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Original Article

Comparison of the Effects of Public and Private Health Expenditures on the Health Status: A Panel Data Analysis in Eastern Mediterranean Countries

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ABSTRACT

Background: Health expenditures are divided in two parts of public and private health expenditures. Public health expenditures contain social security spending, taxing to private and public sectors, and foreign resources like loans and subventions. On the other hand, private health expenditures contain out of pocket expenditures and private insurances. Each of these has different effects on the health status. The present study aims to compare the effects of these expenditures on health in Eastern Mediterranean Region (EMR).

Methods: In this study, infant mortality rate was considered as an indicator of health status. We estimated the model using the panel data of EMR countries between 1995 and 2010. First, we used Pesaran CD test followed by Pesaran's CADF unit root test. After the confirmation of having unit root, we used Westerlund panel cointegration test and found that the model was cointegrated and then after using Hausman and Breusch-Pagan tests, we estimated the model using the random effects.

Results: The results showed that the public health expenditures had a strong negative relationship with infant mortality rate. However, a positive relationship was found between the private health expenditures and infant mortality rate (IMR). The relationship for public health expenditures was significant, but for private health expenditures was not.

Conclusion: The study findings showed that the public health expenditures in the EMR countries improved health outcome, while the private health expenditures did not have any significant relationship with health status, so often increasing the public health expenditures leads to reduce IMR. But this relationship was not significant because of contradictory effects for poor and wealthy peoples.

Background

According to the economic growth literature, improvement in human capital is one of the most important factors in achieving economic growth and development (1). In the neoclassical growth model, increasing the human capital will raise the per capita product. Also, based on Grossman's human capital model, health increases the human capital by making more time for working and increasing utility (2). Nowadays, increasing the individuals' health level is one of the most important policies to provide social equity in countries. Health is the center of sustainable development; therefore, considering health and making attempts for its improvement and expansion have always been a priority (3). Therefore, investment in health is very important in many countries. Health expenditures contain all the expenditures which are used for preparing and improving the individuals' health (4). The concept of health expenditures is different from one country to another. Moreover, Poullier has divided total health expenditures in two parts of public and private health expenditures. Public health expenditures contain social security spending, taxing to private and public sectors, and foreign resources like loans and subventions. On the other hand, private health expenditures contain private health insurance, out-of-pocket health expenditures, etc (5–7).

In order to enhance health, sufficient health recourses must be prepared. Preparing these resources need money, hence achieving a healthy country requires health spending (8). Health expenditures increase the quality of human resources and lead to higher life expectancy as well as longevity (9). An Increase in life expectancy also leads to an increase in the desire of saving and investing and eventually results in higher rates of economic growth (10). However, researchers have come to the conclusion that public health expenditure, especially in developing countries, plays an important role in reaching to some millennium development goals such as achieving universal

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primary education, promoting gender equality empowering women, reducing poverty and disparity, and confronting the deadly diseases (e.g. AIDS, malaria and tuberculosis). However, in most developing countries, governors do not pay attention to health and do not give it an enough share in the budget (11). For example, data have shown that the share of health expenditures in government budget was 7.02% in Lebanon, 8.04% in Jordan, only 2.19% in Pakistan, and 2.75% of GDP in Oman in 2010 (12).

Each of the private and public health expenditures has different effects on the health status. Increase in out of pocket health expenditure, which is one of the private health expenditures, increases the number of catastrophic expenditures and may lead to more poverty (13); of course, in some countries governors like private health expenditures. For instance, they do not have to pay for people and the lack of budget will decrease (14). Higher private health expenditures lead to increase the costs of the insurers' management and marketing and they must take much more money from their customers. Therefore, people do not have to pay more for something which makes them healthier, nor does it protect them against the expensive health expenditures. On the other hand, because of having a competitive health insurance system, in order to have a larger number of costumers, insurers deliver a variety of services providing the costumers with the opportunity to select what they really want (15). Increasing the public health expenditure may increase the budget shortage, but it decreases the number of catastrophic expenditures. Public health expenditure improves the society's health and eventually improves human capital and leads to economic growth. Thus, in order to assess the humane capital, analysts look at the government's share of the health expenditures (16). The present study aims to investigate the effects of public and private health expenditures on the health status in the Eastern Mediterranean Region (EMR) countries. Total health expenditures in these countries have been increased resulting in an increase in the health status. The increase in the health status is different from one country to another; some of them have been very successful in changing the health status, while some have not. In Iran for example, the total health expenditures per capita has been quadruplicated from $209.71 at purchasing power parity in 1995 to $836.27 in 2010, while the infant mortality rate (IMR) has decreased only from 5.48 to 5.04 in these years. In Egypt, the total health expenditure per capita increased from $108.71 in 1995 to 288.56 in 2010 and there was a big change in infant mortality rate, too (from 7.063 in 1995 to 5.121 in 2010) (17). These differences show that in the relationship between the health status and health expenditures, we should take into account not only the total health expenditures but also the share of public and private health expenditures. Studying the effects of public and private health expenditures and their effects on health status will help policy makers to make correct decisions in their decision making. This article shows the importance of each of the public or private health expenditures in changing health status of the population.

Methods

Data

Panel data econometrics method was used in the present descriptive-analytical study. In this study, we used a panel data from 1995 to 2010 from the 20 EMR countries. These countries are: Afghanistan, Bahrain, Djibouti, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tunisia, United Arab Emirates, and Yemen. Data for other EMR countries (South Sudan, Palestine) were not available. The data related to 2011 and 2012 were not available for some indicators; therefore, we decided to exclude these years. The data were gathered from World Bank statistical data bank (12).

Model

We used the following matrix form model:

$$Y_{it} = \beta X_{it} + u_{it} \qquad (1)$$

Where Y_{it} is the dependent variable and shows the level of health in the time of *t* and in the country of *i*. In general, many indicators, such as quality of life, life expectancy, health adjusted life expectancy, infant mortality rate, and maternal mortality rate, can be used in order to show the health status. In this study, infant mortality rate was used as the indicator of health status because its data were available in all the EMR countries and it is the WHO indicator for specifying the countries' health status. We used some determinants of infant mortality rate at the national level. In our model, X_{it} is the matrix form for explanatory variables and u_{it} contains the residuals. The econometrics model of this study is in Cobb-Douglas form and has been presented blew. This model was used by Frey and Field and Homaie Rad *et al* (18,19):

$$H_{it} = \alpha_i Pub_{it}^{\beta 1} Pvt_{it}^{\beta 2} gdp_{it}^{\beta 3} POPU1_{it}^{\beta 4} FLB_{it}^{\beta 5} FER_{it}^{\beta 6} EDU_{it}^{\beta 7} URB_{it}^{\beta 8} u_{it}, \qquad (2)$$

Where:

Hit_{it}: infant mortality rate of the countries

PUB_{it}: public health expenditures per capita at purchasing power parity

PVT_{it}: private health expenditures per capita at purchasing power parity

GDP_{it}: gross domestic product per capita at purchasing power parity

$POPU1_{it}$: proportion of the population under 15 years old

$POPU2_{it}$: proportion of the population between 15 to 64 years old

FLB_{it}: female labour participation rate

FER_{it}: fertility rate

EDU_{it}: mean years of school for the people above 25 years old

URB_{it}: proportion of the population who lives in urban regions

Because of having a Cobb-Douglas model, we must make the model estimable. In doing so, we must take the logarithm of the two parts of the model and make it a linear one.

$$lH_{it} = \alpha_i + \beta_1 lpub_{it} + \beta_2 lpvt_{it} + \beta_3 lgdp_{it} + \beta_5 lpopU1_{it} + \beta_6 lflb_t + B_7 lfer_{it} + \beta_8 ledu_{it} + \beta_9 lurb_{it} + u_{it}, \qquad (3)$$

Where l shows the logarithm form of each variable. Because of having long time series (16 years) and long cross sections (20 countries), before each estimation, we must test the cross sectional dependency as well as the unit roots. If the model has cross sectional dependency, using common panel data unit root and cointegration tests may lead to spurious results. Therefore, we must use the tests which are designed for cross sectional dependent models. In the present study, we made use of STATA 11 (College Station, TX, USA) for using the tests and estimating the model.

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Estimating techniques

For indicating the presence of cross sectional dependency, we used Pesaran cross sectional dependency test (20). After that, we used CIPS test to determine whether the variables were unit root or not (21). After being ascertained about having non-stationary variables, we used cointegration tests which are used to show if there is a long term relationship between the variables. If we estimate a non-cointegration model with non-stationary variables, the model will lead to spurious results. In this study, Westerlund panel cointegration tests were utilized in order to assess the presence or absence of cointegration (22). This test contains 4 various tests named Ga, Gt, Pa, and Pt. All these tests use a bootstrap technique to eliminate the cross sectional dependency (23). Finally, the model was estimated. In order to estimate the model, first we used Hausman test. This test shows whether the model has fixed or random effects. Then, we used Breusch-Pagan test to determine whether the model was a pooled or a panel one.

Results

Table 1 shows the results of descriptive statistics for other variables. In the EMR countries, mean IMR was 33.98 per 1000 births between 1995 and 2010 with the range of 6 to 108.50. Minimum of this range was for United Arab Emirates in 2010 and the maximum was for Afghanistan in 1995. The average of Per capita public health expenditure was 316.20 and the average of per capita private health expenditure was 360.71. Minimum and maximum of these two variables were 0.12 and 2535.05 for public and 0.652 and 8529.56 for private health expenditure. The minimum and maximum of the range for both per capita public and private health expenditures were for Iraq in 1997 and Qatar in 2003.

Table 2 shows the results of Pesaran's cross sectional dependency test. As shown in the table, all the study variables were rejected regarding the hypothesis of not having cross sectional dependency. Now, we cannot use unit root tests without paying attention to cross sectional dependency. Thus, Pesaran's CADF unit root test was utilized. The null hypothesis of this test is having non-stationary variables. Table 3 shows the results of this test.

In the current study, Westerlund panel cointegration test was used to show whether there was a long run relationship among the variables. As mentioned before, Westerlund uses a bootstrap technique to eliminate cross sectional dependency in the model. Table 4 shows the results of Westerlund cointegration tests. We also have to consider the results which have been obtained through the bootstrap technique. The presence of a cointegrated model has been confirmed in all these 4 tests because the null hypothesis of having a cointegration model is accepted in these tests.

Table 1.Descriptive statistics

Variable	Mean	Standard error	Min	Max
IMR	33.98	1.46	6.00	108.50
Pvt	360.71	55.59	0.65	8529.56
Pub	316.20	22.18	0.12	2535.05
GDP	13280.33	892.80	595.04	76900.52
Popu1	34.67	0.44	13.48	50.90
Popu2	60.38	0.45	46.33	85.48
Urb	64.97	1.27	19.34	98.65
Flab	24.78	0.54	10.40	52.10
Edu	3.91	0.12	0.20	8.70
Fer	3.64	1.46	1.67	8.06

Now, we can estimate the model without any disturbance. For estimating the model, we must choose between the pooled–panel effects and fixed–random ones. We used Breusch-Pagan test to find the pooled or panel effects. The χ^2 statistics of this test was 1618 and its *P* was 0.00; therefore, random effects had to be selected. We used Hausman test to select between the fixed and random effects (*P*=0.13); therefore, random effects were used for estimating the model. Table 5 shows the results of estimating the model using random effects. The R^2 statistics for this model is 0.90 and it is good for panel data models. In the table, you can see the results of coefficients, *t* statistics and *P*. As the table depicts, except for Logarithm of mean years of school for the people above 25 years old (LEDU), all the variables had relationships with logrithm of infant mortality rate (LIMR). Some of these variables (lpub, lgdp, lpopu2, lflab, lfer) are significant at 95% confidence interval and others are significant at 90%. The study results revealed negative relationships between public health expenditures, GDP, proportion of the population between 15 to 64 years old, and infant mortality rate. This indicates that if the public health expenditures and GDP increase, the status of health will increase, as well. However, a significant positive relationship was found between private health expenditures and IMR. Private health expenditures contain some health expenditures, such as out of pocket health expenditures and private health insurance. In addition, for poorer families increasing the out of pocket expenditures may lead to catastrophic health expenditures and increasing poverty which eventually results in an increase in infant mortality rate. In wealthy families, using private health insurance is better because they can select from various services leading to increase in the health status rate. The opposing effect of private health

Table 2. The results of Pesaran cross sectional dependency test

Variable	CD-test	*P*
Lpvt	15.76	0.00
Lpub	31.98	0.00
Lgdp	38.74	0.00
Lpopu1	46.86	0.00
Lpopu2	47.17	0.00
Lurb	42.24	0.00
Lflab	25.88	0.00
Ledu	54.28	0.00

Table 3. The results of Pesaran CADF unit root test

Variable	t-bar	cv5	*P*
Lpvt	-1.475	-2.210	0.87
Lpub	-1.959	-2.210	0.16
Lgdp	-2.532	-2.210	0.00
Lpopu1	-0.856	-2.210	1.00
Lpopu2	-1.745	-2.210	0.47
Lurb	-0.252	-2.210	1.00
Limr	-2.925	-2.210	0.00
Ledu	-2.125	-2.210	0.04
Lflab	-1.836	-2.210	0.32

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Table 4. The results of Westerlund panel cointegration test without and with bootstrap technique

Variable	*P*	Robust *P*
Gt	1.00	0.90
Ga	1.00	0.96
Pt	1.00	0.97
Pa	1.00	0.93

Table 5. The results of estimating the model with OLS random effects

Variables	Coef	Z	*P*
Lpvt	0.02	1.85	0.06
Lpub	-0.02	-1.98	0.05
Lgdppp	-0.30	-6.84	0.00
Lpopu1	0.13	1.87	0.06
Lpopu2	-1.58	-9.06	0.00
Lurb	0.26	1.69	0.09
Lflab	0.18	3.55	0.00
Lfer	0.80	1.19	0.00
Ledu	0.04	0.81	0.42
Cons	9.17	7.91	0.00
R^2=0.90, Breusch-Pagan χ^2= 1618, Hausman *P* = 0.13			

expenditures on poor and wealthy families is the reason why the private health expenditures do not have a significant relationship with infant mortality rate at 5%. According to the study results, the coefficient of private health expenditures was positive. This is because there are more poor families in the EMR countries and increasing the private health expenditures decreases the health status of the society. The study findings also revealed a significant positive relationship between the proportion of people under 14 years old and IMR. This might be due to the fertility rate; when the average number of children that would be born to a woman over her lifetime increases, infant mortality rate increases, too. However, the relationship was shown to be negative for other age groups. Overall, increasing longevity is the result of having a healthy society.

Discussion

The findings of the present study showed a positive relationship between public health expenditures and health status, while a negative one was observed between private health expenditures and health status; of course, this relationship for public health expenditure was significant at 5% and for private health expenditure this relationship was significant at 10%. Novignon *et al.* found similar results regarding public health expenditures. In their study, they used a panel data for 44 African countries. Unlike our study, however, they found a significant positive relationship between private health expenditures and health status (24). Moreover, Asiskovitch *et al.* used the panel data for OECD countries and showed that in comparison to the private health expenditures, public health expenditures had a stronger relationship with the health status (25), which is in agreement with the results of the present study. In a study which was performed in Latin America, the relationship between public and private health expenditures and income was analysed. If the health status is improved, people can work more and earn much more money. In this study, in both the public and private sectors, the health expenditures per capita was positively and significantly correlated with income per capita (26). Cremieux *et al.* evaluated the effect of private and public pharmaceutical expenditures on the health status in Canada. In contrast to our study, they found that private expenditures had more positive effects on the health status compared to the public health expenditures (27). Following Cremieux *et al.*, Guidon *et al.* used the panel data cointegration approach to find the relationship between the pharmaceutical expenditures and the health status in Canada. However, they did not find any significant relationships between these health expenditures and the health status indicators (28). On the other hand, Nixon *et al.* found a positive relationship between public health expenditures and health status. Similar results were also obtained in the studies conducted by Filmer *et al.*, Rajkumar, and Farahani (16,29–31).

Conclusion

We used public and private health expenditures in this study. As mentioned above, a positive relationship was found between public health expenditures and the health status, while no significant relationship was observed between private health expenditures and the health status. We suggest dividing private health expenditures into details in order to find the relationships. For example, we can use out of pocket health expenditures and private health insurances as independent variables. In this study, infant mortality rate was used as indicator of the health status. Other indicators, such as crude death rate, life expectancy, and health adjusted life expectancy, can also be used as dependent variables in further studies in order to indicate the health status.

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Ethical issues

Not applicable.

Competing interests

The authors declare no competing interests.

Authors' contributions

Study idea: SV. Gathering data: ABZ, Data analysis and Interpretation of results: EHR, Drafting of manuscript: EHR. Revision of study: MH. Guarantor of the manuscript: MH, Reviewing manuscript: FT, FE, Final Revision: EHR

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