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The Relationship between Defense, Education and Health Expenditures in Selected Asian Countries

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Abstract

This study explores the inter-relationship between military expenditure, education expenditure and health expenditure in eight selected Asian countries namely Malaysia, Indonesia, Singapore, Philippines, Bangladesh, Nepal, Sri Lanka and South Korea. Autoregressive Distributed Lag-Restricted Error Correction Model (ARDL-RECM) procedure was utilized in the analysis. The empirical results suggest that, except for the case of Malaysia and Sri Lanka, whereby no meaningful interrelationship was detected between these three variables, the results for the rest of the countries are mixed, with differing granger causality being detected among these variables. The mixed results obtained in this study is an indicator of differing policy being implemented and will result in varying implication. Generally the error correction term is significant. Implying there is long-run relationship between defense spending, education and health expenditure.

Keywords: Defense, Education, Health, Error correction model

1. Introduction

The portion of the budget in a nation that is dedicated to development, security and welfare varies across nation. It is a very important decision and has to be dealt cautiously and is a matter of utmost importance to policy makers. Lindgren (1984) explains in his review of literature, that it is found that there are two main traditions of empirical studies on the consequences of defense spending in industrialized market economies. One is the Marxist influence from Baran and Sweezy (1968) where defense spending is seen as necessary for the survival of capitalism. Another is the investigation of trade-offs (reduced civilian components when defense spending is increased). Though many more researchers would like to investigate and explore this hypothesis, lack of data and inconsistencies of data, is hindering them to do so. It is a well known secret that data on defense spending are very confidential in nature. From these limited studies, results are often mixed.

Defense spending is believed to have meaningful relationship with the other two variables chosen due to a number of reasons. Firstly, any increase in military expenditure could be at the expense of public spending on social programs such as health and education which in turn will have an equalizing effect. Secondly, the taxes required to support

defense spending may fall disproportionately on the middle classes; if so, post-tax income inequality might be at a risk of increasing. Finally, high levels of defense spending may reflect the use of violence as a means of social control, notably against trade unions and other egalitarian social forces thus; it is not surprising to witness that higher defense spending means more societal control and a sacrifice of egalitarian values.

There is also another possibility, which is good governance, whereby, the respective governments carefully planning their policies and budget, so that military expenditure would not stand in the way of spending on other important aspects, such as education, health, public amenities etc. A sentiment shared by Apostolakis (1992), who mentioned that the use of any resource has an opportunity cost in the alternative instances that are foregones; it is a common thesis through that some burdens are more burdensome than others. He further cautions that the net effect of defense spending calls for a careful investigation. Caputo (1975) was one of the earlier studies on public policy implications of military and welfare expenditures. The subject became more popular and much more researches were conducted, however most of these researches were centered around military expenditure and economic growth, such as to name a few, Hassan et al. (2003), Al-Yousif (2002), Shieh et al. (2002), and Kollias et al. (2004a and 2004b).

The purpose of the present study is to explore the inter-relationship between military expenditure, education expenditure and health expenditure in eight selected Asian countries. There eight Asian countries namely Malaysia, Indonesia, Singapore, Philippines, Bangladesh, Nepal, Sri Lanka and South Korea. This paper is organized as follow, whereby in the next section, we discuss the prior literature. The third section consists of the discussion on the methodology and sources of data. The following section we discuss the results and the last section is the conclusion.

2. Review of related literature

Yildrim and Sezgin (2002) investigate the possible trade-off between Turkish defense spending on health and education expenditure during the Turkish republican era. The study cover the period from 1924-1996 using a multi-equation framework employing the Seemingly Unrelated Regression Estimation (SURE) method. They claimed that while defense spending decisions are made independently of health and education expenditure, there is a trade-off between defense and welfare spending. While the trade-off is negative between defense and health, it is positive between defense and education. They conclude that there is a competition between education and health expenditure in the budgeting process.

The same results were shared by Caputo (1975) whose study is considered as the new perspective on the public policy implications of defense and welfare expenditure in four modern democracies from 1950 - 1970. He found significant departure from prior research finding and suggests that the assumption of an explicit trade-off between defense expenditure and welfare expenditures be reconsidered. Meanwhile in another study, Dabelko and Mc Cormick (1977) examined the impact of changes in military spending on spending levels for public health in a number of countries for selected years from 1950-1972. Their major findings are: (1) opportunity cost does exist for education and health across all nations and all years, but they are weak in magnitude; (2) levels of economic development have little or no impact upon the opportunity costs for these policy areas; (3) personalist regimes tend to have higher opportunity cost of defense than do centrist and polyarchic regimes.

Scheetz (1992) examined the evolution of public sector expenditures which examines central administration functional expenditure for four Latin American countries over the last twenty years. He found that defense expenditure is the single largest (and most volatile) functional outlay, often greater than all public sector social functions combined. On top of that, from 1969 through 1987 (except in Peru) the defense function grew faster than health and education, with defense generally crowding out these social expenditures. Third, military regimes tend to spend more on defense than do civilian regimes. And lastly, police share are inversely related to the country's level of development. On the other hand, Apostolakis (1992) studied the warfare – welfare expenditure substitutions in Latin America from 1953 – 1987. He employs three alternative econometric specifications based on time–series data. He concludes that, overwhelmingly, military expenditure expenses crowd out the potential allocations for social upgrading. He also found positive link only in the defense-public works spending.

Frederiksen (1991) examined the defense and growth causality issues for six Asian countires. He determined on a country by country basis the optimal lag structure for the defense and growth variables for period 1956 through 1988 based on combines Granger causality and Akaike's final prediction error (FPE). He indicated that the lag structure differs from country to country as hypothesized. He also concludes that the causal relationship differs from country to country. On the other hand, Looney and Frederiksen (1990) examined the determinants of defense spending in six Asian countries namely the Philippines, Indonesia, South Korea, Malaysia, Thailand and Singapore. Their research suggested that economic variables and resources availability were the main determinants of military expenditure in the six countries.

Fitzgerald (2006) studied the association between serving active military duty and wealth accumulation. The study using data from the first wave of the health and Retirement study in 1992, the sample cover 5800 men to determine the

relationship between the lengths of time spent on active military duty and net worth. He found that there is an economic disincentive to serve in the military, which may affect the ability of veterans to accumulate wealth and future military recruitment.

Lai and Thyne (2007) examined the negative effects of civil wars and the post-civil war environment on educational expenditure and enrollment from 1980 through 1997. They use a measure of when a state is in civil war, a dynamic post-civil war measure an interaction with military spending, and relevant control variables for examine the percent change in educational expenditure and primary, secondary and tertiary enrollment for all states. They conclude that strong support for the notion that civil war is devastating for a system of education, as both expenditures and enrollment decline during a civil war. They also found no support for the reallocation of education funds towards military spending during a civil war.

3. Methodology

ARDL Approach to Causality Test

In order to test for causality between defense spending, education and health expenditure we utilized the Autoregressive Distributed Lag Model to Restricted Error Correction Model (ARDL-RECM). Error-correction model is likely to have better statistical properties than the two-step Engle-Granger method because, unlike the Engle-Granger method, the ECM does not push the short –run dynamics into the residual term (Banerjee et al., 1998). The ARDL-RECM approach provides robust result in a small sample size. Since the sample size of our study is small, this model is found to be the most appropriate procedure for this study.

The regressands are used interchangeably in order to explore the multi possibilities in the Granger causality.

The ARDL restricted error correction model (RECM) is shown below:

$$\Delta LD_t = \alpha_0 + \sum_{i=1}^{m} \alpha_{1,i} \Delta LD_{t-i} + \sum_{i=1}^{m} \alpha_{2,i} \Delta LE_{t-i} + \sum_{i=1}^{m} \alpha_{3,i} \Delta LH_{t-i} + \gamma_1 ecm_{t-1} \quad (1)$$

$$\Delta LE_t = \beta_0 + \sum_{i=1}^{m} \beta_{1,i} \Delta LD_{t-i} + \sum_{i=1}^{m} \beta_{2,i} \Delta LE_{t-i} + \sum_{i=1}^{m} \beta_{3,i} \Delta LH_{t-i} + \gamma_2 ecm_{t-1} \quad (2)$$

$$\Delta LH_t = \gamma_0 + \sum_{i=1}^{m} \gamma_{1,i} \Delta LD_{t-i} + \sum_{i=1}^{m} \gamma_{2,i} \Delta LE_{t-i} + \sum_{i=1}^{m} \gamma_{3,i} \Delta LH_{t-i} + \gamma_3 ecm_{t-1} \quad (3)$$

For model (1) the hypothesis is:

H_o: health expenditure and/ or education expenditure granger cause defense spending

H_a: health expenditure and/ or education expenditure doesn't granger cause defense spending

For model (2) the hypothesis is:

H_o: health expenditure and/ or defense spending granger cause education expenditure

H_a: health expenditure and/ or defense spending doesn't granger cause education expenditure

For model (3) the hypothesis is:

H_o: education expenditure and/ or defense spending granger cause health expenditure

H_a: education expenditure and/ or defense spending doesn't granger cause health expenditure

whereby D is the ratio of defense spending to GDP, E is ratio of education expenditure to GDP, H is the ratio of health expenditure to GDP, Δ is the first difference operator, L denote variables in logarithm and ecm_{t-1} are the error correction term. The significant of the error term will indicate long run relationship between the three variables. The long run causality can also be inferred from the error term.

Description and sources of data

The data used in this study are annual data on defense, education and health for the selected Asian countries. The data covers the period for 1971 to 2006. The countries are Bangladesh, Indonesia, Korea, Malaysia, Nepal, Philippines, Singapore and Sri Lanka. All the data set for defense spending, education expenditure and health expenditure was obtained online from Key Indicators for Asia and the Pacific provided by Asian Development Bank (ADB). All the expenditure data was then divided by the Gross Domestic Product to obtain the ratio to GDP value. All the data used in the study were transformed into logarithm.

4. Empirical results

Before conducting the causality test, we tested the data series for the order of integration namely for defense spending, education and health expenditure. We conducted the unit root test to determine the order of integration of the series. The

Augmented Dickey-Fuller (ADF) tests are reported in Table 1 and Table 2. The null hypothesis of unit root cannot be rejected at the 5 percent level of significance for the series in levels, while for the series in first difference, the null hypothesis of *I(1)* can be rejected at the 5 percent level of significance. Clearly the ADF test statistic indicates that defense spending, education and health expenditure series in selected Asian countries are stationary after first differencing (I(1)).

Having determined that all series are integrated of order one *I(1),* we proceed for the testing of cointegration between the variables, based on ARDL framework. Interestingly the F statistics value obtained, compared with the critical values by Narayan (2005), are below the critical value of I(0), signalling no cointegration among these variables. Resulting from these results, we proceed for the testing of long-run causality from the restricted ARDL-RECM model. The results are shown in Table 3. From the results it can clearly observed that, for the case of Philippines and Sri Lanka, no meaningful relationship could be detected from the study among these three variables. For the case of Bangladesh, unidirectional causality runs from health to defense, and subsequently from defense to education. As for the case of Indonesia, bidirectional causality between education and health is detected and defense is found to have no meaningful relationship whatsoever.

For South Korea, bidirectional causality is detected between education and defense; on top of that there exist a unidirectional causality running from education to health. In the case of Malaysia, unidirectional causality is found running from health to education. For Nepal, education is being granger caused by both health and defense. Finally, for the case of Singapore, bidirectional causality between education and health, and education granger cause defense. Table 3 also displays the results of the error correction term, for all the equations, all the countries; generally they are significant and negative (sign of a stable relationship). As for the results of the Table 4, which contains the long run coefficient, the conclusion is, for the relationship between defense and education, the results are mixed. For Bangladesh, Nepal, Malaysia, Korea and Indonesia, the results indicates positive relationship (complements) while for Singapore and Sri Lanka the results indicates negative relationship and for Philippines no meaningful relationship could be detected. As for the relationship between defense and health, the results are ambiguous. Lastly for the results for the relationship between education and health, it is very consistent, positive relationship for all the countries (complements)

5. Conclusion

In this study the Autoregressive Distributed Lag-Restricted Error Correction Model (ARDL-RECM) procedure was employed to investigate the inter-relationship between military expenditure, education expenditure and health expenditure in eight selected Asian countries namely Malaysia, Indonesia, Singapore, Philippines, Bangladesh, Nepal, Sri Lanka and South Korea. The sample period was 1970 – 2005 and the data was annual. All the data went through log-log transformation so that the estimates will be less sensitive to outliers or influential observations and also in order to reduce the data range.

The results are not surprisingly mixed, however, one thought provoking aspect is that, the results of Bangladesh and Nepal is in support with Caputo (1975) who found significant departure from prior research finding and suggests that the assumption of an explicit trade-off between defense expenditure and welfare expenditures be reconsidered. We also find that defense spending is positively significant with education in Bangladesh and Nepal. This can be attributed to the fact that these two poor countries, while increasing defense spending, invest in human capital. However it is in contrary with Yildrim and Sezgin (2002) who claimed that while defense spending decisions are made independently of health and education expenditure, there is a trade-off between defense and welfare spending. While the trade-off is negative between defense and health, it is positive between defense and education. They conclude that there is a competition between education and health expenditure in the budgeting process.

As for the results of Sri Lanka and Philippines whereby we failed to find any meaningful relationship between these three variables, it can be concluded as a sign of good governance and good policy making, whereby the decisions of military expenditure is independent and does not have any whatsoever impact on health expenditure and education expenditure.

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Table 1. Results of ADF Unit Root Test for Series in Level

Country	LD		LE		LH	
	ADF *t*-statistic	Lag	ADF *t*-statistic	Lag	ADF *t*-statistic	Lag
Bangladesh	1.316	8	-2.721	0	-3.260	0
	[0.99]		[0.23]		[0.09]	
Indonesia	-1.787	0	-2.120	0	-2.093	0
	[0.68]		[0.51]		[0.52]	
Korea	-2.126	0	-2.166	0	-1.817	0
	[0.51]		[0.49]		[0.67]	
Malaysia	-2.489	0	-3.057	1	-2.556	0
	[0.33]		[0.13]		[0.30]	
Nepal	-2.363	0	-2.982	1	-3.231	1
	[0.39]		[0.15]		[0.09]	
Philippines	-3.033	0	-1.673	1	-2.440	0
	[0.13]		[0.74]		[0.35]	
Singapore	-2.962	0	-2.496	2	-3.309	0
	[0.15]		[0.32]		[0.08]	
Sri Lanka	-1.678	0	-2.982	1	-2.950	2
	[0.73]		[0.15]		[0.16]	

Notes: Asterisk (*) denotes statistically significant at 5% level.

Table 2. Results of ADF Unit Root Test for Series in First Difference

Country	LD		LE		LH	
	ADF *t*-statistic	Lag	ADF *t*-statistic	Lag	ADF *t*-statistic	Lag
Bangladesh	-3.939* [0.00]	4	-5.653* [0.00]	0	-6.227* [0.00]	0
Indonesia	-5.530* [0.00]	0	-5.714* [0.00]	0	-4.537* [0.00]	0
Korea	-6.390* [0.00]	0	-5.227* [0.00]	0	-5.282* [0.00]	0
Malaysia	-6.066* [0.00]	0	-4.194* [0.00]	2	-6.652* [0.00]	0
Nepal	-5.709* [0.00]	0	-4.036* [0.00]	1	-10.621* [0.00]	0
Philippines	-4.886* [0.00]	0	-4.031* [0.00]	1	-5.598* [0.00]	0
Singapore	-5.437* [0.00]	0	-4.114* [0.00]	0	-7.102* [0.00]	0
Sri Lanka	-5.782* [0.00]	0	-7.432* [0.00]	1	-7.370* [0.00]	0

Notes: Asterisk (*) denotes statistically significant at 5% level.

Table 3. Results of Long-Run Causality from the (ARDL-RECM) Model

Country	Dependent variables	t-statistics of restriction ecm term - ARDL models:	Diagnostic Testing		Remarks		Lags
		ecm_{t-1}	R-Squared	DW-Statistic	cointegration	causation	
Bangladesh	Δ LD	-4.4658*	0.75295	1.8892	Yes	Yes: E&H => D	(1,0,2)
	Δ LE	-4.1779*	0.64055	1.8325	Yes	Yes: D&H=> E	(1,2,0)
	Δ LH	-4.5941*	0.67448	2.0074	Yes	Yes: D&E => H	(1,0,1)
Indonesia	Δ LD	-1.5765	0.37922	2.1155	No	No: E&H ≠> D	(1,1,0)
	Δ LE	-4.4839*	0.53872	2.1423	Yes	Yes: D&H => E	(1,0,0)
	Δ LH	-4.0316*	0.42783	2.1041	Yes	Yes: D&E => H	(2,0,0)
Korea	Δ LD	2.0675*	0.45585	1.7310	Yes	Yes: E&H => D	(2,2,0)
	Δ LE	-3.2828*	0.33688	1.6845	Yes	Yes: D&H => E	(1,0,0)
	Δ LH	-1.3448	0.16447	1.7425	No	No: D&E ≠> H	(1,1,0)
Malaysia	Δ LD	-0.4756	0.51016	2.2912	No	No: E&H ≠>D	(1,1,0)
	Δ LE	-2.7605*	0.68701	1.4608	Yes	Yes: D&H => E	(1,0,1)
	Δ LH	-4.6191*	0.69547	2.0683	Yes	Yes: D&E => H	(1,1,0)
Nepal	Δ LD	-2.6225*	0.29858	1.6686	Yes	Yes: E&H => D	(1,0,0)
	Δ LE	-1.5372	0.37091	2.4129	No	No: D&H ≠> E	(1,1,0)
	Δ LH	-5.0810*	0.48895	2.2165	Yes	Yes: D&E => H	(1,0,0)
Philippines	Δ LD	-1.1539	0.22381	1.8109	No	No: E&H ≠> D	(1,0,1)
	Δ LE	-1.8027	0.37567	1.9594	No	No: D&H ≠> E	(2,1,0)
	Δ LH	-2.1596*	0.36936	2.2270	Yes	Yes: D&E => H	(1,0,1)
Singapore	Δ LD	-3.5815*	0.47410	1.9666	Yes	Yes: E&H => D	(1,0,0)
	Δ LE	-3.3095*	0.44159	1.6521	Yes	Yes: D&H => E	(1,0,0)
	Δ LH	-5.3547*	0.63898	1.8114	Yes	Yes: D&E => H	(1,0,1)
Sri Lanka	Δ LD	-1.2988	0.25904	2.0485	No	No: E&H ≠> D	(1,0,1)
	Δ LE	-3.6226*	0.38204	1.8650	Yes	Yes: D&H => E	(1,0,0)
	Δ LH	-4.2581*	0.44481	1.6968	Yes	Yes: D&E => H	(1,0,0)

Notes: Asterisk (*) denotes statistically significant at the 5% level. LD denotes defense spending, LE denotes education spending and LH denotes health spending. The lag was chosen automatically by the test, using the SBC criterion.

Table 4. Long-Run Coefficient

Bangladesh						
				Remarks		
Dependent/independent variables	LD	LE	LH	LD,LE	LD, LH	LE, LH
LD	-	0.6311	-0.2965	C	S	-
LE	0.8261	-	0.9396	C	-	C
LH	0.7252	0.1399	-	-	C	C
Indonesia						
Dependent/independent variables	LD	LE	LH	LD,LE	LD, LH	LE, LH
LD	-	-	-	-	-	-
LE	0.2716	-	0.4952	C	-	C
LH	0.2183	0.6320	-	-	C	C
Korea						
Dependent/independent variables	LD	LE	LH	LD,LE	LD, LH	LE, LH
LD	-	3.9151	-0.1639	C	S	-
LE	0.3320	-	0.1750	C	-	C
LH	-	-	-	-	-	-
Malaysia						
Dependent/independent variables	LD	LE	LH	LD,LE	LD, LH	LE, LH
LD	-	-	-	-	-	-
LE	0.0814	-	0.3940	C	-	C
LH	-0.1107	0.9881	-	-	S	C
Nepal						
Dependent/independent variables	LD	LE	LH	LD,LE	LD, LH	LE, LH
LD	-	0.6855	-0.0964	C	S	-
LE	-	-	-	-	-	-
LH	0.0118	0.3446	-	-	C	C
Philippines						
Dependent/independent variables	LD	LE	LH	LD,LE	LD, LH	LE, LH
LD	-	-	-	-	-	-
LE	-	-	-	-	-	-
LH	0.9902	0.1477	-	-	C	C
Singapore						
Dependent/independent variables	LD	LE	LH	LD,LE	LD, LH	LE, LH
LD	-	-0.0111	0.6286	S	C	-
LE	-0.5372	-	2.0256	S	-	C
LH	0.5453	0.2447	-	-	C	C
Sri Lanka						
Dependent/independent variables	LD	LE	LH	LD,LE	LD, LH	LE, LH
LD	-	-	-	-	-	-
LE	-0.0043	-	0.4165	S	-	C
LH	0.0114	0.4205	-	-	C	C

Notes: Asterisk (*) denotes statistically significant at the 5% level. LD denotes defense spending, LE denotes education spending and LH denotes health spending. C denotes complement, S denotes substitute.