

The United States Government Provided Insurance, a Time-Series Analysis

by

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Abstract

This thesis analyses the United States' health care market, with particular attention given to the effect of the introduction of Medicare and Medicaid on U.S health care expenditure. Econometric analysis was conducted for the years 1948-2007 of numerous models which include variables obtained from various publications and institutions. A series of statistical models were used to investigate the extent to which Medicare and Medicaid influenced United States health care market. In addition, a Chow test was conducted in order to examine if there indeed was a structural break in the fundamental determinants of health care expenditure after the introduction of Government sponsored insurance policies.

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CHAPTER 1

INTRODUCTION

The United States Health care system has been the subject of intense debates and controversies for over 50 years. According to the Health Affairs journal, growth in health expenditure appears to have accelerated in recent years. In fact, following World War II, inflation adjusted health care cost grew at a much faster rate than did the GDP. On average, between 1945 and 1998, the real per capita health care expenditure grew at a rate of 4.1 percent, comparing to a 1.5 percent increase in GDP. Without any doubt, the United States has the most expensive health care system in the world with health care spending accounting for one seventh of the nations' overall GDP. Despite the high level of spending, the Americans are hardly the healthiest people in the world. In fact, the contrary is true - the United States is generally ranked in the bottom half of the industrialized countries with regard to infant mortality and life expectancy. Rising health care costs result in higher insurance premiums for employers, and it subsequently forces them to place a greater part of the burden on their employees. This results in an increase in out-of-pocket costs in form of copayments and deductibles, as well as a decline in employers' willingness to provide health insurance or increase wages.

According to the Partnership for Solutions (2004), along with aging of the population, there has been a substantial increase in the number of Americans living with one or more chronic conditions. In 2004, almost half of all Americans had some kind of chronic condition. The technological improvements in the medical field are the main reason why even the most

threatening diseases and illnesses became treatable. This in turn led a greater number of Americans to encounter problems associated with chronic conditions. In the early 20th century the main objective for medical innovation was to fight infectious diseases such as tuberculosis, pneumonia, and influenza which were the leading causes of death at that time. By the 1950s, Americans were able to fight infectious diseases by countering the problems of overcrowded cities, dangerous working conditions, poor sanitation, inadequate nutrition and insufficient medical care. Since then, the objective shifted towards fighting acute, non-infectious illnesses like strokes and heart attacks. Over the next 50 years, by investing vast amounts of resources into financing, education, and delivery systems, the United States was able to treat many lethal conditions and make them survivable for the patients. As a result, the diseases that used to cause acute illnesses later became long-term chronic conditions that required ongoing medical supervision. Unfortunately, in its recent history, the United States' health care system appeared unprepared to face this new dynamic.

Unlike in other developed nations, the United States health care system is heavily privatized and employer-based. According to Lisa M. Riedel (2009), the United States is among the few developed nations that does not guarantee health care to its citizens. This trend originated in the 1900s when businesses and unions provided sickness funds. President Theodore Roosevelt was one of the pioneers stressing that America is in need of universal health care coverage that would protect U.S citizens from hazardous sicknesses, irregular employment, and old age. Although, there were numerous attempts to provide universal health care coverage, those attempts never really transpired into a meaningful health care system. One of the main arguments by the opposition was that a federal health care system would undermine the values unique to America, such as individualism. A federally mandated health care system which forces workers

to insure would significantly oppose those values. In the 1930s, the United States experienced a large increase in the number of privately owned insurance companies. These newly founded companies were able to become profitable in a short period of time. By using scientific data they were able to convince the insurees that pooling the risk of an accident in a group, as opposed to facing risks individually, will provide more benefits as well as a greater amount of certainty for the insurees. Soon after, government became supportive of this new growing industry, and began lobbying laws that provided a stimulus for health insurance as a form of employee compensation. The 1954 Internal Revenue Code exemption was one of the most influential government policies that supported employer-based health insurance. The main feature of this newly introduced code was the fact that payments for employer provided health insurance were made tax deductible for both the employers as well as the employees.

According to David U. Himmelstein, Deborah Thorne, Elizabeth Warred, and Steffie Woolhandler (2009), nowadays nearly two-thirds of all bankruptcy filings are related to illnesses and medical bills. Surprisingly, the majority of people that are filing for bankruptcy are middle class citizens who have health insurance. Moreover, between 2001 and 2007, the proportion of all bankruptcies related to medical problems rose by 49.6 percent. The authors state that in many cases, as illnesses progress, people are forced to quit their jobs and therefore lose their employer based health insurance. It comes as no surprise that hospital bills accounted for about half of all bankruptcies that were filed. However, there have been some concerns about the number of people filing for bankruptcy under Chapter 7, since it generally results in a discharge of the debt with no repayment to creditors. In contrast, a relatively small portion of people filed for bankruptcy under Chapter 13, which generally requires at least some kind of repayment. In 2005, these concerns forced the Congress to enact the Bankruptcy Abuse Prevention and Consumer

Protection Act (BAPCPA), which makes it more difficult for people to file for bankruptcy under Chapter 7. Another goal of the BAPCPA is to reduce losses to creditors by forcing some of the insolvent people to file for bankruptcy under Chapter 13, instead of Chapter 7. Despite an immediate decrease in the number of bankruptcy filings, as the economy went into recession in recent years, the number of bankruptcy filings increased to its pre-recession level-approximately 1.5 million annually. Dr. David Himmelstein, one of the main authors of the study, when addressing this issue stated: “Our findings are frightening. Unless you’re Warren Buffet, your family is just one serious illness away from bankruptcy. For middle-class Americans, health insurance offers little protection. Most of us have policies with so many loopholes, copayments and deductibles that illness can put you in the poorhouse. And even the best job-based health insurance often vanishes when prolonged illness causes job loss- precisely when families need it most. Private health insurance is a defective product, akin to an umbrella that melts in the rain.”

The World Health Organization ranked the United States’ health care system 37th among all countries and last among all industrialized countries. This should be an alarming fact to all Americans, indicating that their system is in need of major adjustments. Taking into account the recent economic downturn, the question is whether the American health care system can be financially sustainable and overcome the upcoming challenges.

President Obama’s healthcare reform is the most recent attempt to improve the American health care system. Despite the large amounts of money that healthcare firms and their lobbyist have spent to vote against it, the so called Patient Protection and Affordable Care Act was passed on March 23, 2010. Under this act, starting in 2014, Americans will be able to enroll in the so called American Health Benefit Exchange (AHBE). Each state will be required to create its own AHBE system. The primary goal of this system is to help people get quality health insurance

plans, and to ensure that small scale employers are able to provide health insurance for their employees. The AHBE systems are based on the concept of shared risk. By purchasing group insurance, more people would be able to deal with high insurance costs, since the costs are being shared between all people in the group. Also, under the Patient Protection and Affordable Care Act, mental health conditions will be treated equal to physical illnesses. Starting in 2014, all American citizens will be required to purchase health insurance. While there are not regulations about which plan to purchase from what company, people who fail to purchase health insurance will be fined. In addition, insurers will no longer be able to discriminate against anyone who has some kind of preexisting condition. There is no doubt that the Patient Protection and Affordable Care Act will dramatically change the current American health care system, particularly the private health insurance industry. Nevertheless, the outcome of this reform is yet to be seen. This study will partially review the new law while examining its economic consequences.

This thesis will examine the effect of government sponsored health insurance on overall healthcare expenditure, as well as analyze the existence of any premises for universal health care coverage. The purpose of this study is to inspect which factors contribute to an overall increase in health care expenditure. The empirical part of this study will model the magnitude of each of the explanatory variables on healthcare expenditure before and after the introduction of government sponsored insurance, particularly Medicare and Medicaid.

The remaining part of this paper is organized as follows: Background and Literature Review, which will take a closer look at each of the factors causing an increase in healthcare expenditure. Data and Methodology, which will provide a theoretical model based on analysis of previous works, as well as a complete description of the explanatory variables and their expected behavior. Estimation and Results, which includes estimations of the model using the Chow Test,

while also providing an analysis of the results based on the predicted signs and the statistical significance of each variable. Lastly, the Conclusion chapter will summarize the findings and will suggest ideas for future reference.

CHAPTER 2

LITERATURE REVIEW

In this chapter we will take a closer look at the underlying factors that significantly contribute to an increase in health care expenditure. Previous works by various economists and health care advocates will be examined. A review of the historical background will illustrate the reasons why the American health care system is so heavily privatized, while also providing an explanation for the rapid increase in demand for health insurance in the United States.

Even though first efforts to develop a government sponsored insurance system in the United States date back to the early 20th century, it took until 1965 before a solid concept was accepted as feasible. Before 1965, the only contribution of government to the healthcare system were the limited provisions in the social security act that supported state efforts for health care services to mothers and children in the 1930s. During that time there was a substantial increase in the number of people looking for some form of health insurance in order to protect themselves from unpredictable and potentially disastrous medical costs. The question whether health insurance should be provided by the government or by privately owned companies became vital. Ultimately, private health insurance companies gained the majority of public support, primarily because of the group insurance financed through employer-based health insurance. During World War II, private health insurance companies continued to expand, in great part because of

government restrictions on direct wage raises. As a solution for avoiding wartime cost controls, the government allowed employers to provide free health care to their employees as an additional benefit which was not taxed as employee income and was treated as tax-deductible to the employers. The private health insurance companies continued to strengthen in the years following the war, ultimately resulting in the system of employer-financed health care. However this system left a great portion of the poor, the unemployed, and the elderly without health insurance.

In 1950, congress allowed federal participation in the financing of State payments made directly to the providers of medical care for costs incurred by public assistance recipients, in order to provide medical care for people in need. Subsequently, congress was working on improving access to medical care for elderly people. In 1960, these efforts resulted in limited legislation titled “Medical Assistance to the Aged,” which provided medical assistance to the aged population who were not living in poverty, but still needed assistance with medical expenses.

Despite the many different views and lengthy debates in the early 1960s, Congress passed legislation in 1965, establishing the first government provided health insurance under title XVII and XIX of the Social Security Act, simply known as Medicare and Medicaid, respectively. Medicare is a program that was created in order to meet the specific needs of the elderly and disabled population. Medicaid on the other hand was formed in order to provide medical assistance to individuals and families with low incomes and was established in response to wide range of insufficiency of welfare medical care under previous public assistance. Many health care advocates saw the enactment of government financed insurance as the first step toward universal health care coverage. However, the enormous costs that exceeded any early projections

decreased the government's eagerness in its health care efforts. The sustaining of rising health care costs, not universal coverage, became the primary goal of the government's efforts. Nevertheless, ever since these programs were established, they have been subject to many legislative and administrative changes, which have been mostly undertaken in order to improve the provision of health care services for the poor and elderly. As a result, the number of people enrolled in these programs increased rapidly. Precisely speaking, since the enactment of Medicare, the number of people enrolled into this program has increased from 19 million in 1966, to 44 million in 2007. In 2005, Medicare and Medicaid services accounted for approximately one-third of the United States' health care expenditures and for about three-fourths of all publicly financed health care. Even though Medicare and Medicaid are two separate programs, in some instances individuals can be enrolled in both of them, therefore it is important to understand the way they are being managed and implemented. The next chapter of this study will talk in greater detail about the specifics of each program.

The study conducted by Ateev Mehrotra, R. Adams Dudley and Harold S. Luft (2003) takes a close look at some factors that contribute to the overall increase in health care costs. The objective of the study was not to provide definitive reasons why United States spend enormous amount of resources to finance its health care sector, but rather to examine what combination of factors influences the rising health care expenditures. According to the authors, one seventh of the U.S gross domestic product is devoted to the health care sector, making the U.S health care system the most expensive health care system in the world. As stated by the authors, it is logical that health care expenditure rises along with the increase in per capita income. However, comparing the United States to other OECD countries shows that per capita spending on health care is much higher in the U.S than in any other OECD country.

According to the authors of the study, in the near future the United States' health care system will be greatly affected by the aging of the baby-boom generation. The number of people over 65 is projected to increase from 34.8 million in 2000 to 70.3 million in 2030. It is easy to see why this could be a major disturbance for federal and state budgets, considering that people over the age of 65 spend on average three times more on health care than those aged from 19 to 65. Even more concerning should be the fact that life expectancy in the United States has increased from 62.9 years in 1940 to 77.9 years in 2007. This means that nowadays, as a result of this increase, people are expected to consume more health care over their lifetime. Evidence from past studies indicate that the aging population, in combination with the population growth accounted for approximately 20 percent of the rise in acute care costs and 35 percent in long-term care, in the short period between 1987 and 1990.

Considering these facts, it is obvious that federal and state budgets will have to undergo some major adjustments since the projected difference of the percent increase in the number of elderly people and the percentage of workers paying payroll taxes is quite substantial. Therefore, as stated by Mehrotra *et al.* (2003), Medicare and nursing home care costs for people over 65 will increase by 280 percent between 2000 and 2040. The baby-boom generation will be responsible for a 74.3 percent increase in Medicare costs, while increasing longevity will be responsible for only a 3.2 percent increase.

In addition, the authors also state that one of the key elements for the examination of health care sector, which often is neglected, is the role of administrative costs and its persistent increase in the United States. The economic study by Steffie Woolhandler, Terry Campbell, and David U. Himmelstein (2003) considers this important factor in detail. The objective of the study was to investigate how prevalence in computerization, managed care programs, and development

of business-like approaches have influenced health care administrative costs. In order to do so, the authors compared the health care systems in the United States and Canada, specifically focusing on the difference in administrative overhead between the two nations.

For their study, the authors obtained data through different sources, such as Centers of Medicare and Medicaid Services and the Canadian Institute for Health Information, which keeps the estimates for insurance overhead, employers' costs to manage benefits, and the administration of government programs. The authors used gross domestic product purchasing power parities in order to express Canadian dollars in U.S. dollars. In order to provide a more accurate estimate of the amount of administrative costs incurred in each country, the authors took a closer look at the major health care services provided in each country in 1999, such as health insurers, employers' health benefits programs, hospitals, practitioners' offices, nursing homes, and home care agencies. Some of the major findings obtained from this study are summarized in the Table below.

Table one: Costs of Health Care Administration in the United States and Canada, 1999.

Cost Category	Spending per Capita (U.S. \$)	
	United States	Canada
Insurance overhead	259	47
Employers' costs to manage health benefits	57	8
Hospital administration	315	103
Nursing home administration	62	29
Administrative costs of practitioners	324	107
Home care administration	42	13
Total	1,059	307

Source: The New England Journal of Medicine (2003).

According to Woolhandler et al. (2003) health care administration costs in the United States amounted to \$294.3 billion, capturing 31 percent of all health care expenditures in 1991. In contrast to that, health care administration costs in Canada were \$9.4 billion, seizing 16.7 percent of overall health care expenditure. Certainly, due to the difference in size and the population between the two countries, it is more valuable to look at these estimates in per capita terms. Per capita health care administrative costs amounted to \$1,059 in the United States, and \$307 in Canada, indicating an increase in the gap of health care spending between U.S and Canada between 1991 and 1999.

According to the authors there are two factors that are forcing the United States' administrative costs to increase at a higher rate than those in Canada. First of all, private insurers play a much larger role in the United States' health care system, while Canada's system is primarily single-payer based. Such procedures as underwriting, marketing, multiple duplicative claims-processing, and smaller insuree groups have the potential to dramatically increase overhead costs. Secondly, the expansion of managed care and market-based competition, which requires the implementation of complicated accounting and auditing practices, is another factor stimulating this growth.

For many years, one of the major concerns of the United States health care system was to restrain the increase of health care inflation rate. Evidence suggests that the growth in health care costs has very much outpaced the overall U.S inflation rate. A study by Usha Nair Reichert and Richard J. Cebula (1999) examines many of the demand-side and supply-side factors that have been widely referred to as the main contributors to rising health care costs.

The study was one of the first in its field by providing empirical analysis in support of the authors' opinions. They claim that a market based structure of the U.S. health care system does

not produce the expected results in terms of reducing medical costs. The authors conclude “While the lack of competitiveness may potentially explain part of the high level of health care costs, it does not explain the rise in health care costs, unless there has been a corresponding decline in the industry’s competitiveness over time.” As opposed to other developed nations, the United States allow a relatively high level of competition in its health care market, which, as suggested by many health care advocates, should stimulate a decline in medical care costs. In reality, however, as the authors claim, in the past five decades health care costs per capita have been increasing at an average rate of 4 percent per year, the period between 1960 and 1970 notwithstanding, when it averaged 6.5 percent. The growth rate of real GDP for the same period was rising at a slower rate, at about 3.1 percent between 1950 and 1960 to about 1.7 percent between 1980 and 1990. The authors list the expansion of health insurance coverage, which might have led to a so called moral hazard problem, as one of many reasons which induces rising trends in medical costs. In other words, the expansion of health insurance coverage leads risk-averse people to be less cautious with regard to their health, which ultimately led to increased health care expenditures and raised insurance premiums. On the other hand, increases in medical insurance coverage have instigated a faster rate of technological change, and therefore an increase in medical costs. In addition, a limited number of admissions to medical schools and licensing requirements for practicing medicine weaken the competitiveness of the U.S. health care system.

Thus, by examining literature and past studies, the authors constructed a model that, in their opinion, could provide an explanation for the increasing costs in the health care sector. The health care inflation rate was selected as the dependent variable. While the six independent variables entered into this model are as follows: overall inflation rate, number of physicians per

100,000 population, percentage of the population over 65, real average malpractice insurance, percentage of the population covered by Medicare, and the dummy variable to account for an introduction of Magnetic Resonance Imaging (MRI). The data used in this analysis covered the years from 1960 through 1994. The main objective of the study was to provide empirical evidence to show which factors influence the health care inflation rate.

The results obtained in this study showed that all of the selected explanatory variables appeared to be statistically significant at the 5 percent confidence level or beyond (see Table 2). The study revealed that, among other demand-side factors, the percentage of the population over 65 has exerted substantial degree of pressure on the medical costs. The analysis also showed that, unlike the theories described in the literature, the number of physicians per 100,000 population has a negative and highly significant effect on the medical care inflation rate. According to the authors, this may suggest that an increase in the number of physicians provides more competition in the health care market. In addition, the authors also suggested that the acquired results can be used in further debates on how to contain the rising medical costs.

Table Two: Statistical Results on Health Care Inflation Rate.

Variable	Constant	Physicians per 100,000	Population over 65 years	Inflation rate	Real average malpractice medical insurance	Percentage of population covered by Medicare	Magnetic Resonance Imaging
Coefficient	32.1	-3.02	8.24	0.53	0.01	0.11	1.7
t-statistic		-3.16	2.75	6.35	3.49	4.20	2.41
R2=0.82							

Source: Journal of Economics and Finance (1999).

The rising health care costs significantly contribute to the overall health care expenditures due to the inelastic demand of health care commodities. In the study coauthored by Jeanne S. Ringel, Susan D. Hosek, Ben A. Vollaard, and Sergej Mahnovski (2000), the authors examined earlier studies regarding price elasticity of health care goods and services.

The extensive research conducted by the authors has shown that the estimates of the demand for health care are consistently found to be price inelastic. Price elasticity estimates average at about -0.17, meaning that a 10 percent increase in the price of health care will lead to 1.7 percent decrease in the quantity of health care demanded. The authors also state that the actual price the consumer pays depends on various factors such as premiums, coinsurance, deductibles, upper limits on out-of-pocket expenditures, and the price of the good or service provided. However, historically the lower levels of cost-sharing, namely deductibles, coinsurance, and co-pay, were associated with lower levels of demand elasticity.

Depending on the coinsurance rate, the insured are required to pay specified percentage of the induced medical costs after a deductible has been paid. With regard to the hospital stays, the authors concluded that a 10 percent increase in the coinsurance rate leads to a 5 percent reduction in the mean hospital stay, exhibiting relatively inelastic demand for this specific type of health care service. In turn, the demand for physician visits has shown to be relatively insensitive to changes in the price level as well. More precisely, the authors found that the estimates of the demand elasticity with regard to physician services ranged around -0.15 and -0.20 percent.

By use of data on insurance plans in the United States, Canada, and the United Kingdom the authors found that when coinsurance rates ranged between 20 and 25 percent, the price elasticity of demand was estimated to be -0.12 percent. Consequently, when the coinsurance

rates ranged about 15 and 20 percent the price elasticity of demand decreased to -0.07 percent. Lastly, when the coinsurance rates ranged between 10 and 15 percent the price elasticity of demand decreased to -0.04 percent. These facts indicate that lower levels of cost-sharing lead to smaller fluctuations in health care demand with respect to price changes. Indeed, with lower levels of cost-sharing, the insuree is required to pay less for the medical services that he is consuming, which stimulates consumption regardless of the increase in price.

To further analyze the effect of rising medical costs on the United States' economic performance, a research article coauthored by Neeraj Sood, Arkadipta Ghosh, and Jose J. Escarce (2009) investigated the effect of rising medical care costs on different sectors of the U.S. economy.

According to the authors, the motivation behind their study was to measure the impact of rising health care costs on economic performance of the different U.S. industries. The effect of increasing health insurance premiums on working probability and conditions of employment has been a subject of many discussions, but the lack of empirical evidence limited the ability of health care advocates to provide substantial ground for their claims. Thus, in order to fill this gap, the authors estimated the impact of health care costs on the three most important indicators of the nation's economic output: employment, gross output, and value added to GDP. The authors considered data over a 19 year period from 1987 to 2005 among 38 industries across the entire nation. In order to attain accurate results the authors collected data for the following five sectors of the economy: finance and services, wholesale and retail trade, manufacturing, transportation, communication and utilities, and agriculture, mining, and construction. The main goal of the study was to investigate whether the increase in medical care costs had a larger impact on the economic performance of those industries in which a greater percentage of

employees were covered by employer-sponsored insurance (ESI) than on those industries where most employees were not covered by employer-sponsored insurance. The 38 observed industries in the study make up 61.5 percent of the total employed workforce in the U.S. while also accounting for 70.7 percent of GDP in 1987.

The data analyzed in the study showed that health care costs as a fraction of GDP grew from 10.9 percent in 1987 to 16 percent in 2005. Over the time period of the study, the annual growth in health care costs surpassed the annual increase in GDP by an average of 2.2 percentage points. By using bivariate analysis, the authors plotted the percentage change in employment, gross output, and value added to GDP over the entire study period, for each one of the 38 industries, against the industry's percentage of workers with ESI. The authors concluded that industries in which most workers were covered by ESI in 1987 exhibited worse economic performance over the observed 19-year period. More precisely, industries with a larger percentage of workers who had ESI in 1987 showed relatively lower growth with coefficients at -0.05 with respect to employment, -0.02 with respect to gross output, and -0.03 with respect to value added to GDP, on a 99 percent confidence interval. A negative coefficient in this scenario implies that industries with a larger percentage of workers who had ESI experienced a larger decline (or smaller growth) in the subject matter when the growth in health care costs outran the GDP growth.

In order to confirm the accuracy of the obtained results, the authors conducted a multivariate analysis, which accounted for labor productivity in a given industry and the level of unionization across 11 industry groups. In this model employment, gross output, and value added to GDP were established as the dependent variables. In order to measure the influence of the portion of workers with ESI in a certain industry on labor productivity and the level of

unionization, the dependent variables were regressed on the logarithm of the ratio of total health care costs to GDP, while also observing the industry's one year lagged percentage of workers with ESI. The results obtained in this model showed that a faster growth of health care costs does indeed diminish economic performance in the three aggregate performance measures of interest (employment, gross-output, value added to GDP) for industries with a larger percentage of workers with ESI (see Table 2). Among other findings, the authors discovered a positive relationship between the percentage of workers with ESI and economic performance of an industry, which can be explained by the fact that insurance coverage reduces worker turnover and absenteeism (not shown). Unionization on the other hand had a negative impact on economic performance in the observed industries. Labor productivity exhibited mixed effect on the economic performance. An increased growth in labor productivity resulted in a slower growth in employment, which according to the authors is caused by the increased adoption of technology, and as a result from it, the substitution of capital for labor. Nevertheless, increased labor productivity had a positive effect on the other two observed areas of economic performance, namely gross-output and value added to GDP.

Table Three: Multivariate Regression Results: Effects of Excess Growth in Health Care Costs on Employment, Gross Output, and Value Added to GDP.

<i>Independent Variable</i>	<i>Outcome</i>		
	<i>Logarithm of Employment</i>	<i>Logarithm of Gross Output</i>	<i>Logarithm of Value Added to GDP</i>
Lagged percentage of workers with ESI \times logarithm of ratio of health care costs to GDP	- 0.016**	- 0.016**	- 0.016**
Lagged percentage of workers with ESI	0.042**	0.044**	0.044**
Unionization	- 0.027**	- 0.026**	- 0.025**
Labor productivity	- 0.001**	0.001**	0.001**
Constant	7.557**	12.336**	11.501**
Observations	722	722	722
Number of industries	38	38	38

Table entries are regression coefficients. All models additionally control for industry-fixed effects, year-fixed effects, and sector-year interactions (see text).

** $p < .01$.

Source: Health Research and Educational Trust.

Based on their findings, the authors expanded their analysis and created a set of simulations that used earlier estimated coefficients to project economic performance in 2005 under two scenarios: a 2.2 percentage points increase in health care costs from 2004 to 2005 (i.e. the observed mean value), and a 2.42 percentage points increase in health care costs from 2004-2005 (i.e. a 10 percent increase compared to the observed mean value). The results of the simulation indicated that, as a consequence of a 10 percent increase in the growth of health care costs, from 2.2 to 2.42 percentage points, the United States would suffer losses of \$28 billion in gross output, \$14 billion in value added to the GDP, as well as a loss of 120,083 jobs in the 38 industries observed.

Moreover, according to the authors of the study, growth in health care costs has adverse effects on the economic performance of the United States, especially on industries with a high

percentage of workers with ESI. As stated by the authors, the growth in health care costs is a major disturbance to businesses, since about 60 percent of all Americans are covered under ESI. Rising health insurance premiums would increase the pressure on employers, which would in turn force them to reduce health benefits, as well as employment, and increase prices, which would then result in decreased economic performance. However, the authors do not consider the fact that economic losses, attributed to the rise in health care inflation rate, could be partially offset by the reallocation of workers from industries with high percentage of ESI-covered employees to those industries with low percentages of ESI-covered workers. This reallocation process would mostly depend on the ease with which workers can move across different industries.

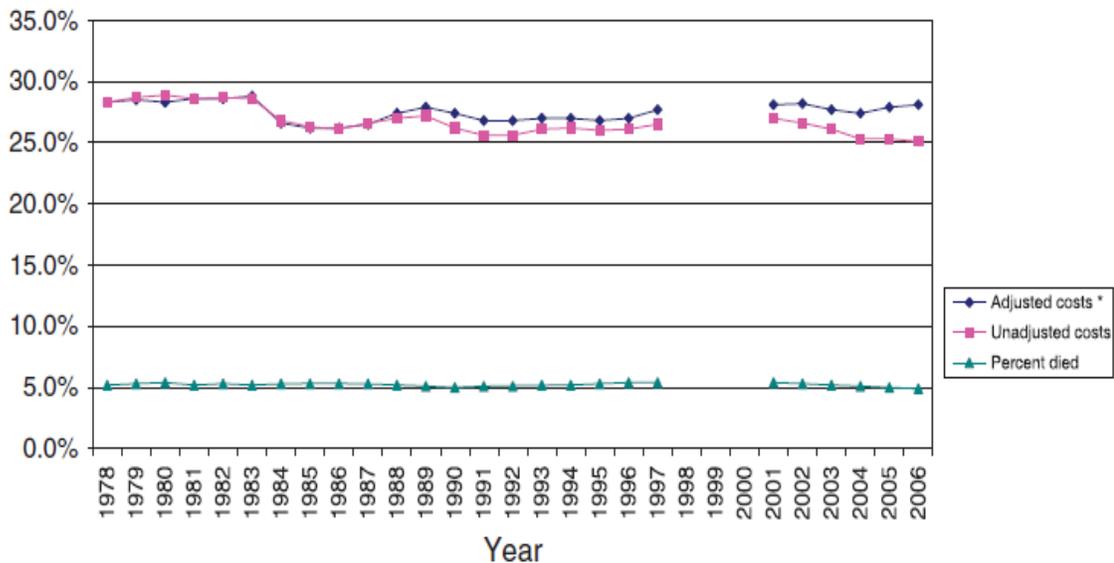
To further analyze the effects of the aging population on the health care sector as a whole, a research brief coauthored by Gerald F. Riley and James D. Lubitz (2010) examined health care expenditures among Medicare beneficiaries during their last year of life.

The study was conducted using the Continuous Medicare History Sample provided by the centers for Medicare and Medicaid services, which contains the number of enrollees and claims for random sample of 5 percent of the Medicare population. The observed time period of the study covered the years 1978 through 2007. The authors had to exclude the years 1998-2000 from the analysis due to a programming error. The authors' analysis focused on the beneficiaries over the age of 65 who were not enrolled in any type of managed care plan at any time during their last year of life. Following methodology from earlier studies, the main goal was to assign Medicare payments either to decedents (persons in their last year) or survivors (all others) for each calendar year. The percentage of payments assigned for each category in each year were adjusted for age, sex, and survival status of the 1987 sample, in order to account for changes in

the Medicare population overtime. More precisely, adjustments were made by applying average payment amounts for each cell to the age, sex, and survival distribution of the 1978 sample for a given year.

The results from the study indicate that between 1978 and 2006, the crude death rate of the Medicare beneficiaries remained stable at around 5 percent (Figure 1). The percentage of Medicare payments to individuals in their last year of life decreased from 28.3 percent in 1978 to 25.1 percent in 2006. However, the adjusted trend did not exhibit significant fluctuations and remained stable, mainly due to the rising age of the decedents from 78.7 in 1978 to 81.9 in 2006.

Figure One. Percent Dying and Percent of Medicare Payments Spent in the Last 12 Month of Life, Among Medicare Beneficiaries Aged 65 and older, 1978-2006.



Source: Medicare Continuous History Sample.

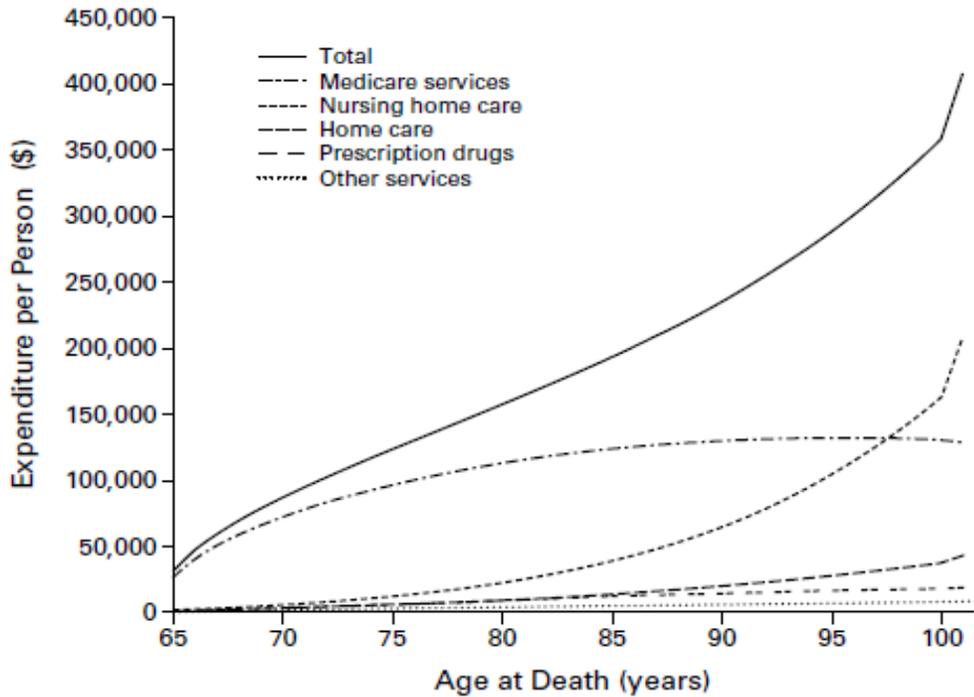
Riley and Lubitz were also able to show that Medicare expenditures in the last year of life remained stable over the observed time period, while still making up a considerable share of decedents' income. However, findings acquired in this study were subject to several limitations.

First of all, the authors did not discuss the quality or appropriateness of care. Secondly, care in the last year of life does not refer to the illness that eventually causes death. The third limitation is the fact that the analysis was focusing primarily on acute care services covered by Medicare, while prescription drugs were neglected from the analysis. Nursing home care was not considered either, since normally it is not covered by Medicare. Nonetheless, nursing home care has been considered as one of the major contributors to increased health care expenditures. Therefore, it is essential to investigate the trends in the provision of this component of the health care system.

According to the study by Brenda C. Spillman and James Lubitz (2000) increasing age leads to lower health care expenditures on acute care, whereas expenditures on long-term care rises. The main goal of the study was to estimate the impact of the aging population on health care costs. The authors estimated total expenditures for Medicare-covered services, nursing home care, and other services starting at the age of 65 until death and particularly in the last two years of life. According to the authors, the major difference between previous studies and their own is the fact that they were able to combine estimated lifetime Medicare expenses according to the age at death, the cost of nursing home care for all elderly persons, and all other services or items not covered by Medicare. Those services and items include in particular home care, prescription drugs, vision care, dental care, and durable medical equipment.

The results obtained from this study show that total expenditures rise significantly with longevity from the age of 65 until the time of death, averaging about \$31,181 for a person who dies at the age of 65, while increasing to over \$200,000 for a person who dies at the age of 90 or older. Nursing home expenditures are listed as the main reason this tendency. Figure 2 depicts the effect of longevity on total health care expenditure and different health services.

Figure Two: Cumulative Health Care Expenditures from the age of 65 years until death, According to the Type of Health Service and the Age at Death



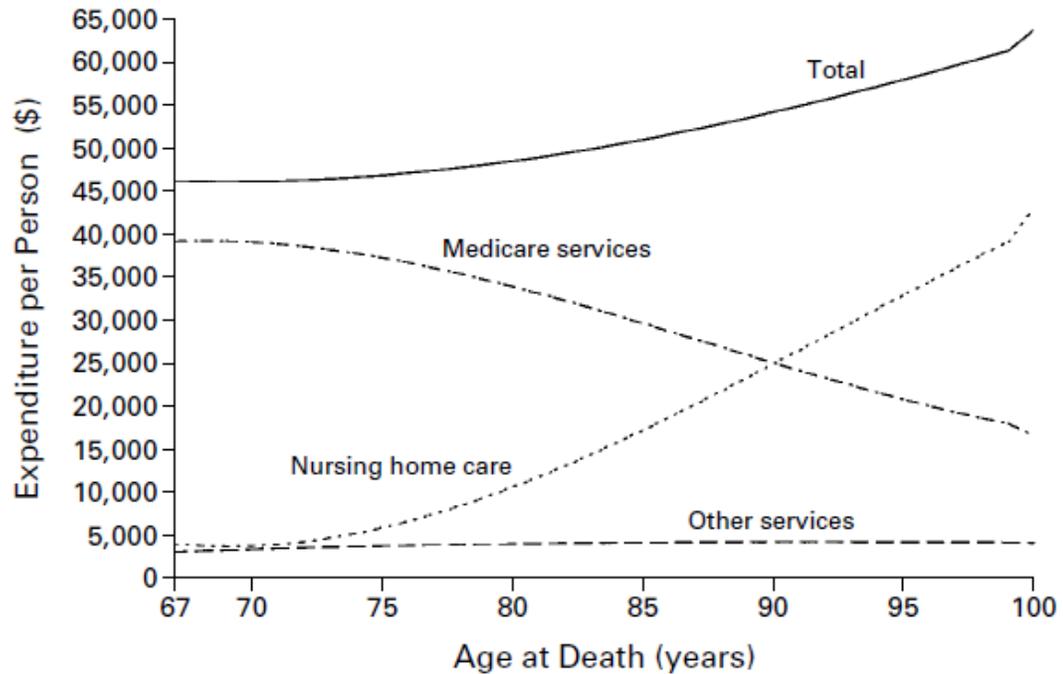
Source: The New England Journal of Medicine.

Figure 2 shows that Medicare expenditures rise along with age, however, at a lesser rate. Whenever a person reaches the age of 90, the Medicare expenditures even out and remain stable at a level of \$130,000. Nursing home care expenditures not covered by Medicare on the other hand, rise at a faster rate, increasing from about \$1,751 for a person who dies at the age of 65 to a remarkable \$64,665 for a person who dies at the age of 90.

Following a similar pattern as longevity, expenditures in the last two years of life tend to increase with age, mainly because of the increase in the use of nursing care. Medicare expenditures tend to decrease as the age increases, whereas nursing home care expenditures

follow an upward trend as the age increases. Figure 3 depicts the changes in total health care expenditures and different health services in the last two years of life.

Figure Three. Health Care Expenditures in the Last Two Years of Life, According to the Type of Health Service and the Age at Death.



Source: The New England Journal of Medicine.

Figure 3 shows that Medicare expenditures at the end of life decline from about \$37,000 for an individual who dies at the age of 75 to about \$21,000 for an individual who dies at the age of 95. In contrast to that, nursing home expenditures rise from about \$6,000 for someone who dies at the age of 75 to about \$32,000 for someone who dies at the age of 95. Expenditures associated with other services do not account for more than 8 percent of all expenditures in the last two years of life, regardless of the age at death.

The authors of the study were able to show that an increase in longevity after the age of 65 has a small impact on expenditures for acute-care, but a quite substantial impact for the long-term care. According to the study “This pattern could result in a greater financial burden for elderly persons and their families and for the Medicaid program as the population ages.” It is yet to be seen who will be dealing with the financial burden of an increasing demand for long-term care. The authors claim however, that serious changes in Medicare and Medicaid programs, as well as private insurance for long-term care, will play an important role in determining this effect. The authors also mention that their study does not account for potential medical innovation, as well as changes in utilization, disease, and disability, and subsequently how the government sponsored insurance will reflect these changes. It is very likely however, that changes in the prevalence of disease and disability will significantly alter the level and distribution of spending among insurance systems. It has been shown that Medicare costs can substantially differ, depending on the underlying cause of death. Therefore, as the authors state, Medicare costs may substantially decrease if longevity increases. This can be seen as the result of a decrease in morbidity and mortality of diseases that are expensive to treat. On the other hand, if longevity increases as the result of newly introduced medical equipment or expensive treatment, Medicare costs may rise.

Medical expenditures in the last year of life significantly exceed those prior to the last year of life, while varying across demographic groups and geographic regions. In the study by Donald R. Hoover, Stephen Crystal, and Rizie Kumar (2002), the authors found that the average annual medical expenditures for individuals over 65 were \$37,581 in their last year of life compared to \$7,365 for those that are not between 1992 and 1996. The authors also claim that more than 33 percent of national healthcare spending is attributed to the elderly population

(individuals over the age of 65). Considering Medicare in particular, the average annual Medicare expenditure for elderly individuals in their final year of life had increased from \$1,924 in 1976 to about \$23,000 in 1995. In this regard, only 5 percent of the Medicare beneficiaries died each year, but the percentage of Medicare expenditures to elderly individuals in their last year of life fluctuated between 27% and 31%. These estimates did not change over the observed 19 year period.

In the article by Aftab Hussain and Patrick A. Rivers (2009), the authors state that America is facing a big dilemma that can potentially lead to the nation's bankruptcy if government fails to deliver new solutions in financing long-term health care payments of the aging population. As projected, due to the aging of the baby boom generation, between 2000 and 2050 the elderly population will increase from 35 million to 87 million. The population group with the highest rate of disability, namely those individuals aged 85 and over, is projected to grow even faster, from 4 million in 2000 to 21 million in 2050. It is also estimated that the elderly population with some type of disability will more than double in a period between 2000 and 2040, increasing from about 10 million to 21 million, respectively. Thus, in recent years it is becoming apparent that the United States is in need of a plan to meet the rising demand of long-term health care by the aging population. The authors claim that failing to meet the upcoming challenges of this problem could lead to a loss of \$33 trillion over the next ten years from 2010 to 2019. As a result of this failure, one can expect the probability of an increase in the number of uninsured individuals to be quite high. Consequently, an expansion of Medicaid seems to be the only possible solution to this problem. It is estimated that, in order to meet these upcoming challenges, Medicaid enrollment of the nonelderly population will have to be increased from the current enrollment level of 44 million to over 50 million by 2019. This expansion however, will

place a heavier burden on federal and state budgets supporting the program. Failing to meet the needs of the elderly would subsequently lead to a rise in employer costs. This increase in costs can be explained by the fact that employers will have to place part of their insurance coverage on employees, forcing them to pay higher premiums and out-of-pocket fees. Furthermore, it is likely that taxes will have to be increased in order to sustain the projected Medicaid expansion.

Many health advocates consider education as a major factor influencing health outcomes. In a study by David P. Baker, Juan Leon, Emily G. Smith Greenway, John Collins, and Marcela Movit (2011), the authors investigate the history of the educational revolution in the U.S. and its effects on the populations' health.

The main goal of the study was to describe the worldwide educational revolution and establish its effect on an individual's health. According to the authors, between 1850 and 1920 there has been a steady growth in primary school enrollment. This growth then increased substantially from the 1940s on. As a result, enrollment in secondary schooling began to climb sharply from the 1960s on. It then consequently led to an increase in higher education enrollment in the early 1970s. The authors refer to the emergence of western-style universities in Europe and North America as the main reason for the growth in primary and secondary school enrollment.

According to the study, the time of the educational revolution is closely aligned with the decline in the crude death rate. As more people were able to acquire knowledge from basic schooling, death rates began to decline sharply. Wide access to basic schooling in the low- and middle-income countries resulted in a significant increase in the life expectancy at birth, as it grew from 40 years in the early 1950s to 65 years by 2005. This increase can be explained primarily by changes in the lifestyle of girls and women, which promoted lower fertility and

lower infant mortality. In consequence, the authors claim that “schooling more directly influences individual behavior and population change by enhancing higher order cognition.”

By use of meta-analysis, the best methodological procedures from various studies were examined and combined in order to evaluate the effect of an independent variable (i.e. education) on a dependent variable (i.e. mortality). Based on the findings from this analysis, the authors stated that less education results in higher likelihood of death. More precisely, obtained results indicate that “people with no education or lower secondary schooling have 46 percent higher probability of dying than people with high school or higher education.” Furthermore, controlling for demographic factors, women with primary education or less are 33 percent more likely to die than college educated women. In contrast to this number, men with primary education or less are 42 percent more likely to die than college educated men. Therefore, the authors have concluded that formal schooling is an important factor in developing reasoning ability, in the form of higher order cognitive skills, which are so crucial in risk assessment and decision-making concerning health.

To further analyze the effect of education on individuals’ health care spending habits, it is worth examining a study by Peter Muennig (2000). The main objective of the study was to estimate the effect of educational interventions on health care costs by presenting various case scenarios.

In the first hypothetical scenario, students received a high school diploma after the completion of 11th grade. In the second scenario, the entire cohort of 600,000 of high school drop outs by age 20 in 2004 were also hypothetically advanced to the next grade instead of being dropped out. In the third through ninth case scenario, subjects were provided with real world education interventions and the associated costs were covered. The educational interventions

examined in this study included the Tennessee STAR program's class size reductions (directed toward 5-years-olds), two pre-garden interventions (the Chicago Child-Parent Centers and Perry/High Scope), a 10 percent salary augmentation (administered toward 5-year-olds), and a multifaceted intervention provided to 14-year-olds. For each subject, benefits were discounted from the point of the intervention and assumed not to accrue until the subject turns 18 years old. The author estimated the changes in costs associated with changes in health care utilization in the intervention and non-intervention group starting at the age of 18. The main goal of the study was to estimate public insurance savings attributed to the education interventions.

By use of quality-adjusted life year (QALY), in which one QALY equals one year of life lived in the perfect health, the author was able to place a monetary value on person's life, which amounted to \$80,000 for one QALY. Furthermore, in order to calculate the per enrollee costs in the public sector, the author used National Health Accounts which were provided by the Centers for Medicare and Medicaid Services.

According to the author, high school drop outs live on average 81 percent of each year of life in perfect health (0.81 QALY's), while high school and college graduates live 0.84 percent and 0.89 percent, respectively, in perfect health each year. As stated by the author, educational attainment promotes higher health care expenditures because it increases an individual's chances of finding a high quality job, which in turn results in a higher level of income that can be spend on health care. Also, better educated people are more likely to comprehend potential threats from certain harmful activities like smoking and drinking. The author provides evidence in order to support his claims by stating that on average, adults who did not graduate from high school are more likely to die prematurely from cardiovascular disease (35% of all deaths), cancer (27% of

all deaths), infection (9% of all deaths), lung cancer (5% of all deaths), and diabetes (4% of all deaths) (Wong, Shapiro et al 2002).

Furthermore, as opposed to better educated individuals, those with less education are generally more likely to be exposed to higher levels of stress associated with little or no income, health related problems, little leisure time, a high amount of environmental noise, and problems in the family. Stress in turn, increases the risk of heart disease, cancer, infectious disease, and diabetes mellitus. When stress becomes chronic, it may lead to premature cell aging, DNA damage, blockages in arteries supplying the heart and brain, and immunosuppression.

The author claims that educational interventions significantly improve an individual's chances of enrolling in a health insurance program. In fact, in his study Muennig was able to show that educational interventions could substantially reduce expenditures incurred by government sponsored insurance programs. According to the author "Public insurance utilization is higher (17%) among those with less than 12 years of education than among high school graduates (13%) or college graduates (7%)." Moreover, discounted public insurance expenditures incurred by the high school drop outs amount to \$35,000 over a lifetime, comparing to \$27,000 among high school graduates, and \$14,000 among college graduates.

Muennig estimated that promoting students from 11th grade to high school diploma, over a lifetime, would generate public savings of \$8,000 per person. In another case, advancing all 600,000 high school drop outs of 2004 by one grade, will produce savings of \$2.3 billion for the cohort over the 52-year span until those individuals become eligible for Medicare. The government's cost of caretaking of the uninsured falls with such educational interventions, due to the fact that those individuals are being moved from public pools and are partially absorbed by the private insurance pools.

The insights acquired from the reviewed studies indicate that the medical care inflation rate, technological change, private health insurance providers, government sponsored health insurance, population over the age of 65, number of people with long term chronic conditions, income per capita, and the education level are potential determinants of health care spending in the U.S.. The next chapter presents the statistical model to be used in this study, as well as stating the anticipated relationships between the factors described in this section and the overall health care expenditure in the U.S..

CHAPTER 3

DATA AND METHODOLOGY

This chapter presents the model to be used in order to estimate the effect of government based insurance on overall health care expenditure in the United States. The most influential factors contributing to the health care expenditure, those described earlier in the literature review, will be incorporated into the model to measure the magnitude of their impact. Furthermore, based on insights from the previous studies and economic inferences, this chapter will posit behavioral hypotheses regarding the effects of the independent variables on health care expenditure, as well as providing data sources.

Supported by the earlier works, the model to be used in this thesis can be defined as:

(1) National Personal Health Care Expenditure Per Capita = f (Health Status; Age; Income Level; Insurance Coverage; Education, Medical Care Price Index ;)

The main goal of this study is to estimate the determinants of health care expenditure in the United States before and after the introduction of government based insurance, mainly Medicare and Medicaid. Therefore, it is important to understand how these two insurance programs are being implemented and financed by the government.

Medicare is a health insurance program for the elderly population that was designed as a supplement to retirement-, survivors-, and disability insurance benefits under Title II of the Social Security Act (1965). Originally Medicare consisted of two parts, but over time it

expanded into four parts. Part A, also known as hospital insurance (HI), helps people pay for inpatient hospital, home health, skilled nursing facility, and hospice care. Individuals that are eligible for Medicare are not required to pay premiums for part A coverage, although those that do not qualify, can pay a monthly premium to become eligible.

Part B, also known as Supplementary Medical Insurance (SMI), helps pay for physician, outpatient hospital, home health, and other services. Unlike part A, part B requires all individuals to pay a monthly premium. According to the Center of Medicare Medicaid services, in 2007 the monthly premium rate for part B coverage was \$93.50 per beneficiary. As evidence suggests, almost all individuals enrolled in part A coverage also choose to enroll in part B.

Part C, also known as Medicare + Choice, was established in 1993 by the Balanced Budget Act, and in 2003 was renamed and reformed by the Medicare Prescription Drug, Improvement, and Modernization Act. Part C allows individuals to acquire insurance (also known as Medicare Advantage Plan) from private insurance companies, and essentially combines part A and part B of the original Medicare plan. These private companies however, have to follow policies set by Medicare in order to be included in the list of companies that offer Medicare Advantage Plans. Coordinated care plans, such as health maintenance organizations, provider-sponsored organizations, and preferred provider organizations are the three leading Medicare Advantage Plans. Normally, Medicare Advantage Plans are offered at a lower cost than the original Medicare plans, and in many cases, provide extra coverage, such as dental, hearing, vision, and health and wellness programs. In addition to that, many companies offer Medicare prescription drug coverage, also known as part D.

Medicare prescription drug coverage (part D) was first introduced in 2004, and provided access to prescription drugs discount cards, at a price of no more than \$30 annually, on a

voluntary basis. For low-income beneficiaries, it offered transitional limited financial assistance for purchasing prescription drugs and a subsidized enrollment fee for the discount cards. In 2006, this part of Medicare was modified and ever since provided access to prescription drugs insurance coverage on a voluntary basis, upon payment of a premium, to individuals entitled to part A or enrolled in part B, with premium and cost-sharing subsidies for low-income enrollees. The primary goal was to help individuals already enrolled in Medicare with reducing their cost for prescription drugs. Similar to part C, in order to be enrolled in Medicare part D, individuals are required to purchase an insurance plan from a private insurance company approved by Medicare.

It is important to understand how Medicare is being financed and how its resources are being allocated to health care providers. There are two trust funds that are responsible for all the financial operations for Medicare. These trust funds are special accounts in the U.S Treasury that deal with all receipts and expenditure charges for benefits and administrative costs. Those assets of the funds not needed for the payment of costs are invested in special Treasury Securities. Interest earnings from these assets are then being used as income of the respective fund.

The HI (part A) trust fund is financed primarily through a mandatory payroll tax. Virtually all employers and their employees are required to pay taxes to support the cost of services provided to elderly and disabled beneficiaries, with employers paying 2.9%, and employees 1.45% of their earnings respectively. In addition, there are several other sources that provide financial assistance: 1) those beneficiaries that have to pay an insurance premium since they are not eligible otherwise; 2) interest earnings from assets invested into Treasury Securities; 3) reimbursements from the general fund of the U.S Treasury in order to provide part A coverage

for individuals that retired when part A began and where unable to work the required amount of time in order to qualify for the coverage; 4) other small income sources.

The SMI (part B and D) trust fund is financed primarily by the general fund of the U.S Treasury, and to a lesser degree by the premiums of the enrollees. It is important to know that even though both parts of the SMI trust fund are being financed from the same sources, each part has its own separate account within the SMI fund. Part B premium costs are generally set at the level that covers 25% of the average expenditures for the elderly individuals. The premiums may change, depending on the level of income and the time of enrollment. The remaining part is paid for by the general fund of the U.S Treasury. Similar to part B, part D receives most of its income from the general fund of the U.S Treasury, and about 25.5% percent is received from premiums paid by the enrollees. According to the Center of Medicare and Medicaid Services, the base beneficiary premium for part D was \$27.35 in 2007. Besides these two main sources, the SMI trust fund receives part of its income from the states and interest earnings from invested assets. Both SMI and HI trust funds are responsible for covering payments to Medicare advantage plans (part C).

There are also differences with regard to each part of Medicare, specifically, in the methods health care providers are being reimbursed for their services. Over time these methods have been either changed or adjusted, but only the most recent techniques will be discussed in this paper.

Nowadays, the prospective payment system (PPS) is used as a reimbursement mechanism for inpatient services under part A. When this system is applied for acute inpatient hospitals, each stay is categorized into a diagnosis-related group (DRG). Consequently, each DRG has a specified dollar amount associated with it, which serves as the basis for payment. Payments for

other services provided by part A, such as skilled nursing facilities, home health care, inpatient rehabilitation hospital care, long-term care hospitals, and hospice care follow similar prospective payment systems. Under such systems, hospitals cannot be sure that they will generate profits. At times, payments received by the hospital are actually less than their costs for providing particular services for the patient. Despite this fact, the same technique is being used in estimating the amount of payments for hospital outpatient services and home health care under part B. However, reimbursements for physician services follow a different approach and are defined as the lesser of 1) the submitted charges; 2) the amount determined by a fee schedule based on a relative value scale.

In regard to Medicare advantage plans (part C), a capitated system has been used as the basis for reimbursement. Under this capitation system, regardless of the cost incurred by the patients, a fixed predetermined amount per month is paid to the plan. In January 2006, the capitated system was adjusted, basing payment rates on a competitive bidding process. The competitive bidding process requires Medicare advantage organizations to submit their bids to provide medical care coverage to beneficiaries depending on their location. Medicare advantage plans, on the other hand, submit separate bids to the Center of Medicare and Medicaid Services for parts A, B, and D. Finally, these bids are compared to the predetermined county level benchmarks in order to find the appropriate payments to the plans. In case of a plan's bid exceeding the benchmark, enrollees are required to pay the difference in form of a monthly premium. Consequently, when a bid is lower than the benchmark, the Medicare program keeps 25% of the difference and the plan receives remaining 75% as a discount, which has to be returned to beneficiaries in the form of additional benefits or lower premiums.

Lastly, in part D, the reimbursement system to providers is slightly more complicated, but uses the same competitive bidding process as in part C. Medicare pays a prospective monthly amount for each enrollee of part D drug plans. Yet, before this procedure takes place, Medicare takes into account the enrollee's case mix and other subsidy factors, such as low-income status and long-term institutionalized status. Furthermore, an enrollee's premium is subtracted from the plan's bid adjusted for case mix.

Medicaid is a federal and state entitlement program that pays for medical expenses of certain individuals and families with low incomes and few resources. It was originally developed in 1965 as a medical care extension of federally financed programs providing cash income assistance for the poor part of population of America, with emphasis on dependent children and their mothers, the disabled, and the elderly. Since then, Medicaid eligibility has been significantly expanded. Through legislation in the late 1980s, Medicaid coverage became available to a greater number of recipients, including low-income pregnant women, children in need, as well as some Medicare beneficiaries that did not qualify for the cash assistance program. Furthermore, this legislation provided incentives for improvements in the quality of care, specific benefits, enhanced outreach programs, and access to the program. According to the Kaiser Family Foundation (2008), the percentage of the population enrolled in the Medicaid program increased from less than 10% in 1975 to 20% in 2005.

Medicaid is funded by both federal and state governments, and is the largest source of funding for medical assistance for the poorest individuals in America. In Medicaid, the state administration has the upper hand in establishing rules and policies on who is eligible, as well as determining the type, amount, duration, and scope of services provided to beneficiaries. A very wide range of national guidelines set by the federal government actually helps the states in

delivering these services. Consequently, eligibility standards may vary substantially even across similar sized states in geographic proximity. As a result, people that are eligible for Medicaid in one state may not qualify for it in another. Moreover, states may change rules and conditions of Medicaid eligibility, services provided, and reimbursement methods at any point in time.

Medicaid eligibility was greatly expanded by the Balance Budget Act of August 5, 1997, also known as the State Children's Health Insurance Program as part of title XXI of the social security act. As a result, states were provided with more Federal funds in order to include a greater number of low-income uninsured children who did not qualify for Medicaid based on the plan that was issued on April 15, 1997.

Nonetheless, a low income and few resources do not guarantee one's qualification for Medicaid. There are sets of standards and requirements that an individual has to meet in order to be eligible for Medicaid. Some examples of what types of groups qualify for the program include: 1) Limited-income families with children, as described in section 1931 of the social security act; 2) Children the age of 6 whose family income is at, or below, 133 percent of the federal poverty level (FPL); 3) Pregnant women whose family income is below 133 percent of the FPL; 4) Infants born to Medicaid-eligible women, for the first year of life with certain restrictions. Additionally, states have the opportunity to provide Medicaid coverage for so called "categorically related" groups that share characteristics of the mandatory groups, which would potentially allow these states to receive financial help from the Federal Matching Fund (FMF).

In order to receive additional financial help from the FMF, states have to meet certain mandatory requirements which would ensure that state's Medicaid program provides medical assistance for basic services to most categorically needy populations, such as: inpatient and outpatient hospital services, pregnancy-related services, vaccines for children, physician

services, nursing facility services for persons aged 21 or older, family planning services and supplies, rural health clinic services, etc.

In 2004, more than 55.6 million people received medical care services through the Medicaid program. The distribution of costs incurred by Medicaid enrollees varied substantially across different age groups. National data indicates that, as of 2004, Medicaid payments for 28.6 million children, who represented 52 percent of all Medicaid beneficiaries, averaged approximately to \$1,615 per child. Likewise, for 13.5 million adults, who constituted 24 percent of all Medicaid beneficiaries, payments averaged about \$2,400 per person. However, payments for the oldest age group were substantially larger and averaged about \$13,295 per person, for 4.7 million elderly individuals, who made up about 8 percent of all Medicaid beneficiaries. In addition, payments for 8.8 million disabled, who represented 16 percent of all beneficiaries, averaged \$13,310 per person. Overall, payments to health care providers in 2004 for all beneficiaries averaged about \$4,640 per person.

According to the Centers for Medicare and Medicaid Services (2007), the Medicaid program was responsible for covering over 41 percent of the total cost of care for people using home health care or nursing facility in 2004. National data indicates that Medicaid payments for nursing facility services for over 1.7 million beneficiaries totaled \$42.1 billion in the same year, indicating that on average \$24,475 were spent per beneficiary. On the other hand, Medicaid payments for home health services amounted to \$4.6 billion for 1.1 million beneficiaries, an average of \$3,975 per beneficiary.

Another important factor contributing to the expansion of Medicaid program is the increased number of managed care programs. Managed care is a system of health care that is responsible for controlling the cost of medical services, managing the use of these services, and

measuring the provider's quality of care. There are two main managed care plans, Health Maintenance Organizations (HMOs), and Preferred Provider Organizations (PPOs), with the remaining plans representing a combination of the two. Under the managed care system, these organizations agree to provide health care services to Medicaid enrollees for a predetermined periodic payment per enrollee. The goal of the managed care programs is to provide greater access to quality care in a cost-effective manner. The number of Medicaid beneficiaries choosing to enroll in some sort of managed care plan has been rapidly increasing over the past 15 years, primarily because the managed care plans are less expensive since they require less cost-sharing procedures. As a result, between 1997 and 2006, the number of Medicaid beneficiaries enrolled in managed care plans increased from 48 percent to 65 percent.

Within a broad range of national guidelines, states have the authority to choose the payment methods as well as the payment rates. The fact that there are no set up repayment procedures allows states to either pay health care providers directly on a fee-for-service basis or through different prepayment arrangements, like health maintenance organizations. However, payment rates must be sufficient to make sure that enough providers and services are available to the general population within specified geographic areas. In turn, providers that have agreed to work with Medicaid have to accept Medicaid payments as payments in full. States have the right to impose nominal deductibles, copayments, or coinsurance on certain enrollees for specific services. However, these types of cost-sharing procedures cannot apply to pregnant women, children under the age of 18, and hospital or nursing home patient who are expected to spend most of their income on institutional care. Likewise, copayments for emergency services and family planning services do not apply to Medicaid enrollees.

The federal government share for medical assistance expenditures to the states' Medicaid programs, known as Federal Medical Assistance Percentage (FMAP), is determined annually by a formula that compares a state's average income per capita with the national income average. Consequently, states with a higher income per capita level receive a smaller percentage of FMAP, and vice versa. Nevertheless, the law requires this Federal share not to be lower than 50 percent or higher than 83 percent. Therefore, the Federal Medical Assistance Percentage may vary across different states in this specified range. As of 2007, the national average FMAP was 56.8 percent. States that provide health insurance for children through SCHIP program receive a higher percentage of FMAP, averaging about 70% nationwide in 2007. The federal government is also responsible for full reimbursements to the states for the cost of services provided through the Indian Health Service, Qualifying Individuals, and 90% of the cost of family planning services. Usually, Medicaid administrative costs are being split by federal and state administrations, although some functions and activities, such as development of mechanized claims processing systems include a larger share of the federal budget.

Since Medicare and Medicaid are the largest publicly financed health programs in the United States of America their range of influence overlaps in some cases. In other words there are some individuals that might be eligible for both, Medicare and Medicaid coverage. These individuals are normally described as "dual-eligibles". Usually, these are the elderly, low-income and sick people. Beneficiaries who are eligible for full Medicaid coverage receive supplemental Medicare health care coverage through services that are offered by their state's Medicaid program, according to their eligibility category. Medicare beneficiaries may be eligible for four types of Medicaid coverage: 1) full Medicaid benefits; 2) coverage for part A premium; 3) coverage for part B premium; 4) coverage for Medicare cost sharing. In order to qualify for dual-

eligibility, individuals have to meet certain criteria in terms of the federal poverty level (FPL), the asset level of Supplemental Security Income (SSI) and the federal benefit rate, which can be described as the maximum amount paid in cash benefits to a person that receives SSI. Table 4 summarizes categories and requirements for dual-eligibility.

Table Four. Dual Eligibility Requirements

Dual Eligible Category	Eligibility Limits		Type of Medicaid Benefit(s)			
	Income Limit Resource Limit		Medicaid Coverage of Medicare Premiums and Cost-Sharing			Full Medicaid
			Part A Premium	Part B Premium	Cost-Sharing	
Medicaid Only	The resource and income limits are usually higher than those listed below		No	Yes	No	Yes
Qualified Medicare Beneficiary (QMB)	100% FPL	Twice the SSI Limit	Yes	Yes	Yes	No
Qualified Medicare Beneficiary Plus (QMB+)	100% FPL	Twice the SSI Limit	Yes	Yes	Yes	Yes
Specified Low-Income Medicare Beneficiary (SLMB)	100% - 120% FPL	Twice the SSI Limit	No	Yes	No	No
Qualifying Individual (QI)	120% - 135% FPL	Twice the SSI Limit	No	Yes	No	No
Qualified Disabled and Working Individual (QDWI)	200% FPL	Twice the SSI Limit	Yes	No	No	No

Source: Centers for Medicare and Medicaid Services.

For those “dual-eligibles”, Medicare is always the first payer for the Medicare provided services. Consequently, Medicaid is the second payer, also known as the “payer of last resort,” and normally covers the remaining difference in the cost of care, but only to the point where a state’s payment limit is reached for specific services. Health care providers have the right to bill Medicaid after they bill Medicare, but must accept payments received from Medicaid as

payments in full. Furthermore, Medicaid pays fully for Medicaid-covered services that are otherwise not covered by Medicare. As stated in the brief of the Kaiser Family Foundation (2009), although the proportion of dual-eligibles comparing to non-dual-eligibles is much smaller (7.1 million versus 30.2 million), the dual-eligibles require much more financial support. In 2003, the amount spent on dual-eligibles by Medicare and Medicaid totaled \$147.9 billion, compared to \$137.7 billion for non-dual-eligible Medicare beneficiaries. The majority of these resources was spent on inpatient hospital, prescription drugs, and ambulatory care, including institutional and community-based long-term care. The main reason why dual-eligibles require more help is the fact that they are generally older, sicker, and poorer, while also using more expensive services. As reported in the brief, 61 percent of those dual-eligibles have an income of less than \$10,000 compared to 9% of other Medicare beneficiaries below that level; 33 percent of dual-eligibles have some form of mental illness compared to 15 percent of other Medicare beneficiaries. Also, 17 percent of dual-eligibles live in specialized institutions compared to 2 percent of non-dual-eligible Medicare beneficiaries.

Many advocates suggest that expanding the health insurance system, in order to cover those that are currently uninsured, is the next big challenge the U.S government is facing. In this context, the expansion of Medicaid will most likely be the key point of interest. The current economic downturn, as well as the ongoing wars overseas, will most likely limit the government's ability to expand Medicare, which means that the states would become the primary factor in improving access to health care. However, in order to expand Medicaid coverage, inevitably states will have to either cut spending on other state funding projects or raise taxes. As of right now, Medicaid is the fastest-growing component of state spending, averaging about 20 percent of state budgets. According to Jennifer Fisher Wilson (2009), Dennis G. Smith - senior

fellow in health care reform at the Heritage Foundation in Washington, DC, claims that “States reach a point where they just cannot have 30% of their budget wrapped into Medicaid. Because then it is crowding out other priorities.” Still, this is not the only problem state administrations will have to deal with. As stated by Wilson (2009) nowadays States face an emerging dilemma - as more Medicaid beneficiaries seek care, fewer physicians are willing to provide their services to them. This is a problem that could potentially undermine the overall future success of a state-based health care reform. As reported by Peter Cunningham and Jessica May (2006), 14.6 percent of physicians did not receive reimbursements for their services for Medicaid patients in 2004-05, compared to 12.9 percent in 1996-97. Furthermore, 21 percent of physicians did not accept new Medicaid patients in 2004-05, compared to 19.4 percent in 1996-97. Some reasons why physicians decline Medicaid participation include delayed payments, complicated billing requirements, and a high rate of no-shows for office visits. However, the main reason for the majority of physicians is the fact that Medicaid simply pays much less than any other insurance plan. Average Medicaid rates are just 70 percent of Medicare rates. Unfortunately, states are not able to afford increases in reimbursement rates, taking into account the fact that the overall cost for Medicaid has already increased considerably. According to data from the Kaiser Family Foundation (2008), the average annual growth rate for Medicaid spending decreased from 9.4 percent in 2001-04 to 2.8 percent in 2004-06. This can be explained primarily by a substantial increase in the number of enrollees that have raised the amount of expenditures, which are already affected by the overall growth in the health care costs, particularly in prescription drugs costs. Wilson therefore suggested that one practical solution to this problem is to focus on improving the management of two patient populations that are especially costly to insure - the disabled and the elderly. According to the research the disabled and the elderly constitute about

25 percent of all Medicaid beneficiaries, but are responsible for about 70 percent of all Medicaid expenditures. Extensive use of acute and long-term care services explains the higher per capita expenditures for these beneficiaries. Dennis G. Smith, in this regard, urges that “Congress should give States more tools for dealing with those populations, such as the ability to use more managed care for them. These individuals and their families should also have greater ability to self-direct their long-term care, such as with cash and counseling program, which allows enrollees who receive personal assistance to hire whomever they want to provide their care and assistance in planning their budgets.”

Thus, based on the information provided above, the model to be estimated in this study is as follows:

$$(2) \quad \text{National Personal Health Care Expenditure Per Capita} = \beta_1 + \beta_2(\text{POPUP}) + \beta_3(\text{DISEASE}) + \beta_4(\text{MCINF}) + \beta_5(\text{INCPC}) + \beta_6(\text{PHI}) + \beta_7(\text{EDU}) + \beta_8(\text{GSHC}) + \beta_9(\text{MRI}) + u$$

The main goal of this study is to estimate how influential government based insurance has become over the observed period, and describe potential issues of its anticipated expansion. In order to do so, the Chow test will be conducted to check for the presence of a structural break in health care spending, before and after the introduction of Medicare and Medicaid. The model will be estimated using ordinary least squares with the LIMDEP statistical package. Data gathered for this study covers a 60 year span starting from 1948 and ending in 2007, based on annual observations. National personal health care expenditure per capita is the dependent variable in the model. This variable includes various medical goods and services, such as home health care, dental services, professional health care, durable medical product, hospital care, physician and clinical services, nursing home health care, drugs, and other medical nondurables.

The data on this variable was obtained from the U.S. Department of Commerce. In order to express all values in per capita terms over a 60-year study period, the acquired data was first divided by the total population for each year, and then further deflated by the CPI to capture the real growth in health care expenditure.

Table 5 presents all the explanatory variables and their expected coefficient signs, which are based on previously performed studies and economic inferences.

Table Five. Expected Signs of the Explanatory Variables

THE PREDICTED SIGNS FOR THE REGRESSION VARIABLES	
VARIABLE	SIGN
POPUP (population over the age of 65)	$B_2 > 0$
DISEASE (number of deaths associated with cancer and heart conditions)	$B_3 > 0$
MCINF (medical care inflation rate)	$B_4 > 0$
INCPC (income per capita)	$B_5 > 0$
PHIP (payments by private insurance providers)	$B_6 > 0$
EDU (percentage of the population with high school diploma or more)	$B_7 > 0$
GSHC (payments by government sponsored insurance)	$B_8 > 0$
MRI (magnetic resonance imaging)	$B_9 > 0$

The variable POPUP, which represents the percentage of the population over the age of 65, is important in estimating health care expenditures. This can be explained by the fact that people over the age of 65 require more medical attention and constant monitoring in case an individual of that age has some kind of disease. The United States Census Bureau collects population estimates since the year 1900. In order to calculate the percentage of the population

over the age of 65 over the entire 60 year study period, the number of individuals over the age of 65 was divided by the total population in a given year.

The DISEASE variable represents the combined number of deaths associated with cancer and heart disease. These two diseases have become the two leading causes of death in the U.S. over the past few decades. This variable is expected to have a positive sign in the model, since any terminally ill individual (from either from the two diseases) faces drastically increased medical expenses associated with the severity of their disease. The number of deaths as a result of cancer and heart disease was obtained from various U.S. Census Bureau reports on death and death rates from 32 selected causes. The two causes of death were combined, since the goal of this study is to measure the effect of chronic conditions, which became so common in recent decades and require constant monitoring and treatment. Thus, because of the nature of heart disease and cancer treatment administration the two selected conditions were the best fit to measure the exact effect of chronic illnesses.

The medical care inflation rate (MCINF) is another important variable which can potentially explain significant a part of the variation in the quantity of health care consumed. MCINF is important to include into the model because it captures the effect of rising health care prices. As it was mentioned in the study of Reichert et al. (1999), health care costs have been increasing at an average rate of 4 percent over the past five decades, while the overall inflation rate grew at rate between 3.1 and 1.7 percent. Therefore it is worth examining how changes in the price level affected health care expenditure. The U.S. Census Bureau keeps CPI data on various types of commodities, including medical care. In order to capture the real growth in medical care commodity prices comparing to all other goods and services - medical care, the health care CPI was divided by the economy's overall CPI. According to economic theory, since

medical care is a normal good, it is logical to assume that an increase in the price level of medical care commodities will have a negative effect on its consumption. However, taking into account the fact price elasticity of demand for health care goods and services is relatively inelastic, we can expect that an increase in the price level will not reduce the expenditures by the same degree. Therefore, the coefficient sign is expected to be positive for this variable.

The variable INPC, which represents income per capita, is another important variable that needs to be included into the model. Yet again, since health care is considered to be a normal good, one would assume that as personal disposable income increases, people will consume more health care services. Therefore, the coefficient of this variable is expected to be positive. The United States Bureau of Economic Analysis collects historical data on personal income and outlays in the country. Among other essential economic measures, it gathers data on the nominal Gross Domestic Product. In order to calculate income per capita over a 60 year period, the nominal Gross Domestic Product was divided by the total population for each year, and then deflated by the CPI in order to account for inflation.

The same positive relationship is predicted to be true for the expenditures sustained by the private health insurance providers (PHIP). Indeed, private insurance providers are still considered to be the biggest payer for the health care services in the United States. As of 2006, private insurance payments for medical services accounted for about 41.7 percent of total expenditures. In addition to this fact, Stanton MW and Rutherford MK (2008) state that in 1996, the top 5 percent of people who were covered by a private insurance plan spent on average \$17,800, compared to \$6,700 for the top 5 percent of the uninsured. The annual data for expenses incurred by the private insurance companies was obtained through the U.S. Census Bureau, which was further adjusted for inflation by use of the CPI.

The percentage of the population that has completed four years of high school or more is another variable which was included in the model. As stated by Peter Muennig (2000), a higher level of education leads to higher health care expenditure per capita. Education attainment increases an individual's future income, as well as social and economic statuses, which then lead to better health outcomes. Moreover, education naturally improves peoples' cognitive abilities about potential illnesses and diseases, which certainly leads to better life choices concerning one's health. In this study, the education level was measured by the percentage of the U.S. population over the age of 25 years with four years of high school education or more. Data for this variable was obtained from the U.S. Census Bureau's historical reports.

Government social health insurance (GSHC) is the main focus of this study. GSHC represents the two main government sponsored health care programs, namely Medicare and Medicaid. Expenditures incurred by each program were added up over the entire 60 year study period in order to account for the total amount of expenditure sustained by the government. Both programs became available to the general population in 1967. The U.S. Office of Management and Budget collects data on Federal outlays for health, by type of program, including expenditures maintained by Medicare and Medicaid services. The coefficient on this variable is predicted to be positive, indicating an overall increase in the percentage of people enrolled in these programs, as well as an increased number of services provided. This opinion is supported by the fact that the Medicare program provides insurance for the people over the age of 65, who in general are more likely to have multiple chronic conditions and therefore face higher medical care costs than the population under 65 years of age.

The MRI variable, which represents magnetic resonance imaging, is the last variable included into the regression analysis. Its purpose is to estimate the effect of technological

change, which is considered to be one of the most significant factors contributing to the rising medical care costs (and therefore medical expenditures). Unlike all the other variables, it is a dummy variable that takes on values of zero until 1981, when magnetic resonance imaging was introduced to the public, and one from there on.

This chapter has outlined the operation of Medicare and Medicaid and presented a model to be used in explaining aggregate health care expenditure in the U.S.. The model incorporated independent variables described in the literature review and the expected relationships with the dependent variable were stated. The next chapter will present the findings from the regression model and examine the relevance of each explanatory variable.

CHAPTER 4

ESTIMATION AND RESULTS

In this chapter the statistical model is evaluated in more detail and the results are presented. In order to obtain a plausible statistical model, some statistical modifications had to be applied to the model. The problems associated with obtaining valid statistical results will also be addressed. After developing an operational statistical model, the new structural equation will be used to conduct the Chow test in order to investigate a possible structural break in health care expenditures after the introduction of Medicare and Medicaid.

Several different regressions were run in order to attain accurate statistical and economical results. For various reasons, when running an ordinary least squares regression on the raw data, some of the explanatory variables appeared to be insignificant while also exhibiting contrary coefficient signs compared to the expected signs. However, after running the same regression with logarithms applied to the data, the statistical outcomes appeared to be more accurate with the majority of the variables exhibiting relatively high levels of significance. The results from the respective regression are summarized in tables 6 and 7.

Table Six. Ordinary Least Squares Regression Results for Raw Data

Variable	Coefficient	Standard Error	t-ratio	P[T >1]	Mean of X
Constant	-879.847922	139.149148	-6.323	.0000	
GSHC	.00098558	.00060686	1.624	.1105	80796.2667
POPUP	110.614349	26.0669460	4.243	.0001	10.7750000
DISEASE	-.00034990	.00016587	-2.109	.0398	.108655D+07
MECPI	144.356577	31.6909011	4.555	.0000	.97633333
PHIP	.00335467	.00059955	5.595	.0000	102585.437
EDU	3.32312749	3.56488780	.932	.3556	62.8450000
INCPC	.02048429	.01073245	1.909	.0619	14678.2330
MRI	21.6873345	25.3459690	.856	.3962	.45000000

Residuals:	Sum of Squares	56293.50
	Standard error of e	33.22340
Fit:	R-squared	.9980583
	Adjusted R-squared	.9977537
Autocorrelation:	Durbin-Watson Stat.	.4388698
	Rho	.7805651

Table Seven. Ordinary Least Squares Regression Result for Data in Logarithms

Variable	Coefficient	Standard Error	t-ratio	P[T >1]	Mean of X
Constant	4.22898657	3.26205132	1.296	.2007	
GSHC	.00972287	.00405406	2.398	.0202	2.36566625
POPUP	.26274026	.40514432	.649	.5196	2.36566625
DISEASE	-.77476477	.18594196	-4.167	.0001	13.8845561
MECPI	.14961937	.05222724	2.865	.0060	-.06225693
PHIP	.27771076	.06325311	4.390	.0001	10.9150661

EDU	.95391335	.33300971	2.865	.0061	4.09723496
INCPC	.57484259	.19834476	2.898	.0055	9.54879677
MRI	.06631540	.03090088	2.146	.0366	.45000000

Residuals:	Sum of Squares	.1037637
	Standard error of e	.4510635E-01
Fit:	R-squared	.9975849
	Adjusted R-squared	.9972061
Autocorrelation:	Durbin-Watson Stat.	.5879391
	Rho	.7060305

Due to the apparent differences in regression results, it is essential to determine what functional form is a better fit for our model. In order to do that, the Box-Cox test was conducted. The likelihood ratio test statistic suggested by Box and Cox is as follows:

$$(3) \quad l = \frac{T}{2} \{ \ln[(SSE_l/Yg^2)/SSE_{ll}] \} \sim \chi^2(1)$$

The value of l^* obtained from this test statistic (4.13) is larger than the critical value on the 5 percent confidence interval (3.84). Therefore, we reject the hypothesis that linear and log linear models are both satisfactory in their explanatory power. Furthermore, since the log linear form has a smaller unexplained variation than the geometric mean adjusted linear model, as measured by the sum of squared errors, we have concluded the log linear model provides a better fit. One benefit of running our model in log form rather than in natural values is the fact that the obtained coefficients would represent elasticities.

The results presented above suggest that the POPUP variable, which stands for the population over the age of 65, is insignificant, regardless of the functional form. Therefore, it was determined that this variable needs to be removed from the suggested model. However, it

should be noted that the effect of it would be partially represented by the government sponsored health insurance (GSHC) variable. This can be explained by the fact that GSHC captures the amount of spending incurred by the Medicare program. As described in the previous chapter, the Medicare program particularly covers medical costs for elderly individuals over the age of 65, and accounts for approximately 67 percent of all expenditures included into the GSHC over the sixty year study period.

Therefore, the original model was adjusted to this reduced form and now is expressed as follows:

$$(4) \quad \text{National Personal Health Care Expenditure Per Capita} = \beta_1 + \beta_2(\text{DISEASE}) + \beta_3(\text{MCINF}) + \beta_4(\text{INCPC}) + \beta_5(\text{PHI}) + \beta_6(\text{EDU}) + \beta_7(\text{GSHC}) + \beta_8(\text{MRI}) + u$$

In order to investigate the effect of autocorrelation on our model, the Durbin-Watson statistic was examined. In case of little or no autocorrelation, one would expect the value of Rho to be closer to zero and the Durbin-Watson statistic closer to two. However, the acquired statistic showed that there is indeed a problem of autocorrelation, since the value of Rho is .706, which implies that the obtained standard errors are biased and inconsistent. In order to account for this complication, the Newey-West correction estimator was implemented. Table 8 shows the results of the log linear model adjusted for autocorrelation and with the POPUP (percentage of the population over the age of 65) variable excluded.

Table Eight. Adjusted Log Linear Model

Variable	Coefficient	Standard Error	t-ratio	P[T >1]	Mean of X
Constant	4.87514669	3.39805934	1.435	.1574	

GSHC	.00919216	.00442973	2.075	.0429	7.77839235
DISEASE	-.79050092	.22733879	-3.477	.0010	13.8845561
MECPI	.16408863	.06845764	2.397	.0202	-.06225693
PHIP	.28662071	.06166131	4.648	.0000	10.9150661
EDU	1.08822711	.26301914	4.137	.0001	4.09723496
INCPC	.52741046	.18274827	2.886	.0057	9.54879677
MRI	.07579537	.02115630	3.583	.0007	.45000000

Residuals:	Sum of Squares	.1046194
	Standard error of e	.4485434E-01
Fit:	R-squared	.9975650
	Adjusted R-squared	.9972372
Autocorrelation:	Durbin-Watson Stat.	.5956434
	Rho	.7021783

The next problem that was encountered in this study is the fact that the R squared statistic was extremely high (.997). The results may imply that we are dealing with a spurious regression, which would make the obtained results meaningless despite high t-values. Therefore, in order to ensure that the obtained results are indeed correct, the Dickey Fuller test was conducted on the model's residual vector to check for the presence of a unit root. The results however, showed that our model did not contain a unit root since the ADF test statistic (two lags) came out to be -3.542, which is greater than critical value of -2.93 at the 5 percent confidence level.

The amount of expenditures incurred by government based health insurance plans proved to be a positively related factor to health care expenditure, and came out to be significant at the 5 percent confidence level.

The medical care inflation rate came out to be positively related to the health care expenditures. Indeed, the results obtained in this model correspond to the findings of Ringel *et.al* (2000). The demand for health care is estimated to be relatively price inelastic. According to the regression output, a 10 percent increase in medical price index results in a 1.6 percent increase in health care expenditures.

The number of deaths associated with heart related conditions and cancer showed a negative relationship with the dependent variable, which is contrary to our expectations. As suggested by the obtained results, a 10 percent increase in the number of deaths associated with cancer and heart related conditions would decrease health care expenditures by 7.9 percent. One of the reasons that might have led to this effect is the fact that we only know the number of deaths associated with a particular condition. However, we cannot know at what point during the year the death took place. In case the death occurred early on in a given year, we would expect that a large portion of medical care spending had taken place in the previous year. Another way to explain the negative relationship is the fact that spending on health care is virtually zero after a patient's death, and people with these diseases may die earlier than others, *ceteris paribus*. This fact implies that the negative sign actually makes more sense, since after the death, health care spending, just like any other spending, ends. Measuring the duration of illness could possibly give us a better estimation of this factor. Unfortunately, due to the fact that there is no such data, we were unable to obtain any of these results.

According to the results in table 8, the payments of private insurance providers is a very influential factor in determining health care expenditures, as it showed to be statistically significant at the 1 percent confidence level. According to the results, a 10 percent increase in

payments of private health insurance providers increases total health care expenditures by 2.8 percent, *ceteris paribus*.

The income per capita variable turned out to be statistically significant at the 1 percent confidence level. As stated earlier, health care is a normal good, and therefore an increased income per capita should result in increased health care expenditures, *ceteris paribus*. In our model, a 10 percent increase in an individual's level of income results in a 5.2 percent increase in the individual's health care expenditures.

The population education level came out to be very influential in describing fluctuations in health care expenditures. According to the results, a 10 percent increase in the level of education will increase health care expenditures by 10.8 percent. This evidence is supported by the study of Muennig et al. (2000). As mentioned in the previous chapter, acquiring education increases individuals' awareness about potential health threats, thereby developing cognitive ability in making better life choices concerning individuals' health, *ceteris paribus*.

Lastly, the MRI variable, which was included into this study to measure the magnitude of technological change, also came out to be significant at the 1 percent confidence level. According to the acquired results, the introduction of magnetic resonance imaging resulted in the 7 percent increase in the overall health care expenditure.

The primary goal of this study was to estimate the magnitude of government based health insurance programs on overall health care expenditure. As mentioned earlier, these programs were initially introduced in the mid-1960s. To be more precise, this study considers 1967 as the year when both Medicare and Medicaid became available to the general public. Hence, the obtained model was used in order to estimate health care expenditure before and after that year.

Furthermore, the acquired sums of squares were subsequently used in examining the presence of a structural break.

As opposed to examining the model with all 60 observations, the data was divided into two subgroups. The following equations represent the three models used to conduct the Chow test:

- 1) $y_t = \alpha_0 + \alpha_1 x_t + u_t$ (first regression used for the entire study period)
- 2) $y_t = \beta_1 + \beta_2 x_1 + u_{1t}$ (second regression applied before the break at time t)
- 3) $y_t = \delta_1 + \delta_2 x_2 + u_{2t}$ (third regression applied after the break at time t)

The first regression represents a full model which was run for the entire study period from 1948 to 2007 (Table 8). The second regression model was run for the period from 1948 to 1966. X_1 represent a matrix of explanatory variables for the first subgroup. Even though government sponsored health insurance (GSHC) and magnetic resonance imaging (MRI) take on values of zero in the first subgroup, they were included into the model in order to preserve the same number of parameters in the second and third regressions. The obtained coefficients, however, are assumed to be zero on these variables. The third regression model was run for the period from 1967 to 2007. X_2 represents a matrix of explanatory variables for the second subgroup. Under the null hypothesis, if parameters estimated in equations two and three are equal, i.e. $H_0: B^1_j = B^2_j$, the two subgroups could be expressed by a single model as in case 1, where there is only one regression line.

Table 9 shows the output of the second regression.

Table Nine. Results from the Second Regression Applied Before the Break at Time t

Variable	Coefficient	Standard Error	t-ratio	P[T >1]	Mean of X
Constant	2.42988599	4.22670706	.575	.5752	
DISEASE	-.36088172	.41031365	-.880	.3951	13.6658915
MECPI	2.63810523	.26094468	10.110	.0000	-.35333374
PHIP	-.15114795	.06086422	-2.483	.0274	9.30962420
EDU	.88145773	.35238961	2.501	.0265	3.70505685
INCPC	.77754036	.29793044	2.610	.0216	9.15605942

Residuals:	Sum of Squares	.1970574E-01
	Standard error of e	.3893361E-01
Fit:	R-squared	.9901162
	Adjusted R-squared	.9863147
Autocorrelation:	Durbin-Watson Stat.	1.8011422
	Rho	.0994289

The Durbin- Watson statistic indicates no autocorrelation problem, therefore the obtained standard errors are unbiased and consistent. Table ten shows the results of the third regression.

Table Ten. Results from the Third Regression Applied After the Break at Time t

Variable	Coefficient	Standard Error	t-ratio	P[T >1]	Mean of X
Constant	-7.96220343	4.86387265	-1.637	.1111	

GSHC	.05900975	.07063809	.835	.4095	11.3830132
DISEASE	.46444518	.37376840	1.243	.2228	13.9858884
MECPI	.07675852	.03809163	2.015	.0521	.07263233
PHIP	.49987377	.09683483	5.162	.0000	11.6590513
EDU	-.11453571	.31134175	-.368	.7153	4.27897604
INCPC	.26237366	.15189406	1.727	.0935	9.73079701
MRI	.02142890	.02521357	.850	.4015	.65853659

Residuals:	Sum of Squares	.2562810E-01
	Standard error of e	.2786771E-01
Fit:	R-squared	.9971160
	Adjusted R-squared	.9965043
Autocorrelation:	Durbin-Watson Stat.	.4113976
	Rho	.7943012

The obtained residual sums of squares from these two models were further analyzed when performing the Chow test. The suggested statistic for the Chow test is as follows:

$$(5) \quad F = \frac{RSS_c - (RSS_1 + RSS_2)/k}{\frac{RSS_1 + RSS_2}{n - 2k}}$$

In this formula RSS_c is the sum of squared residuals from the single model, and RSS_1 and RSS_2 are the sums of squared residuals from the two subgroup models. K represents the total number

of parameters, which in our case is eight, and n is the total number of observation, which in our case is sixty.

By estimating this equation, the obtained F statistic came out to be 7.19, which is greater than the F critical value of 2.95 with $(k, n-2k)$ degrees of freedom. Therefore, we can reject the null hypothesis that there is no structural break.

Considering the t-statistic in the third regression, one would conclude that government sponsored health insurance was not a significant factor in explaining health care expenditure. However, this could be due to the fact that there is a high degree of autocorrelation ($Rho=.79$), which could be reduced by running a Generalized Least Squares (GLS) regression instead of an Ordinary Least Squares (OLS) regression.

After running the third regression using generalized least squares, the Durbin-Watson statistic did in fact increase to 1.50, indicating a relatively low level of autocorrelation. The government sponsored health insurance (GSHC) t-statistic in turn, went up to 2.23, showing a higher level of significance. The output of the GLS regression can be found in the appendix of this thesis.

Furthermore, taking into account the fact that GSHC and MRI take on values of zero in the first subgroup, it would be informative to run one more regression with a dummy variable and its interaction terms included in the model. The description and the output of this procedure can also be found in the appendix of this thesis.

Table Eleven. Coefficients Before and After the Introduction of Government Sponsored Health Insurance

Variable	Coefficient Before	Coefficient After	Difference
Constant	2.42988599	-7.96220343	-10.39208942

DISEASE	-.36088172	.46444518	0.8253269
MECPI	2.63810523	.07675852	-1.87052003
PHIP	-.15114795	.49987377	.65102172
EDU	.88145773	-.11453571	-.99599344
INCPC	.77754036	.26237366	-.5151667

The results obtained from the Chow test showed that there indeed was a structural break after 1967. This means that the introduction of government based health insurance had an effect on overall health care expenditures. Based on the results of the two sub-sample regressions, it seems reasonable to conclude that the presence of Medicare and Medicaid causes the structural shift.

More precisely, the number of deaths associated with the two leading causes of death had a positive relationship with the dependent variable after the introduction of Medicare and Medicaid. This indicates that, along with the new evolving technology in the late twentieth century, government sponsored health insurance also contributed to the rise in health care expenditures. The biggest contribution of Medicare and Medicaid programs is the fact that it allowed a greater number of people to receive medical treatment they would otherwise not be able to receive.

Medical care prices have had less of an impact on health care expenditures after the introduction of government sponsored health insurance, which corresponds to the economic inference. In fact, Medicare and Medicaid programs worked as subsidiary tools that expectedly decreased the effect of a price increase in medical services. One would expect that the introduction of Medicare part D has played a significant role in this aspect, since high

prescription drugs prices set up by the pharmaceutical companies have been one of the major reasons for the overall price increase in the medical sector.

Moreover, the same interpretation can be applied to the level of income per capita. The subsidiary nature of Medicare and Medicaid substantially decreased the amount of income individuals spend on medical supplies. The elasticity of income per capita decreased from .77 to .26. This 50 percent decrease after the introduction of government sponsored insurance indicates how substantial this policy has been for the population of the United States of America.

Payments by the private insurance providers show a somewhat controversial sign before the introduction of Medicare and Medicaid. Until 1967, private insurance was the primary source of health care coverage in the United States. It is therefore odd to observe a negative relationship between private insurance payments and health care expenditures between 1948 and 1967. However, the fact that this was the only way for people to avoid high medical expenditures, it might be logical to assume that an increasing rate of private insurance enrollment generated more savings than expenditures over the observed study period. Furthermore, the fact that medical care prices began increasing later in the twentieth century means that until 1967, private insurers payments to health care providers were relatively lower than after 1967. This assumption is supported by the coefficient observed between 1967 and 2007, which indicated that a 10 percent increase in the payments of private insurance providers resulted in the 5 percent increase in the country's health care spending. In addition, as mentioned in the studies Cunningham et al. (2006) and Wilson et al. (2009), health care providers prefer to work with private insurers since they ensure better returns on their expenditures.

Lastly, education level proved to be positive and very influential in health care expenditures before the introduction of Medicare and Medicaid. More precisely, a 10 percent

increase in the population with at least four years of high school education resulted in 8.8 percent increase in health care expenditures. However, the introduction of Medicare and Medicaid substantially reduced educational effects on health care spending. Between 1967 and 2007 the coefficient of the education level came out to be negative, suggesting that with the introduction of government sponsored insurance, the education level promoted some savings in health care spending.

CHAPTER 5

CONCLUSION

Through the empirical analysis performed in this study it has been shown that the introduction of government sponsored health insurance had a significant impact on overall health care expenditures in the United States of America. In the near future, it is most likely that the Medicare and Medicaid programs will play an even a larger role in the country's health care sector.

The health care system of the United States has been a highly debated subject in recent years. Due to the economic downturn, the number of unemployed individuals is expected to rise, which then subsequently affects peoples' ability to consume health care goods. The loss of employer based health insurance coverage will force the government to take effective measures to make sure that those unemployed individuals will still have access to health insurance coverage. Over the years, the federal government was able to expand its reach in order to help those who have a low income, particularly through the introduction of part D of the Medicare program. Until this policy took effect, the majority of unemployed individuals had to pay for prescription drugs out-of-pocket, which was obviously a hefty and in many occasions an impossible task for them. Rising prescription drugs costs have been the main reason for the Medicaid state budget deficits. Between 1997 and 2000, Medicaid spending on outpatient prescription drugs increased by 18.1 percent, compared to a 7.7 percent increase in overall Medicaid expenditures. In order to counteract this problem, states might have to adopt the

preferred list of drugs procedure to reduce the costs by authorizing most commonly advertised drugs. Nonetheless, the Medicaid program is still the primary source to ensure that those with low incomes and disabilities have a chance to receive the necessary medical attention.

In light of the current economic downturn, federal and state budgets will have to be adjusted for the upcoming challenges. The Patient Protection and Affordable Care Act of 2010, which was enacted by the Obama administration, is projected to provide coverage to 32 million currently uninsured individuals by 2019. Half of those individuals will be accounted for by the expansion of Medicaid. With an increase in the share devoted to health care, government and state administrations will either have to cut off spending on other programs or increase taxes. Major issues concerning Medicaid administration costs as well as low physician participation rate will have to be addressed. It is essential to develop procedures that would simplify the application process, including implementation of online systems that would monitor the applicants' enrollment into the right program and ensure secure data sharing among different programs. However, in order to solve the problem of Medicaid's low physician participation rate, the bill seeks to increase primary care physician reimbursement rates to those enrolled in Medicare by raising funding for community health centers and national health service corporations. Furthermore, during the first three years after the enactment of the bill, states will not be responsible for covering newly insured individuals. The federal matching fund will be the main source covering those newly eligible persons. This could be a significant contribution to the states efforts in expanding Medicaid eligibility.

As of right now, it is too early to talk about the future of the Medicaid since no one can predict when the economy is going to strengthen and recover. The health care reform initiated by

the Obama administration is definitely a huge leap towards a better structured health care system. However, only time can show the real effect of the newly issued bill.

The results obtained in this study showed that there are prerequisites in expanding the influence of government based insurance in the health care sector, as it proved to reduce the effect of price and income. Yet, the cost of providing medical services is extremely expensive for the tax payers, taking into account recent trends in the prescription drug market. The results show that there is some potential in reducing health care expenditures by investing in education. However, the acquired statistics indicate that this result may not be valuable. It will also be difficult to achieve significant improvements in the education level considering the fact that in the future, Medicaid will make up an even larger share of state budgets. For further research, the main point of interest may be the effect of the newly issued health care bill, particularly how it contributes to the population health level, how it affects overall health care expenditures, and how it compares to the states' spending.

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APPENDIX A

Appendix Table One: Generalized Least Squares of the Third Regression Output Applied After The Break at Time t

Variable	Coefficient	Standard Error	t-ratio	P[T >1]	Mean of X
Constant	-3.56020019	2.66685478	-1.335	.1819	
GSHC	.09323988	.04175123	2.233	.0255	11.3830132
DISEASE	.07431357	.19991231	.372	.7101	13.9858884
MECPI	.02601295	.02461132	1.057	.2905	.07263233
PHIP	.9300390	.06826101	5.757	.0000	11.6590513
EDU	.27760716	.31683659	.876	.3809	4.27897604
INCPC	.28658350	.10312596	2.779	.0055	9.73079701
MRI	.01747413	.01573098	1.111	.2667	.65853659

In order to avoid any complications regarding GSHC and MRI variables in the second and third regressions of the Chow test, it was determined that one more regression had to be run.

Variable GSHC was excluded from the regression model, and replaced with a dummy variable, which took on values of one until 1966 and zero from there on. This newly introduced variable was further interacted with all the explanatory variables in the regression, except the MRI variable, since it is a dummy variable as well.

The following equation describes the model to be used as an alternative to the Chow test conducted previously in the study.

$$(1) \quad Y = X\beta + (D+X)\delta + \varepsilon$$

X represents a matrix of explanatory variables and β is a vector of their coefficients. D is a dummy variable which is interacted with all the explanatory variables in matrix X. δ is an interaction coefficient which will be used in analyzing whether the coefficient differences are statistically significant. Lastly, ε represents a vector of residuals.

Appendix tables two and three present the statistics to be used in estimating the structural differences:

Appendix Table Two: Original Regression Model without GSHC and Dummy Variable

Variable	Coefficient	Standard Error	t-ratio	P[T >1]	Mean of X
Constant	2.20685229	3.07998159	.717	.4768	
DISEASE	-.73609082	.22682985	-3.245	.0020	13.8845561
MECPI	.15016756	.06824089	2.201	.0321	-.06225693
PHIP	.19842157	.05293265	3.749	.0004	10.9150661
EDU	1.46914091	.27264764	5.388	.0000	4.09723496
INCPC	.67333061	.15808316	4.259	.0001	9.54879677
MRI	.05826692	.02121248	2.747	.0082	.45000000

Residuals:	Sum of Squares	.1155237
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	Standard error of e	.4668717E-01
Fit:	R-squared	.9973112
	Adjusted R-squared	.9970068
Autocorrelation:	Durbin-Watson Stat.	.5655408
	Rho	.7172296

Appendix Table Three: Original Regression Model without GSHC and with Dummy Variable and Interaction Variables Included

Variable	Coefficient	Standard Error	t-ratio	P[T >1]	Mean of X
Constant	2.42988599	4.22670706	.575	.5681	
DISEASE	-.36088172	.41031365	-.880	.3836	13.8845561
MECPI	2.63810523	.26094468	10.110	.0000	-.06225693
PHIP	-.15114795	.06086422	-2.483	.0166	10.9150661
EDU	.88145773	.35238961	2.501	.0159	4.09723496
INCPC	.77754036	.29793044	2.610	.0121	9.54879677
DISEASE INT	.84193474	.52974859	1.589	.1187	9.55702376
MECPI INT	-2.56027196	.26678992	-9.597	.0000	.04963209
PHIP INT	.70592061	.09341141	7.557	.0000	7.96701842
EDU INT	-.92969898	.42535703	-2.186	.0339	2.92396696
INCPC INT	-.50706725	.37311110	-1.359	.1806	6.64937796
MRI	.01767012	.02631273	.672	.5052	.45000000
DV	-10.9528145	6.12064550	-1.789	.0800	.68333333

Residuals:	Sum of Squares	.4587581E-01
	Standard error of e	.3124229E-01
Fit:	R-squared	.9989323
	Adjusted R-squared	.9986596
Autocorrelation:	Durbin-Watson Stat.	1.0333699
	Rho	.4833151

The obtained sums of squares were further analyzed in performing the F-test, which is as follows:

$$(2) \quad F = \frac{RSS_1 - RSS_2 / K_1}{\frac{RSS_2}{n - 2k}}$$

In this formula RSS_1 represents a sum of squared residuals in the first regression model (Table 13), and RSS_2 is the sum of squared residuals in the second regression model (Table 14). K_1 is the number of parameters in the first regression model, which is equal to seven. K_2 is the number of parameters in the second regression model, which is equal to 13. N is the number of observations, which in this case is 60.

The obtained F statistic was 10.13, which is greater than the critical value of 2.33. This fact indicates that there indeed was a structural break after the introduction of government sponsored health insurance. Appendix table four shows the coefficient differences, while also stating whether they were statistically significant.

Appendix Table Four: Coefficient Difference and Significance

Variable	Coefficient Difference	t-ratio

Constant	-10.9528145	-1.789
DISEASE	.84193474	1.589
MECPI	-2.56027196	-9.597
PHIP	.70592061	7.557
EDU	-.92969898	-2.186
INCPC	-.50706725	-1.359

The obtained results show that coefficient differences are almost identical to the previously obtained results (Table 11). Furthermore, the acquired t statistic shows that the medical care inflation rate, private insurance payments, and the level of education experience a significant change after the introduction of Medicare and Medicaid.