WHAT ARE THE DETERMINANTS OF HEALTH CARE EXPENDITURE? EMPIRICAL RESULTS FROM ASIAN COUNTRIES

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ABSTRACT

This paper uses panel data to identify the determinants of health care expenditure in twelve Asian countries (i.e. Cambodia, China, Indonesia, Japan, Laos, Malaysia, Mongolia, the Philippines, South Korea, Singapore, Thailand and Vietnam) for the period of 1995-2008. The empirical results indicated that only two independent variables (GDPit and POP65it) have significant relationship with health care expenditure in these countries. These two variables are positively correlated with the amount of health care expenditure. In other words, when the countries' income is larger, the amount of health care expenditure is larger. When the share of ageing population in the total population is higher, again the amount of health care expenditure is larger.

Key Words: Health Care Expenditure, Determinant, Asia

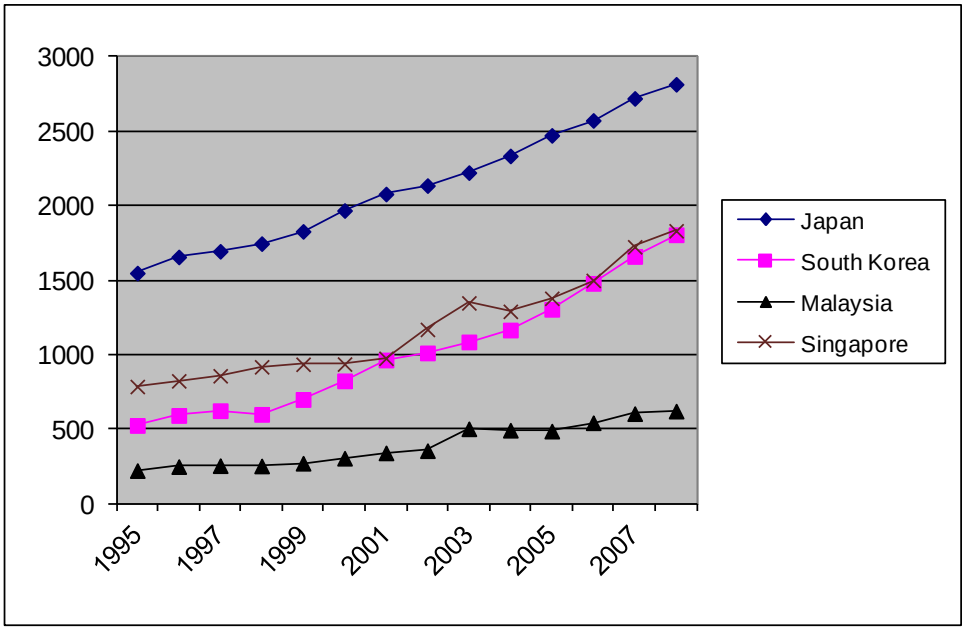
INTRODUCTION

As people become wealthier and the proportion of elderly people in the total population increases, there is an inevitable rise in health care expenditure. This is because the wealthy tend to take better care of their health and elderly people need more intensive health care than younger people. Thus, health care expenditure has increased tremendously in developed countries over the last decade or two. For example, the total health expenditure as a share of Gross Domestic Product (GDP) for selected Asian-Pacific countries has shown an increase for the period, 1980-2001. In the United States, health care expenditure rose from 8.7 per cent to 13.9 per cent for the period, 1980-2001, while in Canada, it rose from 7.1 per cent to 9.4 per cent for the same period. The health care expenditure in Japan increased from 6.5 to 7.8 per cent, Australia from 7.0 to 9.7 per cent, and New Zealand from 5.9 to 8.0 per cent.

However, the fundamental question remains: what are the determinants of health care expenditure? According to Getzen (2004), there are two important determinants of health care expenditure, 1) an ageing population has its effects on cost and utilization of health care, and 2) the role of the government is important in providing funds for health care, though the foregoing could be general factors or determinants of a country's total health care expenditure. When we look at the Asian countries specifically in terms of their total health care expenditure, it is inappropriate to judge the importance of all the determinants mentioned earlier based on the differences of socio-economic background specifications of the selected countries.

This study aims to identify the determinants of health care expenditure in the selected Asian countries. The determinants are vast and varied ranging from economic, demographic and to other exogenous variables. It is hypothesised that the per capita real health care expenditure of the 12 Asian countries, of Cambodia, China, Indonesia, Japan, Laos, Malaysia, Mongolia, the Philippines, South Korea, Singapore, Thailand and Vietnam is influenced by the three main determinants, namely, income level, ageing population and public expenditure on health care.

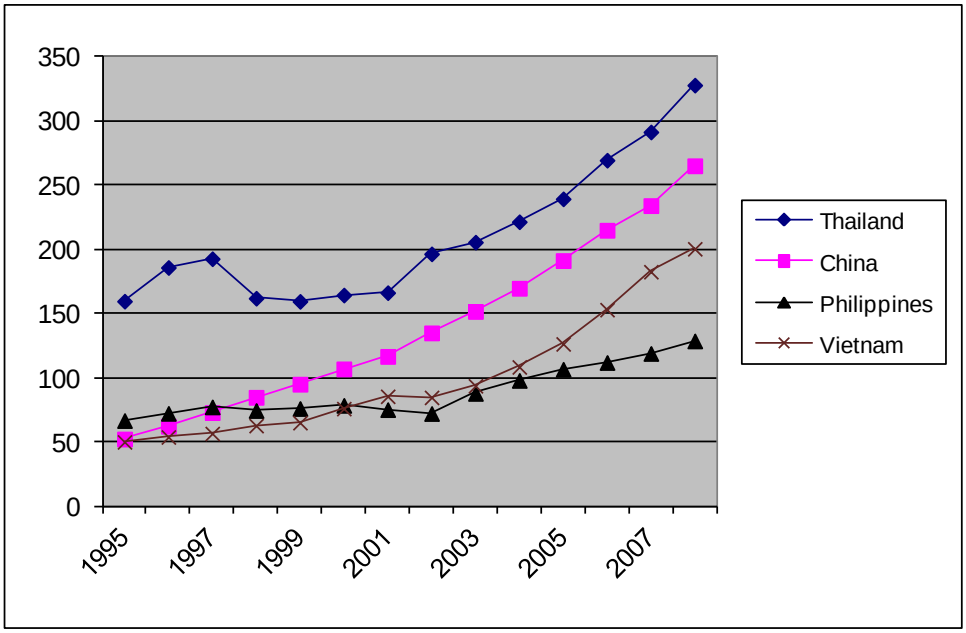
Among these twelve countries, Japan's health care expenditure recorded the highest in the range of about US$1548 to US$2817 per capita for the period of 1995 to 2008. This was relatively high, compared with other selected Asian countries. This was followed by Singapore, with an expenditure in the range of about US$786 to US$1,832 per capita, South Korea, US$524 to US$1,805 per capita, and Malaysia, US$221 to US$603 per capita (See Figure 1). These four countries can be considered countries with high expenditure on health care.



Source: World Bank (2011)

Figure 1. Health care expenditures per capita (US$) in Japan, Malaysia, Singapore and Korea

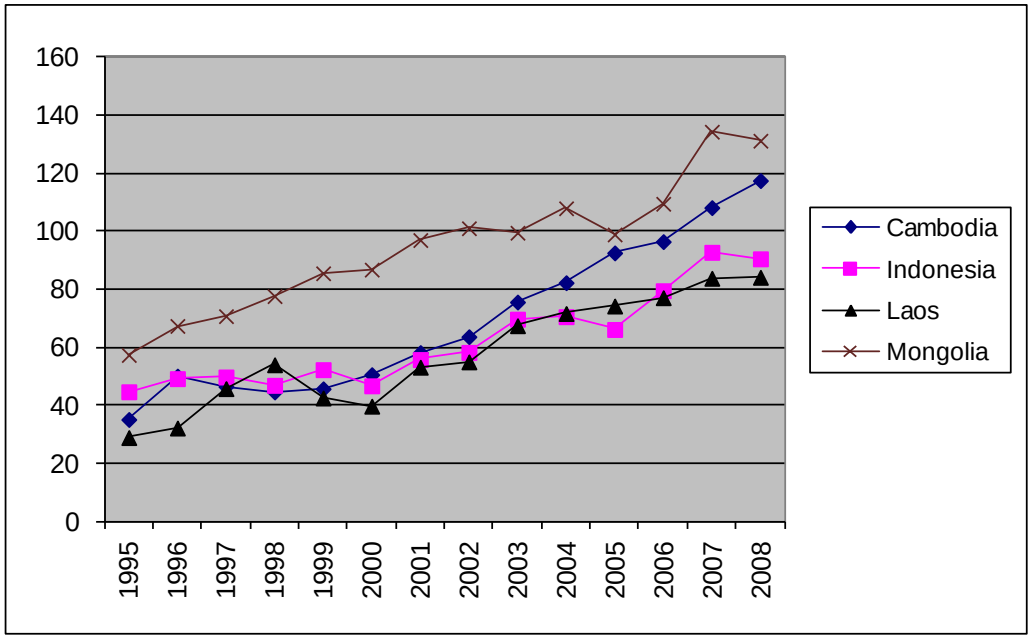
On the other hand, Thailand, China, Vietnam and the Philippines can be considered countries with middle expenditure on health care. Thailand's per capita health expenditure was in the range of US$159 to US$328 per capita, and China US$52 to US$265 per capita. The health care expenditures of Vietnam recorded a range of about US$50 to US$210 per capita and the Philippines about US$66 to US$128 per capita (See Figure 2).



Source: World Bank (2011)

Figure 2. Health care expenditures per capita (US$) in Thailand, China, Philippines and Vietnam

Finally, health care expenditures in Mongolia, Indonesia, Cambodia and Laos are the lowest among the 12 Asian countries. The health care expenditure in Mongolia was about US$57 to US$131 per capita and Cambodia US$35 to US$117 per capita. Indonesia had a relatively low level of health care expenditure, which was in the range of about US$44 to US$99 per capita only. In Laos, health care expenditure was extremely low – at a range of US$28 to US$84 per capita only (See Figure 3).



Source: World Bank (2011)

Figure 3. Health care expenditures per capita in Cambodia, Indonesia, Laos and Mongolia

This paper is organised as follows: Section 2 discusses the background of the health care expenditure of the selected countries. Apart from that, special attention is drawn to some difficulties involved in particular studies on health care expenditure generally without limitation to the countries selected. Section 3 discusses the method used to analyze the major determinants of the selected countries' total health care expenditure. The findings and empirical results are reported in Section 4, and Section 5 gives some concluding remarks.

LITERATURE REVIEW

As the wealth of countries increases, the expenditure on health care tends to increase too. Rising health care expenditure in industrial countries is a very important topic among health economists and politicians. Thus there is no doubt that this important topic has drawn interests from scholars and policymakers. Gerdtham and Jonsson (1991) reported some preliminary results in previous studies on health care expenditure and quantity across 22 Organization for Economic Co-operation and Development (OECD) countries. They postulated an important omission from earlier cross-national comparisons of health care expenditure, that is the failure to distinguish between price and quantity. It has been found that when there is an increase in per capita income, the fraction of national income devoted to health care provision increases too, regardless of whether health care is measured in terms of expenditure or quantity. Since the relative price of health care has a rationing effect on the quantity of health care with a price elasticity close to minus one, it is believed that health care expenditure is not greater in countries with higher prices. Correction for the relative price and income level among

countries is a need in terms of comparisons even though afterwards the differences in health care expenditure or quantity between countries will still persist. The authors explained that the persisting differences were partly because of the differences in the definition of health care among countries.

In a study by Murthy and Ukpolo (1994), time-series data for the period of 1960-87 (instead of cross-sectional series data) has been used in quantifying the role of the determinants of aggregate health care expenditure per capita for the United States. In terms of estimations, this study has applied unit root testing, cointegration and error-correction modelling. Outcomes produced indicate that per capita income, age of the population, number of practicing physicians, and public financing of health care are those important determinants of aggregate health care expenditure in the United States. Moreover, the age structure of the population and the number of practicing physicians are found to be two major determinants which are relatively more important compared to other determinants captured in the study.

In a later study using the same data set, Murthy and Ukpolo (1995) found that two co-integrating vectors were present, suggesting that the system is stable. Real per capita health expenditure is found to be cointegrated with real per capita income, relative price of health care, age structure of the population, number of practicing physicians and ratio of public health care expenditure to total health care expenditure. Consistent with previous studies, the following variables, real per capita income, number of practicing physicians, and age structure of the population, are essentially important determinants of real per capita health care spending. However, this study indicated that a large share of public financing is characterized by lower real per capita health care expenditure. At the same time, the sign of the coefficients of the ratio of health services and medical care price index is positive, indicating that the demand for health care is inelastic in the United States during the period.

Roberts (2000) in her article has offered some comments on the study by Hitiris (1997) regarding determinants of health care expenditure for the United Kingdom. Hitiris (1997) estimates the model of health care expenditure in log-linear form by including independent variables such as per capita GDP, dependency rate, share of total public expenditure in GDP, rate of inflation and a shift dummy for the UK. Based on Roberts (2000), regression equation in Hitiris (1997) has high R-squared (0.924) and extremely low Durbin-Watson statistic (0.062), which suggests a potential spurious regression problem. When the data are re-examined using standard unit root and cointegration testing procedures, the new results show that there is overwhelming evidence for non-stationary of the variables, and no conclusive evidence regarding the existence of equilibrium relationships. It only suggests the short-run income elasticity, which is significantly less than one. In other words, the importance of income in determining aggregate health care expenditure has been found to be overriding in Hitiris (1997).

The results of the study by Karatzas (2000) suggested that per capita real private expenditure is both income inelastic and price inelastic. This indicates that per capita health care expenditure is a necessity in contrast with the argument that it is a luxury good. Karatzas (2000) found that apart from per capita real income, non-income factors such as that of supply-related also determine per capita real health care outlay. However, he singled out ageing population as being insignificant in most subcomponent of his analysis. There is no supporting evidence indicating that the rise of the US's ageing population had any significant impact on per capita real health care outlay during the sample period.

Di Matteo and Di Matteo (1998) examine the data of real per capita Canadian

provincial government expenditures on health care from 1965 to 1991 using pooled-time series cross-section regression analysis. They found that the major determinants of health care outlay are real provincial per capita income, population over age 65 and real provincial per capita federal transfer revenues. The income elasticity of 0.77 indicates that health care in Canada is not a luxury good.

In 2004, Bilgel conducted a study in the Canadian provinces using panel data over the period of 1975 to 2000. He found that income, federal transfers, and the share of senior population have statistically significant effects on health care expenditure. Further, the income elasticity of health care expenditure is below unity. Bilgel (2004) however was indifferent whether the panel is stationary or not as the Im-Pesaran-Shin (IPS) and Hadri's panel unit root tests gave a contradictory result.

Overall, previous studies about determinants of total health expenditure specifically have postulated some difficulties in estimating the subject. Those difficulties include the price differences of health care among OECD countries when cross-country data were applied (Gerdtham & Jonsson, 1991), and non-stationary of the variables in certain regression equation with detected autocorrelation problems when UK is focused (Roberts, 2000).

More recently, a research on the relationship between health expenditure and per capital Gross Domestic Product (GDP) was conducted by Rao, Jani and Sanjivee (2008). According to their findings, in the case of five ASEAN countries, the GDP could Granger cause the expansion of health expenditure in Malaysia and Singapore. There is bidirectional Granger causality between GDP and health expenditure in the case of Indonesia and Thailand.

Murthy and Okunade (2009) examined the major determinant of health care expenditure in African countries. They used ordinary least square (OLS) and two-stage least square (TSLS) method by employing cross-sectional data for the year 2001. Murthy and Okunade concluded that there are two major determinants, namely, per capita real GDP and per capita real foreign aid (FA). In general, studies on the determinants of health care expenditure discussed above employed different methods and types of data. Somehow a number of variables were included, such as age of the population, public health care expenditure and relative price of health care. Per capita income is found to be the major determinant of health care expenditure in most.

METHODS AND DATA

An econometric model is used to identify the determinants of health care expenditure in the selected 12 Asian countries (i.e. Cambodia, China, Indonesia, Japan, Laos, Malaysia, Mongolia, the Philippines, South Korea, Singapore, Thailand and Vietnam) for period the 1995 to 2008. It is hypothesised that per capital real health care expenditure is influenced by three main determinants, income, proportion of ageing population and public expenditure on health care.

The income factor or per capita income is considered the most important determinant to influence the amount of health care expenditure. When countries become wealthier, the people spend more money on health care. Thus, there should be a positive relationship between per capita income and health care expenditure (Abel-Smith, 1967; Pryor, 1968).

Demographic factor is another crucial element to influence the amount of public health care expenditure. If there are higher ratios of elderly people in the total population,

there would be higher spending on health care. In other words, there would be a positive relationship between health care expenditure and the proportion of population aged 65 and over in the total population (Fuchs, 1990; Warshawsky, 1991).

The public sectors have played an important role in health care services. However, there is an on-going debate on the topics. On the one hand, there are some researchers who claim that a positive relationship exists between health care expenditure and public expenditure. When the government spend more money or the share of public expenditure on total amount of health care expenditure is higher, there is higher spending on health care. It means that there would be a positive relationship between health care expenditure and the share of public expenditure in total health spending (Leu, 1986).

On the other hand, there are some researchers who claim that there is a negative relationship between health care expenditure and the share of public expenditure in total health spending. They argue that the private sectors tend to channel more efficiently their funds to the people. In contrast, the public sectors could provide less effective health care outlays to the people (Fraser, 1978). In this study, the health care expenditure (HCE) function is expressed as:

$$HCE_{it} = f\,(GDP_{it}, POP65_{it}, PE_{it}) \qquad (1)$$

where HCE_{it} is the per capita real health care expenditure in country *i* and at year *t*, GDP_{it} is the per capital real Gross Domestic Product in country *i* and at year *t*, $POP65_{it}$ is the percentage of the population aged 65 and over in the total population in country *i* and at year *t*, and PE_{it} is the share of public expenditure on health care in total health care expenditure in country *i* and at year *t*.

With regard to data collection, the main source of data is the World Bank's *World Development Indicator 2011* (World Bank, 2011).

In this paper, there are three hypotheses for the analysis;

1) *There is a statistically significant relationship between health expenditure and income*

2) *There is a statistically significant relationship between health expenditure and ageing population*

3) *There is a statistically significant relationship between health expenditure and government expenditure on health*

Three separate methods are used to analyse the model, i.e., 1) the restricted model, 2) one-way fixed effects model, and 3) two-way fixed effects model, 4) one-way random effect model and 5) two-way random effects model. First of all, the restricted model contains only a constant term:

$$y_{it} = \alpha + x_{it}'\beta + \varepsilon_{it}, \qquad (2)$$

where y_{it} is the regress and; α is the constant; x_{it} is the K regressor vector; β is the $K \times 1$ slope vector; ε_{it} is the error term; K is the number of regressors. In this study, in order to examine the determinants of health care expenditure without taking into account unobservable country-effects and unobservable time-effects, the restricted model could be expressed as:

$$HCE_{it} = \alpha + \beta_1 GDPit + \beta_2 POP65_{it} + \beta_3 PE_{it} + \varepsilon_{it} \qquad (3)$$

where α is the intercept, $\beta 1$, $\beta 2$, and $\beta 3$, are slope parameters and ε_{it} is the error term. To incorporate country-effects, one-way fixed effects model could take the form:

$$HCE_{it} = \alpha_i + \beta_1 GDP_{it} + \beta_2 POP65_{it} + \beta_3 PE_{it} + \varepsilon_{it} \qquad (4)$$

where α_i is recipient-effects. Finally, to incorporate both country- and time-effects, two-way fixed effects model could take the form:

$$HCE_{it} = \alpha_0 + \alpha_i + \theta_t + \beta_1 GDP_{it} + \beta_2 POP65_{it} + \beta_3 PE_{it} + \varepsilon_{it} \qquad (5)$$

where α_0 is the intercept, α_i is recipient-effects, θ_t is time-effects. If there exist country-effects in the regression model, the pooled OLS, or equation (3), does not effectively estimate the linkage between the independent variables and health care expenditure. Similarly, if there exist time-effects, the one-way fixed-effects model, or equation (4), does not effectively estimate the regression model. Thus, there is a need to analyse the significance of country-effects and time-effects. The F test could be used for this purpose (Greene, 2003, p.289). On the other hand, the one-way random effects model can be expressed as:

$$HCE_{it} = \alpha + \beta_1 GDP_{it} + \beta_2 POP65_{it} + \beta_3 PE_{it} + \varepsilon_{it}$$

$$\varepsilon_{it} = \upsilon_i + \nu_{it} \qquad (6)$$

where $\upsilon_i \sim N(0, \delta_\upsilon^2)$ and $\nu_{it} \sim N(0, \delta^2)$. υ_i is the country-specific random effect. Finally, the two-way random effects can be expressed as:

$$HCE_{it} = \alpha + \beta_1 GDP_{it} + \beta_2 POP65_{it} + \beta_3 PE_{it} + \varepsilon_{it}$$

$$\varepsilon_{it} = \upsilon_i + \lambda_t + \nu_{it} \qquad (7)$$

where $\lambda_t \sim N(0, \delta_\lambda^2)$. λ_t is the time-specific random effect. The period-specific random effects model could be estimated by using Feasible Generalized Least Square (FGLS) estimation. The slope parameters in this model could be expressed as:

$$\hat{\beta} = (x'\Omega^{-1}x)^{-1}x'\Omega^{-1}y, \qquad (8)$$

where Ω is the disturbance covariance matrix. The present paper uses the Wansbeek and Kapteyn (1989) methods to estimate the disturbance covariance matrix. They suggested using the residual from the fixed-effects model. The Hausman specification test is employed to

determine whether the fixed-effects approach is better suited for the analysis than the random-effects model.

EMPIRICAL RESULTS

Results of the regression analyses of pooled OLS model are presented in Table 1. The multiple coefficient of determination (R-squared) is 0.945. Controlling for country-effects causes R-squared to increase to 0.992. Conditioning on both country- and time-effects leads to a slight improvement of R-squared to 0.993.

Table 1. The restricted model

	Coefficient	**t-statistic**
Constant	-420.41	-12.50**
GDP	0.02	19.55**
POP65	92.73	20.26**
PE	0.70	0.90
Overall Significance (F test)		946.67**
R-squared		0.946
Adjusted R-squared		0.947

** indicates significance at the 0.01 level
* indicates significance at the 0.05 level

Table 2 shows the results of the one-way fixed effects model. To compare the pooled OLS model with the one-way fixed effects model, the null hypothesis that αi (recipient-effects) equals zero is rejected at the 0.01 level of significance. This implies the presence of country-effects in the model.

Table 2. The one-way fixed effects model

	Coefficient	**t-statistic**
Constant	-771.89	-14.83**
GDP	0.02	9.76**
POP65	156.90	21.28**
PE	4.37	0.16
Overall Significance (F test)		1367.79**
R-Squared		0.992
Adjusted R-squared		0.991

F Test for Model Specification (One-Way Fixed Effects vs. Pooled OLS)	81.88**

** indicates significance at the 0.01 level
* indicates significance at the 0.05 level

Table 3 shows the results of the one-way random-effects model. To compare the one-way fixed-effects model with the random-effects model, the Hausman test indicates that the one-way fixed -effects model is a better choice for the analysis.

Table 3. The one-way random effects model

	Coefficient	**t-statistic**
Constant	-741.58	-7.51**
GDP	0.02	9.90**
POP65	154.96	21.54**
PE	-1.64	-1.94
Overall Significance (F test)		537.137**
R-Squared		0.907
Adjusted R-squared		0.905
Hausman Specification Test (Fixed-effects vs. Random-effects)		8.72*

** indicates significance at the 0.01 level
* indicates significance at the 0.05 level

The same method could be applied to examine the significance of time-effects. Table 4 shows the results of the two-way fixed effects model. To compare the one-way fixed-effects model with the two-way fixed effects model, the null hypothesis that θt (time-effects) equals zero could be rejected. This can be interpreted as significant presence of country-effects in the model.

Table 4. The two-way fixed effects model

	Coefficient	**t-statistic**
Constant	-902.42	-14.88**
GDP	0.03	10.28**
POP65	178.87	21.40**
PE	-1.64	- 1.94
Overall Significance (F test)		798.57**

R-Squared	0.993
Adjusted R-squared	0.992
F Test for Model Specification (Two-Way Fixed Effects vs. Pooled OLS)	43.53**
F Test for Model Specification (Two-Way Fixed Effects vs. One-Way Fixed Effects)	89.03**

** indicates significance at the 0.01 level
* indicates significance at the 0.05 level

Table 5 shows the results of the two-way random-effects model. The Hausman test showed that the two-way fixed-effects regression is better than random-effects model. These results imply that only the two-way fixed-effects analysis is the best model. In other words, health care expenditure in the 12 Asian countries is found to be influenced by country-specific and time-specific fixed effects.

Table 5. The two-way random effects model

	Coefficient	**t-statistic**
Constant	-814.47	-6.37**
GDP	0.02	10.33**
POP65	167.68	22.06**
PE	-1.67	-2.03*
Overall Significance (F test)		409.08**
R-Squared		0.882
Adjusted R-squared		0.879
Hausman Specification Test (Fixed-effects vs. Random-effects)		12.22**

** indicates significance at the 0.01 level
* indicates significance at the 0.05 level

As the two-way fixed-effects model shows, only two independent variables (*GDPit* and *POP65it*) have significant relationship with health care expenditure in these countries. These two variables are positively correlated with the amounts of health care expenditures. This implies that health care expenditure tends to expand as a country's income and the percentage of the elderly among the population increase.

In short, the empirical findings identify two important determinants of health care expenditure in Asian countries. The first determinant is the level of income. In Asia, as countries become wealthier, people spend more money on health care. The second

determinant is the ageing population. Asian countries with a higher share of ageing population in total population tend to spend more money on health care.

CONCLUSION

This study basically aims to identify the determinants of health care expenditure in twelve Asian countries (i.e. Cambodia, China, Indonesia, Japan, Laos, Malaysia, Mongolia, the Philippines, South Korea, Singapore, Thailand and Vietnam). Previous studies about the determinants of health care expenditure have postulated some difficulties in estimating these expenditures. This is mainly due to the differences in the price of health care between various countries. The previous research on this topic also tends to undermine the effect of some important determinants, among them the share of public expenditure in total health spending.

This paper has initiated the forming of a regression equation to estimate the effects on health care expenditure by looking at three variables, namely income, ageing population, and public expenditure on health care. In order to obtain more reliable results, five separate methods have been used to analyse the model, i.e. 1) the restricted model, 2) one-way fixed effects model, 3) two-way fixed effects model, 4) one-way random effects model, and 5) two-way random effect model.

The findings imply that only the two-way fixed-effect model is the best model. The empirical results from the model indicated that only two independent variables (i.e. *GDPit* and *POP65it*) have significant relationship with health care expenditure in these countries. These two variables are positively correlated with the amounts of health care expenditures. In other words, when a country's income is larger, the amount of health care expenditure is larger. When the share of ageing population in the total population is higher, again the amount of health care expenditure is larger.

Although the findings of the current study provide some useful insights into the determinants of health care expenditure in Asian countries, there are some limitations, such as insufficient data. Future studies may want to address this methodological difficulty.

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