A Comparative Economic Analysis of Personnel Operation and Maintenance Expenditures per Commissioned and Non-commissioned Officers: The Case of the Republic of Korea Army

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Abstract

With annual data for 1986 to 2011 from the Republic of Korea (hereafter Korea), the regression results are consistent with the hypothesis that each of commissioned and non-commissioned officers makes a substantial contribution to economic growth in Korea. The ceteris paribus mean elasticity of real income per capita with respect to each of annual average real personnel operation and maintenance expenditures per commissioned officer, non-commissioned officer, and officer shows that a change in real income per capita as a proxy for economic growth is not sensitive to each of annual average real personnel operation and maintenance expenditures per commissioned officer, non-commissioned officer, and officer. The mean elasticity for non-commissioned officer (0.210) is greater than that for commissioned officer (0.196). Therefore, the mean elasticities support the defense reform to recruit more non-commissioned officers.

Keywords: The Korea's defense reform 2014-30, annual average real personnel operation and maintenance expenditures per commissioned officer and non-commissioned officer, real income per capita, The error correction term

1. Introduction

An increase in annual average real personnel operation and maintenance (O&M) expenditure boosts economic growth, through an expansion of aggregate demand. Wilkerson and Williams (2008) argue that defense spending can benefit an economy-for example, by creating or maintaining a climate of national security necessary for both domestic and foreign private investment to flourish. More recently, Feldstein (2011) argues that since government spending on defense is a component of Gross Domestic Product (GDP), the immediate direct effect of a one billion dollar reduction in domestic defense spending is to reduce GDP by one billion dollars. The resulting reduction in pay to military personnel and in compensation to the employees of defense suppliers then causes their spending as consumers to decline. If defense suppliers expect the reduced level of defense spending to be sustained, the defense suppliers will also cut their demand for equipment. The total effect of the one billion dollar reduction in defense spending is to reduce GDP by more than a billion dollars, perhaps about two billion dollars. Alptekin and Levine (2012) use a meta fixed and random effects with 32 empirical studies and present the results that 40% of the 169 estimates find a negative relationship with only 38% statistically significant, whereas 60% of the 169 estimates find a positive relationship between military expenditure and the growth rate of income, with almost half of these are statistically significant.

On the other hand, Korea's National Defense Ministry announced "the Korea's defense reform 2014-30" (The Korea Observer, March 7, 2014). The gist of the defense reform 2014-30 is to recruit more non-commissioned officers to train them as highly skilled forces and to reduce soldiers. Most of the reduction comes from the army, which heavily relies on conscripts. The troop cuts are inevitable, given demographic changes the low birth rate has caused. For example, the number of 20-year old men is predicted to reach 308,000 in 2020 and 233,000 in 2025 (Korean National Statistical Office, 2014).

With unique annual average real personnel O&M expenditure level annual time series data for the period 1986 to 2011 from Korea, we examine whether annual average real personnel O&M expenditures by ranks influence real factor cost national income (real income) per capita. The ranks are classified into three groups: commissioned officer (CO), non-commissioned officer (NCO) including warrant officer, and officer (both CO and NCO)

2. Analytical Framework

In order to test for the hypothesis that the differences in each of annual average real personnel O&M expenditures per CO, NCO, and officer are causal to the differentials in real income per capita, the following function can be formulated:

FCY_t=f (FCY_{t-1}, MPE_{jt}, L_t, K_t, PC_t, $TECH_t$, $EXIM_t$); j=1, 2, 3 (1)

Where *j*=1, 2, 3 stand for CO, NCO, and officer, respectively. The estimated Pearson correlation coefficient between $MPE_1$and MPE_2 is 0.988, implying that two variables are highly correlated. Therefore, these variables are included in separate regressions *t* represents year. We include a lagged dependent variable (i.e., lagged real income per capita) as an explanatory variable to limit the potential impact of reversed causality (Stel et al., 2005).Table 1 provides a description of the variables used in the model. The rank order correlation coefficients between *L* and *EXIM*, and between *K* and *EXIM* are 0.975 and 0.939, respectively, suggesting that *EXIM* is highly correlated with *L* and *K*. This implies that the fit is affected by multicollinearity. Therefore, *EXIM* will be excluded from equation 1. An error correction model (ECM) allows us to study the short-run dynamics in the relationship between real income per capita and each of annual average real personnel O&M expendituresby three ranks. For example,

ΔFCY_t=h(ΔFCY_{t-1}, ΔMPE_{jt}, ΔL_t, ΔK_t, ΔPC_t, $\Delta TECH_t$, $\Delta EXIM_tS_{t-1}$) (2)

whereS_{t-1} denotes the error correction term (see Wooldridge, 2000). Equation 1 represents for well-behaved production functions exhibiting everywhere diminishing returns to inputs.

3. Data

Table 1 contains the commonly used Kolmogorov and Smirnov tests for normality and shows that the tests fail to reject the hypothesis of normal distribution for both *FCY* and MPE_j. We analyse OLS results over the ML (Maximum Likelihood Procedure) results because we limited our observations to 26years, which do not generate a sufficient number of observations.

Table 1: Definition of Variables

Variable	Mean (SD)	K-S Normality test (z value)[1)]
FCY[2)]= Real factor cost national income per capita	1051.524 (346.387)	Accept H_0 (0.502)
MPE_1[3)]=annual average real personnel O&M expenditure per CO	2564.662 (330.437)	Accept H_0 (0.765)
MPE_2[3)]=annual average real personnel O&M expenditure per NCO	3348.908 (428.863)	Accept H_0 (0.732)
MPE_3[3)]= annual average real personnel O&M expenditure per officer	5913.571 (757.091)	Accept H_0 (0.821)
L[4)]= The number of employees aged 15 years or over	206.811 (24.809)	Accept H_0 (0.542)
K[5)]=real domestic investment per capita	434.952 (123.781)	Accept H_0 (0.542)
PC[6)]= business corruption	0.326 (0.138)	Accept H_0 (0.751)
TECH[7)] The number of patents	92.773 (58.287)	Accept H_0 (0.755)
EXIM[8)]=The sum of exports and imports of goods and services	915.218 (504.438)	Accept H_0 (0.736)

Notes: 1). Kolmogorov-Smirnov Test. The Z-value in parenthesis denotes the estimated absolute value.The alternatives are: H_0=the fits of a normal distribution to the sample data is adequate. By "Accept H_0" we strictly mean "cannot reject H_0".The α risk is controlled at 0.01 on a two-tailed test.
2), 3), 5). In ten thousand Korean won. Converted with GPD deflator.
4). Inhunred thousand persons aged 15 years and over. Permanent employees, Temporary and Daily employees.
6). In thousand. The number of unfair trade practice.
7). In thousand. The number of patents used as a proxy for technological development.
Source: 2), 5), 8). Korea National Statistical Office and Korea Institute for Industrial Economics & Trade.
3). Security Management Institute and Republic of Korea Army Headquarters.
4). Yearbook of Employment and Labor Statistics, Ministry of Employment and Labor.
6). Annual Statistical Reports, The Korea Fair Trade Commission.
7). Application by year, Korean Intellectual Property Office.

4. Estimation Results

We have dealt with the functional form issues using the Theil maximum adjusted multiple determination (Adj.R^2) criterions and have found the linear transformation suitable. On the basis of the estimated values of the R^2, F, Durbin-Watson (D.W.), and RESET2 tests in Table 2, it can be suggested that correct specifications are implied in all the three estimated OLS regressions. On the other hand, heteroskedasticity could not be detected because the estimated values for F are less than the 90% critical values. In Table 2, the OLS estimates suggest that an increase in each of annual average real personnel O&M expenditures per CO, NCO, and officer enhances real income per capita. The *ceteris paribus* mean elasticity of real income per capita with respect to each of annual average real personnel O&M expenditures per CO, NCO, and officer (§) is less than 1.0, implying that a change in real income per capita as a proxy for economic growth is not sensitive to each of annual average real personnel O&M expenditures per CO, NCO, and officer. For example, the mean elasticity for NCO (0.210) suggests that a 10 per cent increase in annual average real personnel O&M expenditure per NCO increases real income per capita by 2.1 per cent. The mean elasticity for NCO is greater than that for CO (0.196). Therefore, the results support the Korea's defense reform 2014-30 to recruit more NCOs.

Table 2: The Effect of MPE_j on Real Income Per Capita: OLS Estimates[1]

Independent Variables	Dependent Variable(FCY_t) (1)	(2)	(3)
FCY_{t-1}	0.524 (0.112)***	0.503 (0.115)***	0.511 (0.113)**
MPE_{1t}	0.080 (0.022)***		
MPE_{2t}		0.066 (0.018)***	
MPE_{3t}			0.036 (0.010)***
L_t	4.245 (2.120)*	4.423 (2.145)*	4.368 (2.133)*
K_t	0.291 (0.163)*	0.283 (0.164)*	0.286 (0.163)*
$TECH_t$	0.403 (0.414)	0.390 (0.414)	0.393 (0.414)
PC_t	-127.553 (31.638)***	-113.596 (31.696)***	-119.896 (31.561)***
Constant	-680.605 (327.400)*	-712.766 (332.797)**	-702.517 (330.273)**
§	0.196	0.210	0.202
Causality test[2]	F=212.634***	F=214.263***	F=213.284***
R^2 (Adj.R^2)	0.998 (0.997)	0.998 (0.997)	0.998 (0.997)
F	1230.765***	1237.304***	1238.467***
D.W.	2.020	2.001	2.006
RESET2[3]	t=1.599	t=1.291	t=1.426
Homoskedasticity[4]	F=0.781	F=0.749	F=0.759

Notes:1). Values in parentheses are the estimated absolute standard errors of the regression coefficients.
***, **, and * indicate significance at the 1%, 5%, and 10% levels on a two-tailed test, respectively. § stands for the *ceteris paribus* mean elasticity of real income per capita with respect to each of real personnel O&M expenditures per CO (MPE_1), NCO (MPE_2), and officer (MPE_3).
2). for the test procedure see Stock and Watson (1989). Conditional on one period lag of each of control variables.
3). for the test procedure see Beggs (1988).
4). for the test procedure see Dowrick (1993).

The estimated ECM results in Table 3 indicate that the error correction coefficient is negative and significant. A negative and statistically significant error correction term implies that the null hypothesis of no cointegration is rejected at the 1% level when one period lag is used. This implies, for example, that real income per capita in the previous period has overshot the equilibrium; real income per capita falls by 10~40 Korean won on average in the next year (Wooldridge, 2000).

Table 3: Estimates of the error correction terms[1]

Error Correction Term	Dependent Variable(FCY_t)		
	(1)	(2)	(3)
S_{t-1}	-0.001	-0.004	-0.003
F	23.001***	23.767***	24.229***
Adj.R^2	0.870	0.874	0.876
D.W.	2.026	2.137	2.116

Notes: 1). See Notes in Table 2.

5. Concluding Remarks and Policy Implications

The overall results and analysis of the estimated models allow for the following summary remarks to be made regarding the propositions tested.

1. The regression results are consistent with the hypothesis that annual average real personnel O&M expenditures per CO, NCO, and officer in Korea army have beneficial effects on real income per capita, implying that each of them makes a substantial contribution to real income per capita as a proxy for economic growth.
2. The *ceteris paribus* mean elasticities imply that real income per capita is not sensitive to a change in annual average real personnel O&M expenditures per CO, NCO, and officer. For example, the mean elasticity for each of CO (0.196), NCO (0.210), and officer (0.202) suggests that a 10 per cent increase in annual average real personnel O&M expenditure per CO, NCO, and officer increases real income per capita by 1.96 per cent, 2.10 per cent, and 2.02 per cent, respectively. On that basis, more non-commissioned officers as well as commissioned officers will lead to higher economic growth. The mean elasticities support the defense reform to recruit more NCOs.
3. The estimated ECM results imply that real income per capita in the previous period has overshot the equilibrium

To summarise, more officers, whether it be to COs or to NCOs, are an important influence upon economic growth subject to the Korea-US alliance (see, e.g., Bennett, 2006). Given the importance of national security, therefore, the Korea's defence reform 2014-30 provides a useful approach for sustainable economic growth.

References

Alptekin, A. and Levine, P. (2012). "Military Expenditure and Economic Growth: A Meta-Analysis." European Journal of Political Economy. Vol. 28. No.4, pp. 636-650.

Beggs, J. J. (1988). "Diagnostic Testing in Applied Econometrics."Economic Record. Vol. 64. No. 2, pp. 81-101.

Bennett, B. W. (2006). "A Brief Analysis of the Republic of Korea's Defense Reform Plan." Rand National Defense Research Institute Occasional Paper 165. pp. 1-43.

Dowrick, S. (1993)."Estimating the Impact of Government Consumption on Growth: Growth Accounting and Optimising Models." Paper presented at the Combined Economics Department and Associated Research Programs Seminar/Workshop series, University of Wollongong, NSW. Australia.

Feldstein, M. S. (2011). "The Effect on the U.S. Economy of Changes in Defense Spending." Testimony to the Committee on Armed Services of the U.S. House of Representatives, October 26.

Stel, A. V., Carree, M. and Thurik, R. (2005)."The Effect of Entrepreneurial Activity on National Economic Growth."Small Business Economics. Vol. 24. No. 3, pp. 311-321.

Stock, J. H. and Watson, M. W. (1989)."Interpreting the Evidence on Money-Income Causality."Journal of Econometrics. Vol. 40, pp. 161–81.

Wilkerson, C. R. and Williams, M. D. (2008). "How Is the Rise in National Defense Spending Affecting the Tenth District Economy?" Economic Review. Federal Reserve Bank of Kansas City. Vol. 93. No. 2, pp. 49-79.

Wooldridge, J. M. (2000). Introductory Econometrics: A Modern Approach. USA: South-Western College Publishing.