Assessing the economic impact of the global geopolitical-energy uncertainty index

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Abstract

Employing the text-based method, we develop a novel index (the GEU index) measuring the geopolitical-energy uncertainties at the global scale during the 1996-2023 period. We based on the monthly Global reports of the Economist Intelligence Unit for searching the keywords to construct the index. We then evaluate the efficacy of the GEU index using different empirical techniques, such as the impulse response functions and the quantile connectedness approach. Our key findings are presented as follows. First, we observe that the GEU index coincides with several remarkable events occurring across the globe during the study period. Especially, the index tends to strongly react to both geopolitical events and energy shocks. Second, we find evidence that innovations of the GEU index could foreshadow the decreases in macroeconomic activities. Government fiscal indicators such as the current account balance, budget balance, and debt to GDP ratio are also significantly affected by the GEU index. Notably, a shock from the index is found to cause a significant decrease in global energy price indicators and a significant increase in the political risk. Last, the spillover effect analyses confirm the GEU index's efficacy in absorbing and reflecting most of country-level geopolitical risks as well as sector-level volatilities under different market conditions. The GEU index could be considered as a risk management tool for policymakers to stabilize the economy and energy markets as well as for market participants to adjust their investment portfolios in response to periods of high geopolitical-energy uncertainties.

Keywords: Energy shocks; Energy uncertainty; Geopolitical energy uncertainty; Geopolitical risks; Text-based method; Uncertainty

JEL codes: C43; D80; F51; Q43

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1. Introduction

Over recent periods, the world has witnessed different remarkably serious conflicts, which tend to amplify the level of geopolitical risk and make this kind of risk become one of the most serious global risks (Jin et al., 2023; World Economic Forum, 2020). Especially, the Russian-Ukraine war is considered the largest geopolitical crisis in Europe since the occurrence of the World War II, spreading panic among market participants and causing turbulence on capital markets across the world (Zhang et al., 2022).

Defined by Caldara and Iacoviello (2022), geopolitical risk is "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 has been noted to become a key factor which might impact economic conditions (Jiang et al., 2024). Given that the energy market is considered as an element of the economic system, it is also found to be affected by geopolitical risks (Jiao et al., 2023). According to Klein (2024), geopolitical risk could impact financial markets through different spillover mechanisms, including capital flows, market fluctuations, and market participants' sentiment. Furthermore, geopolitical uncertainty tends to exert significant effects on particular industries or sectors, causing heightened volatility in such market segments (Umar et al., 2022).

As indicated by previous studies, the occurrence of geopolitical conflicts or events might raise and spread panic among market participants, leading to unexpected market variations and eventually exerting significant impacts on energy returns and volatility (Antonakakis et al., 2017; Mei et al., 2020). Energy is typically considered as a key significant factor driving global economic growth as such material is vital to the survival and development of humankind (Acheampong et al., 2021). As an essential strategic resource, energy plays an important role in maintaining the social and economic development of economies across the globe (Wen et al., 2019). Given that oil is a valuable commodity which might impact the global economy (Charfeddine et al., 2020; Klein, 2018), it appears to be tightly integrated with the global politics and national strategies (Mei et al., 2020). Additionally, oil price volatility has been recorded to be closely related to economic activities, monetary policies, capital markets as well as investment decisions (Hamilton, 2003; Jo, 2014; Kilian & Park, 2009). Energy prices are found to be greatly vulnerable to geopolitical uncertainties because energy is characterized by different factors, such as the demand's low price elasticity, the spatial separation between demand and supply, significant strategies as well as resource scarcity (Su et al., 2019).

Pronounced swings in geopolitical risk and oil prices have been noted in recent years (Ivanovski & Hailemariam, 2022). The occurrence of geopolitical conflicts in oil producing countries tends to significantly affect global energy supply, leading to substantial energy price fluctuations (Qin et al., 2020). According to Liu et al. (2019), geopolitical risks might affect both oil supply and demand uncertainties. In term of the supply side, geopolitical uncertainty is likely to impact the oil supply policies of the US and OPEC economies, leading to increasing uncertainties and volatilities of the oil prices. With respect to the demand side, oil demand uncertainties might arise from the impact of geopolitical risks on economic activities to a specific extent (Liu et al., 2019).

Examining the interactions among geopolitical risk, uncertainties and oil prices appears to attract increasing attentions from scholars in recent periods, such as Antonakakis et al. (2017), Huang et al. (2021), Liu et al. (2019), Mei et al. (2020), Wang et al. (2021) among the others. However, to the best of our knowledge, up to now, no study has measured the contemporaneous uncertainties/risks arising from both geopolitical incidents and energy markets. As such, our study contributes to the current literature in the following aspects.

First, we contribute to the literature on uncertainty measurements by proposing a novel index measuring the global geopolitical-energy uncertainties (GEU index), which has not been explored in the extant literature. We follow a text-based approach to construct the GEU index.

Second, we based on the monthly Global reports from the Economist Intelligence Unit (EIU) to develop the GEU index, which is similar to Ahir et al. (2022). The EIU monthly reports are considered high-quality and reliable because they follow a standardized process and structure that might help mitigate concerns with respect to accuracy, consistency as well as ideological bias (Ahir et al., 2022). In addition, our study directly constructs the GEU index at the global scale based on the Global EIU reports, with the aim of reflecting both geopolitical and energy uncertainty dimensions jointly.

Last, our study adopts different approaches, including the impulse response function and the spillover analysis, in evaluating the efficacy of the GEU index in order to provide empirical evidence on the economic impacts of the geopolitical-energy uncertainty, not only at the macroeconomic level but also at the country and sectoral levels.

2. Literature review

According to Ahir et al. (2022), the occurrence of several serious events (including the global financial crisis, political polarization, trade conflicts, and the coronavirus outbreak)

appears to lift concerns regarding uncertainties to the next levels. Intensified uncertainties are found to have the potential to exert significant negative impact on economic activities around the world (Ghirelli et al., 2021). Among the risks/uncertainties that the world has been experiencing, geopolitical risk is reported to be among the top five serious global risks (Jin et al., 2023; World Economic Forum, 2020). As such, investigating and quantifying geopolitical risks have been attracting more and more attention from both scholars and practitioners around the world (Engle & Campos-Martins, 2023). Based on the textual analysis, Caldara and Iacoviello (2022) propose a novel index which measuring the geopolitical risk, not only at the global scale but also for countries across the globe. Recently, Engle and Campos-Martins (2023) propose the novel COVOL measuring the market-based volatility. More specifically, COVOL is to determine a common volatility factor which might impact different asset classes globally. Therefore, this risk factor reflects significant shocks to the international markets among various asset classes as well as geopolitical risks.

Recent empirical studies show evidence that geopolitical risk is relatively associated with traditional energy markets (Bouoiyour et al., 2019; Liu et al., 2021; Mei et al., 2020). One possible explanation for such relationship is that risk regarding fossil fuel appears synonymous with energy-related geopolitics, meanwhile regions or group of economies possessing control of traditional energy tend to possess geostrategic advantages (Su et al., 2021). Jiao et al. (2023) argue that geopolitical risk might exert impacts on oil prices through affecting the demand and supply sides in the spot market. Apart from that channel, the geopolitical factors also appear to impact market participants' expectations, causing behavioral finance biases (i.e., under-response or over-response), and thus affecting the oil prices.

Antonakakis et al. (2017) investigate the relationship among geopolitical risks, stock markets and oil markets during the period 1899-2016 and show evidence that geopolitical risk tends to negatively affect oil returns and volatility. According to El-Gamal and Jaffe (2018), the crude oil demand and supply might be impacted by extreme incidents such as geopolitical conflicts that appears to spread panic, which in turn impacts the prices in crude oil markets. Liu et al. (2019) investigate whether geopolitical risk has a competence to forecast oil volatility and find evidence that serious geopolitical risks possess information which is useful in predicting the recent future oil volatility. Qin et al. (2020) explore whether there are asymmetric impacts from geopolitical risk on the returns and volatilities of energy in various conditions of the markets, employing the quantile regression based on the daily data spanning from June 1990 to October 2018. As a result, they find that heating oil returns and crude oil returns are

negatively affected by the geopolitical risks. Additionally, they also observe a significant positive effect of geopolitical risk on the volatilities of crude oil under various market circumstances. Liu et al. (2021) employ the GARCH-MIDAS framework to look for the effects from geopolitical uncertainty to energy volatility. Their findings indicate that there is a significant positive effect of geopolitical risk on energy volatilities in long term.

Above overview of relevant existing literature shows that the relation between geopolitical risks and energy markets have been extensively investigated under different aspects and approaches. However, to the best of our knowledge, there has not been any study measuring the risks and uncertainties that arise simultaneously from geopolitical incidents and energy markets. Therefore, this paper aims to fill this research void.

3. Methodology and data

3.1. Data

We construct the GEU index based on the monthly Global reports from the Economist Intelligence Unit (EIU) during the period from March 1996 to December 2023 for searching the keywords. The monthly EIU global reports offer the detailed statistics and analyses on economy, business, risks, politics, and government policies at the global scale. Moreover, to evaluate the GEU index, we employed various approaches using different data from different sources.

3.2. Measuring the global geopolitical-energy uncertainty (GEU) index

3.2.1. Measuring the geopolitical risk sub-index (GPR)

For the first step, we count the frequency of specific keywords related to geopolitical risk to construct the GPR sub-index.

$$\text{GPR sub-index} = \frac{\text{Total frequencies of keywords (GPR related)}}{\text{Total wordcount per report}} \times 1{,}000 \qquad (1)$$

3.2.2. Measuring the economic policy uncertainty sub-index (EPU)

We obtain the keywords representing the economic policy uncertainty. Afterwards, the EPU sub-index is constructed as in Equation (2).

$$\text{EPU sub-index} = \frac{\text{Total frequencies of keywords(EPU related)}}{\text{Total wordcount per report}} \times 1{,}000 \qquad (2)$$

3.2.3. Measuring the energy-related sub-index

We use the same keywords which Dang et al. (2023) employed to construct their energy-related sub-index. Subsequently, we obtain the energy-related sub-index after applying Equation (3) as follows.

$$\text{Energy-related sub-index} = \frac{\text{Total frequencies of keywords (Energy related)}}{\text{Total wordcount per report}} \times 1{,}000 \qquad (3)$$

3.2.4. Constructing the GEU index

After constructing three above sub-indices (i.e., GPR sub-index, EPU sub-index, and energy related sub-index), we employ the principal component analysis (PCA) method to construct our ultimate GEU index.

4. Assessing the GEU index

4.1. The GEU index with remarkable events during 1996-2023

We examine if the GEU index has significant responses to remarkable geopolitical, energy-related or economic policy events during the period from 1996 to 2023. Looking at Figure 1, we find that the GEU index does have dramatic fluctuations over the studied period. Furthermore, Figure 1 reveals that the significant spikes of the GEU index appear to coincide with several remarkable incidents occurring around the world. Especially, the GEU index tends to have stronger responses to the geopolitical events and energy shocks as marked in Figure 1. Compared to the period 2007-2013, we note that the GEU index stays at a higher level over the 2014-2023 period. After the great oil crash of 2014, the index keeps fluctuating before reaching the peaks in 2020-2022 when there were significant incidents occurring such as the Covid-19 outbreak and the Russian invasion of Ukraine which appear to exacerbate the global energy crisis.

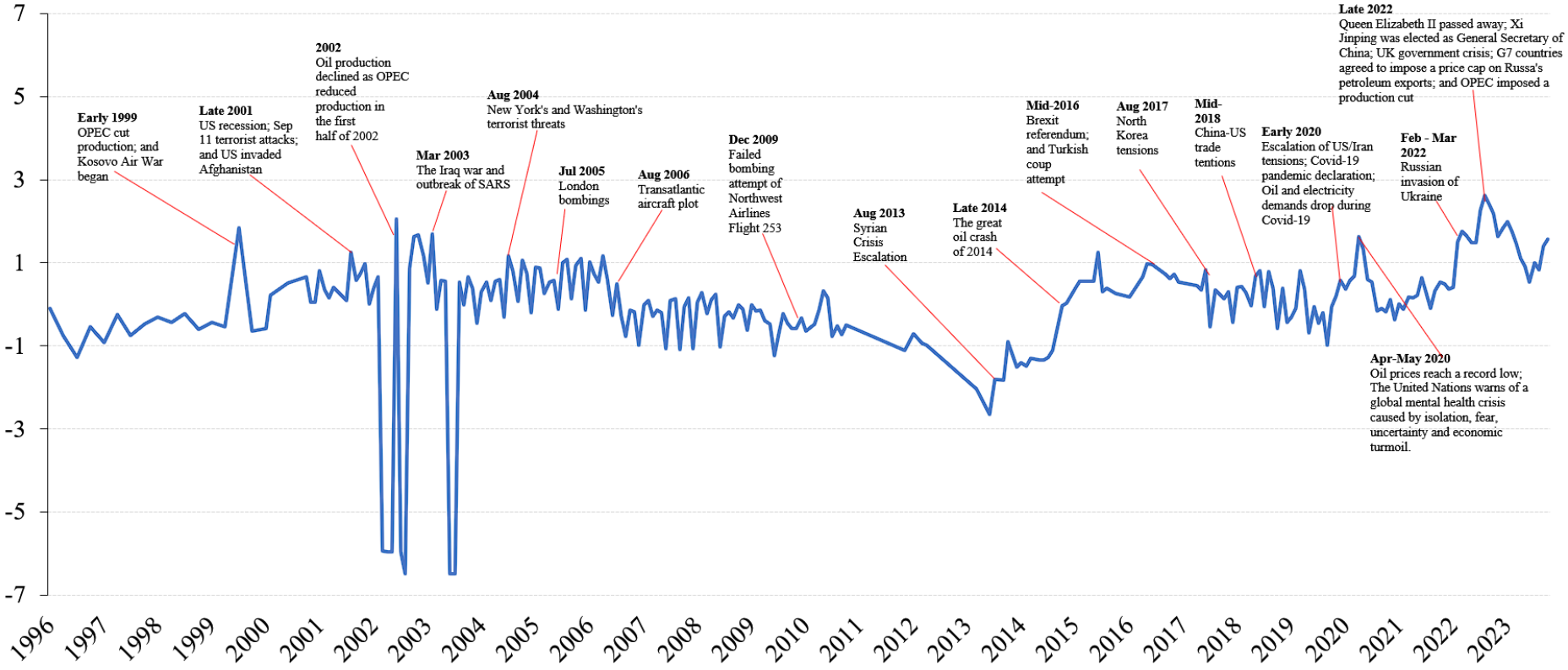


Figure 1. The monthly GEU index during the period from March 1996 to December 2023

4.2. The GEU index versus other relevant indices

This sub-section presents our evaluation of the GEU index by comparing it to other relevant indices that have been proposed by previous studies. As can be seen from Figure 2, the GEU index (left vertical axis, blue line) is plotted along with other uncertainty/risk indices (right vertical axis, red dash line), such as the global energy-related uncertainty index (Global EUI) of Dang et al. (2023) in Figure 2a, the global economic policy uncertainty index (Global EPU) of Baker et al. (2016) in Figure 2b, and the global geopolitical risk index (Global GPR) of Caldara and Iacoviello (2022) in Figure 2c.

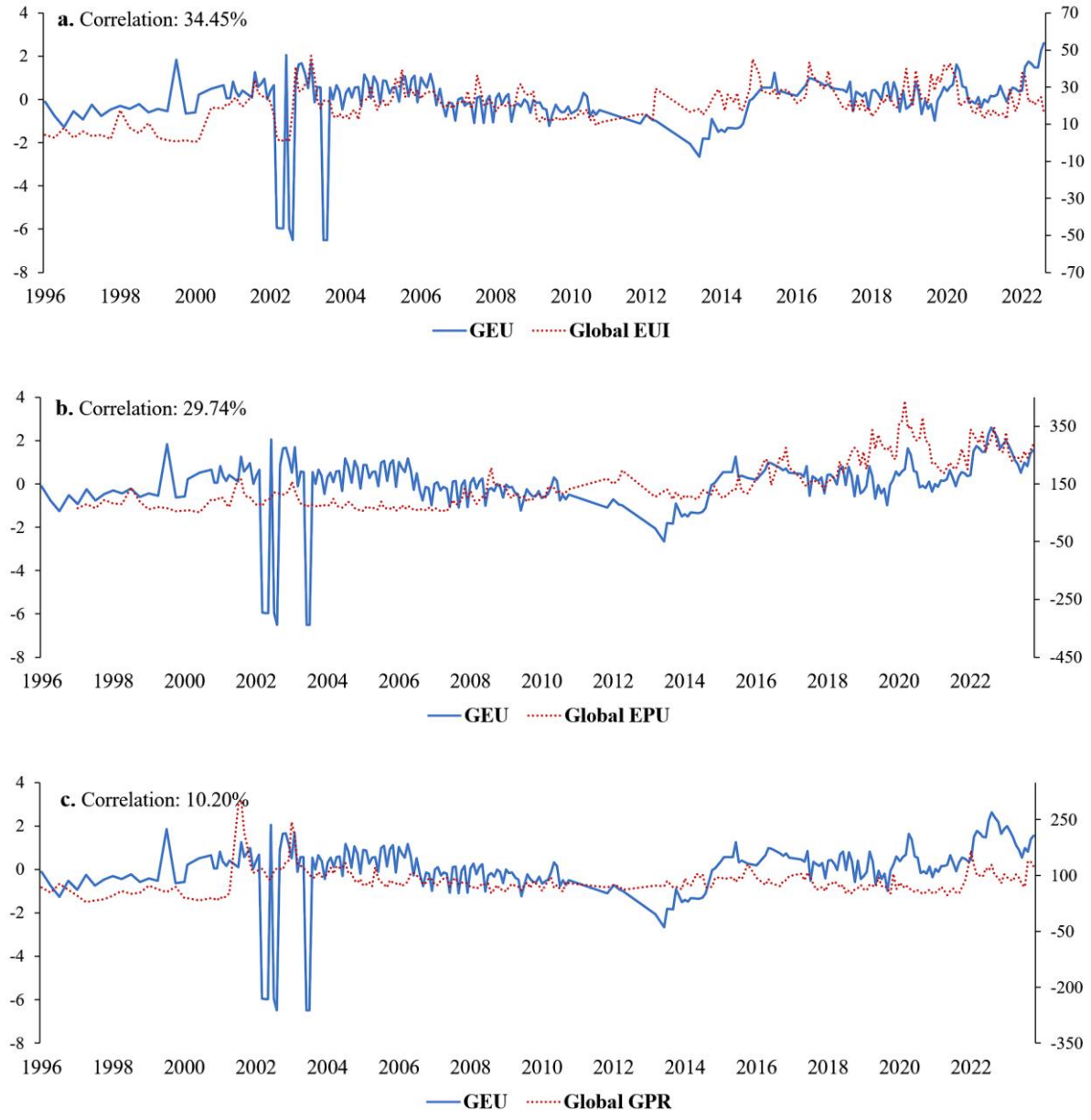


Figure 2. The GEU index versus other relevant indices

Notes: Left vertical axis: the global geopolitical-energy uncertainty index (GEU). Right vertical axis: the global energy-related uncertainty index (Global EUI) of Dang et al. (2023) in Figure 2a, the global economic policy uncertainty index (Global EPU) of Baker et al. (2016) in Figure 2b, and the global geopolitical risk index (Global GPR) of Caldara and Iacoviello (2022) in Figure 2c.

As can be seen from Figure 2, the estimated correlations between the GEU index and other indices are all positive, showing evidence that the GEU index appears to capture and reflect the uncertainties/risks properly. However, those correlation coefficients are not relatively high. One possible explanation is that the GEU index is substantially more focused on both geopolitical aspects and energy uncertainty aspects than the other indices[1]. Additionally, we consider that the differences in the sources which are adopted to develop the GEU index and other indices could be another explanation for their divergence[2]. However, we find that the GEU index shares some similarities with other indices, specifically during the period 2020-2023 when the level of uncertainty appears significantly higher due to unexpected remarkable events.

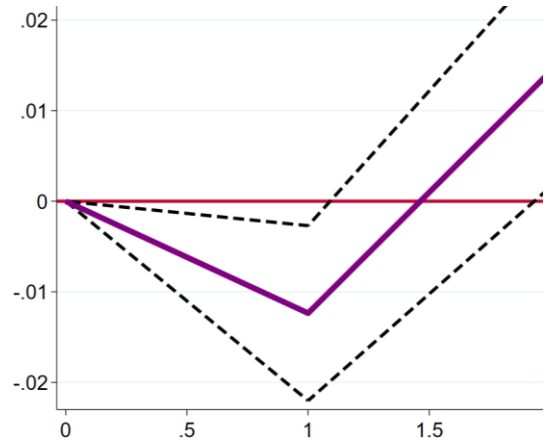
4.3. The GEU index and the responses of macroeconomic fundamentals

We employ the impulse response analysis to investigate how economic indicators respond to a shock from the GEU index.

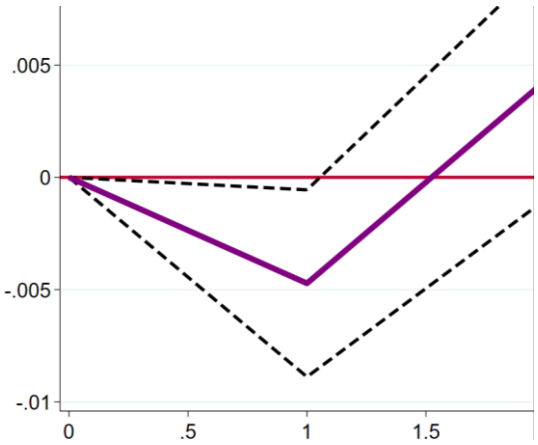
The impulse response analysis is illustrated in Figure 3 emphasizes how the US gross domestic product (GDP) growth and the US manufacturing production growth respond to the GEU index innovations. We find evidence that the responses of selected macroeconomic fundamentals are statistically significant. Especially, the impact of the GEU index's shock appears strongest at quarter 1 before fading over the next quarters. In summary, such findings confirm that the innovations of the GEU index appear to foreshadow the drops in macroeconomic performance.

[1] The global energy-related uncertainty index (Global EUI) focuses on the energy uncertainty aspects only. The global economic policy uncertainty index (Global EPU) focuses on the economic policy uncertainty aspects only. The global geopolitical risk index (Global GPR) focuses on the geopolitical risk aspects only.

[2] The GEU index is based on the Economist Intelligence Unit global reports, whereas the global EUI is constructed based on the EUI of 28 developed and developing countries, which are based on the Economist Intelligence Unit country reports. Meanwhile, the global EPU and the global GPR indices are based on newspapers.



Impulse: GEU index – Response: US GDP growth



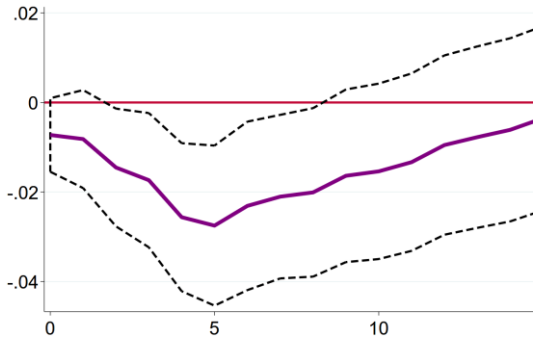
Impulse: GEU index – Response: US manufacturing production growth

Figure 3. Impulse response analysis (macroeconomic factors)

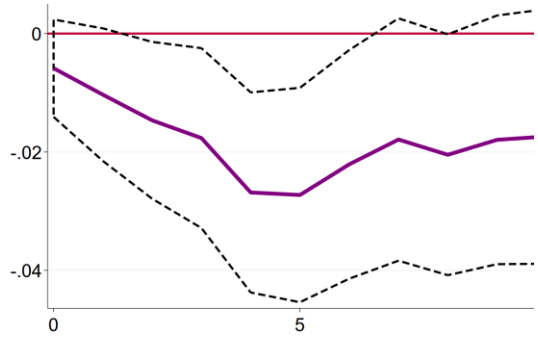
Notes: The analysis is based on the 90% confidence interval. Our impulse response function is based on quarterly data.

Focusing on the energy aspects, we perform further analysis to explore the impact of the GEU index on different energy-related indicators (monthly recorded), such as the global energy price index, the MSCI world energy sector price index, and the oil price uncertainty index. Figure 4 indicates that one shock from the GEU index appears to exert significant negative effects on both energy price indices (Figure 4a & 4b). Meanwhile, Figure 4c shows strong evidence that a shock from the GEU index might lead to a significant increase in the oil price uncertainty index, and that the impact of the GEU index tends to be strongest in the 5th month and diminishes after the first year. Generally, findings from Figure 4 imply that GEU index tends to have remarkably adverse impacts on energy price indicators - which is in line with findings of Dang et al. (2023) - while the index appears positively correlated with other measure of energy uncertainty, i.e., the oil price uncertainty index.

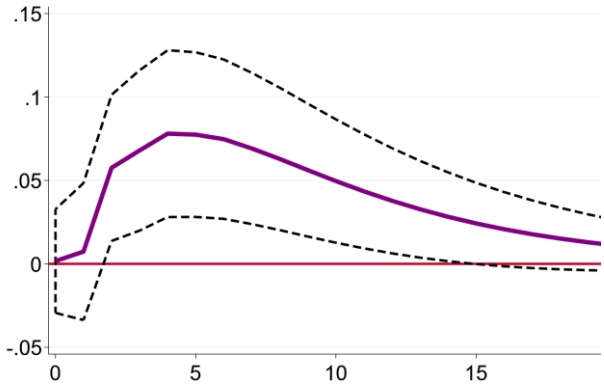
Findings from Figure 4 show that the GEU index significantly impacts the global energy indicators. Next, we shift our focus on the geopolitical aspects of the GEU index. Given that geopolitics and politics are interconnected to each other, we aim to explore how the GEU index affects political risks. Hence, we perform the impulse response function between the GEU index and the firm-level political risk proposed by Hassan et al. (2019). Findings from Figure 5 provides strong evidence of a significant increase in the political risk at firm level during the first quarter when there is a shock occurring to the GEU index. Such finding confirms the positive relation between the GEU index and the firm-level political risk. To summarize, the GEU index is found to properly reflect the uncertainties/risks on both energy and political aspects.



a. Impulse: GEU index – Response: Global energy price index



b. Impulse: GEU index – Response: MSCI world energy sector price index



c. Impulse: GEU index – Response: Oil price uncertainty index

Figure 4. Impulse response analysis (Energy sector)

Notes: The analysis is based on the 90% confidence interval. Our impulse response function is based on monthly data.

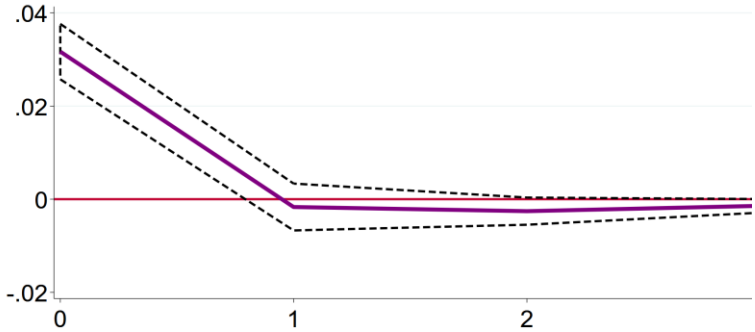


Figure 5. Panel impulse response analysis (Impulse: GEU index – Response: firm-level political risk)

Notes: The analysis is based on the 90% confidence interval. Our panel impulse response function is based on quarterly data.

4.4. Spillover effects between the GEU index and the geopolitical risk (GPR) indices of top oil importing/exporting economies

In this section, we employ the quantile connectedness approach proposed by Chatziantoniou *et al. (*2021) to examine the transmission mechanism between the GEU index

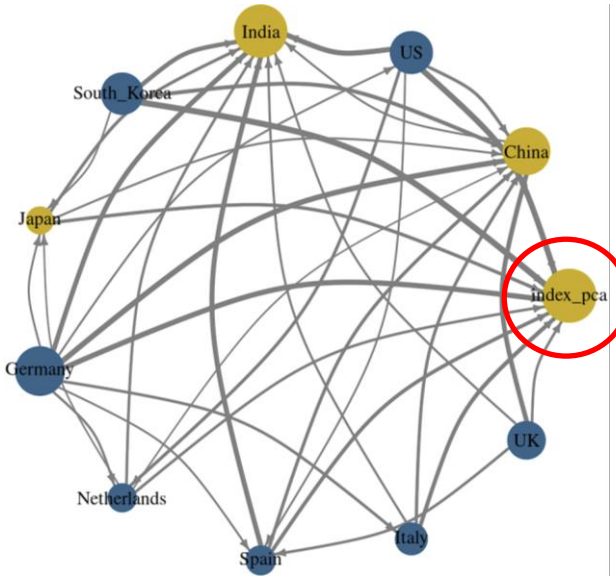
and the GPR indices of top oil importing countries (see Table 2 and Figure 6) and top oil exporting countries (see Table 3 and Figure 7).

Table 2. Spillover effects between the GEU index and the GPR indices of top oil importing economies

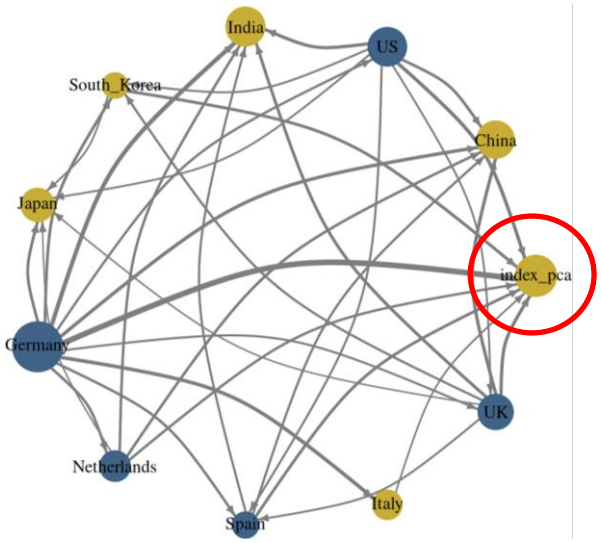
	GEU	China	US	India	Korea	Japan	Germany	Netherlands	Spain	Italy	UK	From
GEU	21.33	6.86	8.36	7.08	9.28	7.76	8.83	7.29	7.86	8.35	7	78.67
China	6.81	13.85	8.92	6.82	11.13	9.56	9.59	7.84	8.03	8.38	9.07	86.15
US	5.57	7.41	16.22	6.45	8.56	7.95	10.94	8.15	8.12	8.41	12.22	83.78
India	7.3	7.83	9.01	17.48	9.03	8.6	8.66	7.73	8.37	7.94	8.04	82.52
Korea	6.32	9.2	8.16	6.86	19.83	11.18	8.94	7.08	7.74	7.33	7.36	80.17
Japan	6.08	8.51	8.49	7.08	12.05	15.91	9.14	8.01	8.22	8.32	8.19	84.09
Germany	6.23	6.92	9.94	6.3	8.76	8.14	18.26	8.87	7.36	8.97	10.26	81.74
Netherlands	5.94	7.06	9.69	6.41	7.66	7.19	10.02	20.97	8.02	8.45	8.59	79.03
Spain	6.06	6.4	9.07	5.94	8.17	7.63	8.35	8.55	20.69	9.78	9.37	79.31
Italy	6.37	6.82	8.88	6.83	7.47	8.28	10.38	8.5	9.08	17.47	9.91	82.53
UK	5.74	6.78	12.77	6.97	7.16	7.55	10.48	7.99	8.02	9.8	16.75	83.25
To	62.41	73.78	93.3	66.74	89.27	83.84	95.33	80.01	80.81	85.75	90.01	**TCI**
NET	**-16.27**	-12.37	9.52	-15.78	9.1	-0.25	13.59	0.97	1.5	3.23	6.76	**90.12**

Notes: This spillover effect analysis is based on the dynamic Quantile VAR connectedness approach (lag length = 1 month based on BIC; Rolling-window size = 24 months; and Forecast horizon (H) = 6 months). Quantile $\tau = 0.5$ (median quantile – normal condition). Our analysis is based on monthly data.

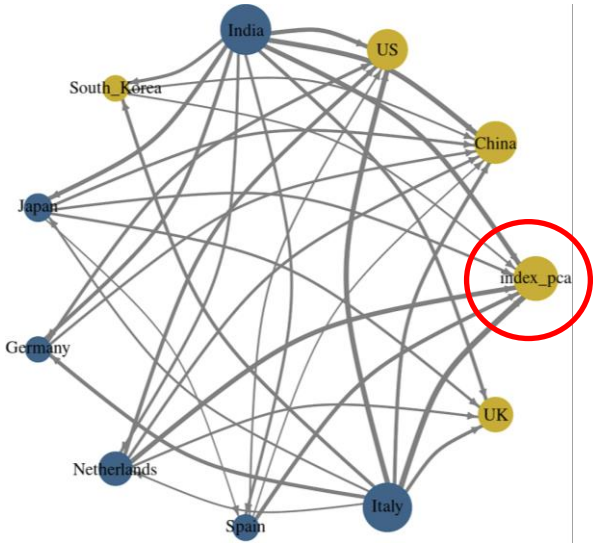
With respect to top oil importing economies, as in Table 2, the total connectedness index is very high (90.12%), indicating that the connectedness between the GEU index and the GPR indices of top oil importing economies appears very strong. Moreover, the GEU index is found to act as the greatest net recipient of risk in the network under the normal conditions (quantile $\tau = 0.5$) as the GEU index has the lowest "NET" value (-16.27) (see Table 2 and Figure 6a). Similar results are also found under the extreme good and bad times (i.e., quantile $\tau = 0.9$ and 0.1, respectively) (see Figure 6c and 6b). Such findings imply that the GEU index could absorb most of the GPR risks in the network, and thus showing the competence of the GEU index to capture and reflect GPR risks of top oil importing countries.



a. Quantile $\tau = 0.5$ (median quantile – normal conditions)



b. Quantile $\tau = 0.1$ (lower quantile - extreme bad conditions)



c. Quantile $\tau = 0.9$ (upper quantile - extreme good conditions)

Figure 6. Network plot between the GEU index and the GPR indices of top oil importing economies

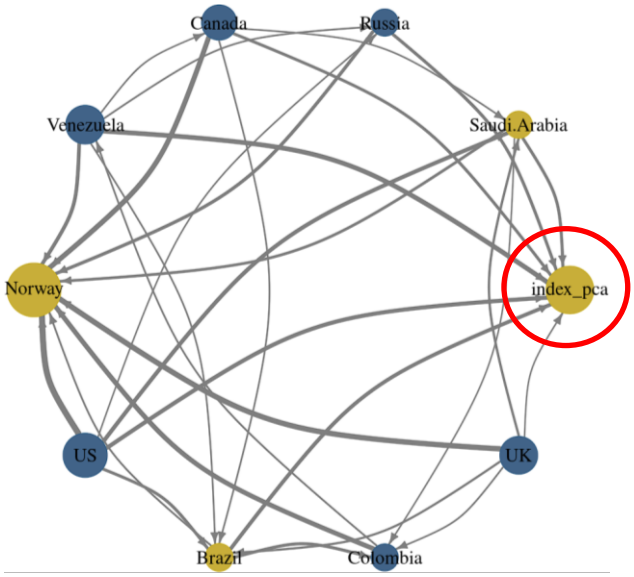
Notes: "index_pca" stands for the GEU index. This spillover effect analysis is based on the dynamic Quantile VAR connectedness approach (lag length = 1 based on BIC; Rolling-window size = 24 months; and Forecast horizon (H) = 6 months). Yellow (blue) nodes represent the net recipient (exporter) of risks. The vertices are weighted based on the averaged measures of net pairwise directional spillover. The nodes' size is based on the weighted averaged measures of net total directional spillover. Our analysis is based on monthly data.

Table 3. Spillover effects between the GEU index and the GPR indices of top oil exporting economies

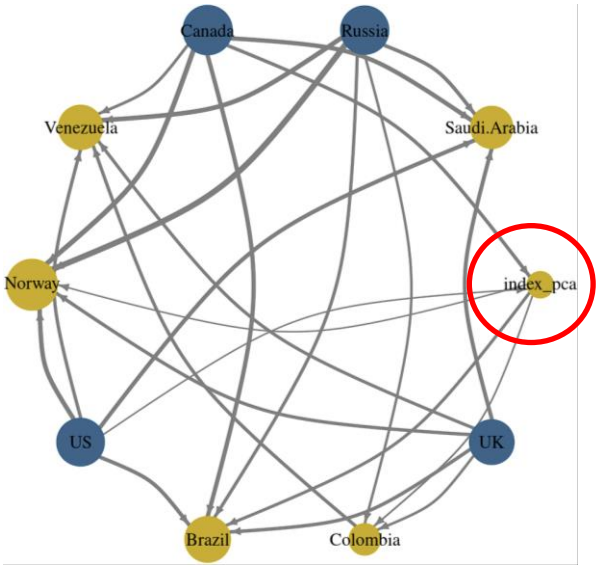
	GEU	Saudi Arabia	Russia	Canada	Venezuela	Norway	US	Brazil	Colombia	UK	From
GEU	25.95	8.26	8.45	7.98	9.68	7.66	8.02	9.03	8.45	6.53	74.05
Saudi Arabia	6.21	23.81	8.84	9.54	8.17	6.72	11.17	8.12	7.66	9.76	76.19
Russia	6.35	9.5	20.98	10.18	8.91	6.3	11.82	7.99	7.41	10.56	79.02
Canada	5.97	8.39	9.28	22.64	7.69	5.89	12.62	8.67	7.42	11.43	77.36
Venezuela	6.47	7.73	7.69	6.6	27.48	6.73	8.09	7.73	13.18	8.3	72.52
Norway	7.04	8.63	8.56	9.29	9.23	21.97	9.68	7.56	8.78	9.25	78.03
US	5.23	8.44	10.75	11.98	8.55	5.58	20.35	8.25	7.11	13.75	79.65
Brazil	6.49	8.34	8.36	9.85	8.92	6.31	10.28	23.69	7.52	10.25	76.31
Colombia	8.16	8.72	6.54	7.97	11.95	5.58	7.75	9.62	25.68	8.02	74.32
UK	5.47	8.11	10.7	10.64	8.89	5.59	14.09	8.74	6.87	20.9	79.1
To	57.39	76.12	79.18	84.01	81.99	56.36	93.52	75.72	74.4	87.85	**TCI**
NET	**-16.66**	-0.07	0.16	6.64	9.47	-21.67	13.87	-0.58	0.08	8.75	**85.17**

Notes: This spillover effect analysis is based on the dynamic Quantile VAR connectedness approach (lag length = 1 based on BIC; Rolling-window size = 24 months; and Forecast horizon (H) = 6 months). Quantile $\tau = 0.5$ (median quantile – normal condition). Our analysis is based on monthly data.

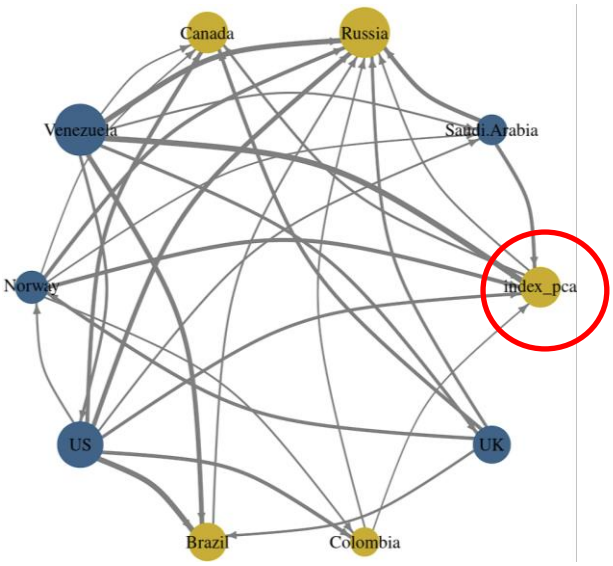
Shifting the focus to top oil exporting economies, as can be seen from Table 3 and Figure 7, we still find strong evidence that the GEU index is one of the largest net risk receivers in the network, not only during normal times (quantile $\tau = 0.5$) but also under extreme good conditions (quantile $\tau = 0.9$). As such, those findings confirm the efficacy of the GEU index to absorb and reflect the geopolitical risks for both top oil importing and oil exporting countries in the world.



a. Quantile $\tau = 0.5$ (median quantile – normal conditions)



b. Quantile $\tau = 0.1$ (lower quantile – extreme bad conditions)



c. Quantile $\tau = 0.9$ (upper quantile – extreme good conditions)

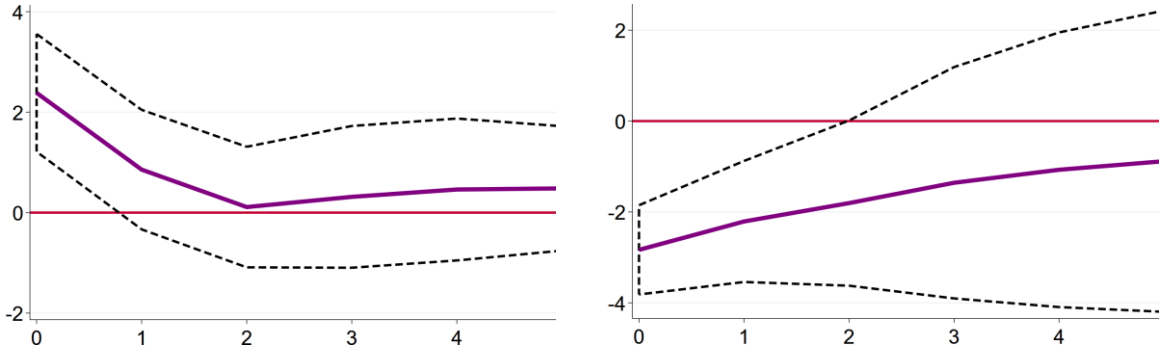
Figure 7. Network plot between the GEU index and the GPR indices of top oil exporting economies

Notes: "index_pca" stands for the GEU index. This spillover effect analysis is based on the dynamic Quantile VAR connectedness approach (lag length = 1 based on BIC; Rolling-window size = 24 months; and Forecast horizon (H) = 6 months). Yellow (blue) nodes represent the net recipient (exporter) of risks. The vertices are weighted based on the averaged measures of net pairwise directional spillover. The nodes' size is based on the weighted averaged measures of net total directional spillover. Our analysis is based on monthly data.

4.5. The GEU index and macroeconomic indicators

4.5.1. The GEU index and the current account balances

Given that energy price shocks are found to exert significant impacts on the current account balances of different countries (Lebrand et al., 2024), in this section, we investigate how the GEU index affect the current accounts of selected 43 developed and developing economies around the world. Such countries are selected based on the availability of their GPR country-level index. We retrieve data on current account balances of those countries from the World Development Indicators (WDI). Subsequently, we categorize each country into two groups: (i) countries with negative current account balances and (ii) countries with positive current account balances.



a. Countries with negative current account **b.** Countries with positive current account

Figure 8. Panel impulse response analysis (impulse: GEU index - response: country-level current account).

Notes: The analysis is based on the 90% confidence interval. Our panel impulse response function is based on annual data. The data on current account balances of countries are obtained from the World Development Indicators (WDI). Our analysis is based on annual data.

First, we calculate the panel impulse response functions to explore how the current account balances of the selected countries respond to the GEU index. As can be seen from Figure 8, we find that one shock from the GEU index appears to lead to a significant increase in the current account for countries having current account deficit over the last five years. On the other hand, in case of countries with surplus in their current accounts for the past five years, we note that the GEU index tends to significantly lower their current accounts.

In the previous findings, we have already noted that the GEU index tends to hinder the economic activities. More specifically, the index is found to not only reduce the GDP growth and the manufacturing production growth but also lower the energy price indices. It appears that the shocks from the GEU index are associated with negative demand shocks (i.e., drops in economic activities), leading to the decreases in energy demand. Such decreases might in turn

result in decreased energy prices.

As such, when there is a shock to the GEU index, for countries with positive current account balances (i.e., exports > imports), the exporting activities (especially regarding energy exports) tend to be hindered due to lower energy prices, which in turn deteriorates the current account balances (see Figure 8b). Meanwhile, in case of countries that currently have current account deficit (i.e., exports < imports), a shock from the index might lead to lower import prices (especially lower energy importing prices) due to lower energy prices, which in turn alleviates the deficit in the current account balances of such countries (see Figure 8a).

Apart from the panel impulse response analysis, we also adopt the quantile connectedness approach to investigate the transmission mechanism between the GEU index versus the GPR indices of the countries with negative current account (Figure 9a) and of countries with positive current account (Figure 9b). It is not surprising to find that the GEU index plays as the greatest risk recipients in the system (see Table 4-5[3] and Figure 9), meaning that the index has the efficacy to absorb and reflect most of geopolitical risks from both groups of countries (i.e., countries with negative and positive current account balances).

[3] Table 4 and 5 shows that the GEU index is the greatest net absorber of risks because it has the smallest "NET" values (-16.89 and -24.58 respectively) in the network for both groups of countries.

Table 4. Spillover effects between the GEU index and GPR of countries with negative current account balances (quantile $\tau = 0.5$)

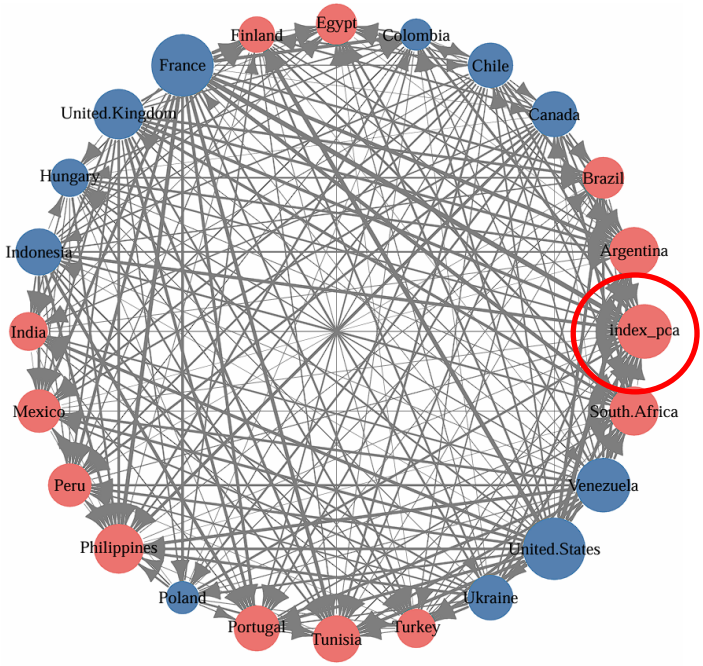
	GEU	ARG	BRA	CAN	CHL	COL	EGY	FIN	FRA	GBR	HUN	IDN	IND	MEX	PER	PHL	POL	PRT	TUN	TUR	UKR	USA	VEN	ZAF	From
GEU	6.01	3.50	3.59	4.42	4.13	4.30	3.59	3.81	5.35	4.62	4.07	4.21	3.95	3.77	3.74	3.71	4.25	3.65	3.94	3.95	4.31	4.74	4.80	3.57	93.99
ARG	3.59	5.50	3.45	4.61	4.63	4.19	3.79	3.89	5.25	4.60	4.42	4.45	3.85	3.81	3.76	3.59	3.99	3.49	3.59	3.76	4.23	5.29	4.61	3.68	94.50
BRA	3.09	3.51	5.89	4.45	4.55	4.06	4.16	3.87	4.90	5.06	4.32	4.41	4.04	3.85	3.77	3.57	4.14	3.50	3.45	3.71	4.30	5.12	5.03	3.23	94.11
CAN	3.58	3.74	3.78	6.37	4.60	3.89	4.10	4.02	4.86	4.86	4.32	4.82	3.90	3.66	3.67	3.45	3.86	3.50	3.55	3.78	4.77	5.13	4.45	3.32	93.63
CHL	3.19	3.48	3.76	4.18	7.78	4.24	3.62	3.63	5.19	4.44	4.34	4.36	3.80	3.70	3.59	3.39	4.02	3.41	3.45	4.10	4.27	5.27	5.07	3.75	92.22
COL	3.24	3.65	3.89	4.17	4.00	6.65	3.50	3.99	5.45	4.62	4.47	4.66	3.93	3.46	3.83	3.33	4.07	3.50	3.71	3.79	4.36	4.74	5.12	3.88	93.35
EGY	3.54	3.57	4.01	4.62	4.16	4.19	5.96	3.92	5.02	5.00	3.79	4.55	4.30	3.66	3.58	3.56	3.72	3.53	3.83	3.88	4.19	5.02	4.88	3.50	94.04
FIN	3.29	3.22	3.74	4.91	4.43	3.92	3.53	7.40	5.12	4.69	4.25	4.58	3.79	3.74	3.57	3.44	4.38	3.55	3.62	3.54	4.52	5.35	4.02	3.40	92.60
FRA	3.28	3.65	3.92	4.63	4.69	3.97	3.97	3.59	7.42	4.82	3.98	4.63	4.26	3.59	3.82	3.07	3.80	3.70	3.57	4.06	4.14	5.41	4.56	3.46	92.58
GBR	3.28	3.46	3.91	4.70	4.59	3.98	4.66	3.78	4.83	6.32	4.13	4.77	3.88	3.75	3.49	3.50	3.76	3.32	3.33	3.85	4.64	5.93	4.92	3.23	93.68
HUN	3.29	3.42	3.62	4.52	4.54	3.85	3.59	4.04	4.51	4.45	7.02	4.58	3.73	3.69	4.01	3.42	4.38	3.64	3.40	3.84	5.09	4.93	4.87	3.57	92.98
IDN	2.81	3.71	3.80	4.67	5.08	4.12	3.97	4.01	4.63	4.78	4.26	6.64	3.86	3.49	4.01	3.54	4.34	3.39	3.68	3.89	4.14	4.76	4.95	3.46	93.36
IND	3.48	3.49	4.07	4.49	4.19	3.90	3.99	3.94	4.88	4.78	4.31	4.59	5.86	3.90	3.57	3.62	3.98	3.25	3.86	3.86	4.33	5.27	4.77	3.63	94.14
MEX	3.44	3.60	3.88	4.48	4.53	4.00	3.73	3.87	4.84	4.62	4.15	4.76	4.14	5.30	3.66	3.84	4.16	3.74	3.51	4.03	4.38	4.95	4.93	3.45	94.70
PER	3.31	3.62	4.01	4.64	4.37	4.23	3.44	4.06	5.13	4.34	4.47	4.55	3.70	3.60	5.44	3.59	4.39	3.67	3.95	3.74	4.43	4.96	4.82	3.54	94.56
PHL	3.40	3.73	3.24	4.72	4.09	4.27	3.51	3.81	4.83	4.61	4.41	4.74	3.86	4.12	3.84	6.34	4.21	3.67	3.91	3.25	4.19	4.80	4.94	3.51	93.66
POL	3.30	3.79	3.83	4.73	4.48	3.78	3.81	3.69	5.08	4.40	4.48	4.50	3.88	3.94	3.85	3.36	6.46	3.51	3.63	3.63	5.08	4.74	4.32	3.71	93.54
PRT	3.63	3.61	3.82	4.29	4.23	4.18	3.57	3.75	5.06	4.62	3.98	4.79	3.71	3.67	3.70	3.67	3.95	6.86	3.32	4.09	4.43	4.84	4.72	3.52	93.14
TUN	3.58	3.57	3.78	4.33	4.41	4.11	3.51	4.18	5.16	4.47	4.19	4.51	3.78	3.45	3.78	3.61	4.50	3.78	5.77	3.93	4.46	4.85	4.62	3.66	94.23
TUR	3.46	3.31	3.57	4.37	4.61	3.94	3.62	3.91	4.94	4.67	4.30	4.50	3.44	4.13	3.49	3.26	4.02	3.68	3.54	6.66	4.60	5.33	5.15	3.49	93.34
UKR	3.22	3.34	3.64	4.63	4.44	4.07	3.73	3.65	5.03	4.57	4.77	4.31	3.52	3.59	3.76	3.01	4.89	3.82	3.38	3.59	7.98	4.83	4.72	3.50	92.02
USA	3.28	3.26	3.74	4.85	4.52	3.87	4.09	3.48	5.12	5.47	4.16	4.53	3.90	3.79	3.86	3.61	3.76	3.57	3.45	3.69	4.86	6.74	4.90	3.51	93.26
VEN	3.51	3.48	3.82	4.21	4.43	4.59	3.98	3.80	5.00	4.58	4.33	4.62	4.00	3.80	3.84	3.56	3.90	3.57	3.55	3.95	3.96	4.79	6.93	3.79	93.07
ZAF	3.32	3.49	3.72	4.58	4.57	4.03	3.65	4.34	5.05	4.45	3.94	4.34	3.73	3.77	3.66	3.73	4.14	4.17	3.61	3.77	4.57	4.84	4.81	5.72	94.28
To	77.10	81.21	86.58	104.19	102.29	93.69	87.11	89.02	115.22	107.51	97.85	104.77	88.95	85.94	85.83	80.41	94.61	82.62	82.83	87.70	102.30	115.89	109.99	81.37	**TCI**
Net	-16.89	-13.29	-7.52	10.56	10.06	0.35	-6.93	-3.58	22.64	13.83	4.87	11.41	-5.19	-8.76	-8.73	-13.25	1.07	-10.52	-11.40	-5.64	10.27	22.63	16.92	-12.90	**93.54**

Notes: GEU stands for our geopolitical-energy uncertainty index. Countries with negative current account balances include: Argentina (ARG), Brazil (BRA), Canada (CAN), Chile (CHL), Colombia (COL), Egypt (EGY), Finland (FIN), France (FRA), United Kingdom (GBR), Hungary (HUN), Indonesia (IDN), India (IND), Mexico (MEX), Peru (PER), Philippines (PHL), Poland (POL), Portugal (PRT), Tunisia (TUN), Turkey (TUR), Ukraine (UKR), United States (USA), Venezuela (VEN), and South Africa (ZAF). Our analysis is based on annual data.

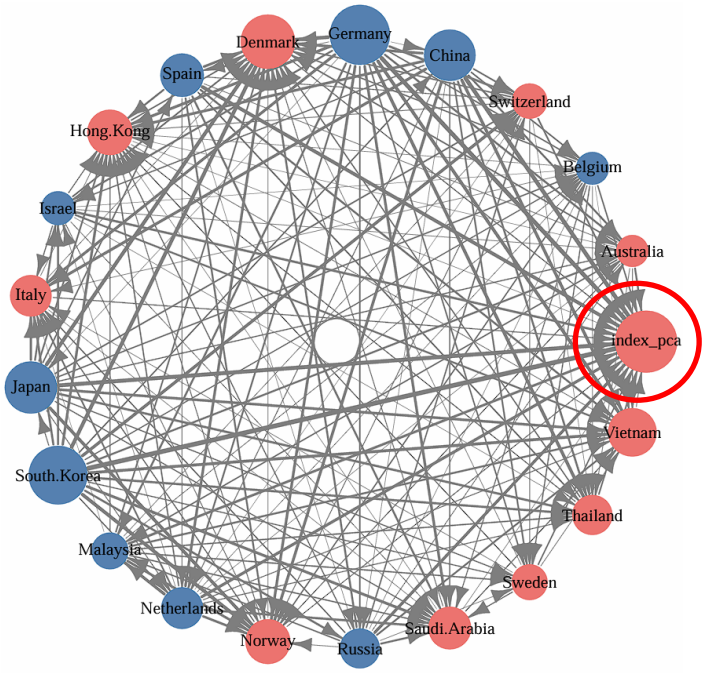
Table 5. Spillover effects between the GEU index and GPR of countries with positive current account balances (quantile $\tau = 0.5$)

	GEU	AUS	BEL	CHE	CHN	DEU	DNK	ESP	HKG	ISR	ITA	JPN	KOR	MYS	NLD	NOR	RUS	SAU	SWE	THA	VNM	From
GEU	7.26	4.64	4.29	4.31	5.88	5.71	4.31	4.99	3.74	4.65	3.91	5.41	5.75	4.85	4.71	4.01	5.01	3.77	4.50	4.29	4.01	92.74
AUS	3.56	7.31	4.39	4.32	5.52	5.68	3.62	5.18	4.23	4.96	4.58	5.04	5.53	5.16	5.32	3.94	4.85	4.11	4.33	4.05	4.32	92.69
BEL	3.46	4.30	9.63	4.42	5.29	6.26	3.50	4.62	3.82	4.35	4.95	5.09	4.84	4.62	5.33	4.03	5.46	3.79	4.10	4.07	4.08	90.37
CHE	3.35	4.56	4.62	8.04	5.30	5.72	3.52	5.25	4.18	4.54	4.57	5.57	5.93	4.50	4.91	3.83	4.89	4.47	4.28	3.89	4.10	91.96
CHN	3.64	4.48	4.46	4.41	7.73	5.59	3.92	5.21	4.17	4.66	4.01	5.82	6.68	4.59	4.74	4.01	4.86	4.12	4.41	4.49	3.98	92.27
DEU	3.42	4.58	5.49	4.43	5.30	8.70	3.66	5.26	4.10	4.38	4.44	5.29	5.49	4.28	5.33	4.26	5.35	4.08	4.38	4.08	3.71	91.30
DNK	3.72	4.44	4.28	4.34	5.39	5.68	7.32	5.02	4.46	4.49	4.12	5.56	6.08	4.53	5.03	4.00	4.85	4.20	4.36	4.45	3.69	92.68
ESP	3.06	4.74	4.72	4.65	5.27	5.70	3.63	10.35	4.19	4.57	4.51	5.75	4.93	4.38	4.61	3.89	4.56	4.02	4.49	4.18	3.78	89.65
HKG	3.41	4.55	4.22	4.72	5.66	5.65	3.66	5.24	7.39	4.30	4.49	5.31	5.46	4.55	4.99	4.48	4.81	4.27	4.60	4.55	3.69	92.61
ISR	3.37	4.52	4.02	4.50	5.38	5.44	3.60	4.59	3.73	8.85	4.33	5.39	5.81	5.05	4.75	4.28	4.96	4.55	4.89	4.38	3.60	91.15
ITA	3.23	4.75	5.36	4.67	5.56	5.94	3.78	4.65	4.08	5.01	7.34	5.52	4.97	4.49	5.16	4.28	5.08	4.18	4.40	3.85	3.68	92.66
JPN	3.18	4.34	4.30	4.72	5.62	5.57	3.58	4.94	4.35	4.35	4.15	8.68	7.39	4.65	4.59	3.74	4.69	4.59	4.48	4.13	3.98	91.32
KOR	3.16	4.44	4.17	4.27	5.94	5.53	4.05	5.08	4.03	4.58	3.75	6.79	10.04	4.50	4.44	3.62	4.31	4.23	4.48	4.37	4.21	89.96
MYS	3.48	5.93	4.21	4.15	4.57	5.40	3.65	4.56	3.91	4.95	4.21	4.74	4.51	10.01	6.71	3.73	5.26	3.96	4.01	4.15	3.91	89.99
NLD	3.14	5.01	5.00	4.65	5.27	6.32	3.57	5.19	4.18	4.40	4.23	5.09	5.09	5.10	8.45	3.89	5.39	3.93	4.29	3.93	3.88	91.55
NOR	3.50	4.46	4.77	4.33	5.58	5.76	3.49	4.94	3.92	4.78	3.64	5.46	5.50	5.08	5.22	7.83	4.91	4.33	4.23	4.33	3.95	92.17
RUS	3.43	4.41	5.14	4.09	5.22	6.22	3.71	4.88	4.15	4.86	4.40	4.89	5.47	4.45	5.28	4.45	7.42	3.93	4.73	4.46	4.39	92.58
SAU	3.44	4.22	4.41	4.52	4.93	5.56	3.64	5.14	3.95	4.94	4.52	5.23	5.75	4.74	5.23	4.31	5.02	7.65	4.77	4.22	3.80	92.35
SWE	3.71	4.49	4.83	4.82	5.38	5.22	3.97	4.70	4.03	5.03	4.02	5.17	5.17	4.83	4.49	4.48	5.12	4.14	8.21	4.55	3.67	91.79
THA	3.41	4.52	4.49	4.25	5.63	5.85	3.74	4.98	3.99	4.71	3.92	5.41	5.66	4.97	4.54	4.10	4.71	4.25	4.46	8.45	3.96	91.55
VNM	3.48	4.83	4.35	4.29	5.69	5.49	3.69	4.87	4.12	4.65	3.83	5.46	5.86	5.01	4.45	4.04	5.38	4.37	4.07	4.19	7.89	92.11
To	68.17	92.21	91.52	88.84	108.37	114.29	74.30	99.31	81.33	93.17	84.58	108.00	111.86	94.33	99.82	81.37	99.45	83.28	88.24	84.61	78.40	**TCI**
Net	-24.58	-0.48	1.15	-3.13	16.10	22.99	-18.38	9.66	-11.28	2.02	-8.08	16.68	21.90	4.34	8.27	-10.79	6.88	-9.07	-3.55	-6.94	-13.71	**91.69**

Notes: GEU stands for our geopolitical-energy uncertainty index. Countries with positive current account balances include: Australia (AUS), Belgium (BEL), Switzerland (CHE), China (CHN), Germany (DEU), Denmark (DNK), Spain (ESP), Hong Kong (HKG), Israel (ISR), Italy (ITA), Japan (JPN), South Korea (KOR), Malaysia (MYS), Netherlands (NLD), Norway (NOR), Russia (RUS), Saudi Arabia (SAU), Sweden (SWE), Thailand (THA), and Vietnam (VNM). Our analysis is based on annual data.



a. Countries with negative current account



b. Countries with positive current account

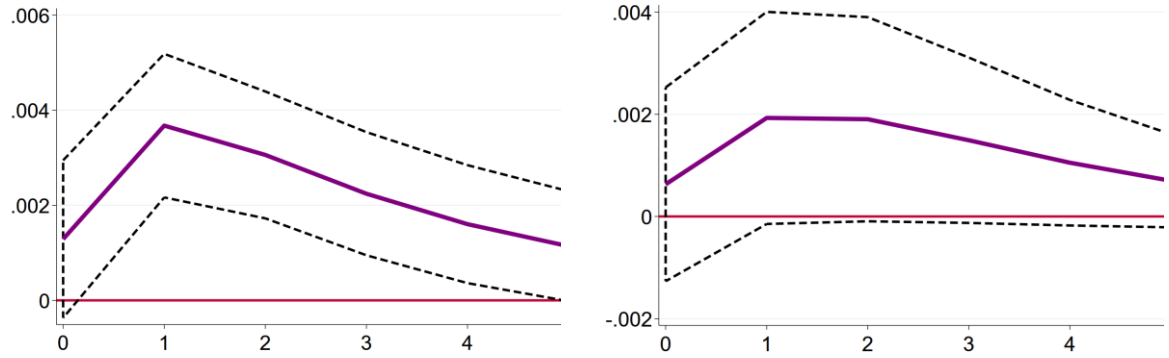
Figure 9. Spillover effects between the GEU index and the GPR of countries with negative/positive current account.

Notes: "index_pca" stands for the GEU index. This spillover effect analysis is based on the dynamic Quantile VAR connectedness approach (lag length = 1; Rolling-window size = 36 months; Forecast horizon (H) = 6 months; and quantile $\tau = 0.5$). Red (blue) nodes represent the net recipient (exporter) of risks. The vertices are weighted based on the averaged measures of net pairwise directional spillover. The nodes' size is based on the weighted averaged measures of net total directional spillover. Our analysis is based on annual data.

4.5.2. The GEU index and other government fiscal indicators

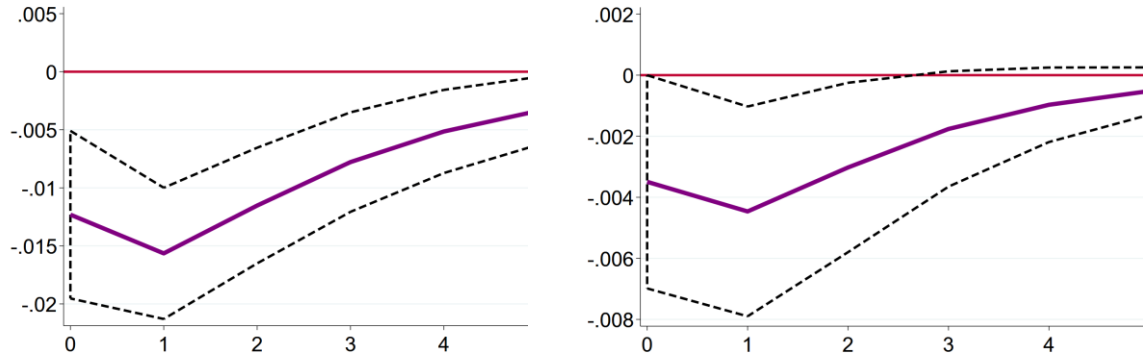
Apart from the current account balance, we also explore how the GEU index explains the variations in government budget balances and government debts. As can be seen from Figure 10.a1, a shock from the GEU index is linked to a significant increase in government budget balances for countries with budget deficit. As discussed previously, the GEU index shock appears to be a negative demand shock, which might lead to decreases in both economic activities and the energy prices. During times of economic downturn, lower business profits and income level might decrease tax revenues, which in turn is likely to result in drops in public spending. However, given that government expenditures could be changed relatively quickly due to adjustments in public services and policies whereas government taxes appear to stay more stable and are not frequently adjusted, the responses of government spending are expected become more rapid than those of government revenue. Therefore, the decreases in government expenditures are likely to be larger than the decline in government income. That is one possible explanation why a shock from the GEU index might eventually lead to improvements in government budget balance. It appears that countries having budget deficit are more likely to be affected by the GEU index shock than countries with budget surplus because we do not find significant impact of the GEU index on the budget balance of countries having budget surplus (Figure 10.a2).

With respect to the responses of public debt (Figure 10.b1 & 10.b2), we observe significant negative impacts of the GEU index shock on the government debt to GDP. According to United Nations (2023), a government debt to GDP ratio of 60% is considered a high debt level. Based on that threshold, we categorize the countries in our sample into two groups: (i) countries with higher debt levels (i.e., debt to GDP ratio is equal to or greater than 60%), and (ii) countries with lower debt levels (i.e., debt to GDP ratio is less than 60%). The panel impulse response function show that countries with higher debt levels appear to experience greater significant impact from the GEU index shocks than countries having lower debt to GDP ratios. Such findings confirm that the GEU index shocks significantly exert negative impact on the demand side of the economy. Indeed, as discussed above, a shock from the index is potentially associated with significant declines in public spending, which in turn discourages the incentives for governments to borrow debts for expenditures. As such, the GEU index shock would ultimately cause lower debt levels.



a1. Countries with budget deficit **a2.** Countries with budget surplus

A. Impulse: GEU index – Response: Government budget balance to GDP



b1. Countries with higher debt levels **b2.** Countries with lower debt levels

B. Impulse: GEU index – Response: Government debt to GDP

Figure 10. Panel impulse response analysis (Impulse: GEU index – Response: other government fiscal indicators)

Notes: The analysis is based on the 90% confidence interval. Our panel impulse response function is based on annual data.

4.6. The GEU index and the volatilities of the global sector indices

In previous sections, we find that the GEU index typically acts as the greatest receivers of geopolitical risks from several countries in our sample. As the GEU index also includes a component measuring the uncertainty, we aim to examine whether the GEU index is able to capture the expected uncertainties at the sectoral level. To serve that purpose, we collect data of 10 global sector indices from Refinitiv Workspace (formerly Refinitiv Eikon). Similar to Dang et al. (2024), we estimate expected sectoral uncertainties (or volatilities) using DCC-GARCH model (Engle, 2002) combined with the univariate GJR-GARCH processes (Glosten et al., 1993).

After obtaining the sectoral volatilities of 10 global sectors, we again employ the quantile connectedness approach to analyze the spillover effects between the GEU index and the

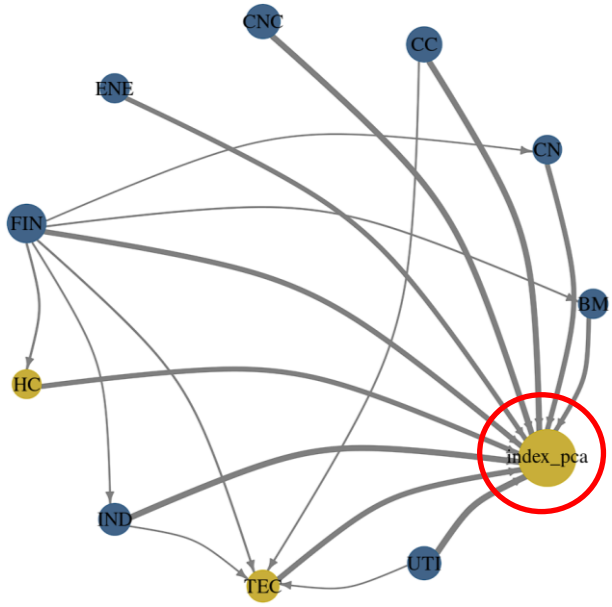
sectoral volatilities. As noted from Table 6, the "NET" value of the GEU index is -43.03, which is the smallest one in the network. This result means that the GEU index becomes the largest absorbers of volatilities in the system.

Table 6. Spillover effects between the GEU index and the volatilities of 10 global sector indices

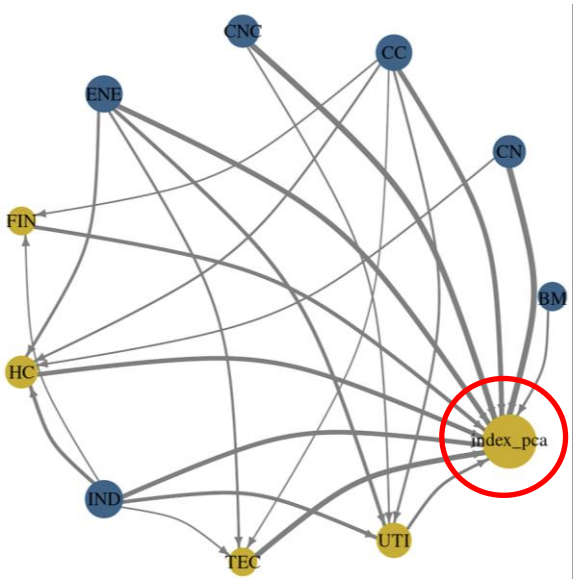
	GEU	BM	CN	CC	CNC	ENE	FIN	HC	IND	TEC	UTI	From
GEU	10.86	8.29	8.69	9.32	9.62	8.52	8.8	8.36	9.3	8.62	9.61	89.14
BM	4.71	10.98	8.57	10.06	10.06	9.12	11.05	8.36	9.67	8.14	9.27	89.02
CN	4.68	8.62	11	10.89	8.99	8.79	10.04	9.09	9.75	9.28	8.86	89
CC	4.65	9.33	9.74	11.36	9.67	8.29	10.93	8.51	10.1	9.09	8.33	88.64
CNC	4.99	9.04	8.48	9.04	12.54	8.77	10.18	9.84	9.23	7.94	9.93	87.46
ENE	4.73	9.81	8.22	9.4	9.84	12.56	10.01	8.32	8.81	8.05	10.24	87.44
FIN	4.6	9.53	8.7	10.64	9.44	8.86	12.67	8.07	9.77	8.81	8.9	87.33
HC	4.32	8.36	9.01	9.58	10.35	8.5	9.93	12.13	9.1	8.49	10.22	87.87
IND	4.51	9.21	9.47	10.55	9.48	8.64	11.29	8.68	10.79	8.73	8.64	89.21
TEC	4.29	9.28	9.81	10.62	8.88	8.68	10.53	8.8	10.07	9.98	9.06	90.02
UTI	4.62	8.85	8.32	8.65	9.83	10.23	9.87	9.36	8.55	7.74	13.98	86.02
To	46.11	90.32	89.02	98.75	96.18	88.41	102.64	87.38	94.37	84.89	93.08	**TCI**
Net	-43.03	1.29	0.02	10.1	8.72	0.97	15.31	-0.49	5.17	-5.13	7.06	**88.29**

Notes: This spillover effect analysis is based on the dynamic Quantile VAR connectedness approach (lag length = 1 based on BIC; Rolling-window size = 24 months; Forecast horizon (H) = 6 months); and quantile τ = 0.5. The sectors are Basic Materials (BM), Communications & Networking (CN), Consumer Cyclicals (CC), Consumer Non-Cyclicals (CNC), Energy (ENE), Financials (FIN), Healthcare (HC), Industrials (IND), Technology (TEC) and Utilities (UTI). Our analysis is based on monthly data.

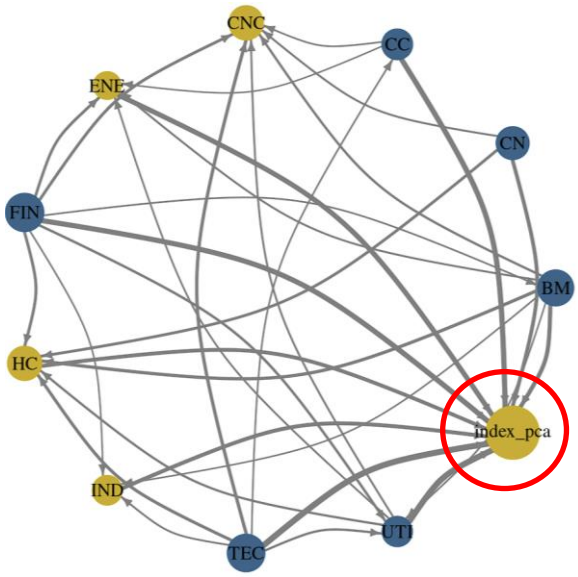
Results from Table 6 are illustrated in Figure 11a. Furthermore, we also investigate the spillover effects at the extreme bad conditions (Figure 11b) and the extreme good conditions (Figure 11c). Generally, Figure 11 shows that the GEU index plays as the greatest net absorber of risks in the network, not only under the normal conditions (quantile $\tau = 0.5$) but also during the extreme good and bad times (i.e., quantile $\tau = 0.9$ and 0.1, respectively). It implies the reliability and competence of the GEU index to capture and reflect the information related to volatilities/uncertainties at the sectoral level under different market conditions.



a. Quantile $\tau = 0.5$ (median quantile – normal conditions)



b. Quantile $\tau = 0.1$ (lower quantile – extreme bad conditions)



c. Quantile $\tau = 0.9$ (upper quantile – extreme good conditions)

Figure 11. Spillover effects between sectoral volatilities and the GEU index

Notes: "index_pca" stands for the GEU index. This spillover effect analysis is based on the dynamic Quantile VAR connectedness approach (lag length = 1 based on BIC; Rolling-window size = 24 months; and Forecast horizon (H) = 6 months). Yellow (blue) nodes represent the net recipient (exporter) of risks. The vertices are weighted based on the averaged measures of net pairwise directional spillover. The nodes' size is based on the weighted averaged measures of net total directional spillover. Our analysis is based on monthly data.

5. Conclusions

This paper proposes a novel index that measures the geopolitical-energy uncertainties at the global scale over the period from March 1996 to December 2023. To construct this GEU index, we employ the text-searching method based on the global EIU monthly reports. Afterwards, we assess the effectiveness of the GEU index using different empirical analyses. Key findings from our paper are presented as follows.

First, the GEU index is found to coincide with several remarkable incidents occurring around the world. In details, the index appears to have strong responses to not only the geopolitical events but also energy shocks, especially the recent crises over 2020-2022 period such as the Covid-19 pandemic, the Russia-Ukraine war, and the global energy crisis.

Second, our impulse response analyses show evidence that innovations of the GEU index tend to foreshadow the decreases in macroeconomic activities. We also note that the index might exert statistically significant effects on macroeconomic indicators such as the current account balance, budget balance, and debt to GDP ratio. Additionally, a shock from the GEU index appears to lead to a significant drop in global energy price indicators and a significant increase in the political risk.

Third, our findings from the spillover effect analyses confirm that the GEU index has the efficacy to absorb and reflect most of geopolitical risks at the country level as well as the information related to volatilities/uncertainties at the sectoral level under different market conditions.

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