Measuring Geopolitical Risk

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Federal Reserve Board

DIW Berlin

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Geopolitical Risks Receive a Lot of Attention

Geopolitical Risks are often cited by policy-makers, investors, and media as key determinants of economic decisions.

Newmont Mining Corp. *(NEM) Cut to Hold*:
Posted by James Conley on Aug 22nd, 2016 // No Comments

company's production may also be affected by lower grades across specific mines and geopolitical issues.

Remarks by Chairman Alan Greenspan
Before the Economic Club of New York, New York City
December 19, 2002

argue by some as having been spawned by the one-off, became more intense. It has in turn damped capital investment and trimmed inventory plans. More recently, of course, geopolitical risk has risen markedly, further weighing on demand. Though unrelated to the bubble burst of 2000, it has muddied the evaluation of the post-bubble economy.

MARKET INSIDER with PATTI DOMM

Russian jet incident boosts geopolitical premium in oil

Europe ends sharply down on geopolitics; oil prices slide
Alexandra Gibbs | Arjun Kharpal | Holly Ellyatt
Wednesday, 6 Jan 2016 // 11:54 AM ET

Carney's chart showing doubling of geopolitical risk in wake of 9/11

Chart 1: Geopolitical risk doubled, on average, after 9/11

Draghi: Downside risks have increased amid heightened uncertainty about EM growth, volatility, geopolitical risk
But their Impact is Unclear

- Little research devoted to quantify geopolitical risks.
- Little research devoted to measure macroeconomic and financial impact of geopolitical risks.
- Many empires of the past, from the Roman empire to China’s Qing dynasty, were brought down by a combination of adverse geopolitical events.
- The economies of many countries (Syria, Libya, Yemen, Venezuela) have collapsed in recent years following wars and political unrest.
Relationship to the Literature on Uncertainty

- Recent research effort devoted to understand effects of macroeconomic uncertainty.

- Most proxies for uncertainty are based/related to economic and financial indicators (EPU, VIX, IVOL, RVOL, JLN, ...)
  - Endogeneity of these proxies.

- Events captured by our index are more exogenous to the macroeconomy than those captured by other uncertainty proxies.

- Periods of high uncertainty often result of shocks to first and higher order moments.
  - We distinguish between geopolitical acts and threats.
Our Questions

1. **How can we measure geopolitical risk?**

   - **Available indices** not very amenable to empirical analysis:
     - Capture very different events;
     - Constructed judgmentally;
     - Little variation or short sample availability;
     - Constructed as combinations of outcome variables (gold, VIX, dollar, oil prices).

2. **What are the real and financial effects of geopolitical risk?**
Definition of Geopolitical Risk

- Geopolitical risk is not a well-defined concept.
- We define geopolitical risk as the risk associated with wars, tensions between states, and terrorist acts that affect the normal course of international relations.
- Definition follows most common (and journalistic) usage, but leaves room for some judgement.
- It helps excluding some geopolitical phenomena:
  - Major economic crisis (e.g. Eurozone debt crisis)
  - Major democratic political events (e.g. Brexit)
  - Climate change, civil right movements, domestic terrorist acts...
The Methodology

- Our methodology follows Baker, Bloom, Davis (2016).

- We construct the geopolitical risk (GPR) index counting in 11 international newspapers the share of articles mentioning phrases related to geopolitical tensions.

- Benchmark index (from 1985):
  - U.S.: Boston Globe; Chicago Tribune; LA Times; NYT; WSJ; WaPo.
  - United Kingdom: Daily Telegraph; FT; Guardian; Times.
  - Canada: The Globe and Mail.

- Historical index (from 1899): NYT, Chicago Tribune, and FT

- GPR as covered by the English-speaking press.

- More weight to events with U.S. involvement.
Measurement

Not as Simple as Searching for 'Geopolitical' AND 'Risks'

- **Language** has changed:
  - Term ”Geopolitical risk” popular after 9/11
  - ”War risks” used to be ”War perils”
  - ”Terror Threats” used to be ”Terrorist Menaces”

- **News articles content** has changed:
  - Focus shifted from ’chronicles’ to ’opinions’.

- **Nature of risks** has changed:
  - From wars to nuclear threats to terrorism.

- We choose search categories through an auditing process and refinements using machine-learning algorithms.
Measurement
Building the Search Terms

- We define 6 search categories based on pilot (stage 1) auditing of articles likely mentioning geopolitical risks.

- Audit \( \mathcal{GP} \) set containing Geopolitics or War or Military or Terrorism/t – most RECURRING WORDS in geopolitics books.

- In 2,500 articles in \( \mathcal{GP} \) set, 35% discuss high geopolitical risk \( (\mathcal{GP} = 1) \).

- Most articles in \( \mathcal{GP} = 1 \) contain additional words related to risks or threats, tensions between states, beginning of wars.

- Construct search categories based on CONTENT OF ARTICLES in \( \mathcal{GP} = 1 \).

- Exclude from searches phrases overwhelmingly associated with false positives \( (\mathcal{GP} = 0) \) (e.g. movie, museum, anniversary, memorial, obituary, ”end of the war”).
# The Search Terms

<table>
<thead>
<tr>
<th>Search Category</th>
<th>Words</th>
</tr>
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<tbody>
<tr>
<td>1. Geopolitical Threats</td>
<td>Geopolitical AND (risk* OR concern* OR tension* OR uncertain*) AND &quot;United States&quot; AND tensions AND (military OR war OR geopolitical OR coup OR guerrilla OR warfare) AND (&quot;Latin America&quot; OR &quot;Central America&quot; OR &quot;South America&quot; OR Europe OR Africa OR &quot;Middle East&quot; OR &quot;Far East&quot; OR Asia)</td>
</tr>
<tr>
<td>2. Nuclear Threats</td>
<td>(&quot;nuclear war&quot; OR &quot;atomic war&quot; OR &quot;nuclear conflict&quot; OR &quot;atomic conflict&quot; OR &quot;nuclear missile&quot;) AND (fear* OR threat* OR risk* OR peril* OR menace*)</td>
</tr>
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<td>&quot;war risk&quot; OR &quot;risk of war&quot; OR &quot;fear of war&quot; OR &quot;war fear&quot; OR &quot;military threat&quot; OR &quot;war threat&quot; OR &quot;threat of war&quot; AND (&quot;military action&quot; OR &quot;military operation&quot; OR &quot;military force&quot;) AND (risk* OR threat*)</td>
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<td>4. Terrorist Threats</td>
<td>&quot;terrorist threat&quot; OR &quot;terrorist threats&quot; OR &quot;menace of terrorism&quot; OR &quot;terrorism menace&quot; OR &quot;threat of terrorism&quot; OR &quot;terrorist risk&quot; OR &quot;terror risk&quot; OR &quot;risk of terrorism&quot; OR &quot;terror threat&quot; OR &quot;terror threats&quot;</td>
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<tr>
<td>5. War Acts</td>
<td>(beginning OR outbreak OR onset OR escalation OR start) &quot;of the war&quot; AND (war OR military) AND (&quot;air strike&quot; OR &quot;heavy casualties&quot;)</td>
</tr>
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<td>6. Terrorist Acts</td>
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| **3. War Threats**       | "war risk" OR "risk" of war" OR "fear of war" OR "war fear" OR "military threat" OR "war threat" OR "threat of war"  
                          | ("military action" OR "military operation" OR "military force") AND (risk* OR threat*) |
| **4. Terrorist Threats** | "terrorist threat" OR "terrorist threats" OR "menace of terrorism" OR "terrorism menace" OR "threat of terrorism" OR "terrorist risk" OR "terror risk" OR "risk of terrorism" OR "terror threat" OR "terror threats" |
| **5. War Acts**          |                                                                                                                                 |
| **6. Terrorist Acts**    |                                                                                                                                 |
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The Benchmark Geopolitical Risk Index

GPR Benchmark Index (GPR)

Index (2000-2009 = 100)
The Benchmark Geopolitical Risk Index

GPR Benchmark Index (GPR)

https://www2.bc.edu/matteo-iacoviello/gpr.htm
**Geopolitical Threats vs. Geopolitical Acts**

- GPR index captures a convolution of shocks to first and higher order moments of the distribution of geopolitical events.
  - Spikes in risk often coincide with realization of big events.

- We organize searches to separate **threats** that do not immediately materialize from **acts** that reveal an underlying threat.
  - Geopolitical Threats (GPT): Search categories 1 to 4;
Geopolitical Threats vs Geopolitical Acts

Correlation coefficient: 0.55

GPR THREATS AND ACTS

Correlation between geopolitical threats and acts depicted through a line graph with events such as TWA Hijacking, Gulf War, 9/11, Iraq invasion, etc., shown with their respective years and magnitudes.
Geopolitical Threats vs Acts in 1991 and 2003

Gulf War

- GPR Threats
- GPR Acts

Iraq Invasion

- GPR Threats
- GPR Acts
Auditing: Reading and Manually Coding Articles

- **Stage 1:** Audit pilot sample of 2,500 articles from set \( G_P \) likely containing all articles mentioning geopolitical risk
  - Use this audit to refine search terms entering construction of GPR

- **Stage 2:** Audit sample of 2,500 articles from set \( G_P \) set
  - 87% mention high or rising geopolitical tensions.
  - 4% mention low or decreasing geopolitical tensions.
  - Correlation between GPR and audited-GPR is 0.98

- **Stage 3:** Audit 6,125 articles (50 per quarter) from \( G_P \) set to construct human GPR index
  - Code articles as 0/1 according to a 20-page Audit Guide
  - Correlation between computer-generated GPR index and Human Index is 84 percent (at quarterly frequency)

Audit is a long, tedious and painful process.
Comparison with Human Index

Quarterly Correlation: 0.84
Additional Checks

- **GPR BROAD**: Include words often associated with true positives (e.g. "military presence" OR "international terror*")

- **GPR NARROW**: Exclude words often associated with false positives (e.g. "death penalty" OR "supreme court")
GPR Robust to Adding/Removing Words

GPR Broad Raw

GPR Narrow Raw
The Historical Geopolitical Risk Index
The Historical Index: War Threats
The Historical Index: War Acts
The Historical Index: Nuclear Threats
The Historical Index: Terror Threats
The Historical Index: Terror Acts
Comparison with Human Index (Historical)

Quarterly Correlation: 0.80
Additional Checks

1. Could you do this with a simple index? No  

2. Could you use other available indicators? No

3. Do Economic News affect GPR? No

4. Do Other News affect GPR? No

5. How does it relate to VIX?

6. How does it relate to EPU?
1. Comparison, Naive Index

Naive index uses only: "war" OR "terrorism/t" OR "military" OR "geopolitics"
2. Comparison, International Crisis Database
3. Comparison: GPR No Econ Words

![Graph showing comparison of GPR and GPR excluding economic related terms over years 1985 to 2015.](image)
4. Comparison: GPR and Natural Disasters

![Comparison Graph]

- Loma Prieta Earthquake
- Northridge Earthquake
- Indian Ocean Earthquake
- Hurricane Katrina
- Tōhoku Earthquake

The graphs compare GPR with the Natural Disasters Index over the years 1985 to 2015.
5. Comparison with the VIX
6. Comparison: Economic Policy Uncertainty

![Graph showing comparison between GPR and EPU from 1985 to 2015]
6. Comparison: Economic Policy Uncertainty

The graph compares Economic Policy Uncertainty (EPU) and Generalized Policy Rule (GPR) over time. Key events highlighted include:

- **US bombs Libya**
- **Gulf War**
- **Kuwait invasion**
- **Black Monday**
- **Clinton Election**
- **Russian Crisis/LTCM**
- **Bush Election**
- **9/11**
- **Iraq invasion**
- **Lehman Failure and TARP**
- **Transatlantic aircraft plot**
- **London bombings**
- **Debt Ceiling Debate**
- **Euro Crisis**
- **Lehman Failure and TARP**
- **Euro Crisis**
- **Debt Ceiling Debate**
- **Fiscal Cliff**
- **Govt. Shutdown**
- **Russia annexes Crimea**
- **Ukraine and ISIS**
- **Paris attacks**

The graph shows fluctuations in EPU and GPR, with notable peaks coinciding with significant events.
Economic Effects of GPR

How could GPR matter?

1. Standard Uncertainty/Macro Channels. Test this using macro VAR.


3. Effects on Stock Returns.
Effects of Higher GPR: A VAR Analysis

- Sample: 1985M1 to 2016M12.

- US VAR:
  1. **GPR Index**;
  2. Economic Policy Uncertainty;
  3. 2-Year Treasury Yield;
  4. US industrial production;
  5. Oil price;
  6. S&P 500 Index;

- International VARs:
  1. **GPR Index**;
  2. Country/Region ’X’ industrial production;

**Identification**: GPR Index ordered 1st in Cholesky ordering.

Shock sized to match rise in GPR after major events
Impulse Responses to a GPR Shock

Effects on US Economy

- GPR Index
- EPU Index
- Consumer Sentiment
- Industrial Production
- Employment
- Gross Trade
- S&P500
- Real Oil Price
- 2-Year Treas. Yield
Impulse Responses to a GPR Shock
Excess Return Over S&P 500 - Selected Industries

Defense

Oil

Aircraft

Steel Works

Mining

Insurance
Impulse Responses to a GPR Shock
International Real Effects
Effects of Higher GPR: Threats vs Acts

- Same VAR as before, replace GPR with GPA and GPT.

- **Identification**: GPA ordered 1st and GPT 2nd in Cholesky ordering.
  - GPT shocks do not move GPA on impact.
  - GPA shocks move GPT on impact.
Impulse Responses to GPA and GPT Shocks
Effects on US Uncertainty
Impulse Responses to GPA and GPT Shocks
Effects on US Economy
Impulse Responses to GPA and GPT Shocks
Excess Return Over S&P 500 - Selected Industries (1)
Impulse Responses to GPA and GPT Shocks
Excess Return Over S&P 500 - Selected Industries (2)
# Geopolitical Risk and Capital Flows

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1) Inflows/GDP Emerging Economies</th>
<th>(2) Inflows/GDP Advanced Economies</th>
<th>(3) Inflows/GDP United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lagged Inflows</td>
<td>0.290 (0.0597)</td>
<td>0.141 (0.0530)</td>
<td>0.497 (0.0866)</td>
</tr>
<tr>
<td>GPR Index, standardized</td>
<td>-0.339 (0.146)</td>
<td>0.901 (0.323)</td>
<td>0.407 (0.382)</td>
</tr>
<tr>
<td>VIX, standardized</td>
<td>-1.116 (0.207)</td>
<td>-1.387 (0.666)</td>
<td>-0.995 (0.441)</td>
</tr>
<tr>
<td>Lagged GDP Growth</td>
<td>0.260 (0.0956)</td>
<td>1.975 (0.475)</td>
<td>-0.209 (0.726)</td>
</tr>
<tr>
<td>Constant</td>
<td>7.280 (0.836)</td>
<td>10.96 (1.551)</td>
<td>5.449 (1.808)</td>
</tr>
<tr>
<td>Observations</td>
<td>1,796</td>
<td>2,065</td>
<td>103</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.157</td>
<td>0.047</td>
<td>0.332</td>
</tr>
<tr>
<td>Number of country</td>
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<td>22</td>
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<tr>
<td>Country FE</td>
<td>YES</td>
<td>YES</td>
<td>—</td>
</tr>
<tr>
<td>Clustered SEs</td>
<td>YES</td>
<td>YES</td>
<td>—</td>
</tr>
</tbody>
</table>

Robust standard errors in parentheses.
# Geopolitical Risk and Stock Returns

**Table 3: GPR and Stock Market Returns**

<table>
<thead>
<tr>
<th>Country</th>
<th>GPR Benchmark</th>
<th>GPR Historical</th>
<th>GPR Historical, Post-1950</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>Std. Errors</td>
<td>Sample</td>
</tr>
<tr>
<td>Australia</td>
<td>-.45</td>
<td>.51</td>
<td>1985-2017</td>
</tr>
<tr>
<td>Austria</td>
<td>-.87</td>
<td>.81</td>
<td>1985-2017</td>
</tr>
<tr>
<td>Belgium</td>
<td>-2.29</td>
<td>.72</td>
<td>1985-2017</td>
</tr>
<tr>
<td>Canada</td>
<td>-1.06</td>
<td>.43</td>
<td>1985-2017</td>
</tr>
<tr>
<td>Denmark</td>
<td>-.92</td>
<td>.86</td>
<td>1985-2017</td>
</tr>
<tr>
<td>Finland</td>
<td>-.03</td>
<td>1.17</td>
<td>1985-2017</td>
</tr>
<tr>
<td>France</td>
<td>-2.05</td>
<td>.9</td>
<td>1985-2017</td>
</tr>
<tr>
<td>Ireland</td>
<td>-1.82</td>
<td>.93</td>
<td>1988-2017</td>
</tr>
<tr>
<td>Italy</td>
<td>-2.54</td>
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</tr>
</tbody>
</table>

*Note: Estimation of individual country effects of geopolitical risk on stock market returns. The table reports the estimated $\beta$’s for the following model: $r_{i,t} = \mu_i + \alpha_i GPRSHOCK_{i,t} + \epsilon_{i,t}$, where $r_{i,t}$ is stock market return in country $i$ in month $t$, and $GPRSHOCK_{i,t}$ is the residual of an AR(1) process estimated for GPR. Standard errors are corrected for autocorrelation using the Newey-West method. Source: Morgan Stanley Capital*
Conclusions

- We construct a quantitative measure of geopolitical risk
- We measure the economic effects of changes in geopolitical risk
- GPR index is perhaps more "exogenous" to economic conditions than other popular measures of risk and uncertainty.
- We are currently working on constructing country-specific GPR indexes.
Available Indices 1: Doomsday Clock
Available Indices 2: Geopolitical Heat Maps
Frequent Unigrams in Flint’s Geopolitics Textbook
Content of Articles in Pilot Auditing

Scatter plot of the 4 principal components from analysis of the top 50 bigrams from 2,500 newspaper abstracts classified as $\mathcal{E}^1$. 
What Does GPR Capture?

![Graph showing GPR and natural disasters index over time.](chart)

- **GPR** compared to **Natural Disasters Index**
- Key events: Loma Prieta Earthquake, Northridge Earthquake, Indian Ocean Earthquake, Hurricane Katrina, Tōhoku Earthquake
- Chart illustrates the impact of natural disasters on GPR over the years.
GPR Argentina

Argentina AND (tensions/risk*/fear/chaos/uncertainty/unrest/violence...)
AND (military/war/geopolitical/coup/guerrilla/warfare/army/terrorism)
GPR Brazil

GPR-BRAZIL

"9/11" Brazil elects leftist Currency War
Human Auditors

Aaron Markiewitz
Andrew Kane
Joshua Herman