Do Geopolitical Risks Raise or Lower Inflation?*

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Abstract

Do geopolitical risks raise or lower inflation? Using long-run historical data for 43 countries, we find that geopolitical risks foreshadow high inflation and are accompanied by lower economic activity, an increase in military spending and in public debt, and a decline in trade with the rest of the world. Higher geopolitical risks are also associated with more uncertain inflation and bigger upside risks to inflation. Using a structural VAR model estimated on global data from the 1970s, we confirm that global geopolitical risks increase inflation, with the inflationary effect of higher commodity prices and currency depreciation more than offsetting the deflationary effects of lower consumer sentiment and tighter financial conditions.

KEYWORDS: Geopolitical Risk; War; Inflation; Commodity Prices; Fiscal Policy; Dollar; Vector Autoregressions; Panel Data Estimation.

JEL CLASSIFICATION: C30. D80. E31. F44. H56.

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1 Introduction

What is the relationship between adverse geopolitical events and inflation? In this paper, we use 120 years of data and various empirical techniques to examine the historical association between higher geopolitical risks and inflation. Although the magnitude of the effects varies across countries and time periods, we find that geopolitical risks are mainly inflationary, and transmit to the broader economy through trade, fiscal policy, and commodity prices.

From a theoretical standpoint, it is unclear whether elevated geopolitical tensions should lead to higher or lower inflation because they are a convolution of adverse demand and supply shocks. These shocks can have negative effects on investment and GDP and could potentially move inflation in either direction. On the supply side, wars and associated risks can destroy human and physical capital, shift resources to less efficient uses, divert international trade and capital flows, and disrupt global supply chains. On the demand side, uncertainty about the range of outcomes of adverse geopolitical events may weigh on activity, delay firms' investment and hiring, erode consumer confidence, and tighten financial conditions. Part of the negative effects on the demand side may be offset by increases in public spending, such as debt-financed military spending, which can boost demand. The overall inflationary effects depend on which of these forces dominate.

Figure 1 provides suggestive long-run evidence that the adverse geopolitical events—as measured by the Caldara and Iacoviello (2022) geopolitical risk index—are historically associated both with higher global inflation and with a higher share of countries experiencing higher-than-average inflation. The rest of the paper digs deeper into this question, using historical data on a large panel of countries, and organizing the analysis around two datasets. To provide a broad historical perspective and explore channels of transmission—most notably fiscal policy—we first use a dataset containing annual data for 43 countries—17 advanced economies and 26 emerging economies. The dataset is described in Section 2 and runs from 1900 through present. It features the country-specific geopolitical risk (GPR) indices developed in Caldara and Iacoviello (2022), expanded to include a larger set of countries, as a means to quantify geopolitical risk. It also includes country-level measures of inflation, GDP, military expenditures, public debt, and trade.

Section 3 exploits this long-run historical data to estimate the effects of geopolitical risk on inflation. We first estimate a bivariate panel VAR, and find that higher geopolitical risks are associated with higher inflation. We then split our panel into United States on the one hand, and all other countries on the other. This decision is motivated by the observation that no major war has ever been fought on U.S. soil throughout the sample, so as to guard against the possibility that the effects of geopolitical risks may partly depend on where a particular conflict ends up taking place. Over the entire sample period, we find that higher geopolitical risks are associated with lower activity outside the U.S., but with higher activity in the United States, a result that is mostly driven by the two world wars. However, both outside the U.S. and in the U.S. higher geopolitical risks foreshadow significantly higher inflation, alongside in an increase in military spending, an increase in public debt, and a decline in trade with the rest of the world.

Section 4 takes a deeper dive into which country characteristics are associated with a higher inflationary impact of geopolitical risks by estimating OLS and quantile regression models. Like in the VAR specifications, these regressions find that inflation rises in response to both global and country-specific adverse geopolitical events. Additionally, using quantile regressions, we document that geopolitical events generate large uncertainty and upside risks to inflation. The effects are larger in emerging economies and in the post world war II sample, while they are smaller for economies hit by GPR shocks in periods of high growth.

In Section 5 we organize our analysis around a monthly dataset starting in 1970 and containing variables aggregated at the global level. We estimate a structural vector autoregressive (VAR) model of the global economy and illustrate our VAR results through a scenario that quantifies the rise in geopolitical risks observed in early 2022, in the aftermath the Russian invasion of Ukraine. According to our estimated model, the ripple effects of the 2022 war shock lead to a rise in global inflation of about 1.3 percentage points while reducing the level of global GDP about 1.5 percent. The adverse effects of geopolitical risks operate through a decline in aggregate demand, captured by lower consumer sentiment and a drop in stock prices, and through a contraction in aggregate supply, captured by higher commodity prices and an appreciation of the dollar. While these channels all tend to reduce global activity, they can have opposite effects on inflation. Our results indicate that the inflationary contribution of higher

commodity prices and the dollar appreciation—which implies that many countries experience a currency depreciation—more than offsets the deflationary effects of reduced aggregate demand.

Our paper makes two contributions. First, we provide a systematic exploration of the relationship between geopolitical events and inflation for a large panel of countries. Papers in the literature typically focus on the effects of wars on real economic activity (Barro, 2006) and on transmission through fiscal policy (Ohanian, 1997; Ramey, 2011). Only a handful of studies touch upon the effects of wars on inflation, and typically the analysis is centered on the United States (Hall and Sargent, 2022; Rockoff, 2015). Second, we explore transmission channels that can be active around episodes of major geopolitical tensions. In line with a vast literature on the fiscal determinants of inflation, we show that higher military spending and higher public debt are inflationary (Sims, 1994). We show that exchange rate depreciation is an important transmission channel to inflation, in line with the evidence presented in Gopinath (2015) and consistent with the view that geopolitical events can lead to large flight-to-safety international capital flows (Forbes and Warnock, 2012).

2 The Data

In this section, we discuss the construction of two dataset that constitute the foundation of our empirical analysis. In doing so, we combine data from multiple sources, and we construct GPR indexes for 17 emerging economies, bringing to 43 the number of countries with available geopolitical risk indicators.

2.1 Country-Level Annual Panel Data

For our first dataset, we construct an annual panel of country-level data for 43 countries, 17 of which are advanced economies and 26 of which are emerging market economies.[1] The panel runs from 1900 through 2021 and includes country-level measures of inflation and GDP, as

[1] Advanced economies include Australia, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and the United States. Emerging market economies include Argentina, Brazil, Chile, China, Colombia, Egypt, Hong Kong, Hungary, India, Indonesia, Israel, Malaysia, Mexico, Peru, Philippines, Poland, Russia, Saudi Arabia, South Africa, South Korea, Taiwan, Thailand, Tunisia, Turkey, Ukraine, and Venezuela.

well as three additional economic indicators: national military expenditure, public debt to GDP ratios, and trade to GDP ratios. Our measure of country inflation utilizes annual data from the IMF International Financial Statistics and is extended back to 1900 with historical data from Jordà et al. (2017) and, for countries not in their database, Reinhart and Rogoff (2009). We winsorize the inflation data at the 1 and 97.5 percentiles in order to attenuate the outsized influence of hyperinflationary outliers. Real GDP per capita data are from Barro and Ursúa (2012), and extended through 2019 using the World Bank World Development Indicators (WDI). Data on military expenditure comes from Roser and Nagdy (2013) and is defined as military spending as a share of GDP. Debt to GDP ratio data are from Jordà et al. (2017), filling in missing countries with the IMF's Public Finances in Modern History database and Reinhart and Rogoff (2009), with debt defined as the total of domestic and external public debt for a given country. Recent data is added to this measure using WDI and the IMF World Economic Outlook. Trade to GDP ratio data are defined as the sum of total imports and exports over nominal GDP; data comes from Jordà et al. (2017) and the Correlates of War project.

Table 1 provides summary statistics for the 43 countries in our panel. Inflation statistics are additionally presented separately for advanced and emerging economies. Average annual inflation for a country in this sample is 8.9 percent but the panel contains sizeable variability and episodes of particularly high inflation, coming largely from years surrounding world war I and II in advanced economies together with the experience of many emerging countries. Countries in our sample display a wide range of fiscal positions, with an average debt to GDP ratio of 47.8 percent and an average share of military spending in GDP of 4.1 percent. Trade to GDP ratios are 48 percent on average in our sample.

We complement this panel with measures of adverse geopolitical events based on recent work by Caldara and Iacoviello (2022). Geopolitical risk is defined 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. Geopolitical risk is measured by counting the fraction of articles discussing geopolitical events in leading newspapers published in the United States, the United Kingdom, and Canada. We focus on a selection of English-speaking newspapers to be able to measure geopolitical risk since 1900. In

order to construct country-specific measures of geopolitical risk, we count the joint occurrences of geopolitical terms and a country's name or capital city. The country-specific indices capture the exposure of a given country to geopolitical concerns and conflicts.

We extend the original country-specific GPR dataset from Caldara and Iacoviello (2022)—which contained country-specific indices for 17 advanced economies and 9 emerging economies—adding country GPR indexes for 17 additional emerging economies. Throughout our analysis, we standardize the GPR indexes by country. The goal of this extension is to present a more balanced analysis that draws on the experience of a large panel of countries with different characteristics. In addition, after the two world conflicts, emerging economies have been at the center of many significant geopolitical events, such as coup and regional wars, which had large economic impact but have not been the subject of a systematic empirical analysis.

There is suggestive evidence that geopolitical risk and inflation are positively correlated. Figure 2 illustrates the joint behavior of GPR and inflation for a select group of countries. Historically, periods of high geopolitical risk are associated with higher inflation across a wide variety of countries. These include both advanced economies, as seen in the left column, and emerging markets, as seen in the right column for India, Indonesia and Thailand—countries that we added to the new country-specific GPR database. While some of the largest spikes in GPR and inflation are dominated by global events like the two world wars, particularly among advanced economies, they are not the only feature of our sample. For instance, in emerging economies, we observe many large co-moving spikes in GPR and inflation throughout the latter half of the twentieth century, demonstrating the driving force of emerging markets in this correlation after 1950.

2.2 Global Monthly Time-Series Data

Our second dataset consists of monthly data on the global economy from 1974 through 2022. We include the following macroeconomic and financial variables: world GDP, world inflation, consumer confidence, oil prices, stock prices, commodity prices, and the dollar exchange rate. Our measure of world GDP is in purchasing power parity and obtained from Cuba-Borda et al. (2018). World inflation is a world aggregate of countries' twelve-month change in the consumer price index from Global Financial Data. The consumer confidence index is from the

Organization for Economic Cooperation and Development, and oil prices from the West Texas Intermediate Index. For financial data, we measure global monthly stock prices using the FTSE World Dollar index, commodity prices using the S&P Goldman Sachs Commodity Index, and the dollar exchange rate using the Federal Reserve Board broad dollar index. For this dataset, we utilize the monthly global measure of geopolitical risk from Caldara and Iacoviello (2022). In addition, the headline global GPR is broken down into two separate components, the geopolitical threat (GPT) and the geopolitical acts (GPA) indices. The GPT index is based on articles that include phrases related to threats and concerns about scope, duration, and ramifications of geopolitical tensions, while the GPA index concerns phrases referring to the outbreak and actual unfolding of wars.

3 The Inflationary Effects of Geopolitical Risk: Country-Level Evidence

In this section, we assess the effects of geopolitical risk on inflation by estimating VAR models on country-level data. In all VAR models estimated in the paper, we identify a GPR shock by using a Cholesky decomposition of the covariance matrix of the VAR reduced-form residuals, ordering the GPR indexes first. The ordering implies that any contemporaneous correlation between economic variables and the GPR indexes reflect the effect of the GPR index on the economic variables. The characteristics of the GPR indexes discussed in Caldara and Iacoviello (2022) support this assumption, as they capture events that are typically not caused by economic conditions within the same month, quarter, or year. We estimate the models on two lags and we bootstrap the standard errors.

3.1 Geopolitical Risk as an Adverse Supply Shock: International Evidence

We start our analysis by estimating a bivariate panel VAR using country-specific GPR indexes and inflation. This parsimonious specification has the benefit of exploiting the most complete panel of countries and observations available to us, as only a handful of countries have missing

data for inflation.

A rise in geopolitical risks have inflationary effects. We illustrate this result in Figure 3, which displays the impulse responses generated by a one-standard-deviation GPR shock. The median response to the shock is marked by the solid blue line, while the dashed lines show the 90% confidence interval bands. In response to an increase in geopolitical risk within a country, domestic inflation rises about 2.75 percentage points in the first three years after the shock, subsiding thereafter.

To explore the transmission of GPR shocks to inflation, we add four variables to the panel VAR: real GDP per capita, military spending, debt to GDP ratios, and trade to GDP ratios. This model includes all countries in our panel dataset, except for the United States—as we study its experience using a separate model—, Hong Kong and Taiwan.[2]

A rise in geopolitical risk has adverse effects resembling a supply shock. As shown in Figure 4, in response to a one-standard deviation shock to GPR, inflation raises by about 2 percentage points. While this response is smaller than in the bivariate model, it is remarkably robust given the different model specification and that lower number of data points (3,000 vs. 4,700 observations). The level of GDP drops by 1 percent after the year, and it remains below trend for years after the shock. Adverse economic effects of wars can materialize through the destruction of human and physical capital, the shift of resources from productive to less productive uses, the increase in precautionary behavior and, as we see next, a decline in global trade.

The rise in inflation and the decline in economic activity are accompanied by expansionary fiscal policy and a decline in trade. Military spending increases: this is expected, as many geopolitical events are associated with wars or the risk of wars. Public debt as a share of GDP goes up substantially, boosted by a decline in real activity and debt-financing of government spending. These responses are in line with studies observing increased public expenditure and debt in response to conflicts Hall and Sargent (2022) While fiscal policy contributes to stabilize activity, it can be a source of inflation. Finally, our findings confirm the destructive tendencies of geopolitical conflict on trade flows. As discussed in Glick and Taylor (2010), lower trade can be inflationary, as a country experiences limited access to external markets and capital.

[2] Hong Kong and Taiwan do not have at least 20% non-missing observations in the sample for each variable.

3.2 Geopolitical Risk as a Government Spending Shock: U.S. Evidence

The United States has a unique relationship with geopolitical risks. Starting with World War I, they have become a superpower that has been directly or indirectly involved in all major conflicts that took place in the past 120 years. However, none of these conflicts happened on U.S. soil, with the notable exception of the 9/11 attacks, whose direct economic impact was small relative to full scale wars.

We find that as a consequence of the unique experience of the United States regarding global geopolitical developments, the effects of GPR shocks in the U.S. are akin to traditional government spending shocks. Figure 5 shows this finding, by plotting the impulse responses to a GPR shock in a model estimated on the six variables used in the panel VAR, but using only U.S. data and adding to the VAR Ramey (2011)'s measure of news about U.S. military expenditures constructed from historical records. Ramey's series reports the present discounted value of expected changes in defense expenditures constructed, akin to the GPR indexes, using news from Business Week and other newspaper sources.

Specifically, a spike in geopolitical risk raises inflation by a little over 1 percentage point, about half the effect estimated in the full panel. The level of GDP rises, peaking at nearly 2 percent above trend before starting to decline. The fiscal transmission of the shock is central to the dynamics of inflation and GDP. High GPR is accompanied by immediate news about future increases in military spending, which materialize over the following three to five years accompanied by a rise in public debt.

Some considerations are in order. First, the supply side effects documented in the panel VAR lead to a very prolonged decline in the level of output, in line with evidence on the effects of rare disasters documented by Barro and Ursúa (2012) and Nakamura et al. (2013). By contrast, the demand effects generated in the United States lead to a less persistent increase in GDP. Second, the different balance of supply and demand factors could be one of the factors contributing to a smaller, albeit economically significant, response of inflation. Third, back-of-the-envelope calculations reveal that the multiplier of government spending on US GDP implied by the GPR shock is broadly in line with estimates in Ramey (2011). Furthermore, as

in Ramey's work, World War II is the key source of variation underlying the effects, as can be noticed by inspecting the size of the responses. During World War II, GPR risk was more than 4 standard deviations above mean, and military spending went from about 1 percent of GDP in 1939 to nearly 40 percent in 1944.

4 Country-Level Evidence by Country Characteristics: Determinants and Effects along the Distribution

In this section, we run panel regressions to establish how the relationship between geopolitical risk and inflation depends on a country characteristics. We first explore this relationship for average future inflation using a standard panel regression framework. We then use quantile regressions to explore this relationship over the entire conditional distribution of future inflation.

4.1 Average Effects on Inflation by Country Characteristics

We estimate the average effect of geopolitical risk on inflation in country i in year t with the following regression:

$$\Pi_{i,t+1} = \alpha_i + \beta_1 GPRC_{i,t} + \beta_{2,k} GPRC_{i,t} \times D_k + \gamma_1 GPR_t + \gamma_2 \Delta GDP_{i,t-1} + u_{i,t}, \qquad (1)$$

where $\Pi_{i,t+1}$ is one-year ahead inflation, α_i are country-fixed effects, and $GPRC_{i,t}$ is the country-specific GPR index. We interact GPRC with dummy variables D_k, indicating country characteristics k, which we include in the regression one at the time. All regressions include the global GPR index GPR_t, common across all countries, and lagged country GDP growth as a control variable.

Table 2 tabulates the results from estimating equation (1), with each column reporting regression coefficients for a different specification. As shown in the first column, a one standard deviation increase in country specific geopolitical risk increases a country's inflation by about 3 percentage points after a year, in line with the panel VAR estimates. A rise in global geopolitical risk constitutes an additional source of inflation, with a one standard deviation in the index raising inflation by 1.5 percentage points.

The remaining columns of the table show that the *average* effect of geopolitical risk on inflation does not depend on most country characteristics that we consider. Country characteristics will be relevant when considering the *distributional* effects in the next subsection. In column 2, we add to the regression a dummy D_{EME} that equals 1 for emerging countries. The coefficient on the dummy is positive, meaning that the inflationary effects of GPR are larger in EMEs relative to advanced economies, but is not statistically significant. Column 3 interacts country GPR with a dummy $D_{post1950}$ that equals 1 for years after 1950. Again, the coefficient is positive, reassuring us that there is a strong link between geopolitical risk and inflation in our data even when excluding the two world wars, but significance is low. Columns 4 through 7 report results using dummies that take value 1 for above-median values across the whole sample—that is, pooling over time and across countries—of the following variables: GDP growth (D_{hGDP}), military spending as a share of GDP($D_{hmilitary}$), public debt to GDP ratios (D_{hdebt}), and trade to GDP ratios (D_{htrade}). In column 4 we find that higher GDP lowers the response of inflation to GPR, suggesting that when economic conditions are sound, the overall impact of geopolitical risk is more muted. A high share of military spending, public debt and trade to GDP are not associated with any differential effect of GPR.

4.2 Quantile Effects on Inflation by Country Characteristics

In this section, we quantify the effects of GPR over the entire conditional distribution of future inflation. While average effects are important, geopolitical risks can have a substantial impact on uncertainty and the risk particularly elevated future inflation. Both can arise as major geopolitical events are relatively infrequent, and when they materialize can have extremely large effects.

To test this idea, we run quantile regressions of the following form:

$$\mathcal{Q}_\tau(\Pi_{i,t+1}|x_{i,t}) = \alpha_\tau + \beta_{\tau 1} GPRC_{i,t} + \beta_{\tau 2,k} GPRC_{i,t} \times D_k + \gamma_{\tau 1} GPR_t + \gamma_{\tau 2} \Delta GDP_{i,t}. \quad (2)$$

Above, we estimate the best linear predictor of the quantile τ of one-year ahead inflation, conditional on values of country-specific geopolitical risk, denoted by $GPRC_{i,t}$ and its interaction with dummies capturing country characteristics D_k. We control for global GPR

and lagged country's GDP growth. Importantly, we include country fixed effects so that the coefficients on GPR variables can be interpreted as capturing the effects of geopolitical risk for the distribution of a country's future inflation. We estimate equation (2) at the median, at the 10th quantile—measuring the left tail of the inflation distribution—and at the 90th quantile—measuring the right tail of the inflation distribution associated with high inflation readings.

Table 3 shows the results. The first column reports for convenience the OLS esimates from Table 2. Panel 1 shows that a rise in GPR has three simultanous effects on the distribution of future inflation: it raises median inflation, as shown by the coefficient on the column labelled $q50$; it raises uncertainty about future inflation; and it raises upside risks to inflation relative to downside risks. Higher uncertainty and upside risks are both a direct implication of the coefficient on the 90th percentile (column labelled $q90$) being larger than the median coefficient—as much as three times larger—and the coefficient on the 10th percentile.(column labelled $q10$). To visualize this result, these estimates imply that while the right tail of the distribution of future inflation shifts disproportionally further to the right, the left tail of the distribution shifts only modestly to the right, meaning higher uncertainty and upside risk.

The remaining panels of the table show that country characteristics mediate the effects of GPR on the conditional distribution of future inflation. For instance, panel 2 shows that GPR generates higher uncertainty and upside risk to inflation both in advanced and emerging economies, but the effect is larger for emerging economies, which display a marginally stronger effect at the 90th percentile. The distributional effects are substantially larger in the sample post 1950, as shown in Panel 3. This is driven mostly by some emerging economies experiencing high geopolitical risks and inflation in this part of the sample (while having a more muted experience during world wars, explaining why this effect is not captured as prominently by the EME dummy).

In panel 4, we learn that high GDP growth reduces the distributional effects of geopolitical risks. Panels 5 and 6 show that the share of military spending and public debt to GDP are not factors mediating the effects of geopolitical risk. Finally, in panel 7 we find that high trade also reduces the distributional effects of geopolitical risk.

The results from the quantile regressions convey that geopolitical risks can cause a simul-

taneous increase in future inflation, in uncertainty about future inflation, and in the risk of particularly high readings of future inflation. These effects are mediated through country characteristics, being higher for emerging economies and lower when countries experience high growth and have a high share of trade. In addition, the statistically significant coefficients estimated at the median support the notion that the relationship between geopolitical events and inflation is broad-based, holding also outside episodes of high inflation during major geopolitical events, for the median coefficient in a quantile regression is less influenced by large observations relative to OLS.

5 The Global Effects of Geopolitical Risk since 1970s: An Application to the Russian Invasion of Ukraine

In this section, we assess the effects of geopolitical risk on inflation estimating a monthly VAR model of the global economy. We do this for three reasons. First, some of the effects of geopolitical risks are, broadly speaking, global in nature. For instance, some wars cause global commodity prices to spike when threatening supply. Second, annual data are not well-suited to quantify the effects of geopolitical risks on fast-moving variables, such as commodity and stock prices. These variables react immediately to news about adverse geopolitical developments. Finally, a monthly VAR model allows to easily construct scenarios to track the effects of historical and ongoing geopolitical events.

The model includes all variables in our monthly time-series database: world GDP, world inflation, global stock prices, real oil prices, the broad real dollar, commodity prices, global consumer confidence, and the geopolitical threats (GPT) and acts (GPA) indexes as measures of geopolitical risks. The VAR model uses data from January 1974 through April 2022 and includes three lags. We assume that changes in the GPT and GPA indexes drive all within-month fluctuations in the other economic variables, so that any contemporaneous correlation between geopolitical risks and financial variables, say, is assumed to reflect the effect of geopolitical risks on financial variables, rather than the other way around. But with a lag, each variable can affect all variables. We estimate the model using Bayesian techniques.

Specifically, we use an uninformative prior as in Uhlig (2005) and take 10000 draws from the posterior distribution of the model parameters.

5.1 Quantifying the Effects of the Russia Invasion of Ukraine

We illustrate the global effects of geopolitical risks through a scenario analysis of the onset of Russia's invasion of Ukraine. Specifically, we use the model to extract the historical realization of shocks to GPT and GPA. We then construct a simulation that tracks the dynamic effects of the shocks that materialized between January and April 2022. We pick April 2022 as the last period since most of the positive innovations to geopolitical risk in 2022 took place between January and April.[3]

Figure 6 shows that the global effects of GPR shocks resemble those of shocks to supply. The solid lines plot the median response of world GDP and world inflation in the simulation relative to a no-war baseline where there is no shock to geopolitical tensions. The dashed lines depict the 70 percent credible sets. The rise in geopolitical risks observed during this period is estimated to produce a drag on world GDP that builds throughout 2022, culminating to a negative impact of around 1.7 percent. Such contractionary effects of GPR are in line with previous literature documenting drops in economic activity for countries experiencing disasters, including adverse geopolitical events, as documented for instance in Barro (2006) and Glick and Taylor (2010). Meanwhile, the rise in geopolitical risks boosts prices, causing an increase in global inflation of 1.3 percentage points by the second half of 2022, after which the effects begin to subside.

5.2 Global Channels of Transmission

What are the global channels of transmission of GPR shocks? With various channels controlled for, the structural VAR estimates leave us well-positioned to answer this question. Figure 7 presents a more detailed picture of the way the global economy responds to a geopolitical risk shock. The estimates highlight how effects of elevated geopolitical risks in 2022 are associated

[3] Between January and April 2022, the average size of the GPT shocks was 2 standard deviations, while the average size of the GPT shock was 0.7 standard deviation. Hence, these impulse responses reflect a combination of GPT and GPA shocks in a three-to-one ratio.

with declining consumer confidence and stock prices, factors that weaken aggregate demand. Meanwhile, the exchange value of the dollar appreciates, in line with the evidence that spikes in global uncertainty and adverse risk sentiment can trigger flight-to-safety international capital flows Forbes and Warnock (2012). The dollar appreciation is inflationary for all countries except the U.S., as their currency depreciates raising the price of imports priced in dollar. Lastly, commodity prices and oil prices increase, putting downward pressure on global activity and upward pressure on inflation.Anayi et al. (2022) show that the Russian invasion of Ukraine has led to an increase in several measures of economic uncertainty.

Taken together, our results suggest that the coexistence of deflationary pressures—coming from lower aggregate demand—and inflationary pressures coming from supply-side disruptions, resolves in favor of the latter, with geopolitical events generating a simultaneous decline in economic activity and rise in inflation.

6 Conclusions

Global geopolitical risks have soared since Russia's invasion of Ukraine, bringing at the forefront concerns of investors, market participants, and policymakers that the war can exert a drag on the global economy while pushing up inflation, with a sharp increase in uncertainty and risks of severe adverse outcomes. As an example of these concerns, the April 2022 edition of the International Monetary Fund's World Economic Outlook contains more than 200 mentions of the word "war."[4] In light of these developments, in this paper we asked: Do Geopolitical Risks Raise or Lower Inflation?

We used historical data for a large panel of countries to quantify the relationship between inflation and geopolitical tensions. Using country-level panel data and global time-series data, we documented that global and country-specific geopolitical shocks are inflationary. Geopolitical risks increase inflation worldwide, with the inflationary effect of fiscal policy, higher commodity prices and supply disruptions more than offsetting the deflationary effects of lower consumer sentiment and tighter financial conditions. Higher geopolitical risks can

[4] See also the discussion on the likely effects of the war in Federal Reserve Chair Jerome Powell's press conference after the May 3-4, 2022, meeting of Federal Open Market Committee (Powell, 2022).

translate into a more uncertain inflation outlook and bigger upside risks to inflation. Finally, we showed that the Russia invasion of Ukraine has led to a substantial raise in inflation and decline in economic activity, thus exacerbating the tradeoffs confronting fiscal and monetary policy.

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Table 1: Summary Statistics

	Mean	SD	p5	p95	Obs.
Inflation	8.9	17.8	-5.1	41.4	4,684
Advanced Economies	4.4	7.0	-3.4	18.4	2,073
Emerging Economies	14.5	32.0	-6.5	70.3	2,611
GDP growth	2.3	5.8	-6.9	10.1	4,528
Military Spending to GDP	4.1	7.4	0.7	14.1	4,078
Public Debt to GDP	47.8	37.4	6.6	116.8	4,102
Trade to GDP	48.0	41.2	10.5	118.7	3,411
Country GPR	0.0	1.0	-0.9	2.0	5,289

The table presents the mean, standard deviation, 5th percentile, 95th percentile, and count for key variables on the sample of 43 countries from 1900 to 2021. GDP is growth in real GDP per capita. Inflation is winsorized at the 1 and 97.5 percentiles. The GPR index is standardized at the country level. Military expenditure is military spending as a share of GDP. Public debt to GDP ratio is the combined domestic and external debt to GDP ratio. Trade to GDP ratio are total imports and exports as a share of GDP. GDP, military spending, public debt to GDP ratio, and trade to GDP ratio data are all in percent terms.

Table 2: Geopolitical Risk and One-Year Ahead Inflation

	Inflation (t+1)						
	(1) No Dummies	(2) AE vs EME	(3) Pre vs Post 1950s	(4) Low vs High GDP	(5) Low vs High Military	(6) Low vs High Public Debt	(7) Low vs High Trade
Country GPR	3.02	2.59	2.28	3.82	3.61	2.73	3.10
	(0.75)	(0.84)	(0.65)	(0.87)	(1.03)	(0.66)	(1.50)
Country GPR × D_{EME}		0.76					
		(1.46)					
Country GPR × $D_{post1950}$			1.74				
			(1.75)				
Country GPR × D_{hGDP}				-2.30			
				(0.77)			
Country GPR × $D_{hmilitary}$					-0.71		
					(1.21)		
Country GPR × D_{hdebt}						-0.25	
						(1.08)	
Country GPR × D_{htrade}							-0.86
							(1.33)
Global GPR	1.56	1.68	1.90	1.53	0.60	1.24	1.96
	(0.84)	(0.86)	(0.80)	(0.83)	(1.00)	(0.93)	(1.31)
GDP Growth (t-1)	-0.28	-0.28	-0.28	-0.27	-0.22	-0.20	-0.29
	(0.12)	(0.12)	(0.12)	(0.12)	(0.13)	(0.10)	(0.13)
Observations	4,267	4,267	4,267	4,265	3,740	3,805	3,277
R^2	0.20	0.20	0.20	0.20	0.23	0.21	0.34
Number of Countries	43	43	43	43	43	43	43

Standard errors in parenthesis clustered by country and year.

Regression effects of inflation on geopolitical risk in a panel of countries from 1900 to 2021. "Country GPR × D_{EME}" is the interaction between country GPR and a dummy specifying emerging markets. "Country GPR × $D_{post1950}$" is the interaction between country GPR and a dummy specifying the period 1950-2021. "Country GPR × D_{hGDP}", "Country GPR × $D_{hmilitary}$", "Country GPR × D_{hdebt}", and "Country GPR × D_{htrade}" are the interactions between country GPR and a dummy specifying values above the median of GDP growth, military spending as a share of GDP, public debt to GDP ratios, and trade to GDP ratios, respectively. Inflation is annual and winsorized at the 1 and 97.5 percentiles. Country-specific geopolitical risk is standardized to have a mean of 0 and standard deviation of 1 for each country. Global geopolitical risk is standardized. GDP growth is expressed in percent. All specifications include country fixed effects.

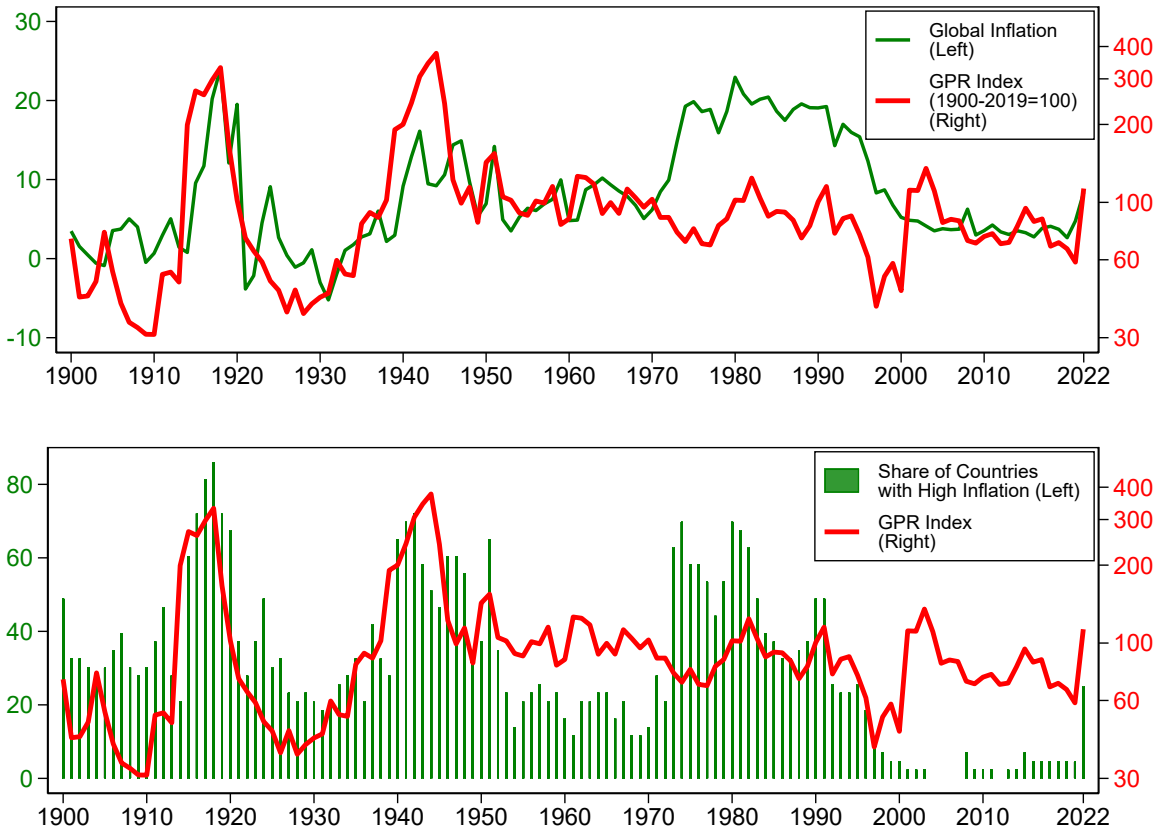
Table 3: Differential Effects of Geopolitical Risk on One-Year Ahead Inflation

	OLS	**Quantile**		
		q10	q50	q90
1. No Dummies				
Country GPR	3.02	0.54	2.31	7.36
	(0.43)	(0.28)	(0.37)	(1.23)
2. AE vs EME				
Country GPR	2.59	0.73	2.06	5.82
	(0.52)	(0.34)	(0.41)	(1.46)
Country GPR × D_{EME}	0.76	-0.30	0.45	2.60
	(0.75)	(0.44)	(0.62)	(2.00)
3. Pre vs Post 1950s				
Country GPR	2.28	1.07	1.94	4.55
	(0.53)	(0.31)	(0.41)	(1.39)
Country GPR × $D_{post1950}$	1.74	-0.79	1.03	6.50
	(0.83)	(0.66)	(0.73)	(2.08)
4. Low vs High GDP				
Country GPR	3.93	0.89	3.08	9.34
	(0.54)	(0.36)	(0.48)	(1.49)
Country GPR × D_{hGDP}	-2.48	-0.79	-2.01	-5.49
	(0.64)	(0.39)	(0.54)	(1.69)
5. Low vs High Military				
Country GPR	3.47	1.06	2.77	7.70
	(0.71)	(0.57)	(0.68)	(1.46)
Country GPR × $D_{hmilitary}$	-0.53	-0.71	-0.58	-0.20
	(0.78)	(0.58)	(0.66)	(1.81)
6. Low vs High Public Debt				
Country GPR	2.26	1.05	1.97	4.29
	(0.48)	(0.31)	(0.39)	(1.29)
Country GPR × D_{hdebt}	0.74	-0.85	0.35	3.41
	(0.75)	(0.54)	(0.67)	(1.86)
7. Low vs High Trade				
Country GPR	4.16	1.59	3.59	8.62
	(0.72)	(0.59)	(0.65)	(1.72)
Country GPR × D_{htrade}	-3.02	-0.90	-2.55	-6.68
	(0.72)	(0.57)	(0.64)	(1.62)

Standard errors in parenthesis.

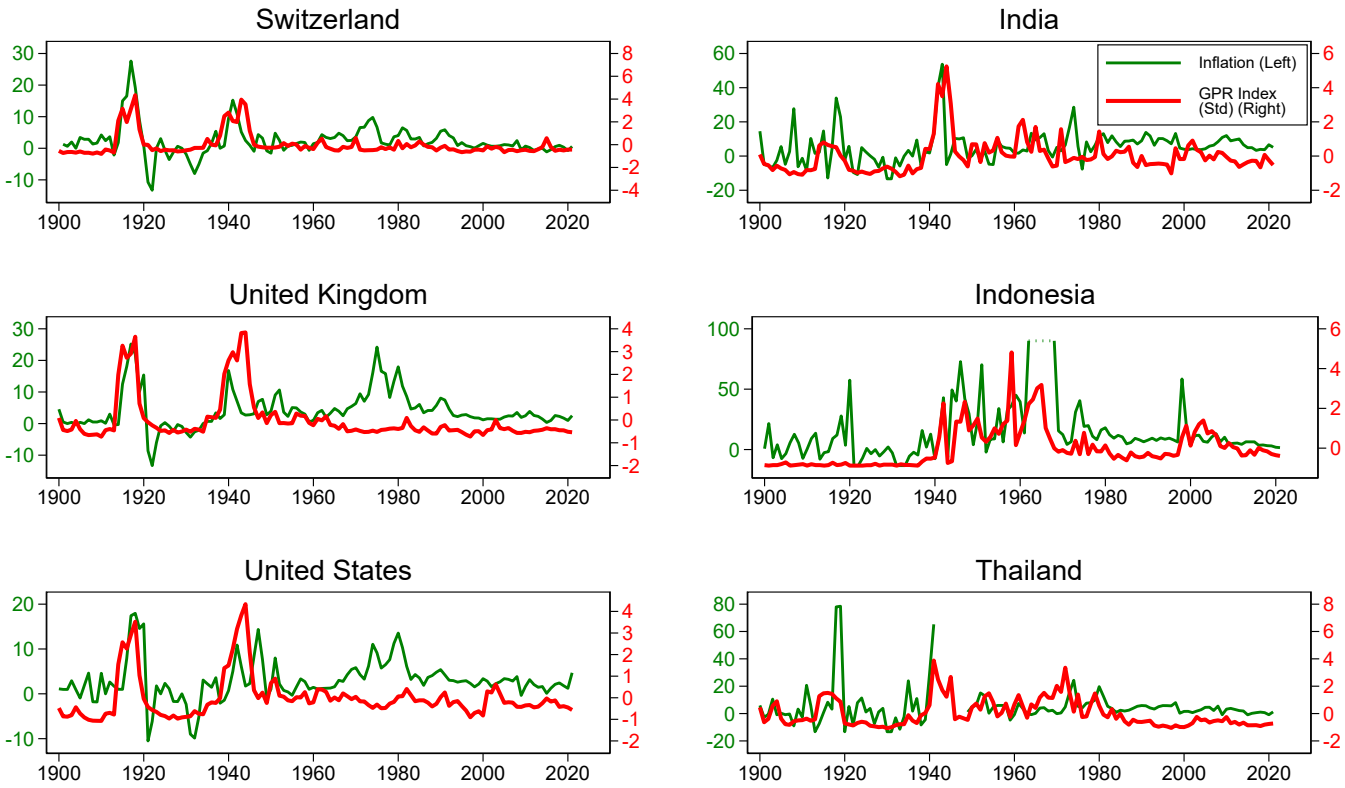
Panel quantile regression effects of geopolitical risk on inflation across countries, 1900-2021. D_{EME}, $D_{post1950}$, D_{hGDP}, $D_{hmilitary}$, D_{hdebt}, D_{htrade}, are dummies for emerging markets, years 1950-2021, above-median GDP growth, above-median military spending, above-median public debt to GDP, and above-median trade to GDP. All models have country fixed effects, standardized global GPR, and lagged GDP growth. Models 1-4 include 4,267 observations and 43 countries. Model 4 includes 4,265 observations and 43 countries. Model 5 includes 3,740 observations and 42 countries. Model 6 includes 3,850 observations and 43 countries. Model 7 includes 3,277 observations and 42 countries. Quantile coefficients report the effects at the 10th, 50th, and 90th percentile of the distribution of inflation. Standard errors are clustered by country and year for the OLS and boostrapped using 500 observations for the quantile regressions.

Figure 1: Global Inflation and Global Geopolitical Risk since 1900



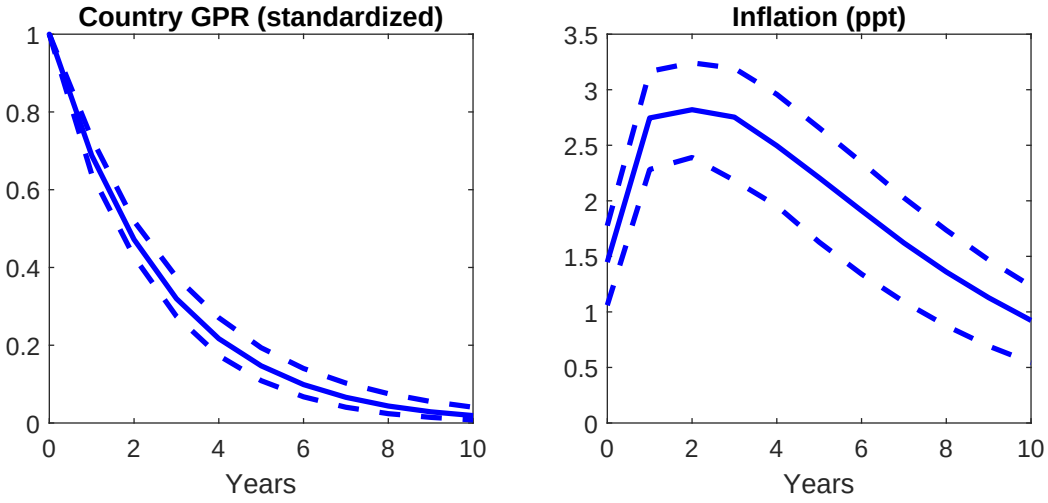
Top panel: Global Inflation and Global Geopolitical Risk from 1900 through 2022. Global inflation is calculated by averaging inflation for countries in our sample using real GDP weights. Bottom panel: Share of countries with "high" inflation and Global Geopolitical Risk from 1900 through 2022. We regress inflation on country fixed effects, and dummies for 1900-1945, 1946-1972, 1973-2022, each interacted with an advanced economy dummy. A country has "high" inflation when the residual is greater than 5 percent, corresponding to about 10 percent of the observations. Global Geopolitical Risk is plotted on a logarithmic scale and is expressed as annual average of monthly readings.

Figure 2: Country-Specific Inflation and Geopolitical Risk since 1900



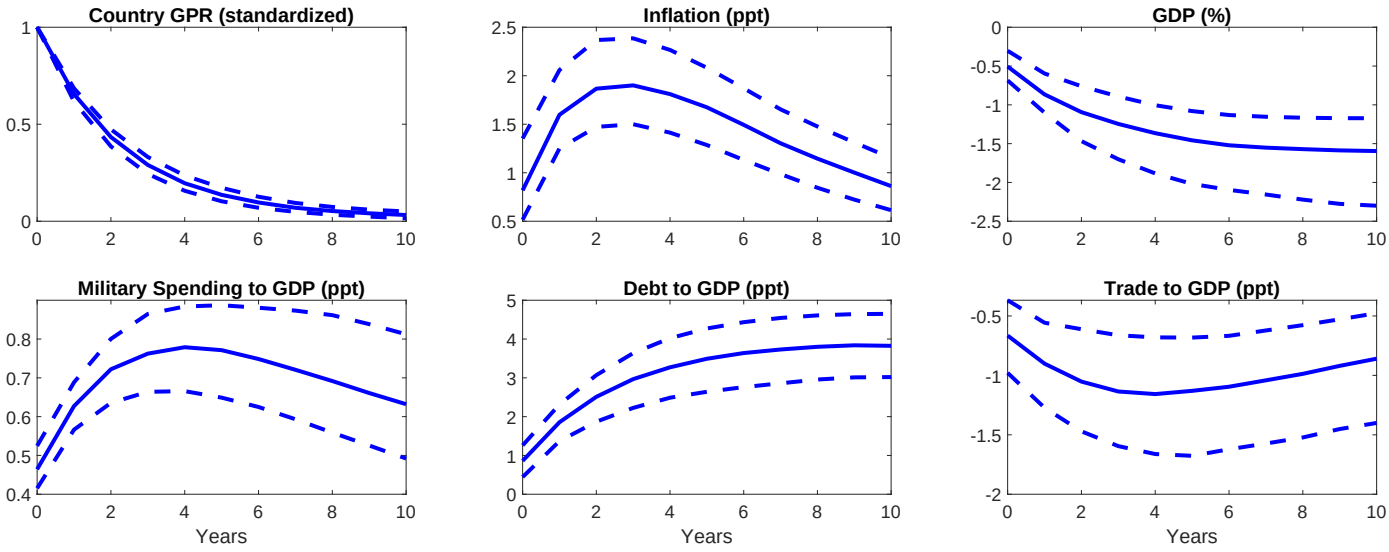
Each panel displays inflation and geopolitical risk from 1900 through 2021 for a selection of advanced economies (Switzerland, United Kingdom, United States) and emerging economies (India, Indonesia, and Thailand) included in our country database. Inflation is winsorized at the 95th percentile across all countries in the dataset, with winsorized values are represented by a dotted line. Country-specific geopolitical risk is standardized so as to have 0 mean and unit standard deviation in each country.

Figure 3: Effects of Elevated Geopolitical Risk on Inflation: Bivariate Panel VAR



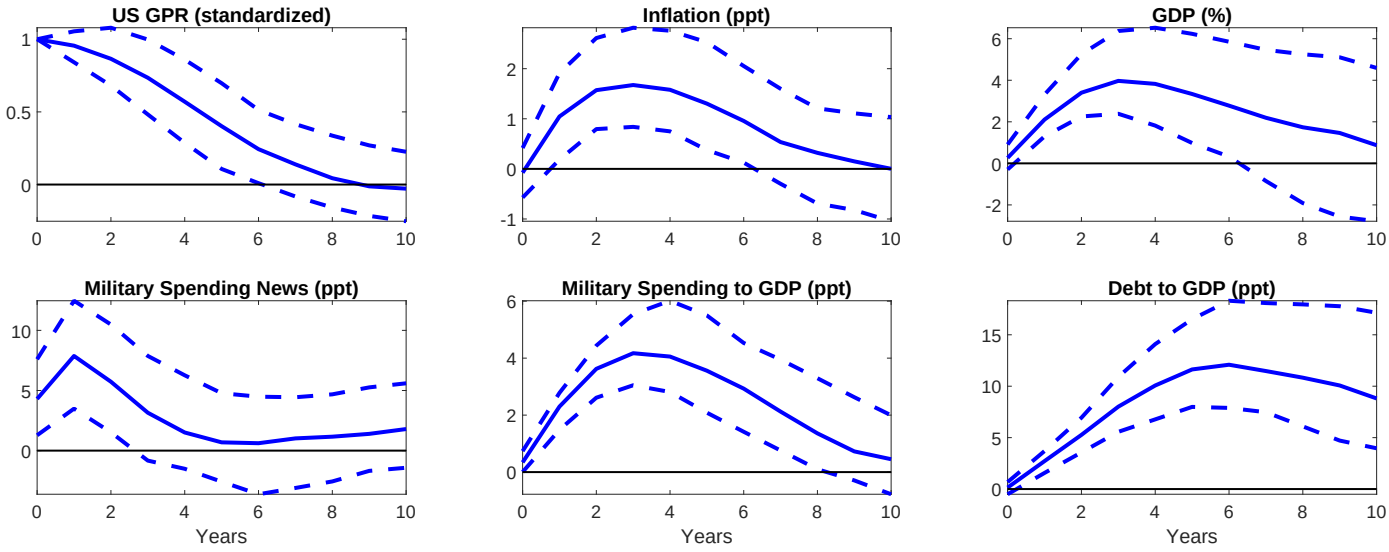
Note: The figure plots the response over time of geopolitical risk and inflation to a one standard-deviation shock to country-specific geopolitical-risk. The impulse responses were estimated using a panel vector autoregression (PVAR) model. Data in the model is annual from 1900 to 2021. The solid blue lines in the figure plot the central estimates. The dashed blue lines denote bootstrapped 90 percent confidence intervals. Variables are plotted in terms of the deviation from a no-shock baseline.

Figure 4: Effects of Elevated Geopolitical Risk on Inflation: Multivariate Panel VAR



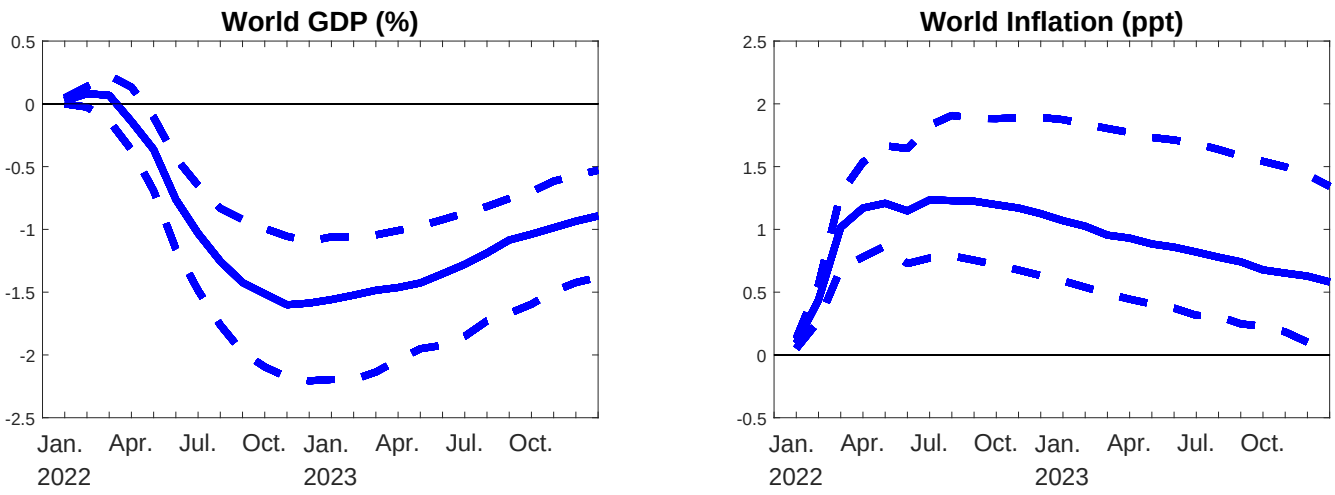
Note: The figure plots impulse responses to a one standard-deviation shock to country-specific geopolitical risk. The impulse responses were estimated using a panel vector autoregression (PVAR) model and includes the following variables: standardized country geopolitical risk (GPR), inflation, real GDP per capita, growth in military spending as a share of GDP, trade (total imports and exports) as a share of GDP, and debt as a share of GDP. Data in the model is annual from 1900 to 2021. The solid blue lines in the figure plot the central estimates. The dashed blue lines denote bootstrapped 90 percent confidence intervals. Variables are plotted in terms of the deviation from baseline.

Figure 5: Effects of Elevated Geopolitical Risk on Inflation: US-Specific VAR



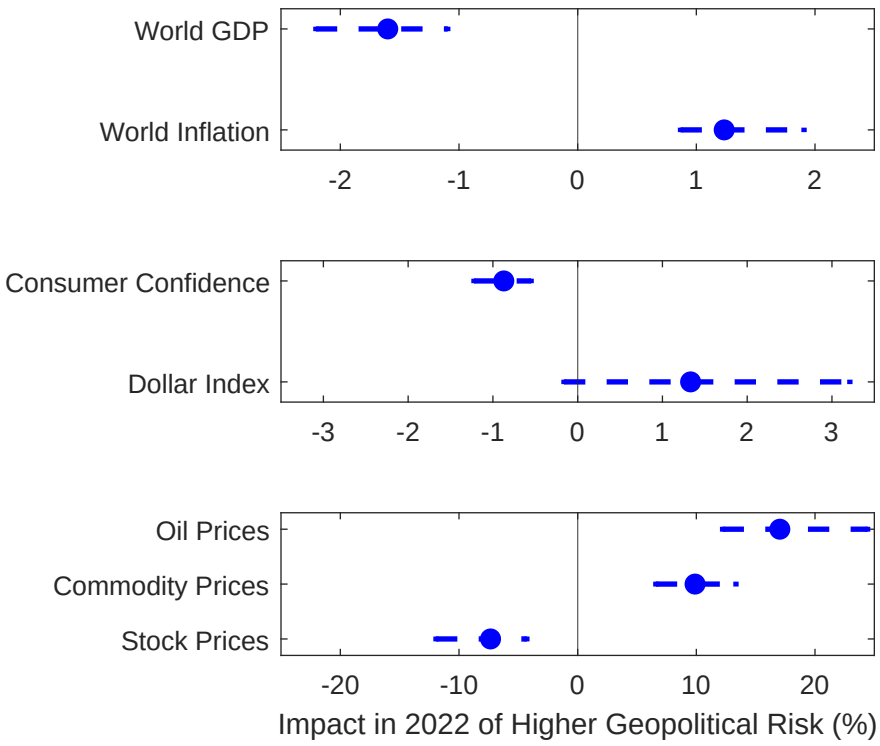
Note: The figure plots impulse responses to a one standard-deviation shock to US geopolitical risk. The impulse responses are estimated using a structural VAR model on US data only and includes the following variables: standardized country geopolitical risk (GPR), news-based present discounted value of expected changes in defense expenditures, growth in military spending as a share of GDP, inflation, real GDP per capita, and debt as a share of GDP. Data in the model is annual from 1901 to 2016. The solid blue lines in the figure plot the central estimates. The dashed blue lines denote bootstrapped 90 percent confidence intervals. Variables are plotted in terms of the deviation from baseline.

Figure 6: Global Effects of Higher Geopolitical Risks on World GPD and Inflation



Note: The figure plots impulse responses over time of world GDP and world inflation to a rise in geopolitical risks sized to mimic the increase occurred between January and April 2022, estimated using a structural vector autoregression (VAR) model. The model includes monthly measures of world GDP, world inflation, global stock prices, real oil prices, the broad real dollar, commodity prices, global consumer confidence, and the Geopolitical Threats (GPT) and Geopolitical Act indexes. Data in the model is from January 1974 to April 2022 and uses three lags.
The solid blue lines in the figure plot the central estimates. The dashed blue lines denote the 70 percent confidence intervals. The variables are plotted from January 2022 to December 2023 in deviation from a no-war baseline.

Figure 7: Effects of Higher Geopolitical Risk on Selected Variables



Note: The figure plots the maximum impact in the first year of a rise in geopolitical risks sized to mimic the increase occurred between January and April 2022, estimated using a structural vector autoregression (VAR) model. The model includes monthly measures of world GDP, world inflation, global stock prices, real oil prices, the broad real dollar, commodity prices, global consumer confidence, and the Geopolitical Threats (GPT) and Geopolitical Act indexes. Data in the model is from January 1974 to April 2022 and uses three lags.
For each variable, the blue dots plot the central estimates of the maximum impact in the first year. The blue dashed error bars denote 70 percent confidence intervals. The effect is measured in percent deviation from a no-war baseline for all variables except inflation, for which it is measured in percentage points.

Appendix

A Appendix on: Data Sources

A.1 Data Sources for Annual Cross-Country Analysis

The list of countries included in the panel sample is Argentina, Australia, Belgium, Brazil, Canada, Chile, China, Colombia, Denmark, Egypt, Finland, France, Germany, Hong Kong, Hungary, India, Indonesia, Israel, Italy, Japan, Malaysia, Mexico, Netherlands, Norway, Peru, Portugal, Philippines, Poland, Russia, Saudi Arabia, South Africa, South Korea, Spain, Sweden, Switzerland, Taiwan, Thailand, Tunisia, Turkey, Ukraine, United Kingdom, United States, and Venezuela.

Data on country-specific geopolitical risk are from Caldara and Iacoviello (2022). To their sample we add data for the following countries: Colombia, Egypt, Hong Kong, Hungary, India, Indonesia, Israel, Malaysia, Philippines, Poland, Saudi Arabia, South Africa, Thailand, Tunisia, Turkey, Ukraine, and Venezuela. This is done using the same methodology as in Caldara and Iacoviello (2022), counting the joint occurrence of geopolitical terms and the name, capital city, or major city for a given country. These indices are constructed using articles from the *Chicago Tribune*, *New York Times*, and *Washington Post* spanning 1900 to 2021.

Country-specific inflation comes from the IMF International Financial Statistics. Data coverage differ between countries and mostly start in the 1950s (with the exception of Canada, for which data begin in 1920). The dataset is extended back to 1900 with historical data from Jordà, Schularick, and Taylor (2017) and Reinhart and Rogoff (2009). Additional gaps in data are covered using information from the World Bank's World Development Indicators (series mnemonics A***CPIA@WDI, where *** indicates the country code) and the IMF World Economic Outlook (series mnemonics A***PCPE, where *** indicates the country code).

The real per capita GDP data are from Barro and Ursúa (2012), extended through 2021 using the World Bank World Development Indicators (WDI) for all countries except Taiwan, for which real per capita GDP is taken from Haver Analytics based on underlying data from national statistical offices (series mnemonics A528GCPC@EMERGE). Growth is calculated using Barro and Ursúa's data until 2005, and the WDI data from 2006 through 2021.

Data on military expenditures as a share of GDP are taken from Roser and Nagdy (2013)

and extend through 2021. The data were retrieved from https://ourworldindata.org/military-spending. Coverage for each of the 43 countries in our panel differs; data for 18 countries is available as early as 1900. The average number of observations per country is 94.

Debt to GDP ratio data are constructed from several sources. For advanced economies, data are from Jordà, Schularick, and Taylor (2017) and their Jordà-Schularick-Taylor Macrohistory Database. Additional data coverage is gained by pulling from the IMF's Public Finances in Modern History database, Reinhart and Rogoff (2009), the World Bank World Development Indicators (series mnemonics G***DCGP), and the IMF World Economic Outlook (series mnemonics A***GDSS), in that order. Data are available for all countries except Hong Kong, Israel, Saudi Arabia, and Ukraine. Data for debt to GDP ratios extends back to 1900 for 27 countries and is available for all countries except Taiwan from 2004. The average number of observations per country is 92.

Trade to GDP ratio data are similarly constructed from two sources. For advanced economies, trade and GDP data are taken from Jordà, Schularick, and Taylor (2017) and the measure is constructed by taking the ratio of total imports and exports over GDP. Data for these countries spans from 1900 to 2019, with some gaps around the two world wars. Further data is filled in using trade data from Correlates of War Project and GDP data from the World Bank's World Development Indicators (series mnemonics N***GPCD@WDI) and constructed in the same manner. This adds available data from 1960 to 2019 for all countries except Hong Kong and Taiwan. The average number of observations per country is 78.

Data on defense expenditure news, used only for the US-specific VAR from Section 3.2, are taken from Ramey (2011) and its extended historical data used in Ramey and Zubairy (2018). The indicator is available quarterly from 1900q1 to 2016q4; the sum is taken for each year to aggregate the measure to an annual basis. The measure is defined as the present discounted value of expected changes in defense expenditures, as reported by selected news sources.

A.2 Data Sources for Monthly Global VAR

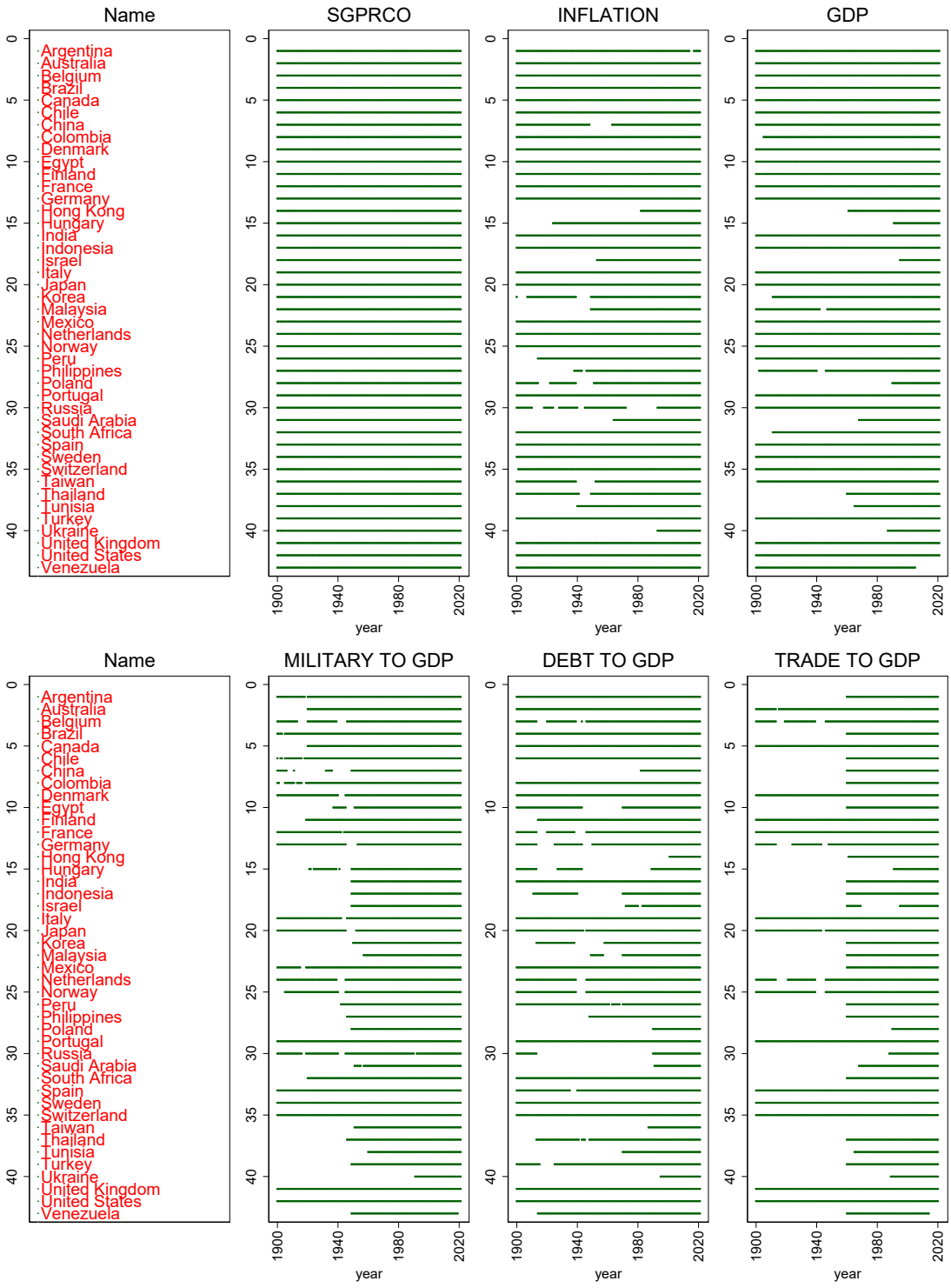
The global indicators used in the VAR are described below:

- Global geopolitical risk (GPR), as well as the geopolitical threats (GPT) and acts (GPA) indices (Caldara and Iacoviello (2022))

- World GDP in purchasing power parity (Cuba-Borda, Mechanick, and Raffo (2018))
- World inflation, defined as the aggregate of countries' twelve-month change in consumer price index (Global Financial data)
- Stock prices from the FTSE World Dollar index (Global Financial data)
- The Conference Board Consumer Confidence Index (Haver mnemonics: CCIN@USECON)
- The spot oil prices from West Texas Intermediate (Haver mnemonics: PXTEXP@USECON)
- commodity prices (GSCI@USECON - from the SP Goldman Sachs Commodity Index)
- The dollar exchange rate (FXTWBDI@USECON - Federal Reserve Board Nominal Trade-Weighted broad dollar index)

Data spans from 1974 to 2022 for all indicators and is at the monthly level.

Figure A.1: Data coverage for the Cross-Country Panel



Note: The figure plots the coverage of country-specific variables over our sample: standardized country-specific geopolitical risk, inflation, log real GDP per capita, military spending as a share of GDP, public debt to GDP ratios, and trade to GDP ratios.