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World War II to the Cold War: The Rise of the U.S. Military-Industrial Complex and Economic Impact Analysis under Computer Simulation

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ABSTRACT

From World War II to the Cold War (1945-1991), the U.S. military-industrial complex went through a process from its rise to its full expansion, which had a profound impact on the global political and economic landscape. In this paper, computer simulation techniques are used to construct a vector autoregressive model (VAR) to quantitatively analyze the impact of the military-industrial complex on the U.S. economy. Smoothness and cointegration treatment and Granger causality test are done on the collected sample data. After that, the VAR model between three sets of variables, namely, military expenditure as a share of GDP, consumption as a share of GDP, and investment as a share of GDP, is designed. Using impulse response function and variance decomposition to analyze the data, we get that the rise of the U.S. military-industrial complex can effectively promote the growth of the economy in the long term, and the development of the economy can also promote the development of the military-industrial complex, but the promotion effect is not obvious.

Keywords: military industrial complex, vector autoregressive model, impulse response function, variance decomposition

1. Introduction

The term "military-industrial complex" was first used by former U.S. President Dwight D. Eisenhower in his "Farewell Address" delivered in January 1961 [1-2]. Simply put, the "military-industrial complex" is part of the United States special economic interests and the relevant part of the national public power closely integrated and formed an interest group [3]. The former includes the industrial and economic sectors directly related to the military, while the latter includes the military executive branch and some committees and members of Congress [4]. It has also been argued that it also includes the

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relevant "academic and scientific communities". That is, it is specified that it should "include certain members of the armed forces, the civilian defense bureaucracy, the legislature, arms manufacturers and their staffs" [5-6].

The military-industrial complex interests were created and developed rapidly primarily as a result of the Great War [7]. The ensuing Cold War further defined the militarization of the United States economy, and during the more than 40 years of the Cold War, the United States paid $10 trillion in defense expenditures for military supremacy with the Soviet Union, with the military-industrial sector of the economy as the main direct beneficiary [8-9]. After the Cold War, with the changes in the international and domestic environments, a series of transformations took place in the huge military-industrial economic system of the United States [10]. The collapse of the Soviet Union, so that the United States internal "anti-communist unity" of the political environment no longer exists, the cold war-style expansion of the army was forced to give up the road. At the end of the Cold War, the United States has more than 20 large-scale military industrial enterprises, after non-stop mergers and acquisitions, the goal of the merger is to reduce the competition in the military industrial sector internal friction, will be used to focus on the resources to foster a small number of larger enterprises, the formation of a new high level of the military industrial system, to consolidate the United States in the hegemony of the military technology [11-13].

At present, the United States huge military-industrial economic system is further deepening the integration with the civilian economy, forming a trend of increasing compatibility between the military and civilian. Actively carry out the two-way transfer of military and civilian technology, not only accelerate the application of advanced science and technology in the military field, reduce the cost of access to cutting-edge technology, but also shorten the equipment development cycle [14-16]. The military-industrial complex interest group structure is known as "government - industry - academia and research" closely integrated "iron triangle" [17]. Industry wants more profits, politicians want to keep their positions, the military wants more and more advanced weapons, and researchers want more funding. Between these different "goals" there is a chain of interests that binds them together [18-20].

Today, the United States military-industrial complex has an extremely prominent influence in military, economic and political aspects. In order to realize its own interests, the military-industrial complex spares no effort in lobbying all year round to ensure that the United States Government increases military spending, while at the same time encouraging the Government to create geopolitical conflicts and even start wars, so as to stimulate the global demand for weapons and expand the scale of the arms trade [21-22]. Very characteristic of the United States "political and business revolving door", so that some of the people who have served in the military industrial enterprises have the opportunity to return to the government, so that the political and business interests of the collusion is more intricate [23]. The U.S. military, government senior officials out of office, but also often to the military industrial enterprises as executives, corporate advisers and lobbyists, the use of contacts and other resources to influence the government's foreign policy for the benefit of enterprises at the same time to make a fortune [24-25].

The study constructs a vector autoregressive model to explore the intrinsic link between the rise of the U.S. military-industrial complex and economic development. The proportion of military expenditures to GDP, the proportion of consumption to GDP, and the proportion of investment to GDP in the United States from 1945 to 1991 are selected as the analyzing variables. The smoothness test, cointegration test and Granger causality test are used to verify whether there is a correlation between the variables. The impulse response function and variance decomposition are used to explore the dynamic response paths of the variables after the shocks and the contribution of different structural shocks.

2. Econometric analysis of the military-industrial complex on economic growth

2.1. Impact of the military-industrial complex on the economy

The military-industrial complex developed with the Second World War, and a very large military-industrial complex emerged in the United States after the Second World War. In the view of the military-industrial interests, "expansion" and "hegemony" are in the best interests of the United States, and many of its domestic problems, such as employment and ethnic conflicts, need to be solved or alleviated through foreign expansion.

The development of the military-industrial complex is an important source of support for the economies of certain regions. Many local societies and economies remain very dependent on defense spending. In the late 1980s, for example, South Carolina, with a population of about $3 million and a gross state product of about $50 billion, saw the Pentagon spend $5 billion in the state. Defense spending supports South Carolina's eight military bases and related services, raw materials equipment and supplies. Military bases are a relatively stabilizing factor in South Carolina's economy, a recession-proof industry that provides steady employment and high-tech training. Huge platform construction programs (Seawolf submarines, aircraft carriers, and jet fighters) support the entire regional economy from time to time in Clanton, Connecticut; Newport News, Virginia; and St. Louis, Missouri. Similarly, the $30 billion spent annually on nuclear weapons in the U.S. has created constituencies (Hanford, Washington; Los Alamos, New Mexico; Savannah River, Georgia) whose livelihoods depend on the development and storage of nuclear weapons and the regulation of nuclear contamination. Military expenditures for weapons development, research, acquisition and production promote employment and increase government tax revenues. For example, the development of the U.S. Peacekeeper (HX) missile would have provided 130,000 jobs nationwide if the $30-40 billion Carter-era program had been completed. In California alone, it could generate $8.5 billion in tax revenue, $350 million in Washington state and $90 million in Utah. The four cities in northern Virginia, near Washington, had 620 high-tech companies employing 47,000 people in the 1980s, 70 percent of them in defense-related engineering, according to a release from the Fairfax County Economic Development Division.

The military-industrial complex is a major channel for absorbing employment.Since 1983, as many as 6.5 million people have been engaged in military production in the U.S. If we add to this the workers who indirectly serve in military production, those engaged in military production account for about 20-22 percent of the total U.S. national workforce. According to a Los Angeles Times analysis of the U.S. defense establishment, 1/10 of the U.S. population is directly or indirectly dependent on defense spending. The defense industry accounts for 10% of U.S. manufacturing. In some states, including California, defense-related jobs are the top source of personal income. The defense industry employs 25% of the scientists and engineers in the U.S. In the 1980s, the federal government continued to devote the largest share of its finances to defense spending, about 30%. Defense products, such as weapons, account for more than one-third of U.S. exports. The military-industrial complex plays an extremely important role in U.S. political, economic, and social life. Defense industry is an important sector of the U.S. economy, even after the end of the Cold War contraction, the output value of the U.S. defense industry still accounted for 3% -4% of the gross national product, which led to the employment figures can not be underestimated. According to some statistics, the signing of a $100 million military trade contract in the United States will increase the employment opportunities of 15,000 people. It feeds about 25% of the nation's engineers, supports about 20% of the nation's manufacturing and 50% of the nation's university computer science research. The defense industry is a strategic industrial sector from both a security point of view and an economic point of view. It is the importance of this industry that provides the military-industrial complex with a strong political foundation in U.S. national security strategy decisions. The United States has adopted a more flexible policy against Cold War restrictions on arms exports. By waging foreign wars and expanding foreign military sales to stimulate domestic production, mitigate the negative impact of strategic contraction on the military-industrial complex, increase employment opportunities, and reduce trade deficits. 1990, as a result of the Gulf War, U.S. military sales increased by $41 billion compared to 1989, which could have created jobs for 615,000 people. Prompted by the war in Kosovo, the U.S. unemployment rate fell to 4.2 percent in the first quarter of 1999, the lowest point in the U.S. in 30 years.

2.2. *Modeling*

2.2.1. Vector autoregressive model. Vector Autoregressive (VAR) models are unstructured models, i.e., the relationships between variables are not based on economic theory. It is usually used for forecasting of correlated time series systems and the dynamic effects of stochastic disturbances on systems of variables [26]. VAR regresses the lagged values of all endogenous variables in the model with current endogenous variables in each equation of the model, thus estimating the dynamic relationship between all endogenous variables, the estimation process is without any prior constraints, and its general form is:

Take the example of a VAR model with two variables y_{1t}, y_{2t} lagged by 1 period:

$$\begin{cases} y_{1,t} = c_1 + \pi_{11.1} y_{1,t-1} + \pi_{12.1} y_{2.t-1} + u_{1t} \\ y_{2,t} = c_2 + \pi_{21.1} y_{1,t-1} + \pi_{22.1} y_{2.t-1} + u_{2t} \end{cases} \tag{1}$$

Among them:

$$u_{1t}, u_{2t}^{-} \parallel D(0, \sigma^2), Cov(u_{1t}, u_{2t}) = 0 \tag{2}$$

2.2.2. Grange non-causality test. Granger non-causality: if the conditional distribution of y_t determined by the lagged values of y_t and x_t is the same as the conditional distribution determined by the lagged value of y_t only, i.e.:

$$f(y_t \mid y_{t-1}, \cdots, x_{t-1}, \cdots) = f(y_t \mid y_{t-1}, \cdots) \tag{3}$$

An alternative formulation of Granger non-causality is that, other things being equal, x_{t-1} is said to be Granger non-causally related to y_t if there is no significant improvement in the predictive accuracy of y_t with the addition of x_t lagged variable.

2.2.3. Impulse Response Function. The impulse response function (IRF) measures a one-standard deviation shock (called an "impulse") to a randomly perturbed term from an endogenous variable. The main idea is to analyze the effect of a one-standard deviation shock to an endogenous variable from a residual term in an information sharing model [27].

Impulse Response Function: For any VAR model can be expressed as a vector $MA(\infty)$ process of infinite order:

$$Y_{t+s} = U_{t+s} + \Psi_1 U_{t+s-1} + \Psi_2 U_{t+s-2} + \cdots + \Psi_s U_t + \cdots \Psi_s = \frac{\partial Y_{t+s}}{\partial U_t} \tag{4}$$

The elements of row i and column j in Ψ_s represent the effect on the i th endogenous variable y_t in period $t+s$ when the error term u_t corresponding to the j th variable y_t is hit by a one-unit shock in period t, conditional on holding the other error terms constant in any period.

2.2.4. Variance decomposition. Variance decomposition provides another way to study the dynamic characteristics of the system, which can provide the same information as impulse response functions, but unlike impulse response functions, variance decomposition decomposes the change in one endogenous variable into all the endogenous variable shocks in the VAR model, which shows the relative importance of the stochastic errors in each variable in the VAR model [28], variance decomposition:

$$\begin{aligned} MSE(\hat{Y}_{t+st}) &= E[(Y_{t+s}-\hat{Y}_{t+st})(Y_{t+s}-\hat{Y}_{t+st})] \\ &= \Omega + \Psi_1\Omega\Psi_1' + \Psi_2\Omega\Psi_2' + \cdots + \Psi_{s-1}\Omega\Psi_{s-1}' \end{aligned} \tag{5}$$

Among them:

$$\Omega = E(u_t u_t') \tag{6}$$

3. Empirical analysis

3.1. Data sources and indicator selection

The object of this paper is to study the relationship between military expenditures and economic growth during the rise of the U.S. military-industrial complex and the effects between them. Since the VAR model is a predictive model, it needs as much antecedent data as possible, so as to make the data measurement results more scientific. Therefore, this paper selects the SIPRI military expenditure database for the period of 1945-1991 as the statistical data, and explores the dynamic interaction between military expenditure and economic growth with the help of the econometric tool software Eviews17.0. Here, the proportion of military expenditures to GDP (MY), the proportion of consumption to GDP (CY), and the proportion of investment to GDP (IY) of the United States from 1945 to 1991 are selected as the analyzing variables.

3.2. Sample Data Smoothness Test

The indicators reflecting military expenditures and economic growth are all time series data, which will change over time. In order to avoid the phenomenon of “pseudo-regression”, it is necessary to carry out a smoothness test on the relevant variables before constructing the VAR model, to verify whether all the data meet the requirements of the model construction of the same order of single integer. At the same time, in order to eliminate the existence of heteroskedasticity, the data can be logarithmically processed. On this basis, the ADF unit root test is used to test the smoothness of all data. The results of the smoothness test are shown in Table 1. The first term of C in the test form indicates the constant term in the test smoothness equation. The second term denotes the time trend term and intercept term of T. The third term denotes the degree of autoregressive lag. By doing the ADF test on the first-order difference series of military expenditure as a share of GDP (MY), consumption as a share of GDP (CY), and investment as a share of GDP (IY), the original hypothesis of the existence of a unit root is rejected at the 5% level for all three variables, and all of them are smooth series. It can be further analyzed whether there is a long-term equilibrium relationship between the variables.

Table 1. The ADF unit root test of each variable

Sequence	Test form	ADF value	1% threshold	5% threshold	p	Test result
LNMY	(C,T,0)	-2.3651	-4.5698	-3.5664	0.0012	Smoothness
LNCY	(C,T,0)	-0.5863	-4.6541	-3.6541	0.0000	Smoothness
LNIY	(C,T,0)	-4.5662	-4.5931	-3.7489	0.0023	Smoothness

3.3. Cointegration tests

After confirming that all the time series variables are first-order monotonic, it is necessary to further test whether there is a cointegration relationship between the variables to determine whether there is a long-run equilibrium relationship. First of all, we need to use the information criteria such as LR (maximum likelihood ratio criterion), FPE (final forecast error criterion), AIC (Akaike criterion), SC (Schwartz criterion) and HQ (Hannan-Quinn criterion) to comprehensively determine the optimal lag order, and then make a judgment in accordance with the principle of “majority rule”. Since this paper studies the interaction between military expenditures and economic growth, it is necessary to model the dynamics between MY, CY, and IY separately. These three VAR models are hereafter referred to as VAR-IY, VAR-MY and VAR-CY. The optimal lags of the three models were tested separately, and the number of lags for the models was chosen as shown in Table 2. * denotes the number of lags selected according to the corresponding criterion at the 5% level. The optimal lags for models VAR-IY, VAR-MY, and VAR-CY are 1, 2, and 3, respectively.

Table 2. The late delay selection of the model

Model	Lag	LogL	LR	FPE	AIC	SC	HQ
VAR-IY	0	-23.345	NA	0.06354	2.6256	2.5426	2.0541
	1	106.361	225.715*	4.56e-06*	-6.6341*	-6.3359*	-6.4185*
	2	102.365	1.2536	5.63e-06	-6.4122	-5.6354	-6.5419
	3	109.631	8.6247	5.09e-06	-6.5223	-5.6541	-6.4245
VAR-MY	0	-37.4161	NA	0.0536	2.7631	2.8562	2.9812
	1	63.4155	163.5667	4.87e-05	-4.6321	-3.6451	-4.1785
	2	83.6522	23.6542*	2.36e-05*	-5.3698*	-5.3369*	-4.5952*
	3	83.6954	3.6524	2.06e-05	-4.6398	-4.2351	-4.1951
VAR-CY	0	-56.3541	NA	0.2365	4.1635	4.3652	4.1589
	1	52.3144	185.522	0.0035	-3.5841	-3.5412	-3.7112
	2	52.9541	12.4225	0.0005	-2.3651	-2.4185	-2.7892
	3	61.4891	10.5526*	0.001*	-3.1748*	-2.5841*	-2.4182*

According to the theory of cointegration, if the series are single-integrated of the same order and there is a cointegration relationship, then there is a long-run equilibrium relationship between the series. Testing whether there is a long-term equilibrium relationship between the series can effectively circumvent the pseudo-regression problem of the VAR model. Therefore, on the basis of determining the optimal lag order of the VAR model, the Johansen test is further used to determine the cointegration relationship between variables, and the results of the cointegration test are shown in Table 3. * denotes the rejection of the original hypothesis at the 5% level. According to the results of the cointegration test, both the results of the performance statistic test and the results of the maximum eigenvalue test, the three groups of variables, VAR-IY, VAR-MY, and VAR-CY, rejected the original hypothesis of the nonexistence of cointegrating vectors at the 5% level and accepted the original hypothesis of the existence of at most one cointegrating vector at the 5% level, which indicates that there is a cointegrating relationship between the economic growth and the military expenditures as a share of GDP, consumption as a share of GDP and investment share of GDP, there is a cointegration relationship between these three sets of variables, and there is a long-run equilibrium relationship between these three sets of variables, which can be further constructed as a VAR model for these three sets of variables.

Table 3. The Johansen cointegral test results

VAR-IY Model			
Original hypothesis	Eigenvalue	Trace statistics (p)	Maximum eigenvalue test (p)
Zero cointegral vector	0.534244	19.2452(0.0365)*	18.6542(0.0354)*
At least one cointegral vector	0.036594	1.26354(0.2364)	3.241526(0.8612)
VAR-MY Model			
Zero cointegral vector	0.632416	40.14593(0.0003)*	27.71256(0.0023)*
At least one cointegral vector	0.365412	11.14233(0.0639)	12.48533(0.03654)
VAR-CY Model			
Zero cointegral vector	0.611526	36.17526(0.0001)*	26.95127(0.0004)*
At least one cointegral vector	0.236155	8.756254(0.0237)	8.365414(0.05964)

3.4. Granger non-causality test

Before building the VAR model, it is also necessary to utilize the Granger causality test to determine whether there is a causal relationship between the time series variables. When there is a causal relationship between the variables, only then can the VAR model be used to analyze and predict the relationship between the variables; otherwise, the VAR model will be meaningless. The results of the Granger test for the causal relationship between military expenditure and economic growth are shown in Table 4. The Granger causality test for each of the six hypotheses yielded a p-value less than the set significance level of 0.01, so all of them can be used to reject the original hypotheses at the 1% confidence level. This paper finds that: the share of military expenditures in GDP is Granger-caused by the share of consumption in GDP and the share of investment in GDP, respectively, indicating that the share of military expenditures in GDP, the share of consumption in GDP, and the share of investment in GDP affect each other.

Table 4. Granger non-causal testing

Original hypothesis	Hysteresis	F statistics	P value	Conclusion
LNIY is not a granger reason for LNMY	1	23.6514	0.0005***	Reject
LNMY is not a granger reason for LNIY	1	1.34526	0.0046***	Reject
LNMY is not a granger reason for LNCY	2	2.54128	0.0023***	Reject
LNCY is not a granger reason for LNMY	2	3.65231	0.0006***	Reject
LNCY is not a granger reason for LNIY	3	12.52364	0.0051***	Reject
LNIY is not a granger reason for LNCY	3	7.26654	0.0036***	Reject

Based on the analysis of the above findings, it can be seen that there is a causal relationship between military expenditures and the dimensions of economic growth, so it is meaningful to use the VAR model to study the relationship between the three sets of variables VAR-IY, VAR-MY and VAR-CY.

3.5. Construction of VAR model and smoothness test

According to the VAR modeling method described in the previous section, we will introduce a VAR model with DMY, DCY, and DIY as endogenous variables and a lag length of 3. From the VAR model generating equation we can get the functional relationship about DMY, DCY and DIY:

$$\begin{bmatrix} DMY \\ DVY \\ DIY \end{bmatrix} = \begin{bmatrix} 11.06 \\ 6.56 \\ -19.91 \end{bmatrix} + \begin{bmatrix} 2.15 & 0.23 & -0.23 \\ -0.18 & 1.65 & 0.04 \\ 3.53 & 1.42 & 0.56 \end{bmatrix} \begin{bmatrix} DMY \\ DVY \\ DIY \end{bmatrix}_{t\text{-}1} + \begin{bmatrix} -1.75 & -0.22 & 0.06 \\ 0.63 & -0.82 & -0.05 \\ -2.32 & -1.78 & -0.62 \end{bmatrix} \begin{bmatrix} DMY \\ DVY \\ DIY \end{bmatrix}_{i-2} + \begin{bmatrix} 0.75 & -0.50 & 0.01 \\ -0.46 & 0.85 & 0.01 \\ 2.21 & 5.35 & -0.78 \end{bmatrix} \begin{bmatrix} DMY \\ DVY \\ DIY \end{bmatrix}_{1-3} + \begin{bmatrix} \hat{\varepsilon}_0 \\ \hat{\varepsilon}_1 \\ \hat{\varepsilon}_2 \end{bmatrix} \tag{7}$$

Combined with the analysis of related information, it can be seen that the VAR model is usually used for smooth series containing multiple variables. Therefore, in the process of research, we can test the unit root of each series and observe whether the corresponding series is smooth, if it is smooth, then the system is smooth and the model meets our needs. Join in the series contains high order autocorrelation, then the process of testing will not be able to carry out one by one test of the order of each variable, so it is not easy to draw conclusions. In this research, in order to avoid the above computational complexity and improve the results of the calculation, the coefficients of the characteristic polynomials of the constructed VAR model are firstly estimated to get the corresponding characteristic polynomial roots, and then the derivatives are taken, and then the VAR model is finally tested. In the process of testing, if the inverse of all root modes obtained is less than 1, then the model is stable. If the model is not stable, then the corresponding results obtained are invalid and have corresponding standard errors. This means that impulse response function analysis and variance decomposition analysis cannot be performed. The VAR model smoothness test is shown in Figure 1. If all the roots of the characteristic polynomial are within the unit circle, then the VAR model is smooth and can be used to perform impulse response function analysis and variance decomposition analysis.

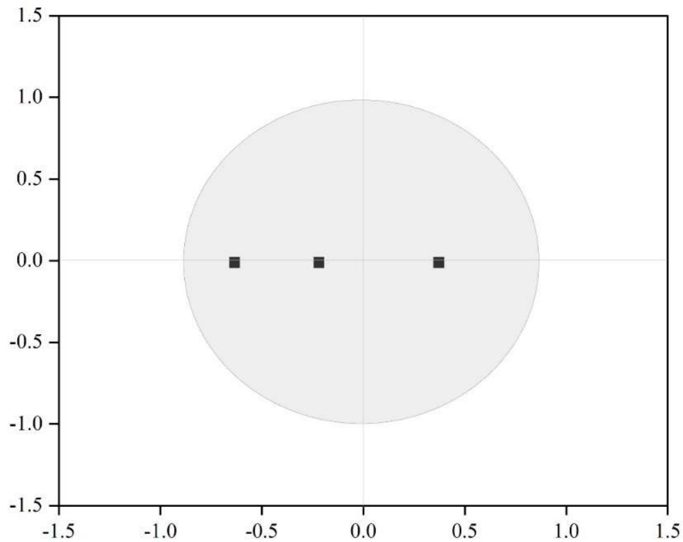

Fig. 1. VAR model stability test

3.6. Impulse Response Function

1) Impulse response function analysis of economic growth due to changes in military spending. Based on the vector autoregressive model, the impulse function of economic growth caused by changes in military spending is analyzed to determine the impact of the rise of the U.S. military-industrial complex on the economy. In this paper, the lag period is set to 10 periods, the solid line represents the calculated value of the impulse response function, and the dashed line is the confidence band of the impulse response function. The impulse response function for economic growth due to changes in military spending is shown in Figure 2. After giving a positive shock of one standard deviation to military expenditures in the current period, there is no change in GDP in the first half of period 1, and then it grows steadily from 0.87% in period 1 to 1.37% in period 4, and it has been stable at about 1.37% from period 4 onwards, indicating that when the total military expenditures are shocked by an external factor of some kind, the economy grows with a lag of about half a year, and then there will be a smooth directional shock, and will have a long-lasting promotion and sustained effect on the rapid development of the economy. From the above results, it can be seen that the rise of the U.S. military-industrial complex has a very strong impact on economic development and this result is consistent with the facts.

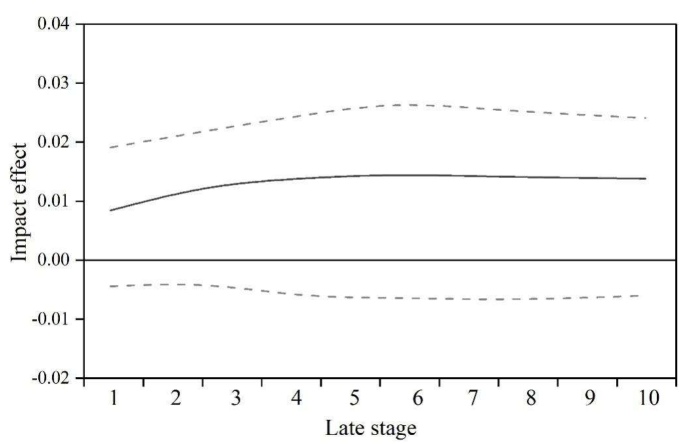

Fig. 2. Pulse response function

2) Impulse response function analysis of military expenditures due to changes in economic growth. Based on the vector autoregressive model, the impulse function of military expenditures due to changes in economic growth is analyzed to determine the impact of economic growth on the rise and development of the U.S. military-industrial complex. The impulse response function of military expenditures due to changes in economic growth is shown in Figure 3. After giving a positive shock of one standard deviation to economic growth in the current period, the effect on military spending is lagged by one period, and in the second period, the effect of this shock is not in line with what we expected, but brings a negative effect, and then the effect of the shock gradually rises, from -1.7% in the second period to 2.6% in the seventh period, and has been stable at about 2.6% from the seventh period onwards. This indicates that when economic growth is hit by some external factor, it does not immediately lead to an increase in military spending in the current period, and even causes a reverse increase in military spending in the second period. It is only after the third period that a positive impact on military spending is brought about. Thus, military spending and economic growth are mutually reinforcing, and work together in a coordinated manner.

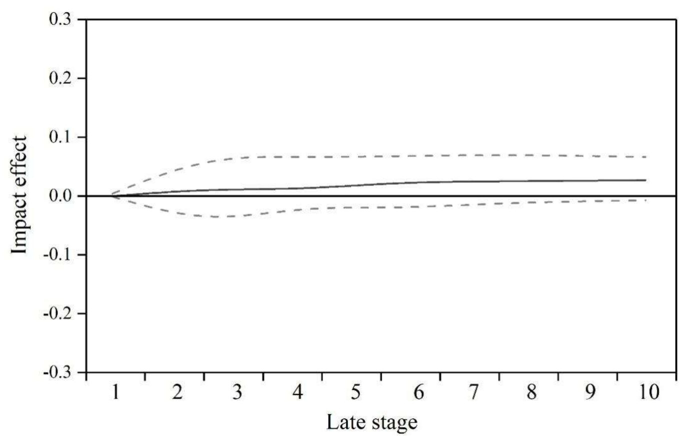

Fig. 3. Pulse response function

3.7. *Analysis of variance*

The impulse response function describes the impact of a shock to one endogenous variable on other endogenous variables in the VAR model. The variance decomposition, on the other hand, further evaluates the importance of different structural shocks by analyzing the contribution of each structural shock to the change in the endogenous variable. Thus, the variance decomposition gives information about the relative importance of each random perturbation that has an impact on the variables in the VAR model. In this section, three variables are analyzed by ANOVA.

The results of the ANOVA decomposition for LNMY are shown in Table 5. In the first period the fluctuation of the military expenditure share of GDP is only affected by its own fluctuation, and the shocks of the consumption share of GDP and the investment share of GDP on the military expenditure share of GDP are only manifested in the second period, and this effect is not significant, only 0.3773% and 15.64%, respectively. And from the second period onwards, the results of the variance decomposition are basically stable, and the contribution of the military expenditure share of GDP to itself reaches 83.98%. This indicates that the rise of the military-industrial complex is mainly influenced by itself, and the growth of the economy does not have a significant effect on the rise of the military-industrial complex.

Table 5. The variance decomposition of LNMY

Period	S.E.	LNMY	LNCY	LNIY
1	0.20742	100	0	0
2	0.2737	83.97692	0.37727	15.63714
3	0.29261	85.29988	0.59034	14.08317
4	0.29607	84.31432	0.77672	14.90627
5	0.30731	84.09068	1.32345	14.57095
6	0.30638	83.57356	1.87548	14.54217
7	0.31478	83.08162	2.56558	14.34776
8	0.32001	82.53919	3.27055	14.22494
9	0.31756	81.98644	3.91758	14.05888
10	0.30624	81.45677	4.62922	13.92937

The results of the variance decomposition of LNCY are shown in Table 6. The fluctuation of the consumption share of GDP in the first period is affected by itself and the fluctuation of the military expenditure share of GDP, and the contribution of the military expenditure share of GDP to the consumption share of GDP grows gradually after the first period and reaches a maximum of 33.39%. This indicates that the rise of the military-industrial complex has a significant and sustained effect on economic growth. The contribution of consumption share of GDP to its own gradually decayed after the first period until 63.77%. The contribution of the investment share of GDP to the consumption share of GDP has been modest, remaining roughly around 2%.

Table 6. The variance decomposition of LNCY

Period	S.E.	LNMY	LNCY	LNIY
1	0.03074	12.65424	87.35397	0
2	0.02523	17.20777	81.95689	0.81126
3	0.05957	21.21646	77.67424	1.13178
4	0.0506	24.32491	74.11697	1.55887
5	0.06694	26.80529	71.31732	1.87143
6	0.07698	28.76167	69.07168	2.16651
7	0.04159	30.33049	67.31455	2.36935
8	0.06395	31.57135	65.88429	2.56321
9	0.08569	32.57762	64.72559	2.68951
10	0.05991	33.39432	63.77352	2.83383

The results of the variance decomposition of LNIY are shown in Table 7. The fluctuation of the share of investment in GDP in the first period is simultaneously affected by the fluctuation of three variables, which receives the greatest influence from the share of military expenditure in GDP. The influence of the share of military expenditures in GDP on the share of investment in GDP dominates from the first period because the contribution of the share of military expenditures in GDP to the share of investment in GDP reaches 99.97% from the first period. Subsequently, it has been maintained at around 82%, although it has slightly decreased. This shows that the rise of the military-industrial complex has a significant and sustained effect on the share of investment in GDP.

Table 7. The variance decomposition of LNIY

Period	S.E.	LNMY	LNCY	LNIY
1	0.20283	99.97246	0.00177	0.02658
2	0.24667	83.60199	0.40889	15.99888
3	0.28193	84.99759	0.62304	14.34479
4	0.29741	84.01493	0.78512	15.19479
5	0.31544	83.83787	1.33319	14.83244
6	0.31617	83.31023	1.88387	14.80963
7	0.30993	82.82537	2.57587	14.59194
8	0.32495	82.27932	3.24459	14.45265
9	0.32085	81.74736	3.95302	14.30507
10	0.30022	81.21102	4.62218	14.1498

In summary, the rise of the military-industrial complex can contribute effectively to economic growth in the long term and in a significant way. Economic growth can also contribute to the development of the military-industrial complex, but the effect of this contribution is smaller than that of the former.

4. Conclusion

The study utilizes the analytical framework of the VAR model and employs Granger causality tests, impulse response functions, and variance decomposition to derive the dynamic relationship between the rise of the U.S. military-industrial complex and economic development:

1) When total military spending is hit by some external factor, there will be a lag of about half a year in economic growth, followed by a smooth directional shock to the economy and a long-lasting promotion and sustained effect to promote rapid economic development. It shows that the rise of military-industrial complex can promote economic development.

2) The contribution of military expenditure as a share of GDP to itself is 83.98%. It shows that the rise of the military-industrial complex is mainly influenced by itself, and the growth of the economy does not have a significant impact on the rise of the military-industrial complex.

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