Geopolitical Risk and Commodities: An Investigation

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Introduction

World newsflow is frequently dominated by geopolitical risk, whether belligerent North Korean rhetoric and actions, the raging Syrian civil war, or the multifaceted situation in other parts of the Middle East. Meanwhile President Trump's election has seen the U.S. become increasingly insular, leaving a potential power vacuum in many parts of the world that strong-arm leaders such as China's President Xi and Russia's President Putin are seeking to exploit. Autocratic rulers are becoming more commonplace in other countries such as Turkey whilst populist parties are enjoying varying degrees of electoral success in many parts of Europe such as the Netherlands, Hungary, Poland, Italy and Greece. After more than half a century during which countries sought to become increasingly amicably interconnected, that trend now appears to be in reverse.

It is therefore notable that many of the world's commodity resources are located in countries generally considered less politically stable (LPS). For the purposes of this report we will define such countries as those ranked in the bottom two quintiles of the World Bank's Political Stability and Absence of Violence / Terrorism indices. Concentrations of reserves located in LPS countries are shown in Table 1 for various commodities (mostly metals) and vary from 28.9% for copper to 69.2% for oil. With the exception of copper, the proportion of reserves located in LPS countries is above 45%.

The second column of the table shows LPS production as a proportion of the total. The share of LPS production exceeds the share of LPS reserves for all commodities analyzed apart from oil.

The last three columns of the table illustrate the extent to which the developed world is dependent on LPS countries for the supply of the highlighted commodities:

- The proportion of reserves and production in and from LPS countries exceeds by some margin the share of global GDP represented by those countries;
- The U.S. relies on commodity imports to satisfy a variable but often significant proportion of its commodity consumption (in four out of eight metals U.S. import reliance is at least 75%);
- The U.S. imports a significant proportion of its commodities from LPS countries.

Table 1
Global Commodity Reserves Located in LPS Countries

	% of Reserves in LPS Countries	LPS Production as % of Total	% of Global GDP of LPS Countries	US Import Reliance as % of Consumption	% US Imports from LPS Countries
Bauxite & Alumina	51.0%	59.6%	34.6%	81.8%	29.9%
Copper	28.9%	40.2%	23.7%	34.0%	16.0%
Iron Ore	48.2%	57.5%	33.5%	12.1%	29.0%
Lead	47.7%	74.2%	33.5%	30.0%	25.0%
Nickel	46.4%	70.3%	28.5%	25.0%	8.0%
Oil	69.2%	60.4%	44.5%	-	-
Rare Earths	70.7%	89.0%	24.0%	100.0%	63.0%
Tin	83.5%	92.7%	29.1%	75.0%	31.0%
Zinc	45.4%	68.6%	28.1%	82.0%	72.0%

Sources: World Bank, IMF, U.S. Geological Survey, EFG calculations.

Given the potential for LPS country and regional instability to disrupt commodity supplies, it is surprising that so little has been written regarding the linkages between geopolitics and commodity prices. Moreover, what has been written generally concentrates on the impact of geopolitics on oil. Hughes and Lipscy (2013) provide a useful overview of the literature on the subject.

Focusing on the potential for supply side disruption due to geopolitical events seems natural, although doing so implicitly assumes a chain of causality from geopolitical instability to supply shocks to prices. Yet the direction of causality is questionable.

One narrative evolves around an exogenous geopolitical shock precipitating a spike in certain commodity prices. An alternative narrative describes a world in which commodity price changes breed economic instability which in turn is a factor in generating or amplifying geopolitical uncertainty. For example, the reliance of many Middle Eastern countries on oil export revenues, as shown in Table 2, is well known.

Table 2
Oil Reliance: General Government Fiscal Balances

	Non-Oil Fiscal Balance as % of Non-Oil GDP		Fiscal Balance as % of GDP	
	Projections		Projections	
	2017	2018	2017	2018
MENAP Oil Exporters	-28.0%	-25.5%	-5.7%	-4.6%
Algeria	-20.4	-17.7	-3.5	-1.2
Bahrain	-30.6	-28.5	-13.2	-11.9
Iran	-11.3	-10.6	-2.2	-2.2
Iraq	-49.9	-45.1	-5.1	-4.7
Kuwait	-55.5	-54.4	1.5	1.5
Oman	-44.5	-41.7	-13.0	-11.4
Qatar	-26.6	-22.6	-1.0	0.5
Saudi Arabia	-35.9	-32.6	-8.6	-7.2
United Arab Emirates	-18.3	-16.1	-3.7	-2.2
Yemen	-13.6	-15.9	-9.9	-6.6
CCA Oil and Gas Exporters	-17.6	-12.9	-3.3	-0.7
Azerbaijan	-29.5	-25.7	-0.3	0.7
Kazakhstan	-16.0	-10.3	-6.6	-2.0
Turkmenistan	-5.6	-4.7	-1.1	-0.1

Source: *IMF Regional Economic Outlook: Middle East and Central Asia*, October 2017.
Abbreviations: MENAP stands for Middle East, North Africa, and Pakistan; and CCA stands for Caucasus and Central Asia.

The term, "Dutch disease," is often used to describe such a narrative, whereby a country becomes overly reliant on exports of a commodity with which it is naturally endowed; when the price of that commodity drops the country suffers an outsized negative shock.[1] An important question therefore relates to the direction of causality between geopolitical uncertainty and commodity prices.

This paper seeks to explore these issues in an attempt to answer the question. The next section discusses how to define and measure geopolitical uncertainty. Having found an appropriate metric, a vector autoregressive (VAR) model is estimated to address the fundamental research question highlighted above. Results are then presented and discussed.

Measuring Geopolitical Risk

Geopolitical risk is hard to define, or at least to do so in a precise way. It is therefore also hard to measure. And without measurement, we can't perform statistical analysis.

Numerous attempts over the years have attempted to define and measure geopolitical risk, with varying degrees of success. Geopolitics for Investors written by Pippa Malmgren for the CFA Institute Research Foundation provides an excellent discussion across a broad range of pertinent issues. In it she notes, "No one can accurately predict what will happen on the geopolitical landscape. But as part of their fiduciary responsibility, fund managers can and should assess how much value is created by geopolitical stability or destroyed by geopolitical instability."

For investors to be able to assess the impact of geopolitics on the investment outlook there are two broad approaches: (i) subjective and (ii) quantitative. The subjective approach requires a variety of inputs from which a holistic assessment can be made. Such approaches are typically enormously time consuming, involving as they do the collection, collation, assessment and interpretation of large amounts of information, much of which is not quantitative. Margolis (2012) describes such an approach as used by the CIA. The quantitative approach relies on the generation of indices that seek to express in a single number the degree of risk inherent in a particular country or region. Whilst it takes time and effort to construct these quantitative indices, they are highly convenient for the user from an analytical perspective since the information is encapsulated in a single data point that can be quickly and easily utilized.

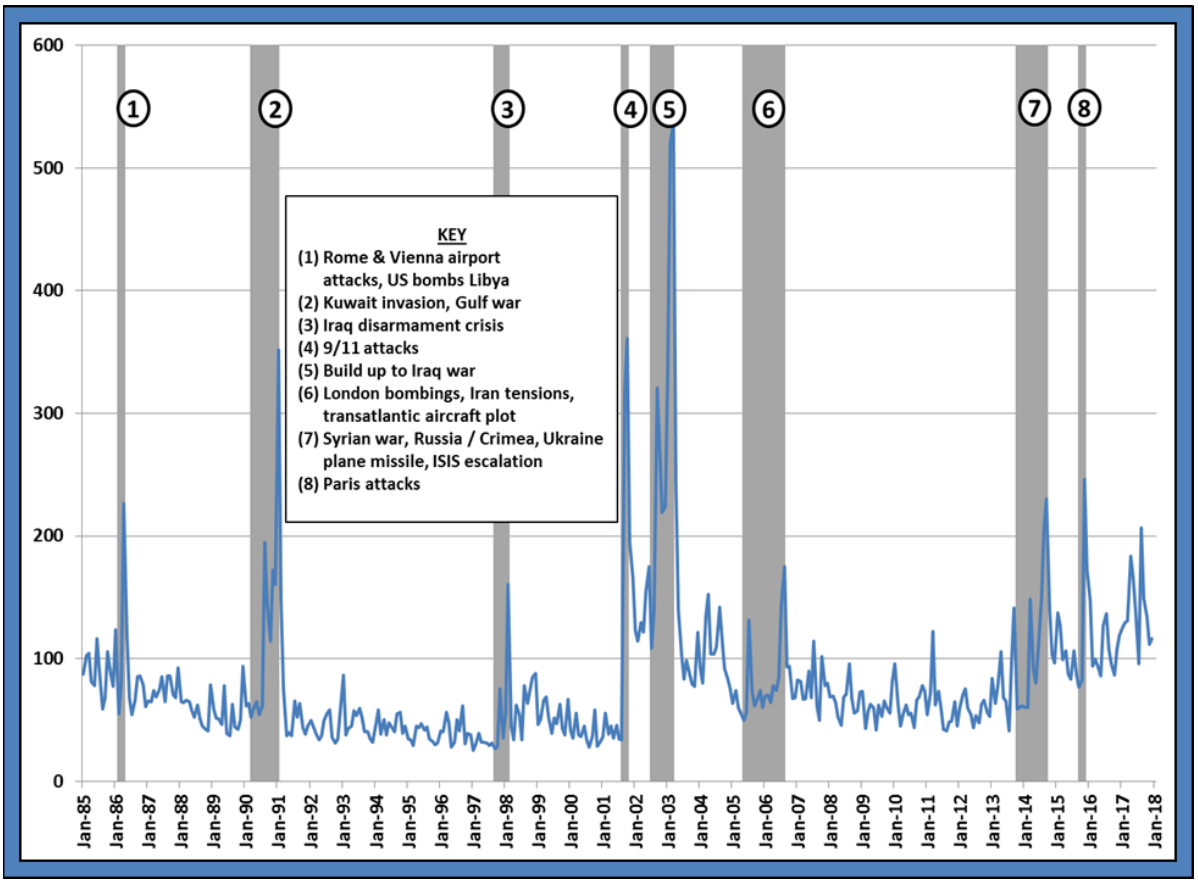
The World Bank index mentioned above is an example of one such quantitative measure. Other examples include the Political Instability Index produced by the Economist Intelligence Unit, the Index of State Weakness from the Brookings Institute, the Fragile States Index by the Fund for Peace, Predata's Geopolitical Volatility Index and the State Fragility Index from the Centre for Systemic Peace. All have their merits and limitations. Some are updated irregularly or infrequently whilst others have limited history. Many share similar methodologies that rank countries – sometimes subjectively – across different dimensions such as political, economic and social factors and then combine these metrics into an aggregate index.

The output from these indices rarely produces any surprises: it simply confirms what we already know. Countries generally perceived as being riskier have the worst scores whilst the top ranks are dominated by so-called developed world countries. For the purposes of answering the research question central to this report, such indices are of limited use. For a geopolitical risk index to be useful for the desired analysis, we need a long history of regularly and frequently updated data that is limited in terms of its subjective influences. The index also needs to be freely and easily available. It is fortunate that two Federal Reserve economists have recently produced an index fitting this description.

Caldara and Iacoviello (2017) produce geopolitical risk (GPR) indices based on the count of certain words in the media, specifically within 11 internationally recognized and respected English language newspapers. Technology facilitates relatively straightforward production of the index (and sub-indices) since the word search can be conducted electronically. Electronic records for all 11 newspapers start in

1985, which is when the index begins. A longer running version starting in 1900 can be produced using electronic records for three of the publications. Figure 1 shows the full index from 1985.

Figure 1
Geopolitical Risk Index (GPR)



Source: Matteo Iacoviello's website (https://www2.bc.edu/matteo-iacoviello/gpr.htm#data).

It is notable that the GPR index has been in a rising trend over the past few years, reflecting in a quantitative way the discussion in the opening paragraph. Whilst there have been occasional spikes since the lull in the early 2010s, none have matched those seen in the early 2000s or early 1990s in terms of scale.

Preliminary Analysis

A preliminary and informal analysis of the relationship between the GPR and different financial indices is shown in Table 3. Each row in the table represents a period during which the GPR spiked, as highlighted in Figure 1. For example, the row representing the period from March 1990 to January 1991 reflects the spike in geopolitical risk associated with Iraq's invasion of Kuwait and the ensuing Gulf War. Data for the VIX index of implied volatility begins in 1990.

Table 3
The GPR and the Behavior of Financial Indices

				Percent Change in:						
	Start	End	Change in GPR	WTI Oil	Gold	GSCI	S&P 500	DXY	Change in VIX	Change in T10 Yield
1	Feb-86	Apr-86	179.4	0.8%	2.2%	0.4%	3.8%	-2.6%	-	-8.0%
2	Mar-90	Jan-91	326.7	7.8%	-0.7%	-2.1%	1.2%	-12.6%	1.2%	-6.2%
3	Sep-97	Feb-98	140.1	-26.8%	-10.4%	-18.2%	10.8%	2.8%	-4.4%	-4.8%
4	Aug-01	Oct-01	330.9	-22.1%	2.0%	-13.6%	-6.5%	1.3%	8.6%	-6.0%
5	Jul-02	Mar-03	416.7	14.9%	11.1%	14.2%	-7.0%	-7.9%	-2.9%	-6.6%
6	May-05	Aug-06	119.6	35.2%	50.2%	31.3%	9.4%	-3.1%	-1.0%	7.4%
7	Oct-13	Sep-14	165.5	-5.4%	-8.7%	-7.7%	12.3%	7.2%	2.6%	-0.7%
8	Sep-15	Nov-15	176.2	-7.6%	-7.6%	-6.5%	8.4%	4.0%	-8.4%	1.7%
	# Occasions the Index Rallied			4	4	3	6	4	3	2
	# Occasions the Index Sold Off			4	4	5	2	4	4	6
	WTI = West Texas Intermediate DXY = Trade weighted US dollar T10 = ten year US Treasury bond					GSCI = Goldman Sachs Commodity Index VIX = implied volatility index				

Sources: Caldara and Iacoviello (2017), Bloomberg, EFG calculations.

The last two rows of the table provide a count of the number of times each of the different financial indices rallied and sold off. For the purposes of clarity, a rally in the VIX signifies an increase in implied volatility whilst a rally in the T10 note yield represents a sell-off in the Ten-Year Treasury note (an increase in yield). An environment of heightened geopolitical risk might reasonably be expected *a priori* to be associated with increases in oil, gold, the VIX and the Ten-Year Treasury note (declining yield) with a sell-off anticipated in the S&P500. However, the simple count analysis shows the results are far from clear cut. Furthermore, not only are the moves often relatively small with no clear directional bias, but it is also true that in some instances the movement is in the opposite direction to that anticipated.

Thus, the S&P500 index has rallied on more occasions than it has sold off whilst a related observation is that the VIX index declined on more occasions than it increased. Perhaps the only financial metric to have behaved broadly as expected is the Ten-Year Treasury yield, which has indeed demonstrated a tendency to decline when the GPR has spiked. With regard to commodities, the GSCI data is inconclusive, rallying on some occasions and selling off on others, often by quite large orders of magnitude in both directions.

This simple analysis suggests there is some ambiguity regarding the relationship between geopolitical risk and financial indices. However, the analysis focusses on only eight specific periods and does not investigate issues related to causality nor how the variables respond to shocks. This latter point is of particular interest given the volatile and unpredictable nature of geopolitical risk. To investigate these issues we have performed a vector autoregressive (VAR) analysis, which is discussed in the next section.

VAR Analysis

There are three pertinent questions in which we are interested:

(i) What, if any, is the causal relationship between geopolitical risk and commodity prices?
(ii) Has the nature of the relationships changed since the global financial crisis (GFC)?
(iii) How do the variables respond to shocks?

To answer these questions a VAR analysis was performed using the following variables:

(1) GPR $GSCI_i$ VIX SP DXY T10 IP

Where:
GPR = Global Political Risk index
SP = S&P500 index
T10 = Ten-Year U.S. Treasury yield
VIX = implied volatility index
DXY = trade weighted US dollar
IP = U.S. industrial production

And $GSCI_i$ represents the aggregate and sub-indices of the S&P Goldman Sachs Commodity Index (GSCI) where i = T (Aggregate), AG (Agriculture), EN (Energy), IND (Industrial Metals), LIVS (Livestock) and PM (Precious Metals)

All variables are expressed in log differences apart from GPR and VIX which are in levels. All variables are stationary after transformation.

The VIX term is included to take into account general market risk as distinct from geopolitical risk. The SP, DXY and T10 terms are included to allow for interaction between the variables and financial markets whilst the IP term represents the broad U.S. economic cycle. Each model formulation was estimated using monthly data over three time periods: Whole Sample is from January 1990 to November 2017; Pre-GFC is from January 1990 to December 2007; and Post-GFC is from January 2008 to November 2017.

Granger Causality

The primary relationship in which we are interested in this paper is that between commodities and geopolitical risk. For the sake of brevity and ease of interpretation Granger causality test results related only to that relationship are shown in Tables A1a-f in Appendix A.

There are a number of interesting results:

- There appears to be no Granger causality in either direction between $GSCI_T$ and GPR although the relationship appears to be stronger from $GSCI_T$ to GPR than the other way round.
- However, the analysis suggests that $GSCI_T$ did Granger cause GPR pre-GFC but that the relationship has subsequently broken down.
- Performing similar analysis using the commodity sub-indices shows that:

- Over the whole sample, evidence of Granger causality is found from $GSCI_{IND}$ to GPR and from GPR to $GSCI_{LIVS}$.
- Pre-GFC there is evidence of Granger causality from $GSCI_{IND}$ and $GSCI_{EN}$ to GPR and to a lesser extent from $GSCI_{PM}$ to GPR.
- Pre-GFC there is also some evidence in support of Granger causality from the GPR to $GSCI_{LIVS}$ and $GSCI_{PM}$.
- Post-GFC there is evidence of Granger causality from $GSCI_{PM}$ to the GPR but not for any other commodity sub-index.
- Post-GFC there is no evidence in support of Granger causality from the GPR to any of the commodity sub-indices.

Impulse Responses

Impulse response functions (IRFs) from GPR to $GSCI_i$ and from $GSCI_i$ to GPR are shown in Appendix B. In all cases the Cholesky ordering follows the order of variables shown in (1) above. The charts show the impact of a one standard deviation shock to GPR on $GSCI_i$ and also the impact of a one standard deviation shock to $GSCI_i$ on GPR. The results are summarized as follows:

- Shocks to the various $GSCI_i$ indices do not appear to have much of an impact on GPR. In all cases across almost all time periods the ±2 standard error range encapsulates 0.
- The message is less clear cut in terms of the impact of a 1 standard deviation GPR shock on $GSCI_i$. In three out of six instances there appears to be little impact ($GSCI_{AG}$, $GSCI_{IND}$, $GSCI_{LIVS}$).
- However, a shock to GPR appears to impact positively $GSCI_T$ and $GSCI_{EN}$ and, to a lesser extent, $GSCI_{PM}$.

Discussion and Conclusions

This paper has investigated the relationship between geopolitical risk and commodity prices, something on which there is a notable dearth of academic literature. A possible reason why the literature is lacking in this regard is that the measurement of geopolitical risk is not straightforward. What is more, even though several measures do exist, they do not easily lend themselves to statistical enquiry. The recently produced GPR index remedies many of the issues associated with other such metrics, permitting much easier analysis. A simple event study of the relationship between this measure of geopolitical risk and financial indices suggests that periods during which geopolitical risk spikes are associated with ambiguous movements in those indices. Moreover, the direction of some of the moves is contrary to what one might have anticipated.

A VAR analysis allows deeper investigation of the relationships. It is interesting to note that there is evidence of Granger causality from commodity prices to the geopolitical risk index in the years preceding the GFC but not afterwards. One can speculate as to why that might have been: to what extent were commodity prices and geopolitical risk impacted by the enormous strains on the financial system that engulfed the world during the GFC? And what was the impact of the unprecedented monetary policy response that followed and which is only now slowly being reversed? Under what conditions might we expect that causal relationship to reassert itself? Furthermore, to what extent have

the fundamental supply-and-demand conditions for commodities changed over the years, for example due to the trend towards cleaner energy or the rise of China? These are all interesting questions for future work.

Impulse response analysis is not particularly revealing. It suggests some impact from a geopolitical shock to commodity prices and in particular energy prices. This perhaps reflects the observation made in the introduction that the world is highly dependent on oil from LPS countries. There is little to highlight other than that. This is perhaps interesting in itself because it is in contrast with commonly held views about the impact of heightened geopolitical risk on certain financial markets.[2]

In addition to the questions highlighted above, there are a number of other issues worthy of further investigation. For example, it is known that differences exist in the timing of production and consumption cycles associated with various commodities and also that there are regional biases. It may be that incorporating such factors into the analysis enhances the work. That may necessitate a more granular approach to thinking about commodities - in this paper high level indices have been used but it would be interesting to explore the usage of individual commodity prices in the analysis. Similarly, it may also be informative to examine relationships between the slope of commodity futures curves and geopolitical risk.

One further thought is that the analysis has focused on short term relationships between the various indices. However, at least in some instances geopolitical risk takes several years to evolve before it erupts. It would therefore also be interesting to explore the longer term dynamics of geopolitical risk and its relationship with commodity markets.

A final comment relates to the underlying nature of geopolitical risk and its interaction with financial markets. Surges in geopolitical risk tend to be events with unique characteristics, some of which require a policy response but many of which don't. Hence, the reaction of financial markets to a geopolitical event will depend to some extent on the nature of the policy response.

Appendix A: Granger Causality

The numbers in the tables represent probabilities that the Null (dependent variable is not Granger caused by the explanatory variables) cannot be rejected. A high (low) probability signifies that the Null cannot (can) be rejected.

Table A1a. Granger Causality: Geopolitical Risk and Commodities

		Jan-90 to Nov-17		Jan-90 to Dec-07		Jan-08 to Nov-17	
		Dependent		Dependent		Dependent	
		GPR	$GSCI_T$	GPR	$GSCI_T$	GPR	$GSCI_T$
Explanatory	GPR		0.3832		0.2157		0.8909
	$GSCI_T$	0.110		0.0129		0.9701	

Table A1b. Granger Causality: Geopolitical Risk and Agricultural Commodities

		Jan-90 to Nov-17		Jan-90 to Dec-07		Jan-08 to Nov-17	
		Dependent		Dependent		Dependent	
		GPR	$GSCI_{AG}$	GPR	$GSCI_{AG}$	GPR	$GSCI_{AG}$
Explanatory	GPR		0.6283		0.3163		0.9487
	$GSCI_{AG}$	0.8572		0.9114		0.6434	

Table A1c. Granger Causality: Geopolitical Risk and Energy Commodities

		Jan-90 to Nov-17		Jan-90 to Dec-07		Jan-08 to Nov-17	
		Dependent		Dependent		Dependent	
		GPR	$GSCI_{EN}$	GPR	$GSCI_{EN}$	GPR	$GSCI_{EN}$
Explanatory	GPR		0.2471		0.2548		0.9186
	$GSCI_{EN}$	0.1667		0.0369		0.9927	

Table A1d. Granger Causality: Geopolitical Risk and Industrial Metals

		Jan-90 to Nov-17		Jan-90 to Dec-07		Jan-08 to Nov-17	
		Dependent		Dependent		Dependent	
		GPR	$GSCI_{IND}$	GPR	$GSCI_{IND}$	GPR	$GSCI_{IND}$
Explanatory	GPR		0.6993		0.2845		0.2735
	$GSCI_{IND}$	0.0200		0.0002		0.9671	

Table A1e. Granger Causality: Geopolitical Risk and Livestock Commodities

		Jan-90 to Nov-17		Jan-90 to Dec-07		Jan-08 to Nov-17	
		Dependent		Dependent		Dependent	
		GPR	$GSCI_{LIVS}$	GPR	$GSCI_{LIVS}$	GPR	$GSCI_{LIVS}$
Explanatory	GPR		0.0477		0.0371		0.7013
	$GSCI_{LIVS}$	0.2127		0.6504		0.6572	

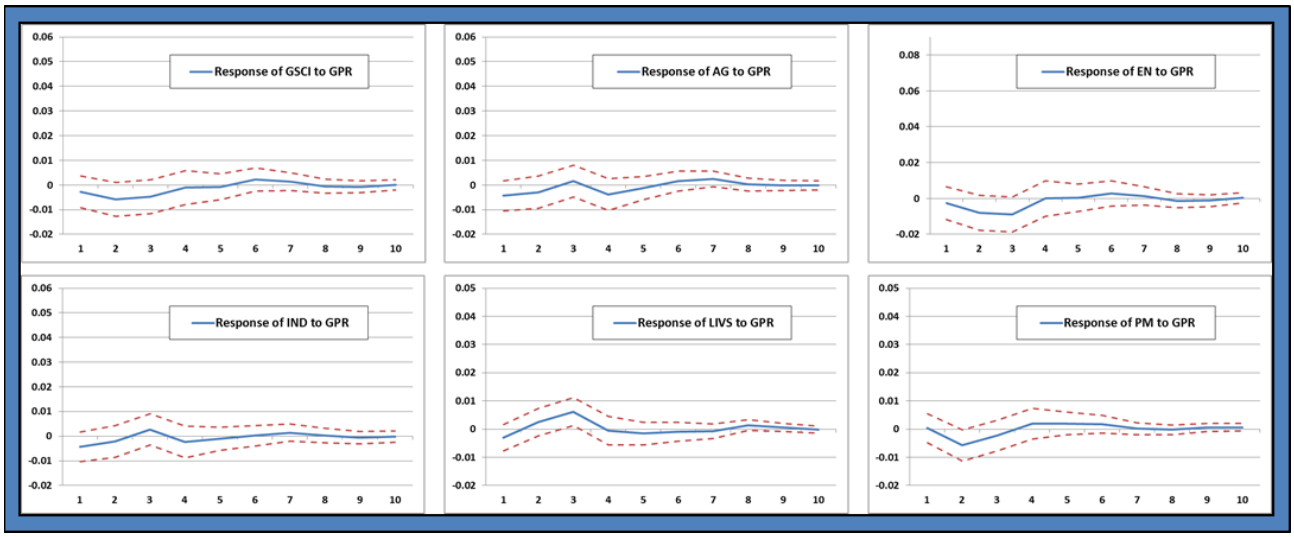
Table A1f. Granger Causality: Geopolitical Risk and Precious Metals

		Jan-90 to Nov-17		Jan-90 to Dec-07		Jan-08 to Nov-17	
		Dependent		Dependent		Dependent	
		GPR	$GSCI_{PM}$	GPR	$GSCI_{PM}$	GPR	$GSCI_{PM}$
Explanatory	GPR		0.0760		0.0563		0.6471
	$GSCI_{PM}$	0.1258		0.0795		0.0491	

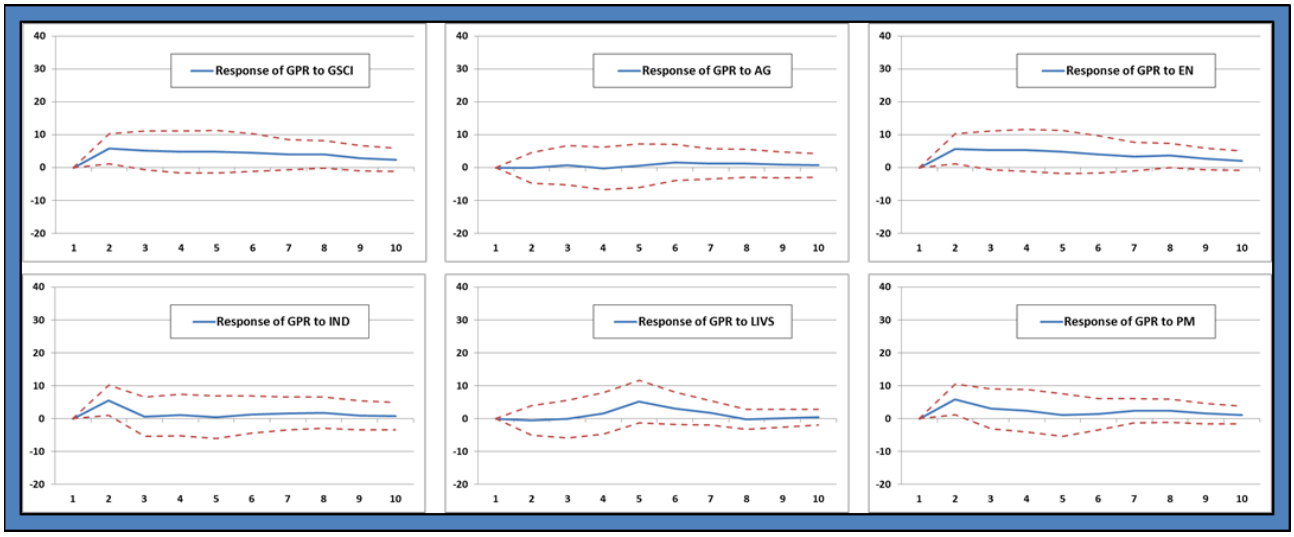
Appendix B: Impulse Responses

Blue lines show the central estimate in response to a one standard deviation shock. Red lines show ±2 standard errors around the central estimate.

Impulse Response Functions from $GSCI_i$ to GPR:



Impulse Response Functions from GPR to $GSCI_i$:



Endnotes

1 See "The Dutch Disease," *The Economist*, November 26, 1977 or Corden (1984).

2 A quick internet search for the term, "geopolitics and commodities," delivers a slew of results propagating the belief that geopolitics is a major factor in driving commodity prices. See for example, "Oil Prices are at the Mercy of Geopolitics," by Daniel Yergin, *Financial Times*, January 20, 2016; "Geopolitics and Uncertainties Keep Gold Gurnished," by Andrea Soh, *The Business Times*, September 26, 2017; or "Commodities: The Need for Geopolitical Perspective," from *Bloomberg*, May 28, 2015.

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Dr. Daniel Murray is Deputy CIO and Global Head of Research at EFG. He was previously employed as a Director of Strategy at Russell Investments, before which he worked as a portfolio manager at Merrill Lynch Investment Managers. He began his career at Smithers & Co. Ltd. He has broad investment experience, having worked as an economist, strategist, asset allocator and portfolio manager with exposure to a wide range of markets, instruments and investment styles. Dr. Murray has a Ph.D. in Economics and has been a CFA charterholder since 2003. He is a previous winner of the CFA U.K. Wincott Prize and was elected to the Board of CFA U.K. in 2014.