Assessing the Impact of International Conflicts on China's Energy Security and Economic Growth: Evidence from U.S. Economic Sanctions on Iran

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International conflicts have become a significant source of uncertainty for global energy markets, particularly for energy-importing economies such as China. This study investigates the impact of international conflicts on China's energy security and economic growth, using the United States' economic sanctions on Iran as a case study. The research examines how sanctions disrupt global oil supply chains, influence energy prices, and affect China's energy imports and overall economic performance. Drawing on trade and energy security frameworks, the study analyzes the transmission mechanisms through which geopolitical tensions influence energy availability, industrial production, and economic growth. The findings suggest that U.S. sanctions on Iran create supply-side pressures in international oil markets, leading to increased energy price volatility and heightened risks to China's energy security. The results further indicate that reduced access to Iranian energy resources can negatively affect industrial output, trade activities, and economic growth, particularly in energy-intensive sectors. However, diversification of energy import sources and strategic energy reserves can partially mitigate these adverse effects. The study highlights the importance of strengthening energy cooperation, enhancing supply chain resilience, and promoting alternative energy development to reduce vulnerability to geopolitical conflicts. The findings provide valuable policy insights for China and other energy-importing countries facing increasing geopolitical uncertainties in global energy markets.

Keywords: International Conflicts, Energy Security, Economic Growth, China, U.S. Economic Sanctions

Introduction:

International conflicts pose a growing threat to energy security in energy-importing countries. The Persian Gulf War, the Ukraine crisis, the Iran-Iraq war, and the Color Revolutions (such as the Rose Revolution in Georgia, the Orange Revolution in Ukraine, and the Tulip Revolution in Kyrgyzstan) have all been associated with geopolitical instability affecting energy availability, costs, and transportation routes [1][2][3][4][5][6]. For instance, Russia's annexation of Crimea in 2014 marked a major escalation in the Ukraine conflict [7][8].

Russia was then subject to economic sanctions by the European Union (EU), which had a major effect on Russia's energy security. Ukraine's energy security was also put at risk when Russia, a major supplier of energy, stopped supplying gas to the country [9][10]. The energy security of major energy-importing nations like China is seriously threatened by complex international disputes that have emerged in Iran, a global producer of gas and oil [11][12]. One of the most prevalent signs of international conflict in Iran is economic sanctions, which have an impact on the world energy market [13][14].

Since the US imposed economic sanctions on Iran in the 1970s [15][16], the country's economic progress has been severely hampered [17][18]. Iran's economy suffered greatly as a result of the US approving more sanctions against the country in 2010 [19]. In an effort to stop Iran's government from advancing its nuclear weapons program, the US, the EU, and other nations have placed severe economic sanctions on Iran's economy since 2011 [20]. Iran's oil exports, which are a major source of income for the country's governments, are the target of the sanctions that are constantly being revised. In an effort to stop Iran from developing nuclear weapons [21][22], the United States announced its departure from the Joint Comprehensive Plan of Action in 2016 and 2017 and blocked Iran's oil exports in 2018 [23][24][25]. In order to close the gap in the world's oil supply, other Persian Gulf nations—who own the greatest amount of spare oil production capacity [26]—increased production and exports [27][28][29]. As it did during the Iran-Iraq War, Iran may harass or even obstruct oil shipping via the Hormuz Strait in an escalation scenario to oppose US sanctions [30]. The energy supply from Iran and other Persian Gulf nations could be drastically reduced as a result of the initial economic sanctions and Iran's possible counter-sanctions, which would cause significant swings in the supply and prices of oil in the world's energy markets. Iran has been China's main oil supplier despite the ongoing sanctions over the past few decades, making China's energy security susceptible to global wars. China has become the world's largest oil importer due to rapidly rising energy demand driven by economic and population growth for energy goods due to its fast economic and population growth. China's oil imports increased from 22.62 million tons in 1996 to 536.3 million tons in 2018, China's oil imports grew, and during this time, their share of the country's overall oil consumption rose to 72.6%. China's oil supply now comes primarily from Persian Gulf nations, particularly Iran, which is crucial to ensuring China's energy security. China's oil imports from Iran grew by almost 11 times between 1996 and 2018, from 2.31 million tons to over 30 million tons (Table 1) [31]

Table 1. Growth of China's oil import dependence

Year	Oil Imports (Million Tons)	Share of Domestic Consumption (%)
1996	22.62	-
2018	536.30	72.60

Iran's percentage of China's overall oil imports has likewise fluctuated upward, going from 1% in 1996 to 5% in 2018. China's energy security and economic growth have been seriously threatened by Iran's involvement in international crises over the past ten years, including the US economic sanctions.

Table 2. China's crude oil imports from Iran

Year	Imports from Iran (Million Tons)	Share of Total Chinese Oil Imports (%)
1996	2.31	1
2018	30.00+	5

The effects of international conflicts have been the subject of a growing number of studies, the majority of which concentrated on the economic penalties intended to harm the target nation's economy. According to the literature now in publication, economic sanctions have the potential to significantly disrupt business operations in sanctioned industries, which could damage the target nation's economic growth. Nakhli and colleagues used the DSGE model was used to evaluate the effects of oil sanctions on Iran's economy and oil production. The results demonstrated that the restrictions decreased oil exports, hindered foreign investment and technological advancement, and ultimately destroyed oil output. Using the fuzzy logic approach, discovered that the sanctions have worsening economic effects and repercussions with time. According to the shadow economy's growth rate was considerably

more negatively impacted by the 2012–2013 international sanctions than Iran's official GDP growth rate. Using a multi-regional computable general equilibrium (CGE) model, proposed that the sanctions reduced Iran's overall welfare and government income by 14–15% and 40–50%, respectively demonstrated that Iran's real GDP fell by more than 17% between 2011 and 2014 as a result of the sanctions, with the biggest decline taking place in 2012 [32].

Despite extensive discussion of the connections between global conflicts, energy security, and economic growth, there are still gaps in the research. First, the majority of research has concentrated on how international wars affect the nations that are the target of the sanctions; collateral harm to other stakeholders' or third parties' economic growth and energy security has largely gone unnoticed. Second, the interacting behaviors of those involved in international wars were rarely examined in earlier studies that evaluated their effects, which could have led to an overestimation or underestimating of such effects. Third, there hasn't been much research done on how international conflicts actually affect the economic development and energy security of nations that import energy. A global energy-extended computable general equilibrium (CGE) model, GTAP-E, is used in this study to assess the impact of international conflict on China's energy security and economic growth, taking into account the aforementioned shortcomings and using the USA-Iran tension as an example. From the following three angles, this paper adds to the body of existing literature: First, a thorough investigation is conducted into how international conflicts affect the energy security and economic development of nations that import energy. Second, to model potential reactions by Iran and other Persian Gulf nations following the imposition of sanctions, three illustrative scenarios are developed. These include fully implemented economic sanctions, an increase in oil exports from Persian Gulf nations other than Iran, and Iran's anti-sanctions measures. Third, the sanctions' effects on non-energy sectors are also investigated in addition to their effects on the economy and energy.

Identifying the Mechanisms of Impact:

This research investigates how international conflicts affect energy security and economic growth using the tension between the United States and Iran as a case study. financial penalties, which are among the most often employed strategies in international conflicts, can have a substantial impact on global energy supply chains by endangering the energy supply from nations that export energy. Iran's energy output and the amount of energy supplied to the world market declined as a result of the US economic sanctions on Iran, which limited and impeded a number of cross-border economic operations, including energy commerce, the acquisition of industrial equipment, and technological transfer. Iran's production capacity was also lowered as a result of the freezing of financial assets, which interfered with energy projects and other cooperative initiatives between Iran and its trading partners. More significantly, by disrupting energy transport routes and reducing transportation efficiency, the sanctions also had an impact on Iran's and other Persian Gulf countries' energy supply. As a result, some insurance companies may decline to provide oil tanker insurance. This demonstrates how the use of economic sanctions to disrupt energy exports and transport corridor movements creates significant threats to the global energy supply chain and limits importers' access to energy products.

China's energy security may be impacted by economic sanctions from three angles: import source, supply, and pricing. In terms of energy costs, the conflict between the United States and Iran may limit Iran's ability to supply oil while raising the price of oil globally. The production and export of oil from all Persian Gulf nations might be severely curtailed if Iran intensifies the confrontation by blockading the Hormuz Strait in response. This would raise oil prices more significantly and leave the global oil market with insufficient supplies. The impact of rising oil prices on energy security will be evident because of China's heavy reliance on foreign oil supplies. Furthermore, when oil prices rise, other energy sources would become

more expensive in China, which could have an impact on energy security. The battle would have an impact on China's energy supply, particularly its imports of oil.

Because China and Iran have close energy cooperation arrangements, imposing sanctions on the oil supply chain will immediately lower China's oil imports in the near future. Long-term sanctions may also lessen China's investment in Iranian energy assets, which may have an indirect impact on China's energy import sources. Economic penalties may have an impact on China's energy trading partnerships in addition to altering the energy supply and prices. This happens when China shifts its trading partnerships to other nations with spare oil production capacity, like Saudi Arabia, Kuwait, Iraq, Russia, or Venezuela, because it takes a long time to develop new import sources due to the unavailability of energy products from Iran or other Persian Gulf countries.

China's economic growth may be harmed by the energy instability brought on by international wars, which could lower investment, consumption, and overall exports.

First, price swings and shortages of energy supplies could seriously impair the activity of Chinese businesses, which consequently result in lower labor income and employment, lower public disposable income levels, and lower consumption.

Second, the significant increases in energy prices would result in poorer investment return rates and higher production costs for businesses, which would diminish the overall investment.

Investor confidence may be damaged by fluctuations in energy prices and an unpredictable energy supply, which could result in additional investment reductions. Third, while rising energy prices worsen China's terms of trade and lower its competitiveness in the global market, which lowers China's total exports oil supply shortages indirectly lower the output of the downstream sectors in the energy supply chain, such as construction and heavy manufacturing. Therefore, by undermining China's energy security, international conflicts may eventually harm the country's economic growth.

Scenario Design and Simulation Model:

The GTAP-E Model:

The impact of the US-Iran tension on Chinese energy security and economic growth was evaluated in this work using a multi-region, multi-sector CGE model (GTAP-E), created at Purdue University, USA. The GTAP-E model, which has a long history of methodical enhancements, is frequently employed to examine the impacts of shifts in energy output, global trade, and climate. A growing corpus of research uses global CGE models, such as the GTAP model, to examine the effects of international conflict. The US and Iran are major participants in the global energy trade and have a significant impact on oil prices worldwide. A global economic equilibrium model must be used to measure the effects on nations' economies and energy systems in order to evaluate the tension between the United States and Iran. When in use, the GTAP-E model accounts for both the direct effects of global conflicts on the target nation's energy trade and the indirect effects of price changes on other energy trading partners.

The GTAP-E model's theoretical foundation is presented in Truong, where it is assumed that the market is fully competitive and that returns are constant regardless of production scale. The paradigm is predicated on the idea that producers minimize costs, consumers maximize utility, and bilateral commerce in goods and services connects all nations or regions. Numerous mathematical formulas that accurately depict the economic processes related to production, consumption, investment, and trade make up the GTAP-E model.

The GTAP-E model describes substitutions between various inputs for each production sector using the nested constant elasticity of substitution functions (CES), with producers choosing the best input based on the cost-minimization principle. For the Leontief

function illustrates how each firm's output is a mix of intermediate items and value-added-energy inputs at the top level of the production hierarchy.

Through a CES structure functioning at the second nest, value-added-energy inputs comprise energy capital and other primary elements. According to the Armington assumption, domestic and imported goods are the sources of intermediate items at the bottom nest, indicating that there is incomplete substitution between domestically produced and imported goods.

Regarding consumption, the model makes the assumption that private savings and government consumption—that is, household consumption of products supplied by the government—are distinct. For all commodities, government consumption expenditures are thus taken to be Cobb-Douglas. It is assumed that household private consumption, or the consumption of private products, is organized using a "constant difference of elasticities" (CDE) functional form. Table 2 shows the intricate nested structure of the capital-energy composite for industrial sectors in the GTAP-E model. The capital-energy commodity, represented by the CES function with a substitution elasticity (σKE) of 0.5 for the majority of industries, is made up of capital input and combined energy consumption in production sectors at the top of the nested structure. With a substitution elasticity (σENER) of 1.0, the energy composite commodity is divided into electrical and nonelectrical energy at the lower level. Coal and non-coal energy make up nonelectrical energy, which has a substitution elasticity (σNELY) of 0.5. Next, a substitution elasticity (σNCOL) of 1.0 is applied when the commodity of non-coal energy is separated into gas, oil, and petroleum products. The Armington assumption, which states that composited energy inputs can only achieve incomplete substitution between domestic and imported products—that is, they differ according to the production location—is at the bottom of the demand for electricity, coal, gas, oil, and petroleum products in the nest.

Information and Conclusion:

This study employed the most recent database version (V10) to create the GTAP-E model database, which is based on input-output tables for 141 nations and regions worldwide using 2014 as the base year. There were five main elements (land, capital, skilled labor, unskilled labor, and natural resources) and 65 production sectors in the initial GTAP database.

We combined the 141 original countries/regions into 19 regions to make the simulation and analysis easier. These regions included the key oil-importing and exporting nations, including China, India, Korea, Japan, Iran, and other Persian Gulf nations (see Appendix A Table A1). The main upstream and downstream components of energy production sectors were covered by the 14 production sectors that were combined from the 65 production sectors (Appendix A Table A2). Land, labor, and capital were the five main factors combined. The GTAP-E model database provided information on the substitution elasticity between various forms of energy, while the GTAP V10 database provided the Armington elasticity values. This analysis examines the effects of the US-Iran conflict using a conventional, long-term macroeconomic closure. The following fundamental presumptions were necessary to adopt this closure. Real wages are endogenous in the labor market, and overall employment is constant.

Capital stocks are free to fluctuate in the capital market while maintaining fixed rates of return. The whole capital stock is followed by the total investment. Government and household spending operate in tandem to meet trade balance restrictions.

Policy Scenarios: Three example scenarios were developed in order to assess how the conflict between the USA and Iran might affect China's energy security and economic growth (Table 1). In Scenario 1 (S1), Iranian oil exports would be completely prohibited and reduced to zero by the United States. The bilateral confrontation between the US and Iran progressively turns into a multilateral one involving other Persian Gulf nations as it worsens. In scenario 2 (S2),

in order to make up for the shortfall in the world's oil supply, other Persian Gulf oil producers fully utilize their spare capacity.

Table 3. Policy scenarios used in the GTAP-E model

Scenario	Description
S1	Complete embargo on Iranian oil exports
S2	Other Persian Gulf countries increase oil production by 12.62%
S3	Hormuz Strait disruption causing 30% reduction in Persian Gulf oil exports

According to the International Energy Agency, OPEC nations produced 3.30 million barrels of spare oil per day in 2018; Saudi Arabia accounted for more than 70% of this capacity, with Kuwait, the United Arab Emirates, and Iraq making up the remaining portion. From the level of 25.35 million barrels per day in 2017, Persian Gulf nations other than Iran could raise their oil output by 12.62% by using the spare oil production capacity. The most significant channel for oil exports from Persian Gulf nations, the Hormuz Strait, is blocked by Iran in scenario 3 (S3) as a countermeasure to the sanctions.

According to this scenario, oil exports from Persian Gulf countries would drop by 30% if Iran used military action to harass ships passing through the Hormuz Strait.

Outcomes:

How International Conflict Affects China's Energy Security

Effects on China's Energy Sector Output, Prices, and Trade

As long as other Persian Gulf nations are able to boost oil exports via the Hormuz oil transport corridor, Table 2 indicates that the USA-Iran tension has little effect on the output, price, and trade of each energy sector in China.

Table 4. Effects of complete embargo on Iranian oil exports

Indicator	Change (%)
Oil Imports	-1.224
Domestic Oil Price	+0.710
Oil Output	+2.520
Oil Exports	-0.749
Gas Price	+0.313
Gas Output	+0.187
Petroleum Products Output	-1.138
Gas Supply Output	-0.294
Electricity Output	+0.034
Electricity Price	+0.062

Under S1, the sanctions would result in lower outputs of coal, petroleum products, and gas supplies and higher outputs of oil, gas, and power. China's oil imports would drop by 1.224% and local oil prices would increase if Iran's oil exports were completely banned (by 0.710%), which in turn increases its own oil production (2.520%) and causes a 0.749% decrease in oil exports. China's gas exports would rise somewhat (0.360%) as a result of the decline in oil exports, which would raise demand for gas (as an alternative to oil) globally and raise domestic gas prices (0.313%) and output (0.187%). The outputs of petroleum products and gas supply would decline by 1.138% and 0.294%, respectively, as a result of these higher domestic oil and gas prices, which would unavoidably raise the costs of energy consumption in the major downstream industries. It is possible to anticipate a minor increase in power costs (0.062%) and the cost of energy derived from fossil fuels, which would result in a 0.034% increase in electricity output.

In S2, the impact of sanctions on the output and prices of the majority of China's energy industries is significantly mitigated by the availability of oil exports from other Persian Gulf nations, which are the world's largest oil exporters. Increased oil exports from other

Persian Gulf nations would effectively raise oil imports (2.747%) and lower oil prices (0.506%) in China when Iran's oil exports are completely embargoed. This would result in a notable drop in output (1.793%) and export (6.515%) from the oil industry. Although the decline in petroleum product exports is less than what S1 expected, the rise in petroleum product imports is far greater. China may be expected to boost its imports of oil and petroleum products in order to offset the decrease in imports brought on by sanctions, as reduced oil import prices are impacted by the rise in oil shipments from other Persian Gulf nations. In the meantime, the model projects that the output of gas supplies and petroleum products will drop by 0.063% and 0.122%, respectively, along with a minor drop in their pricing. Due to the huge growth in gas demand from other nations, gas output would climb by 2.940%; in other words, under S2, gas exports are predicted to increase by 17.08%. On the other hand, the price and output of coal and power would somewhat decrease as a result of the declining oil prices. According to S3, a decline in Persian Gulf oil exports might lead to a more significant increase in the price of oil globally, as well as major fluctuations in the output, price, and trade of other energy sectors (apart from electricity). In this case, cutting back on oil exports from Persian Gulf nations not only directly reduces China's oil imports but also raises world oil prices, which in turn reduces China's oil imports indirectly.

China's domestic oil price (4.795%) and output (16.609%) would rise dramatically as a result of this dramatic drop in oil imports (5.067%). Furthermore, China would see a significant rise in oil exports (15.023%) due to the sharply rising price of oil worldwide.

On the other hand, due to the huge drop in gas exports (−40.868%), gas output is predicted to drop by 9.588%. Coal, petroleum products, and gas supply outputs could drop by 1.244%, 5.187%, and 1.027%, respectively, due to higher production costs and lower imports. However, under S3, the power sector's output rises by 0.343% due to a 0.372% increase in price.

Effects on Chinese Energy Sector Supply:

The US-Iran conflict affects China's energy production and commerce, which alters the energy supply and jeopardizes China's energy security. For any energy format, Equation (1) is used to compute supply, which is the total of domestic production plus net imports (imports less exports):

$$Xsupply = Xproduction + Ximport - Xexport \quad (1)$$

where Xsupply, Xproduction, Ximport and Xexport represent the supply, production, import and export of energy, respectively. By linearizing Equation (1), the percentage changes in energy supply can be calculated, as shown in Equation (2):

$$xsupply = Sproduction \times xproduction + Simport \times ximport - Sexport \times xexport \quad (2)$$

where xsupply, xproduction, ximport, and xexport stand for the percentage change in each energy format's supply, production, import, and export, respectively. The percentages of production, imports, and exports in the supply of each are represented by Sproduction, Simport, and Sexport source of energy. Equation (2) enables us to observe that the percentage change in the energy supply depends on the relative proportions of production, imports, and exports in the supply equation for each energy sector, in addition to the percentage change in these variables.

According to the calculations, sanctions would have a detrimental effect on supply for the majority of energy sectors; however, the causes of the supply reduction in each sector vary greatly (Table 3). While domestic outputs from their respective sectors dominate the supply of coal, petroleum products, gas, and power, China's oil and gas sector mostly depends on imports.

A complete embargo on Iranian oil exports under S1 would significantly jeopardize China's energy security by reducing the supply of goods from the majority of energy sectors (apart from electricity). The biggest decrease (1.116%) would be seen in the oil supply, which

is directly impacted by China's reduced imports of Iranian oil. Since imports account for 82.49% of China's gas supply, a 0.076% drop in gas imports would reduce the country's total gas supply to 0.044%. Due to their decreasing outputs, the domestic supply of coal, petroleum products, and gas would drop by 0.288%, 0.687%, and 0.103%, respectively. Due mostly to the rise in domestic output, the electricity supply would rise by 0.036%. The detrimental effects of sanctions on the supplies of the majority of Chinese energy industries might be substantially mitigated under S2. Oil, coal, gas, and petroleum product net supply would rise by 0.115%, 0.004%, 0.082%, and 0.382%, respectively. However, the gas supply is further cut by 0.569%, indicating that the conflict-related shortage of gas cannot be made up for by using spare oil production capacity from neighboring Persian Gulf nations. The electricity supply would drop to 0.069% if there was less electricity produced. In the event that oil shipments from other Persian Gulf nations are cut (S3), the supply of the majority of energy items in China would fluctuate greatly, with the oil supply being the most adversely affected (down by 4.869%). However, growing imports would be the primary reason of the 1.669% increase in supply in the gas industry. The supply of gas (−0.689%), coal (down 1.379%), and petroleum products (down 4.250%) will drastically drop in comparison to S1 and S2 due to the downturn in their production, indicating a serious deterioration in China's energy security.

Table 5. Changes in China's energy supply under different conflict scenarios

Energy Sector	S1 (%)	S2 (%)	S3 (%)
Oil Supply	-1.116	+0.115	-4.869
Coal Supply	-0.288	+0.004	-1.379
Gas Supply	-0.044	-0.569	+1.669
Petroleum Products Supply	-0.687	+0.382	-4.250
Gas Distribution Supply	-0.103	+0.082	-0.689
Electricity Supply	+0.036	-0.069	Positive

How International Conflict Affects China's Energy Import Sources:

Modifications to the Sources of Oil Imports:

The distribution of foreign oil imports into China before to and (as simulated) Table 3 shows what happens after sanctions. China now buys the majority of its oil from Persian Gulf nations, with the exception of Iran (46.8%), Sub-Saharan Africa (19.9%), Russia (9.1%), Iran (8.3%), and other Middle Eastern and North African (MENA) nations (7.7%), according to the "before" statistics (Panel A, Table 3). This shows that Persian Gulf nations account for more than half of China's oil imports, underscoring the significance of examining how USA-Iran tensions affect China's oil import sources.

According to the findings, China would progressively switch its oil imports from Iran and other Persian Gulf nations to Sub-Saharan Africa, Russia, and other MENA nations as a result of sanctions. The other four oil-exporting regions would mostly make up for China's oil import shortfall if Iran's oil exports were completely limited (Panel B, Table 3).

In particular, the percentage of China's total oil imports from other Persian Gulf nations would rise to 50.4%, while the percentages from Sub-Saharan Africa (21.6%), Russia (10.2%), and other MENA nations (8.5%) would also rise, albeit to a smaller degree. The percentage of China's oil imports from Persian Gulf nations would rise to 55.6% under S2 as a result of the increased oil production (Table 3, Panel C), while the percentages from Sub-Saharan Africa, Russia, and other MENA nations would fall to 19.7%, 8.8%, and 7.6%, respectively. Under S3, a significant shift in the composition of China's import sources is anticipated (Table 3, Panel D). The percentage that comes from Persian Gulf nations drops significantly to about 35.3%. As a result, the percentages that come from Sub-Saharan Africa (26.3%), Russia (13%), and other MENA nations (10%) rise significantly. Together, Venezuela and Latin American sources are expected to account for 8.8% of China's oil imports.

Table 6. Changes in China's oil import structure

Region	Before Conflict (%)	S1 (%)	S2 (%)	S3 (%)
Other Persian Gulf	46.8	50.4	55.6	35.3
Sub-Saharan Africa	19.9	21.6	19.7	26.3
Russia	9.1	10.2	8.8	13.0
Iran	8.3	Restricted	Restricted	Restricted
Other MENA	7.7	8.5	7.6	10.0
Venezuela & Latin America	Minor	Minor	Minor	8.8

Modifications to the Sources of Gas Import:

The current scenario (base data) is depicted in Panel A of Table 4, which reveals that the majority of China's gas imports come from Central Asia (74.5%), ASEAN (12.8%), and additional nations in the Persian Gulf (9.7%). According to the modeling results, these three sources continue to supply more than 97% of China's gas imports even after the restrictions were put in place.

It is anticipated that under various penalty implementation scenarios, the proportions supplied by Central Asia, ASEAN, and other Persian Gulf countries will vary marginally. The percentages obtained from Central Asia and other Persian Gulf nations could is anticipated to slightly decline, to 74.4% and 9.5%, respectively, while the percentage sourced from ASEAN nations marginally rises (Panel B, Table 4). Because the market is anticipated to favor oil consumption over gas at this time, the simulations suggest that the percentage of gas imports from ASEAN and other Persian Gulf nations in S2 will decline by 3.2% and 1.2% in comparison to S1 (Panel C, Table 4). However, 78.9% of China's gas imports come from Central Asia, so when oil exports from other Persian Gulf nations decline, the simulations predict that gas exports from those nations will rise dramatically, making up 24.1% of China's gas imports (Panel D, Table 4). In the meantime, the percentage sourced from ASEAN nations may also rise dramatically to a level greater than that observed in alternative scenarios. As a result, it is reasonable to anticipate that the share supplied by Central Asia would drop to 57.4%, even if it would still be China's main supplier of gas.

Modifications to the Import Sources of Petroleum Products:

China's sources of petroleum products are more varied than those of oil and gas. According to the base data, the top five countries from which China imports petroleum products are South Korea (20.8%), other Persian Gulf nations (14.4%), ASEAN nations (11.2%), Venezuela (9.5%), and Iran (9.0%) (Panel A, Table 5).

It is anticipated that the sanctions under S1 will force Iran to shift its export activities toward exporting more petroleum products, increasing the percentage of Iranian imports into China to 19.4% (Panel B,) and the proportions from ASEAN (10.0%), Venezuela (8.4%), South Korea (18.2%), and other Persian Gulf nations (12.8%) will all decline. Iran's share is predicted to drop by 0.8% compared to S1 if the surplus oil production capacity in other Persian Gulf nations is fully utilized, as happens under S2, while South Korea's share would rise by 0.6% (Panel C). In contrast, it is anticipated that the situation regarding the quantities sourced from Venezuela, ASEAN, and other Persian Gulf nations will stay largely steady.

The percentage of China's petroleum product imports that come from South Korea is predicted to drop to 13.4% if oil exports from other Persian Gulf nations decline, as shown under S3. This is less than the percentage that comes from Iran (21.3%) and other Persian Gulf nations (21.1%). Additionally, it is anticipated that exports of petroleum products from Venezuela and ASEAN countries, which account for 7.6% and 8.5% of China's imports, will decline.

International Conflict's Effects on Non-Energy Sectors:

According to the modeling results, most non-energy industries' output and trade are negatively impacted by sanctions (Table 4).

Table 7. Sectoral output impacts under complete embargo scenario

Sector	S1 (%)
Chemical Products	-0.093
Construction	-0.064
Services	-0.038
Heavy Manufacturing	-0.035
Mineral Products	-0.070
Processed Food	-0.017
Agriculture	-0.015
Light Manufacturing	+0.151

Due to the anticipated rise in imports (0.339%), which lessens its competitive edge in the global market, the chemical products sector under S1 is the most negatively impacted (decreased by 0.093%). The production process's upstream and downstream sectors

The next industry most negatively impacted by the conflict is the chain of energy industries. Construction output is expected to drop to 0.064% in the main downstream sectors, followed by services (0.038%) and heavy manufacturing (0.035%). Reduced output is anticipated as a result of higher production costs for these downstream industries brought on by rising energy prices. Due to the decreased demand for raw materials in the energy industry, mineral products (down 0.070%) suffer from sanctions for the major upstream sectors. The only industry that stands to gain is the export-focused light manufacturing sector, whose exports are expected to increase by 0.151%. The least negatively impacted industries include agriculture and processed food, which saw just minor declines of 0.015% and 0.017%, respectively.

The negative effects on construction (0.110%), heavy manufacturing (0.099%), services (0.037%), processed food (0.016%), agriculture (0.001%), and mineral products (0.002%) are largely offset, if not positive, when the spare oil capacity in other Persian Gulf countries is used (S2) in conjunction with lower energy prices. Due to the anticipated sharp increase in imports (0.769%), the chemical products sector's output further declines by 0.151%. In the meantime, the net output somewhat decreases due to a decline in light manufacturing exports.

Table 8. Percentage Changes in Regional Indicators Across the Three Scenarios (S1–S3)

Region	S1 (%)	S2 (%)	S3 (%)
Iran	-0.647	-	-
China	-0.047	-0.024	-0.342
Japan	-0.076	-0.013	-0.884
South Korea	-0.122	-0.056	-1.619
India	-0.174	-0.103	-1.250
Central Asia	+0.023	Negative	+0.212
Other Persian Gulf	+0.020	+2.920	-
Venezuela	+0.016	Negative	+0.134
Latin America	+0.005	-0.040	+0.026
EU28	-	+0.021	-0.164
USA	-	+0.005	-0.111
Russia	-	-	-0.791

The output losses from the upstream and downstream energy sectors are predicted to rise under S3, while the effects on light manufacturing and chemical products are anticipated

to decrease. This is the opposite of the changes to the outputs from all non-energy sectors that are modeled under S2. 4.4. Effects of International Conflict on Real GDP As indicated by the real GDP declines shown in Table 5, prolonged USA-Iran hostilities could not only jeopardize China's energy security but also have a substantial influence on global economic growth.

According to S1, Iran's real GDP would drop dramatically (by 0.647%) in the event of a complete embargo on its oil exports. The Asian nations most negatively impacted by the sanctions include China (down 0.047%), Japan (down 0.076%), South Korea (down 0.122%), and India (down 0.174%). Other East Asian and South Asian nations are predicted to see real GDP losses of less than 0.008%. Central Asia (up 0.023%), other Persian Gulf nations (up 0.020%), Venezuela (up 0.016%), and Latin America (up 0.005%), the world's top oil exporters, profit from increased oil prices and have marginally higher GDPs. The estimated real GDP damage to oil-importing nations would be partially offset under S2 conditions, with the spare oil production capacity from other Persian Gulf nations being fully utilized. The estimated GDP losses for China (down 0.024%), Japan (down 0.013%), South Korea (down 0.056%), and India (down 0.103%) would be relatively small. In this scenario, the real GDP of other South Asian and East Asian nations would rise. Similar to this, other Persian Gulf nations' real GDPs would rise by 2.92% under S2 due to their higher oil production earnings. However, due to lower global oil prices and exports, the predicted GDP changes for Latin American, Central Asian, and Venezuelan countries are negative (down 0.04%). Similarly, there is very little change in the GDPs of the USA (0.005%), other East Asian nations (0.010%), other South Asian nations (0.004%), and the EU28 (0.021%). The simulations indicate that most countries, especially those in Asia, would experience greater economic losses if the oil transport corridor through the Hormuz Strait is disrupted (S3). They estimate that the GDPs of China, Japan, South Korea, and India would drop by 0.342%, 0.884%, 1.619%, and 1.250%, respectively. Additionally, the GDP of the EU28 (−0.164%), other East Asian nations (−0.861%), other South Asian countries (−0.282%), and the USA (−0.111%) would all shrink as a result of lower oil exports from the Persian Gulf, which would probably result in additional increases in global oil prices. The steep rise in oil prices may cause the GDPs of large oil-exporting nations like Canada (0.013%), Latin America (0.026%), Venezuela (0.134%), and Central Asia (0.212%) to modestly grow, while Russia's GDP may decline by 0.791% as a result of its decreased exports.

Conclusions and Implications for Policy:

Conclusions:

International conflicts threaten energy security and economic growth in energyimporting countries by causing energy price fluctuations and disrupting global energy supplies. Few studies have looked into this, however, and the impact mechanisms and implications of international conflict on the energy security and economies of energyimporting countries, such as China, remain unclear. In this context, this paper considered potential developments in the conflict between the US and Iran, and developed three illustrative scenarios, including the imposition of a full embargo on Iranian oil exports, increased oil production by other Persian Gulf oil producers, and reduced oil exports from Persian Gulf countries due to the disruption of the Hormuz Strait oil transport corridor. A global energy-extensive CGE model, GTAP-E, was applied to simulate the likely impacts from such USA–Iran tension scenarios on China's energy production, trade and supply, as well as on sectoral output and economic growth. The major conclusions from this study can be summarized as follows. First, the negative impacts of the US–Iran tension on China's energy output, trade and supply are comparatively limited when the conflict is restricted to a simple embargo on Iranian oil exports (S1), and could largely be alleviated if spare oil production capacity in other Persian Gulf producers is available (S2). Once Persian Gulf oil exports are effectively curtailed,

however (S3), the output, trade and supply from each Chinese energy sector (excluding electricity) could be expected to fluctuate significantly. Affected by the sharp decrease in oil imports, China's oil price (4.795%) and output (16.609%) could increase significantly, whereas the output of gas (−9.588%) could decline sharply due to a large decrease in gas exports (−40.868%). From the perspective of energy import sources, China's imports of oil, gas, and petroleum products are heavily dependent on Iran and the other Persian Gulf countries. Therefore, US–Iran tensions could threaten China's energy security directly, by affecting energy prices, energy supplies and import sources. Second, our modeling suggests that international conflicts also have negative impacts on the output and trade of most non-energy sectors. The downstream and upstream sectors along energy sector production chains are seen to be severely affected by the conflict, with light manufacturing being the only sector benefiting. The construction (−0.064%), service (−0.038%), and heavy manufacturing (−0.035%) sectors might all see a decline in output as a result of higher energy prices. Sanctions affect mineral products (down 0.070%) as a result of declining demand from the energy sector. Furthermore, it is anticipated that under S2, the adverse effects on the majority of non-energy industries will be substantially mitigated by the availability of spare oil production capacity from other Persian Gulf nations. However, it might get worse if these nations' oil shipments are later cut, as S3 models.

Third, the friction between the United States and Iran may have detrimental effects on economic growth in addition to endangering China's energy security. According to S1, a complete embargo on Iran's oil exports is anticipated to hinder those exports, hence causing a decrease in China's GDP in real terms (-0.047%). Any further escalation in the tension between the United States and Iran, including additional steps by other Persian Gulf nations and Iran's defiance to sanctions, might have a greater impact on China's economic growth than solo sanctions. According to the simulation results, China's real GDP would drop to −0.024% as a result of increasing oil output by other Persian Gulf nations. However, if oil exports from the Persian Gulf are totally stopped, oil prices could spike globally, which would hurt China's economy more (the GDP would drop by 0.342%).

Implications for Policy:

The authors were able to identify a number of improvement initiatives that could mitigate the expected effects thanks to the modeling conclusions established in Section 5.1. First, China should diversify its energy imports as a key goal of its energy policy to lessen its heavy reliance on imported fossil fuels and close the supply deficit. In order to lessen China's reliance on ships passing through the Hormuz Strait and to successfully lower this energy supply risk, efforts could be made to shift away from a high reliance on oil imports from Persian Gulf countries towards a more varied suite of suppliers, such as Sub-Saharan Africa and Russia. Second, in order to improve the energy supply structure and lessen the consequences of the external market volatility brought on by international conflicts, policies involving the government offering market assistance and buffering reactive systems must be implemented.

Increasing the strategic oil reserve, creating and implementing low-carbon technology, boosting energy efficiency, and promoting the growth of renewable energy sources are some of these actions. Lastly, China should increase its investment in foreign energy equipment and actively pursue more belt and road initiatives (known in Chinese and formerly in English as One Belt One Road, or OBOR, partnerships) and other international energy partnerships in order to effectively obtain oil and gas resources.

With an emphasis on possible consequences for China's energy security and economic growth while taking effect mechanisms into account, we presented an illustrative analysis on international conflict in this paper. The three scenarios created in this study were rather simplistic, but future scenarios should also take into consideration other factors, such as the

development of additional oil transport corridors in China, an increase in oil imports from other sources, energy substitutes, and international environmental conventions on limiting the use of fossil fuel energy. However, although being a little oversimplified, this analysis provides a quantitative evaluation of the ways in which China's energy security and economic growth could be significantly impacted by the USA-Iran rivalry as a representative international war. Thus, the analysis also emphasizes how crucial it is to lessen the effects of the global conflict and guarantee China's energy supply.

As the various parties engaged have very varied goals and desires, the growth of the tension between the USA and Iran has remained complex and challenging to forecast.

However, keeping up with policy changes in a timely manner is a significant obstacle to the CGE-based evaluation of international conflicts. OPEC's internal disputes, China's domestic energy policy, and the declining energy prices are only a few of the many ongoing activities of players in the intricate global energy game that should be examined in the future. Additionally, China may invest in oil reserve facilities both domestically and internationally in order to lessen the risks to the oil supply. This might ease the scarcity of oil and reduce short-term swings in oil prices.

Another drawback of the GTAP-E model is that it does not account for nations' oil reserves, which could lead to an overestimation of the sanction's effects on China's economic growth and energy security. Future research should focus on how China's oil reserves affect its economic expansion and energy security.

In addition to posing serious risks to China's economic expansion and energy security, the sanctions would also significantly impact the economic development of other nations that buy oil, including South Korea, Japan, and India. As a result, this study has important policy ramifications since it not only offers a thorough analysis of how China's energy security and economic growth would be affected by a possible escalation of tensions between the USA and Iran, but it also offers advice to other nations that import energy by providing information on how to lessen the harm caused by international conflicts. For instance, in the intricate global energy campaign, nations that import energy should set up more varied avenues for the import of oil.

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