The Asian Journal of Technology Management Vol. 6 No. 2 (2013): 82-91

Measuring Government Expenditure Efficiencies Towards Peace and Human Development

Ahmad Danu Prasetyo*[1] and Alpha Nur Setyawan Pudjono[2]
[1]School of Business and Management, Institut Teknologi Bandung, Indonesia
Graduate School of Economics, Keio University, Japan
[2]Faculty of Business and Commerce, Keio University, Japan
Directorate General of Taxes, Ministry of Finance Indonesia, Indonesia

Abstract. *In this paper, we investigate the efficiency level of government expenditure in 82 countries towards the human development and peace index of the respective countries by using Data Envelopment Analysis (DEA) and Malmquist Index approach during 2007-2011. We found that only few countries that always being positioned in the efficient frontier during the sample period, namely: Japan, Nigeria, and Norway. By using Malmquist Index approach, we also found that Cyprus has the largest government expenditure efficiency improvement.*

Keywords: *Government Expenditure Efficiencies, Human Development Index, Global Peace Index*

1. Background

There is a new paradigm emerges concerning the public goals that should be accomplished by the government. In many countries, governments allocate their expenditures in many sectors that are not directly linked to economic activities. Yet they use traditional macroeconomic indicators which focus exclusively on the expansion of only one choice – income – to measure their outcome. As income is not evenly distributed within a society, people with limited access to income will find their choices fairly constrained. In addition, many of human needs do not necessarily link to income. Valuable social and cultural traditions can be – and are – maintained at all level of income (Ul Haq, 1995). The government is expected to go beyond traditional macroeconomic indicators and seek for higher perceptions of human welfare. Various indicators were introduced in order to fulfill this demand. Two of them are Human Development Index and Global Peace Index that measure human development level and perceptive peace across countries. We focus on these two indices since they proxy broad range of important aspects in the society, i.e. longevity, education, standard of living, government policy, business environment, etc.

*Corresponding author. Email: ahmad.danu @sbm-itb.ac.id

DOI: http://dx.doi.org/10.12695/ajtm.2013.6.2.3
Print ISSN: 1978-6956; Online ISSN: 2089-791X.

Previous studies show mixed results concerning the relationship between government expenditure and human development. Many economists agreed that government expenditure, especially in health and education sectors, would give a positive impact on human capital (Gupta et. al., 1998; Doryan, 2001) and also its productivity (Razmi et. al., 2012). Nevertheless, empirical results might find varieties on the significance of the sectorial expenditures. While agreed on the positive effects of government expenditures towards poverty reduction, Asghar et. al. (2012) found that the impact of government expenditures in health sector was insignificant in Pakistan. Suescún (2007) found that infrastructure spending dominates other forms of public spending (education, health, government consumption and transfers to low-wealth households) in terms of sizable positive effects on growth performance, welfare, human development and social progress in the Latin American countries.

In relation to peace, government expenditure in military services has been traditionally accepted as a medium to provide nation security. There are some cases where military expenditure does not hamper or even gives positive effect to the economy (Murdoch et al., 1997; Atesoglu, 2002; Heo & Hahm, 2006; Bernauer et. al., 2009). However, general acceptance states that military expenditure tends to be a public bad instead of public good (Mintz & Huang, 1990; Gupta et. al, 2001; Abu-Bader & Abu-Qarn, 2003; Barro, 2009).

Government's efficiency is assumed to be the reason why countries with similar economic levels would have a significant gap in the HDI level (Vierstraete, 2012). In addition, the Human Development Report 1991 also mentioned that some retrenchment could be made in government expenses while maintaining the HDI. Government's efficiency is also considered as one of three pillars in erecting peace (IEP, 2012a). Interestingly, despite some beliefs that seen peace (in terms of security) as a foundation of human development (Alkire, 2002), the correlation between HDI and GPI somehow not very high. IEP (2012a) stated that the correlation between HDI and GPI scored -.573.

In this paper, we put the importance of the two indices as measures of human development and peace as targeted outputs that should be pursued by the governments. Our data set includes government expenditures (in terms of percentage to GDP) in 82 countries ranged from 2007 to 2011. Data Envelopment Analysis (DEA) and Malmquist Index are employed to measure the efficiency level of government expenditures on HDI and GPI in the respective countries, and the change of efficiency level during the analysis periods respectively. The rest of the paper is organized as follows: Section 2 will discuss about human development and peace in general. DEA method and Malmquist Index will be explained in Section 3. The result of comparative efficiencies will be analyzed in section 4. And lastly, concluding remarks will appear in section 5

2. Literature Review

2.1. Human Development

Human development is an alternative measure other than the purely economic indicators that seen people as the real wealth of a nation. UNDP (1990) defined human development as the process of widening people's choices and the level of their achieved wellbeing. The development of HDI was inspired of the capabilities approach proposed by Amartya Sen that focus on what people are able to do and be so that they have more freedom to live the kind of life which they find valuable (Nussbaum & Sen, 1993).

Several dimensions have been proposed in the early development of human development (see Alkire, 2002). However UNDP had extracted them into three measures, i.e. longevity, education, and standard of living. The education component of the HDI is measured by mean of years of schooling for adults aged 25 years and expected years of schooling for children of school entering age. The health component is measured by life expectancy at birth. And the living standard is measured by

GNI per capita (PPP). The scores for the three HDI dimension indices are then aggregated into a composite index using geometric mean (UNDP, 1990).

2.2. Peace

Abundant studies have been conducted to measure the effect of government expenditure, especially military spending, towards peace and economy. From these studies, common agreement was reached that there are negative correlation between the increasing of government military spending and economy. Barro (2009) explained that during a war time, where military spending is significantly increased, private investments and net exports were hampered. It also overcrowds the non-military government purchase, and changes the consumption expenses. The terms "Peace Dividend" then used to explain phenomenon of immediate reverse of economy condition after a war is over or after military spending retrenchment.

Table 1. GPI Indicators

No.	Indicators
1	Perceptions of criminality in society
2	Number of internal security officers and police 100,000 people
3	Number of homicides per 100,000 people
4	Number of jailed population per 100,000 people
5	Ease of access to weapons of minor destruction
6	Level of organized conflict (internal)
7	Likelihood of violent demonstrations
8	Level of violent crime
9	Political instability
10	Respect for human rights
11	Volume of transfers of major conventional weapons, as recipient (imports) per 100,000 people
12	Potential for terrorist acts
13	Number of deaths from organized conflict (internal)
14	Military expenditure as a percentage of GDP
15	Number of armed services personnel per 100,000 people
16	Funding of UN peacekeeping missions
17	Aggregate number of heavy weapons per 100,000 people
18	Volume of transfers of major conventional weapons as supplier (exports) per 100,000 people
19	Military capability / sophistication
20	Number of displaced people as a percentage of the population
21	Relations with neighboring countries
22	Number of external and internal conflicts fought
23	Estimated number of deaths from organized conflict (external)

Source: Institute for Economics and Peace (2012)

Some economists still believe that military and defense spending is still important in providing security for the nation as well as helping to support and protect its national allies (IEP, 2012b). In addition, military spending is arbitrarily decided due to geopolitical situation rather than a function of economic factors (Abu-Bader & Abu-Qarn, 2003). While accepting military spending as a measure of peace, IEP (2012a) extend the

definition of peace as "Positive Peace", that is about the appropriate attitudes, institutions, and structures which when strengthened, lead to a more peaceful society.

There are 8 pillars of the positive peace that are inter connected to each other (IEP, 2012a), i.e. (1) Well-functioning government, (2) Sound business environment, (3) Equitable distribution of resources, (4) Acceptance of the rights of others, (5) Good relations with neighbors, (6) Free flow of information, (7) High levels of education, and (8) Low levels of corruption. These pillars are then represented by 23 measures in determining the GPI score as can be seen in table 1. Contrary to HDI score, in valuating GPI, the lowest scores are the better.

3. Data and Methodology

3.1. Data

In conducting this study, we obtained data from 82 countries across the world ranged from 2007 to 2011. We obtained Government-expenditures-to-GDP ratios from The World Bank's database for the input measures. As for the output measures, Human Development Index and Global Peace Index were obtained from UNDP's and IEP's databases respectively. Table 2 enlists all countries being measured in this study.

Table 2. List of countries being studied

No	Country Name	No	Country Name	No	Country Name	No	Country Name
1	Algeria	22	Estonia	43	Kuwait	64	Russia
2	Australia	23	Ethiopia	44	Latvia	65	Serbia
3	Austria	24	Finland	45	Lebanon	66	Slovakia
4	Bangladesh	25	France	46	Lithuania	67	Slovenia
5	Belgium	26	Germany	47	Madagascar	68	South Korea
6	Bosnia and Herzegovina	27	Ghana	48	Malaysia	69	Spain
7	Botswana	28	Greece	49	Moldova	70	Sri Lanka
8	Brazil	29	Guatemala	50	Morocco	71	Sweden
9	Bulgaria	30	Honduras	51	Netherlands	72	Switzerland
10	Cambodia	31	Hungary	52	New Zealand	73	Thailand
11	Canada	32	India	53	Nicaragua	74	Trinidad and Tobago
12	Chile	33	Indonesia	54	Nigeria	75	Tunisia
13	Colombia	34	Iran	55	Norway	76	Turkey
14	Costa Rica	35	Ireland	56	Pakistan	77	Uganda
15	Croatia	36	Israel	57	Paraguay	78	Ukraine
16	Cyprus	37	Italy	58	Peru	79	United Kingdom
17	Czech Republic	38	Jamaica	59	Philippines	80	United States of America
18	Denmark	39	Japan	60	Poland	81	Uruguay
19	Dominican Republic	40	Jordan	61	Portugal	82	Zambia
20	Egypt	41	Kazakhstan	62	Qatar		
21	El Salvador	42	Kenya	63	Romania		

3.2. VRS DEA

Data envelopment analysis (DEA) is a non-parametric mathematical programming to estimate the inefficiency of outputs given inputs and vice versa. This method constructs an envelopment frontier over the data points

such that all observed points lie on or below the production frontier (Coelli, 1996). This method, however, does not generate general relationship and only rely on the input-output ratio optimization. It firstly introduced by Farrell (1957) and then extended by Banker, Charnes, and Cooper (1984) to accommodate when the decision making units (DMUs) are operating at the non-optimal scale environment. These non-optimal scales might be caused by imperfect competition, constraint on resources, etc.

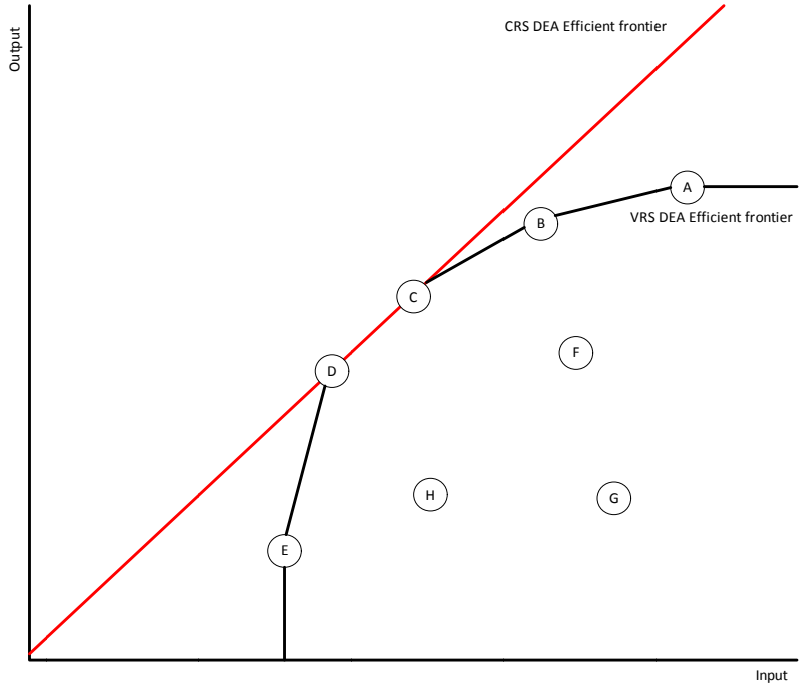

Figure 1. Comparison of Efficient frontier between CRS and VRS method

Coelli (1996) comprehensively discussed about DEA method. Assume there is data on K inputs and M outputs for each of N DMU. For the i-th DMU these are represented by the vector xi and yi, respectively. The KxN input matrix, X, and the MxN output matrix, Y, represent the data of all N. Then the DMU's problem is

$$
\begin{aligned}
&max_{\phi,\lambda}\phi, \\
&\text{St} \\
&-\phi y_i + Y\lambda \geq 0, \\
&x_i - X\lambda \geq 0, \\
&N1'\lambda = 1, \\
&\lambda \geq 0
\end{aligned}
\qquad (1)
$$

Where ϕ is a scalar and λ is a Nx1 vector of constants. *N*1 is a Nx1 vector of ones. This approach forms a convex hull of intersecting planes which envelope the data points more tightly than the Constant Return Scales (CRS) conical hull, and thus provides technical efficiency scores which are greater than or equal to those obtained using CRS model. The value of ϕ obtained will be the efficiency score for the i-th DMU. It will satisfy ϕ ≥1, with a value of 1 indicating a point on the frontier, and hence a technically efficient DMU. The proportional increase in outputs that could be achieved by the i-th DMU with input quantities held constant denotes by ϕ -1, while 1/ϕ defines the technical efficiency scores which varies between zero and one.

The CRS efficient frontier measures the maximum output-input slope from the original point, while VRS efficient frontier sorts the slopes starting from DMU which has minimum input. In figure 1, both DMU C and D are efficient in CRS and VRS method. DMU A, B, and E are considered efficient in VRS method but not in CRS method.

3.3. Malmquist Index

It is interesting to measure how much the efficiency improvement in aggregate has been obtained in a particular period. The measurement is possible by using Mamquist Index – an extension of DEA which compares the technical efficiency at *t+1* and *t*. Fare et. al. (1994) specifies Malmquist index as:

$$m_0(y_{t+1}, x_{t+1}, y_t, x_t) = \left[\frac{d_0^t(x_{t+1}, y_{t+1})}{d_0^t(x_t, y_t)} \times \frac{d_0^{t+1}(x_{t+1}, y_{t+1})}{d_0^{t+1}(x_t, y_t)}\right] \quad (2)$$

Where

$$[d_0^t(x_t, y_t)]^{-1} = max_{\phi,\lambda}\phi, \quad (3)$$
St
$$-\phi y_{it} + Y_t\lambda \geq 0,$$
$$x_{it} - X_t\lambda \geq 0,$$
$$\lambda \geq 0.$$

$$[d_0^{t+1}(x_{t+1}, y_{t+1})]^{-1} = max_{\phi,\lambda}\phi, \quad (4)$$
St
$$-\phi y_{it+1} + Y_{t+1}\lambda \geq 0,$$
$$x_{it+1} - X_{t+1}\lambda \geq 0,$$
$$\lambda \geq 0.$$

$$[d_0^t(x_{t+1}, y_{t+1})]^{-1} = max_{\phi,\lambda}\phi, \quad (5)$$
St
$$-\phi y_{it+1} + Y_t\lambda \geq 0,$$
$$x_{it+1} - X_t\lambda \geq 0,$$
$$\lambda \geq 0.$$

$$[d_0^{t+1}(x_t, y_t)]^{-1} = max_{\phi,\lambda}\phi, \quad (6)$$
St
$$-\phi y_{it} + Y_{t+1}\lambda \geq 0,$$
$$x_{it} - X_{t+1}\lambda \geq 0,$$
$$\lambda \geq 0$$

The formula of Malmquist index in equation (2) is basically measuring of how much the technical efficiency of DMU has changed due to changes of its input and ouϕut values, from its origin at (x_t , y_t) to its position in the next period at (x_{t+1}, y_{t+1}). Equation (3) and (4) is similar to the DEA method explained in section 3.2. The formula calculate the technical efficiency scores 1/ϕ at period *t* and *t+1* respectively. Equation (5) and (6) measure the inter-temporal technical efficiency scores. Equation (5) calculates the technical efficiency scores of DMU at (x_{t+1}, y_{t+1}) relative to all input-output set at time *t*. While equation (6) calculates the technical efficiency scores of DMU at (x_t , y_t) relative to all input-output set at time *t+1*. An index value greater than 1 indicates positive improvement on efficiency.

4. Results and Discussion

In general, Japan, Nigeria, and Norway have become the most sophisticated countries in terms of government expenditure efficiency as they have always positioned on the efficient frontier during the analysis period. In more detailed disaggregate analysis, it can be found that Nigeria excels in efficiencies towards both human development and peace in all years. Japanese government expenditure is always efficient towards peace during the 5 years analysis, but only efficient towards human development in 2007 and 2008. On the other hand, Norway is always positioned in the efficient frontier when output is human development, but only appears to be efficient in 2007 towards peace. There are several other countries that appeared on the efficient frontier occasionally, such as The US, Cambodia, Qatar, Australia, Switzerland, Denmark, New Zealand, and Bangladesh. The detailed list of efficient countries can be seen in Table 3 and Table 4.

Table 3. Countries with efficient government expenditure towards human development

2007	2008	2009	2010	2011
Japan	Cambodia	Australia	Australia	Australia
Nigeria	Japan	Nigeria	Nigeria	Cambodia
Norway	Nigeria	Norway	Norway	Nigeria
US	Norway	Switzerland	Switzerland	Norway
	Qatar			Switzerland
	US			US

Table 4. Countries with efficient government expenditure towards peace

2007	2008	2009	2010	2011
Cambodia	Cambodia	Japan	Bangladesh	Bangladesh
Japan	Denmark	New Zealand	Japan	Cambodia
Nigeria	Japan	Nigeria	New Zealand	Japan
Norway	Nigeria	Switzerland	Nigeria	New Zealand
			Switzerland	Nigeria
				Switzerland

We also measured the change of efficiencies by Malmquist Index with 2007 is taken as base year. Overall, the efficiencies of government expenditure in the analyzed countries are slightly decreased in 2008 and 2009, and then it became positive in 2010 and 2011. There are 23 countries that made positive improvement of the government expenditure efficiencies, ranked from the highest index score are Cyprus, Colombia, Zambia, Lebanon, Sri Lanka, Jordan, Indonesia, Switzerland, The Philippines, Turkey, Peru, Jamaica, Brazil, Israel, Honduras, Trinidad and Tobago, Poland, India, Botswana, Austria, Serbia, Moldova, and South Korea. Surprisingly it seems that only Switzerland that occasionally appeared on the efficient frontier while maintaining positive improvement of its government efficiency. Averagely, the Malmquist Index score equals .983. This means that, in general, the sampled countries have become less efficient during the analysis period. By looking at the data, we reckon that the negative improvement was happened because the increase in government expenditures were not balanced with the increase in HDI score and the decrease in GPI score.

Table 5. Geometric average score of Malmquist Index by years

Year	Score
2008	0.971
2009	0.945
2010	1.010
2011	1.007

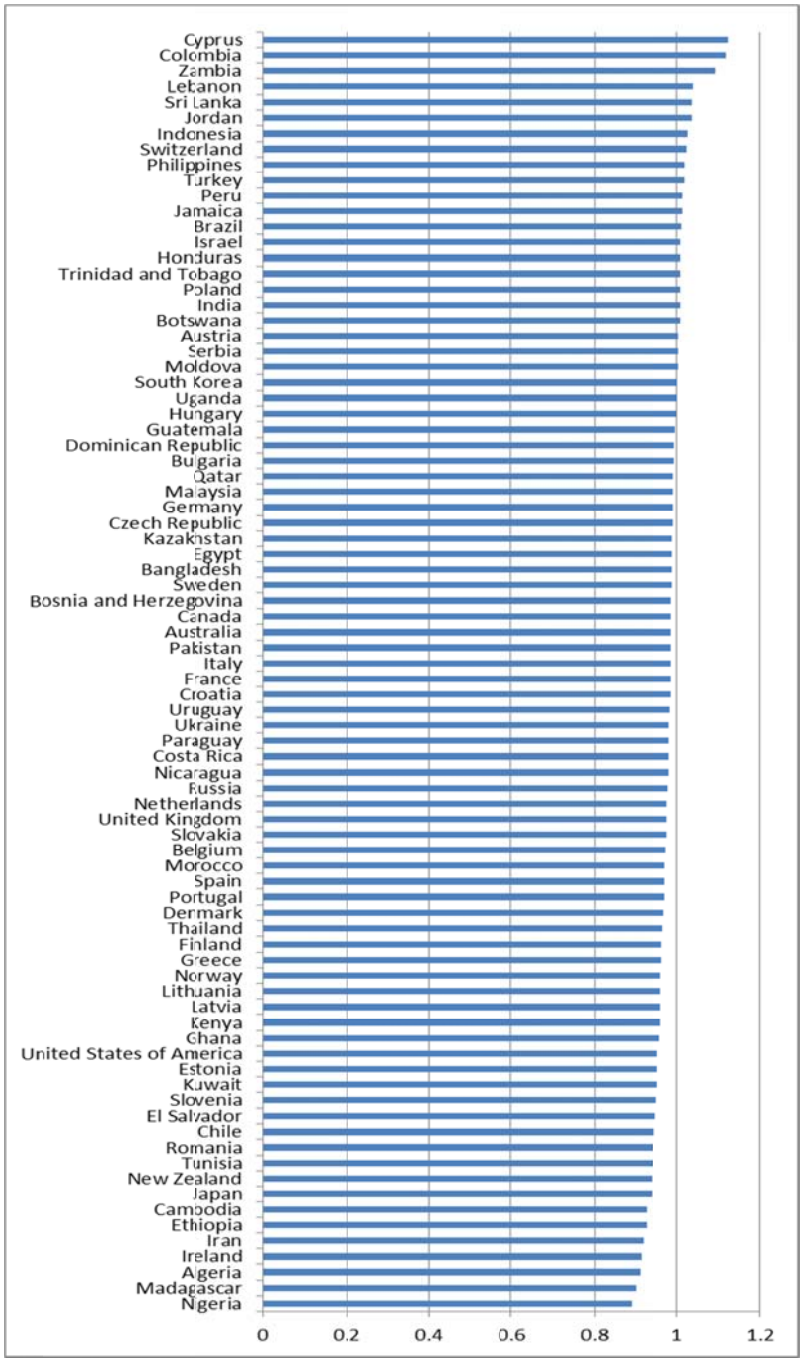

Figure 2. Geometric average score of Malmquist Index by countries

5. Conclusion

In this paper, we investigate the efficiency level of government expenditure in 82 countries towards the human development and peace index of the respective countries by using Data Envelopment Analysis (DEA) approach during 2007-2011. In general, Japan, Nigeria, and Norway have become the most sophisticated countries in terms of government expenditure efficiency as they have always positioned on the efficient frontier during the analysis period. There are several other countries that appeared on the efficient frontier occasionally, such as The US, Cambodia, Qatar, Australia, Switzerland, Denmark, New Zealand, and Bangladesh. There are 23 countries that made positive improvement of the government expenditure efficiencies measured by Malmquist Index where Cyprus has obtained the largest score. However, in general, the world has obtained negative efficiency improvement. We reckon that this was happened because the increase in government expenditures were not balanced with the increase in HDI score and the decrease in GPI score.

References

Abu-Bader, S. and A.S. Abu-Qarn (2003). Government expenditures, military spending and economic growth: causality evidence from Egypt, Israel, and Syria. *Journal of Policy Modeling* 25 : 567–583.

Alkire, S. (2002). Dimensions of Human Development. *World Development* 30 (2): 181–205.

Asghar, N., Z. Hussain, H., and Ur Rehman (2012). The Impact of Government Spending on Poverty Reduction: Evidence from Pakistan 1972 To 2008. *African Journal of Business Management* 6 (3): 845-853.

Atesoglu, H.S. (2002). Defense Spending Promotes Aggregate Output in the United States--Evidence from Cointegration Analysis. *Defence and Peace Economics* 13 (1): 55-60.

Banker, R.D., A. Charnes and W.W. Cooper (1984). Some Models for Estimating Technical and Scales Inefficiencies In Data Envelopment Analysis. *Management Science* 30: 1078-1092.

Barro, R.J. (2009). *Government Spending Is No Free Lunch. The Wall Street Journal*, http://online.wsj.com/article/SB123258618204604599.html, published January 22, 2009, retrieved July 4, 2013.

Bernauer, T., V. Koubi and F. Ernst (2009). National and Regional Economic Consequences of Swiss Defense Spending. *Journal of Peace Research* 46 (4): 467-484.

Chan, S. (1995). Grasping the Peace Dividend: Some Propositions on the Conversion of Swords into Plowshares. *Mershon International Studies Review* 39 (1): 53-95.

Coelli, T. J., (1996). A Guide to DEAP Version 2.1: A Data Envelopment Analysis (Computer) Program. *CEPA Working Papers No.8*, Department of Econometrics, University of New England.

Doryan, E. (2001). *Poverty, Human Development, and Public Expenditure: Developing Actions for Government and Civil Society*, in *Equity and Health: Views from the Pan American Sanitary Bureau* Pan American Health Organization, Editor, PAHO, Washington, D.C.: 50

Fare, R.S., S. Grosskopf, and C.A.K. Lovell, (1994). *Production Frontiers*, Cambridge University Press.

Farrel, M.J., (1957). The Measurement of Productive Efficiency. *Journal of the Royal Statistical Society* 120 (3): 253-290.

Gupta, S., L. de Mello, and R. Sharan. (2001). Corruption and military spending. *European Journal of Political Economy* 17 : 749–777

Gupta, S., B. Clements, and E. Tiongson, (1998). *Public Spending on Human*

Development. Finance & Development 35 (3):10-13.

Heo, U. and S.D. Hahm (2006). Politics, Economics, and Defense Spending in South Korea. *Armed Forces & Society* 32 (4): 604-622.

Mintz, A. and C. Huang (1990). Defense Expenditures, Economic Growth, and The 'Peace Dividend'. *The American Political Science Review* 84 (4):1283-1293.

Murdoch, J.C., C.R. Pi and T. Sandler (1997). The impact of defense and non-defense public spending on growth in Asia and Latin America. *Defence and Peace Economics* 8 (2): 205-224.

Nussbaum, M. and A. Sen (1993). *The Quality of Life*. Oxford: Clarendon Press.

Razmi, M.J., E. Abbasian, S. Mohammadi (2012). Investigating the Effect of Government Health Expenditure on HDI in Iran. *Journal of Knowledge Management, Economics and Information Technology* 5.

Suescún, R. (2007). *The Role of Fiscal Policy in Human Development and Growth. LAC Regional Study, Latin America and the Caribbean Region*, World Bank, March 2007.

The Institute of Economics and Peace – IEP (2012a). *Pillars of Peace*. Publisher: The Institute of Economics and Peace, Sydney, 2012.

The Institute of Economics and Peace – IEP (2012b). *Economic Consequences of War on the U.S. Economy*. Publisher: The Institute of Economics and Peace, Sydney, 2012.

Ul Haq, Mahbub (1995). *Reflections on Human Development*. Publisher: Oxford University Press, New York, 1995.

United Nation Development Programme – UNDP (1990). *1990 Human Development Report*. Publisher: UNDP, 1990.

Vierstraete, Valérie (2012). Efficiency in Human Development: a Data Envelopment Analysis. *The European Journal of Comparative Economics* 9 (3): 425-443.