BLACKROCK
INVESTMENT
INSTITUTE

BLACKROCK INVESTMENT INSTITUTE – JANUARY 2019

BlackRock geopolitical risk dashboard

Tom Donilon

Chairman,
BlackRock Investment Institute

Isabelle Mateos y Lago

Chief Multi-Asset Strategist,
BlackRock Investment Institute

Amer Bisat

Head of Sovereign and EM Alpha,
BlackRock Global Fixed Income

Kfir Godrich

Global Head, BlackRock
Technology and
Enterprise Services

Ron Ratcliffe

Member of BlackRock's Risk and
Quantitative Analysis group

Gerardo Rodriguez

Portfolio Manager,
BlackRock's EM group

We are upgrading the likelihood of three of our geopolitical risks, even as overall market attention to geopolitics has edged down recently. We see geopolitical risk as a material market factor in 2019, especially in an environment of slowing growth and elevated uncertainty about the economic and corporate earnings outlook. It's the risks investors are *not* focused on that tend to have the greatest market impact. With that in mind, we have chosen *Major cyberattack(s)* as our focus risk. These attacks are a growing threat to key physical, financial and technology infrastructure, yet also represent a market opportunity.

Our geopolitical risk dashboard features both data-driven market attention barometers and judgment- based assessments of our top-10 individual risks. We show the market attention to each risk, assess the likelihood of it occurring over a six-month horizon, and analyze its potential market impact. We adjust the market impact reading for how much each risk may already be priced into markets. The greater the market's attention to the risk, the lower the potential market impact. Lastly, we highlight assets sensitive to two key risks that are on the market's radar screen: *U.S.-China relations* and *European fragmentation*. Key points of our latest update:

We see trade remaining at the center of U.S. foreign policy in 2019. We are keeping the likelihood of our *U.S.-China relations* risk at a high level, despite a recently agreed 90-day trade truce. We could see a modest agreement that extends the tenuous truce, but expect structural tensions related to China's industrial policy and competition for global technology leadership to persist. We also keep our *Global trade tensions* risk unchanged for now, but could see it rising as the threat of U.S. tariffs on imported cars looms and ratification of the U.S. trade deal with Canada and Mexico becomes more uncertain. The market attention to both risks has nudged down, highlighting the potential for greater impact.

Market attention to our *European fragmentation* risk is among the highest on our list, and we have increased its likelihood of occurrence. We see major flare-ups in the next few months as unlikely but worry about a confluence of European political risks against a backdrop of slowing growth. Italy's populist government reached a compromise with the European Commission over the country's 2019 budget, but the agreement does little to improve Italy's medium-term fiscal outlook. Recent provincial elections in Spain and riots in France show the strength of populist sentiment. We believe Brexit negotiations are unlikely to conclude with a "no-deal exit" scenario, but expect twists and turns along the way. We don't see new leadership of the German CDU party changing Germany's approach to Europe.

We have upgraded the likelihood of two other risks: *Gulf tensions* and *Russia-NATO conflict*. In the Gulf, we see a prospect of additional Western sanctions against Saudi Arabia. Market attention to this risk has subsided a bit, but we have nudged up the likelihood of it occurring. In Eurasia, Russian ships' firing on Ukrainian boats marks a significant escalation in hostilities. This risk remains off the market's radar screen. We have reduced the likelihood of our *LatAm populism* risk as the conclusion of the Mexican and Brazilian elections has allowed uncertainty to recede.

Our focus risk this month is *Major cyberattack(s)*. We expect the volume and sophistication of cyberattacks to increase as the world grows more digitalized. We expect financial markets to pay increasing attention as the threat to critical infrastructure and companies rises. We address three cyber-related risks and opportunities with potential market implications: i) threats to critical infrastructure; ii) threats to individual corporations; and iii) opportunities in cybersecurity. At a geopolitical level, we see cyber warfare risks exacerbating existing tensions, while also providing an opportunity for greater cooperation between nations.

The effect of geopolitical shocks on global markets often is short-lived, according to our analysis of asset price reactions to 50 risk events since 1962, but can be more enduring in markets where the event occurs. The global impact has been more acute and long-lasting when the economic backdrop was weak. We see markets becoming more sensitive to geopolitical risks as global economic growth slows. We see U.S. Treasuries and gold providing a potential buffer against risk asset selloffs triggered by geopolitical crises. These perceived safe havens have historically rallied ahead of "known unknowns" such as elections, then lagged after the event as fading uncertainty boosted risk assets.

Tracking geopolitical risks and their market impact is as much an art as a science. We are continuously updating our risk scenarios and fine-tuning our methodologies. The scenarios are hypothetical, and our analyses related to market impact are not recommendations to invest in any particular investment strategy or product.

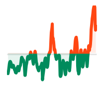
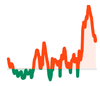
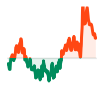
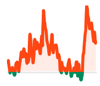
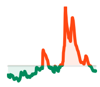
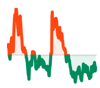
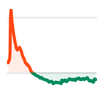
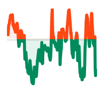
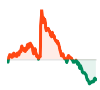
Contents

Global overview 2
Likelihood and impact 3
How it works 4
Market impact 5
Focus risk 6-7

Global overview

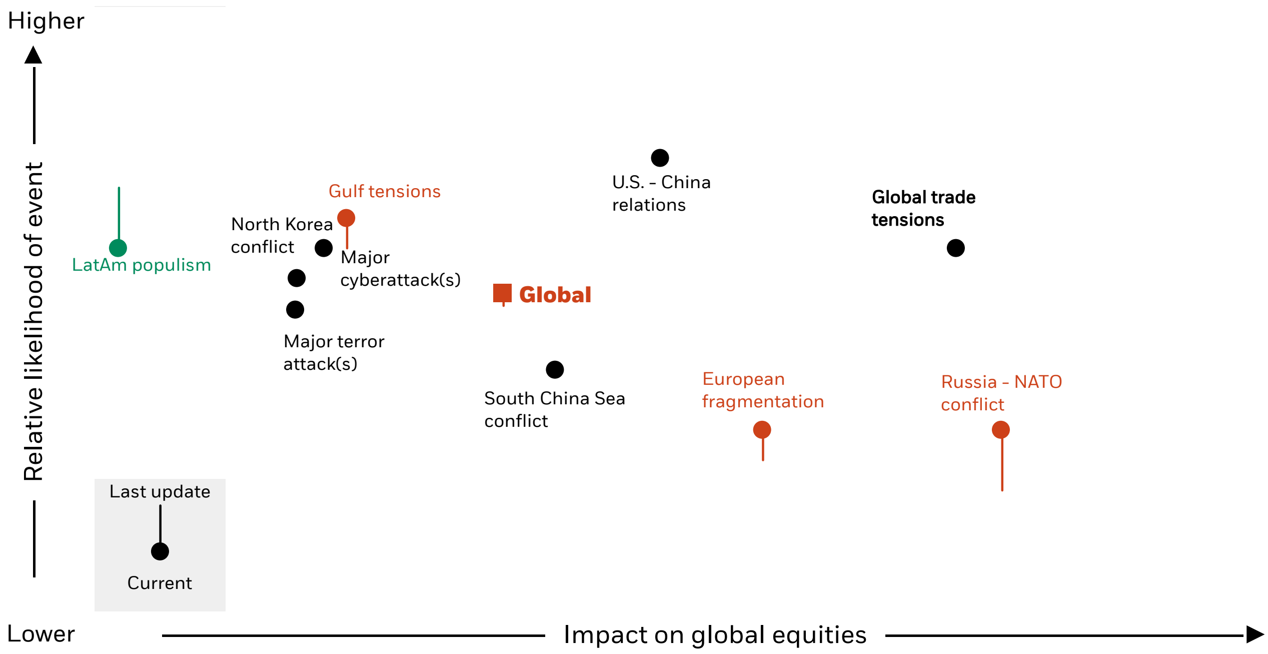
We take a bird's eye look at our top-10 geopolitical risks, describing the hypothetical scenarios that power our market impact and likelihood analysis as well as summarizing our views. We show our focus risk first, then list the other nine risks by level of market attention as measured by the BGRIs. We next show the latest reading of our global geopolitical risk barometer, and plot the risks in a graphic that shows each risk's relative likelihood and potential market impact.

Snapshot of top-10 geopolitical risks, January 2019

Risk	Scenario description	Our view	Risk index since 2014
Focus risk: Major cyberattack(s)	Cyberattacks increase in intensity and reach. Possibilities include attacks on the U.S. power grid, a breaching of the defenses of the global financial system, or hackers taking over key technology infrastructure and disrupting the operations of dependent industries.	Cyberattacks by state and non-state actors have increased in sophistication and quantity. We see a persistent risk of attacks on business-critical infrastructure and major elections — and would worry particularly about a nation state attacking the U.S.	
European fragmentation	Tensions between Italy's populist government and Brussels rise over spending rules and other policies, and Italy threatens to leave the bloc. This scenario focuses specifically on Italy, but we see rising populism, trade frictions and Brexit uncertainty posing additional challenges to Europe, especially considering a weak economic backdrop.	A budget agreement between Italy and the European Commission does little to improve the country's medium-term outlook, but postpones further confrontation until later in the year. We see a no-deal Brexit scenario as unlikely, but expect a bumpy road ahead.	
U.S. - China relations	The U.S. sets tariffs on nearly all Chinese imports. China retaliates with its own tariffs and adds roadblocks for U.S. business.	We believe the 90-day trade truce is fragile. We see an extended period of economic tensions longer term, and view rivalry in the tech sector and disputes over market access as fundamental points of contention.	
Global trade tensions	The U.S. escalates trade disputes, and U.S. allies impose retaliatory tariffs. The erstwhile champion of free trade plans to overhaul key multilateral trade agreements in response, further undermining the global trade web. Market sentiment deteriorates amid fears of a global trade war.	The U.S. has shaken up the system of global trade with the aim to reduce its trade deficit. The U.S. has China in its crosshairs, but we could see frictions with the EU rising, with the threat of auto tariffs still looming, and believe ratification of the U.S. trade deal with Canada and Mexico has become less certain.	
Gulf tensions	The war in Yemen escalates and internal strife in Saudi Arabia increases. U.S. sanctions hit companies doing business in Iran, roiling the Iranian economy and threatening a full unraveling of the nuclear deal.	Additional Western sanctions against Saudi Arabia could challenge economic and security ties with the country, and could impede its economic and social reform agenda. We do see pressure building for a political solution to the Yemen conflict.	
North Korea conflict	A U.S. surgical strike neutralizes North Korea's missile capabilities after the country carries out a new nuclear test. North Korea retaliates with scattered firing across the demilitarized zone but ultimately backs down.	We saw the risk of military conflict on the Korean peninsula reduced sharply following the June summit between the U.S. and North Korea. Follow-on negotiations may derail on implementation and verification, and we see potential for talks to break down.	
South China Sea conflict	The Chinese navy exchanges fire with a regional country's forces after the accidental sinking of a fishing boat near the disputed Spratly Islands. The countries withdraw their ambassadors, and the U.S. steps up naval exercises in the area.	The U.S. is taking steps to increase its local presence following further Chinese militarization of the region over the summer. We see potential for an accidental or deliberate clash between China and another regional country.	
Russia - NATO conflict	Simmering tensions between Russia and the West boil over due to an accidental clash between a Russian and NATO fighter jet. This leads to mutual recriminations, military preparations and potential for direct conflict.	Tensions remain high between Russia and the West. We could see them increasing further as the West confronts Russian activities in Ukraine, the Middle East and in cyberspace.	
LatAm populism	Populist policies in Brazil and Mexico take shape and erode investor confidence. U.S.-Mexico relations deteriorate across a range of social, political and economic issues.	Early indications of the new Mexican government's near-term policy priorities make us a bit cautious on the economy and asset prices. Newly elected Brazilian President Jair Bolsonaro has appointed business-friendly technocrats in his cabinet, boding well for markets.	
Major terror attack(s)	Terror attacks in a major Western European city cause significant casualties. Investigations pinpoint a network originating in the Middle East and active in the U.S., prompting the U.S. and NATO allies to start planning for a military response against Middle East militants.	Most assaults now are carried out by autonomous cells or individuals. We see this risk as greatest if an attack triggers domestic strife or U.S. military retaliation against a suspected state actor.	

Source: BlackRock Investment Institute, January 2019. Notes: The table shows the top-10 geopolitical risks identified by the BlackRock Geopolitical Risk Steering Group. The list is topped by our bi-monthly focus risk; other risks are organized by level of market attention as indicated by the BlackRock Geopolitical Risk Indicator for each. See the "How it works" section on page 4 for details.

Relative likelihood and market impact of risks



Forward-looking estimates may not come to pass. Source: BlackRock Investment Institute. January 2019.
Notes: The graphic depicts BlackRock's estimates of the relative likelihood (vertical axis) of the risks over the next six months and their potential market impact on the MSCI ACWI Index (horizontal axis). The market impact estimates are based on analysis from BlackRock's Risk and Quantitative Analysis group. See the How it works section on our Geopolitical risk dashboard and the 2018 paper Market Driven Scenarios: An Approach for Plausible Scenario Construction for details. The chart shows our original estimate of market impact at the time the scenario was conceived. The Global dot represents our overall assessment of geopolitical risk. Its likelihood score is based on a simple average of our top-10 risks; the market impact is a weighted average by likelihood score of 10 risks. Some of the scenarios we envision do not have precedents – or only imperfect ones. The scenarios are for illustrative purposes only and do not reflect all possible outcomes as geopolitical risks are ever-evolving. Colored lines and dots show whether BlackRock's Geopolitical Risk Steering Committee has increased (orange), decreased (green) or left unchanged (black) the relative likelihood of any of the risks from our previous update. The chart is meant for illustrative purposes only.

The risk likelihood and impact chart shows our assessment of the relative likelihood of our top-10 risks and the potential severity of their market impact. Our geopolitical experts identify potential escalation triggers for each risk and then assess the most likely manifestation of the risk over the next six months. The relative likelihood of each event (vertical axis) is then measured relative to the remaining risks. The severity of market impact (horizontal axis) is based on Market-Driven Scenarios (MDS) analysis from our Risk and Quantitative Analysis group and estimates the one-month impact of each risk on global equities (as measured by the MSCI ACWI) if it were to come to pass. Colored lines and dots show whether BlackRock's Geopolitical Risk Steering Committee has increased (orange) or decreased (green) the relative likelihood of any of the risks from our previous update. We also show our overall assessment of geopolitical risk. Its likelihood score is based on a simple average of our top-10 risks; the market impact is a weighted average by likelihood score of our 10 risks.

The chart shows the changes in our assessment of four risks:

Russia-NATO conflict: risk up

- Russian ships fired on and seized three Ukrainian boats off the coast of Russian-annexed Crimea in November. Ukraine has since lifted martial law, but tensions remain elevated. Western nations have condemned Russia's use of force and may impose a fresh round of sanctions.
- The U.S. Treasury announced new sanctions against Russians accused of electoral interference, hacking and the UK nerve agent attack.
- NATO formally accused Russia of breaching the 1987 Intermediate-range Nuclear Forces Treaty, which banned land-based nuclear missiles in Europe. The U.S. has threatened to withdraw from the agreement within 60 days if Russia fails to become compliant with the treaty's terms.

European fragmentation: risk up

- Italy and the European Commission ended a long-standing battle over Italy's 2019 budget, agreeing to a reduced budget deficit of 2.04% of GDP. The revisions mostly delayed spending to future years rather than meaningfully changing Italy's fiscal path. This tees up another confrontation between Rome and Brussels.
- The "gilet-jaune" protests illustrate the strength of populist sentiment in France. President Emmanuel Macron has effectively abandoned his reform agenda, loosening fiscal policy to appease an angry electorate. We see populist parties targeting the European parliamentary elections in May as an opportunity to strengthen their grip.
- Brexit talks remain gridlocked after the withdrawal agreement negotiated by Prime Minister Theresa May and the EU was heavily defeated in UK parliament. The EU is taking a wait-and-see attitude but may soften its stance if the UK shifts previous red lines. A delay in the Brexit process appears increasingly likely, although a "no-deal exit" scenario cannot be ruled out. A second referendum or a general election may be required to break the deadlock.

Gulf tensions: risk up

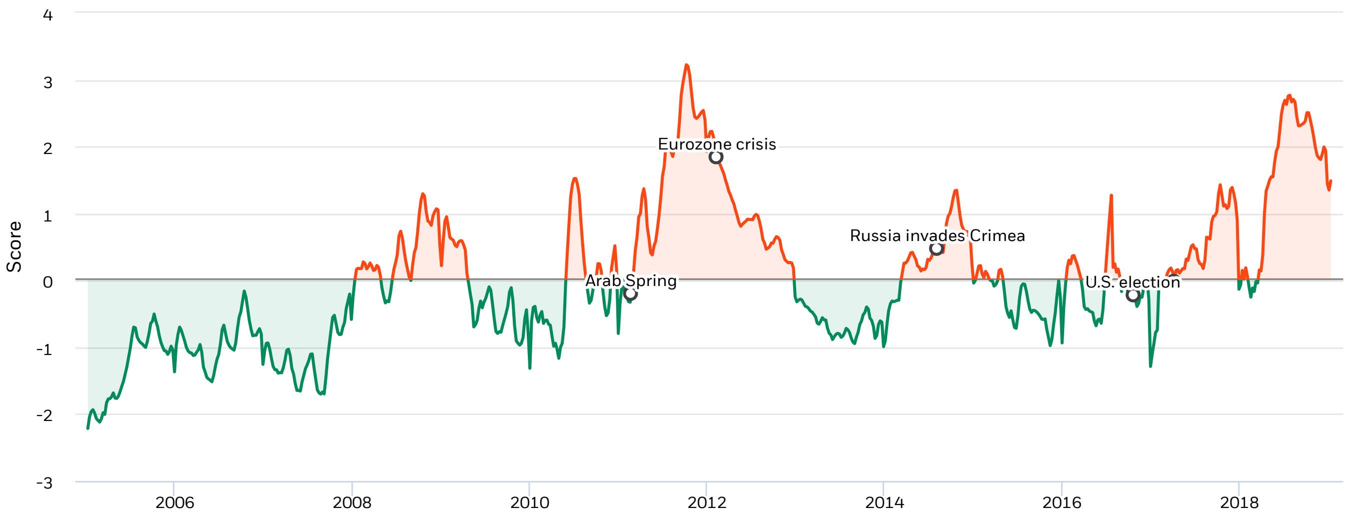
- The mission of Saudi Crown Prince Mohammed bin Salman (MBS) to diversify Saudi's economy is under increasing strain amid the killing of a prominent Saudi journalist critical of the regime and a protracted war in Yemen.
- Momentum is building for legislation imposing sanctions against individuals and entities considered responsible for the humanitarian crisis in Yemen. The U.S. Senate voted in December to end U.S. involvement in the Yemen war and approved a resolution to hold MBS responsible for the death of the Saudi journalist.

LatAm populism: risk down

- In Brazil, far-right Jair Bolsonaro decisively won the presidential election, and early policy signals indicate a pro-business approach. Newly appointed technocratic cabinet members look committed to build on the reform agenda put in place over the past two years. These reforms – spending curbs, privatizations and a loosening of labor market laws – have supported a gradual economic recovery.
- In Mexico, early indications of the new government's near-term policy priorities make us a bit cautious on the economy and asset prices. However, with the uncertainty of elections out of the way, markets may breathe a bit easier.

How it works

BlackRock Global Risk Indicator



Source: BlackRock Investment Institute, with data from Thomson Reuters. Data as of January 11, 2019. Notes: We identify specific words related to geopolitical risk in general and to our top-10 risks. We then use text analysis to calculate the frequency of their appearance in the Thomson Reuters Broker Report and Dow Jones Global Newswire databases as well as on Twitter. We then adjust for whether the language reflects positive or negative sentiment, and assign a score. A zero score represents the average BGRI level over its history from 2003 up to that point in time. A score of one means the BGRI level is one standard deviation above the average. We weigh recent readings more heavily in calculating the average. We recently improved the methodology of our global BGRI, tying it closely to our other risks and updating the keywords. The chart may look different from previous updates as a result.

The **BlackRock Geopolitical Risk Indicator (BGRI)** continuously tracks the relative frequency of analyst reports, financial news stories and tweets associated with geopolitical risks. We have used the Thomson Reuters Broker Report and the Dow Jones Global Newswire databases as sources, and recently added the one million most popular tweets each week from Twitter-verified accounts. We calculate the frequency of words that relate to geopolitical risk, adjust for positive and negative sentiment in the text of articles or tweets, and then assign a score. We assign a much heavier weight to brokerage reports than to the other data sources because we want to measure the *market's* attention to any particular risk, not the *public's.*

Our global BlackRock Geopolitical Risk Indicator has edged down but is still well above its historical average, driven by heightened market attention to our *Global trade tensions, U.S.-China relations, Gulf tensions* and *European fragmentation* risks. See the *Global overview* chart. We view recent declines in attention to each of these four risks as a sign that markets may be growing complacent. We advocate caution instead, and have either upgraded or held steady the likelihood of these four risks.

The BGRI is primarily a market attention indicator, gauging to what extent market-related content is focused on geopolitical risk. The higher the index, the more financial analysts and media are referring to geopolitics.

We also take into account whether the market focus is couched in relative positive or negative sentiment. For example, market attention on geopolitical risks was extremely high during the Arab Spring of 2011. Much of the attention was focused on the potentially positive effects of the regime changes, however. The adjustment for this positive sentiment mitigated the Arab Spring's impact on the BGRI's level. Sentiment adjustment also helps us avoid overstating geopolitical risk when risks actually are being resolved.

Here's the step-by-step process:

1. **BGRI attention:** This is the market attention score. The global BGRI uses words selected to denote broad geopolitical risks. Local BGRIs identify an anchor phrase specific to the risk (e.g., North Korea) and related words (e.g., missile, test). A cross-functional group of portfolio managers, geopolitical experts and risk managers agrees on key words for each risk and validates the resulting historical moves in the relevant BGRI. The group reviews the key words regularly.

2. **BGRI sentiment:** This is the sentiment score. We use a proprietary dictionary of about 150 "positive sentiment" words and 150 "negative sentiment" words. We use a weighted moving average that puts more emphasis on recent documents.

3. **BGRI total score:** This is BGRI attention — (0.2 * BGRI sentiment). We want the indicator to fundamentally measure market attention, so we put a much greater weight on the attention score. A 20% weight of the sentiment score can mitigate spikes at times when risk may actually be receding.

4. **Meaning of the score:** A zero score represents the average BGRI level over its history from 2003 up to that point in time. A score of one means the BGRI level is one standard deviation above the average. We weigh recent readings more heavily in calculating the average.

Market impact

Our MDS framework forms the basis for our scenarios and estimates of the one-month impact on global equities. The first step is precise definition of our scenarios – and well -defined catalysts (or escalation triggers) for their occurrence. We then use an econometric framework to translate the various scenario outcomes into plausible shocks to a global set of market indexes and risk factors.

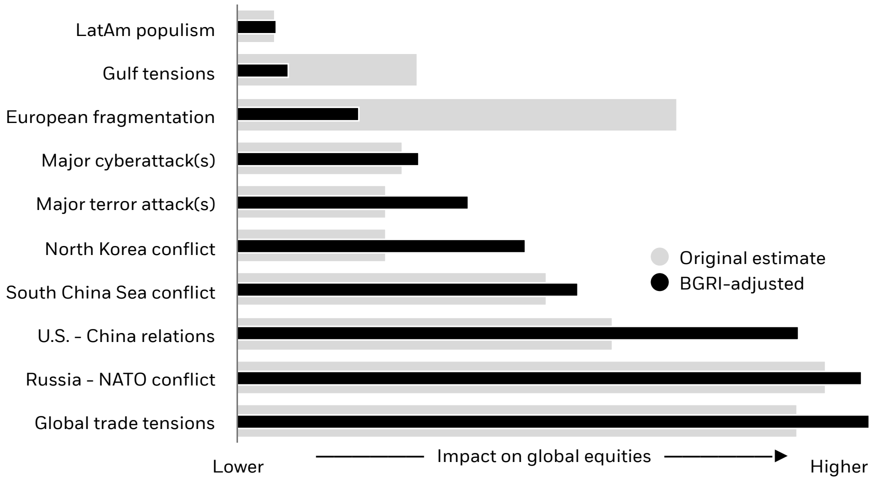
The size of the shocks is calibrated by various techniques, including analysis of historical periods that resemble the risk scenario. Recent historical parallels are assigned greater weight. Some of the scenarios we envision do not have precedents – and many have only imperfect ones. This is why we integrate the views of BlackRock's experts in geopolitical risk, portfolio management, and Risk and Quantitative Analysis into our framework. See the 2018 paper Market Driven Scenarios: An Approach for Plausible Scenario Construction for details. The BGRI's risk scenario is for illustrative purposes only and does not reflect all possible outcomes as geopolitical risks are ever-evolving.

BGRI-adjusted market impact

We enhance our market impact analysis by adjusting the market impact scores to reflect shifting market attention over time. When scenarios are first defined, market shocks are calibrated to reflect what is not already priced in to the market by investors. We call this the original estimate.

As market attention fluctuates, the BGRI-adjusted market impact either increases or decreases in severity based on how market attention evolves. For example, an elevated BGRI level relative to the point at which a scenario is first defined would suggest an increase in investor attention. This would result in a less severe BGRI-adjusted market impact relative to our original estimate. The converse result — in the case of a depressed BGRI level — would also hold. We determine a factor that scales the size of the BGRI move since the date of our original market impact estimate to calculate the BGRI-adjusted market impact. We use a sigmoid function to do so, or a statistical technique that is characterized by an S-shaped curve. We then multiply our original estimate of the market impact by (1 – scaling factor) to reach the BGRI- adjusted market impact score.

Market impact of risks

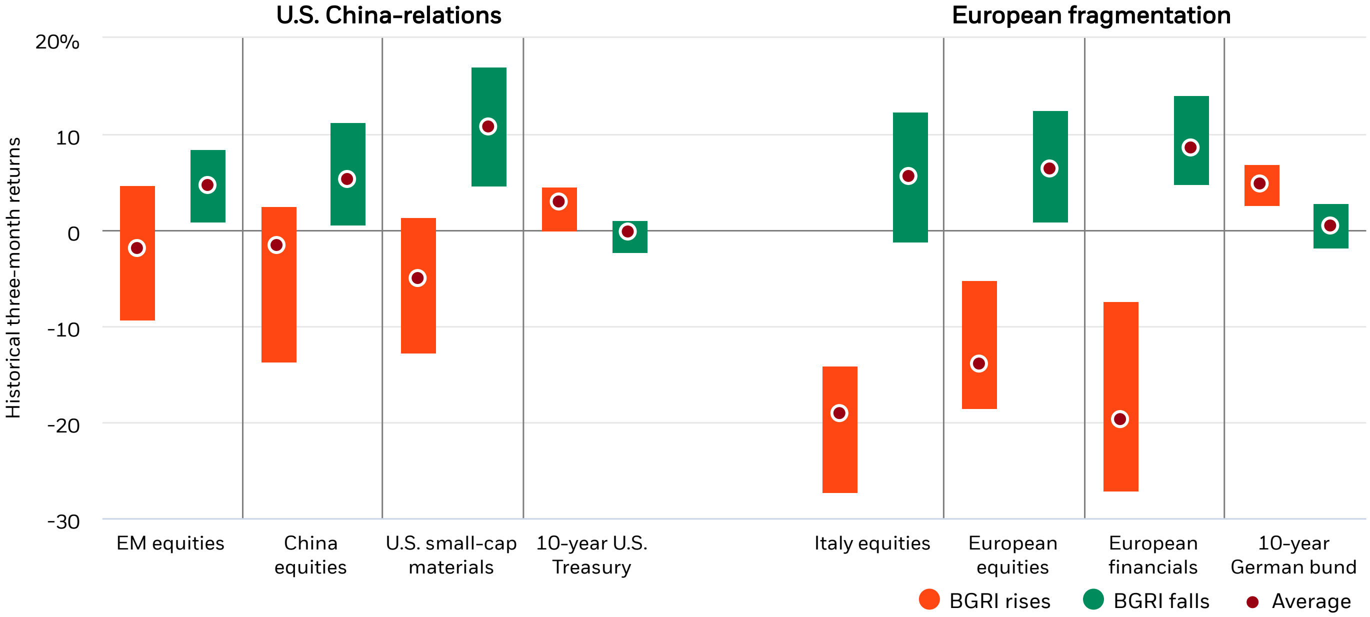


Source: BlackRock Investment Institute, with data from Thomson Reuters. Notes: The chart shows our estimates of the potential market impact on the MSCI ACWI Index, the grey bar shows our original estimate, the black bars show the adjusted impact based on the level of the BGRI. For example, an elevated BGRI level for a risk would suggest increased investor attention and therefore a lower BGRI-adjusted market impact. Estimates are based on analysis from BlackRock's Risk and Quantitative Analysis group. See the How it works section and the 2018 paper Market Driven Scenarios: An Approach for Plausible Scenario Construction for details. Some of the scenarios we envision do not have precedents – or only imperfect ones. The scenarios are for illustrative purposes only and do not reflect all possible outcomes as geopolitical risks are ever-evolving. Original estimates are based on the analysis run on the following dates:
LatAm populism: March 21, 2018
Gulf tensions: March 6, 2018
European fragmentation: July 3, 2018
Major cyberattack(s): December 18, 2018
Major terror attack(s): November 3, 2017
North Korea conflict: June 2, 2017
South China Sea conflict: April 23, 2018
U.S. - China relations: June 11, 2018
Russia - NATO conflict: April 23, 2018
Global trade tensions: June 11, 2018

BGRI-specific asset analysis

We are now working to pinpoint assets that have moved along with big changes in individual BGRIs, based on statistically meaningful relationships. We have focused on two risks that are solidly on the market's radar screen: *U.S.-China relations* and *European fragmentation*. The chart below shows the historical ranges of three-month returns for selected assets in three-month periods when the respective BGRI rose (the orange bars) or fell (the green bars) by more than one standard deviation. The analysis focused on three dozen assets we believed are related to these two risks.

Risk assets generally underperformed, and perceived safe-haven assets outperformed, in this analysis. We include times the BGRIs stayed at elevated levels over the three-month time frame. The reason: The level of the BGRIs changes over time even if market attention remains constant. This is to reflect the concept that a consistently high level of market attention eventually becomes "normal." In other words, the effects of elevated BGRIs wash out over longer periods as investors become more accustomed to the risk. Such declines have often coincided with risk asset rallies.

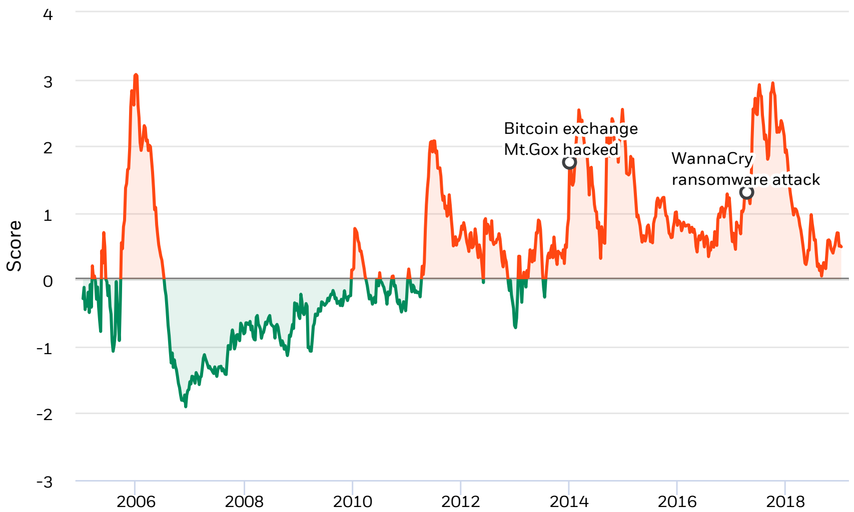


Past performance is not a reliable indicator of future results. This information is not intended as a recommendation to invest in any particular asset class or strategy or as a promise - or even estimate - of future performance. Source: BlackRock Investment Institute, with data from Thomson Reuters. Data as of January 11, 2019. Notes: The chart shows the 25%–75% percentile ranges (bars) and average three-month returns (dots) for selected assets during rolling three-month periods when the BlackRock Geopolitical Risk Indicator rises or falls by more than one standard deviation. MSCI USD indexes price returns are used for equities, and Thomson Reuters benchmark indexes total returns are used for government bonds.

Focus risk

Major cyberattack(s)

BlackRock Geopolitical Risk Indicator



Risk scenario description:

Cyberattacks increase in intensity and reach. Possibilities include attacks on the U.S. power grid, a breaching of the defenses of the global financial system, or hackers taking over key technology infrastructure and disrupting the operations of dependent industries.

Our view:

Cyberattacks by state and non-state actors have increased in sophistication and quantity. We see a persistent risk of attacks on business-critical infrastructure and major elections — and would worry particularly about a nation state attacking the U.S.

Source: BlackRock Investment Institute, with data from Thomson Reuters. Data as of January 11, 2019. Notes: We identify specific words related to this geopolitical risk in general and to our top -10 risks. We then use text analysis to calculate the frequency of their appearance in the Thomson Reuters Broker Report and Dow Jones Global Newswire databases as well as on Twitter. We then adjust for whether the language reflects positive or negative sentiment, and assign a score. A zero score represents the average BGRI level over its history from 2003 up to that point in time. A score of one means the BGRI level is one standard deviation above the average. We weigh recent readings more heavily in calculating the average. The BGRI's risk scenario is for illustrative purposes only and does not reflect all possible outcomes as geopolitical risks are ever-evolving.

Background

- The volume and sophistication of cyberattacks on critical physical, financial and technology infrastructure have been increasing.
- Digital warfare is becoming an important tool for nation states to interfere in the domestic affairs of rivals.
- We see cyberattacks on critical infrastructure as a growing economic, political and market risk.

Key recent developments

- A data breach affecting 500 million customers of a hotel chain illustrates the vulnerabilities of companies during extended merger periods.
- The U.S. Secretary of Homeland Security has described the spread of malware and other cyber threats as a pandemic. U.S. company executives and intelligence officials have cited persistent attempts by Russian military intelligence to infiltrate control rooms of power plants.
- The recently implemented General Data Protection Regulation (GDPR) in Europe requires companies to publicly disclose data breaches to national data protection authorities and to individuals when the threat of harm is significant.
- The International Monetary Fund has recognized cyberattacks as posing a threat to the financial system, describing cyber risk as a "textbook example of a systemic risk," given how interconnected financial institutions and markets are.
- Some 50 nations and hundreds of companies have signed on to a pact to thwart election hacking and intellectual property theft. Major cyber powers — including the U.S., China, Russia, Iran, Israel and North Korea — have abstained from the deal, likely hoping to avoid non-binding restrictions on their cyber activities.

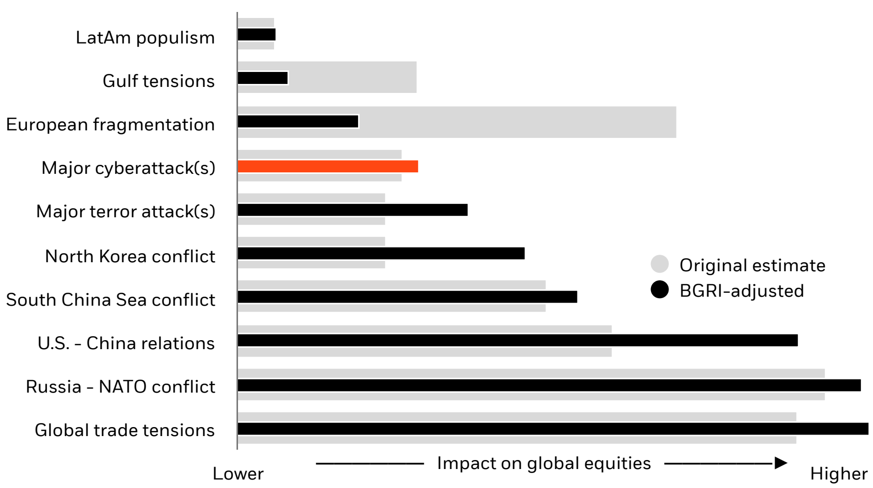
Escalation triggers

- Major cyber interference in a Western election that is directly linked to a nation state.
- A cyberattack that significantly disrupts critical physical, financial or technology infrastructure.

Potential market implications

- Global risk assets sell off and investors flee to perceived safe-haven assets. Market moves reverse within a few days.
- Industries most at risk are utilities, information security, communications, financials and energy.
- We find limited market attention to this risk, indicating its occurrence could have a high impact on global equities.

Market impact of risks



Source: BlackRock Investment Institute, with data from Thomson Reuters.
Notes: The chart shows our estimates of the potential market impact on the MSCI ACWI Index. The grey bar shows our original estimate, whereas the black and orange bars show the adjusted impact based on the level of the BGRI. For example, an elevated BGRI level for a risk would suggest increased investor attention and therefore a lower BGRI-adjusted market impact. The market impact estimates are based on analysis from BlackRock's Risk and Quantitative Analysis group. See the How it works section and the 2018 paper Market Driven Scenarios: An Approach for Plausible Scenario Construction for details. Some of the scenarios we envision do not have precedents – or only imperfect ones. The scenarios are for illustrative purposes only and do not reflect all possible outcomes as geopolitical risks are ever-evolving. The original estimate for Major cyberattack(s) is based on the scenario analysis run on December 18, 2018.

Focus risk

Major cyberattack(s)

The BGRI for our *Major cyberattack(s)* risk is hovering above its historical average, signaling moderate market attention to this risk. Yet cyberattacks are increasing in scope and intensity. We believe markets are underestimating the impact of cyberattacks as four broad trends are converging:

1. Both the opportunity for attack and the threat posed are rising as the world becomes increasingly digitalized. The increased use of artificial intelligence in business also heightens exposure to cyber risks.

2. The proliferation of Internet-connected devices and availability of open source code have lowered the barriers to entry for cyber crimes. Cyber actors across the world vary in sophistication and capability, ranging from well-funded government agencies to poorly resourced criminal groups and terrorist networks.

3. Digital warfare is becoming an important tool of statecraft, allowing countries to pursue their geopolitical and economic objectives through a wider variety of means. In 2016, NATO expanded its definition of "war domains" beyond air, land and sea to include cyberspace.

4. Defensive capabilities have been slow to evolve. In fact, many organizations have effectively conceded that their infrastructure will be breached, and are instead focusing on minimizing the ensuing damage. In the U.S., more than 50 federal, state and local laws mandate disclosure of cyber breaches to regulators or affected consumers. In Europe, the recently implemented General Data Protection Regulation (GDPR) requires companies to publicly disclose data breaches to national data protection authorities and to individuals when the threat of harm is significant. Failure to do so can result in substantial fines.

As the cyber threat rises, we expect financial markets to pay increasing attention. We see three cyber-related risks and opportunities with a potential market impact: threats to critical infrastructure; threats to specific corporates; and opportunities for cybersecurity.

1. **Threats to critical infrastructure**

   > *Physical infrastructure:* Modern economic activity depends on the availability of electricity, meaning any significant interruption to power supply could directly damage assets and infrastructure and force a loss in sales revenue to electricity supply companies and the businesses that rely on them. Our analysis of the potential impact of an attack on the U.S. power grid shows equity market sell-offs, led by utilities and industrials. U.S. Treasuries, the yen and gold would rally. Utility credit spreads would widen, and natural gas rally as an alternative resource.

   > *Financial infrastructure:* The IMF has now recognized cyberattacks as posing a systemic risk to the financial system. Attacks in advanced economies typically target data or business disruptions, while attacks in emerging markets are more frequently related to fraud. We see the market impact in such a scenario exacerbated by a drop in confidence among market participants. We could see financial stocks leading a global risk-off reaction; Treasuries and gold rallying; and the U.S. dollar benefiting from broad risk aversion and foreign investors liquidating overseas assets to meet margin calls.

   > *Technology infrastructure:* A cyberattack on technology infrastructure could result in a prolonged outage. This may cause significant disruption and loss of business to industries that rely on these services, as well as reputational damage for the data, storage and internet providers. The effects of such an outage could cascade through supply chains and to other industries such as insurers. We believe large-cap companies would underperform smaller companies, as the top technology service providers and their clients tend to be larger companies. We see the Internet software and services, retail, and insurance industries suffering the most.

2. **Threats to specific corporations:** Many companies have witnessed sharp share price declines after disclosing cyberattacks in recent years. Attacks have typically targeted companies with large amounts of personal data. Data is a double-edged sword: It has huge value in allowing companies to understand customer trends, but also becomes an enormous burden to protect. The IMF estimated in 2017 that the cost of cyber losses to the U.S. economy range between 0.6% to 2.2% of GDP a year , although this is more than offset by the positive contribution from Internet-based activity. Major financial services and tech companies are often targets but tend to have advanced defenses. We see the utility, energy and defense sectors as among the most vulnerable, although they are now increasing their spending on cybersecurity. Across all industries, risks to watch include companies involved in drawn-out mergers, and firms that rely heavily on third-party vendors.

3. **Opportunities in cybersecurity:** It is broadly accepted within the technology industry that no cybersecurity provider is able to provide a comprehensive solution — the scope of the threat is too broad. Companies' chief security officers are charged with patching together a wide range of tools. The existing technology has its faults, but we believe spending is extremely durable given regulatory requirements to demonstrate preventative technology is in place. We find opportunities in four main areas.

   > *Cloud computing:* Some see cloud technology as vulnerable to an attack, but others believe shifting operations to "the cloud" is one of the best ways to protect against cyberattack. Technology companies are offering two types of cloud-based solutions. The first provides cloud-based network services, making the servers that were previously hackable redundant. The second aims to negate the impact of hack attempts: All of a company's IP traffic is sent to the cloud, cleaned and returned to the company. This is a thorough method to prevent cyberattacks, but it comes at the cost of speed.

   > *Network segmentation:* An alternative approach sees companies focusing the bulk of their technology spending on software that "fragments" the network to minimize the damage of a potential cyber risk, rather than looking to prevent hackers from gaining entry altogether. The company is alerted when a hacker has gained access to a very small part of a database/server, and the company can then shut down that part of the operation until the attack is nullified.

   > *Identity:* User verification is one of the biggest challenges in cybersecurity. Systems are much harder to hack if there is constant verification. This means companies offering solutions that implement regular checks via single sign-on are in increasing demand.

   > *Blockchain*: Distributed ledgers store information in multiple locations across a single network, meaning that if hackers succeeded in altering one record, it can instantly be identified as different to other records in the system. Blockchain technology is also offering improved data encryption, and producing new and more secure ways of controlling network access, including through multi-signature and multi-party computation cryptography. This can eliminate the need for password-based security systems.

BLACKROCK INVESTMENT INSTITUTE

The BlackRock Investment Institute (BII) provides connectivity between BlackRock's portfolio managers; originates economic, markets and portfolio construction research; and publishes investment insights. Our goals are to help our portfolio managers become even better investors and to produce thought-provoking investment content for clients and policymakers.