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Defence Spending and its Impact on Economic Growth

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Abstract

In this paper, we examine the relationship between defence spending and economic growth of G-20 countries over the period of 2000- 2010 using panel data analysis. We study this relationship using both linear as well as log models. We have included *human capital* (education and health), *infrastructure* and *innovation* growth rates as independent variables along with the *defence spending* to study the impact on GDP growth rate. We found out positive but insignificant impact of defence expenditure on GDP growth, but this impact turned out positive and significant when we controlled for human capital variables (health and education). So, we conclude that investing in human capital along with the defence will enhance the GDP growth.

Introduction

The purpose of this paper is to find out the reasons of studying the relationship between defence spending and economic growth. Defence spending has a considerable share in government expenditure in several countries and therefore, it becomes imperative to study this association.

Defence expenditure may result into two types of effects: 1) spin off effect 2) trade off effect which depends upon whether there exists a positive or a negative relationship between defence expenditure and economic growth respectively.

We may find a positive relationship between the defence expenditure and economic growth when defence expenditure leads to increase in aggregate demand which further provides stimulus to the level of business activity in a country causing reduction in the level of unemployment, increase in profits and outputs of firms, thereby boosting economic growth. When resources are employed in defence expenditure, it may give a trigger to research and development activities, promoting important new inventions and improvements and encourage technical competence. It provides a suitable environment for production and investment activities, increased capacity utilization thereby stimulating domestic and foreign trade. Also, it has a positive impact on human resource development since it leads to educational training and enhancement of technical skills. Moreover, it leads to increase in security level and prevention of crisis. Thus, it provides a sound base for overall economic development of a country by giving necessary infrastructure facilities, competitive environment and broader market and serving as a source of income and employment. These effects are the "spin – off" effects of defence expenditure.

A negative relationship between defence spending and economic growth might occur as it may crowd out investment in growth leading productive activities like expenditure on health and educational activities. If the scarce resources are transferred from civilian to defence activities, it may contribute negatively to the growth of a country. Thus, there exists a trade- off between defence expenditure and expenditures on various other components of public budget like: Education, Health, General Administration, Infrastructure, and Social Services. If a government finances its defence spending by issuing money, it may lead to inflationary pressures in the country. It possesses an opportunity cost in terms of lower level of physical capital formation and reduction in outlays on research and development. As a result, a country might reduce outlays on defence expenditure despite rising security issues depending upon the seriousness of negative impacts of defence spending on the economy.

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So, a country must balance the opportunity costs and security and other benefits of defence spending. The main aim of a country should be to maximize welfare by redistribution of resources among defence and other expenditure. Therefore, it is very crucial to study the link between economic growth and defence spending in order to ascertain the appropriate amount of budget to be allocated to the defence expenditure.

Literature Review

Several studies have been undertaken to unravel the relationship between defence expenditure, other components of fiscal spending and economic growth since the study conducted by Benoit (1973, 1978) which suggested a positive relationship between Defence spending and economic growth. While some studies suggest a positive relationship between defence spending and economic growth due to spill overs, spin-offs and positive externalities due to increase in aggregate demand, improvement in infrastructure facilities and by encouraging research and innovation; other research works indicate a negative impact on economic growth due to crowding out of investment which might have direct and larger productivity effects. Negative crowding out happens when there is a decrease in other economic activities due to rise in defence spending. There can be greater productivity impacts if the government directly channelizes funds into education, health or infrastructure which might contribute more towards growth. Also, if the Defence expenditure is funded through increase in taxation, it may crowd out some of the private investment. Moreover, it might utilize best capital equipment and technological innovations that might be used for growth oriented consumption or investment purposes. Furthermore, it might cause balance of payments problem if major proportion of foreign exchange is used to by defence equipment. While some argue that defence expenditure is looked upon as unproductive, others argue that it provides a safe environment for investment, hence contributing to the growth process and is crucial for achieving aims of prevention of war, security and peace. On one hand, defence sector might take skilled labor away, while on the other hand, it may also provide educational and technical training. Therefore, it still remains a debatable issue, may be because there is difference in countries under study, the time period and the methods used in the research.

Further, the link between the two variables under study may be bi-directional, that is, apart from defence spending affecting economic growth, growth of economy may also affect defence spending.

There are broadly four groups of study in defence literature: the Keynesian, the Neoclassical, the Liberal and the Marxist.

The Keynesian approach focuses on multiplier effects in respect of increase in output (when aggregate demand is ineffective) stressing on the fact that increased defence spending can lead to increased capacity utilization, increased profits and hence, increased investment and economic growth. Empirical research has suggested a negative relationship between defence spending and economic growth using this demand- concentrated model. The main shortcoming of this model is that it only considers demand- side issues and neglects the supply side issues. This problem was first overcome by Smith and Smith who included explicit production functions.

Marxists hold a socio-political view towards military expenditure rather than an economic one. They claim that military expenditure boosts economic growth by providing safe environment and preventing crisis. Baran and Sweezy (1966), in their underconsumptionist approach claim that military expenditure will further the economic growth when the economy is in disequilibrium.

On the other hand, neoclassicals view defence expenditure as a pure public good provided by the State, which tries to maximize the national interest by balancing opportunity costs and security benefits of the military expenditure. The aggregate supply function is derived from this supply- side model.

Many researchers have used Feder - Ram Model which is a supply side model in order to determine the link between defence outlay and economic growth. This model is considered to be as one of the most influential Neo- Classical model. It was initially established to analyze the effect of the export sector on economic growth in developing countries. Three years later, Ram and Biswas adapted this model to research the effects of military spending on economic growth. Aggregate production function approach has been used in this model in order to find out the link between the above two variables. This model throws light on externality effect of military size on output and increase in the input productivity due to military sector compared to the civilian sector; thereby explaining the positive impact of military expenditure on economic growth. A number of researchers have used

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this approach which was first proposed by Feder (1983) and Biswas and Ram (1986); although it has received huge criticism by Dunne et al (2005).

Most studies are based on well specified theoretical frameworks- neoclassical or Keynesian and avoid ad hoc specifications. However, there is no well-defined agreement among the researchers regarding the growth effects of military expenditure. While some researchers have found a positive effect, some have found a negative effect while others claim that there is no effect at all.

There is another aspect that can be focused upon. Alesina et al. (2008) claimed that "there are economies of scale in the production of public goods. The per capita cost of many public goods is lower in larger countries, where taxpayers pay for them". The rate of growth is high in large economies and therefore, the per capita cost of producing public goods is lower as compared to smaller economies. Defence spending in larger countries is subject to less foreign aggression. This means that smaller countries may have to spend proportionately more than the larger ones given the economies of scale in the defence spending. The table of the papers reviewed is specified in the appendix.

Model Specification

Fixed Effects Model: Linear

(i) $G = \alpha + \beta_1 def_{it} + \mu_{it}$

(ii) $G = \alpha + \beta_1 def_{it} + \beta_2 hcap_{it} + \mu_{it}$

(iii) $G = \alpha + \beta_1 def_{it} + \beta_2 hcap_{it} + \beta_3 inv_{it} + \mu_{it}$

(iv) $G = \alpha + \beta_1 def_{it} + \beta_2 hcap_{it} + \beta_3 infra_{it} + \beta_4 inv_{it} + \mu_{it}$

(v) $G = \alpha + \beta_1 def_{it} + \beta_2 edn_{it} + \beta_3 health_{it} + \beta_4 infra_{it} + \beta_5 inv_{it} + \mu_{it}$

(vi) $G = \alpha + \beta_1 def_{it} + \beta_2 infra_{it} + \mu_{it}$

(vii) $G = \alpha + \beta_1 def_{it} + \beta_2 inv_{it} + \mu_{it}$

(viii) $G = \alpha + \beta_1 def_{it} + \beta_2 inv_{it} + \beta_3 infra_{it} + \mu_{it}$

Fixed Effects Model: Log

(i) $ln\, G = \alpha + \beta_1 ln\, def_{it} + \mu_{it}$

(ii) $ln\, G = \alpha + \beta_1\, ln\, def_{it} + \beta_2 ln\, hcap_{it} + \mu_{it}$

(iii) $ln\, G = \alpha + \beta_1 ln\, def_{it} + \beta_2\, ln\, hcap_{it} + \beta_3\, ln\, inv_{it} + \mu_{it}$

(iv) $ln\, G = \alpha + \beta_1 ln\, def_{it} + \beta_2\, ln\, hcap_{it} + \beta_3\, ln\, infra_{it} + \beta_4\, ln\, inv_{it} + \mu_{it}$

(v) $ln\, G = \alpha + \beta_1 ln\, def_{it} + \beta_2\, ln\, edn_{it} + \beta_3\, ln\, health_{it} + \beta_4\, ln\, infra_{it} + \beta_5\, ln\, inv_{it} + \mu_{it}$

(vi) $ln\, G = \alpha + \beta_1 ln\, def_{it} + \beta_2 ln\, infra_{it} + \mu_{it}$

(vii) $ln\, G = \alpha + \beta_1\, ln\, def_{it} + \beta_2 ln\, inv_{it} + \mu_{it}$

(viii) $\ln G = \alpha + \beta_1 ln\, def_{it} + \beta_2 \ln inv_{it} + \beta_3\, ln\, infra_{it} + \mu_{it}$

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This paper provides causal relationship between defence spending and economic growth for the G-20 countries. We examine the effect of defence spending on economic growth by controlling for human capital variables: Health and Education. Also, we examine how the Infrastructure Spending and Research and Development affect the GDP and whether they contribute more towards GDP growth than the Defence Spending.

Since we are examining various countries over a span of time, we have used Panel Data analysis. Fixed Effects Model is used when we are interested only in finding out impact of variables that vary over time. It is used to explore the relationship between dependent and independent variables within an entity. In this model, the individual-specific effect is a random variable that is allowed to be correlated with the explanatory variables. When we use fixed effects model, we assume that something within the individual might affect the outcome variables and we need to control for this. In the random effects model, the individual-specific effect is a random variable that is uncorrelated with the explanatory variables. We have used fixed effects model in both linear and log linear form and examined the results.

Here, *G* represents GDP growth rate, *def* represents growth rate of Defence Expenditure, *hcap* represents growth rate of Human Capital (Education and Health) and *inv* represents Research and Development Expenditure as a percentage of GDP. *Infra* includes expenditure on Energy, Telecom, Water & Sanitation and Transport. We have first taken the summation of all the components of infrastructure and then calculated the growth rate of the total expenditure incurred on the same. *Ln* represents natural log. Here, "i" represents a particular country and "t" represents a particular year.

Interpretation ofthe Data

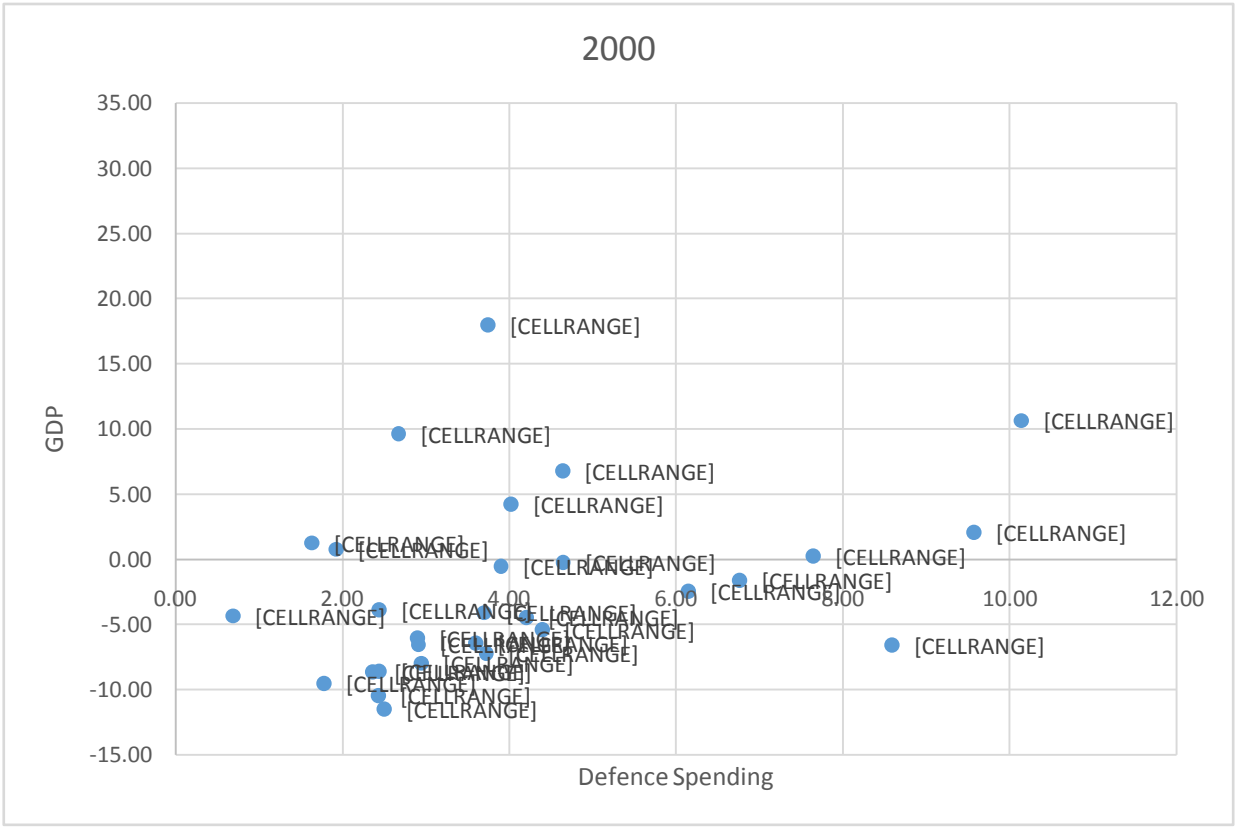

Figure 1

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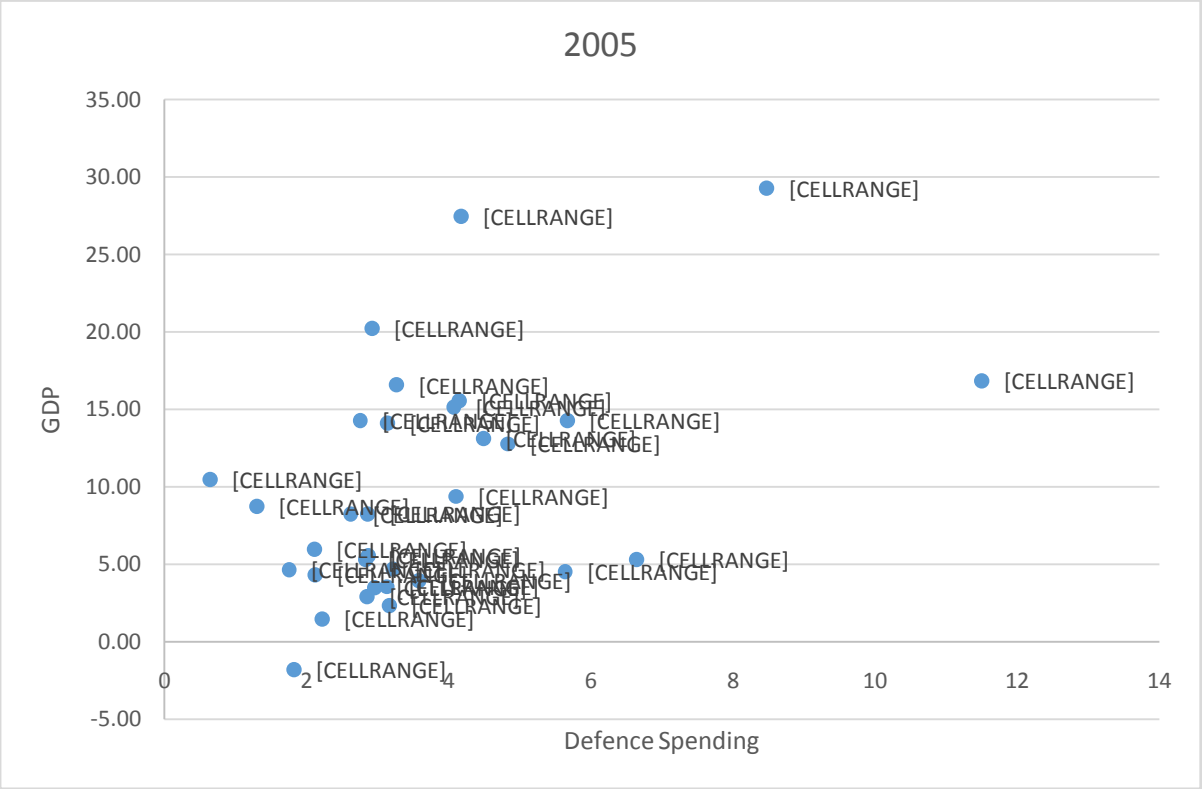

Figure 2

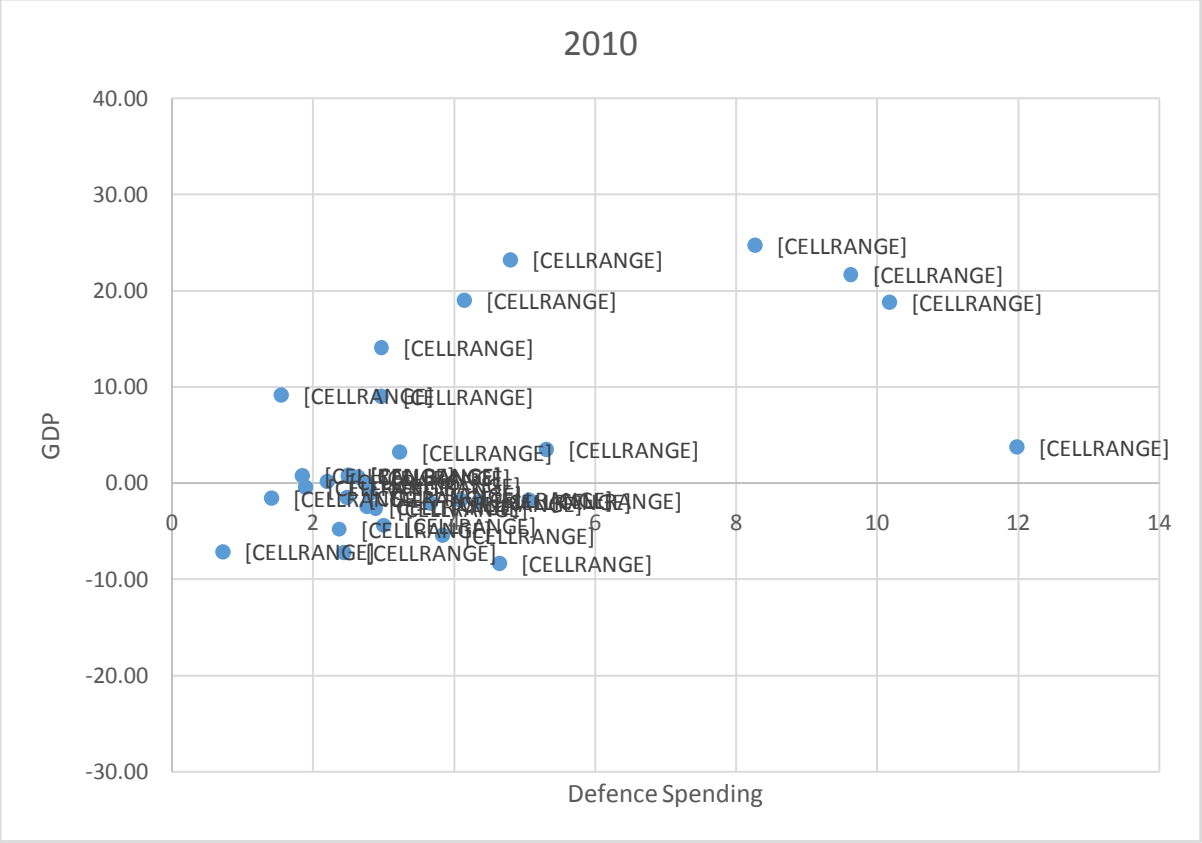

Figure 3

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Figure 1, 2 and 3:GDP growth versus Defence Spending. Observations are plotted for 43 countries. Horizontal axis measures the level of defence spending and vertical axis measures the corresponding level of GDP for the years 2000 (Figure 1), 2005 (Figure2) and 2010 (Figure 3). Data for Defence Spending has been taken from GFS and data for GDP has been taken from WDI. Data for GDP has been taken in the terms of current US$ and then converted into growth rates by applying the formula:$(\frac{Previous\ \ Value - Current\ \ Value}{Previous\ \ Value})$*100.

From the above graphs, we see that the defence expenditure growth rate of Mexico has increased from 3.75 in the year 2000 to 8.48 in the year 2005 and then decreased a bit to 8.27 in the year 2010 and the GDP growth rate has followed a different trend; from 17.98% in 2000, the growth rate decreased to 12.31% in the year 2005 and then increased to 16.97% in the year 2010.

If we look at Australia, the defence spending growth rate has diminished a bit from 4.64% in 2000 to 4.49% in 2005 and then increased to 4.80% in 2010. The GDP growth rate has increased from 6.77% in 2000 to 13.12% in 2005 and further to 23.20% in 2010.

When we examine China, the Defence Spending increases from 10.14 to 11.50 from 2000 to 2005 and then falls to 10.18 in the year 2010. However, the GDP growth rate experiences a constant rise from the year 2000 to 2005 and then to 2010: from 10.63% to 16.83% and finally jumped to 18.81%.

The scatter diagram illustrates that the defence expenditure for Spain decreases from 2.90% in 2000 to 2.86% and further to 2.37% in the year 2010. Whereas, the GDP Growth Rate has increased from -6.029% in 2000 to 8.25% in 2005 and then the growth rate plunged to -4.77% in year 2010.

Analysis of graph for Germany reveals that the defence expenditure growth rate decreases from 2.51% to 2.22% from the year 2000 to 2005 and further to 2.20% in 2010. On the other hand, the GDP Growth Rate increased from -11.48% in 2000 to 1.46% in 2005 and then reduced to 0.188% in the year 2010.

The data for GDP has been taken from WDI (World Development Indicators) in current US$ terms and then converted into growth rates. Also, the data for R&D was also compiled from WDI. Further, the defence spending, human capital (health and education) and infrastructure (energy, telecom, water & sanitation and transport) is from GFS (Government Finance Statistics) database.

Table 1

FIXED EFFECT MODELS : LINEAR								
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Defence	2.513145 (1.744049) (0.0822)	2.675575 (2.030469) (0.0432)	2.194141 (1.462753) (0.1446)	0.427127 (0.213464) (0.8319)		0.946988 (0.554552) (0.5814)	2.156845 (1.329575) (0.1847)	
Education	-	-	-	-		-	-	
Health	-	-	-	-		-	-	
Human Capital (Education + Health)	-	1.102320 (2.861444) (0.0045)	0.739316 (1.780685) (0.0760)	0.364143 (0.371030) (0.7122)	-	-	-	
Infrastructure	-	-	-	0.022350 (1.586577)		0.020735 (1.528853)	-	

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				(0.1190)		(0.1319)		
Innovation	-	-	-12.13754 (-3.199669) (0.0015)	-3.726916 (-0.312491) (0.7560)		-	-13.54443 (-3.708980) (0.0003)	
R^2	0.140300	0.160628	0.197847	0.195192		0.174005	0.189780	

Table 2

FIXED EFFECT MODELS : LOG LINEAR								
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Defence	0.033009 (0.053187) (0.9576)	0.075920 (0.109778) (0.9127)	-0.062203 (-0.088380) (0.9297)	1.081484 (1.715837) (0.1044)		0.136764 (0.266675) (0.7924)	-0.091318 (-0.144875) (0.8850)	0.418572 (0.771817) (0.4502)
Education	-	-	-	-		-	-	-
Health	-	-	-	-		-	-	-
Human Capital (Education + Health)	-	0.064139 (0.513796) (0.6079)	0.042247 (0.329455) (0.7421)	0.210809 (2.365423) (0.0302)	-	-	-	-
Infrastructure	-	-	-	-0.052075 (-0.871839) (0.3954)		-0.036686 (-0.595492) (0.5582)	-	-0.057009 (-0.908045) (0.3759)
Innovation	-	-	-0.510559 (-1.298067) (0.1957)	1.241332 (1.583653) (0.1317)		-	-0.512693 (-1.308882) (0.1920)	1.297644 (1.525294) (0.1446)
R^2	0.242951	0.243407	0.244007	0.689751		0.598004	0.243808	0.652235

The first term in each table is the coefficient in the particular equation, the term in parenthesis is the t -value and the third term denotes the p value in Table 1 and 2.

From Table 1 we see from the first equation, that one unit increase in defence expenditure growth rate leads to 2.513 units of increase in GDP growth rate but is statistically insignificant (at 5 per cent level). The log model from Table 2 also reveals similar insignificant result: one unit increase in defence expenditure growth rate leads to 0.033 units of increase in GDP growth rate. Since it is statistically insignificant, we cannot comment on whether military spending exerts a positive impact on economic growth in G-20 countries. Not only are the coefficients statistically insignificant, but also the R^2 is quite low which means that the model is not strong enough to explain the variation of economic growth.

Second equation results from Table 2 depict a significant increase in GDP growth rate of 2.67 units with we control for human capital (education and health). Also, a significant rise of 1.102 units is recorded in GDP growth rate with one unit increase in human capital growth. But the effect of human capital as well as defence growth rate on GDP become insignificant when we consider the log model.

In the third equation, when we add innovation apart from human capital expenditure, we get insignificant results. Similarly, for the third equation for Table 1, we get positive but insignificant impact of defence spending, human capital, infrastructure and innovation on GDP growth rate. Likewise, we have got insignificant results except human capital when we consider log model which has a significant positive impact on GDP growth rate. Although the coefficient of infrastructure is negative when we consider the log model, but it has insignificant impact on GDP growth.

When we study the impact of infrastructure along with defence spending in equation 6, we get insignificant and positive results of defence spending on GDP in linear and log model, and insignificant positive result of infrastructure in linear model but negative insignificant result in log model.

When innovation is added with defence, the coefficient of defence is positive but insignificant while innovation contributes negatively to growth of economy when we consider the linear model. The results become negative (but insignificant) for both the variables when we talk about the log model.

Adding infrastructure and innovation both along with the defence spending gives us positive insignificant results in case of log model.

Conclusion and Policy Results

In this paper, we examine the relationship between defence spending and economic growth of G-20 countries over the period of 2000- 2010 using panel data analysis. We study this relationship using both linear as well as log models. We have included human capital (education and health), infrastructure and innovation growth rates as independent variables along with the defence spending to study the impact on GDP growth rate.

GFS (Government Finance Statistics) yearbooks have been used to compile data on defence spending and human capital (health and education). While the data for GDP, Research and Development and Infrastructure (energy, telecom, water & sanitation and transport) has been collected from WDI (World Development Indicators).

We get positive but insignificant impact of defence spending on economic growth in both the models. Therefore, we cannot comment whether defence spending exerts a positive pressure on GDP growth of G-20 countries or not. But when we control for human capital variables: growth rate of expenditure on education and health, we get significant positive coefficients for both defence spending as well as human capital in the linear model. But defence spending has a greater positive effect on GDP growth than the human capital. So, G-20 countries should invest in human capital development along with defence in order to boost their GDP growth rates. Even if we add innovation along with defence, we get a significant positive coefficient for human capital in log model. So, human capital development plays a crucial role in improving GDP growth rates of G-20 countries. The coefficient for infrastructure is positive but insignificant when we consider the linear model but negative and insignificant when we talk about the log model. The coefficient of research and development is significantly negative when we consider the impact of R&D expenditure on GDP growth along with the defence spending. In conclusion, we can say that investing in human capital along with the defence will enhance the GDP growth.

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