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ANALYZING THE INTERPLAY BETWEEN ECONOMIC GROWTH AND HEALTH EXPENDITURES: THE CASE OF EMERGING ECONOMIES

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ABSTRACT

In emerging countries, health investments are increasing rapidly along with the opportunities provided by economic growth. Examination of the relationship between the efficiency of investments made, in other words, the efficiency of health expenditure – EHE – and economic growth is the main purpose of the study. The study was carried out on BRICS (Brazil, Russia, India, China and South Africa) and MIST (Mexico, Indonesia, South Korea and Turkey) countries, which are defined as emerging economies, between 2008 and 2012. For this purpose, firstly, the efficiency of health expenditures of emerging economies within the scope of the study was analyzed using the Data Envelopment Analysis. The reasons for inefficiency in health expenditures in these countries are evaluated comparatively in the sense of damages suffered in private and public. In the second stage analyses, the effects of economic growth and population on EHE are analyzed using the multiple regression model. The analysis results indicate that South Korea, Russia, and Brazil were at the top in terms of the efficiency of health expenditures in all years, but South Africa India and Indonesia were at the lower level. In the analysis results, while it was found out that economic growth had a significant and positive effect on EHE, it was seen that population negatively affected the relationship between economic growth and EHE by its moderator variable feature. This study is important in terms of evaluating the relationship between health expenditures and economic growth based on efficiency and provides guiding recommendations for policymakers in this regard.

Keywords: *Economic Growth, Health Expenditure, Efficiency, Data Envelopment Analysis*

INTRODUCTION

It is seen that some criteria have gained importance when the groups of countries that will develop very rapidly in the next 50 years are examined. Some ratios such as Gross Domestic Product (GDP), Income Per Capita, Health Expenditures Per Capita are the most important among them. It is estimated that countries with the largest-scaled economies as GDP will not be the richest countries as "Per Capita" in future years. This situation requires some strategic moves for the countries and is so important that it will lead the existing superpower states to take measures. For instance, it is envisaged that BRICS countries will surpass the economies of the G6 countries on a dollar basis by 2050. Brazil, which has a relatively lower growth rate than the other union countries in terms of economic structure and growth within the BRICS, may be included into competition again by making a further structural reform. For instance, China has eight times larger volume of export compared to Brazil. Brazil, where there are lower investment and savings, has a debt of 57% of gross domestic product in domestic and foreign borrowing.

The fact that BRICS achieves growth at a higher rate within itself and becomes one of the strongest economic forces of the future depends on some factors. The first of these is to ensure continuity at the macro level. Indicators such as a longer lifetime, an increase in educational level, lower state taxes, lower inflation and wage stability will gain importance in the coming years. Another factor is the stability of the institutions within the countries. The state is the most important institution, but an autonomous and dynamic free market, health systems, schools, universities and financial institutions are also involved in this order. The factors with accelerating effects such as the investment made for new technologies can also be considered as a strategic move (Wilson and Purushothaman, 2003). Especially BRIC countries cannot be ignored when the figures they constitute are taken into consideration. These countries encompass 42 percent of the world's population and 1/3 of the land (Yelkikalan and Aydin (2015).

As it is known, only 35 of the 192 countries connected to the United Nations (UN) fall within the developed country category. All of the remaining countries are classified within the category of countries developing for decades. Exactly in the period we are in, it is seen that the growth rates of American, Japanese and European economies have slowed down considerably. When the averages of national income per capita are examined, although the Czech Republic and South Korea, Turkey and Poland, and Thailand have shown a high country performance in the ranges of 20.000-25.000 dollars, 10.000-15.000 dollars, and 5.000-10.000 dollars, respectively, for each, it cannot be said that this growth has constituted a regional integrity (Sharma, 2012). The MINT and BRICS countries have constituted around a fifth of world GDP and about 50% of world FDI in recent years (Asongu, 2016). In particular, the BRICS countries' target of entry into the G9 country group, which is classified immediately after the G7, is increasingly becoming clearer (O'Neill, 2001). This group which is expected to take the place of G7 countries between 2020 and 2050 also attracts the attention of all economists (Barker, 2013).

South Africa, which represents the largest economy of the continent of Africa, was added to the group consisting of Brazil, Russia, India, and China, so the letter "s" was added to the abbreviation of BRIC. In fact, one of the commonly used methods of grouping such countries is foreign direct investment known as FDI (Foreign Direct Investment). Moreover, this analysis is carried out at three different levels including global, sectoral and firm level (Gammeltoft, 2008).

MIST, which is another rising country group, is considered as a new structure created by promising economies just like BRICS. The common point of these two actors, that are candidates to shape the future of the world economy, is described as the very rapid change and development of some indicators in the member countries of these communities compared to the country-based and regional economies in the world. For instance, ratios such as gross revenue per capita, health expenditures and growth rate indicate that these countries have a difference. Nevertheless, this rise in MIST countries is weak when it is compared to BRICS. For instance, Gross domestic product ratios are calculated to be a total of 3.9 trillion dollars for the MIST countries while making a comparison based on the year 2011, BRICS has about three times larger volume with 13.5 trillion dollars. Only China is at the top of the list with $ 7.3 trillion dollars GDP.

It is known that developed countries still have a voice in the World Health Assembly. Besides, the effect of the western countries on decision makers in emerging countries is increasingly felt although they have no direct intervention. The World Health Organization (WHO) is gaining strength as a dominant institution that determines the structure of health in the world and the rules in this sector along with its members (Van der Rij and Pang, 2014). New country groups formed in a period during which the borders are beginning to disappear, and the new-generation behavioral models, cultural structures brought by these groups and organizations with complex structures will bring a new perspective to the health sector. At this stage, it will be difficult to predict to what extent BRICS and MIST countries will change this new world model when we look at the economic indicators in the health sector, but health expenditures for country citizens provide us with some key information (Harmer et al., 2013).

THEORETICAL BACKGROUND

According to the studies stating that there is a positive relationship between the health expenditures and economic growth in the long term, Mayer (2001) examined the variables of 5-year number of primary school graduates over the age of 25, real investments, government expenditures and total fertility (child per woman) including 13 Latin American countries and covering the years of 1975-1985 by cross-sectional and panel data analyses. As a result of the study, it was found out that there is a strong relationship between the long-term health expenditures and economic growth. Badi H. Baltagi and Francesco Moscone (2010) observed the years of 1971-2004, 1-year real health expenditures per capita, income, public health expenditure, age and GDP in 20 OECD countries with the CCEP approach. As a result of the study, they found out that the share of the young population within the total population plays an important role in health expenditures, and there is a linear relationship between health expenditures and economic growth in the long term. Seema Narayan et al. (2010) examined the variables of 1-year real GDP per capita, the share of health expenditures in GDP, the share of gross fixed capital formation in GDP, the share of export in GDP, the share of import in GDP, the share of r&d expenditures in GDP, the share of education expenditures in GDP over 5 Asian countries covering the years 1974-2007 by the panel data analysis. As a result of the study, it was found out that health expenditures contributed to economic growth but this contribution level was low. On the other hand, Kuan Min-Wang (2011)

discussed the variables of international total health expenditures, international personal health expenditures and international health expenditures per capita in selected 31 countries covering the years of 1986-2007 by the panel regression and quantile regression analyses. As a result of this study, they found out that the increase in health expenditures would positively affect the economic growth in the long term, but health expenditures could not be effective on economic growth in countries with very low and very high-income levels. Henryk Gurgul et al. (2012) examined the variables of quarterly GDP growth rate, total public expenditures, health and social security expenditures, education and scientific expenditures, national defense and public security expenditures, and the administrative expenditures of the government are addressing Poland and covering the years of 2000-2008 by the Granger causality test. In the study, they concluded that health expenditures increase the economic growth and are more important than education and scientific expenditures in terms of economic growth. Nadide Sevil Halıcı et al. (2016) examined the variables of private health expenditures, public health expenditures and gross fixed capital over 25 high-income and 19 low-income countries and covering the years of 1995-2012 and 1997-2009 by the panel data analysis. As a result of the study, they found out that there is a correlation between health expenditures and economic growth in the short term in low-income countries, and public health expenditures have a one-way causality on economic growth in the long term. They concluded that public and private health expenditures do not have causality on economic growth in the short term in high-income countries, and there is not a one-way causality between private health expenditures and economic growth in the long term.

According to the studies regarding the fact that economic growth increases the health expenditures rather than the fact that health expenditures affect the economic growth, Hartwig (2008) examined the variables of wage per worker, real GDP and labor force in 19 OECD countries covering the years of 1960-2005 by the panel data analysis. As a result of the study, it was concluded that economic growth increased the health expenditures. Khan et al. (2015) examined the variables of 1-year GDP per capita, health expenditures per capita, the rate of literacy, life expectancy at birth, labor force and the proportion of the population aged 65 and over in Southeast Asian region countries including the years of 1995-2012 by the panel cointegration and panel causality analyses. As a result of the study, they concluded that there is a positive and significant relationship between health expenditures and economic growth in the short terms, and flexibility plays a major role in the long term. Bedir (2016) examined the variables of GDP per capita, health expenditures per capita, income increase rate per capita and the growth rate of health expenditures per capita in 16 countries (Asia, Europe, and Africa) covering the years of 1995-2013 by the Granger causality test. As a result of the study, they found out that the ratio of health expenditures in total GDP also increases as the economic growth increases.

According to the studies explaining the relationship between health expenditures and economic growth within the context of structural breaks, Clemente et al. (2004) examined the cointegration relationship between private health expenditures, public health expenditures and total health expenditures and GDP in 22 OECD countries covering the years of 1960-1997 by the cointegration analysis. As a result of the study, they concluded that long-term structural breaks could change this relationship and there is a cointegration between health expenditures and economic growth when they are examined separately for each country. Besides, Silvestre (2005) examined by the panel data unit root and stationarity test in 20 OECD countries between 1960-1997. As a result of the study, he found that structural breaks affected the relationship between economic growth and health expenditures. As Berenguer et.al. (2016) points to The DEA technique has been employed in many industries, including the health care delivery industry (Hollingsworth, 2008) and at different DMU levels, from hospitals (Cooper et al., 2007; Jacobs, 2001) and nursing homes (Bjorkgren et al., 2001; Ozcan, € 1998) to physicians (Chilingerian, 1995). Our research paper is to use DEA techniques to evaluate the economic growth's effect on the efficiency of health expenditures.

DATA AND METHOD

The data envelopment analysis method was used to evaluate health expenditure effectiveness in BRICS and MIST countries, which are defined as emerging economies. DEA is a linear programming technique which measures how efficiently a decision making unit (DMU). Basically, DEA provides a categorical classification of the units into efficient and inefficient ones (Despotis, 2005). DEA aims to find DMUs that produce the highest levels of outputs by using the lowest levels of inputs. Therefore, it maximizes the ratio of weighted outputs to weighted inputs for the DMU under consideration. This maximization

objective is subject to the constraint that the same ratio for all DMUs be less than or equal to one. (Gok and Altindag, 2014; Öngel and Gok, 2014).

Health expenditure was used as the only input criterion in the DEA model in this study. The damage suffered in health expenditures constitutes the output criteria under two sub-criteria as public and private. It is necessary to decrease inputs and/or increase outputs to achieve a higher efficiency score as in classic DEA models. However, the outputs used in this model are the outputs unwanted to be increased, in other words, undesirable outputs. Therefore, undesirable outputs should firstly be transformed to perform efficiency analyses.

Three different approaches are used in the transformation of undesirable outputs to be used within the efficiency model as stated by Scheel (2001) and Pasupathy (2002). The first approach is the inversion of undesirable output as suggested by Koopmans (1951) (transforming them by the additive inverse method. This involves including the undesirable outputs using values f(Q) = -Q) The second approach was developed by Ali and Seiford in 1990. According to this approach, large scalar β is added to each of the undesirable output values such that the transformed values are positive. The transformation is done using

$$f_r^j(Q) = -q_r^j + \beta_r$$

The multiplicative inverse method developed by Golany and Roll (1989) constitutes the third transformation approach. According to this approach, Q represents the undesirable output, and the undesirable output can be included in the efficiency model as a desirable output by doing the transformation of f(Q)=1/Q. Within the scope of this study, the criteria of damage suffered in public and private health expenditures were included in the DEA model based on the third approach developed by Golany and Roll.

In the DEA model, two approaches can be used depending on the priority target of reducing inputs (input-oriented) or increasing the outputs (output-oriented) (Cooper et al., 2007). In this study, the input-oriented DEA model was used as the main purpose was to analyze the efficiency value of health expenditure used as an input criterion, in other words, the input was mostly focused.

In this study, the stepwise process multiple regression analysis is used to analyze the moderator effects of population on the form of the relationship between economic growth and efficiency of health expenditure. The moderator effect is represented in the multiple regression by using the following equation:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_1 X_2 + e$$

where, β_0= intercept; $\beta_1 X_1$= linear effect of X_1(X_1: economic growth); $\beta_2 X_2$= linear effect of X_2 (X_2: population); $\beta_3 X_1 X_2$= moderator effect of X_2 on X_1 (interaction term). To determine whether the moderator effect is significant, the following steps are performed.

1. Estimate the original (unmoderated) equation [see Table 4, Model 1]

2. Estimate the moderated relationship (original equation plus moderated variable) [see Table 4, Model 2]

Accordingly, the proposed research model in this study is presented in Fig. 1.

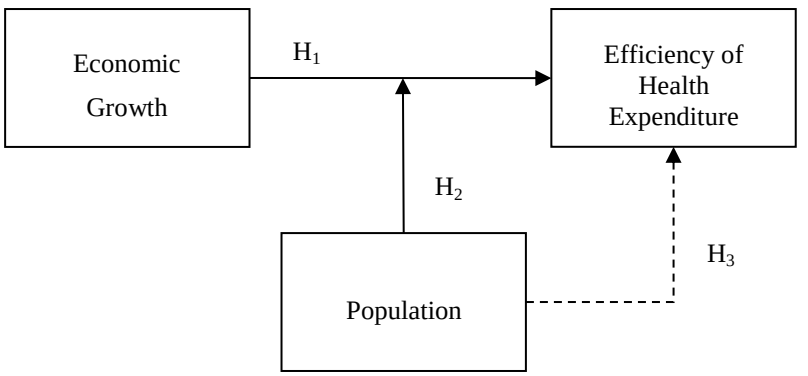

Figure 1. Proposed Research Model

In this model, we examine three primary hypotheses as follows;

H_1: Economic growth has a positive effect on the efficiency of health expenditures

H_2: Population is correlated with the efficiency of health expenditures

H_3: Population changes the form of the relationship between economic growth and the efficiency of health expenditures as a moderator variable

Within the scope of the study, the health expenditure data covering the years of 2008-2012 used in performing the DEA analyses, and the economic growth and population data used in the regression model were obtained from the World Bank database. Descriptive statistics regarding the data used in our analysis are presented in Table 1.

Table.1 Descriptive Statistics of Health Expenditures

	Health Expenditures	Out-of-Pocket Health Expenditures (Public)	Out-of-Pocket Health Expenditures (Private)
Brazil	922.32	31.44	57.30
	(187.24)	(0.71)	(0.75)
Russia	695.51	32.11	85.49
	(148.41)	(4.51)	(3.31)
India	52.57	61.23	86.40
	(8.91)	(2.56)	(0.45)
China	231.05	36.45	78.73
	(66.78)	(2.52)	(1.31)
South Africa	569.99	37.61	54.33
	(103.15)	(10.54)	(9.82)
Mexico	590.89	46.74	92.10
	(37.17)	(2.01)	(0.57)
Indonesia	83.68	47.60	76.06
	(20.73)	(1.53)	(0.64)
South Korea	1462.04	35.01	78.79
	(226.61)	(0.82)	(0.30)
Turkey	639.40	16.76	64.41
	(38.78)	(0.72)	(1.91)

The values in parenthesis describe the standard deviations

ANALYSIS AND RESULTS

The analyses in this study were carried out in two stages. At the first stage, the health expenditure efficiency analyses were performed, and an efficiency score (the efficiency of health expenditure - EHE) was obtained for each of the BRICS and MIST countries within the scope of the study. At the second stage, regression analyses, in which the relationship between economic growth and EHE and the moderator effect of the population were analyzed, were performed.

The DEA analyses were applied after performing the transformation of the public and private out-of-pocket health expenditure data constituting the undesirable outputs in the study. The data regarding the technical efficiency scores obtained as a result of the analyses in which the CRS hypothetical input-oriented DEA model was applied are presented in Table 2.

Table.2 Health Expenditure Efficiencies of Emerging Economies

	2008	2009	2010	2011	2012
Brazil	1.00	0.89	0.87	0.87	0.89
Russia	0.88	0.90	1.00	0.85	0.88
India	0.24	0.22	0.17	0.19	0.21
China	0.67	0.54	0.51	0.62	0.61
South Africa	0.32	0.23	0.17	0.21	0.24
Mexico	0.71	0.67	0.63	0.69	0.72
Indonesia	0.28	0.34	0.31	0.29	0.30
South Korea	0.92	1.00	0.89	1.00	1.00
Turkey	0.72	0.79	0.77	0.82	0.81

The DEA results through which the EHE scores were obtained for BRICS and MIST countries suggest an interesting result. According to the health expenditure efficiency scores, BRICS and MIST countries are divided into high and low efficiency within their own groups. Namely, Brazil and Russia are at the top within the BRICS group with high-efficiency scores, India and South Africa fall behind with low-efficiency scores. There is a similar situation within the MIST countries group. In this group, while South Korea is at the top, Indonesia falls behind with efficiency scores in all years. China in BRICS countries and Mexico and Turkey in MIST countries exhibited above average and rising efficiency scores.

The analysis results revealed that emerging economies have difficulties in using their health investments effectively, especially in certain countries. It is important to identify the source of the problem for the realization of the improvement studies. In this sense, inefficiencies in public and private sectors were evaluated by performing the health expenditure inefficiency analysis. In Table 3, the inefficiency ratios in public and private sectors for each research country are given as a percentage.

The percentage inefficiencies of emerging economies regarding the out-of-pocket health expenditure are calculated as follows. The 5-year (2008-2012) average of slacks obtained as a result of the DEA analyses and the 5-year average of the values of these criteria realized in the existing situation are summed up for each country's public and private out-of-pocket health expenditure values. Thereafter, the percentage inefficiency values (improvement rates) can be found for each country by doing percentage proportioning between the current value and the target value. At this point, the percentage inefficiencies values were obtained by doing inverse proportioning instead of linear proportioning while doing percentage proportioning as the criteria in question are the undesirable output criteria.

Table.3 Percentage Inefficiencies of Emerging Economies Regarding to the Out-of-Pocket Health Expenditures

	Public	Private
Brazil	0.03	0.12
Russia	0.05	0.15
India	0.45	0.67
China	0.19	0.34
South Africa	0.38	0.59
Mexico	0.17	0.39
Indonesia	0.41	0.69
South Korea	0.02	0.08
Turkey	0.15	0.29

When the analysis results obtained in Table 2 and Table 3 are evaluated together, an extremely interesting situation is encountered. That is to say, although Brazil, Russia, and South Korea have high-efficiency scores, there is a need for improvement in health expenditures in these countries. Of course, when the inefficiency ratios are examined publicly and privately, it is seen that the inefficiency ratios in the private sector are much higher not only in these three countries but also in all countries. This situation also reveals the fact that the efficiency of health expenditures in the private sector should be further questioned. The health investments inefficiency ratios in the private sector are over 50% in India, South Africa and Indonesia ranking at the lowest in terms of the efficiency scores. In brief, it would be appropriate for emerging economies to focus on removing the health expenditure inefficiency, especially in the private sector if they want to increase the efficiency of health expenditures.

In the second stage analyses of the study, the relationship between economic growth and health expenditure, and the effect of population on this relationship were evaluated using the multiple regression analysis. The following regression model is developed for this analysis.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + e$$

In this equation, economic growth, population, and efficiency of health expenditures are represented by X_1, X_2, and Y, respectively.

The model is significant at the $p < 0.01$ level. Here, economic growth significantly increases the efficiency of health expenditures, providing support for Hypothesis 1 ($\beta = 0.321$). Besides, tolerance values provide the evidence that there is not any multicollinearity between these variables. Although the population has not any significant influence on the efficiency of health expenditures, there might be an indirect relationship between them. One of the major research questions of our study is "*how the*

population changes the form of the relationship between economic growth and efficiency of health expenditures". Therefore, a second regression model is developed in order to examine this effect:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_1 X_2 + e$$

In this equation, the Interaction term ($\beta_3 X_1 X_2$) represents the moderator effect of population. The second model is significant at the $p < 0.01$ level. The regression analysis results suggest that population can be considered ($p < 0.1$) as a negative moderator ($\beta = -0.109$) on the relationship between economic growth and the efficiency of health expenditures.

DISCUSSION

When it is considered that one of the primary purposes of economic development is increasing the quality of life, it will not be surprising that the investments in the health field will increase rapidly, especially in emerging countries. In parallel to this, health investments both in public and private sectors have shown a rising trend over the past 10 years. The increase in investments in question especially in developed and developing countries has come into prominence in the public space and also has found a significant place in the private sector.

Therefore, it is seen that the investments in the health field have increased with the government support and private sector financing in economically growing countries. However, to evaluate only the investment size portion of this table will be like focusing on only a specific part of a puzzle. One of the top priority questions that need to be questioned at this point is how efficient these investments are. Moreover, the questions of "are public and private sector investment efficiencies different and, if any, what are the possible causes of these differences?" appear as the issues that need to be answered for policymakers in the health field.

At this point, our study in which the efficiency of health investments is evaluated not only contributes to the relevant literature but also offers practical suggestions and provides an insight for the policymakers, especially in the health field.

In this sense, the efficiencies of health expenditures in BRICS and MIST countries, which are defined as emerging economies, were firstly analyzed within the scope of the study. The results showed that both groups of countries were separated into high and low-efficiency aspects within themselves. Namely, while Brazil and Russia have comparatively high-efficiency values among BRICS countries, India and South Africa have lower efficiency values. Similarly, while South Korea showed a high efficiency within the MIST group, Indonesia had comparatively lower efficiency values. While China had average values in all research years in the BRICS group, Mexico and Turkey had average values with a rising trend in the MIST group.

These results show that health investment efficiencies in emerging countries, which are defined as emerging economies, showed similar characteristic features in a sense although they were different. More clearly, countries are divided into successful and unsuccessful groups regarding the efficiency of health expenditures. This situation essentially brings along important tips for policymakers for the implementation, as well. In particular, the countries that are unsuccessful in the sense of efficiency values can take the countries that are successful in planning health investments and transforming investments into practice as a role model. Thus, they can increase their health investment efficiencies by adapting successful application models to their own structures.

Significant health investments are made by private sector financing in addition to the investments made by the state. At this point, to analyze the question of "are the inefficiencies of the investment due to public or private sector applications" is important for the planning of improvement studies. The analyses carried out within the scope of the study have revealed a very interesting finding. The inefficiency values in the private sector are higher than inefficiencies in the public in all research years both in countries with low health expenditure efficiency (such as India, South Africa, and Indonesia) and in countries with high efficiency (such as Brazil, Russia, and South Korea).

Therefore, it is important to carry out improvement studies on private sector investments. The issue that needs to be addressed at this point is to what extent the investments made are beneficial, successful, in short, efficient, how high or how much budget is provided to make an investment. Therefore, it would be appropriate for decision makers in the private sector to give more importance to investment efficiency evaluations at this point. Furthermore, it will also be appropriate to examine the public control

mechanisms in the private sector investment reviews when it is considered that significant government supports have been provided to the health expenditures of the private sectors in many emerging countries.

Another research question within the scope of the study was the evaluation of the relationship between economic growth, population and health expenditure efficiency. Essentially, as it was expected (as proposed in Hypothesis 1), the positive effect of economic growth on the efficiency of health expenditure was observed in the analysis results. Therefore, it is seen that health investments increased in economically growing countries, and this situation was relatively reflected positively on investment efficiencies.

On the other hand, no direct effect of population on efficiency was found, but it was seen that population affected the relationship between economic growth and efficiency with a negative moderator effect. Therefore, the efficiency of health expenditures will be relatively low in countries where the population is rising as well as the economic growth compared to countries with lower population growth rates. The main reason for this situation is the fact that the need for investment in different fields also increases (e.g. infrastructure, education, etc.) along with the increasing population although economic growth brings along more investment opportunities, as well. In this sense, not only the investment budget allocated for the health field from the general budget is reduced relatively, but the increased needs can make the investment planning and evaluation processes more difficult. The fact that the population affects the relationship between economic growth and the efficiency of health expenditure as a negative moderator may be due to this reason.

At this point, there are important tasks for policymakers and practitioners. In particular, the increasing investment needs in the health and other fields depending on the rising population should be planned much more carefully, and the control assessments should be carried out more efficiently after getting into the implementation phase. Because it was seen in this study, in which the experiences during the years of 2005-2012 were analyzed, that there is a need for improvement in all countries in terms of health investments, and that the rising population may have adverse effects on investment efficiency. Therefore, the fact that emerging economies focus on policymakers' planning and evaluation processes related to health investments and concentrate their improvement efforts in these areas can provide positive returns.

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