Do Geopolitical Risks Raise or Lower Inflation in Sweden?

A quantitative study

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Bachelor Thesis

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Abstract:

Using two main datasets, one annual from 1900 to 2022, and one monthly from 2012 to 2023, containing a geopolitical risk index and multiple inflationary factors for both Sweden and Denmark, we construct VAR models to estimate the effect geopolitical risk has on inflation. In our annual dataset, we find that higher geopolitical risks foreshadow higher inflation and lower economic activity in Sweden. In our monthly dataset analysis, we observe that the ongoing Ukraine conflict is exerting a dampening influence on various facets of the Swedish economic landscape. Specifically, we note a decline in consumer confidence, a dip in stock prices, and a noticeable uptick in the prices of event-specific commodities, such as wheat and natural gas. Additionally, we find that the main source of geopolitical risk-driven inflation comes from trade, where supply chain deficiencies and higher import prices lead to higher Swedish inflation. The paper gives insight into how geopolitical risk impacts inflation in a country that is not directly involved in the conflict, and which sources of inflation are dominant in times of high geopolitical risk.

Keywords:

Geopolitical Risk, War, Inflation, Vector Autoregression, Sweden, Denmark, Trade

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1. Introduction

This paper is an extension of "Do Geopolitical Risks Raise or Lower Inflation?" by Matteo Iacoviello, Dario Caldara, Sarah Conlisk, and Maddie Penn. In this paper, historical data for Sweden and Denmark, and a multitude of empirical techniques, are used to examine the potential association between geopolitical risks and inflation in Sweden. Even though the magnitude of the effects of geopolitical risk (GPR) on inflation differs in Sweden and Denmark over time, we find that geopolitical risks do affect inflation in Sweden, and have implications on commodity prices, trade, debt, and military spending. These are examples of factors used to explain the observed effects.

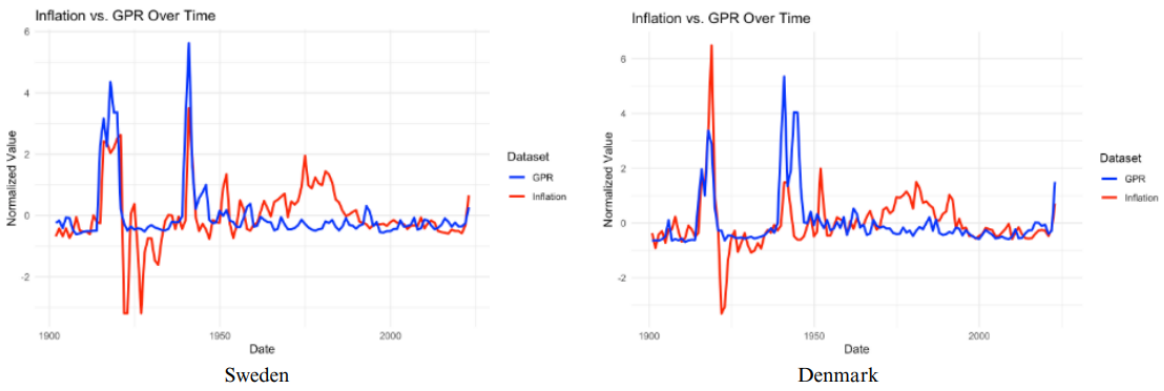
The primary reason why an extension in this field is created is the relevance of the topic, where both geopolitical risk and inflation are subject to discussion in everyday life, and influences people in their day-to-day spending habits, and firms in their acquisition behavior. Sweden has recently been experiencing unusually high inflation, which raises the question; why? The interest in answering this question drove us to write a thesis on one of the hottest topics of today.

From a theoretical standpoint, forces are pulling in opposite directions on whether higher geopolitical risks lead to higher or lower inflation since they are entanglement of adverse demand and supply shocks that can move inflation in either direction. Wars and risks that come with them can destroy human and physical capital, make actors move resources to less efficient uses, redirect international trade, and disrupt supply chains. On the other hand, the uncertainty about the future concerning geopolitical risks can affect the activity in the economy, postpone companies' investments and hirings, corrode consumer confidence, and increase financial constrictions. Some of the aspects that decrease inflation, such as the postponing of firms' investments, can be offset by increases in public spending, for example, military spending financed by debt, which can increase inflation. The aggregate change in inflation depends on which of these forces dominates, and this is investigated in this paper, with a focus on Sweden.

As seen in the normalized model in Figure 1, there are long-term similarities between inflation in both Sweden Denmark and adverse geopolitical events as measured by Caldara and Iacoviello's (2023) geopolitical risk index. The GPR index is reflected by automated text-search results of three U.S. newspapers, namely The New York Times, Chicago Tribune and The Washington Post, and "Caldara and Iacoviello calculate the country-specific index by counting the monthly share of all newspaper articles from 1900 to present (or 1985 to present for the Recent Index) that both (1) meet the criterion for inclusion in the GPR index and (2) mention the name of the country or its major cities." (Caldara et. al., 2023)

One can see how shocks in the geopolitical risks tend to impact inflation (as measured by CPI), since they move in a similar pattern. This effect is further investigated through, as previously mentioned, various empirical techniques such as vector autoregression shocks on the different factors considered as explanations for the correlation. The below graph's purpose is to give an insight into how the two main factors have moved historically, where one, for example, can see a spike in the 1940s due to World War II, and a recent upward trend, caused by the turbulent world situation. This is also a subject of further investigation in the paper.

Figure 1: Swedish and Danish Inflation vs. GPR over time (normalized)



Note: The graph illustrates how inflation and GPR for Sweden and Denmark have moved over time (1900-2022). There are a few global events that have resulted in spikes in both GPR and inflation. There were substantial high levels of both GPR and inflation during WWI & WWII, as well as large increases in recent times after a fairly long period of calamity following the Ukraine war.

Two main datasets are used in the paper, and the primary analysis is organized around them; an annual dataset dating back to the year 1900, which measures the GPR and will provide us with a historical overview of how the two main factors broadly correlate. The annual data also contains measures of inflation, GDP, military spending, public debt, trade, and broad money growth. These inflationary forces are used to explain the results and are chosen due to our beliefs of them being interesting explanatory factors, both because of our attentiveness to the factors and through some of them being used in previous papers touching the subject. The results from the tests are compared to Danish data, which is used to gain further insight into the potential effects of the results.

Additionally, to explain which sub-categories of inflation are affected by GPR, VARs on annual data are run for the three largest inflationary subgroups - namely, food, shelter, and transportation. These subgroups are counted as the joint average price levels of the selected commodities or services within the group. It is found that food is impacted positively by GPR, which is in line with the argument of trade being the main factor of inflation affected by GPR since it is an international factor compared to shelter and transportation.

A monthly dataset dating back to 2012 is also used, which will explore how agile the correlation between the two variables is, and how Russia's invasion of Ukraine affects Swedish inflation. This dataset contains monthly values for Swedish GPR, inflation, OMXS30 price levels, consumer confidence indexes, and global averages for prices of wheat and natural gas. S&P's Dow Jones Commodity Index Energy is also used as a commodity-specific factor for wheat prices and natural gas prices. This factor is included since some of the price variations in these two commodities can be explained by commodity-specific factors instead of geopolitical risks. The factors used will give us insights into what causes the inflationary effects found through the constant shift in GPR, and the global effects on Swedish inflation. The data is described in further detail in section 3.

In section 4 the methodology for testing the data and retrieving the results is described. The methodology is mainly based on a vector autoregression model. The methodology section includes a description of how the results are retrieved and analyzed for both the annual and monthly datasets and how, with different approaches to handling the data, one can pinpoint the different forces that impact inflation in times of shifts in GPR.

Section 5.1 uses the data from 3.1 to explain the effects of GPR on inflation. First, a simple regression with GPR on inflation is run, and one can see that both the Swedish data and the Danish data show a positive correlation (0.495 for Sweden and 0.498 for Denmark). The connection is further investigated by estimating a VAR model that shows that a one standard deviation shock in GPR creates higher inflation. The same shock is used on the other indicators, leaving us with the following reactions: GDP decreases, military spending increases, public debt decreases, trade decreases and broad money growth decreases, all as results of a one standard deviation shock in GPR. The results of these shocks are analyzed to investigate which forces drive inflation in times of high GPR.

In section 5.2, a deep dive into the results found in section 5.1 is done, with the goal of finding the reason why increased inflation may be caused by higher GPR, testing the different factors, and comparing them to the Danish data. Here, a linear regression of GPR on inflation is used, and later a discussion and examination of the results is conducted. This is done in the process of figuring out if Sweden or Denmark is more exposed to inflation changes when GPR increases/decreases. Methodologically, an average GPR dataset with Sweden's and Denmark's combined GPRs is created. One main effect in the findings is that of the reasoning behind cost-push inflation, where, even though purchasing power and economic activity decrease, the costs of production, and hence also the prices of commodities and services, increase and create inflation. One main reason for this is the effect of trade, where supply chains are disrupted, and commodity and service prices increase. The effect of international effects is further investigated in the next section.

In section 5.3, a monthly dataset dating back to 2012 is used to estimate a more detailed analysis of the correlation between GPR and inflation. This is done to get an insight into how Russia's invasion of Ukraine has affected inflation in Sweden. A VAR model of the Swedish economy is estimated and illustrates the IRF results in a scenario that projects how the response variables move over a 12-month period after a shock in GPR. It is found, as mentioned earlier, that inflation in Sweden goes up with a shock in geopolitical risk. Consumer confidence and OMXS30 price levels both decrease at first, before they go back to normal levels, wherein OMXS30 price levels even show higher than initial levels after the 12-month period. Natural gas prices are positively affected by the shock in GPR. It is also found that wheat prices initially spike as geopolitical risk in the Ukraine conflict goes up before going back to more normal levels. When regressing natural gas and wheat prices on the commodity-specific factor, it is concluded that wheat prices are more affected by geopolitical risks than commodity-specific factors and that it is ambiguous if natural gas prices are, since the commodity is embedded within the Dow Jones Commodity Energy Index. A discussion on this ambiguity is further conducted in section 5.3. The takeaways from the results are conducted to show a connection between Swedish inflation and international GPR. This can further deepen the analysis of which factors are driving Swedish inflation in times of high GPR.

2. Literature review

The paper makes one main contribution. We give a systematic explanation of the relationship between geopolitical risk and inflation for a specific country - Sweden. Studying the effect of geopolitical risks on inflation in a country like Sweden, which has not been directly involved in a war since 1814 (Sveriges Radio, 2014), is a meaningful contribution to the literature since it explores how the inflation of a specific country that is not involved in a war is impacted by other countries who are. This differs from existing papers in the scope of similar literature, which often focus on the U.S. since they have been directly and indirectly involved in many conflicts in the last century (Kelly, 2020). We investigate the notion that in U.S.-focused papers, the understanding of why inflation goes up in times of high geopolitical risk may be different for a country like Sweden since factors like national military spending tend to differ. With the topic of geopolitical risk also being so prevailing in Sweden's nearby territory, the aspect of non-involvement becomes even more engaging.

We also explore aspects of the economy that tend to increase in activity with heightened geopolitical tensions - military spending and public debt. We show that military expenditure is inflationary for Sweden, which along with the findings of Tzeng, Shin-Jen, Ching-Chong Lai, and Chun-Chieh Huang (2007) should mean that in the scope of the VAR model projections, the increase in the marginal benefit of holding money exceeds the increase in the marginal product of private capital.

We could, however, not find any evidence that public debt is inflationary for Sweden - a developed economy - which is in line with what was produced in the paper "Public Debt, Money Supply, and Inflation: A Cross-Country Study" by Kwon, Goohoon, Lavern McFarlane and Wayne Robinson (2008), but contradicts what was found in the paper by Caldara et. al. (2023). We show that the depreciation of the exchange rate specifically for the Swedish crown is an important transmission channel to inflation which is in line with evidence presented in "The International Price System" by Gopinath (2015). However, when comparing to the euro-pegged Danish crown, the Danish economy still sees higher inflation. This is further explained by the two countries' different emphasis on fiscal and monetary policies.

The paper, from which this one is an extension of; "Do geopolitical risks raise or lower inflation" by Caldara et. al. (2023), provides a systematic explanation for how heightened geopolitical risks can affect global inflation. They use historical data for a panel with 44 countries dating back to 1900 where they find that geopolitical risks lead to high inflation and subsequently also lower economic activity, an increase in military spending and public debt, a decline in trade with the outside world, and higher broad money growth. Not only do they find that higher geopolitical risks are associated with higher inflation, but also more uncertain inflation and bigger upside risks to it. They also use a monthly VAR model on global data since the 1970s where they specifically look at the Ukraine conflict and confirm that geopolitical risks' impact on inflationary effects like higher commodity prices and currency depreciation is larger than the deflationary effects of lower consumer confidence and tighter financial restrictions - resulting in a positive relationship between geopolitical risks and higher inflation.

Earlier papers in academia generally put the scope on the effect of wars on economic activity ("War and Economic Performance" by Koubi, V. 2005). More specifically, Koubi studies the consequences of inter- and intrastate wars for economic growth for a large panel of countries between 1960 and 1989. Koubi concludes that differences in economic growth between countries are related to the severity and duration of war and that countries that have fought long/severe wars will see higher long-term growth rates of the economy post-war. Our paper

emphasizes non-involved parties and the impact of other wars on their economy, making it an extension of what was found by Koubi.

Subsequently, papers in the existing literature often analyze how wars and their economic impacts are translated into the fiscal policy ("World War II Fiscal Policies and the End of the Great Depression" by Vernon, J. 1994). This paper studies and explores the fiscal policies that were instrumental in restoring the USA's full-employment output from the Great Depression to 1942, which was when they had been restored. During the period 1933 to 1940, fiscal policies played a small role, but became the most crucial factor after 1940. Before 1940 only half of the full-employment output had been restored and after 1942 it was back to normal levels, thus these fiscal policies played a large role. We use the concepts of fiscal and monetary policies and discuss how Sweden and Denmark, with different capabilities, utilize these tools to stimulate the economy.

As mentioned in the paper by Caldara et. al, the effects of wars on inflation are seemingly scarce (2023), and oftentimes the analysis is focused on the United States ("Three world wars: Fiscal-monetary consequences" by Hall and Sargent, 2022; "War and Inflation in the United States from the revolution to the First Iraq War" by Rockoff, 2015). Hall and Sargent focus on US monetary-fiscal responses to WWI and WWII as well as the COVID-19 pandemic. They detect and interpret the consequences of the U.S. decisions on fiscal and monetary policies during these large economic events. Hugh Rockoff studies wars the U.S. has been involved in post-revolution and explores the different ways of funding a war. He later describes how larger wars cannot be solely financed by taxes and borrowing, instead, the government turns to printing more money, resulting in substantial inflation. We investigate similar concepts and behaviors but on a non-involved party.

The paper "Public Debt, Money Supply, and Inflation: A Cross-Country Study" by Kwon et. al. (2008) shows extensive empirical evidence that an increase in public debt is inflationary for countries with large public debt - but that this does not apply to developed economies. The paper "Does military expenditure matter for inflation and economic growth?" by Tzeng, et. al. (2007) provides a model that can explain that the relationship between military expenditure and its effect on the observed inflation is ambiguous. They find that the inflation rate may either rise or fall depending on whether the increase in the marginal benefit from holding on to money is higher or lower than the increase in the marginal product of private capital. In Gopinath's paper "The International Price System" (2015), empirical evidence shows that the world trades in a few dominant currencies and that economies that do not trade in these currencies are more affected by inflationary changes in import and export prices. Exchange rate depreciations make U.S. exports cheaper, while for other countries they mainly raise mark-ups and hence profits. A large currency like the U.S. dollar has spillover effects on inflation in other countries while spillovers from other countries are more muted. The empirical findings of these papers are used and discussed to explain and analyze the quantitative results we retrieve from the statistical models.

3. The Data

Two GPR datasets will lay the basis for the empirical analysis. One historical annual dataset and one monthly dataset, which will, with the measures and estimations collected from different sources, lay the foundation for the results. The primary objective of the paper, and hence also the data, is to find relevant effects in Sweden. By also investigating the same factors and conducting the same experiments on Danish data, one can compare similarities and differences to further investigate the underlying reasons for the results retrieved.

3.1 Swedish and Danish Historical Annual Data

The first dataset is a historical annual dataset dating from 1900 to 2022. This dataset contains annual Swedish and Danish measurements for inflation (CPI) and GDP per capita, as well as four additional economic indicators: military expenditure to GDP ratios, public debt to GDP ratios, trade to GDP ratios, and broad money growth. The numbers for the Swedish inflation is annual data from SCB (2023a), and range from 1900 to 2022. The numbers for the annual Danish inflation cover the years 1901 to 2022 and are retrieved from (Statistics Denmark, 2023). The data for Swedish and Danish inflation are winsorized at the 1st and 97.5th percentiles to diminish the influence of hyper-inflationary periods since these will affect the data and hence derange the results. Annual data for the Swedish and Danish GDP per capita covers the years 1900 to 2022. The GDP per capita data for the years 1900 to 2018 are retrieved from (Öljemark, J, 2023*)* for both countries and are presented in the form of an international dollar indexed from 2011. For the missing years, 2019 to 2022, the country-specific annual growth rates of the GDP per capita from Macrotrends are used to manually compute the values (2023).

Data on Swedish and Danish military expenditure from the years 1960 to 2022 comes from The World Bank (2022b) and is defined as military spending as a share of GDP. The data for Swedish public debt to GDP is retrieved from Riksgälden (2023) and covers the years 1980 to 2023. Danish public debt to GDP data covers the years 1961 to 2021 and the data for the years between 1961 to 2015 is retrieved from the International Monetary Fund (2015). The data for the years 2016 to 2021 is retrieved from Eurostat (2022).

Trade to GDP ratios cover the years 1960 to 2022 and are defined as the sum of exports and imports of goods and services as a share of the GDP and contains data for both Sweden and Denmark. They are retrieved from The World Bank (2022c). Broad money growth data for both countries range from 1961 to 2021 and is defined as the annual growth rate of "the sum of currency outside banks; demand deposits other than those of the central government; the time, savings, and foreign currency deposits of resident sectors other than the central government; bank and traveler's checks; and other securities such as certificates of deposit and commercial paper." (The World Bank, 2022a). The broad money growth data is also winsorized at the 1st and 97.5th percentiles for the same reason as for the inflation data - to diminish the influence of hyper-growth periods.

In the U.S., the three main sub-groups when calculating the consumer price index are food, shelter, and transportation (DeSilver, 2022). Due to a lack of data on Swedish weights, it is assumed that the three largest subgroups for Sweden are the same. These factors are used for the analysis. Data on Swedish shelter, food, and transportation prices are retrieved from SCB (2023c).

In Table 1 in the appendix, a summary statistics table for the variables used in the dataset is found. The table provides the mean, median, standard deviation, minimum value, maximum value, and the number of observations. GDP is the per capita value of an international dollar index from 2011. Geopolitical risk is measured as a number between 0 and 1, where 0 is the lowest and 1 is the highest measure of geopolitical risk. Trade, military spending, and public debt are all expressed as a percentage of total domestic GDP. Broad money growth and inflation are annual percentages compared to the previous periods.

The different inflationary forces are compared to, and regressed on, the Swedish geopolitical risk index retrieved from Caldara and Iacoviello (2023).

For the impulse response functions, a summary table in the appendix (Tables 3 & 4) is provided, where one can view the minimum and maximum values the response takes on.

3.2 Monthly Time Series Data

For section 5.3, a construction of a vector autoregression model with monthly data on Swedish geopolitical risk, consumer confidence, inflation, and stock prices from OMXS30 is conducted. Variables for global wheat and natural gas prices are also included. Then a scenario analysis is conducted in order to study how a one standard deviation shock in geopolitical risk influences the other five response variables. A lag of 2 periods is used for the VAR model and a VAR model projection is created for how the response variables will change.

All data for the monthly time series data cover the period 2012-01 to 2023-06. The monthly data for Swedish GPR is retrieved from Matteo Iacoviello's website (2023). The data for Swedish monthly inflation is retrieved from SCB (2023b). The data for Swedish consumer confidence comes from Statista (2023). Statistics for OMXS30 price levels are retrieved from the investing.com website (2023). Data on natural gas is from the U.S Energy Information Administration (2023) and is defined as U.S. dollars per million Btu, where Btu is the British Thermal Unit (measure of heat). Finally, the statistics for wheat prices come from Index Mundi (2023). For the commodity-specific factor used as a regressor, the S&P Dow Jones Commodity Index for Energy (2023) is used.

Furthermore, it is assumed that changes in the financial variables used are reflected by changes in geopolitical risk and not the other way around. This is also ensured by using the lag since this will show the effect of inflation as a response to GPR, not vice versa.

For the impulse response functions, a summary table is provided in the appendix (Tables 7 & 8), where one can view the minimum and maximum values the responses take on. A summary statistic table for the variables can be found in Table 6 in the appendix.

4. Methodology

The analysis is started by plotting normalized graphs of geopolitical risk and inflation for Sweden and Denmark from 1900 to visually see the relationship between the two variables, shown in Figure 1 in the introduction. The basis for the analysis is mainly built on two vector autoregression models where a simulation of an impulse shock in geopolitical risk is conducted, and one can study the result in the dependent variables. A vector autoregression model is used for several reasons. Firstly, the VAR model is well suited for capturing interdependencies and dynamic relationships between several time-series variables. Secondly, there is no need for exogenous variables. Instead, it focuses on the endogenous relationships within the set of variables under consideration, which simplifies model specification and estimation. Lastly, VAR models are well-suited for forecasting. They can be used to show how the impact of shocks develops over time in the model, helping us better understand the dynamic response of variables.

First, a primary regression is run to find that there is a correlation between geopolitical risk for both Sweden and Denmark. The first VAR model is run on annual data for Sweden and Denmark for the following variables: GPR, inflation, GDP per capita, military spending, trade % of GDP, public debt % of GDP, and broad money growth. A simulation of a one standard deviation shock in geopolitical risk is reported and one can record the responses in each of the other variables. Through doing this one can see which variables move in the same (opposite) directions as inflation does and thus make an analysis with regards to whether those variables are the reason for the increased (decreased) inflation. In addition to the previously mentioned variables, analysis of the impulse responses of the consumer price index subgroups food, shelter, and transportation, is conducted through a one standard deviation shock in GPR in a VAR model.

In addition to the primary regressions, a GPR index is created by averaging out Sweden's and Denmark's GPRs and testing the correlation of Swedish and Danish inflation on this index instead, giving us more insight into what could be the possible reasons for the outcome found in the VAR outputs.

The second VAR model is run on Swedish and global monthly data from January 2012 to June 2023 where a similar analysis as the first VAR model is made, that specifically looks at one certain event that caused GPR indexes to increase globally - Russia's invasion of Ukraine. In this model, other event-specific variables, that can have a more significant effect on Swedish inflation than those used in the first VAR model, are included. The variables included are Swedish GPR, Swedish inflation, Swedish consumer confidence, OMXS30 price levels, global natural gas prices, and global wheat prices. Like the first construction, the model simulates a one standard deviation shock in geopolitical risk and then records the responses in the other variables over a 12-month period. This enables for a discussion on which event-specific variables play a larger role than others, regarding the recent Swedish inflation spikes.

In addition, a commodity-specific factor, S&P Dow Jones Commodity Index Energy is added as a regressor on an additional VAR on natural gas and wheat prices. The effects of geopolitical risks versus the commodity-specific factor are compared and the implications of the differences are discussed.

All the VAR models have 95% bootstrapped confidence intervals with 2000 runs. These are shown by the red lines in the graphs. Function 1 shows the function used for the VAR model.

Y_t represents the vector of endogenous variables at time t, $Y_{(t-1)}$ represents lagged values of the endogenous variables and A_p are coefficient matrices for the lags. u_t is an error term.

$$Y_t = A_1 * Y_{(t-1)} + A_2 * Y_{(t-2)} + \ldots + A_p * Y_{(t-p)} + u_t \quad (1)$$

Results found from the methods are reliant on the datasets retrieved and conducted from various sources. Some results appear surprising, and therefore more than one method on a single variable is run to explain the possible reasons for the results based on the data, methodology, and economic reasoning. The reason why this is done is to ensure the robustness of the findings. The motivation for why all the different factors in the VAR models are tested is not solely to find the cause of why inflation increases with GPR, but also to ground the findings in a model that works consecutively, not only with two set parameters and by chance. An additional factor that provides robustness to the findings is that of the cross-comparison to Danish data. The same methodology is used for testing the data and retrieving the results, and similar, or at least comparable, results are retrieved, indicating replicability; a fundamental principle for the scientific method.

As shown by graphs produced by the VAR model, one can observe that the confidence bands generated in the Impulse Response Functions appear notably broad, creating an uncertainty in the reliance on the data. This phenomenon prompts us to investigate possible reasons for the observed uncertainty, investigate what could be done, and if the data would allow for it, get more precision in the results.

One possible reason for the broad confidence interval bands is that of a small dataset. The factors used are sensitive and agile, meaning that they do not always follow the patterns one would, from theory, suppose. Therefore, by having a larger dataset, these "flaws" would be dampened by the vast majority of movements of the factors. VAR modeling heavily relies on sufficient data to adequately capture the underlying dynamics of the variables involved. Since the analysis conducted is for a single country, the sample cannot be broadened by adding more countries, but one would have to go back further in time, which is difficult to do due to a lack of reliable data.

When comparing the results received from the yearly and monthly Impulse Response Functions, the response for inflation is higher for the yearly dataset (increase by 1.02 percentage points) than for the monthly dataset (increase by 0.14 percentage points). The reason for this is that one standard deviation in GPR is smaller when looking at the monthly data since the difference from one month to another will on average not be as large as from one year to another. When checking the standard deviation of the annual data of GPR in Sweden it is found to be ≈ 0.098, and for the monthly GPR data, it is ≈ 0.073, hence proven. For reference, the standard deviation of the annual data of GPR in Denmark is ≈ 0.080.

In addition to this, the results are tested by changing the lag order in the monthly datasets. Easily liquefiable assets like wheat and OMXS30 have tendencies to respond quickly to the regressor. To be consistent in the paper, the same lag for the different variables is used, but the data is also tested by decreasing the lag to 1 instead of 2 for some factors, and the results from this change are discussed to get a better grasp of unexpected results.

5. Empirical results

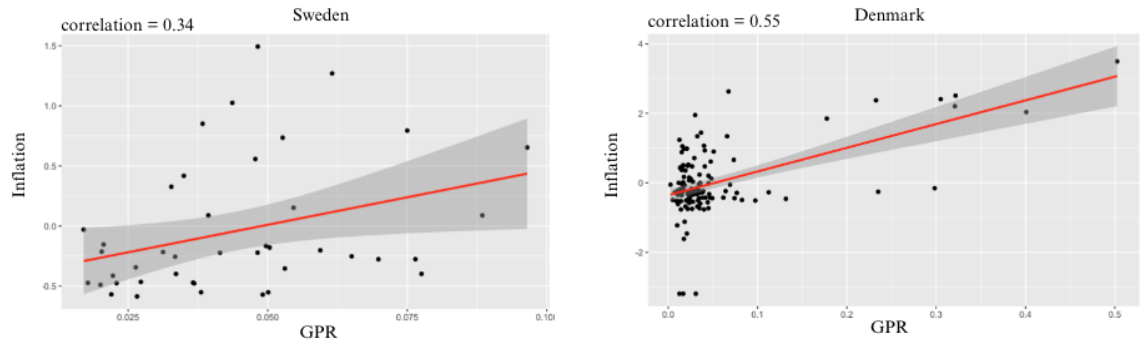
5.1 Geopolitical Risks' Effect on Inflation

In this section, geopolitical risks' effect on inflation will be assessed. This is done with the yearly dataset dating back to the year 1900 and through analyzing the results by referring to the graphs and tables created by the models to later understand the underlying reasons for the connections found.

5.1.1 The Movement of Inflation with Geopolitical Risk

Using the datasets described earlier, a linear regression model is created to find the correlation between GPR and inflation. As seen in Figure 5.1.1.1, one can find that the correlation in Sweden lands at 0.34. Hence there is a correlation between the two. The reason why the correlation is not higher could be explained by the fact that GPR affects inflation (when GPR increases, so does inflation), but not vice versa. It is not necessarily implied that when inflation is high, GPR would be as well. The inflationary phenomenon that occurs due to high demand is demand-pull inflation, and it is this phenomenon that weakens the correlation between the two factors; inflation is high whilst GPR is low, as visualized by Figure 1, where inflation can be high even though GPR is not. The same goes for Denmark, which has a higher correlation of 0.55. The explanation of the difference is further developed in section 5.2. So, there is a correlation, but it could be value-adding to isolate the effect GPR has on inflation, and a more advanced model is therefore introduced.

Figure 5.1.1.1: Swedish and Danish correlation matrices for inflation and GPR



Note: The graph illustrates the Swedish and Danish correlation between country-specific inflation and GPR. Sweden correlates 0.34 whereas Denmark correlates 0.55.

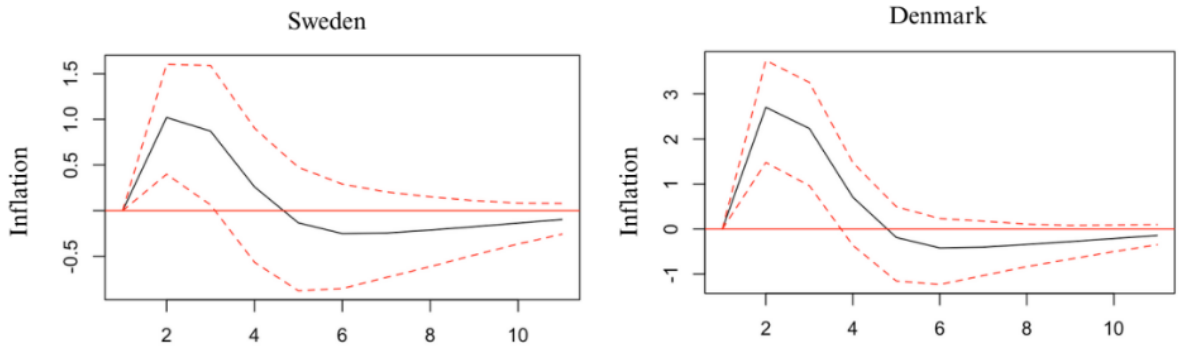
Instead of solely using a simple linear regression to describe the connection, a VAR model that simulates a one standard deviation shock in GPR and shows the response of the chosen y-axis parameter is introduced. Through doing this, one can visualize the effect of GPR on inflation without relying on the linear regression and hence excluding the low correlation between the two factors in times when high inflation is not caused by high GPR, but for example through a higher demand amongst consumers (demand-pull inflation).

The results show that a rise in Swedish GPR causes an increase in Swedish inflation by 1.02 percentage points. This is illustrated in Figure 5.1.1.2, where inflation (CPI) is shown as an impulse response of a one standard deviation GPR shock. The response to the shock is

illustrated through the black line that goes up by 1.02 percentage points (Table 3), going back to the starting level after less than 5 years. The red dashed lines show the 95% bootstrap confidence intervals.

This can be compared to the Danish VAR test of GPR and inflation found below. The movements of the shock are similar, however, the effects are slightly more extreme, as inflation goes up by 2.70 percentage points (Table 4). The possible reason for this difference will be further investigated in the next section (5.1.2), where an analysis of various inflationary factors is performed, as well as in section 5.2.

Figure 5.1.1.2: Swedish and Danish impulse responses in inflation to GPR shock



Note: The graphs show Swedish and Danish impulse responses in inflation to a one standard deviation shock in country-specific GPR. Sweden sees an increase of about 1.02 percentage points, whereas Denmark has an increase of a bit more than 2.70 percentage points.

5.1.2 Inflationary Factors Response to Geopolitical Risk

Five variables that can further conduct an inquiry into, and explain the connection between, GPR and inflation are added. The variables are GDP, military spending, public debt to GDP ratio, trade to GDP ratio, and broad money growth. Refer to summary statistics Tables 1 & 2 in the appendix to investigate the behavior of the factors.

As seen in Figure 5.1.2.1, Swedish GDP per capita responds to a GPR shock through decreasing by 98.21 international dollars (Table 3). The now-established fact that GDP goes down in times of high geopolitical risk is expected and can be the response of multiple factors such as reduced investment (both domestic and foreign), lower purchasing confidence, increased costs, trade disruptions, and military spending which can decrease spending in other sectors, etcetera. These are all factors that can directly affect inflation, and vice versa, and are thus analyzed further. Comparing the result in GDP to the ones retrieved in Denmark (Figure 5.1.2.2), one can see that, as in section 5.1.1, the effects are slightly more extreme in Denmark (decreasing by 228.31 international dollars – Table 4), but the movements are similar.

Another expected result from the VAR model is that military spending increases with geopolitical risk (an increase of 0.04%). This is shown for Sweden in Figure 5.1.2.1 and Table 3. Military expenditures somewhat stimulate the economy, at the same time as it reduces capital to invest in other, potentially more economically influential, sectors. We hence believe that, whilst the results support the connection between GPR and inflation, this is not a major effect, nor a sole explanation. We also believe that, compared to for example the US, the Swedish economy is not as affected by military spending due to Sweden not being involved in a war in over 200 years, as well as Sweden's historical lack of emphasis on a strong military (World

Bank, 2022d). In Figure 5.1.2.2 we can view the same effects in Denmark, however, they show a minimal change. One reason for the difference in magnitude is Denmark's involvement in NATO since they are assured to have backing in the event of a conflict. They therefore do not have to take action to the same extent as Sweden when facing risk.

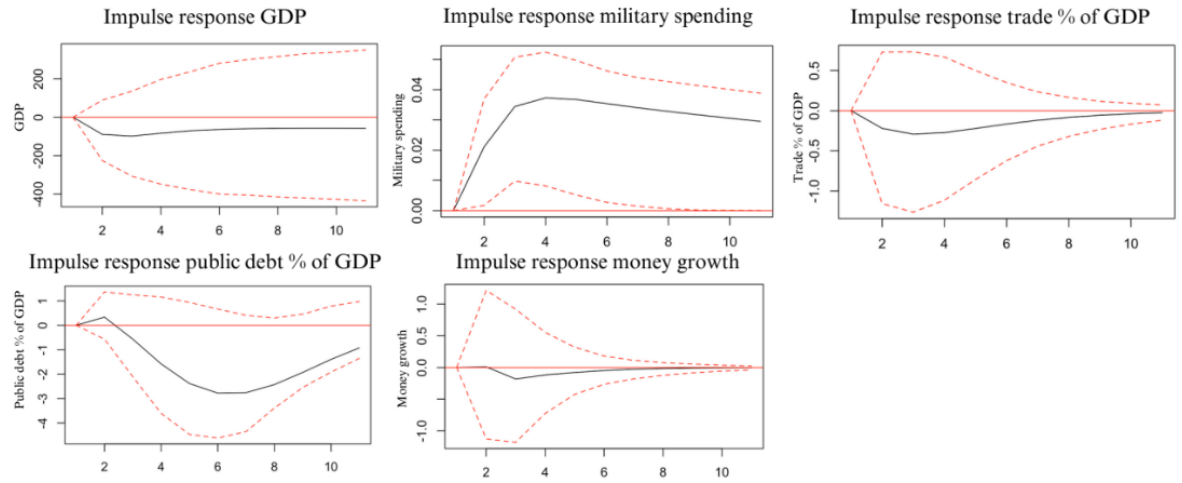
Moving on, it was earlier mentioned that one reason for GDP decreasing in times with higher GPR is that of lower trade, which is supported by the outcome in Figure 5.1.2.1 where a VAR is run with the impulse response "trade percentage of GDP". Trade decreases by 0.29% in Sweden and by 0.26% in Denmark (see Tables 3 & 4). In Denmark, being a large export country, it bounces back after about three years, which could be an effect of its export of oil and wind technology turbines (International Trade Administration, 2022).

Swedish public debt to GDP decreases by 2.78% in response to a GPR shock (Table 3). The reasoning behind this could be that, in times of turbulence, overall spending goes down and hence governments manage to decrease their debt. They also have the incentive to decrease debt since it is not beneficial to be highly indebted in times of high economic risk (Burriel, Checherita-Westphal, Jacquinot, Schön, Stähler, 2020:16). This is, however, a force that contradicts the results of inflation going up. If public debt would increase, there would probably be more government spending, which stimulates the economy, incentivizes consumption, and increases inflation. Danish debt to GDP also decreases by -0.72% (Table 4).

Looking at broad money growth, the results show that in Sweden, it decreases by -0.18 percentage points in response to a GPR shock (Table 3). Broad money growth is a flexible way to measure a country's money supply. It measures cash and other assets that are easily converted to cash in a currency. As previously mentioned, public debt decreases in response to a GPR shock, which can be a reason, amongst other monetary policy tightening measures, why broad money growth also decreases. Currency depreciation can also be caused by loss of confidence in the currency which in turn can lead to higher inflation due to importing being expensive (Gopinath, 2015). As a response, the central bank may decrease the money supply to try to stabilize the currency, ultimately decreasing broad money growth. Referring to the previous discussion about Denmark's NATO involvement, it is likely that Sweden is more susceptible to currency depreciation, not only because the Swedish crown is not pegged to a large currency like the EURO, but also because the non-involvement in NATO could deter foreign investors when there is high geopolitical risk present.

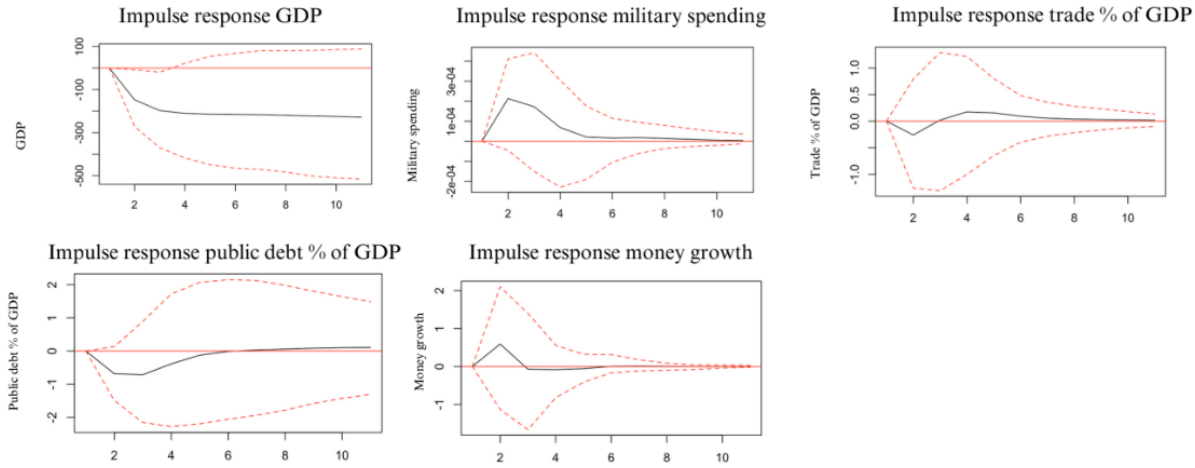
Expanding on the discussion about broad money growth, there is not much to be said about the results retrieved for Sweden. However, Danish broad money growth increases by 0.59 percentage points (Table 4). The difference, although small, could lie in the high Danish reliance on fiscal policy, where they need to stimulate the economy through either buying/selling the EUR/DKK when consumer confidence goes down as a result of the increased geopolitical risk (Danmarks Nationalbank, 2018*)*.

Figure 5.1.2.1: Swedish impulse responses to a one standard deviation shock in GPR



Note: The graphs show Swedish impulse responses in selected variables to a one standard deviation shock in GPR. The only variable that increases is military spending, whereas GDP, trade % of GDP, public debt % of GDP, and money growth all decrease.

Figure 5.1.2.2: Danish impulse responses to a one standard deviation shock in GPR



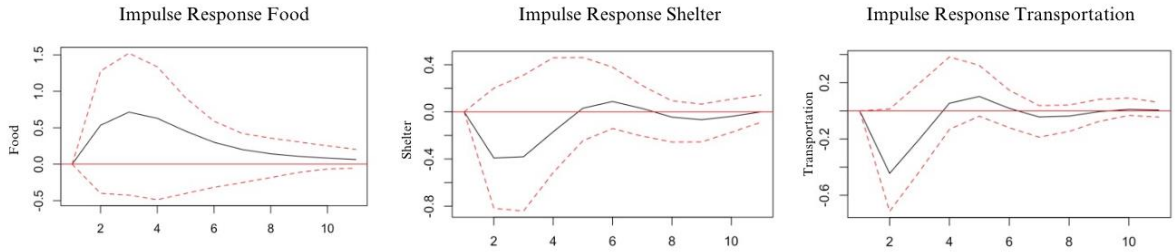
Note: The graphs show Danish impulse responses in selected variables to a one standard deviation shock in GPR. The variables that increase are military spending, trade % of GDP, and money growth, whereas GDP and public debt % of GDP decrease.

From the regressions run up to this point, the aim is to find specific reasons as to what factors GPR affects, that subsequently impact inflation. Now, to understand which sub-sectors of inflation, as defined by SCB (2023c), are most affected by GPR, a new VAR model is conducted where the three largest inflationary groups (as measured by U.S. inflationary subgroups defined by DeSilver, 2022) are tested. By doing this, one can further analyze to what extent GPR impacts inflation through these inflationary components. The three largest sub-sectors are food, shelter, and transportation. From the IRF, one can see that the main positive impact comes from food, which increases by 0.71%. The results from the models can be viewed in Figure 5.1.2.3 and Table 3.

What this implies in the field of the research is that imported commodities, through a shift in GPR, affect Swedish inflation. Since Sweden is not directly involved in conflicts, domestic GPR is affected by international conflict. The international conflict has an impact on the prices of commodities that are imported, and is hence the underlying reason for the effects visible when running the regression on Swedish GPR and Swedish inflation. A sub-sector like shelter

will also affect inflation in different ways, but since this is an internal market that is not as affected by international conflict, it will not see its effects through movements in GPR. This is a finding that is further backed in the following section (5.2). Transportation also moves in a way that is contradictory to the notion of higher inflation. This means that the increase in food prices outweighs the decreases in shelter and transportation, or that other variables not included in the analysis make up for a portion of the increased inflation.

Figure 5.1.2.3: Swedish impulse responses in inflationary components to a one standard deviation shock in GPR



Note: The factors are the three largest sub-components of the consumer price index.

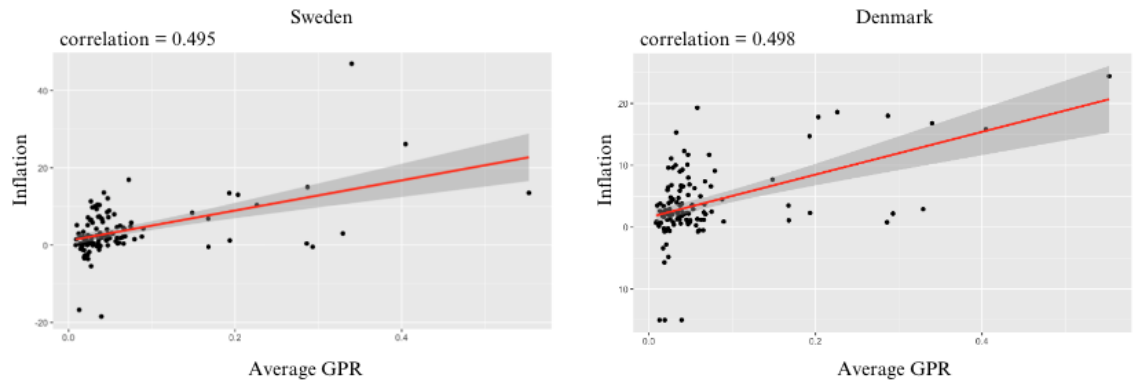
5.2 Reasons for Geopolitical Risks' impact on inflation

In this section, an inquiry into why geopolitical risk affects inflation is conducted. The results gathered in section 5.1 are used and a test where an average GPR is run against inflation is estimated. This is done to find out which of the two countries' inflations that are more affected by GPR. Drawing from different macroeconomic analyses will help us understand the underlying reasons for the connection between inflation and GPR in Sweden.

5.2.1 Differences in Inflationary Effects Responses of Geopolitical Risk in Sweden and Denmark

To run the regression, an average of the GPR of Sweden and Denmark from 1901 to 2022 is calculated. A linear regression is then run with Swedish inflation and Danish inflation separately, and the results shown in Figure 5.2.1 are retrieved. Danish inflation has a correlation of 0.498, whilst Sweden has a correlation of 0.495. The differences are not large, but if a comparison is made to the results retrieved in the primary regressions in Figure 5.1.1.1, one can see that the Danish correlation drops, whilst the Swedish correlation increases. An explanation for this could be that Denmark is more affected by domestic GPR, whilst Sweden is more affected by macro trends in the nearby economy, since Sweden imports more, as a ratio to GDP, than Denmark (countryeconomy.com, 2023). Further investigation into this phenomenon and the possible reasons why Sweden has a lower correlation between GPR and inflation is conducted in the following section.

Figure 5.2.1: Swedish and Danish correlation matrices with average GPR



Note: The graphs show the Swedish and Danish correlation between country-specific inflation and an average GPR between the two countries. Swedish correlation is 0.495 and the Danish correlation is 0.498.

5.2.2 Analysis of Differences

The difference in correlation between the two regressions is not large: 0.003. However, an interesting takeaway is that of the difference in the regressions run with the national GPR datasets (Figure 5.1.1.1). The Danish correlation decreases, but the Swedish correlation increases. So, why does Swedish inflation have less of a correlation to GPR than Danish inflation, why does the joint GPR index decrease Danish correlation with inflation and increase Swedish correlation with inflation, and what does this imply?

One possible explanation is that the Danish crown is pegged to the euro, whilst the Swedish crown has a free exchange rate. Denmark has a strategy of buying or selling their own currency to keep the exchange rate within the established range, and does not use monetary policy in the same way as the Swedish Central Bank does. Sweden can freely adjust interest rates through the Central Bank in order to monitor the habits of Swedish consumers. The Swedish central bank will increase the repo rate when inflation is high to discourage consumption and hence inflation will be subdued (Sveriges Riksbank, 2023). Denmark has a fixed exchange rate policy to the EUR and instead chooses to use fiscal policy. This can leave them more vulnerable to inflation changes since monetary policy is a more blunt tool to manage inflation levels whereas fiscal policies are better equipped for influencing aggregate demand in the economy (Segal, Troy, 2023).

What does this say about the inflationary forces of Sweden? As seen in Figure 5.1.2.2, broad money growth of Denmark goes up with inflation, seemingly due to the lack of monetary policy usage. In Sweden it does not increase in the same way, meaning that this inflationary effect is merely a response to the inflation found by the central bank and trade behavior, rather than a reason for inflation increasing.

Also, the notion of public debt decreasing is in line with how the Swedish fiscal policy responds to times of inflation. Instead of public debt being a cause of inflation, which it could be through public spending, it is a response to the ongoing inflation - a precaution to not increase inflation further. The output of the public debt graph in Figure 5.1.2.2 is therefore merely a way for the Swedish government to respond to rising inflation. This can also be an explaining variable to broad money growth decreasing since taking on less debt ultimately leads to having less liquidity. Therefore, these effects can be viewed as mere responses to inflation, not responses to GPR. The same goes for Denmark, making the regression results similar for the two.

We instead turn to trade, where in Sweden it is clear that it decreases in response to GPR rising. In Denmark, the results are not as clear. We believe, from this comparison, that trade could be one of the main explanatory factors to why inflation is affected by GPR in Sweden. In Denmark, trade has to be somewhat regulated to keep the Danish Crown pegged to the Euro. In Sweden, this is not as important, and when GPR increases, the Swedish crown depreciates, and Swedish commodities increase in price, since import becomes more expensive. Swedish inflation is hence, in times of high GPR, driven by commodity and service prices increasing, not a higher purchasing power, which is an example of cost-push inflation. The underlying reason for commodities and services becoming more expensive is that of production costs going up, and trading (more specifically importing) as a result being more expensive. Since Sweden is not directly involved in any conflicts during the data's timeframe, it is mainly international conflict that affects Swedish GPR, and therefore it is logical that inflation in Sweden is affected by trade and supply-chain deficiencies. The reason why the comparison to Denmark is important and interesting to this reasoning is that of its forced trade to keep the Danish crown pegged.

This resonates well with what was found in the paper by Gopinath, "The International Price System" (2015). According to Gopinath, global trade only uses a few dominant currencies. The economies that do not use these currencies are more susceptible to inflationary changes in imports and exports. Thus, Sweden and Denmark who use their own, and in comparison to the EUR or USD, small currencies will see larger increases in inflation as import prices increase. As mentioned previously, the effect on inflation in Sweden is lesser than the effect observed in Denmark due to the Swedish central bank being able to use monetary policies to combat the inflation. It is an earlier established phenomenon that inflation increases with GPR (Iacoviello et. al., 2023), but this analysis emphasizes and develops the theory further, by finding the reason why a country like Sweden is affected by GPR, in contrast to a global study.

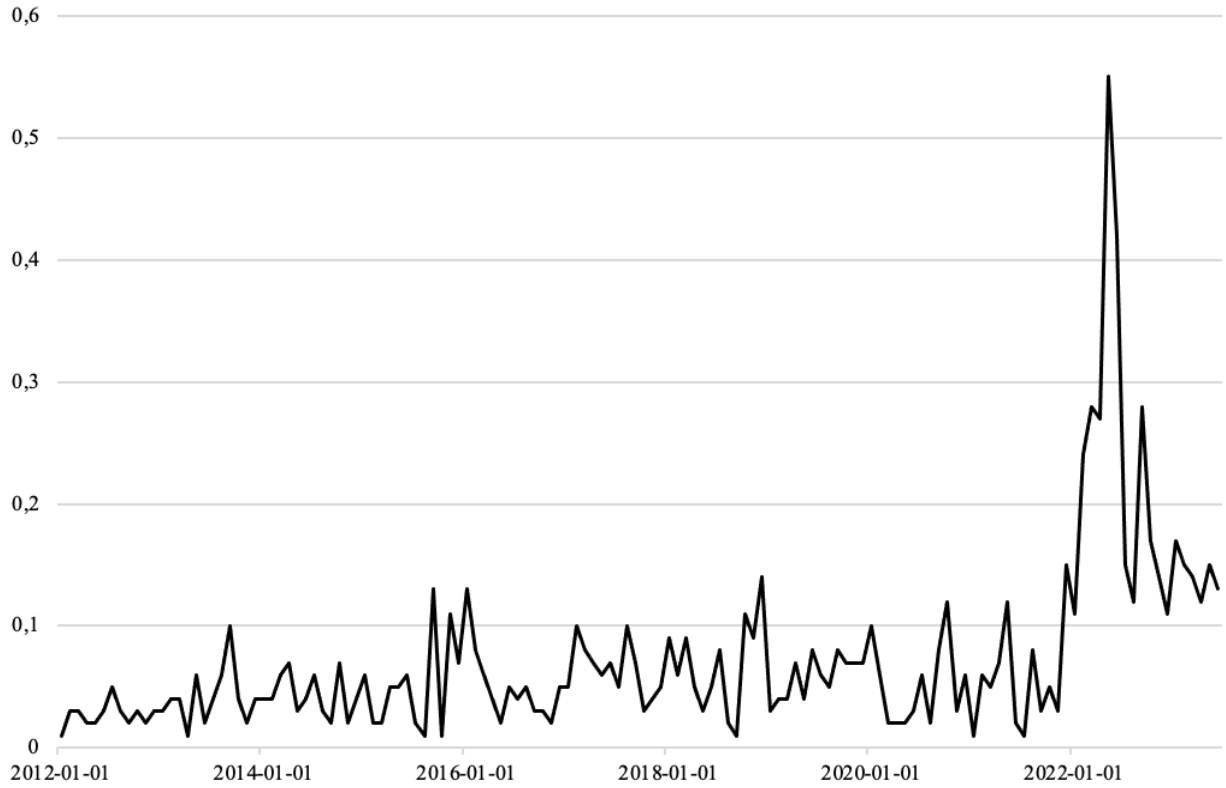
One can also, from running the regressions, make the argument that the relationship between high GPR and inflation is not specific to Swedish GPR, but is also reflected by the GPR of surrounding geographic areas, due to a correlation of the GPRs of nearby countries. If commodity prices rise in one export country due to tensions or war, it will ultimately affect importers' prices, and hence their inflation, more than it affects their GPR index. An example of this is the war in Ukraine. Ukraine is a large exporter of wheat, and as a result of the war, the lack of wheat exports from Ukraine affects the global supply. If the global supply of wheat decreases, prices will increase globally and eventually lead to inflation in Sweden (due to spillover effects on several commodities and services). The war in Ukraine will, of course, affect Swedish GPR as well, since there is a higher risk of Russian invasion, but not to the same extent as that of the inflationary effects. We therefore believe that there is more to this research than just looking at Swedish inflation and Swedish GPR. Further investigation into the effect of foreign events on Swedish inflation will be conducted in section 5.3, where an inquiry into Swedish inflation in relation to Russia's invasion of Ukraine is made.

5.3 Foreign Effects on Swedish Inflation: A Deep Dive into the Consequences of Russia's Invasion of Ukraine

In this section, the monthly dataset is used to investigate the extent to which Russia's invasion of Ukraine affects Swedish inflationary forces. By doing this, it becomes evident how it is not only country-specific geopolitical risks that influence the inflation in Sweden. In a world where trade and open markets are emphasized, no country evades the ripple effects of a war. This theory is in line with the hypothesis that trade is one of the main reasons why GPR does affect

inflation in Sweden. Sweden has, as earlier mentioned, not been in a war in about 200 years, but is still affected by GPR. This would then imply that supply chain uncertainty, caused by a rise in GPR, is a precedent factor. One crucial basis for the tests is that Swedish GPR has increased due to Russia's invasion of Ukraine, which can be seen in Figure 5.3.1.

Figure 5.3.1: Swedish monthly GPR (2018-01 - 2023-06)



Note: The graph shows Swedish monthly GPR between the dates 2018-01 and 2023-06. There are large increases in GPR 2022-01 following the invasion of Ukraine.

5.3.1 Analysis of Global Geopolitical Effect

As seen in the impulse response function in Figure 5.3.2 and Table 7, inflation rises with a maximum increase of about 0.14 percentage points after roughly 9 months, before it gradually starts going back to normal levels. This is in line with what has been produced earlier in this paper: as geopolitical risk goes up - so does inflation.

In the aforementioned graph and table, one can also see that stock prices in the OMXS30 index decrease to a minimum level of SEK -14.49, reaching its lowest level after 2 months. However, in contrast to one's intuition, prices go up again quickly and instead show a positive development after the 12-month period, which ends on SEK 2.02. One potential explanation for this could be a psychological aspect of stock trading. The initial geopolitical risk shock causes widespread panic, resulting in stock markets plummeting and the general economy's downturn. However, after a while, people come to their senses and realize that maybe a war in Ukraine does not mean that Sweden also will head into an armed conflict - people and companies hence start investing their capital again and stock prices start rising. The consumer confidence starts by decreasing to -0.12% and then gradually makes its way up to normal levels. This resonates well with the discussion about why stock prices start by going down before they

rise again - as the shock of geopolitical risk subdues, the consumers' confidence in the overall economy goes back up.

Both the effects of the stock prices and the consumer confidence are forces that push in the opposite direction of how the inflation moves for this period. As consumer confidence and the appropriate allocation of capital decrease, inflation should, from a macroeconomic theoretical framework, do the same. Instead, inflation goes up and only comes back down after consumer confidence is restored and stock prices are increasing - why is that?

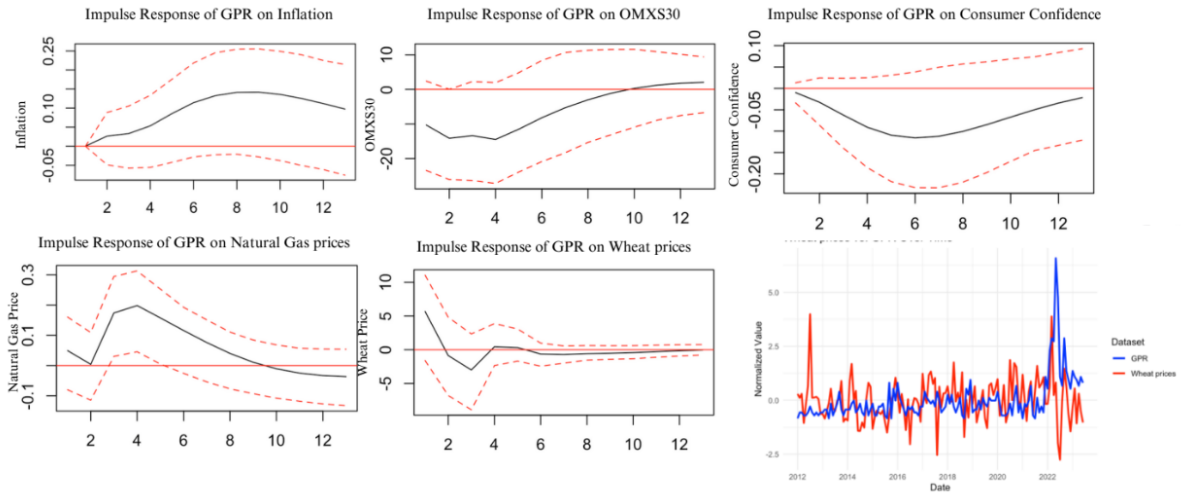
The answer again lies in what the source of the inflation is, and which powers overwhelm the opposite ones. The effect of the disruption of supply chains, especially with regards to grain export from Ukraine and how Russia has stopped natural gas export to the European Union, are both forces that drive commodity prices up. These global forces far exceed the psychological effects on Swedish stock prices and consumer confidence, thus driving inflation upwards; another demonstration of cost-push inflation. The natural gas price graph in Figure 5.3.2 serves as an example of this. As the global supply of natural gas decreases following the increase in GPR, the price is driven up by 0.20 $ per million Btu and does therefore have a helping hand in the increased observed inflation in Sweden. After the 12-month period, one can see that the natural gas price has its lowest point at -0.04 $ per million Btu – which can be explained by the aforementioned psychological aspects of investors (see table 7).

When studying the first wheat price graph in Figure 5.3.2, the model predicts that wheat prices decline by 3.01 percentage points initially, and then get back to normal levels (see Table 7). This is something that goes against the theory of cost-push inflation, but the answer to the opposition is simple. As wheat is such a liquefiable commodity, the price increases quickly after the one standard deviation shock in GPR, and what the graph plots is the time when the price is already making its way down to normal levels after the shock.

To further prove that this is the case, the price of wheat and GPR's development in the secondary wheat price graph in Figure 5.3.2 is included. Around the time of 2012, one can see a large price increase in wheat, whereas GPR is relatively low. This large difference in the data could be an explanation as to why the VAR model forecasts movements that are not in line with the theory of cost-push inflation. In addition, when looking at the period in which Russia invaded Ukraine and there is a large increase in GPR, one can see an instant reaction in wheat prices that increase, before they rebound down to normal levels rather quickly. One explanation for the fast rebound of wheat prices could be the tariff-free agricultural import from Ukraine that the EU implemented, thus undercutting suppliers from other non-EU countries and dragging down prices.

It can also be concluded, when studying the second wheat graph in Figure 5.3.2, that wheat prices move with GPR but GPR does not necessarily move with wheat prices. This makes intuitive sense since war or the threat of war disrupts trade - as discussed earlier in the paper, and as the supply of wheat decreases, prices increase due to excess demand, leading to cost-push inflation. There is an argument to be made nonetheless with regards to how a sudden lack of supply of an important good like wheat is something that can create conflict and thus drive up GPR. This is however something that has to be evaluated independently in each case, and looking at the current conflict in Ukraine wheat prices have not affected GPR.

Figure 5.3.2: Impulse responses to a shock in GPR (monthly data) & wheat prices vs. GPR over time



Note: The graphs show the response to a one-standard-deviation shock of GPR in a 12-month timeframe. The graph in the bottom right corner shows a graph of normalized values of GPR and wheat prices, where it is evident that there has been a recent spike in GPR, whilst wheat prices have decreased after a recent spike.

It is unclear whether the increase in wheat and natural gas prices and subsequently their effect on Swedish inflation is attributable to the conflict in Ukraine (GPR), or if it is due to a commodity-specific factor (Dow Jones Commodity Index Energy).

A new regressor is therefore introduced; a commodity-specific factor in the form of the energy index. The response from wheat prices when regressing the GPR index starts with a highly positive number (5.67 percentage points), and when regressing with the energy index the response takes its largest value at 1.06 percentage points (see table 7 & 8). The index is closely related to the wheat industry - as energy is needed for all steps in the wheat life-cycle (planting, harvesting, storing, transporting). Natural gas, as an energy source, is also closely related to the index.

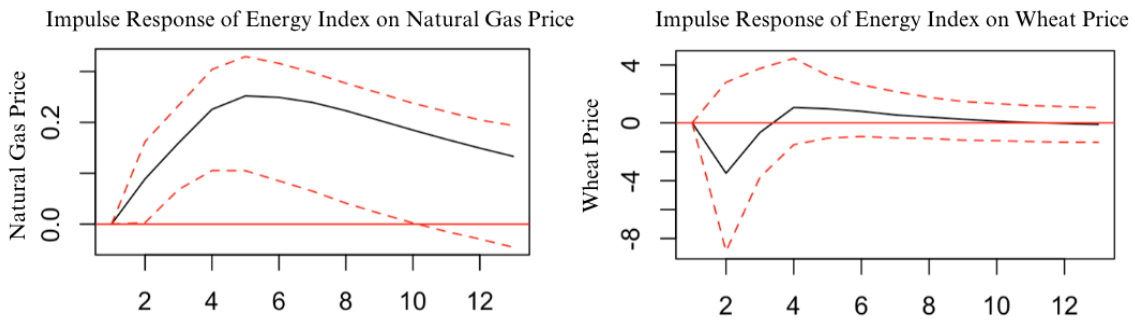
The fact that the effect of a one standard deviation shock in GPR is larger than the effect of the energy index on wheat prices signals that in the case of the Ukraine conflict, it is the ripple effects of the war that affect the wheat prices. This suggests that the inflationary effect influenced by GPR is a significant explanatory factor for the research.

The reason why wheat prices initially decrease in response to a commodity-specific shock is due to the lag order in the VAR model. To be consequent in the tests, a lag of 2 periods for all variables is implemented. However, when decreasing the lag to one period, the initial response is positive, meaning that it is the quick response of wheat prices to energy prices that influences the IRFs. All easily liquefiable variables, wheat prices, OMXS30 prices, and natural gas prices, have a quicker reaction than, for example, GDP per capita or military spending, which explains why some of these variables do not start at zero in the graphs.

Studying Table 8, and as visually presented in Figure 5.3.3, one can see that natural gas prices increase more to a one standard deviation shock in the commodity-specific energy index ($ 0.25 per million Btu) compared to when there is a shock in GPR ($ 0.20 per million Btu - see table 7). This would suggest that in this case, commodity-specific factors explain the price increase in natural gas and not to the same extent the GPR resulting from the ongoing war in Ukraine. However, the results from the VAR model with the Energy Index and natural gas prices are biased since natural gas prices are a component of the index. Thus, natural gas prices are too closely related to the index, and does therefore not serve as an independent variable.

The energy index will influence natural gas prices, and natural gas prices will have an effect on inflation.

Figure 5.3.3 Impulse responses to a shock in commodity-specific factor on wheat and natural gas prices



Note: The graphs show the response of natural gas prices and wheat prices to a one-standard-deviation shock of the Dow Jones Commodity Index on Energy.

Conclusion

Geopolitical risk is an indicator of a shift in power, conflict, or crisis. Sweden has not been in a war in over 200 years. We therefore thought that the value in finding a connection between geopolitical risk and inflation in Sweden is an interesting and relevant subject to study. We use two different datasets, one annual and one monthly, with GPR and different inflationary forces to run tests on their connection. The primary source of conclusions is based on the VAR models, where we simulate the response of our inflationary factors on a one-standard-deviation shock of GPR. We use various methods, like creating a standard GPR index for both Sweden and Denmark and looking at Russia's invasion of Ukraine, to further understand what it is that makes GPR affect inflation as it does.

We find that geopolitical risk affects inflation positively, meaning that the forces that pull inflation upwards in times of economic turbulence (like higher import prices due to supply-chain inefficiencies and military spending) are stronger than those pulling inflation downwards (like lower purchasing power and economic activity). Following Russia's invasion of Ukraine, the Swedish geopolitical landscape has witnessed a substantial surge in risks. Our conducted tests illuminate the specific forces influenced by these geopolitical risks; subsequently propelling inflation rates upwards. We, from this, can conclude that international geopolitical risk does impact national geopolitical risk and that this force affects national inflation.

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Appendix

Table 1: Summary statistics for Sweden

Variable	Mean	Median	SD	Min	Max	Obs
GDP (per capita, int. $)	8229.27	1980.00	11930.00	1221.00	53576.00	323
GPR	0.08	0.05	0.10	0.01	0.60	123
Inflation	2.52	2.01	6.08	-18.45	46.95	192
Trade % of GDP	64.64	63.84	17.21	38.52	92.56	61
Military Spending % of GDP	2.34	2.45	0.96	1.02	3.97	61
Broad Money Growth, %	8.10	7.58	5.06	-0.44	22.43	61
Debt % of GDP	43.91	43.00	15.91	18.00	73.00	45

Table 2: Summary statistics for Denmark

Variable	Mean	Median	SD	Min	Max	Obs
GDP (per capita, int. $)	20278.77	15178.00	14248.91	4948.00	51698.63	122
GPR	0.03	0.03	0.01	0.01	0.08	61
Inflation, %	3.80	2.40	5.89	-15.00	24.40	122
Trade % of GDP	77.09	70.79	18.03	53.22	112.18	56
Military Spending % of GDP	1.90	1.94	0.53	1.11	3.04	61
Broad Money Growth, %	7.60	8.43	7.41	-9.95	27.79	61
Debt % of GDP	37.15	40.37	21.07	4.26	69.23	61

Table 3: IRF response of factors of one standard deviation GPR shock for Swedish annual data

IRF response	Min	Max
Inflation, (% points)	-0,25	1,02
GDP (per capita, int. $)	-98,21	0
Broad Money Growth, (% points)	-0,18	0,01
Military Spending % of GDP,(%)	0	0,04
Trade % of GDP, (%)	-0,29	0
Debt % of GDP, (%)	-2,78	0,34
Food Index	0	0,71
Shelter Index	-0,39	0,09
Transportation Index	-0,44	0,10

$Y_t = A_1 * Y_{(t-1)} + A_2 * Y_{(t-2)} + \ldots + A_p * Y_{(t-p)} + u_t$

Table 4: IRF response of factors of one standard deviation GPR shock for Danish annual data

IRF response	Min	Max
Inflation	-0,42	2,70
GDP (per capita, int. $)	-228,31	0
Broad Money Growth, % points	0,09	0,59
Military Spending % of GDP, %	0	0,0002
Trade % of GDP, (%)	-0,26	0,18
Debt % of GDP, (%)	-0,72	0,11

$Y_t = A_1 * Y_{(t-1)} + A_2 * Y_{(t-2)} + \ldots + A_p * Y_{(t-p)} + u_t$

Table 5: Linear model of regression output for Sweden and Denmark, both with national GPR and the Danish and Swedish average GPR

Linear model	Model Corr.	Estimate	Std. Error	t value
Sweden, national GPR	0.34	9.16	4.07	2.25
Sweden, average GPR	0.495	39.04	6.25	6.25
Denmark, national GPR	0.55	6.82	0.95	7.14
Denmark, average GPR	0.498	34.51	5.49	6.29

Table 6: Summary statistics for monthly dataset

Variable	Mean	Median	SD	Min	Max	Obs
Inflation, % points	2.04	1.35	3.03	-0.60	12.30	138
GPR	0.071	0.05	0.073	0.01	0.55	138
OMXS30	1612.23	1571.70	350.11	975.98	2419.73	138
Consumer Confidence index	99.41	99.65	2.02	93.06	103.58	138
Natural Gas Price, $/mil Btu	3.33	2.93	1.33	1.63	8.81	138
Wheat Price, % points	0.37	0.29	6.22	-16.77	25.16	138

Table 7: IRF response of factors of one standard deviation GPR shock for monthly data

IRF response	Min	Max
Inflation	0	0.14
OMXS30	-14.49	2.02
Consumer confidence	-0.12	-0.01
Natural Gas Price, $/mil Btu	-0.04	0.20
Wheat Price, % points	-3.01	5.67

$Y_t = A_1 * Y_{(t-1)} + A_2 * Y_{(t-2)} + \ldots + A_p * Y_{(t-p)} + u_t$

Table 8: IRF response of Natural Gas and Wheat Price of one standard deviation energy commodity index shock for Swedish monthly data

IRF response	Min	Max
Natural Gas Price, $/mil Btu	0	0.25
Wheat Price, % points	-3.49	1.06

$Y_t = A_1 * Y_{(t-1)} + A_2 * Y_{(t-2)} + \ldots + A_p * Y_{(t-p)} + u_t$