

# Factors Affecting Health Care Spending

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## Abstract:

With an aging population and an increase in health care spending across many nations, there is a need to determine what is affecting this increase and whether this trend can be expected to continue into the future. This paper aims to investigate the possible differences in health care expenditures in different countries. The study incorporates the use and analysis of several independent variables that are believed to affect health care spending in an array of countries including life expectancies, the increase in aging populations, health care spending on private sectors, and the quality of health care as represented by the number of hospital beds available to patients. This paper seeks to determine if there is in fact a steady correlation among these independent variables among all thirty pre-selected countries, or whether health care expenditure varies by country and is affected by other determinants. The results of this study reveal that, as predicted, female life expectancy, spending on private health care sectors, and the increase of population over the age of 65 does in fact positively affect the health care expenditures among countries.

JEL Classification: I10, I11, I12, I18

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## **1.0 Introduction**

The topic of comparing public health expenditures among a variety of different countries is important to analyze because there is a general trend of increasing health care costs across the globe. As the general population in many countries continues to age and baby boomers begin to retire, health care costs are expected to rise drastically across multiple countries. This is a concern to many, particularly in lower income countries with a lower GDP where the quality of health care is much lower than in other developing or fully developed countries. Over the next fifty years, the aging population will continue to increase. While not all countries are affected by an overwhelmingly large population of “baby boomers” and adults reaching the age of 65, almost all countries are faced with rising health care costs. Generally speaking, the older population requires more health care and as the elderly population increases, health care costs will most likely be expected to increase with it.

A second reason for the increasing health care costs across countries could be explained by the fact that many countries, particularly developing countries, are attempting to provide better quality health care to their citizens. Naturally, it is expected that as the quality of health care provided to citizens increases, so will the cost.

This paper aims to investigate and analyze the determinants of health care expenditures among thirty different countries. A regression analysis will be run and results will be compared for a variety of different variables between the years of 2000 and 2005. A selection of about thirty countries ranging from low income countries to high income countries have been chosen, with many of these countries belonging to the Organization for Economic Cooperation and Development (OECD).

One of the main empirical questions that this paper aims to answer in researching this topic on health care expenditures includes determining which variables affect health care expenditures the most and why.

This paper will address these topics of interest and will be organized in the following order: Section 2.0 addresses trends in the health care market; Section 3.0 provides a literature review of previous research; Section 4.0 explains in detail the empirical model, data, and methodology and is broken into subsections; Section 5.0 provides empirical results and an analysis of the research findings; Section 6.0 will end the paper with a conclusion and reasoning. Finally, additional charts and tables can be found in Appendix A and B, followed by a listing of all the tables used within this paper.

## 2.0 Trends in the Current Health Care Market

Identifying some of the major factors of rising health care expenditures is a pressing topic in recent years. With the general population aging over the next forty to fifty years, health care is on the rise in countries across the globe.

**Figure 1: Current Patient Trends**

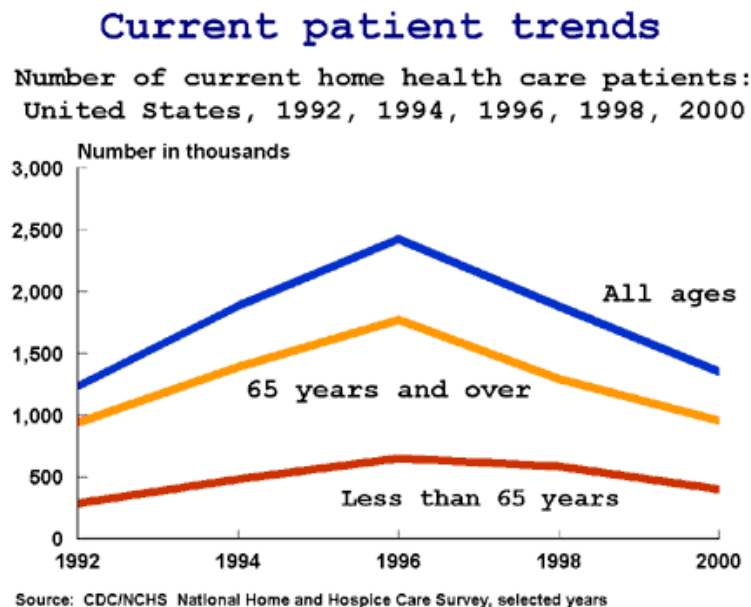


Figure 1 illustrates trends in patients between the years of 1992 and 2000. The graph shows how there was a large peak in the year 1996 of patients who received health care at home, and that the majority of this peak was a result of a spike in patients over the age of 65. However, after 1996, the number of home health care patients has decreased, which could indicate that more patients are receiving health care in public facilities such as hospitals and private practices and that less are staying at home. This is important in analyzing factors in rising health care costs because if more and more citizens are moving to hospitals for treatment and are staying in these facilities as opposed to returning home, the costs of health care will clearly increase as well.

**Figure 2: Government Health Care Spending as a Percentage of GDP**

**TABLE V**  
**Government Health Care Spending as a Percentage of Gross Domestic Product**

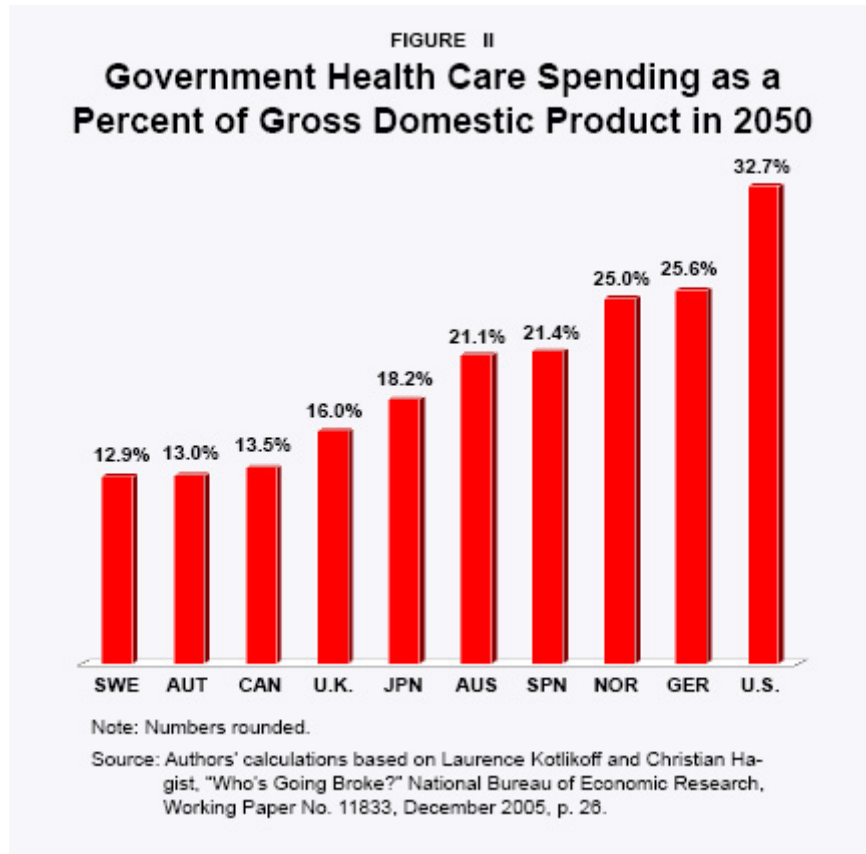
	<b>2002</b>	<b>2025</b>	<b>2050</b>
Australia	6.4%	11.5%	21.1%
Austria	5.4%	8.3%	13.0%
Canada	6.7%	9.5%	13.5%
Germany	8.6%	14.7%	25.6%
Japan	6.7%	11.7%	18.2%
Norway	8.0%	13.9%	25.0%
Spain	5.5%	10.5%	21.4%
Sweden	7.9%	10.2%	12.9%
United Kingdom	6.4%	10.0%	16.0%
United States	6.6%	13.8%	32.7%

Note: Numbers rounded.

Source: Authors' calculations based on Laurence Kotlikoff and Christian Hagist, "Who's Going Broke?" National Bureau of Economic Research, Working Paper No. 11833, December 2005, p. 29.

Across the globe is a trend of higher spending in terms of a country's gross domestic product (GDP). Figure 2 shows a comparison of different countries and their spending on health care. We can see how the United States is one of the top countries in spending on health care, with other developed countries following. Moreover, we can see how developing countries are beginning to focus on health care spending.

**Figure 3: Government Health Care Spending as a Percentage of GDP in 2050**



Many countries, even lower income and developing countries are experiencing higher levels of spending on health care due to a demand for better care, more services, and a movement in many countries towards a public health care plan. As a result, many countries are making a move towards a public policy in terms of health care, which enables all tax-paying citizens to receive medical attention and health care as sponsored and provided by the government. This is a new, fast growing trend among many countries, and it is arguable that it provides better, higher health care than private health care providers with lower spending. Figure 3 illustrates how the United States, an extremely developed country, compares to other high-income countries in terms of health care spending and how it is expected to continue in the future. The graph shows health care spending in terms of a country's GDP in the year 2050.

### **3.0 Literature Review**

Previous studies have investigated possible correlations between variables and health care spending among individual countries. Each of these studies has developed different results about variables and health care expenditures.

According to Huang (2004), some of the “key determinants are growth in gross domestic product and percentage of government health expenditure to gross domestic product. Other factors, like the ageing population and the number of doctors per thousand populations do not significantly affect the growth of health care expenditure.” This is an important conclusion because while Huang concludes that the aging population and quality of health care based on the number of doctors available does not affect spending on health care for high income countries, this paper will aim to either support or contradict this claim.

Another study on this topic performed by Herwartz (2000) makes a similar claim by determining through his research that high GDP growth in countries is directly correlated with health expenditures. This study focused primarily on OECD countries. However, this study by Herwartz “applied methods of statistical inference, which took into account cross-sectional error correlations and heteroskedasticity and which perform particularly well in small samples.” In other words, there were doubts about whether the results would be statistically significant and valid, and the author took precautionary steps to ensure that running tests with a small sample did not affect the validity of his results.

One particular working paper (by Dreger and Reimers (2005)) showed results that claims that there are other determinants involved in health care spending. In Dreger and Reimers (2005), a study on health care expenditures resulted in discovering that along with income and GDP growth, “the other driving force is medical progress, which can be observed in the evolution of

several variables, like life expectancy, infant mortality and the share of the elderly.” This directly contradicts Huang (2004) who claims that only GDP and health expenditures affect spending.

Interestingly, in a study on health care determinants in Portugal, Salvado (2007) claims that there are not only many determinants that affect spending and health care quality, but also that public health care combined with private care can be both beneficial and harmful. “Both private insurance and subsystems ensure additional cover and are widely used by approximately 25% of the Portuguese population. They may constitute an object of study about excess of consumption associated with moral hazard problems.” This is an interesting topic that is discussed further in this working paper by Salvado (2007), and a claim is made that even though it is possible that having both public and private care can be harmful and may cause problems, it can also be beneficial because sometimes, public care is not enough to handle the high demand for medical attention.

In a study performed by Or (2000), one of the limitations of his study on health care determinants of OECD countries included analyzing differences between males and females and isolating their effects on health care expenditures. Because this was seen as a limitation on a previous study and these factors are believed to have significant effects on health care spending, these variables were included in this study and their effects on health care will be discussed later on in this paper.

## **4.0 Data and Empirical Methodology**

### **4.1 Definition of Variables**

$$HE = \beta_0 + \beta_1 AD + \beta_2 POP + \beta_3 LEF + \beta_4 LEM + \beta_5 HEP + \beta_6 BED + \beta_7 GDP + \epsilon$$

This model is different from regression models and studies that have been run in the past. While other regression models have focused on only two or three independent variables that are thought to affect health care spending, this model that will be studied and analyzed in this paper takes into account different variables that were used in a variety of papers. Of course, in the real world there are many factors and variables that affect the health care costs in different countries. By analyzing all of these variables in one model, the results will capture the effects of each independent variable on health care costs, taking into account other variables.

The regression model will include the dependent variable, which is public health expenditures, and the following independent variables, including age-dependency ratio, population of males and females over the age of 65, percentage of a country's GDP that is spent on private health expenditures, life expectancies of males and females, the number of hospital beds per 1000 people, and a country's individual GDP. The basis of these independent variables lies on some preliminary research that has been previously conducted by examining other working papers of similar topics. By indicating that the dependent variable is the total health expenditure of a country allows for an investigation of any relationships between the dependent variable and the independent variables. The dependent variable, which is total health care expenditure (HE) for a country, was given as a total percentage of an individual country's GDP for a given year.

The first independent variable, which is the age-dependency ratio, AD, allows for an investigation of any relationship between the ratio of dependents to the working-age population. In other words, using this variable aims to examine a possible relationship between every worker in the labor force and the number of dependents that they have claimed and whether this affects health care costs. By examining the population of citizens who are 65 and above, POP, which is the second independent variable, the researcher is able to determine if health care costs rise in various countries as citizens' age and as the average population age increases.

The third and fourth independent variables, which are life expectancy for males, LEM, and females, LEF, allow the regression to capture any relationship between gender and the health care costs. Life expectancy provides a general idea of how long males and females are expected to live. This number does range from country to country and may be an indicator of the level of quality of health care in a given country. One would expect that better health care would yield a longer life expectancy, which would in turn result in higher health care costs for a given country.

The fifth independent variable, which is private health expenditures, HEP, investigates any relationship between a country's total health expenditures and a country's spending on private expenditures. This variable is a percentage of a country's total GDP. The sixth variable, which is the number of hospital beds available, BED, investigates the relationship between health care expenditures and the quality of health care provided in a given country. This variable is investigated in terms of the number of beds available per one-thousand people in the country's population.

The seventh and final independent variable is each country's current GDP, GDP, which is a country's gross domestic product for a given year. This is the total market value of all final goods and services produced within a given country in a given period of time (usually a calendar year)

## **4.2 Data**

The study uses annual data from 2000 to 2005. Data were obtained from the World Development Indicators (WDI) website. By conducting a cross-sectional analysis, data was collected for the six year time period from 2000-2005 for thirty countries. One of the advantages to running a cross-sectional analysis is that for the few circumstances in which data was unavailable for a particular independent variable within a certain year, an average of the

following year's figure and the previous year's figure calculated a figure for the missing data.

Summary statistics for this data can be found in Table 1 below.

**Table 1: Summary Statistics**

<b>Variable</b>	<b>Obs.</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>
HE	30	6.701600	1.942326	2.260000	9.880000
AD	30	0.563080	0.114766	0.423000	0.919000
POP	30	9.347760	5.246896	3.613000	19.12800
LEF	30	76.38444	5.374724	64.02700	85.20800
LEM	30	70.45656	5.379637	58.79200	78.26900
HEP	30	2.709000	1.050476	1.333000	5.222000
BED	30	3.744960	3.467822	0.500000	14.500000
GDP	30	4.81E+11	9.06E+11	6.21E+9	4.33E+12

### **4.3 Research Methodology**

In a cross-section analysis, a comparison of many countries is performed over a specified time period while a time-series or longitudinal analysis is performed for one specified country over a length of time. For the intent and purpose of this paper, a cross-sectional regression analysis will be used because of the fact that more data was available for a specified time period of 2000-2005 for about 30 countries than was data for one specific country for a time period of about 30 years.

A multivariate regression will be run, where the multivariate regression coefficient indicates the change in the dependent variable associated with a one-unit increase in the independent variable in question, holding constant the other independent variables in the equation. The primary goal of running an Ordinary Least Squares is to choose the Beta-hat as to

minimize the summed square residuals. Ordinary Least Squares is a very easy regression model to use and is effective. Many times, there is a tendency among economists to accept regression estimates as they come directly from a computer, or as they are published in an article, without thinking about the meaning or validity of those estimates.

## 5.0 Empirical Results

The primary purpose of this study was to determine whether specific variables had a significant effect on health care expenditures consistently over a variety of different countries. In order to accurately regress the determinants of health care expenditures for thirty countries from 2000-2005, four separate regressions were run, one that captured the results of female life expectancy on health care expenditures, a second that captured the results of male life expectancy on health care expenditures, a third that captured the results of the age-dependency ratio on health care expenditures, and a fourth and final regression that identifies the effects of the aging population about 65 years old on health care expenditures. These four separate regressions were performed in order to prevent any multi co-linearity between the variables of life expectancy of males and females and the age-dependency ratio and the population over the age of 65. Because the these variables are not only related, but similar and also interchangeable, regressions were run, one with each variable, to avoid any possible bias or skewed results and to avoid any multi co-linearity that might have altered the regression results and to try and accurately capture the effects of each variable. The results of these regressions are displayed in Table 2 below.

**Table 2: Regression Results for Factors Influencing Health Care Expenditures**

	<b>HEALTH CARE EXPENDITURES</b>			
	<b>I</b>	<b>II</b>	<b>III</b>	<b>IV</b>
<b>CONSTANT</b>	-14.21789 ** (5.919648)	-11.19949 * (6.544245)	-18.44117 *** (6.295904)	-12.58643 *** (4.832347)

<b>AD</b>	1.223227 (3.109296)	1.545232 (3.491426)	-0.179873 (3.579780)	
<b>POP</b>	0.190826 * (0.095646)	0.217555 ** (0.104658)		0.198679 ** (0.094257)
<b>LEF</b>	0.218544*** (0.069054)		0.412708 ** (0.184818)	0.345056 ** (0.165109)
<b>LEM</b>		0.181254 ** (0.076791)	-0.122131 (0.189279)	-0.144068 (0.163514)
<b>HEP</b>	0.768801 *** (0.257296)	0.792305 *** (0.283483)	0.827267 *** (0.275075)	0.731420 *** (0.257415)
<b>BED</b>	-0.076231 (0.154406)	0.073382 (0.206813)	-0.004662 (0.237084)	-0.236961 (0.210539)
<b>GDP</b>	-9.07E-14 (4.37E-13)	-4.04E-13 (5.53E-13)	9.15E-14 (6.54E-13)	2.71E-13 (5.24E-13)
<b>R<sup>2</sup></b>	0.699641	0.643001	0.673014	0.709583
<b>F-statistics</b>	6.988044	5.403377	6.517747	7.329985
<b>Number of obs.</b>	30	30	30	30

Note: \*\*\*, \*\*, and \* denotes significance at the 1%, 5%, and 10% respectively. Standard errors in parentheses.

The results of these regressions do in fact show that out of seven variables and a constant, that only four variables were statistically significant throughout all four regressions. These significant variables include the constant, the population over the age of 65, the life expectancy of females, and the health expenditures on private health sectors.

The variable for the population of age 65 and above was not only statistically significant, but had an expected positive sign that corresponded to the results of the study. This indicates that whether all of the other variables and factors are held constant or not, population will have an effect on health care expenditures across all countries. This corresponds with many studies and information provided that claims that as the population of citizens age 65 and above increases, as will the health care expenditures for all countries. This can be explained simply by taking a look at a simple fact. As people age, they become more likely to encounter health problems and will likely require more medication, treatment, and health care in general. As the population continues to age, health care spending can be expected to rise in order to meet the demand of these people.

The second variable that was statistically significant was that of private health care spending. The expected sign for this variable was positive and the results indicate that a country spending on private health care will also positively affect the spending on health care as a whole. This was not surprising, as one would expect overall health care spending to increase as one spends more on private health care. However, thinking about the current trends of increasing quality of health care and spending, it cannot be determined from this study that there is any relationship that proves that private health care spending affects the quality of health care received or not. A sound conclusion cannot be drawn from this information because there is no correlation.

The third statistically significant variable is the life expectancy of females. Consistent with the study's results, it was predicted that this variable would have a positive expected sign, which indicates that as the life expectancy of females increases over time, so will the overall spending on health care. This can be explained by the fact that women have a longer life expectancy than males, therefore resulting in more time for health problems to arise, and consequently, more demand for health care. This regression was run independent of the male life expectancy, again to prevent the possibility of multi co-linearity and to capture the full effect of women's life spans on health care spending. It is interesting to see that when these two variables are run separately, the life expectancy of males is only significant when it is run separately while the life expectancy of females is consistently significant. This could indicate that the life expectancy of males may not affect health care expenditures for several reasons. First, even though current trends indicate that the male life expectancy is rising more rapidly than female life expectancy ages, females have an overall higher life span than males.

It is interesting to note that out of all of the variables that were studied and tested, that only three variables and the constant were significant. Therefore, conclusions can only be drawn

on these significant conclusions. The results of this study could be skewed due to some limitations on data. Several studies have been performed in the past that analyze a variety of factors that influence health care expenditures. However, valid and reliable data was not available for all of these variables for the countries analyzed, which resulted in studying the above variables. This may or may not affect the significance of these variables.

## **6.0 Conclusion**

With an increasingly aging population and an increase in health care spending across many countries, there is a need to determine what is affecting this increase and whether this trend can be expected to continue into the future. The primary purpose of this study was to identify specific factors that contribute to this rapidly increasing spending on health care expenditures among both developing nations and developed nations alike.

The results of this study indicate that there are several factors that will consistently affect the spending on health care in all countries, independent of other variables. As expected, as the population of people over the age of 65 continues to increase, spending on health care will also increase. The second variable that affects health care expenditures is the life expectancy of females, which indicates that because females have a higher life expectancy in general than males, that spending will continue to increase as long as this trend prevails. The third factor that affects health care spending is spending on private health care sectors. Naturally, as private spending will increase, overall spending on health care for nations will increase as well.

This study indicates that there is a direct correlation between all three variables and health care expenditures, indicating that these three factors may be constant variables across all countries, which contradicts Huang's (2004) claim in his analysis of Singapore's factors affecting health expenditures. Of course, there may be other factors that were not analyzed in this

study that could affect a country's spending on health care. However, from the results of this study, there is no solid evidence to support such a claim.

### **Appendix A: Variable Description and Data Source**

<b>Acronym</b>	<b>Description</b>	<b>Data source</b>
<b>HE</b>	Total Health Care Expenditure for a given country, taken in terms of a percentage (%) of country's GDP	World Development Indicators Online
<b>AD</b>	Age-Dependency Ratio, ratio of dependents to the working-age population per country.	World Development Indicators Online
<b>POP</b>	Country's population over the age of 65, taken as a percentage (%) of the total population	World Development Indicators Online
<b>LEF</b>	Life Expectancy of Females, average life expectancy of all females for a given country, in years	World Development Indicators Online
<b>LEM</b>	Life Expectancy of Males, average life expectancy of all males for a given country, in years	World Development Indicators Online
<b>HEP</b>	Private Health Expenditures, government spending on private health care costs, in terms of percentage (%) of country's total GDP)	World Development Indicators Online
<b>BED</b>	Number of Hospital Beds available per 1,000 people	World Development Indicators Online

<b>GDP</b>	Gross Domestic Product (GDP) per country, in current US dollars (\$)	World Development Indicators Online
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### Appendix B: Variables and Expected Signs

<b>Acronym</b>	<b>Variable Description</b>	<b>What it Captures</b>	<b>Expected Sign</b>
<b>AD</b>	Age-Dependency Ratio	How many dependents are claimed for each person in the labor force	+
<b>POP</b>	Population over the age of 65	Percentage of population that is over the age of 65	+
<b>LEF</b>	Life Expectancy of Females	Average life span for females	+
<b>LEM</b>	Life Expectancy of Males	Average life span for males	+
<b>HEP</b>	Private Health Expenditures	How much is spent on private health care in terms of the country's GDP	+
<b>BED</b>	Hospital Beds	Quality of health care, number of beds available	+
<b>GDP</b>	Gross Domestic Product	The total market value of all goods and services produced in given country	-

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