***Energy, Defense, Trade, and Macroeconomic Dynamics:***

***Exploring Long-Term relationships in Oil Markets***

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## Overview

The recent surge in global conflicts in recent times have contributed to heightened market uncertainty. The outbreak of the war in Ukraine of February 2022 shattered the long-standing post-WWII feeling of indefinite peace in Europe, with energy markets clearly reflecting such sentiment [1]. The most recent conflict affecting Israel and Gaza, as well as the increasing tensions between China and Taiwan, highlight the delicate geopolitical landscape. Any disruption of the current global order may cause an aggressive and uncontrolled escalation of unrest, accounting for the potential intervention of international defence alliances in response to perceived threats.

The intersection between this hypothetical scenario and the current challenges of the energy transition may have catastrophic consequences for both energy and carbon markets. It is worth noticing that the first months of the Israel-Gaza conflict produced more planet-warming gases than 20 climate-vulnerable nations do in a year [2]. This sole latest news supports the importance of the research question addressed in this paper: to explore military macroeconomic data as a proxy for disruptions in oil markets and to use those indicators as a quantitative indicator of geopolitical unrest.

## Methods

The following annual averages of monthly time-series data will be object of the econometric study, for the years 1973 to 2022:

* WPRO: World Oil Production Annual (Thousand Barrels Daily) (Source: BP statistics statistical review, 2022).
* SIP: Global Military Expenditure (Source: Stockholm International Peace Research Institute, 2022).
* DXY: ICE US Dollar Index - Index - C (DX-Y.NYB) (Source: Yahoo Finance, 2024).
* WTI: West Texas Intermediate (WTI) (Source: Federal Reserve Bank of St. Louis, 2022).
* WTO: World Total Global Merchandise Exports (Source: World Trade Organization, 2022).
* GOLD: Gold Price per Troy Ounce (USD) (Source: World Gold Council, 2023).
* FEDF: Federal Funds Effective Rate (Source: Federal Reserve Bank of St. Louis, 2022).
* WGDP: World GDP (Source: The World Bank, 2023).

Qualitative considerations about these series inferred based on market news relevant to the field of geopolitics will be provided as a key for the readers’ interpretation of the conclusions of the work. The first differences of the logged series above will be assessed for stationarity through Augmented Dickey-Fuller tests. Multiple Covariate-Augmented Dickey-Fuller tests with results of statistical relevance will be reported, together with trends of relevance found within these time-series. Relevant information about each of these series from testing for seasonal ARIMA terms, harmonic regression terms and seasonal dummy variables will follow. A few linear dynamic models of relevance will be included, upon investigating seasonality, non-stationarity, structural breaks, Granger causality and dynamic relationships between multiple combinations of independent variables, being WTI the main dependent variable under investigation. A few models using any of the dependent variables above will be reported to support the conclusions of the paper.

## Results

The WTO time-series consistently showed a significant correlation with the WTI time-series across various model sets. This correlation remained statistically significant even after incorporating additional economic variables into the models. The DXY, GOLD and FEDF time-series have been used to control for the effects of monetary policies and the related market news.

A significant negative correlation was observed between trade and global military expenditure as a percentage of the global GDP. This correlation was identified by constructing a new time series derived from the ratio of global military expenditure (SIP) to global GDP (WGDP) on an annual basis.

## Conclusions

## The economic hypothesis that WTO plays as a proxy for the global economy activity will be proved to be statistically significant. That is, based on the rationale that around 70% by value and 80% by volume of goods traded globally is carried by maritime global transportation, and that oil and oil-related products contribute to around 30-35% of total maritime trade volume.

## The SIP time series serves as an effective proxy indicator for disruptions in the long-term dynamic relationships between WTO, WPRO, WGDP, and GOLD, with WTI as the dependent variable. ARIMA models will be employed to forecast the impact of conflicts on the next few global economic cycles. That is proving that even regional conflicts can significantly affect global markets for years due to their liquidity and to the disruptions in the globalized supply chain. The paper establishes a long-term correlation between trade contractions and military expenditures as a percentage of global GDP. The level of militarism in the global economy is thus indicative of trade and oil markets disruptions, altering price-making mechanisms.

## Future follow up studies will include the potential of those disruptions on carbon markets. As 2050 approaches with its zero-net CO2 targets, the backward and forward linkages of the green economy will influence macroeconomic variables more significantly. The global diplomacy is already struggling to consider air a common good and cooperate effectively to tackle the climate change emergency. This study emphasizes the need for cautious diplomatic handling of international crises or potential threats, to avoid catastrophic consequences on the economy and on the energy transition.

## References

[1] Nichilo P., Dahl C. (2023) “On the geopolitical disruption of the EU natural gas market: a correction model,” 44th IAEE International Conference, February 2023, Riyadh, Kingdom of Saudi Arabia.

[2] Emissions from Israel’s war in Gaza have ‘immense’ effect on climate catastrophe, The Guardian, 2024.