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Measuring the concentration of military power in the international geopolitical system: Singer's methodology using only military indicators

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This study quantitatively examines the impact of the COVID-19 pandemic on the concentration of military power within the international geopolitical system from 2014 to 2023. Utilizing a modified Composite Indicator of National Capability (mCINC) based on defense budgets and military personnel, this study analyzes the relative concentration of military capabilities among 145 states. Derived from the Correlates of War Project, our methodology enables an examination of variations in military capability concentration, especially during the pandemic years. The results trend towards the dispersion of military capabilities, with notable variations observed during the COVID-19 period, reflecting a more equitable distribution among states, notably major powers. These variations are attributed to a decrease in military capabilities among democracies, particularly the United States, and an increase in Russia's military power. The study concludes that the pandemic years have led to a nuanced adjustment towards greater multipolarity, hinting at potential instability and uncertainty in geopolitics.

Introduction

Over the past 3 years or so, the coronavirus disease 2019 (COVID-19) pandemic had shaken up the world and unprecedentedly claimed millions of lives. The impact of the pandemic among nations was not merely about contagious diseases and public health. Many scholars postulated that it would have repercussions on the politics among nations (Babić, 2021). Systemically, they presumed that the worldwide pandemic would have significantly impacted the "relative distribution of power"—more precisely, referred to as the "relative concentration of power"—in an international geopolitical system (Duggan and Grabowski, 2021; Hrabina, 2021; Alhammadi, 2022). Thereby, power concentration would be dispersed more equally among major powers, inevitably reshaping major-power relationships (Yang, 2020a,b; Hicken et al., 2021). Additionally, some scholars anticipated that the COVID-19

effects might lead to greater degrees of instability and uncertainty in world politics, affecting international issues, such as United Nations peace operations (de Coning, 2021).

Nevertheless, scholars, like Drezner (2020), disagreed with the above-stated arguments. He argued that the COVID-19 pandemic did not produce profound *ex-post* consequences on the concentration of power in the international geopolitical system; therefore, major-power relations and world affairs would remain the same. This opinion held true for geopolitics as well (Drezner, 2022). Yet, to verify whether the pandemic has had a significant impact on the international system requires quantitative research measuring variation in the system concentration. Among the existing literature on this and related topics, only Hrabina (2021) touched upon how to evaluate international power configuration scientifically, indicating that methodologies constructed by the Correlates of War (COW) Project should be performed. Without quantitative evidence, one could not empirically prove the extent of the variation the pandemic introduced into the international geopolitical system.

As a result of the earlier debate, our research question is straightforward: Has the COVID-19 pandemic significantly impacted the international geopolitical system? Based on the majority of the cited literature, we formulated the following hypothesis:

> Hypothesis: The COVID-19 pandemic has substantively impacted the international geopolitical system in terms of the concentration of power.

This study is descriptive and, to some extent, explanatory. Its principal objectives are:

- Measuring the concentration of military power in the international geopolitical system between 2014 and 2023.
- Describing system characteristics—specifically, power polarity—during the same period.
- Explicating any *ex-post* changes in the concentration of military power during the pandemic years and quantitatively testing the hypothesis.
- Addressing the implications for understanding major-power relations and broader geopolitics.

The time span from 2014 to 2023 should be sufficient to reveal trends in the international geopolitical system, thereby enabling meaningful comparisons.

Definitions

Before proceeding further, some key terms used throughout this article are defined *a priori* to prevent any confusion between the authors and readers. Additionally, defining these terms in advance is advantageous for constructing the argument. They are as follows:

- Definition 1. Power is a state's military capability, measured by defense personnel and spending. At the systemic level, power is the total military capabilities of all states in the international geopolitical system.
- Definition 2. The international geopolitical system is a three-component structure consisting of anarchical ordering,

survival-seeking states as constituent units, and the concentration of military capabilities. The first two components are functionally static, whereas the concentration of military capabilities varies over time (Chatterjee, 1997). Given that the military is the sole dimension of power, the system is inherently geopolitical in nature (see Cohen, 1994; Levy and Thompson, 2010).

- Definition 3. The concentration of power, or power concentration, is the degree to which military capabilities (i.e., military power) are concentrated in a relatively small number of states (Hart, 1985).
- Definition 4. Polarity, or power polarity, is the number of autonomous power centers, also referred to as power poles, within the international geopolitical system. This is a function of the concentration of military power predominantly among major-power states (Modelski, 1974; Farmer, 1992; Suporn et al., 2021).

Method

This study adopted a case study research design (Gerring and McDermott, 2007; Gerring, 2017). The aforesaid design was selected because it enabled us to explore "variation through time and across space while maintaining *ceteris paribus* assumptions" (Gerring and McDermott, 2007, p. 688). To identify general patterns in the concentration of military capabilities within the global geopolitical system, we employed quantitative techniques to analyze numerical data, thereby illuminating key system features. The present study relied primarily on variables developed by J. David Singer's COW Project, including methodologies for indexing the Composite Indicator of National Capability (CINC) and the capability concentration of an international system (Singer et al., 1972; Singer, 1988, 1990). This, in turn, enabled the drawing of implications for geopolitics, notably major-power relations.

Military capabilities

Measuring the concentration of an international geopolitical system first requires the measurement of the military capabilities of the states constituting the system. The capability of each state was computed using a similar calculating method as the COW Project's CINC (Singer et al., 1972, Singer, 1990); however, unlike the original CINC index relying on six indicators (see Singer, 1988), our modified version of it (hereafter, mCINC) is built on two military indicators, namely, defense budgets and military personnel.

The mCINC is derived by aggregating observations related to each of the two military indicators for a specific year, transforming each country's absolute values within these indicators into a proportion of the international geopolitical system, and then calculating the average value across the two indicators. Specifically, we present below the notation for mCINC's two military indicators:

DB_i = state i's defense budgets.
MP_i = state i's military personnel.

Next, the total number of states constituting the international geopolitical system (i.e., the unit of analysis) is identified. After that, we put a figure to a single state's share of a separate military capability.

For example, in a 4-state system, X's share of total defense budgets (i.e., $\%DB_x$) is given by the following equation:

$$\%DB_x = \frac{DB_x}{DB_w + DB_x + DB_y + DB_z}$$

The same is used to compute state X's share of the remaining indicator of military power, thereby determining a value for $\%MP_x$. Each share ranges from zero to one. Averaging combines the shares into a unitary indicator:

$$mCINC_x = \frac{\%DB_x + \%MP_x}{2}$$

The concentration of military capabilities

Relying on the mCINC scores, the military capability concentration of an international geopolitical system, denoted as MILCON, is computed using Singer et al.'s (1972) formula:

$$MILCON = \sqrt{\frac{\sum_{i=1}^{N}(Si)^2 - \frac{1}{N}}{1 - \frac{1}{N}}}$$

In this systemic-concentration formula, N equals the number of states in the international geopolitical system; Si equals the state i's share of the system's military capabilities. The value of MILCON ranges from 0.00 to 1.00. The MILCON value is zero in the hypothetical scenario when the system's capabilities are perfectly equally distributed. Contrariwise, the MILCON value is 1.00 in the hypothetical scenario when one state holds 100% of the system's capabilities (Singer et al., 1972).

Data and operationalization

The raw data for calculating mCINC scores and MILCON values were extracted from The Military Balance Plus (MB+), an online subscription database of defense information from the International Institute for Strategic Studies (IISS). Although MB+ has been highly regarded for its comprehensiveness, it did not cover the information of all nations. In the period 2014–2023, data on defense budgets and active military personnel of approximately 150 states were available. Despite that, our analysis included only states with complete data (N = 145) in that time.

Therefore, operationally, we assumed that the international geopolitical system consisted of 145 states, of which seven were designated as major powers according to the COW Project: (1) United States, (2) United Kingdom, (3) France, (4) Germany, (5) Russia, (6) China, and (7) Japan (Sarkees and Wayman, 2010). Meanwhile, the military power or capability of each state, including major powers, was operationally represented by its mCINC score.

All computations and visualization used Microsoft Excel 2019 and SPSS Statistics 20.0 software.

Limitations of the study

There are several caveats concerning the design of this study. The research design focuses narrowly on a military dimension of power, quantified by defense budgets and military personnel. Dimensions, such as population, are deliberately omitted, deriving from the fact that today's warfare does not hinge on the number of conscripts but on military technologies, whose innovations need large defense budgets. Concurrently, modern military equipment has become substantially automated, reducing the size of active armed personnel. Other dimensions, such as socio-economy, are also omitted. The underlying reason is simple and straightforward, namely: "military power" is the "currency" of international relations and geopolitics (Schweller, 1997). Thus, our interpretation and discussion are strictly based on military capability, and we do not consider socio-economic dimensions.

Aside from the above limitations, as we relied solely on IISS MB+ for data, our assessment and analysis are not a complete picture of the international geopolitical configuration. Nonetheless, the total number of 145 states includes all key actors in world affairs. Apart from seven major powers, medium-sized powers, such as India and South Korea, are included. Given the large-N samples, the findings reported here are fairly deemed scientifically valid, albeit limited to a certain degree.

Lastly, this study focuses exclusively on "power polarity" and does not explore "alliance polarization" or "cluster polarity" (see Suporn et al., 2021). Therefore, further in-depth research is essential to comprehensively understand the implications of polarization on geopolitics. Moreover, it is recommended that future studies address the limitations of the present research and conduct comparative analyses on the impacts of similar, albeit not identical, viral outbreaks.

Results

The mCINC scores for 145 states during the period 2014–2023 were computed based on defense budget and military personnel data. The defense budgets and active military personnel of major powers during the same period are reported in Tables 1, 2 for reference purposes. The United States ranked first in terms of both military expenditures and personnel, followed by China in second place. Russia ranked third, but only in terms of active military personnel.

Then, the MILCON index for the same period was calculated using Singer et al.'s (1972) formula. The result of the calculation is reported in Table 3. The concentration of military power in the international geopolitical system was generally dispersed. In 2015, the MILCON index dropped by 0.01. But since then to 2019, the military capability concentration fluctuated only trivially. During the COVID-19 pandemic from 2020 to mid-2023, the MILCON index had steadily become more dispersed, indicating that the system's total military capabilities had been distributed more equally.

The trend of dispersion in the years of the COVID-19 pandemic seemed to be caused by the shrinking military capabilities of the major democratic powers, particularly the United States, while the military capabilities of Russia increased substantively (see Table 4). Table 4 reports the military capabilities of major-power nations between 2014 and 2023.

TABLE 1 Defense budgets of major powers (in constant 2015 USD, millions).

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
USA	628,060	598,391	618,241	638,723	691,472	697,751	715,251	670,752	691,938	732,033
UKG	60,364	61,612	61,266	62,151	63,260	65,455	65,598	70,469	75,729	72,364
FRN	43,979	46,626	46,667	47,361	48,924	49,966	50,258	51,146	51,472	52,304
GMY	36,660	36,589	37,548	39,923	40,740	44,764	46,397	46,308	47,246	51,449
RUS	43,413	51,941	47,345	40,179	38,733	39,764	41,672	39,486	48,762	57,521
CHN	133,144	145,931	155,456	159,821	166,995	177,363	184,983	191,850	201,234	217,848
JPN	42,180	42,877	43,191	43,635	44,705	46,305	46,522	46,521	49,972	53,216

USA, United States; UKG, United Kingdom; FRN, France; GMY, Germany; RUS, Russia; CHN, China; JPN, Japan.

TABLE 2 Active military personnel of major powers.

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
USA	1,433,150	1,381,150	1,344,300	1,348,400	1,359,450	1,379,800	1,388,100	1,395,350	1,359,600	1,326,050
UKG	159,150	154,700	152,350	150,250	148,350	148,450	148,500	153,200	150,350	144,400
FRN	218,150	208,950	202,950	202,650	203,900	203,800	203,350	203,400	203,250	203,850
GMY	181,550	178,600	176,800	178,600	179,400	181,400	183,500	183,400	183,150	181,000
RUS	771,000	798,000	831,000	900,000	900,000	900,000	900,000	900,000	1,190,000	1,100,000
CHN	2,333,000	2,333,000	2,183,000	2,035,000	2,035,000	2,035,000	2,035,000	2,035,000	2,035,000	2,035,000
JPN	247,150	247,150	247,150	247,150	247,150	247,150	247,150	247,150	247,100	247,000

USA, United States; UKG, United Kingdom; FRN, France; GMY, Germany; RUS, Russia; CHN, China; JPN, Japan.

Overall, the MILCON index had been roughly between 0.27 and 0.28 during the entire period. In the global pandemic period, the MILCON index dropped from 0.28 in 2020 to 0.27 in 2023. Ergo, the results reported here did not support the hypothesis derived from the majority of the cited literature on the impact of the COVID-19 pandemic on geopolitics. Specifically, the global pandemic did not substantially impact the international geopolitical system, at least in terms of the concentration of military power.

Discussion

In the period 2014–2023, fluctuations in the concentration of military power in the international geopolitical system were of little consequence to world politics. During the COVID-19 pandemic years, the concentration became more dispersed, as the MILCON index dropped by about 0.01 from 2020 to 2023 due to the decreased proportion of military capabilities among democracies, especially the United States and its allies, and the increased size of Russia's military power. The authors, however, did not find statistically significant evidence indicating the impact of COVID-19 on military capabilities. Rather, the probable cause is Russia's expansion of military power for the war in Ukraine (Rustamova, 2023).

Considering the MCINC scores of major powers, it is justified to interpret that the system has been "multipolar" at least since 2014. This situation is because the mCINC scores held by the two strongest powers were less than 0.50, or 50% of the system's total military capabilities (Farmer, 1992). The recent global pandemic did not alter this proportion. Accordingly, geopolitics should be interpreted based on the fact that multipolarity has been a systemic characteristic of the international power configuration since 2014.

TABLE 3 The concentration of military power in the international geopolitical system.

Year	MILCON
2014	0.282
2015	0.272
2016	0.273
2017	0.273
2018	0.279
2019	0.277
2020	0.278
2021	0.273
2022	0.269
2023	0.267

MILCON = Concentration index of total military capabilities.

Theoretically, multipolar power configuration, characterized by power dispersion, tends to be conflict-prone. Multipolarity reduces stability while escalating uncertainty, thereby creating a condition leading to conflict and war (Singer et al., 1972; Modelski, 1978; Thompson, 1986; Waltz, 1988). According to Waltz (1988), in multipolarity, dangers are prevalent and unclear to states in general and policymakers in particular. Instability and uncertainty have made international politics—above all, major-power chessboard—murkier and more unpredictable. This situation is contrary to bipolarity, such as during the Cold War years, when geopolitics was easier to read, as threats were clear and existential. Since no large-scale war took place, the Cold War era was named by one renowned historian as the "Long Peace" (Gaddis, 1986).

TABLE 4 Military capabilities of major powers, 2014–2023.

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
USA	0.249	0.236	0.237	0.238	0.246	0.243	0.244	0.236	0.232	0.228
UKG	0.025	0.025	0.024	0.024	0.023	0.023	0.023	0.025	0.025	0.023
FRN	0.021	0.021	0.021	0.021	0.021	0.020	0.020	0.021	0.020	0.020
GMY	0.017	0.017	0.017	0.018	0.017	0.018	0.019	0.019	0.018	0.019
RUS	0.037	0.040	0.039	0.039	0.038	0.037	0.038	0.038	0.046	0.049
CHN	0.111	0.115	0.113	0.109	0.109	0.110	0.111	0.115	0.112	0.113
JPN	0.021	0.021	0.021	0.021	0.021	0.021	0.020	0.021	0.021	0.021

USA, United States; UKG, United Kingdom; FRN, France; GMY, Germany; RUS, Russia; CHN, China; JPN, Japan.

Practically, today's geopolitical Great Games, especially among major powers, come with higher stakes than before, not only for major-power nations but also for smaller powers. For smaller nations, vulnerability to geopolitical tensions is prominently exemplified by the full-scale Russian invasion of Ukraine. Unilateral use of force by a major power makes a "chain-ganging" scenario—the root cause of the First World War (Quackenbush, 2015)—more likely. That is to say, a group of states have to be involved in war, even if without political will, as they are chained by alliance bonds (Christensen and Snyder, 1990).

Given all the aforementioned, geopolitics has tended to become riskier due to the systemic repercussions of multipolarity. The situation has been intensified by the power transition, wherein China, a revisionist power, has endeavored to be treated as an equal to the United States (Pisciotta, 2023). Moreover, concurrently, Russia had strongly signaled the U.S.-led democracies to respect its sphere of influence via a series of armed interventions on Ukrainian soil several years before the war against Ukraine occurred (Kurth, 2022). The global viral spread appeared to create favorable conditions for such armed interventions, as all democracies had to allocate resources to domestic public health emergencies. Hence, the more uncertain world for all nations.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

PB: Conceptualization, Funding acquisition, Investigation, Methodology, Writing – original draft, Resources. ST: Writing – original draft, Methodology, Supervision. PF: Methodology, Supervision, Writing – original draft. PK: Formal Analysis, Validation, Writing – original draft.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpos.2024.1412260/full#supplementary-material

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