be highly exposed to the fallout from terrorist attacks. The third component,  $Z_{i,t}$ , is idiosyncratic and isolates firm-level geopolitical risks that are not reflected at the aggregate and industry levels.

We first describe how we calculate industry exposure  $\Lambda_k$ . We regress daily portfolio returns in the 49 industry groups of Fama and French (1997) on changes in the daily GPR index:

$$(4) \quad R_{k,t} = \alpha_k + \beta_k \Delta GPR_t + \varepsilon_{k,t}$$

where  $R_{k,t}$  is the annualized daily excess return in industry  $k$  over the one month Treasury bill rate and  $\Delta GPR_t$  is the change in the daily GPR index. The sample runs from 1985 through 2019. Our idea is that stock returns in sectors with higher exposure drop relatively more than the aggregate market in response to spikes in the GPR index. By contrast, sectors with lower exposure tend to gain from geopolitical risks relative to the market. For instance, on September 17, 2001, the day the stock market reopened after 9/11, the returns in the transportation and precious metals sectors were  $-13$  and  $+7.4$  percent, respectively. This example underscores the importance of using daily data. Stock prices quickly react to news. Daily data also allow for a more granular taxonomy of geopolitical risks that, for episodes that do not dominate the news cycle for a prolonged period, is partly lost by aggregating data to monthly or quarterly frequencies.

We estimate the  $\beta_k$  coefficients in equation (4), demean them and change their sign so that positive values indicate high exposure. Figure A.8 in the online Appendix plots the average exposure by industry. Precious metals, petroleum, and defense are among the industries negatively exposed to increases in geopolitical risk. Shipping and transportation are among the industries with positive exposure. For our empirical application below, the exposure measure  $\Lambda_k$  is a dummy that equals one for industries with above-median exposure, and zero otherwise.<sup>22</sup>

Next, we turn to the measurement of idiosyncratic geopolitical risk  $Z_{i,t}$ . A company might face elevated geopolitical risks because it operates in countries whose events are not reflected in the aggregate and industry measure (e.g., an oil company operating in Gabon). Alternatively, a company could have unique and time-varying exposure to aggregate geopolitical events, due to its location, political connections, trade exposure, or risk-management strategies.

Following Hassan et al. (2019), we perform text analysis on the transcripts of quarterly earnings calls of US-listed firms. The sample runs from 2005:I through 2019:IV. We construct firm-level geopolitical risk by counting mentions of adverse geopolitical events and risks in the earnings calls. Specifically, we count the joint occurrences of “risk” words within ten words of “geopolitical” words, normalizing the counts by the total number of words in the transcript.<sup>23</sup> In online Appendix Figure A.9, we plot the GPR index alongside the index obtained by aggregating across firms, each quarter, the transcripts that discuss concerns about geopolitical risk. The correlation between the two indices is 0.19. The positive correlation, albeit calculated on a short sample, bolsters our confidence that investors’ and newspapers’ concerns about geopolitical events are aligned.

### B. Dynamic Effects of Industry-Specific Geopolitical Risk

We quantify the differential effects of geopolitical risk on investment across industries. Using Compustat data, we measure investment as the ratio of capital expenditures to previous-period property, plant, and equipment, and denote it by  $ik$ .

<sup>22</sup>The use of a dummy makes the estimation more robust to the exact quantification of exposure. Results using the  $\beta$  coefficients as a measure of exposure are similar and are shown in the online Appendix (Table A.7).

<sup>23</sup>See online Appendix E.3 for details. Examples of geopolitical words include “war,” “military,” “terror,” “conflict,” “coup,” and “embargo.” Examples of risk words include “risk,” “potential,” “danger,” “dispute,” “incident,” and “attack.”

We regress firm-level investment at various horizons against aggregate GPR interacted with industry exposure. Our baseline strategy follows the local projection approach developed by Jorda (2005). We estimate

$$(5) \quad \log ik_{i,t+h} = \alpha_{i,h} + \beta_h(\mathbb{D}_{\mathbb{K}} \Delta \log GPR_t) + \mathbf{d}_h \mathbf{X}_{i,t} + \varepsilon_{i,t+h},$$

where  $h \geq 0$  indices current and future quarters. The goal is to estimate, for each horizon  $h$ , the sequence of regression coefficients  $\beta_h$  associated with the interaction between aggregate geopolitical risk and industry exposure. In the equation above,  $\alpha_i$  denotes firm fixed effects. The term  $\mathbb{D}_{\mathbb{K}} \Delta \log GPR_t$  is the product of the industry exposure dummy times log changes in aggregate geopolitical risk. The term  $\mathbf{X}_{i,t}$  denotes control variables, namely firm-level cash flows, firm-level Tobin's Q, and the lagged value of  $\log ik_{i,t}$ .

The top panel of Figure 11 shows the differential response of firm-level investment to a two standard deviation aggregate GPR shock, for a firm belonging to an industry with high exposure to GPR. In the first year after the shock, an exposed firm experiences a decline in investment that is about 1 percentage point larger than its nonexposed counterpart. These estimates indicate that the negative repercussions of a typical spike in geopolitical risk on the investment rate vary depending on the industry of operation.

We conclude with a cautionary note on how to interpret our industry regressions. Our approach can be interpreted through the lens of a two-stage regression. In the first stage, we extract industry exposure by regressing stock returns on daily geopolitical risk industry-by-industry. In the second stage, we look at how investment responds to geopolitical risk depending on industry exposure. Accordingly, our second regression has the flavor of an instrumental variables regression of industry investment on industry stock returns where the instruments are industry dummies interacted with GPR. That said, our regression does not merely confirm that investment and stock prices are positively correlated, but also shows that movements in geopolitical risk affect some industries more than others, and that the differential effect is captured by the differential response of stock prices.<sup>24</sup>

### C. Dynamic Effects of Firm-Specific Geopolitical Risk

To assess the dynamic relationship between investment and geopolitical risk at the firm level, we estimate

$$(6) \quad \log ik_{i,t+h} = \alpha_{i,h} + \alpha_{k,t,h} + \gamma_h Z_{i,t} + \mathbf{d}_h \mathbf{X}_{i,t} + \varepsilon_{i,t+h}.$$

The goal is to estimate, for each horizon  $h \geq 0$ , the coefficient  $\gamma_h$  which measures the dynamic effect on investment of changes in firm-level geopolitical risk. The regression includes firm fixed effects ( $\alpha_i$ ) and sector-by-quarter dummies ( $\alpha_{k,t}$ ). Firm-control variables  $\mathbf{X}_{i,t}$  include firm-level cash flows, firm-level Tobin's Q, and  $\log ik_{i,t-1}$ .

<sup>24</sup> Alfaro, Bloom, and Lin (2018) look at differential firms exposure to energy prices, exchange rates, and economic uncertainty shocks and use the differential exposures to draw conclusions about the effects of uncertainty.

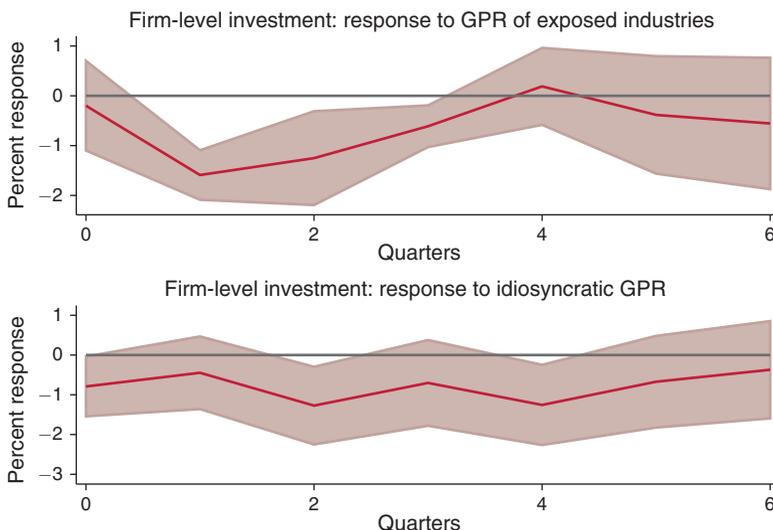


FIGURE 11. RESPONSE OF FIRM-LEVEL INVESTMENT TO GEOPOLITICAL RISK

Notes: The top panel plots the dynamic response of investment following a two standard deviation increase in aggregate GPR for a firm in an industry with positive exposure to geopolitical risk. The bottom panel plots the dynamic response of investment following a two standard deviation increase in firm-level GPR. The shaded areas denote 90 percent confidence intervals. Standard errors are two-way clustered by firm and quarter-industry.

Mentions of geopolitical risks in the text of the earnings calls are a proxy for  $GPR_{i,t}$ , as the typical earnings call of a firm contains references to idiosyncratic as well as aggregate and industry-specific geopolitical risks. To isolate the firm-specific component  $Z_{i,t}$ , we absorb the aggregate and industry-specific components by including in equation (6) sector-by-quarter dummies. Our sample runs from 2005:I through 2019:IV and is dictated by the availability of the earnings calls data.

The bottom panel of Figure 11 plots the response of firm-level investment (the sequence of coefficients  $\gamma_h$  at different horizons) after an increase in firm-level GPR of two standard deviations. Firms gradually reduce their investment over the two quarters after the shock, with investment declining more than 1 percent at the trough and staying below the baseline for up to one year.

#### D. Summary of Firm-Level Evidence

Table 5 summarizes the analysis, tabulating the investment response to changes in geopolitical risk at the firm and industry levels. We focus on the response of investment two quarters ahead, in line with the results from the local projections that show that changes in geopolitical risk materialize with a delay of one to two quarters. In columns 1 and 2, investment responds to changes in geopolitical risk more for industries with above-average exposure. In column 3, investment at the firm level is negatively associated with changes in firm-level geopolitical risk. Of note, in column 4, the response estimated with our firm-level variable is similar in sign and magnitude to the response of firm-level investment to firm-level *political*

TABLE 5—GEOPOLITICAL RISK AND FIRM-LEVEL INVESTMENT

$IK(t+2)$	(1)	(2)	(3)	(4)
$\Delta$ GPR $\times$ dummy industry exposure	-0.63 (0.29)	-0.64 (0.27)		
GPR firm level			-0.67 (0.30)	
$\Delta$ GPR	-1.39 (1.19)			
Political risk Hassan et al. (2019)				-0.75 (0.25)
Cash flow	2.72 (0.46)	2.78 (0.46)	2.67 (0.38)	2.48 (0.30)
Tobin's Q	8.91 (1.68)	7.93 (1.56)	9.31 (0.92)	9.47 (0.90)
$IK(t-1)$	0.31 (0.01)	0.30 (0.01)	0.24 (0.01)	0.26 (0.01)
Observations	374,727	374,727	95,073	112,161
Firm fixed effects	Yes	Yes	Yes	Yes
Time effects	No	Yes	Yes	Yes
$R^2$	0.45	0.47	0.59	0.58
Sample	85Q1–19Q4	85Q1–19Q4	05Q1–19Q4	05Q1–19Q4

Notes: Standard errors, in parentheses, are clustered by industry and quarter in columns 1 and 2, by firm and quarter-industry in columns 3 and 4. The table shows results from regressions of firm-level investment on geopolitical risk at the industry or at the firm level. The dependent variable  $IK$  is defined as  $100 \times \log ik$ , where  $ik$  is the ratio of capital expenditures to previous-period property, plant, and equipment, as defined in the text. All variables (except the dummy exposure variable) are standardized.

risk as measured by Hassan et al. (2019).<sup>25</sup> Overall, changes in geopolitical risks are associated with heterogeneous effects on firm investment, depending on the industry of operation and on firm-specific risks. The link between geopolitical risk and firm-level activity is significant, economically meaningful, and persistent over time.

## VI. Conclusions

We propose and implement indicators of geopolitical risk that measure the threat, realization, and escalation of adverse geopolitical events. A detailed set of validation exercises confirm that our GPR indices accurately capture the timing and intensity of adverse geopolitical events, both across countries and over time. Higher geopolitical risk foreshadows lower investment and is associated with higher disaster probability and larger downside risks to GDP growth. The adverse consequences of geopolitical risk are stronger for firms in more exposed industries, and high firm-level geopolitical risk is associated with lower firm-level investment.<sup>26</sup>

We conclude highlighting three areas for future research.

<sup>25</sup>The measure by Hassan et al. (2019) is a broader concept of risk at the firm level encompassing concerns for instance about the government budget, health care, trade, and national security.

<sup>26</sup>While we find that higher geopolitical risk is associated with adverse economic outcomes, we caution that our empirical analysis is limited to analyzing past historical events. Future geopolitical risks could take different forms and yield different economic effects than in the past.

First, an implicit hypothesis underlying the construction of our indices is that newspapers' attention to geopolitical events is an accurate measure of the perceptions of investors, economic agents, and policymakers. It would be useful in the future to extend our measurement exercise using additional sources, such as foreign-language publications, periodical country reports, or the transcripts of parliamentary debates.

Second, an important extension would be to investigate the international ramifications of geopolitical risks. Geopolitical risks can impact the price of risky assets and the flow of capital across countries. In a similar vein, tensions among countries can be an important force shaping trade flows and global supply chains through firms' actions and government policies.

Finally, in the empirical analysis, we have treated geopolitical risk as a driver of business fluctuations, highlighting a new force and a new set of shocks that economists have not traditionally emphasized. That said, an active literature in economics and political science has worked to better understand the causes of internal conflict and interstate warfare (see e.g., Blattman and Miguel 2010 and Jackson and Morelli 2011, among others). We hope that our measures can help researchers to better address these questions as well.

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