JPS Journal of Policy Studies

J. Policy Stud. 2025;40(3):1-21
https://doi.org/10.52372/jps.e687
pISSN 2799-9130 eISSN 2800-0714

Article

Defense or health? budgetary trade-offs in government spending, incrementalism, and government debt

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Received: December 11, 2024
Revised: February 05, 2025
Accepted: March 26, 2025

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Competing interests
No potential conflict of interest relevant to this article was reported.

Funding sources
This work was supported by a New Faculty Research Grant of Pusan National University (2023). This study was funded by a grant from National Research Foundation in Korea (NRF-2019S1A5A8038640).

Acknowledgements
This study is a revised and developed version of the paper presented at the 2022 Spring Conference of the Korean Association for Policy Studies. We would like to thank the anonymous reviewers for their in-depth comments.

Abstract

This paper analyzes the relationship between defense expenditure and public health expenditure. In addition, we consider the effect of the incrementalism theory of budget and total amount of government debt. Prior controversial research results were reviewed based on the theory of growth-stimulating effects and crowding out effects. Panel fixed effects model and simultaneous equation models (SEMs) were applied to perform a comparative analysis based on the panel data. The analysis results showed crowding out effects in all models. In addition, the positive effect of last year's budget on defense and public health expenditures in accordance with the budget's incrementalism was also confirmed. Government debt negatively influenced defense and public health expenditures. Analysis results that distinguished between high- and low-growth domestic product (GDP) countries were also presented to confirm the stability of results.

Keywords: defense expenditure, public health expenditure, crowding out effects, growth stimulating effects, incrementalism, government debt

Introduction

This study has two main objectives. The first purpose is to identify the relationship between defense expenditures and public health expenditures when controlling systemic, political, and economic factors. The second objective is to examine the other government expenditure (OGE), the characteristics of budget expenditure according to the incrementalism theory. In addition, we analyze the effect of government debt to defense and public health expenditure. We will also check whether the relationship between defense and public health expenditure remains stable after considering the effects of incrementalism and the government debt.

In previous studies, the relationship between defense expenditure and public health expenditure has not reached a full agreement. Differences in advanced study results are indicated by the number of countries analyzed, time, period, and method of analysis, and variable settings. Differences may occur depending on the methodology including those analyzed for the same time and countries. The differ-

Availability of data and material
Upon reasonable request, the datasets of this study can be available from the corresponding author.

ences from previous studies and the importance of this study are as follows.

First, previous studies with important contributions focused on regime, political, and economic factors (Bove & Brauner, 2016; Fan et al., 2018; Kollias & Paleologou, 2013). These factors need to be considered comprehensively and studied with more focus on governmental factors. In other words, budget execution characteristics in accordance with incrementalism theory are identified, and the effect of government debt on government expenditure and public health expenditure is comprehensively reviewed.

Second, the reasons for controversial results in advanced research on the relationship between defense expenditure and public health expenditure should be examined because the measurement method of variables is more reasonable in crowding out effects theory. In addition, by applying multiple statistical analysis methods using the same measurements of variables is required to derive the same analysis results.

Third, the robustness of the results must be checked. We will examine whether the relationship between defense and public health expenditures changes in relation to incrementalism and government debt. In addition, whether the relationship changes after applying different analysis methods and classifying countries and whether the analysis results are stable must be examined.

Many studies have analyzed factors affecting defense expenditure. These studies can be mainly classified into system and institutional aspect, economic aspect, and the relationship with public health expenditure. First, studies showed that defense expenditure depends on the form of the regime due to the characteristics of democracy and authoritarianism (Acemoglu et al., 2010; Bove & Brauner, 2016; Fordham & Walker, 2005; Goldsmith, 2003; Hewitt, 1992).

Second, studies on economic factors are influenced by the degree of national economic growth (Aizenman & Glick, 2006; Alptekin & Levine, 2012; Benoit, 1973, 1978; Collier & Hoeffler, 2006; Dunne, 1996; Dunne & Smith, 2010; Dunne & Tian, 2013; Heo, 2010; Kollias & Paleologou, 2013; Lin & Ali, 2009; Pieroni, 2009; Ram, 1995; Smith, 1989, 2000; Smith & Willenbockel, 2005; Smyth & Kumar Narayan, 2009) and development and showed that defense expenditure promotes economic growth (Chowdhury, 1991; Joerding, 1986; Kollias et al., 2004a).

Third, previous studies examined the relationship between defense expenditure and public health expenditure and showed positive and negative effects of the relationship and absence of a relationship (Ali, 2011; Apostolakis, 1992; Babin, 1990; Caputo, 1975; Dabelko & McCormick, 1977; Fan et al., 2018; Harris et al., 1988; Kollias & Paleologou, 2011; Lin et al., 2015; Mintz, 1989; Ozsoy, 2002; Peroff & Podolak-Warren, 1979; Russett, 1969; Yildirim & Sezgin, 2002). In other words, the debate in research results continues.

Based on previous researches and the most recent research results, this study used 139 countries from 2000 to 2014 for analysis. Simultaneous equation models (SEMs) and Panel Fixed Effects Model were used. In addition, panel fixed effects model was used to compare the results. According to incremental budget theory (Wildavsky, 1961), we will test a hypothesis on expenditure impact of the past year. This analysis aims to confirm the importance of incremental budgeting and whether the relationship between defense expenditure and public health expenditure is consistent when lagged dependent variables are controlled. Moreover, we will examine how government debt impacts defense and public health expenditures as a large proportion of government spending.

https://doi.org/10.52372/jps.e687

Theoretical Discussion and Hypotheses

Studies on the relationship between defense expenditure and public health expenditure are largely based on two theories. Studies of the positive relationship between defense expenditure and public health expenditure are based on the theory of growth-stimulating effects sectors (Harris et al., 1988; Kollias & Paleologou, 2011). By contrast, studies of the negative relationship between defense expenditure and public health expenditure are based on crowding out effects theory (Ali, 2011; Apostolakis, 1992; Babin, 1990; Dabelko & McCormick, 1977; Fan et al., 2018; Lin et al., 2015; Ozsoy, 2002; Peroff & Podolak-Warren, 1979; Russett, 1969; Yildirim & Sezgin, 2002). Previous research also showed that defense expenditure and public health expenditure are not significantly related.

First, growth-stimulating effects theory explains the positive relationship between defense expenditure and public health expenditure. The increase in government expenditure in one sector affects the increase in expenditure in other sectors (Harris et al., 1988; Kollias & Paleologou, 2011). According to this discussion, if one part of government expenditure increases, then other parts of government expenditure are likely to increase. However, this discussion focuses on the total amount of government expenditure or per capita government expenditure. This condition is because the relationship of each part decreases as one part increases when focusing on the proportion of government spending.

Second, crowding out effects theory explains the negative relationship between defense expenditure and public health expenditure. In addition to growth-stimulating effects theory, several studies analyzed the negative effects between defense and public health expenditures (Ali, 2011; Apostolakis, 1992; Babin, 1990; Dabelko & McCormick, 1977; Fan et al., 2018; Lin et al., 2015; Ozsoy, 2002; Peroff & Podolak-Warren, 1979; Russett, 1969; Yildirim & Sezgin, 2002).

Budget refers to the limited resource in terms of budget competition. It competes with budgets in different government departments. As defense expenditure increases, other parts of government expenditure also decrease. Defense and public health expenditures comprise the large portion of national budget and are thus in conflict with the Gun versus Butter discussion (Mintz, 1989).

The government's budget execution reflects this relationship, which can also be observed in the recent COVID-19 pandemic. Many governments are considering plans to cut their defense budget to allocate emergency disaster funding which is related to public health for dealing with the COVID-19.[1] This phenomenon is a good example of the relationship between defense expenditure and public health expenditure.

Third, other studies hold that defense expenditure and public health expenditure have no statistically significant relationship (Caputo, 1975; Mintz, 1989). Analyzing the previous studies, crowding out effects theory showed the most negative relationship between defense expenditure and

[1]CNBC, May 13, 2020. "Coronavirus could hit defense spending and spark NATO tensions once again" by Silvia Amaro. https://www.cnbc.com/2020/05/13/what-coronavirus-means-for-nato-and-defense-spending.html
Washington Post, May 16, 2020. "Military faces another potential coronavirus toll: Budget cuts" by Missy Ryan. https://www.washingtonpost.com/national-security/military-faces-another-potential-coronavirus-toll-budget-cuts/2020/05/14/ae7abbf6-906b-11ea-8df0-ee33c3f5b0d6_story.html
Defense One, April 28, 2020. "Global defense spending decline expected as nations deal with coronavirus" by Marcus Weisgerber. https://www.defenseone.com/politics/2020/04/global-defense-spending-decline-expected-nations-deal-coronavirus/164997/

public health expenditure. However, it lacks evidence to reach an academic consensus. In addition, research results presented based on this theory considered defense expenditure and public health expenditure per capita only.

The relationship between defense and public health expenditures may differ based on the theories applied. However, analyzing the competition between the proportions of each part of the total amount of government expenditure would be more reasonable. This condition is because defense and public health expenditures per capita increase along with government expenditure.

Based on the ratio of defense and public health expenditures to total government expenditure, the zero-sum game would occur. This discussion could apply equally to defense and public health expenditures in relation to government expenditure in other sectors. In accordance with the above discussion, the following hypotheses are established.

- Hypothesis 1: Defense expenditure and public health expenditure have the crowding out effects.
- Hypothesis 2: Government expenditures in other sectors negatively impact defense expenditure and public health expenditure.

The debate on the relationship between defense and public health expenditures is also related to the decision-making principle of government budget. Incremental budget decisions can strengthen the relationship between defense expenditure and public health expenditure. This is because decisions can be made to maintain the results of existing budget settings. The current budget can be seen as the result of rational discussion and decision-making in the process of the government setting the budget plan and the National Assembly approving the budget plan. Therefore, the current rational budget plan can lead to the result of maintaining or slightly increasing the total budget.

In the case of rationalism (Daft, 2015; Rainey, 2009), budget expenditure is determined and executed according to economic efficiency. However, Wildavsky (1961, 1964) criticized the rationalist approach and proposed the incremental budget theory based on incrementalism (Braybrooke & Lindblom, 1963). True (2000) suggested the disconnected equilibrium theory based on the perspectives of political process and policy measures. The disconnected equilibrium theory explained budget process reflecting policy changes and repeating incremental trends.

Although rationalism and incrementalism theories cannot be combined to provide an influence direction, budget decisions cannot be made only through rational decision-making and have an incremental characteristic. This incremental policy decision is also linked to bounded rationality (March & Simon, 1958; Simon, 1997, 2013). The new budget proposal predicts and considers annual environmental changes and circumstances because due to several constraints and public officials cannot easily make rational decisions that consider all of these factors (Good, 2011; Pal, 2011; Schick, 1983; Wildavsky, 1964; Wildavsky & Caiden, 2004). To account for this incrementalism theory, a statistical analysis is necessary by including the lagged dependent variable of defense and public health expenditures in the model. Thus, the hypothesis for incremental budgeting is formulated as follows:

https://doi.org/10.52372/jps.e687

- Hypothesis 3: Incrementalism theory of budget positively impacts defense expenditure and public health expenditure.

Studies on the relationship between government debt and spending are largely divided into two types. First, some studies hold government expenditure and public health expenditure increase government debt (Dunne et al., 2004, 2005; Kollias et al., 2004a). Second, other studies hold that government debt affects government expenditure (Davis et al., 1974; Wong, 1988).

Based on these studies, a question is raised of whether defense and public health expenditures will continue to increase government debt. In many developed countries, fiscal rules are established to regulate government spending when government debt reaches a certain level and thus avoid crisis in fiscal policy when government debt increases. Unlike the budget incrementalism theory, the government debt theory aims to reduce the government budget. When the government adopts a tight fiscal policy, the target of the tightening is likely to be a sector with a large budget. This is because the effect of budget reduction can be the greatest. Defense expenditure and public health expenditure are sectors where many countries set high budgets, so they can be sectors that are greatly affected by the national debt.

Davis et al. (1974) and Wong (1988) argued that budget decision-making and expenditures are driven by political factors and external environmental influences. However, budget expenditures of government cannot be discussed except for the effects of basic fiscal conditions along with political and environmental factors. Even if the influence of political factors is critical, if the government's fiscal condition is bad, it cannot unconditionally increase government expenditure.

The situation of sovereign debt crisis (default) that ignored the government's fiscal situation and spent government budgets politically on the basis of populism can be seen through Greece and Argentina (Benkendorfer et al., 2019; Pappas, 2014). The reason for the sovereign debt crisis is not seen in all countries because the budget is decided not only by the politicians' incentives, but also by considering the government's financial condition, such as government's budget scale and government debt.

If fiscal pressure continues, such as government debts, fiscal crisis develops, which may lead to failure to respond to the expenditure demand. Of course, in a state where there are many government debts, the trend of contraction may appear not only in defense expenditures and public health expenditures, but also in other sectors. However, it can be expected that defense expenditures and public health expenditures, which have a large share of government expenditure, will be more affected than other sectors. Thus, it can be concluded that as government debt increases, government expenditure (defense expenditure and public health expenditure) decreases. Based on the above discussion, the following hypothesis was established:

- Hypothesis 4: Government debt negative impacts defense expenditure and public health expenditure.

Dataset and Variables

This paper uses a national panel data for the period 2000–2014. Variables were selected based on the open data released in 2020 by the Quality of Government Institute. A total of 131 countries are targeted for analysis, except for missing values. Data before 2002 were not included because their continuity cannot be secured, and STATA version 14.1 was used as a statistical program. Table 1 presents the descriptions of the variables and their corresponding data sources.

The dependent and independent variables are defense expenditure and public health expenditure, respectively. Data from the World Development Indicators (WDI) are used for defense and public health expenditures (public). The measurement % of government total expenditure has been logarithmically transformed. OGE were calculated as the total government expenditure minus defense expenditure and public health expenditure (% of government total expenditure). Many advanced studies have used the WDI data to indicate government, defense, and public health expenditures (Fan et al., 2018; Hess & Mullan, 1988; Hewitt, 1992; Khalid & Noor, 2015; Lin et al., 2015).

The lagged variables of defense and public health expenditures used to verify incrementalism theory hypothesis were set with a time gap of 1 year. In other words, the lagged variable affecting defense expenditure in 2001 was set as defense expenditure in 2000. Generally, the fiscal year of the country is budgeted and settled on a yearly basis. In this process, the government's budget proposal is decided based on various factors based on the previous year, and the budget deliberation of the National Assembly is also affected.

Control variables were constructed based on of general economic status. Government debt variable used the logarithmically transformed value of the WDI's total government debt (US dollar). Growth domestic product (GDP) used the logarithmically transformed value of the IMF's GDP index. Democratic index uses to measure the democracy level of the Freedom House and corruption index of Transparency International were used as variables related to the regime and institutions. WDI's foreign direct investment index was used as economic variables and estimated % of GDP. In addition, CSPV's citizen, race, and international violence scores were used as indicators

Table 1. Variables, measurements, and sources

Variables	Description	Source
DE (log)	Ratio of military expenditure (% of government total expenditure)	WDI
HE (log)	Ratio of public public health expenditure (% of government total expenditure)	WDI
DEBT (log)	Government debt (billions, US dollars)	WDI
OGE (log)	Ratio of other government expenditure (excluding military and public public health expenditure, % of government total expenditure)	WDI
GDP (log)	Gross domestic spending per capita (billions, US dollars)	WDI
DI	Level of democracy (0–10)	FH
CP	Corruption perception index (0–100)	TI
FDI	Foreign direct investment (% of GDP)	WDI
CI	Magnitude score of civil, ethnic, international violence (0–2)	CSPV
POP	Total population (in millions)	WDI

DE, Defense Expenditure; HE, Health Expenditure; DEBT, Government Debt; OGE, Other Government Expenditure; GDP, Gross Domestic spending Per capita; DI, Democracy Index; CP, Corruption Perception index; FDI, Foreign Direct Investment; CI, Civil International violence; POP, Population; WDI, World Development Indicators; FH, Freedom House; TI, Transparency International; CSPV, Center for the Study and Prevention of Violence

https://doi.org/10.52372/jps.e687

of domestic instability. Finally, the total population of WDI was also included.

Research Methodologies

Contrary results regarding the relationship between defense and public health expenditures have been presented. Differences in results were identified depending on methods, period, and target of analysis. Ordinary least squares (OLS), pooled OLS, seemingly unrelated model (SUR), and SEMs were applied as analysis methods, and the results are inconsistent in advanced researches.

The SEMs is the most rigorous because it considers endogenous variables in the three models. The residual term and endogenous variable are correlated when the term is characterized by the endogenous variable. In this case, the OLS estimate is biased (Greene, 2012; Wooldridge, 2009). Moreover, as mentioned previously, results can be considered as a consistent and efficient estimation in that the analysis result of the SEMs can reduce errors compared with the 2SLS model (Henningsen & Hamann, 2008; Kapteyn & Fiebig, 1981; Kennedy, 2008; Li, 1993; Larcker & Rusticus, 2010; Zellner & Theil, 1962).

However, if the SEMs does not contain group and year variables, this model is considered as independent observation data (pooled data), which differ from panel analysis. In this study, the panel fixed effects model will be applied and analyzed in addition to SEMs. For the results of the panel random effects model, the Hausman test (Hausman, 1978) results will be reported.

The advantage of the panel fixed effects model is that the amount of change in each country can be recognized, considering factors that do not change over time. In addition, some of the unobservable factors can be used to control error of estimation results on defense expenditure and public health expenditure (Greene, 2012; Wooldridge, 2009). Finally, an additional analysis will be conducted to confirm the robustness of research results, including the results of each country group based on median GDP.

Model 1 (panel fixed effects)

$$ln\,DE_{it} = \beta_0 + \beta_1 laglnME_{it} + \beta_2 lnHE_{it} + \beta_3 lnOGE_{it} + \beta_4 lnDEBT_{it} + \beta_5 lnGDP_{it} + \beta_6 DI_{it} + \beta_8 lnFDI_{it} + \beta_9 CI_{it} + X_{it}\gamma + \varepsilon_{it}$$

$$lnDE_{it} = \beta_0 + \beta_1 lag\ lnDE_{it} + \beta_2 lnHE_{it} + \beta_3 lnOGE_{it} + \beta_4 lnDEBT_{it} + \beta_5 lnGDP_{it} + \beta_6 DI_{it} + \beta_7 CP_{it} + \beta_8 lnFDI_{it} + \beta_9 CI_{it} + X_{it}\gamma + \varepsilon_{it}$$

Model 2 (simultaneous equation models [SEMs])

$$lnHE_{it} = \beta_0 + \beta_1 laglnHE_{it} + \beta_2 lnDE_{it} + \beta_3 lnOGE_{it} + \beta_4 lnDEBT_{it} + \beta_5 lnGDP_{it} + \beta_6 DI_{it} + \beta_7 CP_{it} + \beta_8 lnFDI_{it} + \beta_9 CI_{it} + X_{it}\gamma + \varepsilon_{it}$$

$$lnDE_{it} = \beta_0 + \beta_1 lag\ lnDE_{it} + \beta_2 lnHE_{it} + \beta_3 lnOGE_{it} + \beta_4 lnDEBT_{it} + \beta_5 lnGDP_{it} + \beta_6 DI_{it} + \beta_7 CP_{it} + \beta_8 lnFDI_{it} + \beta_9 CI_{it} + X_{it}\gamma + \varepsilon_{it}$$

$$lnOGE_{it} = \beta_0 + \beta_1 laglnHE_{it} + \beta_2 lag\ lnDE_{it} + \beta_3 lnHE_{it} + \beta_4 lnDE_{it} + \beta_5 lnOGE_{it} + \beta_6 lnDEBT_{it} + \beta_7 lnGDP_{it} + \beta_8 DI_{it} + \beta_9 CP_{it} + \beta_{10} lnFDI_{it} + \beta_{11} CI_{it} + X_{it}\gamma + \varepsilon_{it}$$

where $lnHE_i$, $lnDE_i$, $laglnHE_i$, $lagInDE_i$ for example, is the expenditure measure of each

country i; X_i is a vector of control variables for POP.

Results of Analysis

The analysis observations totaled 1,495. In the case of defense expenditures and public health expenditures, the difference between the minimum and maximum values for each country was significantly large. It waanalyzed as -0.6378–3.5981 for national preventive expenditure and 0.2214–3.6659 for public health expenditure. Table 2 reports the number of observations, means, standard deviations, and the minimum and maximum values for each variable.

The histograms of defense and public health expenditures are in the form of a normal distribution, and performing regression analysis for SEMs, and panel fixed effects had no problem, which are to be applied in this study (Fig. 1).

The average ratio of defense expenditure increased by approximately 1% in early 2000 and then returned to the previous rate. In contrast, the average ratio of public health expenditure has been increasing slightly since 2008. Table 3 presents the annual average values of military expenditure,

Table 2. Basic statistics

Variables	Obs	Mean	Std. dev.	Min	Max
lnDE	1,495	1.6821	0.7345	−0.6378	3.5981
lnHE	1,495	2.4029	0.4207	0.2214	3.6659
laglnDE	1,415	1.6893	0.7307	−0.6378	3.5981
laglnHE	1,415	2.4039	0.4185	0.2214	3.6659
lnDEBT	1,495	3.6710	0.7650	−0.3079	6.4660
lnOGE	1,495	4.3921	0.0753	4.0555	4.5653
lnGDP	1,495	8.5485	1.5645	4.7128	11.6593
DI	1,495	7.0079	2.9127	0.0000	10.0000
CP	1,495	44.3439	21.9229	8.0000	100.0000
lnFDI	1,495	1.0568	1.1914	−6.5235	5.5307
CI	1,495	0.0127	0.1287	0.0000	2.0000
POP	1,495	32.4984	49.5365	0.4440	318.7890

DE, Defense Expenditure; HE, Public Health Expenditure; DEBT, Government Debt; OGE, Other Government Expenditure; GDP, Gross Domestic spending Per capita; DI, Democracy Index; CP, Corruption Perception index; FDI, Foreign Direct Investment; CI, Civil International violence; POP, Population; Obs, Observation; Std. dev, Standard deviation; Min, Minimum; Max, Maximum

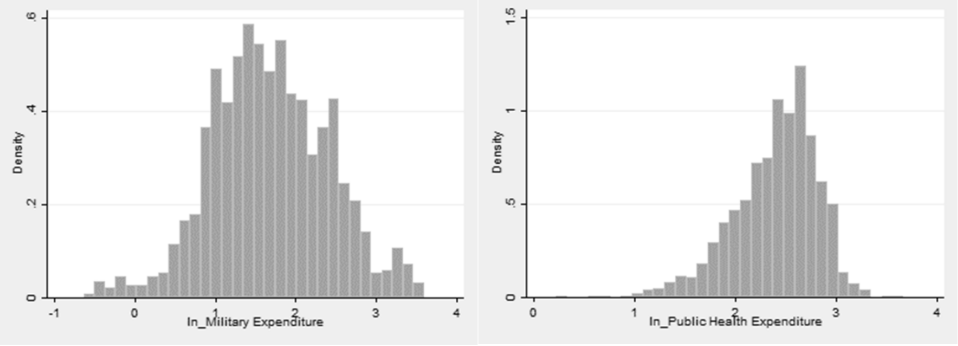

Fig. 1. Histograms of defense expenditure and public health expenditure.

https://doi.org/10.52372/jps.e687

Table 3. Mean of defense expenditure, public health expenditure, and other government expenditure

Years	lnDE	lnHE	lnOGE
2000	6.8186	11.6305	81.5508
2001	6.6703	11.9278	81.4018
2002	6.6218	11.6792	81.6989
2003	7.5915	11.3915	81.0169
2004	7.7331	11.5524	80.7144
2005	7.6237	11.8817	80.4945
2006	7.5865	12.0689	80.3445
2007	7.3374	11.7787	80.8837
2008	6.9438	11.8050	81.2510
2009	6.8794	12.0208	81.0997
2010	6.4572	12.1641	81.3785
2011	6.3788	12.3501	81.2709
2012	6.2468	12.4320	81.3211
2013	6.6005	12.4232	80.9762
2014	6.6160	12.8759	80.5079

DE, Defense Expenditure; HE, Public Health Expenditure; OGE, Other Government Expenditure

health expenditure, and other government expenditures.

Results of Simultaneous Equation Models (SEMs), and Panel Fixed Effects Model

Table 4 shows the results of SEMs and panel fixed effects model. Crowding out effects between defense expenditure and public health expenditure are present in all models. The impact of public health expenditure on defense expenditures was −0.2743*** and −0.3447*** using SEMs and panel fixed effects model. The impact of defense expenditure on public health expenditure was −0.1401*** and −0.2591*** using SEMs and panel fixed effects model. This result supports hypothesis 1, indicating a negative relationship between defense expenditure and public health expenditure.

This negative relationship has also been seen in relations between defense and public health expenditure and expenditures in other government sectors. The impact of OGE on defense expenditure was −2.0969*** and −3.6079*** using SEMs and panel fixed effects model, and on public health expenditure was −1.7610*** and −3.5994*** using SEMs and panel fixed effects model. This result supports hypothesis 2. It may be a predictable result that when budget expenditures in other fields increase, defense expenditure and public health expenditure decrease. This study considered the impact of budget expenditures in other fields, but it should not be overlooked that the purpose is to comprehensively analyze the relationship between defense expenditure and public health expenditure as a crowding out effect even if such an impact occurs. That is why it is significant that hypothesis 2 was statistically supported.

To confirm the incremental budget decision theory, the lagged variable was considered. Based on the analysis results, the incremental budget decision theory of hypothesis 3 was adopted. First, defense expenditure in the following year increased to 0.8118*** and 0.3940*** using SEMs and panel

Table 4. Results of SEMs, and panel fixed effects model

Variables	SEMs (1)	SEMs (2)	Panel fixed effects (3)	Panel fixed effects (4)
	lnDE	lnHE	lnDE	lnHE
lnDE		−0.1401***		−0.2591***
		(0.0095)		(0.0201)
lnHE	−0.2743***		−0.3447***	
	(0.0198)		(0.0267)	
laglnHE (T-1)		0.7170***		0.2692***
		(0.0138)		(0.0190)
laglnDE (T-1)	0.8118***		0.3940***	
	(0.0106)		(0.0162)	
lnDEBT	−0.0199***	−0.0114**	−0.0359***	−0.0199**
	(0.0057)	(0.0049)	(0.0097)	(0.0090)
lnOGE	−2.0969***	−1.7610***	−3.6079***	−3.5994***
	(0.1139)	(0.0925)	(0.1307)	(0.1126)
lnGDP	0.0008	−0.0075	−0.0819***	−0.0123
	(0.0059)	(0.0051)	(0.0122)	(0.0115)
DI	0.0100***	0.0115***	0.0097	0.0157***
	(0.0022)	(0.0018)	(0.0060)	(0.0055)
CP	−0.0015***	−0.0005	−0.0008	−0.0002
	(0.0003)	(0.0003)	(0.0007)	(0.0007)
lnFDI	−0.0017	−0.0075**	0.0073**	−0.0018
	(0.0035)	(0.0030)	(0.0037)	(0.0034)
CI	−0.0179	−0.0037	−0.0189	−0.0195
	(0.0343)	(0.0297)	(0.0299)	(0.0275)
POP	0.0001	−0.0000	0.0016	0.0050***
	(0.0001)	(0.0001)	(0.0011)	(0.0010)
Constant	10.1923***	8.6416***	18.8133***	18.1177***
	(0.5558)	(0.4496)	(0.6480)	(0.5743)
Observations	1,415	1,415	1,415	1,415
Adj R-sq/R-sq	0.9604	0.9088	0.7060	0.6640
Countries	136	136	136	136
Hausman test			p<0.000	p<0.000
Breusch-pagan test		220.0512***		

Standard errors in parentheses * p<0.1, ** p<0.05, *** p<0.01.
DE, Defense Expenditure; HE, Public Health Expenditure; DEBT, Government Debt; OGE, Other Government Expenditure; GDP, Gross Domestic spending Per capita; DI, Democracy Index; CP, Corruption Perception index; FDI, Foreign Direct Investment; CI, Civil International violence; POP, Population; SEMS, Simultaneous Equation Models

fixed effects model, as defense expenditure in the past year increased. As public health expenditures increased in the past year, public health expenditures in the following year also increased to 0.7170*** and 0.2692*** using SEMs and panel fixed effects model. It is also significant that the results of the incremental budget theory have been statistically verified. This is because incremental budget decisions are being made in the government's budget-setting and decision-making processes. This result not only explains that incremental budget decisions themselves have an impact on defense expenditure and public health expenditure, but also that the relationship between defense

https://doi.org/10.52372/jps.e687

expenditure and public health expenditure is maintained even when such an impact exists.

Government debt has also been shown to decrease defense expenditure and public health expenditure. As government debt increases, defense expenditure is −0.0199*** and −0.0359*** using SEMs and panel fixed effects, and public health expenditure is −0.0114** and −0.0199** using SEMs and panel fixed effects model. This result satisfies hypothesis 4, and government debt has a negative relationship with defense expenditure and public health expenditure. The negative impact on defense expenditure and public health expenditure when government debt increases is also a very important result. This is because the ratio of defense expenditure and public health expenditure, which can be said to be large areas of expenditure, decreases as government debt increases. However, it is meaningful in that the crowding out effect between defense expenditure and public health expenditure occurs even in this decreasing situation.

Crowding out effects between defense expenditure and public health expenditure remained stable in the model including lagged dependent variables of defense expenditure and public health expenditure. In addition, the relationship with OGE, excluding defense and public health expenditures, remained negative. Government debt also remained by reducing defense expenditure and public health expenditure. The ratio of defense expenditure and public health expenditure is affected by budget spending in other areas (negative effect), incremental budget spending decisions (positive effect), and the impact of government debt (negative effect). Considering these negative and positive effects on defense expenditure and public health expenditure, we can not only verify the theory of government expenditure but also confirm the trend of budget spending in each country. More importantly, the relationship between defense expenditure and public health expenditure showed a crowding out effect even amidst these various effects of budget spending.

This study discussed the relationship between defense expenditure and public health expenditure by considering both the crowding out effect and the growth stimulating effect. Unlike previous studies that focused only on the relationship between defense expenditure and public health expenditure, this study analyzed the main theories that affect defense expenditure and public health expenditure themselves. The purpose is to confirm whether the crowding out effect is maintained even when considering these effects simultaneously. What can be seen through the analysis results is that even if these effects are statistically significant, the relationship between defense expenditure and public health expenditure appears as a crowding out effect.

High Growth Domestic Product (GDP) Countries vs. Low GDP Countries

Table 5 shows the SEMs results of dividing and analyzing the two groups based on the median value of the total GDP of the countries. The reason for conducting additional analysis here is that each country has different priorities and policy considerations for budget expenditures. In this study, we included several control variables that could affect the relationship between defense expenditure and public health expenditure in the model and conducted the analysis. Among them, we divided the countries into two groups based on GDP as a variable that can classify the characteristics of the countries, and analyzed the relationship between defense expenditure and public health

Table 5. Results of SEMs of high GDP countries and low GDP countries

Variables	High GDP SEMs (5) lnDE	High GDP SEMs (6) lnHE	Low GDP SEMs (7) lnDE	Low GDP SEMs (8) lnHE
lnDE		−0.1913***		−0.0696***
		(0.0158)		(0.0097)
lnHE	−0.3882***		−0.1417***	
	(0.0341)		(0.0200)	
laglnHE (T-1)		0.6228***		0.8442***
		(0.0215)		(0.0174)
laglnDE (T-1)	0.7361***		0.9042***	
	(0.0182)		(0.0095)	
lnDEBT	−0.0383***	−0.0256***	−0.0016	−0.0034
	(0.0115)	(0.0095)	(0.0046)	(0.0045)
lnOGE	−2.9843***	−2.4248***	−1.0215***	−0.9202***
	(0.1997)	(0.1499)	(0.0999)	(0.0964)
lnGDP	0.0317***	0.0028	−0.0252***	−0.0149**
	(0.0121)	(0.0101)	(0.0070)	(0.0070)
DI	0.0104***	0.0121***	0.0031	0.0082***
	(0.0035)	(0.0028)	(0.0023)	(0.0023)
CP	−0.0006	0.0005	0.0000	0.0001
	(0.0009)	(0.0007)	(0.0003)	(0.0003)
FDI	−0.0068	−0.0125**	0.0013	−0.0030
	(0.0068)	(0.0057)	(0.0028)	(0.0027)
CI	0.0721	0.0881	−0.0315	−0.0325
	(0.1060)	(0.0884)	(0.0237)	(0.0236)
POP	0.0000	−0.0003*	0.0002***	0.0001*
	(0.0002)	(0.0001)	(0.0001)	(0.0001)
Constant	14.2130***	11.8393***	5.1914***	4.6169***
	(0.9864)	(0.7273)	(0.4934)	(0.4749)
Observations	684	684	731	731
R-squared	0.9270	0.8876	0.9868	0.9373
Breusch-pagan test	135.7938***		86.1426***	

Standard errors in parentheses * p<0.1, ** p<0.05, *** p<0.01.
DE, Defense Expenditure; HE, Public Health Expenditure; DEBT, Government Debt; OGE, Other Government Expenditure; GDP, Gross Domestic spending Per capita; DI, Democracy Index; CP, Corruption Perception index; FDI, Foreign Direct Investment; CI, Civil International violence; POP, Population; SEMS, Simultaneous Equation Models.

expenditure.

The main results remained stable in the results of classifying high- and low-GDP countries. First, crowding out effects between defense and public health expenditures were the same between the two country groups (high GDP: −0.3882***, −0.1913***; low GDP: −0.1417***, −0.0696***). Second, the negative relationship between defense and public health expenditure and other government sectors was also the same between the two country groups (high GDP: −2.9843***, −2.4248***; low GDP: −1.0215***, −0.9020***) Third, the positive effect of the incremental budget theory was the same between the two country groups (high GDP: 0.7361***, 0.6228***; low GDP: 0.9042***, 0.8442***).

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The difference between the two groups of countries was also analyzed. The effect of government debt on high- and low-GDP country groups was different. The effect of government debt on defense expenditure and public health expenditure was significantly negative in high-GDP countries only (−0.0383***, −0.0256***).

Table 6 shows the fixed effects results of dividing and analyzing the two groups based on the median value of the total GDP of the countries. The main results remained stable in the results of classifying high- and low-GDP countries. First, crowding out effects between defense and public health expenditures were the same between the two country groups (high GDP: −0.1981***,

Table 6. Results of fixed effects model of high GDP countries and low GDP countries

Variables	High GDP panel fixed effects (9) lnDE	High GDP panel fixed effects (10) lnHE	Low GDP panel fixed effects (11) lnDE	Low GDP panel fixed effects (12) lnHE
lnDE		−0.1666***		−0.3041***
		(0.0264)		(0.0316)
lnHE	−0.1981***		−0.3824***	
	(0.0360)		(0.0399)	
laglnHE (T-1)		0.3530***		0.2145***
		(0.0293)		(0.0284)
laglnDE (T-1)	0.5534***		0.3090***	
	(0.0224)		(0.0243)	
lnDEBT	−0.0405***	−0.0077	−0.0101	−0.0099
	(0.0106)	(0.0103)	(0.0196)	(0.0183)
lnOGE	−2.5513***	−3.0582***	−3.9461***	−3.8391***
	(0.1787)	(0.1546)	(0.1902)	(0.1680)
lnGDP	−0.0809***	0.0006	−0.0640**	0.0001
	(0.0140)	(0.0139)	(0.0260)	(0.0242)
DI	−0.0065	0.0125	0.0165*	0.0139*
	(0.0100)	(0.0096)	(0.0086)	(0.0080)
CP	0.0014**	0.0000	−0.0037**	−0.0025*
	(0.0007)	(0.0006)	(0.0015)	(0.0014)
FDI	0.0047	−0.0006	0.0141*	−0.0095
	(0.0031)	(0.0030)	(0.0080)	(0.0074)
CI	−0.0297	−0.0168	0.0426	0.0406
	(0.0230)	(0.0222)	(0.0848)	(0.0785)
POP	−0.0003	−0.0004	0.0034**	0.0074***
	(0.0016)	(0.0015)	(0.0017)	(0.0016)
Constant	13.6641***	15.5212***	19.3415***	18.9788***
	(0.8896)	(0.7847)	(0.9990)	(0.8900)
Observations	684	684	731	731
R-squared	0.6635	0.6583	0.7816	0.6509
Hausman test	p<0.000	p<0.000	p<0.000	p<0.000

Standard errors in parentheses * p<0.1, ** p<0.05, *** p<0.01.
DE, Defense Expenditure; HE, Public Health Expenditure; DEBT, Government Debt; OGE, Other Government Expenditure; GDP, Gross Domestic spending Per capita; DI, Democracy Index; CP, Corruption Perception index; FDI, Foreign Direct Investment; CI, Civil International violence; POP, Population.

−0.1666***; low GDP: −0.3824***, −0.3041***). Second, the negative relationship between defense and public health expenditure and other government sectors was also the same between the two country groups (high GDP: −2.5513***, −3.0582***; low GDP: −3.9461***, −3.8391***) Third, the positive effect of the incremental budget theory was the same between the two country groups (high GDP: 0.5534***, 0.3530***; low GDP: 0.3090***, 0.2145***).

The difference between the two groups of countries was also analyzed. The effect of government debt on high- and low-GDP country groups was different. The effect of government debt on defense expenditure was significantly negative in high-GDP countries only (−0.0405***).

When comparing the results of SEMs (Table 5) and Fixed Effects (Table 6), the results remained stable, and only the impact of government debt on public health expenditure was not statistically significant. These results also confirm the robustness of research on the effects of crowding-out, incrementalism theory, and government debt.

These results may be due to the influence of fiscal policies, such as fiscal rules existing in high-GDP countries. According to fiscal rules, if government debt exceeds a certain level, then incentives will be created to reduce government spending. Another interpretation is that in the case of low-GDP countries, reducing the expenditure on these two sectors is difficult because the fundamental demands of defense and public health expenditures are necessary to maintain the government. These demands include national security and safety, medical expenses, pharmaceutical expenses, and health expenses. Thus, further analysis of these influencing factors is needed in future studies.

Conclusion and Discussion

This study identified the relationship between defense expenditure and public health expenditure and confirmed the effects of budget's incrementalism theory and government debt. Research results confirmed that the relationship between defense expenditure and public health expenditure was the crowding out effects. In addition, the hypothesis of the incrementalism theory was analyzed considering that the lagged dependent variable was adopted. Lastly, government debt was analyzed to reduce defense and public health expenditure.

Each analysis confirmed the stability of the results through SEMs, and panel fixed effects models. The results remained stable, though lagged dependent and government debt variables were included. Moreover, crowding out effects were maintained between high- and low-GDP countries. However, the effect of government debt significantly affected high-GDP countries only due to their stricter financial rules and fiscal policies.

As a limited resource, competition in each government ministry against the government budget is conducted by interlocking factors, such as the importance and authority of each ministry. The Ministry of National Defense and the Ministry of Health and Welfare are representative ministries of power and budget. Therefore, budget competition between the two is a common issue. According to interest group theory, the size of interest groups influences government expenditure (Mueller & Murrell, 1986). Particularly, beneficiaries of welfare expenditures can resist due to reduced spending. In the case of national defense expenditures, politicians must consider the political support of soldiers in terms of labor costs.

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When the budget of the ministry is enforced, such as a continuing expenditure, the budget is likely to be decided in a sustained or expanded form rather than reduced. Competition will emerge through additional budgets that arise while pushing for specific policies and projects in a budget that is set and executed similar to a fixed cost. In this process, national defense and welfare expenditures are in constant budget competition. This study did not cover the details and process of such budget competition. Thus, we intend to study more details in future studies.

However, budget competition occurs among government organizations in all countries and cannot be concluded as a negative phenomenon. This phenomenon is because the necessity of budget is presented more robustly for budget competition among ministries, and the limited budget can be used more efficiently. Budget competition within the government may be reasonable than political consideration on the legislature's regional budget. This reason is because politicians are likely to prioritize their electoral districts rather than consider national priorities because of their desire for re-election. Therefore, studying the government's budget proposal, legislative decision-making process, and enforcement procedures is necessary.

The recent global trend is that the proportion of public health expenditure is continuously increasing due to the change in population structure and life expectancy (Keehan et al., 2015; Sisko et al., 2019; Zhao et al., 2020). In addition, problems are also occurring due to information asymmetry in welfare policies caused by economic growth and population aging (Kwon & Lee, 2016). On the other hand, defense expenditure has maintained a similar trend or is declining (Fleurant & Quéau, 2020; Khan & Haque, 2019; Khan et al., 2021). In the case of South Korea, as suggested in Oh's (2018) study on the power index of ministries, the power and authority of the Ministry of Health is increasing significantly. Although the budget increase due to the increase in welfare demand is reasonable, the threat of war and terrorism still exists. From the realistic point of view of political science (Heywood, 2015), there are aspects that must be maintained in efforts to strengthen national defense capabilities to protect national interests and safety.

Defense and public health expenditures account for a large proportion of government expenditures and are important areas on which to base the country. However, citizens' preference for budget expenditure in the defense sector is lower than that in the health sector. They believe that the greater the expenditure in the health sector, the greater are the benefits (Sears & Citrin, 1982). The preference of citizens for their budget expenditure may be influence the government's budget expenditure. Future research on the conflicts and paradoxes that arise between the importance of budget and citizens' preferences is also needed.

In addition to the competitive relationship between defense expenditure and public health expenditure, the budgets of many government departments are also in a competitive situation. However, as Fukuyama (2017) argued, areas such as defense expenditure are essential budget expenditure areas for the existence of a country. There can always be tension between expenditure on these essential areas and expenditure on areas that citizens prefer. Even in recent conflicts between countries, the theory of realist politics is still useful in explaining the international order, and it also leads to an increase in the ratio of defense expenditure in each country. What we note from the results of this study is that while the relationship between defense expenditure and public health expenditure is important, each country needs to consider the relationship between the two

expenditures in the process of deciding and executing its budget. Citizens' preference for health expenditure is linked to politicians' incentives for reelection, but it is unlikely that direct incentives will occur through defense expenditure. In this situation, each country should set reasonable standards for defense expenditure in order to maintain the country. Rather than maintaining or strengthening the trade-off between defense expenditure and public health expenditure, efforts will also be needed to alleviate the trade-off by setting minimum standards in each field.

The Korean government is working to promote fiscal rules for efficient management of finance and budget (Kim & Park, 2024), and is producing positive results by strengthening the transparency of budget reporting for budget stability (Choi, 2022; Kim & Park, 2024). However, additional research is possible on structural problems of each country. From the perspective of budgetary incrementalism and bureaucratic expansion, it should be considered that the power of powerful ministries can be reflected in the budget (Choi & Jeong, 2017), and it would be possible to conduct good research on the management of budget expenditures due to economic recession by linking it with the study of government deficits by the U.S. House of Representatives Appropriations Committee (Lim, 2017).

It is true that the results analyzed in this study showed a crowding out effect, but in order to strengthen the external validity of this result, it is necessary to overcome the limitations of this study. Although we included variables in the analysis to control the characteristics of each country, we did not consider variables such as policy priorities. Each country has important policies and their priorities may vary. There are essential budget expenditures that can sustain and survive the country, and budget expenditures that are only possible when the prerequisites for the survival of the country are secured. Defense expenditure is important to all countries in that it is an expenditure for the survival of the country, but its importance may vary depending on various conditions such as politics, crisis, geography, and culture. Health expenditure also plays an important role as much as defense spending in terms of protecting the people. The areas of national budget expenditure are very diverse, but as shown in the basic statistical analysis of this study, the ratio of defense expenditure is decreasing while the ratio of health spending is increasing. Considering the size of the budgets in both areas, the results are the same as the results of this study, but it is true that there is a lack of analysis of the detailed decision-making process and relationships. The comprehensive analysis of the government's budget decision-making process, the budget adjustment process within the government, and the budget deliberation process of the National Assembly was not presented in the analysis results of this study. Authors will research this in future studies by conducting both qualitative and quantitative analyses.

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