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The Effects of the Healthcare System on Medical Expenditures in South Korea

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Introduction

I Introduction

The South Korea has sought to reduce the inequality of healthcare resources available nationwide since 1981, when it first introduced public health doctors (PHDs) and public health clinics (PHCs), while also reforming the nationwide network of healthcare services to make more resources available in some of the country's more remote areas. The National Health Insurance (NHI), first introduced in 1977, was expanded in 1988 and 1989 to provide benefits for rural residents and self-employed urban residents, respectively, and has been providing universal healthcare for all Koreans ever since. The increase in the supply of medical resources and expansion of public health insurance have led to quantitative and qualitative increases in available medical and health services in Korea, contributing significantly to the betterment of public health. In the meantime, policy-makers have also attempted to implement various reforms to increase the efficiency of the medical system by refining the service jurisdictions and medical care delivery systems.[1] Despite these achievements, inequity along

1) The Korean state first introduced the concepts of service jurisdiction and medical care delivery in 1989 in an effort to increase the overall efficiency of the healthcare system by eliminating the functional compartmentalization of medical services, reducing regional inequality in the availability of medical institutions, decreasing the concentration of patients in large hospitals, and

income and regional lines continues to persist in terms of access to medical and health care, while the regional disparities in the availability of medical resources remain as well. Coupled with these shortcomings, the diversification and growth of demand for various healthcare services continue to raise the national medical expenditure.

The accepted opinion regarding the performance of the healthcare system in Korea is that it is generally efficient, as it has helped improve public health significantly compared to the amounts of national medical expenditure put into it. This opinion, however, has been countered by some rebuttals. It is worthwhile to assess the performance of the Korean healthcare system by comparing the state of Korean public health and the level of medical expenditure to those of other comparable countries. Such analysis will also reveal the ways in which the Korean healthcare system can be improved in the future. Maximizing the efficiency of the system will be one of the top-priority policy goals in the future, for the purpose of not

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enhancing the vulnerable lower-level care system. However, the expansion of roads and other parts of the transportation infrastructure has made it possible for Koreans to travel to other regions of the country for medical care. The existing inequality in the distribution of medical resources by region also caused the service jurisdiction and medical care delivery requirements to unnecessarily restrict the residents of certain regions from seeking and obtaining the care they needed. Service jurisdictions were thus abolished, and the medical care delivery system was reformed from a three-tier structure to a two-tier one. Korean patients today can seek initial care and treatment from all types of medical institutions except for tertiary care hospitals (TCHs). Even at TCHs, certain departments, such as family medicine, can provide primary care for patients.

only keeping medical expenditure in check, but also maintaining the health of the Korean public. In other words, it is important to envision and explore a healthcare system that ensures greater equity and efficiency.

A healthcare system is a wide-ranging concept that consists of six core subsystems, spanning healthcare resources to payments. Evaluation of its performance thus requires assessing each subsystem's contribution to national medical expenditure and public health. In this study, the Korean healthcare system is divided into multiple sections so that it can be compared to equivalent systems in other members states of the Organization for Economic Cooperation and Development (OECD) in terms of regulations, financing, and provisions of medical care services.[2] To this end, OECD member states are also divided between those where the public/state makes most healthcare decisions and those where the private sector/market makes most of such decisions. The quantitative model of analysis used in this study is incapable of capturing all these diverse

2) In terms of medical regulation, the health care system is classified into state-led and social and individual-driven types. The former is a system in which the government directly manages and regulates the medical system, and the latter regulates the medical system by the market. In terms of financing, the health care system is divided into state-led and social and individual-led types. The former is funded by national taxes for the provision of health services, while the latter is financed by social or personal insurance. From the perspective of the health care provision system, the health care system is classified into state-led and social and individual-led types. The former is the system in which the state owns most of the medical facilities, while the latter is the system in which most of the medical facilities are privately owned.(OECD Health Data, 2016).

policy factors, but it is suited to quantitatively assessing the effects on national medical expenditures as the performance of the Korean healthcare system in light of its financing and payment structures as well as the health status of the people.

Ⅱ Literature Review on National Medical Expenditure

II Literature Review on Notional Medical Expenditure

Research on factors that lead to changes in national medical expenditure has been carried out since the late 1970s. Researchers have been employing diverse socioeconomic variables as well as variables of the given healthcare systems to examine how these variables affect national medical expenditure per capita. These studies can be generally categorized as earlier ones utilizing cross-sectional data, on the one hand, and later ones utilizing panel data, on the other (Yu et al., 2003). The research findings, however, have had little to do with the types of data used; rather, the findings have varied widely depending on the idiosyncratic combinations of the research methods and data chosen by researchers. For instance, controversy arose when it was discovered that even early studies based on cross-sectional data differed in their conclusions on whether and how changes in the proportions of public medical spending affected changes in national medical expenditure.

Yet there is a consensus on how GDP per capita affects national medical expenditure. The vast majority of studies on this topic have confirmed that increases in GDP per capita lead to increases in national medical expenditure per capita. However, factors that influence changes in national medical expenditure per capita are complex. We thus need to examine the types of models and data used by researchers and determine whether there are correlations between the types of variables identified and research methods chosen, on the one hand, and the research findings, on the other. We also need to examine the shortcomings of the existing literature on this subject.

Newhouse (1977) was the first to attempt an international comparison of medical expenditure. The author performed a regression analysis on medical expenditure in 13 developed countries as of 1971 and analyzed possible factors. The sole explanatory variable used was GDP per capita. The study concluded that GDP per capita alone accounted for 92 percent of the variations found in national medical expenditure. The omission of factors other than GDP per capita, however, made the author unable to estimate the extent of the effect of GDP per capita with reliability.

Leu (1986) analyzed data from 19 OECD member states using multivariate regression and examined factors of variation in national medical expenditure. The author found that a 10-percent increase in GDP per capita raised national medical expenditure per capita by 11 to 13 percent, while a 10-percent increase in the number of public hospital beds per capita also raised expenditure per capita by eight to nine percent. A 10-percent increase in the proportion of medical expenditure in public finance raised national medical expenditure per capita by two to three percent. On the other hand, the introduction of a national healthcare system was shown to decrease national medical expenditure per capita by 20 to 25 percent.

One study based on the data of 18 OECD member states explored the relationship between national medical expenditure and national income. It showed that GDP per capita had a strong explanatory effect on changes in national medical expenditure, and income elasticity was measured at 1.25. In other words, the study supported Newhouse's conclusion that income was a core factor of national medical expenditure and that medical and healthcare services were luxury goods (Parkin, 1989).

Whether a given healthcare system and related variables affect national medical expenditure per capita remains the subject of heated controversy. In another analysis by Gerdtham, Sogaard, Andersson, and Jonsson (1992a) that included national income, the healthcare system, and socioeconomic factors in its model of national medical expenditure, the variables that exerted significant effects were national income per capita (purchase power parity, USD), urbanization, proportion of medical spending in public finance, proportion of public spending on hospitalization costs, and the fee-for-service policy. This is in contradiction to Leu (1986).

The same authors went on to analyze factors of national medical expenditure per capita in 19 OECD member states as of 1974, 1980, and 1987 (1992b). In addition to the variables analyzed previously, the authors also analyzed the effects of population aging (i.e., ratio of seniors aged 64 or older to the working-age population aged 15 to 64) and the number of doctors per capita. They found that, for a 10-percent increase in population aging, national medical expenditure rose by two percent, while a 10-percent increase in the number of doctors per capita caused a 10-percent decline in national medical expenditure per capita.

Gerdtham (1992) also estimated changes in national medical expenditure per capita over a 15-year period, from 1972 to 1987, in 22 OECD member states. The author concluded that controlling the nation-specific factors each year exerted considerable effects on the elasticity of GDP per capita and the estimated national medical expenditure per capita. Specifically, the static model estimated the elasticity of GDP per capita to be 0.75, while the dynamic model did not nullify the hypothesis that long-term elasticity would be one. The analysis also estimated the elasticity of the inflation rate to be 0.17, suggesting that national medical expenditure per capita rose more slowly than consumer prices.

Gerdtham et al. (1998) attempted to explain national medical expenditure per capita using diverse socioeconomic as well as healthcare system variables. Of the socioeconomic variables analyzed, GDP per capita and smoking per capita emerged as the only two with significant correlations to national medical expenditure per capita. The elasticity of GDP per capita was 0.74, suggesting that medical spending was essential. Each 10-percent increase in smoking per capita was also shown to raise national medical expenditure per capita by 1.3 percent. The authors thus concluded that smoking was a proxy variable that represented other factors with upward influences on national medical expenditures. Of the healthcare system variables, societies with higher public medical spending and ratios of public hospital beds were generally tied to lower national medical expenditure per capita, as were higher numbers of doctors. However, societies with fee-for-service payment models had higher national medical expenditure per capita.

Roberts (1998) analyzed data on 20 OECD member states from 1960 to 1993 using a model for national medical expenditure. The author concluded that a 10-percent increase in the proportion of public medical spending raised national medical expenditure per capita by seven percent.

Studies conducted outside Korea place great emphasis on income as a major variable of national medical expenditure, with one even holding that the variable by itself explains over 90 percent of such expenditure. Estimates of the effect of the income variable vary from study to study, but the income elasticities estimated so far range from 0.72 to 2.02, supporting the general consensus that an increase in income leads to an increase in national medical expenditure. Contrary to the majority of overseas studies that found no significant correlation between population aging and national medical expenditure, however, Korean studies have found significant correlations between the two. Different age groups have different medical and healthcare needs, and increases in the proportion of the elderly population were shown to increase the demand for and cost of medical care (Eom and Choi 1997; Sagong and Son 1999; Kim 2000).

Tacke and Waldmann (2009) utilized cross-sectional data on 73 countries to analyze correlations among income distribution, infant mortality, and national medical expenditure. The authors found that, the greater the income inequality, the less the public spending on medicine and healthcare and the poorer the state of public health. Cremieux et al. (1999) included such lifestyle factors as drinking and smoking rates in the model they used to analyze national medical expenditure in Canada, but found no significant correlations. Some have argued that increasing the number of doctors raises national medical expenditure (Koh 2008; Choi 2006). Christiansen et al. (2006) performed a cross-sectional analysis on European countries, demonstrating that increases in the numbers of doctors and hospital beds were associated with increases in national medical expenditure.

Kim and Kim (2010) also examined the effect of income inequality on national medical expenditure using a multiple regression model and cross-sectional data from 86 countries. The authors demonstrated that GNI per capita is the most important factor of national medical expenditure in most states, except for high-income ones. They also found that, in countries with low to low-to-middle income levels, rising Gini coefficients led to increases in national medical expenditure per capita. The opposite was the case for high-income countries. Shin and Lim (2012) employed a vector error correction model (VECM) to find policy measures for keeping increases in total medical expenditure in Korea in check. Their analysis revealed age to be the main long-term factor and health insurance the main short-term factor of total medical expenditure, while supply-side factors exerted only transient effects for a short time after their introduction.

Murthy et al. (2009) analyzed data from 44 regions in Africa as of 2001 to quantitatively analyze the correlations between effective medical expenditure per capita, on the one hand, and economic and non-economic factors, on the other. They confirmed that GDP per capita and international aid per capita bore statistically significant positive correlations to medical expenditure. Ke et al. (2011) analyzed the decisive factors of medical expenditure in developing countries using panel data on 143 countries spanning a 14-year period from 1995 to 2008.

They revealed that GDP per capita held a statistically significant correlation to both public and private medical expenditures in all models. Income elasticity ranged from 0.75 to 0.95 under the fixed effects model, but fell further under the static model.

III Data and Research Method

III Data and Research Method

1. Data

The sources of data used for this study are OECD statistics,[3) the World Bank,[4)] and the United Nations Food and Agriculture Organization (UN FAO).[5)] The data provide information on the demographic, economic, and social indicators as well as medicine-related variables of 34 OECD member states over a 38-year period from 1980 to 2017. There are missing observations evident in these databases by nation and year, so the number of variables actually entered into the quantitative analysis was reduced considerably. The number of effective observations used in regression analysis is determined in reference to the intersection among all variables. As more and more variables are added to the analysis, the number of observations is reduced and the reliability of the resulting estimates is compromised. Accordingly, the missing data are estimated as much as possible in the present study so as to minimize the number of missing observations per nation excluded from the

3) OECD Stat, https://stats.oecd.org (accessed September 17, 2018).
4) World Bank, http://datatopics.worldbank.org/world-development-indicators (accessed September 17, 2018).
5) UN FAOSTAT, http://www.fao.org/faostat/en (accessed September 17, 2018).

analysis. The missing values can be estimated by employing general statistical methods and techniques. First, when a given country provides no observations for a given variable for at least one year in the cross-sectional data, the missing values can be estimated through regression analysis. Second, where observations in a given country for a given variable are missing for the previous one year, exponential smoothing is applied. Third and finally, where there are some missing values among observations for a given value in the time-series data, linear interpolation is applied.

2. Empirical Models

The main indicator of the performance of healthcare systems subjected to our analysis is national medical expenditures. We are interested in determining the decisive factors of this indicator. Where national medical expenditures per capita is the dependent variable, the explanatory variables include expenditure such as private medical spending relative to GDP and public medical spending relative to total medical cost. Demographic, social, and economic variables include GDP per capita, proportion of the elderly population aged 65 or older, proportion of the population with at least primary school education, women's economic participation rate, food supply (kcal/capita/day), and ratio of R&D spending to GDP. Variables related to medical and healthcare resources include the number of doctors per 1,000 persons, number of hospital beds per 1,000 persons, proportion of public hospital beds, and number of hospital beds for acute conditions per 1,000 persons. The healthcare systems subject to comparison are also divided between those with the National Health Insurance (NHI) schemes and those with the National Health Service (NHS) schemes. Regulation-related variables include dummy variables for state-led systems, on the one hand (assigned a value of one), and society- and market-led systems, on the other (assigned a value of zero). Financing-related variables are also dummy variables for state-funded systems, on the one hand (assigned a value of one), and society- and market-funded systems, on the other (assigned a value of zero). The dummy variables for the different types of medical service delivery (one for state-led systems) are also included in the quantitative model so as to determine whether and how the effects of state-led and market-led health systems differ(Table 1).

〈Table 1〉 Variables Included in the Quantitative Models (Performance of Healthcare Systems)

Type	Explanatory variable	Dependent variable: log (national medical expenditure per capita)
State of health	log(average life expectancy)1)	x
	log(infant mortality rate)2)	x
Medical costs	log(national medical expenditure per capita)1)	
	log(public medical spending relative to GDP)1)	
	log(private medical spending relative to GDP)1)	x
	Public medical spending relative to total medical cost1)	x
Demographic, social, and economic factors	log(GDP per capita)1)	
	log(GDP per capita squared)1)	
	Proportion of 65+ population1)	x
	Proportion of 65+ population squared1)	
	Proportion of population with at least primary school education2)	x
	Women's economic participation rate1)	x
	log(food supply)3)	x
	log(food supply) squared3)	
	R&D spending relative to GDP2)	x
Medical resources	Number of doctors per 1,0001)	x
	Number of hospital beds per 1,0001)	x
	Proportion of public hospital beds1)	x
	Number of hospital beds for acute conditions per 1,0001)	
System variables	Regulation1)	x
	Financing1)	
	Medical service delivery1)	x

Note: The "x" indicates that the given variable is included in the regression as an explanatory variable.

Sources: OECD Stat, https://stats.oecd.org (accessed September 17, 2018); World Bank, http://datatopics.worldbank.org/world-development-indicators (accessed September 17, 2018); UN FAOSTAT, http://www.fao.org/faostat/en (accessed September 17, 2018).

3. Estimation Methods

When we combine the cross-sectional and time-series data into national data by year for analysis, the error term of our model will likely reflect the causes of confusion not only inherent in the cross-sectional and time-series data but also resulting from the combination of the two types of data. In other words, we can reasonably predict that applying the ordinary least square (OLS) method to our combined data will give rise to heteroskedasticity and autocorrelation in our error term. It is therefore necessary to first subject the combined data to panel analysis. Panel data can be understood as temporal elements added to a given set of cross-sectional data (Maddala, 1992).

The standard panel analysis model goes as follows:

$$y_{it} = \alpha_i + \mathbf{z}_{it}\boldsymbol{\beta} + \varepsilon_{it}, \text{ for } i = 1, \cdots, N, \; t = 1, \cdots, T, \qquad \cdots(3.1)$$

Where, z_{it} is $1 \times k$ vector, and β is $k \times 1$ vector.

There are mainly two types of panel analysis models, i.e., fixed effects and random effects models. The choice between these two necessarily depends upon which is better suited to explaining the given data. As for testing the orthogonality between random effects and explanatory variables, Hausman (1978) suggests a specification test. The Hausman test is the most commonly used method for testing the hypothesis that there is no misspecification in the given model (Maddala, 1992). Where the null hypothesis (i.e., that there is no autocorrelation between variables) stands, the estimators of both the fixed effects and random effects models would be consistent, but the fixed effects model would also be rendered inefficient. Where the alternative hypothesis stands, however, the estimator of the fixed effects model would be consistent, while that of the random effects model would not. Moreover, where the null hypothesis stands, there would be little difference between the estimates produced by the two models, while the alternative hypothesis, if true, would significantly widen the difference between estimates. The Hausman test therefore examines the difference between estimates produced by the two types of models.

Where H_0 equals random effects, and H_A equals fixed effects…(3.2)

$$V(\hat{\boldsymbol{\beta}}_{CV} - \hat{\boldsymbol{\beta}}_{GLS}) = V(\hat{\boldsymbol{\beta}}_{CV}) - V(\hat{\boldsymbol{\beta}}_{GLS}) \equiv \boldsymbol{\Sigma}.$$

As it is impossible to estimate Σ directly, we use the variance-covariance matrices of regression coefficients estimated by the fixed and random effects models to estimate it as follows:

$$W \equiv [\hat{\boldsymbol{\beta}}_{CV} - \hat{\boldsymbol{\beta}}_{GLS}]'\hat{\boldsymbol{\Sigma}}^{-1}[\hat{\boldsymbol{\beta}}_{CV} - \hat{\boldsymbol{\beta}}_{GLS}] \sim \chi^2_{(K-1)}. \qquad \cdots(3.3)$$

IV Results

1. Descriptive Analysis
2. Estimating National Medical Expenditure

IV

Results

1. Descriptive Analysis

The table below shows the trend of changes that occurred in the healthcare systems (in terms of regulation, financing, and medical service delivery) by variable from 1980 to 2017. Average life expectancy in general increased by 1.12 times over the 37-year period, from 72.39 years to 81.24 years, while the overall infant mortality rate dropped significantly from 17.30 percent to 3.64 percent. National medical expenditure per capita increased by 8.66 times, from USD 478.07 to USD 4,137.87, outpacing the growth of GDP per capita, which increased by 5.34 times. Public medical spending relative to the GDP rose from 4.39 percent to 6.84 percent, while the proportion of public hospital beds decreased slightly, from 58.04 percent to 57.25 percent. The number of doctors per 1,000 persons grew by 1.63 times, from 2.08 to 3.39, while the number of hospital beds per 1,000 persons dropped from 7.81 to 4.58 (Table 2).

Since 1980, average life expectancy in society- and market-led systems has consistently exceeded life expectancy in state-led systems. Society- and market-led systems have also consistently had lower infant mortality rates than state-led ones. At the same time, national medical expenditure per capita in society- and market-led systems has been persistently higher than has been the case in state-led systems, with the disparity growing even larger over the years.

〈Table 2〉 Trend of Changes in Major Variables by Regulations of Healthcare System

Regulations on healthcare systems		Average life expectancy	Infant mortality rate	National medical expenditure per capita	Public medical spending relative to GDP	Public medical spending relative	Proportion of public hospital beds	Number of doctors per 1000	Number of hospital beds per 1,000
Private-based	1980(A)	73.09	12.53	782.48	4.41	66.52	39.64	2.09	9.65
	1990	75.53	7.87	1734.28	5.11	67.96	39.25	2.51	8.12
	2000	77.85	4.87	3049.81	6.03	68.09	38.46	2.87	6.62
	2010	80.48	3.67	5191.78	7.27	71.08	39.16	3.33	5.64
	2015	81.17	3.27	6200.72	8.25	76.22	38.61	3.63	5.42
	2017(B)	81.67	3.11	6553.41	9.03	76.40	38.44	3.75	5.28
	B/A	1.12	0.25	8.38	2.05	1.15	0.97	1.79	0.55
Government-based	1980(A)	72.24	18.33	412.84	4.39	76.24	61.98	2.07	7.41
	1990	74.61	11.87	904.63	4.71	75.23	61.47	2.43	6.56
	2000	77.01	7.08	1575.91	4.98	72.26	63.05	2.70	5.30
	2010	79.62	4.62	2884.28	6.33	74.09	62.87	3.03	4.67
	2015	80.66	3.97	3403.76	6.37	73.39	61.66	3.21	4.48
	2017(B)	81.15	3.75	3620.25	6.37	73.64	61.28	3.30	4.43
	B/A	1.12	0.20	8.77	1.45	0.97	0.99	1.59	0.60
Total	1980(A)	72.39	17.30	478.07	4.39	74.53	58.04	2.08	7.81
	1990	74.78	11.16	1051.03	4.78	73.95	57.55	2.45	6.83
	2000	77.16	6.69	1836.01	5.17	71.52	58.71	2.73	5.53
	2010	79.77	4.45	3291.49	6.50	73.56	58.69	3.09	4.84
	2015	80.75	3.84	3897.34	6.70	73.89	57.60	3.29	4.65
	2017(B)	81.24	3.64	4137.87	6.84	74.12	57.25	3.39	4.58
	B/A	1.12	0.21	8.66	1.56	0.99	0.99	1.63	0.59

On the other hand, average life expectancy has continued to be higher in healthcare systems funded by the state than in those funded by either society or the market. The reverse was found to be the case with respect to infant mortality rates. National medical expenditure per capita has also been higher in systems funded by society or the market than in state-funded ones. As for medical service delivery, state-led systems have had higher average life expectancy, while society- and market-led systems have had lower infant mortality rates. National medical expenditure per capita has also been higher in market-led systems of medical service delivery(Table 2, Table 3, Table 4).

〈Table 3〉 Trend of Changes in Major Variables by Financing of Healthcare System

Financing of healthcare systems		Average life expect-ancy	Infant mortality rate	National medical ex-penditure per capita	Public medical spending relative to GDP	Public medical spending relative	Proportion of public hospital beds	Number of doctors per 1000	Number of hospi-tal beds per 1,000
Private -based	1980(A)	73.09	12.53	782.48	4.41	66.52	39.64	2.09	9.65
	1990	75.53	7.87	1734.28	5.11	67.96	39.25	2.51	8.12
	2000	77.85	4.87	3049.81	6.03	68.09	38.46	2.87	6.62
	2010	80.48	3.67	5191.78	7.27	71.08	39.16	3.33	5.64
	2015	81.17	3.27	6200.72	8.25	76.22	38.61	3.63	5.42
	2017(B)	81.67	3.11	6553.41	9.03	76.40	38.44	3.75	5.28
	B/A	1.12	0.25	8.38	2.05	1.15	0.97	1.79	0.55
Govern ment-based	1980(A)	72.24	18.33	412.84	4.39	76.24	61.98	2.07	7.41
	1990	74.61	11.87	904.63	4.71	75.23	61.47	2.43	6.56
	2000	77.01	7.08	1575.91	4.98	72.26	63.05	2.70	5.30
	2010	79.62	4.62	2884.28	6.33	74.09	62.87	3.03	4.67
	2015	80.66	3.97	3403.76	6.37	73.39	61.66	3.21	4.48
	2017(B)	81.15	3.75	3620.25	6.37	73.64	61.28	3.30	4.43
	B/A	1.12	0.20	8.77	1.45	0.97	0.99	1.59	0.60

〈Table 4〉 Trend of Changes in Major Variables by Medical Provision System

Medical Service Delivery Systems		Average life expectancy	Infant mortality rate	National medical expenditure per capita	Public medical spending relative to GDP	Public medical spending relative	Proportion of public hospital beds	Number of doctors per 1000	Number of hospital beds per 1,000
Private -based	1980(A)	72.40	15.98	498.58	4.43	74.67	50.57	2.16	8.37
	1990	74.60	10.48	1084.87	4.80	74.12	46.46	2.49	7.44
	2000	76.96	6.38	1890.11	5.12	70.96	47.70	2.68	6.19
	2010	79.65	4.38	3414.96	6.47	72.26	50.15	2.96	5.49
	2015	80.51	3.80	4044.25	6.70	73.45	49.53	3.16	5.38
	2017(B)	81.01	3.59	4301.27	6.92	73.75	49.31	3.26	5.34
	B/A	1.12	0.22	8.63	1.56	0.99	0.98	1.51	0.64
Government-based	1980(A)	72.36	20.08	435.20	4.32	74.24	73.66	1.81	6.63
	1990	75.15	12.59	980.28	4.72	73.59	80.74	2.31	5.57
	2000	77.58	7.33	1722.90	5.28	72.71	81.73	2.92	4.15
	2010	80.03	4.61	3033.32	6.54	76.26	76.53	3.51	3.49
	2015	81.25	3.95	3590.17	6.69	74.82	74.46	3.72	3.11
	2017(B)	81.71	3.74	3796.19	6.68	74.91	73.84	3.83	2.98
	B/A	1.13	0.19	8.72	1.55	1.01	1.00	2.12	0.45

2. Estimating National Medical Expenditure

A. Performance of Healthcare Systems in All OECD Member States

Below is a summary of the panel analysis of all 34 OECD member states from 1980 to 2017, with national medical expenditure per capita as the dependent variable of medical costs. The table after that summarizes the results of one- and two-way fixed effects and random effects analyses on each variable. The discussion of analysis is focused upon models that are revealed to be the most fitting according to the Lagrange multiplier (LM) and Hausman tests.

A wide range of studies have been done on the determinants of national medical expenditure. Table 7 presents the factors identified as decisive by this study. Because the two-way fixed effects model was also revealed to be the most fitting to the analysis of factors of national medical expenditure, our discussion shall focus on the results of that model. Average life expectancy and infant mortality, both variables of health, are shown to exert significant effects on expenditure—the former with a positive correlation and the latter with a negative correlation. For example, when average life expectancy increases by one percent, national medical expenditure per capita jumps by 2.575 percent, while a one-percent increase in infant mortality reduces national medical expenditure by 0.288 percent. Increases in public and private medical spending relative to the GDP also raise national medical expenditure per capita. As already affirmed by the existing literature, GDP per capita is a core factor here, too.[6] However, this study differs significantly from existing studies in that it shows the income elasticity of medical expenditure, which is an indicator of the extent to which medical expenditure rises in response to a one-percent increase in GDP per capita, to be 0.14, falling far below the reported range of 0.74 to 1.33. The majority of ear-

6) Cf. Newhouse (1977), Leu (1986), Parkin (1989), Gerdtham et al. (1992a, 1992b), Gerdtham et al. (1998), Hitiris and Posnett (1992), Barros (1998), and Roberts (1998).

lier studies in this regard estimate the income elasticity of medical expenditure to be greater than one, thus concluding that medical care is a luxury good. This study, however, agrees with the minority of studies, most notably Gerdtham et al. (1992a, 1992b, and 1998), which estimated the income elasticity of medical expenditure to be less than one. The proportion of the elderly population was once again shown by this study, as by earlier studies,[7] to be an insignificant factor. On the other hand, national medical expenditure per capita grew by 0.906 percent for every one-percent increase in food supply, while it decreased by 0.046 percent for every one-percent increase in R&D spending relative to the GDP. As for medical resource variables, the greater the numbers of doctors and hospital beds and the proportion of public hospital beds,[8] the greater the national medical expenditure per capita.

7) Leu (1986), Gerdtham et al.(1998), Barros (1998), and Roberts (1998) show that the proportion of the elderly population bears no statistically significant correlation to medical expenditure. Gerdtham et al. (1992b) was the only study that showed increases in medical expenditure to be tied to the growing proportion of seniors in the population.

8) There is not yet a consensus on how the proportion of public hospital beds affects medical expenditure. Leu (1986) showed a positive correlation, but Gerdtham et al. (1998) showed a negative one.

〈Table 7〉 Determinants of National Medical Expenditure per Capita for all OECD Members

Explanatory variable	log (national medical expenditure per capita)			
	1FEM	1REM	2FEM	2REM
Constant	-16.2349*** (-4.82)	-17.8963*** (-6.06)	-13.9093*** (-3.86)	-16.9645*** (-5.50)
log(average life expectancy)	2.6719*** (3.44)	3.1036*** (4.57)	2.5753*** (3.10)	3.2288*** (4.54)
log(infant mortality rate)	-0.3244*** (-5.82)	-0.2897*** (-5.70)	-0.2880*** (-5.02)	-0.2330*** (-4.47)
log(public medical spending relative to GDP)	0.7580*** (16.31)	0.7367*** (16.38)	0.6422*** (13.07)	0.6633*** (14.38)
log(private medical spending relative to GDP)	0.2154*** (22.07)	0.2187*** (23.10)	0.1973*** (19.85)	0.2045*** (21.50)
log(GDP per capita)	0.3728*** (9.60)	0.3746*** (10.10)	0.1399*** (2.92)	0.1767*** (4.07)
Proportion of 65+ population	0.0065 (1.47)	0.0068* (1.67)	0.0007 (0.15)	0.0021 (0.50)
Proportion of population with at least primary school education	0.0001 (0.09)	-0.0006 (-0.98)	-0.0001 (-0.09)	-0.0006 (-1.12)
Women's economic participation rate	0.0014 (0.60)	0.0003 (0.12)	-0.0018 (-0.75)	-0.0027 (-1.16)
log(food supply)	0.8484*** (15.79)	0.8741*** (16.69)	0.9059*** (16.85)	0.9326*** (17.77)
R&D spending relative to GDP	-0.0084 (-0.75)	-0.0030 (-0.27)	-0.0459*** (-3.80)	-0.0315*** (-2.72)
Number of doctors per 1,000	0.0926*** (5.07)	0.0698*** (4.01)	0.0655*** (3.51)	0.0455** (2.58)
Number of hospital beds per 1,000	-0.0036 (-0.84)	-0.0101** (-2.55)	0.0112** (2.37)	0.0038 (0.87)
Proportion of public hospital beds	0.0037*** (3.90)	0.0002 (0.41)	0.0017* (1.78)	-0.0010 (-1.60)
Regulation dummy variable (1=government-based)		-0.0787 (-1.16)		-0.2213*** (-3.16)
Medical service delivery dummy variable (1=government-based)		-0.0750 (-1.16)		0.1339* (1.91)
R^2 (overall)	0.893	0.94	0.901	0.943
Hausman test	Chi^2 (12)=63.56(0)***		Chi^2 (14)=58.35(0)***	

B. Regulations on Healthcare Systems and Their Performance

Now we need to understand whether the types of regulations imposed on healthcare systems in OECD member states affect the performance of those systems. To that end, the 28 state-led systems and six society- and market-led ones were subjected to panel analyses. As with the overall analysis of all OECD member states, one- and two-way fixed and random effects models were used to compare the differences in the resulting estimates. The following discussion, however, shall focus on only the results of the models that are shown to be the best fit for the given variable(s) according to the LM and Hausman test results.

With respect to national medical expenditure per capita, the one-way fixed effects model emerged as the best fit for state-led systems, while the one-way random effects model was the best fit for society- and market-led systems. First, both variables of health (average life expectancy and infant mortality) are significant factors under state-led systems only. Under state-led systems, increases in average life expectancy raise national medical expenditure per capita, while rising infant mortality rates have the opposite effect. Second, the proportion of the elderly population and proportion of the population with at least primary school education are also statistically significant factors that increase national medical expenditure per capita under state-led systems only. Third, increases in food supply are inversely correlated to medical expenditure under state-led systems, while proportionally correlated under society- and market-led systems. Fourth, the numbers of doctors and hospital beds per 1,000 persons retain statistical significance under state-led systems only. Increasing the number of doctors increases national medical expenditure per capita, while increasing the number of hospital beds has the opposite effect. Public and private medical spending relative to the GDP and GDP per capita are all proportionally correlated to national medical expenditure per capita under both state-led and society- and market-led systems(Table 8, 9).

〈Table 8〉 Determinants of National Medical Expenditure per Capita under State-led Regulatory Systems

Explanatory variable	log (national medical expenditure per capita)			
	1FEM	1REM	2FEM	2REM
Constant	-0.7812 (-0.23)	-4.3709 (-1.61)	-2.3988 (-0.67)	-5.8554** (-2.01)
log(average life expectancy)	1.8951** (2.58)	2.5902*** (4.46)	2.3714*** (3.01)	2.9027*** (4.60)
log(infant mortality rate)	-0.1575*** (-2.87)	-0.0808* (-1.73)	-0.0990* (-1.69)	-0.0644 (-1.29)
log(public medical spending relative to GDP)	0.6241*** (13.95)	0.6753*** (16.58)	0.5601*** (11.76)	0.6569*** (15.27)
log(private medical spending relative to GDP)	0.2162*** (24.80)	0.2189*** (26.76)	0.2058*** (22.68)	0.2122*** (24.74)
log(GDP per capita)	0.6246*** (15.70)	0.6527*** (17.75)	0.4479*** (8.87)	0.5371*** (11.84)
Proportion of 65+ population	0.0069* (1.68)	0.0022 (0.63)	0.0047 (1.08)	0.0016 (0.43)
Proportion of population with at least primary school education	0.0037*** (6.18)	0.0036*** (6.07)	0.0038*** (6.30)	0.0035*** (5.94)
Women's economic participation rate	0.0119*** (5.07)	0.0094*** (4.33)	0.0078*** (3.10)	0.0074*** (3.18)
log(food supply)	-1.0364*** (-7.88)	-0.9915*** (-8.49)	-0.8802*** (-6.50)	-0.8459*** (-6.68)
R&D spending relative to GDP	0.0134 (1.30)	0.0174* (1.77)	-0.0141 (-1.23)	0.0035 (0.33)
Number of doctors per 1,000	0.0860*** (5.00)	0.0671*** (4.27)	0.0737*** (4.14)	0.0605*** (3.66)
Number of hospital beds per 1,000	-0.0084** (-2.23)	-0.0145*** (-4.33)	0.0007 (0.17)	-0.0085** (-2.21)
Proportion of public hospital beds	-0.0005 (-0.59)	-0.0007 (-1.53)	-0.0019** (-1.99)	-0.0011** (-2.22)
Medical service delivery dummy variable (1=Government-based)		-0.0549 (-1.32)		0.0264 (0.51)
R^2 (overall)	0.964	0.972	0.955	0.969
Hausman test	Chi^2 (12)=31.18(0.0018)***		Chi^2 (14)=41.19(0.0002)***	

〈Table 9〉 Determinants of National Medical Expenditure per Capita under society- and market-led Regulatory Systems

Explanatory variable	log (national medical expenditure per capita)			
	1FEM	1REM	2FEM	2REM
Constant	-13.9029 (-1.30)	-15.7939* (-1.83)	-21.8708 (-1.26)	-22.1573** (-2.11)
log(average life expectancy)	1.4533 (0.62)	2.2346 (1.09)	2.8484 (0.78)	3.4252 (1.39)
log(infant mortality rate)	-0.2902** (-1.99)	-0.1775 (-1.58)	0.1062 (0.45)	0.1745 (1.00)
log(public medical spending relative to GDP)	0.8325*** (4.51)	0.7991*** (6.83)	0.4281* (1.81)	0.4220** (2.47)
log(private medical spending relative to GDP)	0.2797*** (3.86)	0.3236*** (6.87)	0.3729*** (4.08)	0.4225*** (6.36)
log(GDP per capita)	1.1080*** (4.84)	0.8110*** (6.56)	1.4000*** (3.53)	0.9632*** (6.97)
Proportion of 65+ population	0.0019 (0.12)	0.0171 (1.37)	-0.0297 (-1.18)	-0.0126 (-0.75)
Proportion of population with at least primary school education	-0.0024 (-1.08)	-0.0031 (-1.64)	-0.0015 (-0.57)	-0.0016 (-0.75)
Women's economic participation rate	-0.0317** (-2.43)	-0.0316*** (-5.61)	-0.0349* (-1.78)	-0.0264*** (-4.34)
log(food supply)	0.5409*** (4.23)	0.7126*** (8.36)	0.4088** (2.59)	0.5832*** (5.90)
R&D spending relative to GDP	-0.0932 (-1.48)	-0.0531 (-1.12)	-0.0337 (-0.49)	0.0197 (0.38)
Number of doctors per 1,000	-0.0909 (-0.83)	-0.0405 (-0.91)	-0.1606 (-1.03)	-0.1854*** (-2.84)
Number of hospital beds per 1,000	0.0703 (0.96)	0.0019 (0.12)	0.1255 (1.36)	0.0847** (2.49)
Proportion of public hospital beds	-0.0040 (-0.81)	-0.0011 (-1.00)	-0.0027 (-0.36)	0.0007 (0.52)
R^2 (overall)	0.939	0.982	0.923	0.986
Hausman test	Chi^2 (4)=4.19(0.3807)		Chi^2 (4)=3.57(0.4668)	

C. Financing of Healthcare Systems and Their Performance

The OECD member states were also divided for the analysis of the impacts that the different structures of financing had on the performance of their national medical expenditures. Specifically, the 16 countries in which the state funded the healthcare systems and the 18 others with society- or market-funded systems were subjected to panel analyses. One- and two-way fixed and random effects models were used for the analysis of both groups, but the following discussion shall focus on only the results of the models shown to be the best fitting according to the LM and Hausman tests.

In relation to national medical expenditure per capita, the one-way fixed effects model emerged as the best fit for state-funded systems, while the two-way fixed effects model was the best for society- and market-funded systems. First, increases in GDP per capita raise national medical expenditure per capita under state-funded systems, and have the opposite effect under market-funded systems. Second, the proportion of the elderly population bears a proportional correlation to national medical expenditure per capita under state-funded systems only, while the proportion of the population with at least primary school education has a positive correlation under society- and market-funded systems only. Women's economic participation rates show a significant negative correlation under society- and market-funded systems only. Third, increases in the proportion of public hospital beds lead to increases in national medical expenditure per capita under state-funded systems only(Table 10, 11) .

〈Table 10〉 Determinants of National Medical Expenditure per Capita under State-led Financial Systems

Explanatory variable	log (national medical expenditure per capita)			
	1FEM	1REM	2FEM	2REM
Constant	-5.0958** (-1.97)		-24.1041*** (-7.45)	-3.3199 (-1.57)
log(average life expectancy)	0.7397 (1.31)	0.5322* (1.76)	5.0141*** (7.47)	0.5749* (1.74)
log(infant mortality rate)	-0.1528*** (-4.26)	-0.1164*** (-4.66)	-0.1128*** (-3.28)	-0.1270*** (-4.56)
log(public medical spending relative to GDP)	0.7913*** (22.04)	0.8561*** (28.10)	0.8478*** (23.83)	0.9502*** (26.65)
log(private medical spending relative to GDP)	0.0936*** (7.23)	0.1030*** (10.76)	0.0573*** (4.52)	0.0754*** (6.48)
log(GDP per capita)	0.9479*** (28.17)	1.0169*** (38.48)	0.8107*** (17.46)	0.9509*** (24.39)
Proportion of 65+ population	0.0077** (2.06)	0.0082*** (4.60)	-0.0016 (-0.41)	0.0083*** (4.07)
Proportion of population with at least primary school education	-0.0010 (-1.47)	-0.0011* (-1.73)	-0.0001 (-0.07)	-0.0017** (-2.52)
Women's economic participation rate	-0.0024 (-1.13)	-0.0025 (-1.39)	-0.0068*** (-3.33)	-0.0037* (-1.85)
log(food supply)	-0.1624 (-1.25)	-0.1812 (-1.60)	0.0338 (0.26)	-0.2968** (-2.40)
R&D spending relative to GDP	-0.0113* (-1.70)	-0.0111** (-2.00)	-0.0350*** (-4.72)	-0.0214*** (-3.56)
Number of doctors per 1,000	-0.0276 (-1.14)	-0.0936*** (-7.42)	0.0476** (2.00)	-0.1056*** (-7.16)
Number of hospital beds per 1,000	0.0028 (1.16)	-0.0054*** (-2.87)	0.0064*** (2.77)	-0.0023 (-1.08)
Proportion of public hospital beds	0.0012** (2.19)	0.0001 (1.28)	0.0016*** (3.06)	0.0001 (1.46)
Regulation dummy variable (1=Government-based)		-4.5979** (-2.49)		
Medical service delivery dummy variable(1=Government-based)		-0.0129 (-0.94)		-0.0239* (-1.69)
R^2 (overall)	0.986	0.994	0.958	0.995
Hausman test	Chi^2 (8)=46.02(0)***		Chi^2 (8)=89.33(0)***	

〈Table 11〉 Determinants of National Medical Expenditure per Capita under Society- and Market-led Financial Systems

Explanatory variable	log (national medical expenditure per capita)			
	1FEM	1REM	2FEM	2REM
Constant	-8.3992* (-1.75)	-10.3811*** (-2.60)	-1.5601 (-0.30)	-7.8385* (-1.92)
log(average life expectancy)	1.6011 (1.49)	2.2052** (2.43)	0.5652 (0.48)	1.9052** (2.04)
log(infant mortality rate)	-0.6490*** (-7.36)	-0.5989*** (-8.49)	-0.6993*** (-7.59)	-0.5206*** (-7.29)
log(public medical spending relative to GDP)	0.9288*** (13.36)	0.9035*** (13.26)	0.7231*** (9.52)	0.7647*** (11.02)
log(private medical spending relative to GDP)	0.2337*** (20.39)	0.2348*** (20.97)	0.2111*** (17.93)	0.2215*** (20.19)
log(GDP per capita)	0.0670 (1.12)	0.1055* (1.95)	-0.2259*** (-3.21)	-0.1244** (-2.10)
Proportion of 65+ population	0.0151** (2.38)	0.0059 (1.02)	0.0092 (1.35)	0.0005 (0.08)
Proportion of population with at least primary school education	0.0012 (1.60)	-0.0004 (-0.64)	0.0015** (2.03)	-0.0001 (-0.18)
Women's economic participation rate	-0.0050 (-1.27)	-0.0158*** (-4.59)	-0.0079** (-1.98)	-0.0185*** (-5.48)
log(food supply)	0.9214*** (14.54)	0.9378*** (15.19)	1.0148*** (15.76)	1.0490*** (17.07)
R&D spending relative to GDP	-0.0083 (-0.45)	0.0042 (0.23)	-0.0638*** (-3.21)	-0.0249 (-1.37)
Number of doctors per 1,000	0.0314 (1.18)	0.0283 (1.13)	0.0170 (0.63)	0.0250 (1.01)
Number of hospital beds per 1,000	-0.0268*** (-3.25)	-0.0432*** (-6.70)	-0.0020 (-0.22)	-0.0175** (-2.47)
Proportion of public hospital beds	0.0039** (2.21)	-0.0026*** (-3.52)	-0.0004 (-0.22)	-0.0047*** (-6.22)
Regulation dummy variable (1=Government-based)		-0.0922 (-1.61)		-0.2992*** (-4.89)
R^2 (overall)	0.851	0.944	0.864	0.955
Hausman test	Chi^2(12)=88.19(0)***		Chi^2(12)=67.23(0)***	

D. Types of Medical Service Delivery and Performance of Healthcare Systems

To analyze whether and how differences in medical service delivery systems affect the performance of healthcare systems, we need to divide the OECD member states into two groups, i.e., 11 states with state-led delivery systems and 23 with market-led delivery systems, and subject each to a panel analysis. As with the foregoing, one- and two-way fixed and random effects models have been applied to both groups, but our discussion shall focus on only the results of the models proven to be the best fitting according to the LM and Hausman tests.

The two-way fixed effects model was found to be the best fit for both state- and market-led systems with respect to national medical expenditure per capita. First, when infant mortality rates rise under market-led systems, national medical expenditure per capita drops, but the same phenomenon has little statistical significance under state-led systems. Second, GDP per capita and the proportion of the elderly population are significant factors with proportional correlations to national medical expenditure per capita under state-led systems only. Third, increases in women's economic participation rates also increase national medical expenditure per capita under state-led systems, but the opposite effect occurs under market-led ones. Fourth, increases in food supply raise national medical expenditure per capita, but increases in R&D spending relative to the GDP reduce it under market-led systems. Finally, the number of hospital beds per 1,000 persons is proportionally correlated to national medical expenditure per capita, while the proportion of public hospital beds is inversely correlated, under state-led systems. The effects exerted by other medical resource variables have little statistical significance(Table 12, 13).

〈Table 12〉 Determinants of National Medical Expenditure per Capita under State-led Delivery Systems

Explanatory variable	log (national medical expenditure per capita)			
	1FEM	1REM	2FEM	2REM
Constant	-1.1948 (-1.43)		-2.0554* (-1.78)	-1.7401** (-2.03)
log(average life expectancy)	-0.6534*** (-4.08)	0.1948 (1.31)	-0.2618 (-1.06)	-0.1723 (-1.21)
log(infant mortality rate)	-0.0473*** (-4.38)	-0.0569*** (-5.03)	-0.0224 (-1.60)	-0.0453*** (-4.06)
log(public medical spending relative to GDP)	0.8107*** (70.52)	0.7768*** (63.08)	0.8249*** (65.71)	0.8051*** (62.99)
log(private medical spending relative to GDP)	0.0922*** (26.29)	0.1084*** (31.95)	0.0859*** (19.89)	0.0836*** (21.73)
log(GDP per capita)	0.9421*** (85.79)	0.9608*** (79.93)	0.8819*** (41.30)	0.8819*** (58.17)
Proportion of 65+ population	0.0066*** (6.39)	0.0077*** (10.44)	0.0079*** (6.33)	0.0060*** (7.28)
Proportion of population with at least primary school education	-0.0005** (-2.51)	0.0002 (0.96)	-0.0003 (-1.45)	-0.0004** (-2.00)
Women's economic participation rate	0.0029*** (5.16)	-0.0015** (-2.18)	0.0013* (1.88)	-0.0001 (-0.20)
log(food supply)	0.0440 (1.04)	-0.0480 (-0.87)	0.0042 (0.09)	-0.0647 (-1.20)
R&D spending relative to GDP	0.0121*** (6.39)	-0.0003 (-0.17)	-0.0032 (-0.94)	-0.0116*** (-5.31)
Number of doctors per 1,000	0.0340*** (4.68)	0.0059 (0.84)	0.0310*** (3.87)	0.0027 (0.39)
Number of hospital beds per 1,000	-0.0003 (-0.58)	0.0021*** (3.11)	0.0016** (2.21)	0.0047*** (7.51)
Proportion of public hospital beds	-0.0005*** (-2.93)	0.0004*** (8.56)	-0.0005*** (-2.77)	0.0003*** (5.64)
Regulation dummy variable (1=Government-based)		-4.1325*** (-4.56)		
R^2 (overall)	0.995	0.999	0.997	1.000
Hausman test	Chi^2(6)=110.85(0)***		Chi^2(6)=61.19(0)***	

〈Table 13〉 Determinants of National Medical Expenditure per Capita under Market-led Delivery Systems

Explanatory variable	log (national medical expenditure per capita)			
	1FEM	1REM	2FEM	2REM
Constant	-12.0153*** (-2.73)	-14.9452*** (-3.74)	-7.7936 (-1.59)	-12.3195*** (-2.90)
log(average life expectancy)	1.9897* (1.96)	2.8053*** (3.06)	1.4300 (1.28)	2.5504*** (2.61)
log(infant mortality rate)	-0.4478*** (-6.15)	-0.4220*** (-6.29)	-0.4422*** (-5.81)	-0.3727*** (-5.41)
log(public medical spending relative to GDP)	0.8485*** (13.97)	0.8247*** (13.90)	0.7193*** (10.71)	0.7209*** (11.50)
log(private medical spending relative to GDP)	0.2158*** (19.27)	0.2217*** (20.24)	0.1958*** (16.64)	0.2042*** (18.34)
log(GDP per capita)	0.3034*** (6.01)	0.2737*** (5.61)	0.0950 (1.56)	0.0826 (1.49)
Proportion of 65+ population	0.0020 (0.34)	0.0010 (0.18)	-0.0070 (-1.11)	-0.0072 (-1.24)
Proportion of population with at least primary school education	0.0001 (0.09)	-0.0008 (-1.13)	-0.0001 (-0.17)	-0.0009 (-1.31)
Women's economic participation rate	-0.0025 (-0.68)	-0.0068** (-2.01)	-0.0067* (-1.78)	-0.0108*** (-3.15)
log(food supply)	0.8266*** (13.29)	0.8724*** (14.36)	0.8866*** (13.86)	0.9318*** (15.17)
R&D spending relative to GDP	-0.0086 (-0.50)	-0.0030 (-0.17)	-0.0446** (-2.42)	-0.0324* (-1.85)
Number of doctors per 1,000	0.0871*** (3.57)	0.0753*** (3.20)	0.0774*** (3.06)	0.0644*** (2.68)
Number of hospital beds per 1,000	-0.0184** (-2.45)	-0.0313*** (-4.86)	-0.0033 (-0.40)	-0.0139** (-1.98)
Proportion of public hospital beds	0.0054*** (3.97)	0.0004 (0.43)	0.0023 (1.55)	-0.0015* (-1.68)
Regulation dummy variable (1=Government-based)		-0.1078 (-1.23)		-0.2555*** (-2.85)
R^2 (overall)	0.856	0.93	0.882	0.943
Hausman test	Chi^2(12)=46.61(0)***		Chi^2(13)=33.27(0.0016)***	

E. Evaluation of Performance of Healthcare Systems for National Medical Expenditures

Based upon these findings, we may reach a tentative conclusion regarding the performance of the Korean healthcare system by comparing how the Korean system fares in comparison to the average estimates of OECD-wide performance as well as to the actual state of Korean national medical expenditures. Table 14 summarizes the disparities between the Korean and OECD-wide estimates under each model. As of 2017, national medical expenditure per capita in Korea was USD 2,897, while the OECD-wide estimates ranged from USD 1,379 to USD 2,768. The disparities with the actual Korean case ranged widely from USD 129.4 to USD 1,518.4. All models, however, estimate that national medical expenditure per capita in Korea is quite high. On the other hand, the two-way fixed effects model, which test results showed to be the best fit for estimating this variable, produced the estimate that differed the most from the actual national medical expenditure in Korea. If, other things being equal, low medical expenditure represents the good performance of a given medical and health system, the Korean system appears to lag behind the OECD average.

〈Table 14〉 Estimates and Actual Values of Korea's Performance of Healthcare System in OECD Countries

Classification		All OECD countries			
		1FEM	1REM	2FEM	2REM
National medical expenditure per capita	Actual value(A)	2,897	2,897	2,897	2,897
	Estimates(B)	2,383	2,768	1,379	1,594
	Difference(A-B)	513.6	129.4	1518.4	1303.3

We may compare state- and market-led systems in terms of performance, and compare each type to Korea's case. National medical expenditure per capita in Korea was higher than the average of state-led systems estimated using the one-way fixed effects model, but it was lower than the average of market-led systems estimated using the one-way random effects model. In other words, the Korean healthcare system seems to underperform in comparison to state-led systems, but fares better than market-led systems with respect to medical costs(Table 15).

〈Table 15〉 Estimates and Actual Values of Regulation of Healthcare System in Korea

Classification		Regulation							
		Government-based				Private-based			
		1FEM	1REM	2FEM	2REM	1FEM	1REM	2FEM	2REM
National medical expenditure per capita	Actual value(A)	2897	2897	2897	2897	2897	2897	2897	2897
	Estimates(B)	2574	2615	1724	2004	5102	3274	7952	4733
	Difference(A-B)	322.9	282.2	1173.3	893.2	-2205.4	-376.5	-5054.8	-1836.4

The two-way fixed effects model emerged as the best fit for estimating the performance of both state-funded and market-funded systems. The one-way and two-way fixed effects models emerged as the best fits for state-funded and market-funded systems, respectively, with respect to the estimation of national medical expenditure per capita. National medical expenditure in Korea was higher than the average of the systems of either kind, but the difference was greater in comparison to market-funded systems. Insofar as the performance of a healthcare system can be measured in terms of national medical expenditure per capita, Korea's system lags behind the OECD-wide average and even farther behind market-funded systems(Table 16).

〈Table 16〉 Estimates and Actual Values of Financing of Healthcare System in Korea

Classification		Financing							
		Government-based				Private-based			
		1FEM	1REM	2FEM	2REM	1FEM	1REM	2FEM	2REM
National medical expenditure per capita	Actual value(A)	2897	2897	2897	2897	2897	2897	2897	2897
	Estimates(B)	2488	2555	2467	2059	2221	2692	1169	1407
	Difference(A-B)	409.3	341.8	430.1	838.5	676.2	205.4	1728.4	1489.7

We should also compare Korea to other OECD systems in terms of how medical services are delivered. The two-way fixed effects model is the best fit for state-led medical service delivery systems, while the one-way fixed effects model is chosen for market-led ones. The two-way fixed effects model is also the best fit for both types of medical service delivery systems with respect to national medical expenditure per capita. Korea's national medical expenditure per capita is higher than the estimates for the systems of either type, and the difference is especially pronounced in comparison to market-led systems. This suggests that the Korean healthcare system requires measures to enhance the efficiency of medical expenditure(Table 17).

〈Table 17〉 Estimates and Actual Values of Medical Service Delivery of Healthcare System in Korea

Classification		Medical service delivery							
		Government-based				Private-based			
		1FEM	1REM	2FEM	2REM	1FEM	1REM	2FEM	2REM
National medical expenditure per capita	Actual value(A)	2897	2897	2897	2897	2897	2897	2897	2897
	Estimates(B)	2378	2442	2079	1960	2140	2431	1275	1395
	Difference(A-B)	518.8	455.1	818.2	936.6	756.6	465.8	1621.9	1501.6

V Conclusion

V Conclusion

This study analyzes the performances of the healthcare systems of 34 OECD member states from 1980 to 2017. It involved a panel analysis of these systems' performances with respect to national medical expenditures as well as the results of one- and two-way fixed and random effects analyses of given variable. Moreover, this study determines which of these four models is the best fit for the variable, using the LM and Hausman tests, and discusses the results of the best-fitting models accordingly.

The tentative conclusion that may be reached on the basis of this study's findings can be summarized as follows. Korea's national medical expenditure per capita was USD 2,897 as of 2017 (OECD Health Data 2018). The OECD-wide average national medical expenditure per capita, however, ranged from USD 1,379 to USD 2,768, as estimated using the best-fitting models. In other words, the Korean medical expenditure per capita hovers above these OECD-wide estimates by USD 129.4 to USD 1,518.4. Insofar as we assume that, the lower the medical cost, the better the performance of a given healthcare system, we may conclude that the Korean system fares relatively poorly in comparison to other OECD member states in this regard at least.

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