Military expenditure and economic growth: the case of India

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Abstract

Purpose – The relationship between military expenditure and economic growth is complex. The purpose of this paper is to examine this relationship in India.

Design/methodology/approach – The design of this study is descriptive in the theoretical part, and quantitative in the applied one. The study uses time series approach, and Hendry General-to-Specific (GTS) modeling methodology, to examine and analyze the relationship between military expenditure and economic growth in India, during the period 1980-2016.

Findings – The study shows the following: Absence of causal relationship between military expenditure and economic growth in India, during indicated period. The continuous regional tensions facing India represent the main factor for adopting Indian military strategy and emphasizing military capabilities. India has been able to build and develop links between civilian and military sectors. The Indian military scientific and manufacturing policies have achieved self-sufficiency in some of its military needs, a strong military industrial base and high levels of military exports. India participated with developed countries in military strategic industries. Such participation contributed to the integration of civilian and military sectors. India gave rights to private sector and foreign direct investment (FDI) for manufacturing in military industries, giving full marketing rights to the Indian government. These new policies considered a great move toward deep changes for Indian military manufacturing policy.

Social implications – The findings shed light on the importance of stimulating links between civilian and military sectors, particularly in the industrial sectors and scientific activities.

Originality/value – This study has a contribution to literature of military expenditures' economic effects. Theoretically, this study tries to fill the research gap regarding the impact of military expenditure in Indian case. Furthermore, to the best of the authors' knowledge, this is the first study that examines the relationship between military expenditure and economic growth in India using Hendry general-to-specific (GTS) modeling methodology and time series approach.

Keywords India, Economic growth, Time series analysis, Military expenditure, Military Keynesianism

Paper type Research paper

1. Introduction

The relationship between military expenditure and economic growth is debatable, whether in the nature of these expenditures and methods of financing it, or in the effect of military expenditure on economic growth[1]. The objective of this study is to examine this relationship in India.

Although India is one of the most important developing countries that has high levels of military expenditure, and sizable military industry base[2] (Section 3), the literature which assess the relationship between economic growth and military expenditure in India is rather scarce. This literature also differed in the analysis methods, and in dealing with Indian case as part of a group of countries, or particularly examined, as we will discuss later (Section 2).

On the practical side, most of preceding researches about the relationship between the two variables-military expenditure and economic growth – disregarded the importance of interrelations between the civilian and military sectors. On the applied side, the preceding researches have shown a debate in determining the causality relationship between military expenditure and economic growth. These studies differed in the methodology and quantitative methods used. Most of preceding studies used cross-sectional analysis, using a sample consisting of a large number of countries, which assumes generalizing the results to all countries in the used sample, despite the differences between these countries in structure of economy and military expenditure attitudes. Moreover, some studies disregarded the stationarity test for the variables, and neglected the possibility of long-term relationship, which may lead to biased estimates and spurious regression (Granger and Newbold, 1974).

In the present paper, we will fill the research gap regarding the impact of military expenditure on economic growth in Indian case. To achieve this objective, we will analyze the relationship between military expenditure and economic growth, using time series approach, and Hendry general-to-specific (GTS) modeling methodology. To the best of our knowledge, this kind of analysis has not been carried out before for Indian case. In line with preceding research results (Tahir, 1995; Yildirim and Ocal, 2006), we hypothesize that there is bi-directional causality between military expenditure and economic growth.

According to this background, we will test the causality between military expenditure and economic growth in India, during the period 1980-2016. The study consists of five sections, in addition to introduction (Section 1), Section 2 is devoted to a brief literature review. Section 3 discusses Indian economy: main features, modeling and data and results. Section 4 concluding remarks.

2. Literature review

The relationship between military expenditure and economic growth is a debatable. More than 40 years ago, Benoit pioneered analysis of this relationship in developing countries. He concluded that increasing military expenditure led to increasing economic growth rates (Benoit, 1972, 1973, 1978). He also assumed that developing countries reduced development expenditure for military programs, and the reduction of military expenditure did not lead to increasing economic growth[3]. Benoit also identified the direction of causality from military expenditure to economic growth (Benoit, 1978).

In general, we can classify the literature in this field to four groups as follow: *Military expenditure boosts economic growth*, (Kaldor, 1976; Ando, 2009; Halicioglu, 2003, 2004; Yildirim *et al.*, 2005; Atesoglu, 2009). *Military expenditure hinders economic growth*, (Smith,1977; Rothschild,1977; Smith, 1980a; Smith, 1980b; Lim, 1983; Deger and Smith, 1983; Deger and Sen,1983;; Deger and Smith, 1985; Deger,1986; Roux,1996; Knight *et al.*, 1996; Antonakis, 1997; Heo,1998; Dunne *et al.*, 1999; Batchelor *et al.*, 2000; Dunne and Skons, 2011;

Shahbaz *et al.*, 2011). *The causality runs from economic growth to military expenditure* (Joerding, 1986; Kollias *et al.*, 2004; Ali and Abdellatif, 2013; Ma *et al.*, 2015). There was *no causality between the two variables* (Biswas and Ram, 1986; Chowdhury, 1991; Kusi, 1994; Dakurah *et al.*, 2001; Pradhan, 2010)[4].

In the Indian case, research in relationship between military expenditure and economic growth had only three cases: Military expenditure boosts economic growth; Economic growth enhances military expenditure; No causality relationship between the two variables. These three cases illustrated as follows:

In the first case; Military expenditure boosts economic growth, some studies that investigated relationship between the two variables dealt with Indian case as part of a group of countries, using panel data analysis. While few studies specifically examined Indian case.

Dealing with Indian case as part of a group of countries, Ismail (2017) applied on South Asia region (SAR) countries including India, using panel fixed effect model and panel data for five South Asian Countries; Sri Lanka, Pakistan, Nepal, India, Bangladesh, during 1988-2013. The results revealed for the group as whole a positive relationship from military expenditure to economic growth[5].

In the same genre, Yildirim and Ocal (2006) investigated arms race between India and Pakistan and its effect on economic growth, during period 1949-2000. In the case of India, the results revealed a bi-directional causality between military expenditure and economic growth. But in the case of Pakistan, causality was from economic growth to military expenditure, and no evidence of causality from military expenditure to economic growth[6].

Dealing specifically with Indian case, Tiwari and Shahbaz (2011) analyzed the relationship between military expenditure and economic growth in India during period 1971-2010, using cointegration method. The result revealed a positive relationship between the two variables[7]. This result is in line with Tiwari and Tiwari (2010), who applied VECM analysis, and found bi-directional causality between gross domestic product (GDP) and military expenditure[8]. Ward *et al.* (1991) study on Indian economy during 1950-1990, concluded that the effects of military expenditure on economic growth appear to be positive.

In the second case; Economic growth enhances military expenditure, Ma *et al.* (2015) examined the relationship between economic growth and military expenditures in five countries: United States, Russia, Japan, India and China, during period 1988-2013. The main result was that economic growth tended to increase military expenditure, as well as military capabilities.

In the third case; No causality relationship between the two variables, Pradhan (2010) investigated relationship between military expenditure and economic growth in China, India, Nepal and Pakistan, using cointegration analysis, during period 1988-2007. The long run relationship between military expenditure, economic growth and public debt were identified in a cointegration framework. The most important result was absence of the causality from military expenditure to economic growth in India. Behera (2002) examined affordability of India's military expenditure, during period 1997-2007, to see if military expenditure hinders or boosts economic growth. The results revealed that although the growth of military expenditure did not boost economic growth, it also did not hinder it.

As we mentioned before, most of preceding researches about Indian case disregarded the interrelations between the civilian and military sectors. Moreover, most of previous studies used cross-sectional analysis, using a sample consisting of a large number of countries, including India, and also disregarded stationarity test of the variables, and neglected the possibility of long-term relationship, which may lead to biased estimates and spurious regression.

3. The Indian economy: main features; modeling and data; and results

The relevant variables for analyzing development of Indian economy are, gross domestic product (GDP), military expenditure as a percentage of GDP "Military expenditure burden" (M), the ratio of government consumption expenditure excluding military expenditure to GDP (GE), the degree of trade openness expressed as the ratio of exports to GDP (X), and aid received expressed as receipts of aid as percentage of GDP (AID). These variables will be used in formulation quantitative model in this study.

For examining causality relationship between military expenditure and economic growth in India, using time series approach, we will examine stationarity of time series of these variables, using the augmented Dicky–Fuller Test (ADF). Then we will run cointegration test, to determine whether the time series of these variables are cointegrated. Finally, we will run Granger Causality Test to examine the possibility of causality relationship between military expenditure and economic growth. If so, we will determine the direction of relationship; unidirectional or bidirectional relationship.

In this section we discuss the following: features of Indian economy, with emphasis on military expenditure; the model and data; and results.

3.1 Features of Indian economy

The following figure shows trend of the variables previously discussed, at constant prices, during period 1980-2016.

All such data were calculated by the authors using raw data, relied on Stockholm International Peace Research Institute (SIPRI); US Arms Control and Disarmament Agency (ACDA) for annual military expenditure data; and World Bank Development Indicators for the annual data of other variables. All data are expressed in natural logarithm and calculated by the authors.
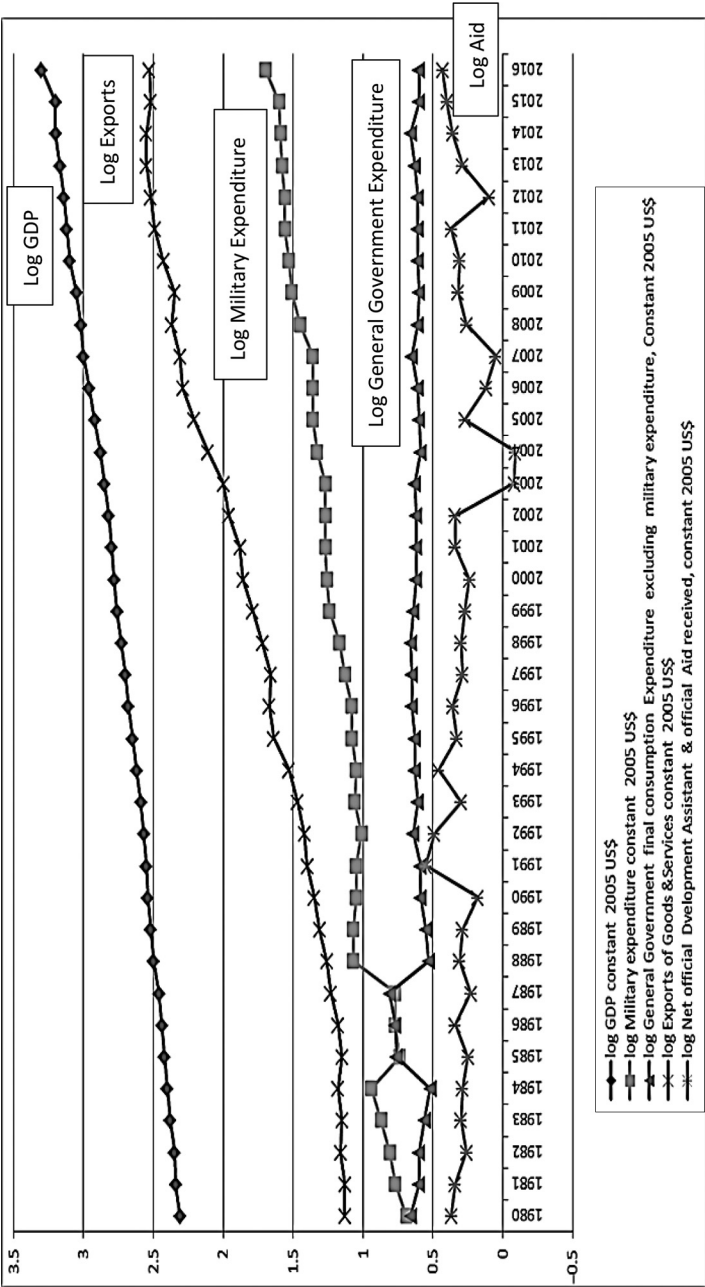
Figure 1 shows trends the variables during two main periods, 1980-1990 and 1991-2016. During the first period, military expenditure fluctuated. During 1980-1984, military expenditure increased, driven by increasing regional military tensions, sectarian violence and the government desire to achieve self-sufficiency in military policy[9]. The increase in military expenditure during this period was also driven by applying limited deterrence policy for Indian military doctrine, after applying sufficient deterrence policy in 1970s, and increasing Indian nuclear capabilities at the end of 1984[10] (Chapman, 2009).

During period 1985-1987, military expenditure declined, driven by announcement of Indian Government to reduce military budget[11], due to the improvement in regional relationships, particularly with Pakistan[12]. During 1988-1990, military expenditure increased, driven not only by sectarian violence in India, that had been controlled by armed forces but also to support and enhance military industry and exports[13], and the Indian Government desire to stimulate the linkages between civilian and military sectors[14] (Ward et al., 1991).

Indian GDP at constant prices increased slowly during the period 1980-1991, compared with following periods. During this period, India applied economic policies aimed at achieving self-reliance; implementing imports substitution industrial strategy; supporting national industry; and particularly enhancing military industry and exports[15] (Stephn and Atkinson, 2014).

During this period, Indian manufacturing policies were also an integral part of the economic and planning policy, driven by the initial role given to the Indian industry by five years' plans[16] (Ward et al., 1991). Indian industrial policy during this period based on import substitution and export promotion strategies. But the Indian industry faced slowdown growth because of four main reasons: shortage in public investments; inefficient

Figure 1.
GDP, military
spending,
government spending
and aid at constant
prices during the
period 1980-2016

Source: By researchers, based on: World Bank (2017), Stockholm Peace Research Institute (SIPRI) (2017), ACDA (1995)

management of public sector; slowdown growth of agriculture sector, resulting from limited demand of industrial goods; and the inclusion of trade police in the industrial policy framework (Ahluwalia, 1986). In the same context, the military industrial sector in India was considered as military-industrial complex, supervised by Indian Government via department of defence production and supplies, which controlled most of the military production during this period[17] (Ward *et al.*, 1991).

At the end of this period, India faced economic difficulties[18], leading India to take conditional approval for loans of IMF, and conducting structural reform program[19]. The main conditions of this program were reducing the government role in the economic activity, and decreasing government expenditure (Stephn and Atkinson, 2014). Which may lead to reduce military expenditure during the following periods, driven by conditionality of the structural reform program.

The period 1991-2016 revealed at its beginning during 1991-1997 stability in military expenditure, compared with the previous period, coupled with the beginning of economic reform program in 1991 (Stephn and Atkinson, 2014), and also coupled with the reinforcement of the military co-operation with USA, after disintegration of Soviet Union[20] (Chapman, 2009). The trends of military expenditure during this period were driven by the trends of reducing military expenditure, as an integral part of general policy that aimed at reducing government expenditure, which agreed with IMF conditionality programs, as we previously mentioned.

During this period, the competitiveness of Indian industry increased, particularly in military industry, driven by increasing productivity; improvement the quality and technologies of production; reduction in production costs; and stimulating research and development (R&D) activities, which led to give incentives and enhance military exports[21] (Dasgupta and Chraborty, 2005).

During period 1998-2016, Indian military expenditure increased, this increase could be driven by some factors, such as: the escalation of regional tensions; sectarian violence directly controlled by armed force; upgrading the Indian military doctrine driven by the escalation of military operations in the Gulf, Afghanistan, Pakistan and also upgrading Indian military nuclear doctrine, which completed in 2003 (Chapman, 2009). During the same period, aid received and capital inflows increased, compared with the preceding periods, driven by the agreement with IMF, coupled with increasing export rates, and clear trend to reduce government expenditure (Joseph *et al.*, 2011). This may refer to the increasing reliance of Indian economy on exports and the reduction of government expenditure, that represented one of the main conditions of economic reform policies[22].

These policies reflected on the military industrialization, which had been developed to focus on the co-production with licenses for military equipment and systems, produced by European and American groups and companies. These policies aimed at enhancing the domestic capabilities to develop the designs and production of military equipment systems and weapons, with effective participation of civilian sector, that may lead to enhance the technological and design capabilities of military and civilian sectors (Singh, 2017), particularly in aeronautics, electronics, shipbuilding, and iron and steel industries (Ward *et al.*, 1991).

Moreover, Indian Government had given the private sector and foreign direct investment (FDI) the rights to manufacture and produce in military industry, via licenses from department of industrial policy and promotion (DIIP); co-operation with the domestic producers; and via giving marketing rights to the Indian government (Singh, 2017)[23].

Thus, India aimed at military sufficiency and self-reliance. Moreover, India also tried to develop a sophisticated technological base, to design and produce sophisticated military

equipment systems; nuclear weapons; and medium range ballistic missiles. India moved to develop its military industrial sector by encouraging foreign direct investment in this field, and by co-operation in manufacturing with foreign companies[24], with effective participation of civilian industrial sector.

3.2 The model and data

The formulation of the quantitative model as we mentioned will be based on five main variables as follow: GDP, government expenditure, trade openness, military expenditure and aid received.

For the GDP variable, the changes will reflect economic growth or slowdown, and the GDP data will be expressed as real values, to exclude the impact of price changes. The military expenditure variable will be expressed as the ratio of military expenditure to GDP "military expenditure burden".

The model will also include three other variables; government expenditure, economic openness, and aid received. The importance of government expenditure that is considered as potential determinant of economic growth and military expenditure. The increase of the country revenues may increase government expenditure and thus increasing military expenditure. The government expenditure will be expressed as the ratio of government consumption expenditure excluding military expenditure to GDP. Trade openness may enhance economic growth by increasing market access, whether for new products or technologies, and will be expressed as the ratio of exports to GDP. Finally, aid received, that is used in Benoit's studies (Benoit, 1973, 1978) and has an impact on developing countries' economies as whole, and particularly on Indian economy. The aid received will be expressed as the ratio of aid received to GDP.

The hypotheses of the study are as follow:

H1. Military expenditure does not cause economic growth.

H2. Economic growth does not cause military expenditure.

The quantitative model for testing these hypotheses can be formulated as follows:
For first hypothesis:

$$G_t = \alpha_0 + \sum_{i=1}^{n_1} \alpha_{1i} G_{t-i} + \sum_{i=1}^{n_2} \alpha_{2i} M_{t-i} + \sum_{i=1}^{n_3} \alpha_{3i} GE_{t-i} + \sum_{i=1}^{n_4} \alpha_{4i} X_{t-i} + \sum_{i=1}^{n_5} \alpha_{5i} AID_{t-i}$$
$$+ \lambda EC_{t-1} + e_t$$

For second hypothesis:

$$M_t = \beta_0 + \sum_{i=1}^{m_1} \beta_{1i} M_{t-i} + \sum_{i=1}^{m_2} \beta_{2i} G_{t-i} + \sum_{i=1}^{m_3} \beta_{3i} GE_{t-i} + \sum_{i=1}^{m_4} \beta_{4i} X_{t-i} + \sum_{i=1}^{m_5} \beta_{5i} AID_{t-i}$$
$$+ \phi EC_{t-1} + u_t$$

G: gross domestic product (GDP) in real values;
M: ratio of military expenditure to real GDP;
GE: government expenditure as a percentage of real GDP excluding military expenditure burden;

X: the degree of trade openness, measured by the ratio of exports to real GDP;
AID: ratio of economic aid to real GDP;
EC: error correction coefficient taken from **an** asymmetric integration relationship.;
e: is white-noise error term;
t: time in years;
n: lag periods;
α_{2i} short run Granger Causilty;
λ : long run Granger Causilty;
β_{2i}: short run Granger Causilty; and
Φ: long run Granger Causilty.

For *H1*, The null hypothesis is that military expenditure does not cause economic growth. It will be rejected if the coefficients of military expenditure (α_{2i}) are statistically significant as group, and/or EC coefficient (λ) is significant. The coefficients of military expenditure (α_{2i}) Indicate causality in the short term, and the EC coefficient (λ) indicates to causal relationship in the long term. But if there is no cointegration, the EC coefficient (λ) will not appear, so the causality will be available only in the short term. Thus, the null and alternative hypotheses are as follows:

$$H_0 : \ \alpha_{2i} = 0, \ \lambda \ = 0 \ for \ i = 1, \ldots \ldots, n_2$$

$$H_1 : \ \alpha_{2i} \neq 0, \ \lambda \ \neq 0 \ for \ at \ least \ one \ i$$

For *H2*, the null hypothesis is that economic growth does not cause military expenditure. It will be rejected if GDP coefficients (β_{2i}) is statistically significant as a group, and/or significant EC coefficient (Φ). The coefficients of GDP (β_{2i}) indicate to causality in the short term, and the EC coefficient (Φ) refers to causal relationship in the long term. But if there is no cointegration, the EC coefficient (Φ) will not appear, so the causality will only be available in the short term. Thus, the null and alternative hypotheses are as follows:

$$H_0: \ \beta_{2i} = 0, \ \lambda \ = 0 \ for \ i = 1, \ldots \ldots, m_2$$

$$H_1 : \ \beta_{2i} \neq 0, \ \lambda \ \neq 0 \ for \ at \ least \ one \ i$$

All data included in the model were calculated by the authors, using raw data of annual time series of the five variables during the period 1980-2016. This period is sufficient to determine the relationship between military expenditure and economic growth in India, using time series analysis approach.

The annual raw data of GDP, government expenditure, exports and aid were taken from World Bank Development Indicators, while annual raw data of military expenditure were taken from Stockholm International Peace Research Institute (SIPRI) and US Arms Control and Disarmament Agency (ACDA) as we mentioned before. All such collected data of the variables were in current prices, and converted to constant prices, using GDP deflator of base year 2005.

In addition, we also calculated the ratio of military expenditure to real GDP as a measure of military expenditure burden (M). And also calculated (GE), which refers to the ratio of government expenditure excluding military expenditure to real GDP. Moreover, we calculated(X), which stands for the ratio of exports to real GDP. Finally, we calculated (AID), which refer to the ratio of aid to real GDP. All these data are expressed in the natural logarithm and calculated by the authors.

3.3 Results
To examine causality relationship between military expenditure and economic growth in India, we will proceed according to the standard practice:

- examine the stationarity of time series of variables;
- determine the lag structure;
- examine the cointegration among the variables;
- determine the possibility of applying vector-error-correction model (VECM), using Hendry modeling methodology from general to specific (GTS); and
- conduct the Granger causality test.

3.3.1 Stationarity test. Table AI shows the results of unit root for the Augmented Dicky–Fuller (ADF) test. The results show that all variables are not stationary at the level. By taking the first difference of all variables, the results show stationarity of first difference of these variables, at 5 per cent level of significance. This indicates that they are I $\sim$ (1). These results allow the error-correction-model(VECM) to be applied, after examining the cointegration of variables, with appropriate lag structure.

3.3.2 Lag structure. Table AII shows the results of lag structure determination during period 1980-2016. The results reveal that one lag period will be selected according to SIC and HQC. We will use it to examine the cointegration between variables, vector-error-correction model (VECM) and also the Granger causality tests.

3.3.3 Johansen cointegration test results (trace) Lag 1. Table AIII shows the results for the Johansen cointegration test. The results reveal that there is one cointegration relationship (Trace), at 5 per cent level of significance. This result allows for applying vector - error-correction model (VECM).

3.3.4 Vector-error-correction model and general-to-specific modeling methodology results. Table AIV shows the results of vector-error-correction model (VECM). Applying the General-to-Specific (GTS) modeling methodology, by deleting non-significant variables, at 10 per cent level of significance. Results reveal that the model was applied first using D (log GDP) as a dependent variable. Serial correlation test between variables shows there is no serial correlation between the endogenous variables. Heteroskedasticity Test (ARCH) shows there is no ARCH effect. The normal distribution of errors is also verified, and the null hypothesis is accepted using the Normality test. Finally, testing for stability of the model shows stability within the range. Using D (log M) as a dependent variable, we reached to similar results. This leads us to determine the Granger causality between military expenditure and economic growth in India.

3.3.5 Granger causality test results. Tables AV and AVI show the results of Granger causality. In Table AV, whereas D (log GDP) is dependent variable, with one lag period, there is no Granger causality from military expenditure to economic growth, as the null hypothesis is accepted and the alternative is rejected, and $p = 0.5400$, at 10 per cent level of significance. The results reveal also Granger causality from government consumption expenditure and exports to economic growth, where the null hypothesis is rejected and the alternative is accepted, and $p = 0.0865$, $p = 0.0601$ respectively, at 10 per cent level of significance.

In Table AVI, D (log M) is dependent variable. The absence of Granger causality from economic growth to military expenditure is confirmed, as the null hypothesis is accepted and the alternative is rejected, and $p = 0.3569$, at 10 per cent level of significance. But the results reveal Granger causality from aid received to military expenditure, as the null

hypothesis was rejected and the alternative is accepted, and $p = 0.0627$, at 10 per cent level of significance.

4. Concluding remarks

We conclude the absence of causal relationship between the two variables; military expenditure and economic growth in Indian case, during period 1980-2016. This result is in line with the findings of Pradhan (2010) and Behera (2002). The results also revealed that there is Granger causality from government expenditure and exports to economic growth. In light of these results, we reached the following conclusions:

First, the continuous regional tension is the main factor behind adopting Indian military strategy, and supporting military capabilities. India realized the importance of the strategic and economic dimension of military industries; trying to achieve self-sufficiency for its armed forces as an objective. India also tried to increase military exports, which become as one of the most important factors that cause economic growth, as we concluded above. It may be suggested that military expenditure indirectly enhanced economic growth.

Second, despite the absence of direct role of military expenditure on economic growth, the Indian military industry has supported Indian development and economic growth through technological spillover to the civilian sectors, thereby raising productivity and enhancing growth.

Third, several factors and activities have been contributed to the development of Indian military manufacturing, and increased interactions and linkages with civilian sector. The most important of these activities and factors are research and development (R&D) activities, and self-reliance as an objective to manufacture for basic components and electronic systems.

These factors and activities also enhanced civilian industry and export levels, by getting the marketing rights of foreign military equipment and systems, manufactured and produced in India via licenses.

Fourth, there are still major difficulties in the interactions between Indian civilian and military sectors. The most notable difficulties are the inability of civilian industrial sector to produce certain materials for military industries, and the small scale of production, which lead to higher production costs.

Despite these difficulties, the Indian military manufacturing and scientific policies have achieved self-sufficiency for some of India's military needs.

Fifth, India was able to participate with other countries in some of strategic industries. Such participation contributed to the integration of the civilian and military sectors. The most important of these industries are space and aeronautics industries, such as satellites and missiles. These industries are in co-operation with foreign military companies and groups, particularly those located in the USA, Europe and Israel. Such partnerships with these companies give strength to the linkages between industrial sectors; military and civilian. Thereby, India was able to make real benefits to its national economy as a whole.

Sixth, the most notable new Indian military manufacturing policies were as follows: India has steadily walked towards the objective of self-reliance, by becoming one of few nations that possess and develop advanced military equipment. However, it has continued a long-standing policy of support from the technologically advanced countries for its military capabilities. Indian Government also gave rights to private sector and foreign direct investment (FDI) for manufacturing and producing in military industries, strengthened linkages with the domestic producers, and giving full marketing rights to the Indian government. These new policies considered a great move towards deep changes for Indian military manufacturing policy, as one of important developing countries in this field.

Finally, military expenditure in India is a broader phenomenon, and further researches are needed, particularly in analyzing the linkages between military and civilian industrial sectors, and determining the sectors of Indian economy that are more sensitive to military expenditure. Such researches will help to determine the channels of military expenditure that indirectly influence on economic growth in India, and better explain the causality between military expenditure and economic growth.

Notes

1. Adam Smith considered military expenditure as public service, and pointed to difficulties of measuring the real cost of defense services accurately because of its zero marginal cost (Whynes, 1979). David Ricardo preferred taxes other than public debt to finance military expenditure during war period (Ricardo, 1951). Keynes considered military expenditure as one of components of effective demand, which could be used to stimulate economic activities (Keynes, 1940). According to socialist economic thoughts, military expenditure is necessary to sustain capitalist system and to ensure its effective functioning by absorbing surplus without increasing wages or capital. Baran and Sweezy argued that military expenditure was one of the most effective elements of demand components that prevented capitalism from falling into recession and unemployment. Therefore, it is a blessing to capitalism rather than a burden on it (Baran and Sweezy, 1966).

2. In the field of military expenditure, India is considered one of the most important developing countries in this area, both in terms of the value of military expenditure, or in terms of military manufacturing. In terms of military expenditure, in 2016 and 2017, India ranked sixth and fifth among the largest world countries in military expenditure, with value $55.9bn and $63.9bn, respectively. According to SIPRI (2018), India also ranked fourth to world countries in terms of military expenditure, after the USA, China and Saudi Arabia, respectively, with military expenditure value $66.5bn. Moreover, the Indian military industries characterized by legacy and strength. Pre-independence (pre-1947) military-industrial infrastructure in India was limited. It generally involved in repair activities of imported weapons systems. Since Indian independence, the goal of self-reliance has encouraged India to expand the military industrial base. In 1947, majority of Indian military infrastructure and equipment was established by colonial ruler, Britain. In the 1980s, India began a renewed effort to boost its domestic military industry by expanding investments in military Research and Development Organization (DRDO), and development of missile systems. During this period, India also began the development of its aeronautical project, the Light combat aircraft. In 1998, India also signed an agreement with Soviet Union to develop a supersonic cruise missile system, through joint venture. In the beginning of the twenty-first century, India opened doors to liberalization and progressive economic reforms. The era of State-run enterprises and centrally planned economy took a back-seat and open the way for private sector. The private sector was given access to the military manufacturing. The military Procurement Policy in 2006 allowed the industry to develop and produce advanced military equipment, with government commitment to provide 80% of the development costs. Foreign direct investment (FDI) was also permitted in military sector. However, the government continued its reliance on import of advanced weaponry (Nishith Desai Associates, 2018).

3. Benoit suggested that military expenditure could enhance economic growth in developing countries through different channels, such as the directly contribution of military sector to civilian sector, through submitting education, technologies and training, which leads to human productivity development; military activities may be linked to R&D activities and productive activities deployed in the civilian sector; and the positive impact of military expenditure on economic growth by stimulating aggregate demand, that may lead to increase using of unemployed capital, and will increase economic growth (Benoit, 1978).

4. By reviewing general literature about the relationship between military expenditure and economic growth, we found that researches in this field differ both in the method of analysis

used, and in choosing a sample consisting of a number of countries, or separately analyzing each country. We can classify the literature of the relationship between military expenditure and economic growth to four groups: (i) *Military expenditure boosts economic growth according to "military Keynesianism"*. Kennedy and Whynes confirmed the previous results of Benoit, applying on number of developing countries. Kennedy concluded that growth rates did not affect their military allocations (Kennedy, 1974). Whynes confirmed the positive impacts of military expenditure on economic growth (Whynes, 1979). Applying on a sample that consisting of a large number of countries, Kaldor used US Arms Control and Disarmament Agency(ACAD) data, applied on a sample of forty countries. The main result was strong correlation between manufacturing and military expenditures (Kaldor, 1976). In the same context, Ando used panel data analysis during period 1995-2003 to test relationship between military expenditure and growth for 109 countries; 30 OECD countries included. The main result was a positive impact of military expenditure on economic growth (Ando, 2009). For testing the relationship between the two variables for each country separately, Yildirm *et al.* used Dynamic Panel Data to test relationship between military expenditure and economic growth in the OECD countries. The results showed the stimulation of military expenditure for economic growth (Yildirim *et al.*, 2005). In the same genre, Atesoglu concluded positive relationship between military expenditure and economic growth in the case of the USA (Atesoglu, 2009). Halisioglu found positive impact of military expenditure on economic growth in Turkish economy (Halicioglu, 2003, 2004). (ii) *Military expenditure hinders economic growth*: researchers tried to identify channels which military expenditure affects the growth rate, through its effect on total supply and aggregate demand. The models were derived from production function and developed by a number of studies, the most important were, (Smith, 1980a; Smith, 1980b; Deger and Smith, 1983; Deger, 1986; Roux, 1996; Antonakis, 1997). The results of these studies revealed the indirectly negative effects of military expenditure on growth; by crowding out the investments and savings. And also revealed the direct positive impact of military expenditure, by stimulating effective demand. These studies presented a broader vision of the relationship between military expenditure and growth, but criticized for disregarding economic theory.

Using a sample consisting of large number of countries, Smith applied on sample of 15 countries, during the 1960s period Applied. The results revealed that the burden of military expenditure crowded out investment (Smith, 1977). Lim applied the "Harrod - Domar" growth model on 54 LDCs during period 1965-1973. The results revealed negative impact of military expenditure on economic growth (Lim, 1983). Knight *et al.* applied on a sample consisting of 22 developing countries, divided time period to 1975-1985 and 1986-1990. The results revealed negative relationship between military expenditure and economic growth (Knight et al., 1996). The same result concluded by Heo, using a nonlinear regression model for 80 countries during period 1961-1990 (Heo, 1998). In the same genre, more researchers, using Cross-Sectional Analysis, concluded negative impacts of military expenditure, both direct impacts (Faini *et al.*, 1984), or indirect impacts through the effects on savings (Deger and Smith, 1985); investment (Deger and Sen, 1983); and exports (Rothschild, 1977). Dunne *et al.* analyzed the relationship between military expenditure and growth in Greece and Turkey during the period 1960-1996, using VAR analysis. The results revealed that growth in both countries did not cause military expenditure, and also revealed a negative causality relationship from military expenditure to growth (Dunne *et al.*, 1998). In the same line, Dunne and Skons also concluded negative impacts of military expenditure on growth, with external effects on the civilian sector (Dunne and Skons, 2011). Batchelor, *et al.* Discussed the relationship between military expenditure and economic growth in South Africa, during period 1964-1995. The results revealed no significant impact of military expenditure on economic growth, and also revealed a negative impact of the military expenditure on the industrial sector (Batchelor et al., 2000). the same results reached by Shahbaz *et al.* about the Pakistani economy, the results revealed negative relationship between military expenditure and economic growth (Shahbaz et al., 2011). (iii) *The causality runs from economic growth to military expenditure*: in this line of literature, Joerding used causality test to investigate the relationship between military expenditure and growth, for 57 developing countries, during period 1962-1977. The results revealed that the causality run from economic growth to military

expenditure; suggested that state growth could increase the desire to strengthen itself against domestic and external threats by increasing military expenditure (Joerding, 1986), which was an addition in this field. Kollias *et al.* confirmed these findings, by applying cointegration and causality tests for 15 EU countries. The results revealed that the causality was from economic growth to military expenditure (Kollias *et al.*, 2004). In the same genre, Ali and Abdellatif examined the impact of natural resources availability on military expenditure, for a number of MENA countries, during period 1987-2012. The results revealed that there was "resource curse" , resulting from the natural resources discovery, especially forest and petroleum resources (Ali and Abdellatif, 2013). (iv) *No causality relationship between the two variables*: In this line of literature, Chowdhury used a sample of 55 developing countries, the result revealed no causality relationship between military expenditure and growth. But also revealed that the relationship between the two variables could not be generalized for all countries (Chowdhury, 1991). Kusi had same result using a sample of 77 developing countries (Kusi, 1994). Biswas and Ram did not also conclude a significant impact between military expenditure and economic growth (Biswas and Ram, 1986). Dakurah *et al.* used the cointegration and error correction model to test the impact of military burden on growth, for 62 countries. The results revealed that no causality relationship between the two variables (Dakurah *et al.*, 2001).

5. Although this results, the study revealed that military expenditure has huge opportunity cost and categorized military expenditure as a sub-optimal means of increasing economic growth, given that other alternative uses of government spending, such as spending on infrastructure. The study indicated that boosting of economic growth through higher military expenditure is not the only efficient way to achieve economic growth. And also revealed the importance of private investment, which may be crowding out by military expenditure. Empirical results revealed that resources used; such as productive capital formation, is four times more growth enhancing compared to the resources allocated for military expenditure. Therefore, as result, there is a strong need of peace initiatives for boosting economic growth rate (Ismail, 2017).

6. The study of Yildirim and Ocal (2006) also revealed a mutual causality relationship between the military expenditures of India and Pakistan. More studies focused on the arms race between India and Pakistan in the literature, the results were not conclusive about the possible relationship between military expenditures and arms race for both countries. Dunne *et al.* (1999) showed that there is a bi-directional causality between the military expenditures of both countries. Similarly, Tahir (1995) claims that there is a bi-directional causality between the military expenditure and GDP for both India and Pakistan. Oren (1994) revealed that each hypothesis with regard to the nature of the arms race between the two countries could be supported. Deger and Sen (1990) reported an asymmetric arms race between India and Pakistan, with Pakistani responding to Indian military expenditure. The results of Deger and Sen confirmed by Ocal (2003), using nonlinear models to investigate the nature of arms race between India and Pakistan.

7. The researchers explained that the causality relationship between military expenditure and economic growth was due to stable environment for investment and productive activities for investors, as well as research and development (R&D) activities, technological and educational skills linkages with the civilian sector, and also the infrastructure necessary to achieve sustainable growth (Tiwari and Shahbaz, 2011).

8. The study of Tiwari and Tiwari (2010) revealed that there is bi-directional causality between GDP and military expenditure. Which implies that increase in either military expenditure or GDP will bring momentum and both will increase. The results revealed also that GDP Granger caused merchandise trade but merchandise trade did not Granger cause GDP. Similarly, gross domestic savings Granger caused merchandise trade.

9. Military expenditure in India may be driven by some factors such as: India's desire to maintain its regional magnitude; the Indian hostility perceives from neighbors, particularly from Pakistan and China; and the government desire to achieve self-sufficiency in military policy. Furthermore,

the potential role of armed force to provide internal security in face of increasing internal turmoil in India (Ward *et al.*, 1991).

10. One of the most reasons influenced military expenditure in India was the impact of threats from neighboring nations, especially Pakistan. So, it seems not only international political and economic consideration that have been played the main roles in trends of military expenditure but also geo-political considerations that must not be neglected (Ward *et al.*, 1991).

11. During this period, the Indian government announced that the military budget would be reduced by about $100m. And also intended to boost military exports to increase foreign funds for purchasing high technological military equipment and systems (Ward *et al.*, 1991).

12. The decrease in regional tensions during this period, especially with Pakistan, driven by reduction of American military assistance to Pakistan; and the absence of Pakistani military assistance to Sikh separatists in India (Ward *et al.*, 1991).

13. During this period, India's primary military supplier was Soviet Union, driven by the existence of barter system of payment between both countries. During the 1980s, India managed inflation, which enhanced Indian-Soviet trade ties, driven by the shortage of hard currency in India. During 1987-1990, India military exports were increased in order to fund for purchasing of high technological military systems from Europe and USA, this trend continued during 1990s. During this period, most of Indian military equipment were domestically manufactured and produced with licenses, and also India exported acceptable technological military systems to many industrializing and developing countries (Ward *et al.*, 1991).

14. The primary goal of the Indian defence planners was to acquire self-sufficiency in military equipment systems design and production. At the same time, Indian security policies were aimed at developing technological self-reliance in the civilian sector, especially in areas such as aeronautics; electronics; shipbuilding and Iron-steel industries. The India's priorities in acquisition military equipment systems were to develop domestic designs, and to manufacture these products with licenses, and to get real effective participation in collaboration with domestic producers in civilian sector (Ward *et al.*, 1991).

15. These policies based on two main principles, "small is beautiful" and "lump of labor". According to the second principle, the Indian Government determined the employment ratios that must be employed in industrial sector (Stephn and Atkinson, 2014).

16. During this period, India experienced dual economy phenomenon, first the well-developed industrial sector, which had been moved from heavy industries to light and high technology industries. While the second sector was agriculture, which was inefficient compared to industrial sector, and suffered from a barter nature of many transactions; massive scale of population; and inefficiency of technologies used, which led to low standard of living in the agriculture sector (Ward *et al.*, 1991).

17. During this period, the department of defence production and supplies had supervised defence public sector undertakings (PSUs) in India. Moreover, during this period, the most important companies of military sector were Hindustan Aeronautics Limited (HAL), the aerospace institution in India; Bharat Electronics Limited (BEL), which manufacture electronic equipment and components; Bharat Earth Movers Limited (BEML), which considered a supplier of equipment and vehicles to the civilian sector in India; and the Mazagon Dock Limited (MDL) which considered a major shipbuilding and repair units that have the capability to manufacture warships, submarines, missile boats. India also imported high technology armaments from England, France and USA such as advanced combat aircraft, submarines, and tanks. However, India had tried to indigenously produce these military systems with license. There had been also a strategy to move low-technology and non-sensitive production from military sector to the civilian sector, where the capacity and capability for efficient production had been existed (Ministry of Defence: Annual Report,

1986-87). Thus, the Indian defence industrial base during this period was strong and became more oriented to high technology production (Ward *et al.*, 1991).

18. At the end of this period, the Indian economy faced some difficulties, driven by increasing petroleum price crisis; declining in remittances from labor abroad; and increasing deficit in both balance of payment and budget (Agarwal and Ghosh, 2015).

19. During this period, India conducted some arrangement that agree with immediate goal of IMF conditionality approval for loan reported to be in the range of $5bn-$7bn The most important of these arrangements were as follows: devaluation of domestic currency; implementation of free trade regulations such as lifting barriers of exports and reducing tariffs and non-tariffs barriers of imports; encouraging the foreign direct investment; increasing accessibility to international capital markets; moving toward giving up India's policy of government protection for commercial policies; and other arrangements that aimed at restructuring the quasi-planned economy of India, to agree with the IMF conditionality approval for loans (Stephn and Atkinson, 2014; Ward *et al.*, 1991).

20. In the beginning of 1991, the USA resumed high-technology military products and systems sales for India, after slowdown in Indian-American military co-operation. USA aimed at gaining influence in the region, and taking place of Soviet Union as the main supplier of Indian armed force (Ward *et al.*, 1991).

21. India also planned to boost its military exports, to raise funds for importing high technological military equipment and systems and for improving its armed force. During this period, India designed and produced military equipment and systems, based on collaboration with several American groups and companies specialized in military production, and exported military technologies to oil-rich West Asian nations (Broder, 1988).

22. It should be noted that military expenditure in India had stable levels during period 2004-2008. However, the decrease in economic growth rate from 9 to 6.8 per cent during 2008-2009 was driven by the global financial crisis and by the decrease in saving and investment levels, which may be reflected the impacts of global crisis on Indian economy, due to relaying on exports (Joseph *et al.*, 2011). However, military expenditure did not change, which may be referred to using military expenditure for compensating the shortage in effective demand.

23. It should be referred that the most important private military production companies in India are, Tata Advanced System Limited (TASL), which set in 2007, and working in military technological production; Mahindra Defence Systems Group (MDS), which considered multinational group in 2002, and produce small weapons for military sector, develop infrastructure and logistic services for civilian sector in India (ICD research, 2011).

24. It should be noted that in 2014, India announced "Make-In-India" initiative, to encourage foreign direct investment in Indian industry. The initiative enhanced foreign direct investment, which achieved about $61.96bn in 2017(for more details, www.makeinindia.com/home, last retrieved: 30 June 2018). This initiative reflected on the military industries by increasing manufacture contracts with foreign companies particularly located in USA and Europe, such as Lockheed Martin, Boeing, Raytheon in USA, and Airbus Group in Europe.

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Appendix. Estimating results of quantitative model

Variables at 1st difference	t-statistics(L)	p-value
D (log GDP)		
Constant and trend	−4.757478(0)**	0.0027**
Constant	−4.314654(0)**	0.0017**
None	−0.818449(0)	0.3542
D (Log M)		
Constant and trend	−5.958824(9)**	0.0005**
Constant	−5.332444(9)**	0.0003**
None	−6.829212(0)**	0.0000**
D (log GE)		
Constant and trend	−6.161018(0)**	0.0001**
Constant	−6.261494(0)**	0.0000**
None	−6.331987(0)**	0.0000**
D (log X)		
Constant and trend	−6.654878(0)**	0.0000**
Constant	−6.698386(0)**	0.0000**
None	−2.549768(1)**	0.0124**
D (log AID)		
Constant and trend	−7.802904(1)**	0.0000**
Constant	−7.890154(1)**	0.0000**
None	−7.323153(1)**	0.0000**

Table AI.
Stationarity test
(ADF)

Notes: All variables in natural log. (L) is the optimal lag according to the Schwarz Criterion (SC); * indicates rejection of null hypothesis at 10% level of significance; ** indicates rejection of null hypothesis at 5% level of significance

	AIC	SIC	HQC
Lag 0	−10.24461	−10.01786	−10.16831
Lag 1	−18.06284	−16.70238*	−17.60509*
Lag 2	−17.42091	−14.92673	−16.58170
Lag 3	−18.19986	−14.57196	−16.97918
Lag 4	−18.61168*	−13.85006	−17.00954

Table AII.
The results of
determining the time
lags for variables in
India during the
period 1980-2016

Note: * Indicates lag order selected by the criterion

H_0	T-statistics	Prob.
$r = 0$*	71.91132	0.0337
$r \leq 1$	45.91082	0.0753
$r \leq 2$	26.31594	0.1195
$r \leq 3$	8.561512	0.4075
$r \leq 4$	0.189151	0.3744

Table AIII.
Results of Johansen
cointegration test
(trace), Lag 1

Notes: Trace test indicates 1 co-integration eqn (s) at 0.05 level of significance. (r): denotes the numbers of cointegrating vectors; * indicates the rejection of the null hypothesis of no cointegration at 5% level of significance

D (log GDP) as a dependent variable
Significant variables and keep   C(1), c(2), c(4), c(5), c(7)
Insignificant variables and delete   c(3), c(6)
Add   C(8)*d(log M), c(9)*d(log ge), c(10)*d(log x), C(11)*d (log aid)

Tests:
Breusch–Godfrey Serial Correlation LM Test $P = 0.6794$, accept H_0, no serial correlation
Heteroskedasticity Test: ARCH $P = 0.8363$, accept H_0, no Arch effect
Normality $P = 0.848066$, accept H_0, the residuals are normally distributed
Stability   In the range

D (log M) as a dependent variable
Significant variables and keep   c(8), c(13)
Insignificant variables and delete   C(9), c(10), c(11), c(12), c(14)
Add   C(15)*d(log GDP), c(16)*d(log ge), c(17)*d(log x), (18) *d(log aid), c(19)

Tests
Breusch-Godfrey Serial Correlation LM Test $P = 0.5880$, accept H_0, there is no serial correlation
Heteroskedasticity Test: ARCH $P = 0.7706$, accept H_0, there is no Arch effect
Normality $P = 0.698543$, accept H_0, the residuals are normally distributed
Stability   In the range

Table AIV.
The results of vector-error-correction model (VECM) and the "Hendry methodology (GTS)"

Dependent variable D (logGDP): Sample: 1980-2016 Lags: 1			
Null hypothesis	No. of observations	Chi-Sq	Prob.
M does not Granger Cause GDP	35	0.37551	0.5400
GE does not Granger Cause GDP	35	2.938262	0.0865
X does not Granger Cause GDP	35	3.533760	0.0601
Aid does not Granger Cause GDP	35	0.124058	0.7247

Table AV.
Results of Granger causality test (military expenditure burden (M) as an independent variable)

Dependent variable D (log M) Sample: 1980-2016 Lags: 1			
Null hypothesis:	No. of observations	Chi-Sq	Prob.
GDP does not Granger Cause M	35	0.848762	0.3569
GE does not Granger Cause M	35	2.482775	0.1151
X does not Granger Cause M	35	1.990480	0.1583
Aid does not Granger Cause M	35	3.463806	0.0627

Table AVI.
Results of Granger causality test (military expenditure burden (M) as a dependent variable)