

Determinants to Health Care Expenditures in 23 OECD Countries: A Preliminary Empirical Study

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Abstract : This study explores the determinants of health care spending in OECD countries. This study shows several distinctive findings compared to the previous research. First, this study introduces lagged variables to capture the impact of past values. Few studies have dealt with relationships such as temporal stability or lags between income and health care spending. In this study, previous income and health care spending reveals a statistically significant impact on the annual change of health care expenditures. Second, this study examines the effect of the time trend variable on health care spending, the effect of which its effect appears to be related to technological change in medical care. Third, the study explores how non-income variables such as demographic variables and the number of physicians to reveal that there are no significant effects on health care spending from the proportion of the aged and the number of physicians. Finally, based on the fixed-effect model, the specific country effects across health financing systems are examined. It suggests that country differences in increasing costs are related to the different objectives of health policies (e.g., equal access or good quality), different health care management systems (market-oriented system), and other unique country factors.

INTRODUCTION

Recent health care reforms in OECD countries have been concerned about keeping health care expenditures to an acceptable proportion of national resources. These costs have been contained in various ways. To some extent, the variable success in cost containment may have been caused by different national, economic and political circumstances, which include health delivery systems. Thus, it is difficult to generalize among the 24 OECD countries which factors increase health care costs. In addition, aging populations and health technologies have been the dominant factors in increasing health care spending. However, little attention has been given to the relationship between the success in containing costs and ways of organizing services.

The level of expenditures and success in cost containment depends on various factors that involve both the supply (e.g. income, the number of physicians, and health care systems) and the demand (e.g. medical technology, demographic structure) sides. It is not, however, yet fully known which factors have increased the cost of health care. Part of the problem is that such causes are intertwined. Another problem is the difficulties in distinguishing the effects of rising costs for medical care from the rising quality of care.

This study explores the impact of both income and non-income variables on health care spending among 24 OECD countries in the period from 1960 to 1990. More specifically, this study uses four different measurement and model specification from

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previous studies.

First, health care expenditures are converted by purchasing power parities (PPPs). Second, lagged variables are used to capture the impact of past values because few studies have dealt with relationships such as temporal stability or lags between income and health care spending. Third, based on the fixed-effect model with the same slope coefficients and different intercepts, 23 country-specific dummy variables are used. Finally, the time trend variable is used in order to analyze the effects of technological change, although it does not represent the impact completely. This paper uses a linear regression model based on first difference (annual change) to reduce auto-correlation in time series data. It also uses a Weighted Least Squares (WLS) model due to the non-constant error terms in the regression models. In order to capture country-specific effects, the analysis relies on fix-effects models.

RESEARCH BACKGROUND

A Brief Review: Approaches to the Study of Health Care Expenditure

Most studies have shown a strong relationship between GDP per capita and health care spending. One of the prominent studies on health care costs maintained that GDP per capita accounted for about 90% of the variation in health care spending per capita across the OECD countries (Newhouse 1977). Many other studies have also shown the impact of income on health care expenditures (Leu 1986, Gerdtham *et al.* 1992, Hitiris and Posnett 1992). However, there are different studies that concern non-income variables, such as the aging population, the share of public expenditure on total health care spending, urbanization, and the number of physicians. In other words, there are no consistent findings on the impact of non-income factors. Leu (1986) provided some evidence that urbanization and public sector provision of health care could be important factors to explain the variance of medical care expenditures across countries. In contrast, Gerdtham *et al.* did not support Leu's findings (Gerdtham *et al.* 1992). Further studies are needed to discover the true impact of non-income variables on health care costs. It appears that aforementioned controversies mainly stem from different data and different statistical methodologies.

Controversial Issues in Previous Studies

Type of Data

Recent analyses consist of three types of data (cross-sectional, time-series, and panel data). All analyze the relationship between health care expenditures and income. In addition, variables such as age, structure and the number of physicians are included in the models. Despite these similarities, each study has a unique area.¹⁾ For instance,

1) Unlike the time series analysis, cross-sectional analysis allows the measure of effects of different health care system. Gerdtham and his colleagues (1992) argue that the institutional factors of health care systems contribute significantly to the expansion of the health care variation between countries

previous cross-sectional analyses have illustrated the existence of a strong positive relationship between HCE and GDP. However, this method has been criticized for the lack of data and the assumption that health care is homogeneous across countries (Culler 1990, Hitiris & Posnett 1992). In addition, previous time series approaches raise statistical and methodological issues, which were not relevant in previous cross-sectional studies (King 1996).²⁾ The recent development of detailed annual health care statistics by the OECD enabled health policy analysts to estimate cross-section and time series models that were pooled from OECD countries.

Models of Health Care Expenditures

Determinants of health care expenditures fall into three broad areas. The first is based on demand factors and the second supply factors, while the third is based on types of health care systems, which include financing and delivery systems.

A demand model is based on the “need” in a health care market. This model takes into account factors such as cost, the age distribution of the population, health care systems (e.g. centralized or decentralized institutional structure, reimbursement arrangements, and the relationships among political groups), and expectations of health care based on culture, education, income, and individual health status.

Previous studies (Hoffmeyer and McCarthy 1994, Hitiris and Posnett 1992) on the supply side have focused on analyzing the relationship between health care expenditure and national income. They include such factors as the number of physicians and hospital beds to population ratio. However, despite importance of the supply side, fewer studies have been conducted. Unlike the aforementioned approaches, recent studies (Hitiris and Posnett 1992) emphasize the role of health care financing and delivery systems.³⁾ More specifically, several studies have examined how the public sector influences the level of national health care spending.⁴⁾

in terms of the way of outpatient care physicians are paid, the combination of private/public funding, and inpatient/outpatient care. The study shows that the health care expenditure is about 11% higher in countries with fee-for-services as the dominant form of remuneration for outpatient care. Time series analysis can provide long-term trends in health care expenditure. Murthy and Ukpolo (1994) conclude that from 1960 to 1987, per capita income, age of population, the number of physicians, and public financing of health care expenditures are important determinants of aggregate health care expenditures in the United States. For pooled time series analysis, a combination cross sectional data and time series data are employed. Like previous cross-sectional studies, Hitiris and Posnett (1992) use country dummy variables, which confirm the importance of income and demographic variables as determinants of health care spending.

- 2) King (1996) examined whether the data used by the time series is stationary. He argued that the strong positive correlation between HCE and GDP can result from non-stationarity {??} in the respective time series, rather than evidence of an economic relationship.
- 3) Hitiris and Posnett (1992) argue that the system of health financing and delivery can significantly influence the demand for health care, either directly through influencing health production functions, or indirectly through by influencing relative costs.
- 4) For instance, Culyer (1989) questions the argument that the public sector creates waste. He argues that private sector bureaucrats are not necessarily better controlled than their colleagues in the public sector are. Costs in the private sector may be larger due to advertising and selling costs. Market pressures may be less reliable than professional ethics and regulation. Stoddart and Labelle (1985) also show that privately owned for-profit hospitals do not operate at lower production costs than do non-profit hospitals.

Measurement Problems

International comparisons of health policies are problematic because of the lack of standardized data across countries and the methodological problems that arise from comparing different economic, demographic, and institutional structures.

One particular problem comes from the different analytical units. Many international studies use aggregate data to analyze economic concepts such as Engel curves and income elasticity. However, this method is usually based on a microanalysis of the data. Some authors have criticized these studies because the use of aggregate data is unreliable (Parkin, McGuire, and Yule 1987).

Second, it is difficult to find valid a conversion factor to compare international data. Exchange rates are inappropriate because they do not reflect relative purchasing power. Recently, Purchasing Power Parities (PPPs) have become the preferred alternative approach, despite numerous practical problems in the measurement process. Previous studies (Gerdtham and Jonsson 1991) have revealed that different conversion factors can produce different results.

Third, although PPPs provides a better measurement tool relative to exchange rates, there are still measurement problems. PPPs are not enough to capture the inherent differences among countries because there are difficulties in defining and measuring the output of various health care systems (Aaron 1991; Schieber and Poullier 1996), consequently system performance cannot be easily evaluated. It is also difficult to measure and control for social, medical, cultural, demographic, and economic differences across countries.

Statistical Problems

One of statistical problems lies in the stationarity {??} of time series data. For instance, Hanson and King (1996) criticize previous studies for using non-stationary data. Non-stationarity {??} of the data can make the t and F values unreliable. Furthermore, King and Hansom (1996b) find that Murthy and Ukpolo's model, which is based on aggregate health care expenditures of 20 OECD members, is not stationary. They argue that the possible source for this non-stationarity {??} may come from the cointegration tests in using a small sample, misclassified functional forms, and the exclusion of supply side influences. Thus, the argument that there is a strong relationship between health care expenditure and GDP may be spurious.

Another statistical problem comes from specification errors in current models. In health care, some previous studies have shown that the adequacy of the fit and the elasticity estimate can be considerably affected by the choice of functional form. Generally, however, the log-linear (double log) format is the preferred functional form, even though a linear functional form has been considered. Previous studies have also neglected factors such as the combination of permanent income and transitory income, the cost of health care, and the cost of all other goods (Hansen and King 1996).

DATA AND MODEL SPECIFICATION

Data

The data set consists of a pooled sample of cross-section and time-series observations covering 24 OECD countries for the 30 years from 1960 to 1990. Of 744 observations, only 471 cases were analyzed because of missing data and outliers. Data is drawn from OECD sources (see Table 1). The following describes information about demographic and macro-economic aggregate data.

Total expenditure on health care per capita at purchasing power parity is based on US dollar at the current rate. Health care expenditures per person converted by GDP purchasing power parities (PPPs) removes the effects of cyclical fluctuation or exchange rate instability, and the effect of overall differences in relative costs among OECD countries. During the 1980s, exchange rates experienced considerable fluctuations in opposite directions: however, GDP PPPs reduce the amplitude of these fluctuations (OECD 1993b, 62-63). Thus, health care expenditure data calculated with GDP PPPs present a more plausible valuation of health care expenditure than do exchange rates.

Table 1. Sources of Data and Measurement

Data	Sources
Purchasing Power Parities for GDP (National currency units per US \$)	OECDa, 1993 Table A 1.3.2
Total Expenditure on Health Per Capita at Purchasing Power Parity (In US \$ at current rates)	OECDb, 1993 Table A 2.1.2
Gross Domestic Product (In millions of national currency units)	OECDa, 1993 Table A 1.2.3
Per Capita GDP converted by PPPs for GDP	OECD, 1998
Total Population (Mid-year estimates in thousands)	OECD, 1998
Population Aged 65 and Over (% of total population)	OECD, 1998
Practicing Physicians (Persons-mid-year estimate unless noted sources)	OECD, 1998
Public Sector Share of Total Expenditure on Health (%)	OECD, 1998

Source: 1) OECD, 1993a, OECD Health Systems: Facts and Trends 1960-1991 (Volume I, Paris: OECD). 2) OECD, 1998, OECD Health Data, Paris: OECD.

Total expenditure on health care is comprised of the following:

- (1) Household final consumption on medical care and health expenses
- (2) Government-supplied health care services including schools, those in prisons and the armed forces, as well as special public health programs
- (3) Investment in clinics, laboratories
- (4) Administration costs
- (5) Research and development
- (6) Industrial medicine often treated as an intermediate consumption
- (7) Outlays of voluntary organizations.

Medical care refers to in-patient and outpatient care, medicine and other pharmaceutical products, medical equipment and therapeutic appliances, and ambulance services. When converted by means of PPPs, GDP expenditures for different countries are in effect expressed at the same set of international costs.

Practicing physicians include the number of general practitioners and specialists.

The data exclude qualified physicians working abroad, but include licensed foreign physicians. The public sector includes central and local authorities, health boards and social insurance institutions.

Model Specification

In the light of the aforementioned literature review, some general hypotheses can be formulated (see Table 2). Table 3 describes the list of variables.

Table 2. Test Model

<p>Model 1 (constant coefficient model)</p> $HCEpc_1 = a + b1 * GDPpc_1 + b2 * GDPpc_1_{t-1} + b3 * HCEpc_1_{t-1} + b4 * HCEpc_1_{t-2} + b5 * pop_1 + b6 * rpe_1 + b7 * doc_1 + e$ <p>Model 2 (intercept is different, slope coefficients are constant : fixed effect model)</p> $HCEpc_1 = a + b1 * GDPpc_1 + b2 * GDPpc_1_{t-1} + b3 * HCE_1_{t-1} + b4 * HCE_1_{t-2} + b5 * pop_1 + b6 * rpe_1 + b7 * doc_1 + b_i * CNTRY_i + e$

In the regression models, the dependent variable is the first difference (annual change) of health care expenditure per capita (HCEpc₁). Independent variables include the first difference (annual change) of national income per capita (GDPpc₁), one lagged variable of the first difference income (GDPpc_{1t-1}), two lagged variables of dependent variable (HCPpc₁, HCEpc₁), the first difference of the proportion of population over 65 (pop₁), the first difference of share of public expenditure on total health (rpm₁), and the first difference of number of physicians (doc₁). The time trend variable controls for the effects of changing technology and tastes over time.

In Model 2, 23 country-specific dummy variables are introduced. Each country dummy is expected to control for any unique aspects of health care system and other national differences, including health care financing and delivery system, diseases, environmental hazards, etc. In this case, the reference group is the United States.

Strategy of Statistical Methods

In the cross-sectional and time series data, the key issue is how to control cross-sectional differences while satisfying regression assumptions such as no auto-correlation and no heteroscedasticity. This paper uses a fixed-effect model to capture country-specific effects and time-specific effects. To this end, it is assumed that slope coefficients are constant across countries, while intercepts differ. In order to capture differences

Table 3. Lists of Variables

- HCEpc = Health care expenditures per capita converted by purchasing power parities (PPPs) for GDP
- HCEpc_1 = First difference data of HCEpc
- HCEpc_1_{t-1} = The one period lagged value of HCEpc_1
- HCEpc_1_{t-2} = The two period lagged value of HCEpc_1
- GDPpc = GDP per capita converted by PPPs for GDP
- GDPpc_1 = First difference data of GDPpc
- GDPpc_1_{t-1} = The one period lagged value of GDPpc_1
- DOCpc = Number of practicing physicians per 1000
- doc_1 = First difference of DOCpc
- POP65 = Population Aged 65 and Over (% of total population)
- pop_1 = First difference of POP65
- RPE = The Public Sector Share in Total Expenditure on Health (%)
- rpe_1 = The first difference of RPE
- time = A time trend variable that controls for the effects of changing technology and preferences over time
- CNTRYi = country dummy variable (Reference Group : USA)

over cross-sectional units, country-specific dummy variables based on fixed effects are introduced. Time-specific effects are controlled by the time trend variable. It is assumed that time trend is stationary in the model.

Most previous studies assume that intercept terms vary to capture individual differences while slope coefficients are constant. In a pool of health care expenditure for 24 countries, it is reasonable to assume that each country has a different level of expenditure. Thus, the fixed-effect model is preferred over the constant coefficient model.

Despite correcting for country-specific and time-specific effects, the estimation of relationships that combine cross-sectional and time series data raises statistical problems such as heterogeneity and auto-correlation. To control heteroscedasticity, this paper uses a Weighted Least Square (WLS) model. The models in the paper are weighted by the first difference of GDP (GDPpc_1) because the residuals increase against GDPpc_1 (the error variance is proportional to $(GDPpc_1)^2$). This reveals that as income increases, residuals also increase. For the auto-correlation problem, the first difference method is used. Also, three lagged variables and a time trend variable are introduced to capture effects of previous income and health care expenditure and the change of medical technology.

EMPIRICAL RESULTS

The significant determinants of the change in health care spending are identified in Table 4. They include income, two dependent lagged variables, time trend, age, the ratio of public sector spending on total health care costs, the number of physicians and country dummy variables. More details are in the following.

National Income and Previous Health Care Costs

The statistical results in Table 1 indicate that the effect of increasing income is spread or distributed over time. For the short-term effect of the annual change in GDP per capita, a one percent increase in GDP per capita increases the annual health care expenditure per capita by about 0.5% ($p < .01$), holding other factors constant. In the long-term, the impact of the annual increase in personal income is lower than the short-term impact of income growth because of the negative impact of the preceding year. The income elasticity of the long run effect is about 0.366 $[(0.51) + (-.134) = 0.366]$.

Previous spending in health care significantly influences current health care spending.⁵⁾ In this study, for the one-period lagged value of HCEpc_1, the elasticity is about 0.29 ($p < .01$). This means a one percent increase in the preceding year's annual change of health care spending per capita increases this year's annual change of health care expenditures by about 0.29%. In the long-term, a one percent increase in each of the previous two years' annual health care expenditure per capita is associated with about a 0.414 $[(0.29) + (0.124) = 0.414]$ percent of previous annual change, *ceteris paribus* ($p < .01$).

Time Trend

The development of new medical technologies (e.g., innovative diagnostic procedures, new drugs, etc.) has resulted in new, expensive treatments and increasing health care costs. In particular, technological advances tend to create new demands for health care. Although it is difficult to capture the effect of technological change, the 'time trend' variable is expected to represent the impact of technological change and tastes over time. This paper shows that the time trend variable has significantly positive effects on the annual change of health care costs ($p < .05$).

5) The impact of income on health care expenditure has been analyzed at both the micro and macro levels. Many studies at the micro level show a weak relationship between household income and utilization of health care (Grossman 1972, Newhouse and Phelps 1974, Muurinen 1982; Wagstaff, A 1986 Health care is usually considered to be relatively inelastic with respect to the effective consumer price. Strong empirical support for this has been provided by the Health Insurance Experiment (Manning *et al.* 1987). Among the reasons given for the weak correlation is that at the individual level, a consumer does not have to pay the full resource cost of utilization due to subsidies or insurance. This is not true, however, for the nation as a whole. In fact, most empirical studies have reported that the income elasticity of aggregate health care expenditure per capita exceeds one (Gbesemete and Gerdtham 1992, Gerdtham, *et al.* 1992). Previous macro studies have shown a strong and positive correlation between per capita income (GDP) and per capita health care expenditure (HCE). The analyses based on cross-sectional data have shown that health care expenditure increases proportionally more than aggregate per capita income, and that per capita income is the statistically most significant factor determining health care expenditure. Most estimates of the income elasticity of health care spending have exceeded one, which means health care is a luxury good, at least for developed countries.

Table 4. Results of the Estimating Equation (N=471)

Variables	Mean	STD	Model 1	Model 2 [elasticity]
GDPpc_1	389.7	265.8	0.058(0.0041)	0.056(0.004) [0.51]
GDPpc_t-1	379.76	263.57	-0.01(0.005)	-0.0152(0.005)[-0.134]
HCEpc_1t-1	42.7	31.9	0.34(0.04)	0.294(0.04)[0.29]
HCEpc_1t-2	37.35	31.2	0.19(0.04)	0.143(0.04)[0.124]
pop_1	0.143	0.1720	-1.4(2.9)	-2.8(2.9)
Rpe_1	0.3288	2.62	-0.17(0.173)	-0.25(0.174)
Doc_1	0.055	0.051	-10.2(10.4)	-12.3(11.1)
Time	17.19	7.96	0.22(0.09)	0.71(0.134)[0.172]
Austria	0.053	0.224		-8.7(3.0)
Belgium	0.053	0.224		-8.5(3.4)
Canada	0.041	0.199		-1.0(4.8)
Denmark	0.049	0.216		-7.4(3.5)
Finland	0.053	0.224		-7.6(3.2)
France	0.055	0.228		-5.9(3.42)
Germany	0.049	0.216		-6.5(3.48)
Greece	0.055	0.228		-12.7(3.2)
The Netherlands	0.055	0.228		-8.47(3.4)
Iceland	0.045	0.208		-15.1(4.6)
Ireland	0.023	0.152		-24.7(5.9)
Italy	0.047	0.212		-7.2(3.2)
Japan	0.047	0.212		-10.6(3.3)
Luxembourg	0.023	0.152		-17.88(6.3)
New Zealand	0.029	0.169		-12.3(5.87)
Norway	0.047	0.208		-8.3(3.3)
Portugal	0.025	0.146		-19.7(4.88)
Spain	0.055	0.228		-9.98(3.29)
Sweden	0.053	0.224		-6.1(3.8)
Switzerland	0.049	0.216		-8.1(3.12)
Turkey	0.016	0.124		-23.2(5.24)
United Kingdom	0.023	0.152		-11.9(5.86)
Adjusted R-square			0.81	0.83

Note: 1) Reference group for the country dummies is the United States. 2) Standard errors are in parentheses.

Demographic Variable

Many previous studies show that the proportion of the aged in the population has been a significant factor in increasing health care spending.⁶⁾ However, this study shows that the proportion of population over 65 is not a significant factor in predicting changes in health care expenditure, which is consistent with the one recent study (Gerdtham, *et al.* 1992). The opposing views can be explained by the fact that international comparison of health care spending is very sensitive to functional form. In this paper, a linear model is

6) The age of the population is presumed to be one of the prime factors in determining the level of health care expenditure because the consumption of health care is unevenly distributed over the life cycle. In general, health care spending is greatest for most people in their first and last years of life. Leu (1992) reports a significant effect from the proportion of the population under 15. Hitiris and Posnett (1992) also show that the proportion of the population over 65 is a significant factor. However, recent studies maintain that changes in the age distribution of the population are not major factors in accounting for the increase in health care spending over the past three decades. One cross-sectional study also shows that the age variable is not significant (Gerdtham, *et al.* 1992).

used, whereas the double log linear model has been preferred in most previous studies. The age variable does have a weak impact relative to other factors such as income, technological change, and health care systems because the share of the population over 65 in OECD countries has shown stable increase since the 1970s.

The Number of Physicians

With regard to the number of physicians, statistical results in this study differ from previous studies.⁷⁾ This paper shows that there is no significant impact on health care spending per capita. In contrast, one previous study argues that an increase in the number of physicians actually decreases the annual change in health care spending. Thus, that study argues that an increase in the number of physicians contributes to controlling health care costs (Murthy and Ukpolo 1994).

However, this argument can be criticized on two fronts. First, Murthy and Ukpolo's study is based on only the time series analysis in the United States, while this paper is based on pooled times series data from 24 countries. Second, we can expect that if health care providers are not a perfect agent and their incomes are threatened by a reduced demand for some services, they will respond by prescribing additional services, or by raising the prices of less discretionary services in order to maintain income. Thus, these health care providers' responses can counteract the effect of the increasing supply of physicians.

The Ratio of Public Sector Spending on Total Health Care Costs

There are two competing hypotheses of how the ratio of public sector spending on health care influences the national level of health care spending. Two factors predominate in studies of this kind: (1) the public sector's share of total spending, and (2) the health care system's inclusion of options such as fee-for-service, and global budgeting.

First, it is controversial whether an increase in public sector expenditures decreases health care spending. Some studies suggest a positive relationship between the total health care expenditures and the ratio of public health care expenditure to total health care expenditure. A public choice perspective argues that public sector provision increases health care expenditure through two different positive effects on the supply side: (1) budget maximizing tendency in the public sector or nonprofit institutions, and (2) less intensive competition in the public sector, which reduces incentives for cost

7) Previous studies show that the ratio of the number of practicing physicians to the population is positively related to the level of aggregate health care expenditure (Reinhardt 1985, Phelps 1986, Rice 1987). The increase of the ratio tends to increase the health care expenditure. According to this argument, physicians can counteract increased physician density by increasing the utilization of their services, which might be manifested in terms of unnecessary visits and redundant medical care, without reducing their fees. However, Murthy and Ukpolo (1994) argue that an increase of number of physicians can decrease health care costs. This study shows that based on their study that the demand for health care in the United States is price inelastic, an increased number of physicians will lead to a reduction in the cost of health care in the market, and consequently a reduction in aggregate per capita health care expenditure.

minimization (Niskanen 1971 {not in references}, Leu 1986).

Several studies have focused on health care financing systems, which include global budgeting versus fee-for service. Open-ended financing systems are characterized by multiple insurance companies and by fee-for service remuneration. Closed systems are characterized by few financing agents, capitation for outpatient services, and global budgets for hospitals. Generally, countries with more closed financing systems show lower health care expenditures than those with open financing systems, and that the system with fee-for-service increases health care costs. One study shows that the health care expenditure is about 11% higher in countries with fee-for-services than other financing systems (Gerdtham, *et al.* 1992).

This paper maintains that it is difficult to find any significant effect of public sector provision on health care costs. From a public choice perspective, Leu (1986) argues that public sector provision and public financing of health care increases health care expenditure because civil servants act as budget maximizers, and because less intensive competition in the public sector reduce incentives to minimize costs. However, Culyer (1990) argues that private sector provision of health care can result in higher costs because of advertising and marketing costs. One previous study argued that when the share of public sector health care expenditures increases by 10%, health care expenditures would fall by about 5% (Gerdtham, *et al.* 1992). However, in contrast to previous studies, this paper shows the ratio of public sector expenditures on total health is insignificant. This paper argues that after controlling for the unique situations in 23 countries, there is no relationship between the increase in health care spending and the public sector's share of total health care spending. It is important to note that the previous study does not control for country-specific effects. It is expected that the impact of public sector expenditures on health care spending varies from country to country in terms of national economic and political circumstances.

Country Specific Effects

Each country-specific effect allows for various differences among countries. Country-specific effects indicate that compared to the United States, nineteen OECD countries of have lower health care expenditures, holding income, age structure, number of physicians, and time trend constant ($p < .01$). Three more countries, Sweden, Germany and France, have lower personal health care spending than the United States at the 10% confidence level. In sum, country dummy variables show that U.S. health care costs are higher than any other country except Canada.⁸⁾

This is consistent with US health care spending being the highest in the world. In particular, over the past 10 years, both in absolute dollar terms and relative to GDP, US health care costs have increased faster than in other country (White 1995). This means that the cost-containment measures of the past have done little to slow the growth of US

8) Health care spending in Canada is not significantly different from that of the United States. Canada's health care costs to GDP ratio increased sharply from 7.4% in 1980 to 9.3% in 1990, a rate of growth that was second only to that of the United States. Canadian nominal health care expenditures relative to GDP have also grown faster than in other OECD country with the exception of the United States (Schieber, *et al.* 1992).

health care expenditures. One study argues that in the United States, various factors (such as tax subsidies, fee-for-service reimbursement, non-price competition among providers, consumer expectations, and malpractice risks) virtually promote increased spending (Schieber, *et al.* 1992). Moreover, unlike other countries, the United States has not introduced an equitable method to disburse health insurance across the population. However, despite higher health care costs than other countries, there is no evidence that America's high costs have resulted in increased benefits, such as higher quality medical care, increased access to services, and decreased social problems (White 1995).

These differences can be explained by a variety of factors. Generally, it is argued that the main difference is between a system financed primarily by private sector providers (commercial insurance) and a system financed primarily by public sector providers (social insurance and taxation). Thus, it is expected that the health care system in some OECD countries will result in lower personal health care spending than a system financed by voluntary insurance and mainly private sector providers. However, it is uncertain whether systems financed mainly by the public sector can reduce health care spending. The reason is that there is no significant difference between Canada and the United States in annual personal health care expenditure despite the significant difference between the two health financing systems. It remains controversial whether centralized systems can keep down costs in comparison with decentralized systems. Thus, it is necessary to investigate other factors such as environmental hazards.

No particular model of the organization of health service delivery and financing (contract, integrated, or reimbursement) seemed to have a clear advantage in controlling costs. As mentioned earlier, the proportion of public expenditure does not have a statistically significant impact. There is also no difference between systems financed primarily by taxation or those financed by public sector providers (Canada) and the American system of health care. Thus, this paper concludes that since it is difficult to find a significant impact from health care system on health care costs, and country specific effects are an important factor in explaining the difference in health care costs across countries.⁹⁾

CONCLUSIONS

The three issues this study is concerned with are: how do annual changes in per capita health care expenditures respond to changes in income with a lapse of time and the past value of the annual change of health care expenditures; how do non-income variables such as demography and the number of physicians influence health care spending; and finally, how does one capture specific effects across health financing systems and countries.

9) However, there is some evidence that health care systems that are financed primarily by social insurance but with mixed public and private providers (e.g., Denmark, Finland, Sweden, Portugal, Iceland), have lower health care expenditures relative to systems financed mainly by voluntary insurance with private providers (e.g., the US). Also, countries with capitation or salaried payments have a lower share of GDP devoted to health care. In the European Union countries at least, the existence of a strong referral system tended to help keep costs down (OECD 1994).

The empirical results indicate that previous income and health care spending analyses have a statistically significant impact on the annual change of health care expenditures. Further research is required to determine the nature of lagged phenomena in health care expenditure per capita.

After controlling for previous income and health care spending, the ratio of public expenditure to total health and time trends (such as the change of technology and tastes), country specific-effects indicate that personal health care expenditures in the United States are higher than in 19 other OECD countries at the 95% confidence level. Three countries (Sweden, France, and Germany) also show lower expenditures than the United States at the 90% confidence level. Only Canada shows no difference. In order to account for the variation in per capita health care costs, the relative difference in the cost of health care services across countries and the unique manner each country consumes and provides health care services must be considered. This study argues that variations in the increased costs result from a variety of factors such as the specific circumstances within each country, the different objectives of health policy (equal access or high quality), the different health care management systems (market-oriented system or government-oriented system), and other unique factors.

In this study, age structure and the number of physicians are not statistically significant. This result differs from previous studies, which had found these two factors influential. This inconsistency might be the result of different data, or different models or statistical methods. At this stage, it is uncertain which particular factor led to the different result. Most notably, the number of physicians recorded in previous results may be unreliable since the numbers are based on data from only the United States. This study argues that considering other countries, the number of physicians is insignificant.

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