The spillover effects of military spending across superpowers using the TVP - VAR approach

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ABSTRACT

The amount of money spent on military activities across superpowers globally has generally caused significant concerns regarding military conflicts, the arms race, economic growth development, security, political stability, and governance. This paper investigates the spillover effects of military spending among the world's largest spenders on military activities over the period 1997 - 2022. We use the advanced Time-Varying Parameter Vector Autoregressive (TVP-VAR) model to examine these effects, which is not used in the literature on defense economics. Our empirical results indicate the dynamic international spillovers of military spending among eleven countries. We find that the average total dynamic military spending connectedness was at the strongly interrelated level of 83.84 percent, ranging from 89.37 percent to 94.23 percent. Among these eleven, the world's largest spenders on military activities, the USA (China) is the most significant contributor (receiver) of total spillover. At the same time, Australia and Iran transmitted and received the least spillover of military spending.

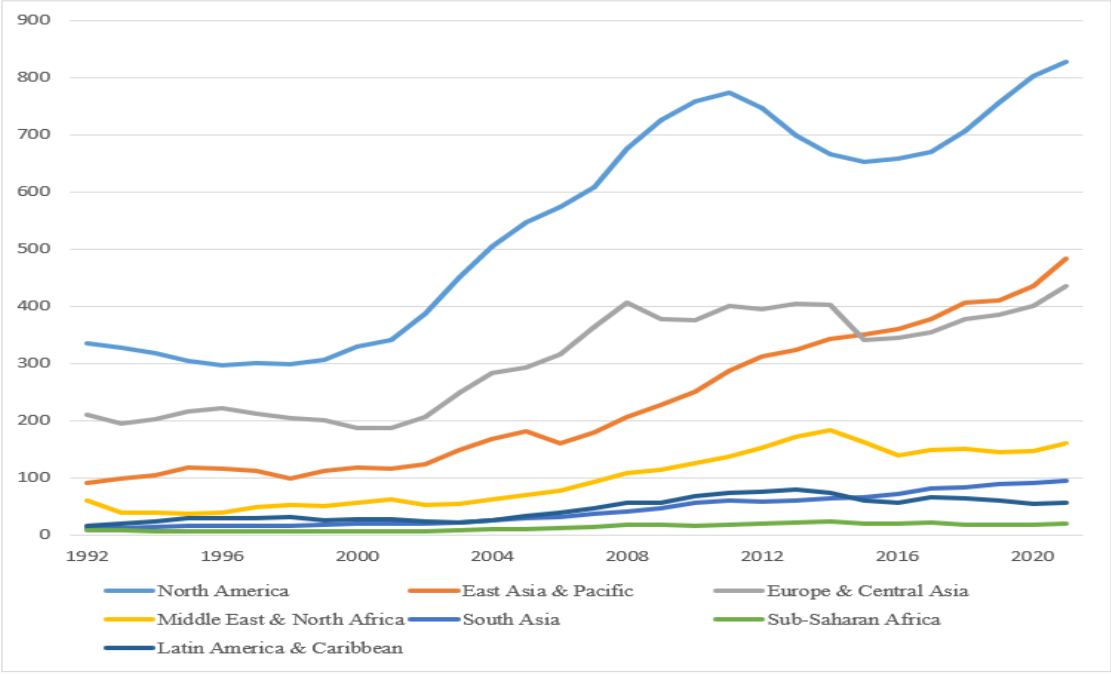
1. Introduction

The significant increase in military expenditure in many countries worldwide has recently attracted widespread attention. Figure 1 depicts the massive increase in global military spending over 30 years. The world's military expenditure has increased sharply from more than 700 billion dollars in 1992 to more than 2,000 billion dollars in 2021.

It is challenging to do a theoretical analysis of military spending because it involves a complex interplay of economic, political, strategic, psychological, and even moral considerations. There are several theories concerning the decision-making process and the influence of diverse military, political, strategic, and economic elements, even if the economic theory does not explicitly address military spending as a specific economic activity. The demand for military expenditure is considered to be influenced by external circumstances, such as the military spending of allies or potential foes. In this instance, arms-race models (Richardson, 1960) or models of alliances (Olson & Zeckkhauser, 1966; Sandler & Keith, 2001) can be used to simulate the need for military spending, implying that security is influenced by the countries and other countries military spending.

Figure 1

Military Expenditure in Billions of US Dollars from 1984 to 2020 by Regions



Source. SIPRI (Stockholm International Peace Research Institute)

Military expenditure, on the one hand, strengthens national security and minimizes external threats. It also stimulates economic growth by expanding the demand for goods and services. On the other hand, its consequences are obvious and enormous. Large arms purchases will likely harm the available resources for developmental efforts. In some countries, military spending harms many economic factors, including income inequality, national debt, unemployment, and financial development (Ali & Galbraith, 2003; Dunne et al., 2004; Shahbaz et al., 2013). Additionally, there is a trade-off between defense and non-defense spending, such as education, health care, and technology, which are essential in supporting economic growth and providing a broader basis for socioeconomic development (Looney & Frederiksen, 1986). Therefore, analyzing factors that can predict military expenditure has significant implications for a country. Policymakers can understand the country's military spending by examining the spillover effects between countries, particularly among countries with relatively significant military spending globally. Lowering military spending and the arms race may enhance peace and foster economic growth and development.

Previous empirical analyses examined the effects of defense expenditure on various socioeconomic factors among countries in recent years. However, the spillovers in military spending between countries, which may determine the characteristics of free riding in military spending, have largely been ignored, particularly empirical studies using the advanced TVP-VAR-based approach proposed by Antonakakis et al. (2020). In this paper, we explore the dynamic volatility spillovers across eleven countries' military expenditures from 1997 to 2022. This paper expands the existing literature in two ways. First, to the best of our knowledge, this is one of the first papers to explore spillovers across military spending of countries, particularly those with high levels of military spending in the world. Second, utilizing the TVP-VAR-based connectedness technique, we give new evidence on the dynamic spillover effect of the military amongst eleven nations. In comparison to its predecessor, the VAR-based connectivity

technique, this approach has various advantages, such as overcoming arbitrary rolling window size and losing valuable observations.

Following this introduction, the paper is structured as follows. Section 2 outlines and discusses empirical studies regarding the determinants of defense spending. The data and model specification are presented and discussed in section 3. Section 4 reports our empirical results, followed by the concluding remarks in section 5 of the paper.

2. Literature review

Spillover is a concept used to evaluate the interconnectedness of subjects. The spillover mechanism was proposed by Engle et al. (1990) through two hypotheses: heat waves and meteor showers. According to the Heat Wave hypothesis, information does not spread; for example, a hot day in New York will be followed by another hot day in New York, but not in Tokyo. Meanwhile, the Meteor Shower hypothesis implies that information spreads, so that if a meteor shower occurs in New York, it has already occurred in Tokyo. As a result, the study is based on this hypothesis to investigate the extent of information spillover on military spending across countries with high levels of military spending in the world.

Multiple internal and external factors affect the amount of money allocated to defense and national security. Empirical findings from the existing literature demonstrate that economic, strategic, political, and security considerations affect military expenditures. For instance, Dunne and Perlo-Freeman (2003) evaluated the determinants influencing military expenditure in 98 developing nations during and after the Cold War. The findings indicate that military burden relies on neighbors' military spending, even non-hostile neighbors, although hostile neighbors have a more significant effect. Using the same data set but a different estimating technique, Dunne et al. (2008) analyzed the factors influencing military spending for a group of developing nations between 1981 and 1997. Their findings confirm that the security web (military spending of neighboring nations and other security-influencing powers), population, democracy index, and trade openness are among the determinants affecting military spending. Trade openness is found to positively impact military spending, whereas the national income, the democracy index, the security web, and the population negatively impact military spending. Likewise, Flores (2011) examined the factors influencing military spending for 168 nations. The findings from spatial autoregressive models indicate that a country's military spending is strongly impacted by the military spending of its alliance partners. However, the impact of a neighboring country's military spending is even more substantial. Moreover, Seiglie (2016) examined the factors driving military spending in 36 nations between 1968 and 1978. The results demonstrate that trade openness, real GNP, and the enemy country's military expenditure positively affect a country's military expenditure. However, trade arrangements and allied nations' military spending have a negative impact. In another study, Droff and Malizard (2022) evaluated the key drivers of French defense spending from 1958 to 2017. The authors concentrated on strategic elements such as proxies for alliance membership and external threats. They additionally mentioned transnational terrorism as an alternative to internal dangers. They discovered that defense spending is positively associated with GDP, NATO membership, military actions overseas, and external threats and adversely related to population as a proxy for public service demands. These findings proved resistant to changes in specifications and alterations in defense policy after 1991. This article emphasizes that economic factors are the primary determinants of French defense policy.

Many research approaches are employed in order to investigate the factors that influence military spending. Yalta and Yalta (2021) used a partial adjustment model with the Three-Stage

Least Squares (3SLS) approach to analyze the factors influencing military spending in the sample of six Gulf Region nations. Their study considers several strategic and economic elements to shed light on free riding and spillover effects between 1980 and 2016. Empirical findings from their analysis show that military spending is highly heterogeneous between nations and driven by economic and strategic factors. The results also demonstrate that the GCC members do not support one other's military spending. The amount of money spent on defense in the region is also significantly affected by the presence of US troops. Finally, the findings also demonstrate that the GCC members do not free-ride on each other's military expenditures. Kollias et al. (2018) evaluated the demand for military spending throughout the 1965 - 2015 period using a panel of 12 Latin American nations and quantile regression analysis. The findings suggest that both internal and external factors contributed to military spending. A significant factor in allocating military resources involves the intrastate conflicts that have plagued several Latin American nations. The military spending from bordering neighbors is the external strategic factor affecting the need for defense spending. Odehnal and Neubauer (2018) conducted an empirical study of the determinants of military expenditures in 27 NATO countries from 2001 to 2017. Panel models were used to examine economic, security, and political determinants. The following variables were used to analyze the economic environment as a determinant of military expenditure: Budget Balance Risk, Foreign Debt Risk, Inflation Risk, GDP Per Capita Risk, GDP Growth Risk, and a control variable, Current Account Risk as a percentage of GDP. Terrorism, cross-border conflict, ethnic tension, and foreign pressures were the variables used in the security risk analysis. To assess political risks, a variable measuring Democratic Accountability and a control variable, Government Stability, were utilized. The findings reveal significant variations in factors influencing military expenditures in old and new NATO member countries.

Our review of the literature reveals that, while factors influencing military spending have been extensively researched, spillovers across countries' military spending have largely been ignored in the existing literature. Furthermore, several methodologies, such as spatial autoregressive models, the Three-Stage Least Squares (3SLS) approach, quantile regression, etc. were utilized to ensure the robustness of the findings. However, no previous research has employed Antonakakis et al.'s (2020) TVP-VAR-based connection approach to quantify how much military spending has spilled over among countries. These gaps make our study, as presented in the following sections, exceptional and deserving of investigation.

3. Data and methodology

3.1. Data

Yearly data from 1997 to 2022 are used to investigate the spillover effects of military spending among the eleven superpowers with the most significant spending on military (including the USA, China, the UK, Russia, France, Japan, Germany, Australia, Canada, and Iran). The data are collected from the SIPRI (Stockholm International Peace Research Institute). SIPRI's military spending data are derived from the NATO definition, which includes all current and capital expenditures on the armed forces, including peacekeeping forces; defense ministries and other government agencies involved in defense projects; paramilitary forces, if they are judged to be trained and equipped for military operations; and military space activities. Military and civil personnel expenses include retirement pensions for military personnel and social services for personnel; operation and maintenance; procurement; military research and development; and military aid (in the donor country's military expenditures). In our analysis, military spending was calculated as a proportion of GDP. Table 1 below provides the summary statistics of the variables used in this study.

3.2. Methodology

This paper examines the 1960 - 2021 military spending spillover among nine nations using the TVP-VAR-based approach proposed by Antonakakis et al. (2020) based on Diebold and Yilmaz's connectedness approach. The modified approach allows us to examine the dynamic evolution of spillover effects, including total, directional, net, and pairwise spillovers. Additionally, this approach uses graphs to illustrate spillover dynamics. Considering a VAR model with N variables for a stationary covariance process:

$$\mathbf{Y_t} = \sum_{\mathbf{i=1}}^{\mathbf{p}} \boldsymbol{\phi_i} \mathbf{Y_{t-i}} + \boldsymbol{\varepsilon_t} \quad (1)$$

Where Yt is the vector of N observed dependent variables, ϕ_i $(i = 1, 2, \ldots, p)$ is time-varying coefficients matrices, and $\varepsilon t \sim N(0, \sum)$ is vector error disturbances which are assumed to be dispersed across time independently and identically. Y_t can be written in a moving average form below $\gamma_t = \sum_{i=0}^{\infty} A_i \varepsilon_{t-1}$

Where N x N coefficient matrices Ai is defined as:

$$\boldsymbol{A_i} = \boldsymbol{\phi_1 A_{i-1}} + \boldsymbol{\phi_2 A_{i-2}} + \cdots + \boldsymbol{\phi_p A_{i-p}} \quad (2)$$

and Ai = 0 for i < 0.

Assuming H is the prediction horizon, we refer to $D^{gH} = \left[d_{ij}^{gH}\right]$ as the H-step generalized variance decomposition matrix. The fraction of the sector i's H-step-ahead generalized forecast error variance attributable to the military expenditure of the country j's shocks is represented by the element d_{ij}^{gH}. Then the paper calculated each row of the normalized matrix $\overline{D}^{gH} = \left[d_{ij}^{gH}\right]$ as $\bar{d}_{ij}^{gH} = \frac{d_{ij}^{gH}}{\sum_{j=1}^{N} d_{ij}^{gH}}$. The normalized matrix $\overline{D}^{gH}$ is the matrix of the volatility connectedness network.

Table 1

Descriptive Statistics of the Variables

Variable	Obs.	Mean	Std. Dev.	Min	Max
USA	31	0.0385	0.0057	0.0308	0.0497
China	31	0.0179	0.0017	0.0159	0.0244
India	31	0.0268	0.0018	0.0242	0.0312
UK	31	0.0248	0.0044	0.0193	0.0386
Russia	31	0.0379	0.0055	0.0273	0.0542
France	31	0.0208	0.0025	0.0183	0.0269
Japan	31	0.0094	0.0003	0.0088	0.0107
Germany	31	0.0131	0.0016	0.0106	0.0186
Australia	31	0.0189	0.0012	0.0163	0.0217
Canada	31	0.0127	0.0021	0.0098	0.0186
Iran	31	0.0244	0.0037	0.0170	0.0331

Source. Research findings

This measure specifies the Total Connectedness Index (TCI), which presents the interconnectedness between all variables. In this paper, the total connectedness of military expenditures of nine countries is calculated as:

$$\mathbf{C_T^H = \frac{1}{N} \sum_{i,j=1,j\neq i}^{N} \bar{d}_{ij}^{gH}} \quad (3)$$

Which measures the average spillover in the system over time.

This approach allows us to obtain more information about the directional connectedness across the variables. The directional connectedness is categorized into to-directional connectedness (Ci→j) and from-directional connectedness (Ci←j). The former computes the directional spillovers, which variable i contributes to all (other) variables j while the latter measures directional spillovers, which variable i receives from all (other) variables j. The directional spillovers which military expenditures of country i transmit to all other military expenditures of countries j is specified as: $\boldsymbol{C_{i\leftarrow j}^{H} = \frac{\sum_{j=1,j\neq i}^{N} \bar{d}_{ij}^{gH}}{\sum_{j=1}^{N} \bar{d}_{ij}^{gH}}}$ (4)

The directional connectedness of military expenditures of country i that receives shocks from all other military expenditures of country j is defined as follows:

$$\boldsymbol{C_{j\leftarrow i}^{H} = \frac{\sum_{j=1,j\neq i}^{N} \bar{d}_{ji}^{gH}}{\sum_{j=1}^{N} \bar{d}_{ji}^{gH}}} \quad (5)$$

Considering that differences between to-directional connectivity and from-directional connectedness are used to calculate net volatility spillovers (Net):

$$Net_{ij} = TO_{ij} - FROM_{ij}$$
$$= \mathrm{C_i^H} = \mathrm{C_{j\leftarrow i}^H} - \mathrm{C_{i\leftarrow j}^H} \quad (6)$$

The positive sign of the net connectedness shows that the military expenditure of country i is a source of shocks to the military expenditure of all other countries j. In contrast, a negative sign of net connectedness indicates that the military expenditure of country i is the recipient of shocks from the military spending of other countries j.

The net pairwise spillover between the military spending of country (i) and the military spending of country j, $\mathrm{Netpairwise_{ij}}$ is defined as:

$$Netpairwise_{ij} = Spillover_{i\rightarrow j} - Spillover_{j\rightarrow I} \quad (7)$$

4. Empirical results

The details of the empirical results regarding the spillovers of military expenditures among countries are presented in Table 2 and illustrated in Figures 2, 3, 4, and 5. Again, the primary diagonal elements contribute on their own, while all off-diagonal elements either "from" or "to" others.

In Table 2, the columns represent the impact of a particular country's military expenditure on all other nations separately, while the rows represent the contributions of each country's military spending to the single country's military expenditure in the system. "Net" is the average net total connectedness of military spending in country i, which determines the net transmitter (contributor) or net receiver (receiver) of the connectedness in the system (To-From). Finally, the total spillover index is the value in the lower right corner of Table 2. This index evaluates the average of the total dynamic connectedness in the system.

Table 2 indicates that the total spillover index is about 83.84 percent. This finding implies that 83.84 percent of the total forecast error variance in the system is due to cross variables, implying that the military expenditures of countries in the system are strongly interrelated. The volatility spillover within military expenditures among eleven countries is

highly interdependent. This finding indicates that, while military spending is an issue for individual countries, it is significantly affected by military spending in other countries. Our findings are consistent with the findings of Dunne et al. (2008), who examined the determinants impacting military spending for a set of developing countries between 1981 and 1997. Their findings suggest that the security web (military spending of neighboring countries and other security-influencing forces) is one of the factors influencing military spending. Furthermore, the finding also aligns with Flores's (2011) research, which utilized spatial autoregressive models to examine the factors influencing military spending for 168 nations and found that a country's military spending is heavily influenced by its alliance partners' military spending. The impact of a neighboring country's military spending, on the other hand, is significantly greater.

In the "To" row, the USA contributes the most to the military expenditure of the other countries in the system (118.6%), followed by Canada (112.08%), the UK (103.06%), India (99.04%), Germany (94.24%), Australia (84.45%), Iran (76.82%), France (72.43%), Japan (65.3%), Rusia (49.64%), and China (46.15%). For the "From spillover" column, China receives 92.91% from the other countries, followed by Iran (88.83%), Russia (87.4%), Japan (86.95%), France (85.97%), India (85.6%), Australia (83.94%), Canada (81.72%), the UK (78.21%), Germany (76.83%) and the USA (73.86%). Thus, the USA is the most significant contributor to military spending in the system, while China received the most spillover in the system. We also found that the USA, Canada, the UK, Germany, and India were the net (total) contributors, and the remaining countries were the net (total) receivers of military expenditure spillover in this system of these countries.

Following the pairwise connectedness results for the USA presented in the first row of Table 2, we discovered that India, Canada, and the UK were the most significant contributors to US military expenditure spillover. At the same time, Russia and France transmitted the least spillover to the United States, implying that India, Canada, and the United Kingdom's military expenditure had a greater impact on the United States' military expenditure in this system. Moreover, the results also indicate that the effects of military spending from Russia and France on US military expenditures were less than those of other countries in the system. Meanwhile, in the first column of Table 2, the finding indicates that in this system, US military spending explains 21.51 percent of Australian military spending, 17.24 percent of Chinese military spending, 13.92 percent of Canadian military spending, 13.63 percent of Iran military spending, 11.22 percent of Russian military spending, 10.46 percent of French military spending, 7.89 percent of Japanese military spending, 7.47 percent of German military spending, and 5.42 percent of Indian military spending.

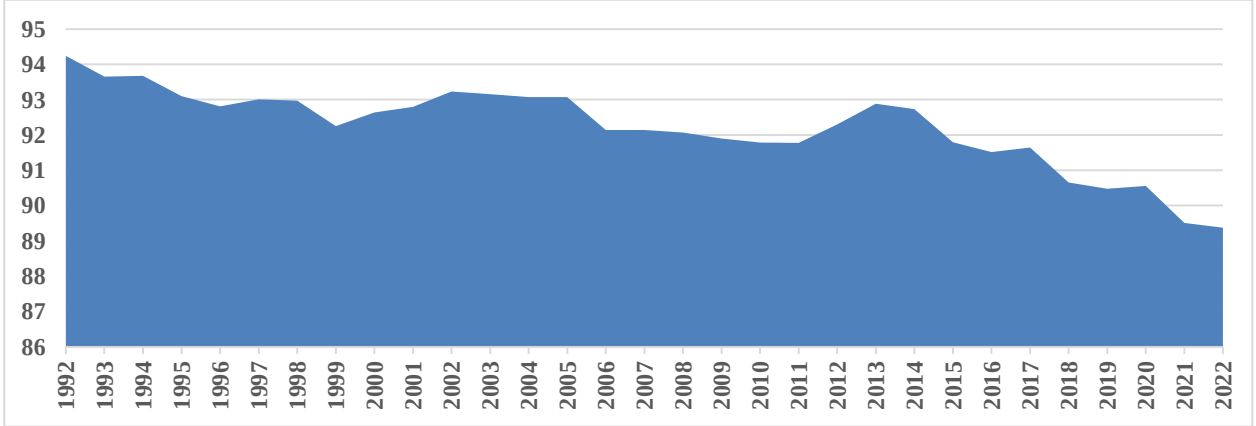
The result presented in Table 2 only considers the average dynamic spillover indices over the whole sample period and ignores the variation in the spillover indices over time in the sample. As a result, we concentrated on the dynamic total connectedness of countries' military expenditures from 1997 to 2022. The dynamic total military expenditure connectedness is plotted in Figure 2. The dynamic complete connectedness index fluctuated over time, ranging from 89.37% to 94.23%, which implies that the degree of information transmission about military expenditure across countries in this system varied with time. This could be attributed to emergency events. The total spillover index between these countries peaked in 1992, following the Gulf War in 1991 between Iraq and a coalition of around 38 countries led by the United States. Because of terrorism, this transmission has been on "Red Alert" since 2014. The rise in terrorist attacks has alarmed many nations and cities around the world, shocking the worldwide community. It is vital to acknowledge that terrorist acts are not only numerous, diverse, and widespread, but they are also professional.

Figure 3 depicts the net pairwise directional connectedness network across the military expenditures of each country. The findings present the direction and strength of the net military spending connectivity from one country to another in the system. The arrows reflect the transmission direction of the net pairwise connection between a pair of countries, while the cells represent the military spending of the system's participating nations. The transmitters of military spending spillover for these nations are represented by the blue cells in this scheme whereas the nations receiving the system's military spending spillover are represented by the yellow cells. The thickness of the edges indicates the degree of the net pairwise connection across countries. Findings from Figure 3 confirm that the net pairwise connection of military expenditures between the USA and China, the USA and Australia, France and China, Australia and Russia, and Germany and Canada are stronger than the net pairwise connection of military spending between other countries. We also note that the direction of the arrows is from the USA to China, the UK, Russia, France, Japan, Australia, Canada, and Iran. These findings suggest that the USA contributed more military expenditure spillover to China, the UK, Russia, France, Japan, Australia, Canada, and Iran than the country received from these countries. On the contrary, the direction of the arrows is from India and Germany to the USA indicating that military expenditure spillover from India and Germany to the US is greater than military expenditure spillover from the US to these countries.

The result presented in Table 2 only considers the "Net" and "Net pairwise" spillover indices of the countries over the whole sample period and ignores the variation in the spillover indices over time in the sample. From Figures 4 and 5, we can see the change in the indexes over the years. Figure 4 depicts the net total connectedness of military spending in country i from 1997 to 2022, which defines the system's net transmitter (contributor) or net receiver (receiver). Notably, during the study period 1997 - 2022, China and Russia were always the receivers, whereas Germany and Canada were always the transmitters. Except for 2011, when the US operated as the receiver, the US operated as a transmitter for the most part. Similarly, except for 2022, the United Kingdom served as a transmitter. On the contrary, during the study period, France, Japan, and Iran primarily performed the role of receivers rather than transmitters. The difference between the fluctuations transmitted from country i's to country j's military spending and those transmitted from country j's military spending to country i's military spending is the net pairwise spillover between country i's and country j's military spending. If there is a positive net pairwise spillover index, the previous nation's military spending is assumed to be the net transmitter; if not, it is assumed to be the net receiver. Figure 5 indicates that the net pairwise spillover effect between the military spending of different countries is time-varying and different.

Figure 2

The Dynamic Total Connectedness from 1992 to 2022



Source. Research findings

Table 2

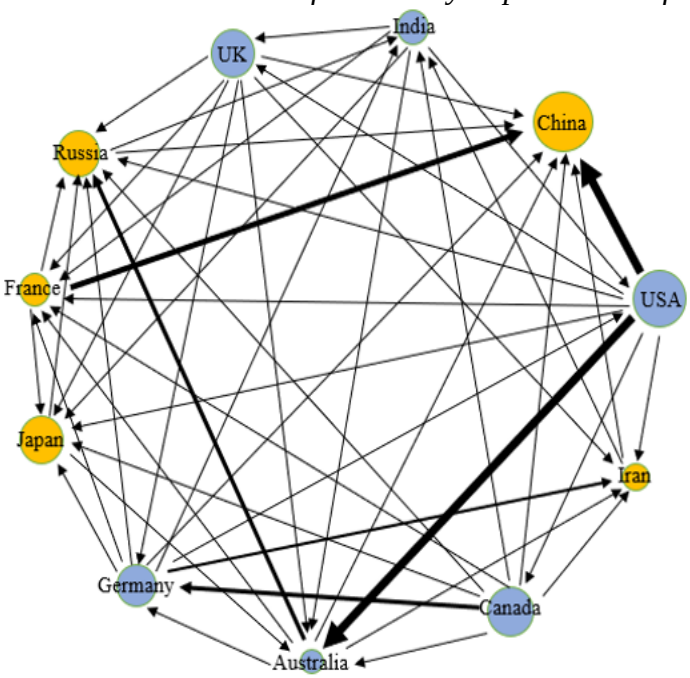
The Dynamic Connectedness of Military Spending Across Countries

	USA	**China**	**India**	**UK**	**Rusia**	**France**	**Japan**	**Germany**	**Australia**	**Canada**	**Iran**	**FROM**
USA	26.14	4.03	13.92	9.24	2.90	3.24	7.02	7.73	8.27	10.1	7.41	73.86
China	17.24	7.09	6.9	8.64	6.55	12.11	5.66	12.3	10.54	6.41	6.55	92.91
India	5.42	6.58	14.4	11.68	8.76	7.99	5.84	12.02	5.74	12.02	9.56	85.60
UK	9.84	3.36	15.44	21.79	1.49	10.29	3.58	11.65	5.29	14.14	3.12	78.21
Rusia	11.22	5.71	6.76	4.98	12.6	8.27	9.16	6.91	12.9	7.62	13.86	87.40
France	10.46	4.69	9.84	17.89	3.74	14.03	4.06	10.09	7.61	12.76	4.82	85.97
Japan	7.89	5.88	12.82	7.34	6.42	5.46	13.05	11.01	9.77	10.65	9.71	86.95
Germany	7.47	2.82	9.85	15.33	3.75	9.34	3.38	23.17	4.24	16.15	4.5	76.83
Australia	21.51	4.46	8.99	7.91	3.3	3.77	10.73	2.35	16.06	11.92	9.02	83.94
Canada	13.92	3.41	7.54	14.34	4.83	7.08	6.51	6.6	9.2	18.28	8.29	81.72
Iran	13.63	5.21	6.97	6.1	7.88	4.88	9.36	13.58	10.88	10.32	11.17	88.83
TO	118.6	46.15	99.04	103.46	49.64	72.43	65.3	94.24	84.45	112.08	76.82	TCI=
NET	44.74	-46.76	13.43	25.25	-37.77	-13.53	-21.64	17.41	0.51	30.36	-12.0	83.84

Source. Research findings

Figure 3

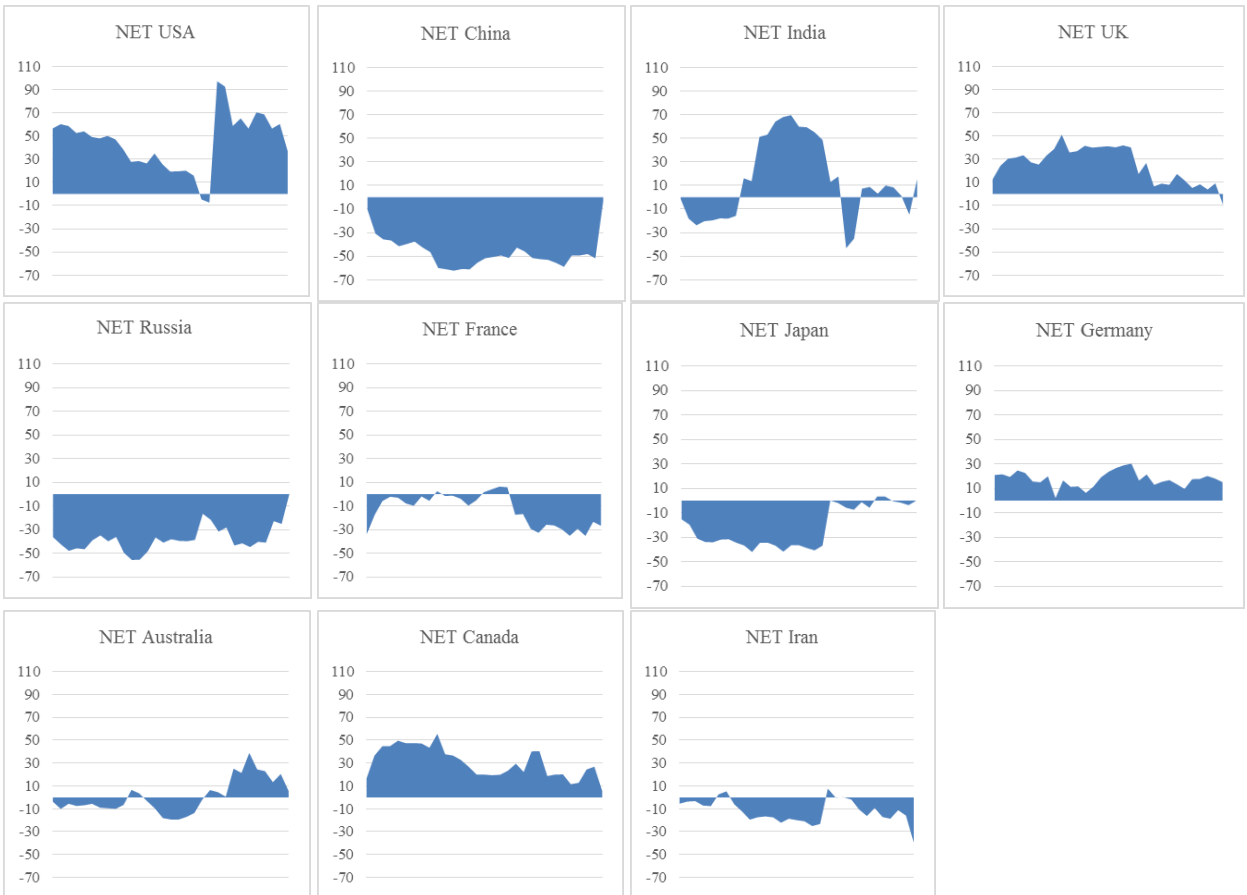
Network Connectedness for Military Expenditures of Nine Countries



Source. Research findings

Figure 4

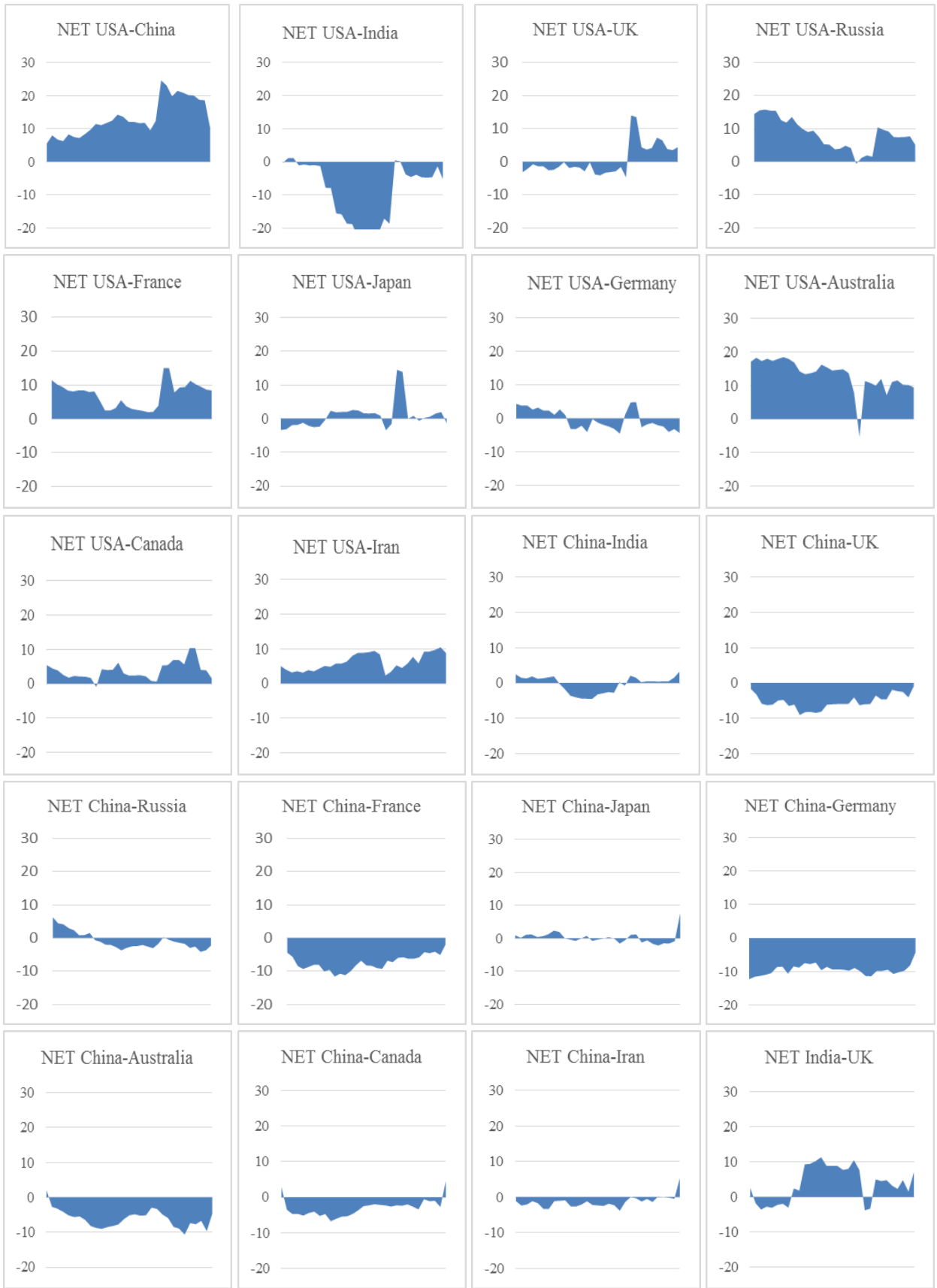
NET Spillovers for Military Expenditures of Eleven Countries

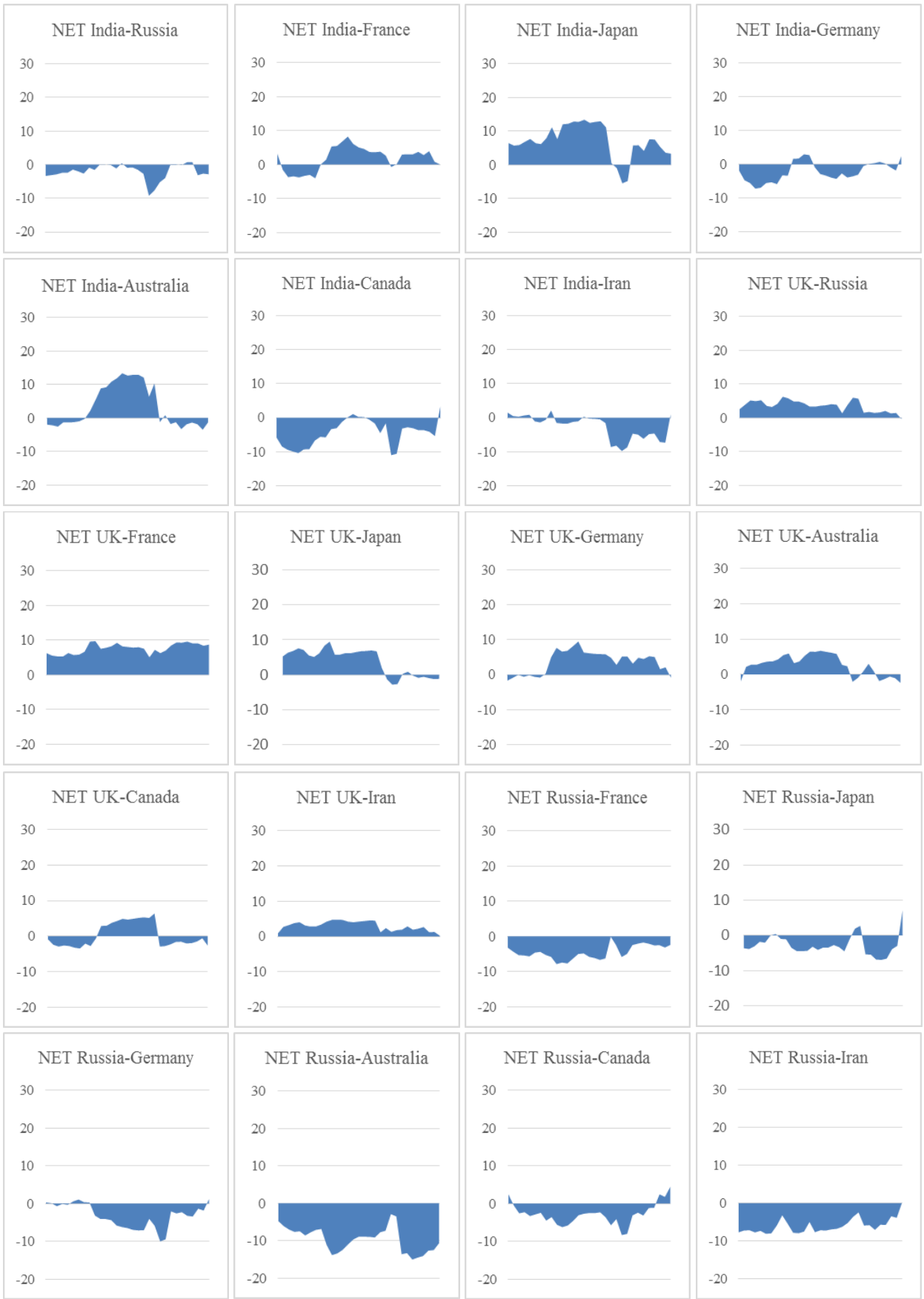


Source. Research findings

Figure 5

Dynamic Net Pairwise Directional Military Expenditures Connectedness

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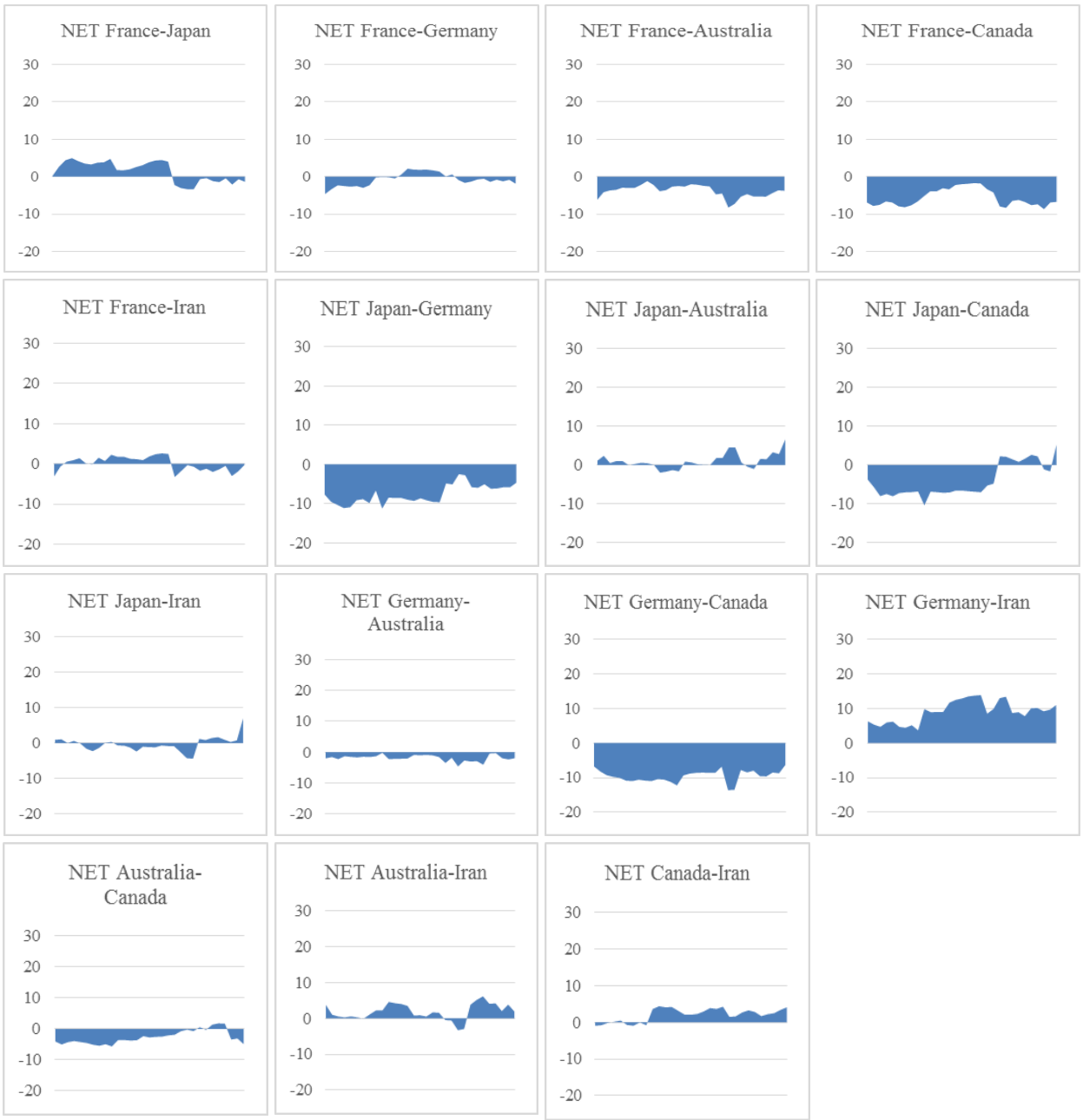

Source. Research findings

5. Conclusions and policy implications

The world's military spending has risen rapidly in recent years and is always a fascinating topic that attracts many researchers. As a result, an increasing body of literature is attempting to describe various factors contributing to the military expenditure of one nation or area. However, no attempt has been made to examine the volatility connectedness of military spending among countries, particularly considering the time-varying nature of volatility of spillover. As such, this paper uses a TVP-VAR-based approach proposed by Antonakakis et al. (2020) to examine the from-connectedness, to-connectedness, net-connectedness and the dynamic total connectedness between the military expenditures of nine countries with the most significant military spending in the past half a century (The United States of America, China, India, The United Kingdom, Russia, France, Japan, Germany, Australia, Canada, and Iran) from 1997 to 2022.

Key empirical findings from this study can be summarized as follows. *First*, the average total dynamic military expenditure connectedness was at a very high level of 83.84 percent Military spending in a country is a complicated issue influenced by various elements. In addition to internal factors such as income, political institutions, national security, etc., a country's military spending is also heavily influenced by external factors, most notably the military spending of other countries. *Second*, the dynamic total connectedness across military expenditure of countries varied with time and ranged from 89.37 percent to 94.23 percent. *Third*, the United States and Canada contributed the most to spillover, while China and Russia received the greatest spillover in the system.

Several policy implications have emerged based on the findings from this study. *First*, our findings inform policymakers about the connectedness of information between countries' military expenditures, particularly those with high military spending or strategic countries. The findings enable policymakers to understand the dynamic transmission and receiving of military spending and then initiate and implement appropriate policy measures that prevent the negative impact of military spillovers on the stability of national security and regional and world security. *Second*, military spending has a spillover effect between nations. As a result, decision-makers should carefully monitor international military spending. International agendas should be held to discuss possibilities of lowering defense spending and allocating funds to social stability and sustainable growth.

Although this study expands on the existing research literature, it does have limitations. The study did not examine the change in spillover effects before and after the 2022 conflict between Russia and Ukraine. As a result, future research might investigate the mechanism to explain the change spillover effects in military spending before and after political events.

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