Rising Health Care Expenditures: The Red Herring Further Explored

Bachelor's Thesis

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Abstract

Health care expenditures have been rising all around the globe. When it comes to explaining why, aging of the population is often put forward as one of the main causes. There is little attention for the role of other macro-economic variables in this process. This research shows that such variables are generally of more importance when it comes to explaining the rise in health care expenditures, at least in the OECD countries. The correlation between aging of the population and health care expenditures is altered when a few macro-economic variables are added into the analysis. These findings confirm the existence of a 'red herring'. The results of this paper have several policy implications. Regression analyses and literature studies are the main methods of research.

Key words: health care expenditures, aging of the population

Contents

Chapter 1.

Introduction

Aging of the population is a worldwide phenomenon. It is mainly caused by a higher longevity and a lower fertility rate. In general, aging of the population results into higher government expenditures, such as pensions and health care. The focus will be on the latter. In an aging population, there is an increased share of elderly[1] relative to the total population. If a larger share of the population consists of elderly people, health care expenditures are expected to rise since intuitively the largest part of health care expenditures can be attributed to the elderly. Health care expenditures have indeed been rising, at least in the OECD countries [OECD Health Data, 2009]. When it comes to explaining why, the role of aging of the population has been emphasized and there is little attention for the role of other macro-economic variables. It can be expected though that these underemphasized variables, such as inflation, levels of income, government expenditures or expenditures on technology have a considerable impact on the level of health care expenditures as well. Although many researchers have been aimed at showing that other variables do have an influence on health care expenditures as well, almost none have been aimed at exploring how the significance of the correlation between aging of the population and health care expenditures is influenced when other variables are included in the analysis. This is what this paper will be focused on.

There have been publications about other variables than aging of the population influencing health care expenditures, but it has become clear that not much has been published about how introducing other variables might alter the relationship between aging of the population and health care expenditures. This project will thus be an interesting addition to this particular research field. The results of the research might contradict the commonly accepted view that aging of the population is the main cause

[1]The elderly are defined as those people aged 65 and above.

for the rise in health care expenditures. Therefore it will expand the existing knowledge in this research area. In addition, the aim is to show the rise in health care expenditures might not be accounted for solely by an uncontrollable variable. It might also be influenced by a number of controllable variables. Recognizing this can have a major impact on policies regarding health care. Therefore it is not only interesting for the academic community studying this research area, but it also has an additional value for society if it shows the rise in health care expenditures can be controlled by making different choices.

For the sake of not making this research too complex, it will be limited to the countries in the Organisation for Economic Co-operation and Development (OECD)[2], which are known for fostering prosperity and fighting poverty through economic growth and financial stability. In general, these countries are known for having an aging population. There is also a lot of data available for these countries, which is necessary for this research. Thus, in these countries the correlation between aging of the population and the rise in health care expenditures can easily be researched. The results of this research might be of importance for policy decisions with respect to health care in the OECD countries. Because there are a lot of differences between the thirty OECD countries, the results of this research might be generalized for the rest of the world. This should happen with caution though, since the non-OECD countries differ from the OECD countries with respect to variables such as the population structure, income levels, health care standards and development in general.

1.1. Methodology

In this research various research methodologies will be used. For Chapter 2, a literature study will be combined with the analysis of statistical data from the United Nations and the World Development Indicators. The following variables will be used: population aged 65 and over as a percentage of the total population, old-age dependency ratio, life expectancy at birth and the fertility rate. Goal of this part is to gain insight into the process of aging of the population.

[2]The countries in the OECD are Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea Republic, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom and United States.

In Chapter 3, a literature study will be combined with various regression analyses using SPSS. Furthermore, both SPSS and Eviews will be used to test various assumptions regarding regression analyses. The data will be provided by the following sources: the OECD, the World Development Indicators and the International Monetary Fund. The variables that will be used are: health care expenditures, population aged 65 and over as a percentage of the total population, inflation, gross domestic product, government expenditures and research & development expenditures. Goal of this part of the research is to show how the above-mentioned variables in a particular country are correlated to its health care expenditures. This will provide a foundation for the rest of the research. The goal of the last section in this chapter is to show how the correlations are altered when all variables are included into the analysis simultaneously.

In the last part of the research a literature study will be combined with the results of the analyses performed in this paper. Goals of this part are to show why there is such a fixation on aging of the population when it comes to explaining the rise in health care expenditures and to show what kind of policy implications might follow from recognizing the results of this research.

1.2. Structure

In order to be able to reach the main research goal, this paper will be divided into different chapters. In Chapter 2 the phenomenon of aging of the population is introduced and it will be explored how this trend is expected to develop in the future. In Chapter 3 health care expenditures will be introduced. First, the relation between aging of the population and these expenditures will be researched. Next, the impact of other variables on these expenditures will be investigated. Finally, these other variables will be introduced into the analysis that this part started with. In Chapter 4, the 'red herring'[3] will be investigated. It will be researched why there has been such on emphasis on aging of the population instead of on other often more important causes when it comes to explaining the rise in health care expenditures. In Chapter 5, possible policy implications of this paper will be examined.

[3]A red herring is a clue that is misleading or that has been falsified, intended to divert attention.

Chapter 2.

Aging of the Population

Nowadays, aging of the population is a phenomenon that is observed in almost all countries around the world. There are only 18 countries on the globe where this is not occurring [United Nations Development Programme, 2005]. Aging of the population means that the average age of the world's population increases in the course of time because of the larger number of older people relative to the total population. The distribution of a country's population shifts towards older ages. Figure 2.1 shows this phenomenon can indeed be observed in the OECD countries. It also shows the population is expected to keep on aging in the coming decades.

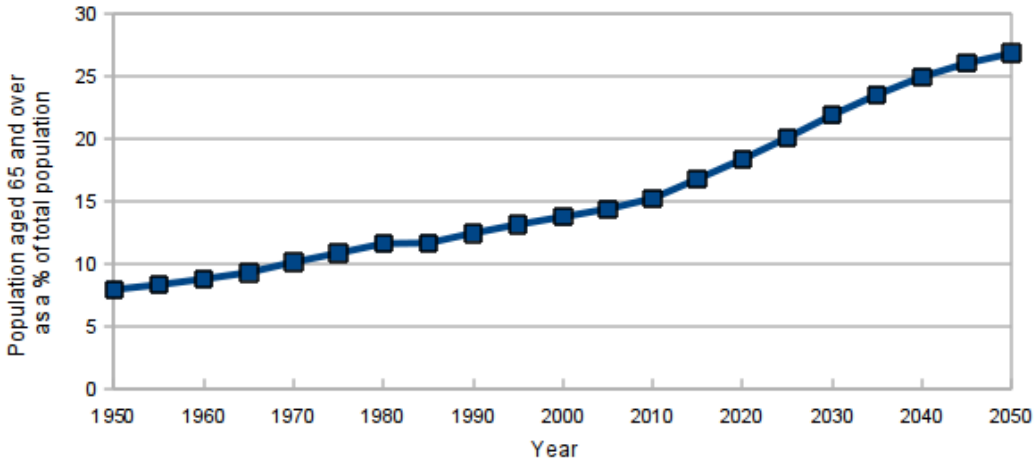

Figure 2.1.: Aging of the population in the OECD countries.

Source: [United Nations Data, 2010].

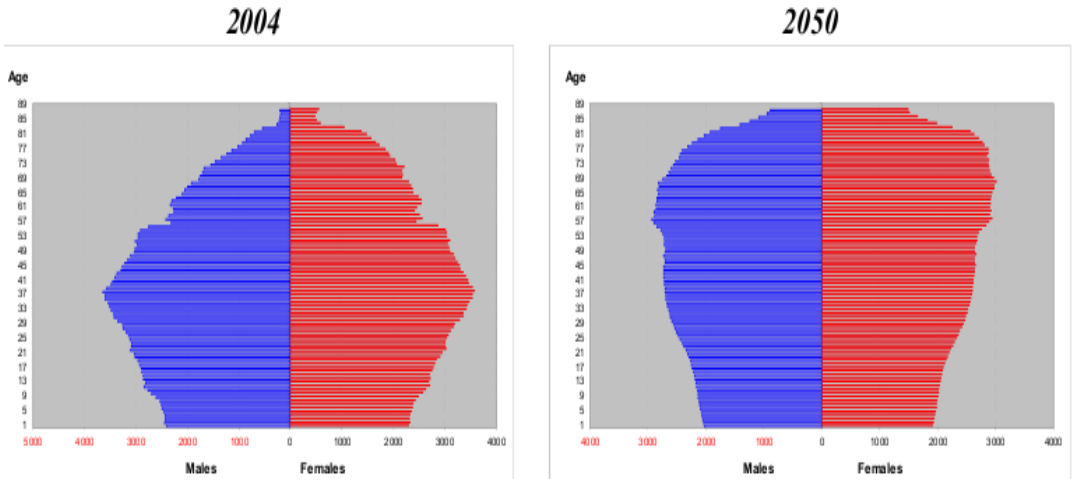

Figure 2.2.: Aging of the population in the EU25 countries.

Source: [European Commission, 2009].

The age pyramids in Figure 2.2 also show the distribution of the population is expected to keep on shifting towards older ages in the EU25 countries[1] in the coming decades.

Aging of the population directly results in an increase in the old-age dependency ratio. This is the ratio of older dependents, people aged 65 and above, to the working-age population, people aged 15-64. Since the proportion of people older than 65 relative to the total population is increasing, this ratio is also increasing. Figure 2.3 shows the old-age dependency ratio has increased in the past and this is expected to continue in the future in the OECD countries.

The aging of the population has a series of effects on macro-economic variables. For instance, it reduces saving rates, decreases the labor force and increases government expenditures on variables such as pensions and health care. Using MULTIMOD[2] it is argued that since aging of the population is expected to continue, these effects may become substantial around 2025. Some of these effects considerably differ between countries due to the extent and speed of aging of the population in the different countries [Masson and Tryon, 1990]. Using Minilink[3], it is shown that output growth, private savings and

[1]The EU25 countries are Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden and United Kingdom.

[2]MULTIMOD is a multicountry macroeconomic model of the world economy designed by the International Monetary Fund to study shocks across countries and the effects of different policies.

[3]Minilink is a multi-region general equilibrium model of the world economy designed by the OECD to examine policy issues over time.

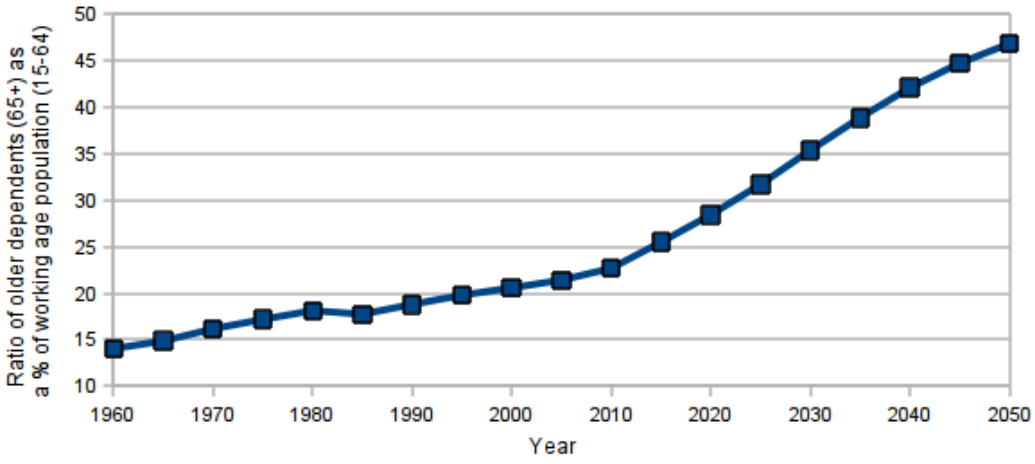

Figure 2.3.: Old-age dependency ratio in the OECD countries.

Source: [United Nations Data, 2010] and [World Development Indicators Online, 2010].

the levels of GDP are likely to decrease in the OECD countries in the coming decades. It is even argued aging of the population will decrease economic growth in general and will slow down the growth in living standards [Turner et al., 1998].

Aging of the population is generally caused by changes in two demographic variables. The first is the increase in longevity. The second is the decrease in the fertility rate [United Nations Department of Economic and Social Affairs, 2009]. The increase in longevity causes the average age of the population to increase because it results in the elderly getting older than before. This results in the growth of the population of elderly relative to the total population. This effect is stimulated even more by a reduction in the fertility rate in the last few decades [European Commission, 2009], which results in a smaller population of people aged 0-64 relative to the total population. This is because a lower fertility rate means there are less children and over time less young people and adults, resulting in a relatively smaller working age population. The aging of the population is expected to continue in the coming decades since longevity is expected to keep on increasing and the fertility rate is expected to stabilize. Another possible explanation for the aging of the population is migration, but this is a less important factor than the other two.

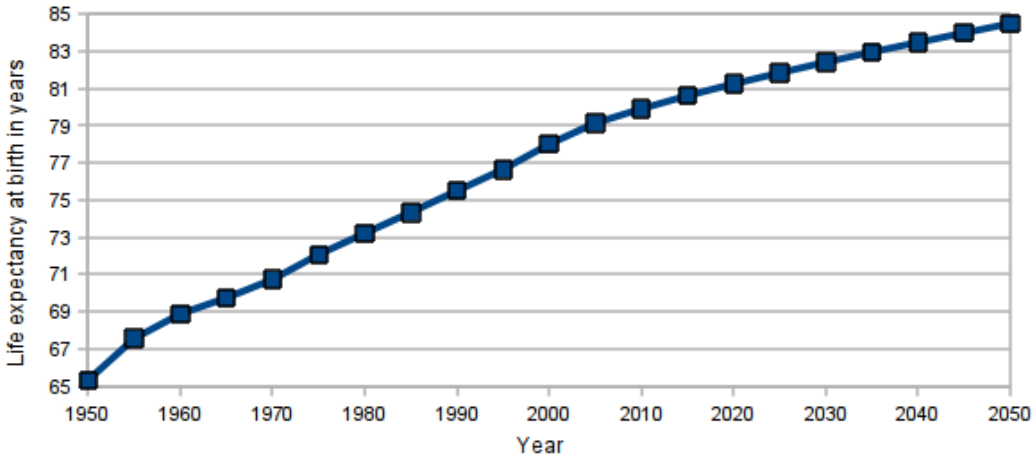

Figure 2.4.: Life expectancy in the OECD countries.

Source: [United Nations Data, 2010].

2.1. Longevity

Longevity is defined as the average lifetime of people. This is increasing as a result of better nutrition and better provision of health care around the globe. Health insurance programs, income changes, and social policies also play a role. All variables together result in a decreasing mortality rate. The world's population tends to live longer than before because of this and thus the life expectancy is increasing. In the OECD countries the average life expectancy in 1950 was 65 years. This number is expected to rise to nearly 85 years in 2050. In Figure 2.4 the rise in life expectancy can be observed for the OECD countries. It is also shown that the life expectancy is expected to keep on increasing in the future.

In the beginning of the twentieth century public health started to improve and economic measures were taken, which increased the provision of proper nutrition. Because of this, people were able to withstand diseases better and since this was more important for the young than the old, the decrease in the mortality rate was mostly accounted for by decreases in infant mortality.

Around the middle of the century, medical care became more important. New drugs were introduced resulting in mortality reductions for people at both young and old ages.

At the end of the twentieth century, cardiovascular disease could be treated better, resulting in a mortality reduction for people at old ages. Mortality rates for people at young ages were already very low; most of the increase in life expectancy in the last

few decades can be accounted for by reductions in the mortality rate of people at old ages [Cutler and Meara, 2001].

2.2. Fertility

The fertility rate is defined as the average number of children per woman. It is a global trend that less babies are born than before. The average fertility rate in the OECD countries was 3.2 in 1950. This number is expected to decrease to 1.8 in 2050, which is below the replacement level for developed countries of 2.1 [Espenshade et al., 2001]. The replacement level is the number of births per woman that is needed to exactly replace each generation. Figure 2.5 shows the fertility rate has dropped rapidly in the past decades. It also shows the fertility rate is expected to stabilize or even slightly increase.

After the end of World War II, many men returned home and started families. Many couples had postponed getting married and having children during the war. From the end of the war until the 1960's many new children were born, which coincides with a high fertility rate. This is often referred to as the baby boom[4].

Starting from the 1960's the fertility rate has decreased significantly. There are a few causes for this change. Many couples postpone having their first child, mostly because of emancipation of women who want to build a career before becoming a mother. There are also more couples who have only one child or who have no children at all comparing to the baby boom period [European Commission, 2009]. Also, the increasing use of contraceptives and in particular the introduction of the birth-controll pill in the 1960's is another reason why the fertility rate has decreased, since using this pill considerably reduces the chance of becoming pregnant to nearly zero. Many women started using this pill to be certain they would not get pregnant and thus the fertility rate decreased [Tyrer, 1999].

[4]A baby boom is a period characterized by a temporary highly increased fertility rate.

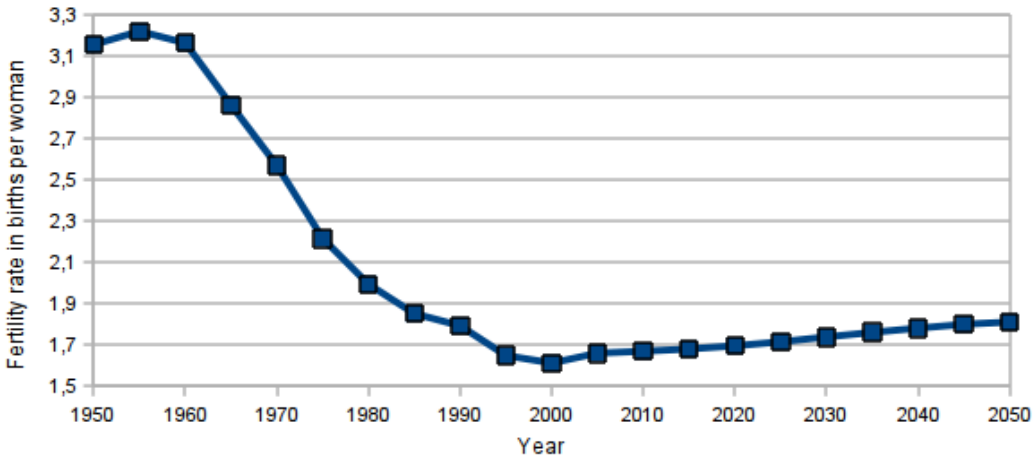

Figure 2.5.: Fertility rate in the OECD countries.

Source: [United Nations Data, 2010].

Chapter 3.

Health Care Expenditures

In a research mentioned in Chapter 2 a positive relationship has been shown between aging of the population and government expenditures, such as pensions and health care [Masson and Tryon, 1990]. The focus in this paper will be on the latter. Figure 3.1 shows health care expenditures have risen in the last years in the OECD countries.

A few researches show aging of the population is seen as a cause for this increase in health care expenditures. It is shown health care costs in the Netherlands increase slowly as one gets older during adult life and increase exponentially after the age of 50 [Meerding et al., 1998]. This thus means health care costs will increase in an aging population. The most important causes of the rise in these costs are costs related to mental disorders, musculoskeletal disease and dementia. Because of this, a large share

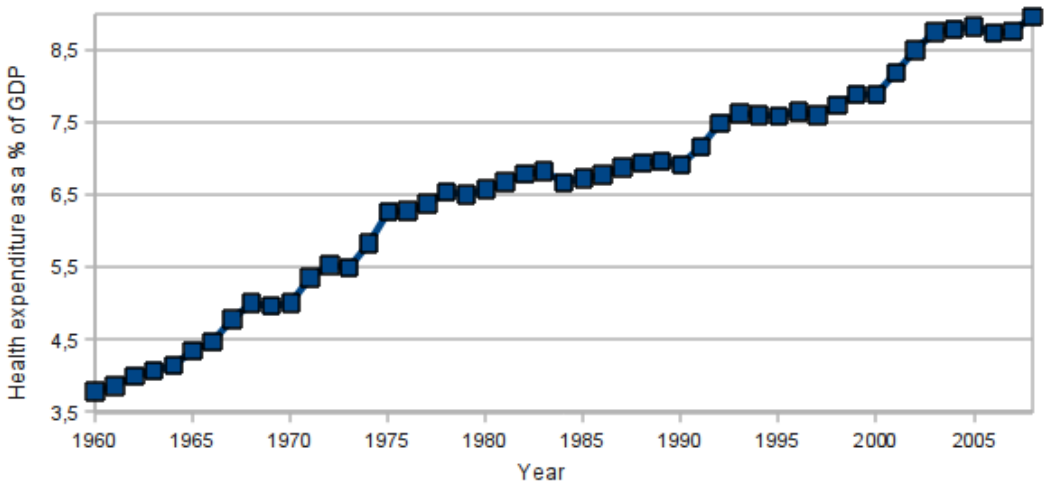

Figure 3.1.: Health care expenditures in the OECD countries.

Source: [OECD Health Data, 2009].

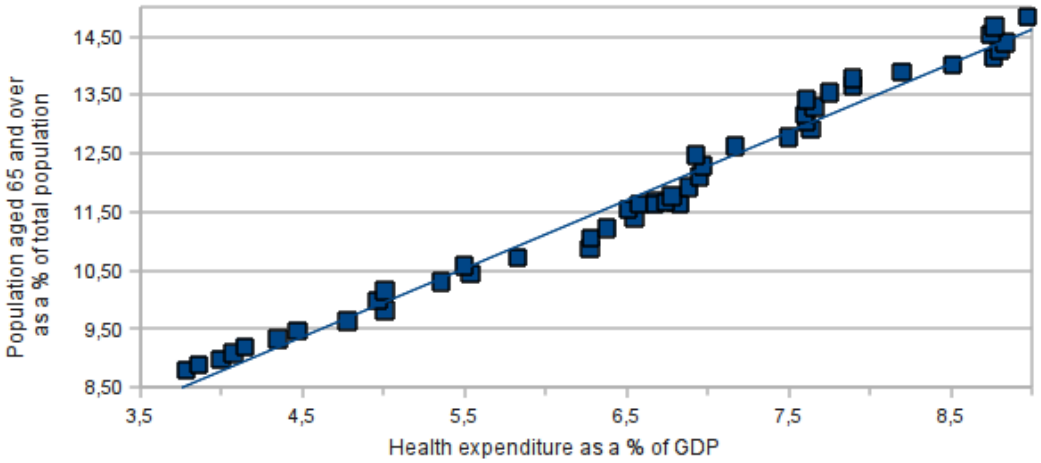

Figure 3.2.: Health care expenditures and aging of the population in the OECD countries.

Source: [OECD Health Data, 2009] and [World Development Indicators Online, 2010].

of the health care expenditures are spent on long term nursing care. Since this care will have to be provided on a longer term in an aging population, it is straightforward these expenditures will increase in an aging population [Meerding et al., 1998]. It is also shown this trend is expected to continue: as populations keep on aging, health care costs will keep on rising. The costs of treating people aged 65 and over increased more than the costs of treating people aged between 0 and 64 [Mendelson and Schwartz, 1993]. Figure 3.2 shows a positive relationship between aging of the population and health care expenditures in the OECD countries from 1960-2008. As a population ages, its health care expenditures rise. The trend line clearly shows this positive relationship.

Table 3.1 shows the results of a linear regression analysis using the data on aging of the population and health care expenditures in the OECD countries in the last few years (1980-2008). Thus the number of observations, N, is 29. Health care expenditures as a % of GDP (Hce) is the dependent variable and population aged 65 and over as a % of total population (Pop) is the independent variable. The formula will then become:

$$Hce = Constant + x * Pop \tag{3.1}$$

For instance, if it is expected in a certain year that 15% of the total population consists of people aged 65 and over, the expected health care expenditures as a % of GDP would be: -1,83 + 0,72 * 15 = 8,97. The R^2 of the correlation between aging of the population and health care expenditures is 0,940. This means 94% of the variation of health care expenditures can be explained by aging of the population. This leaves only

Table 3.1.: Health care expenditures and aging of the population in the OECD countries.

Hce = Constant + x * Pop		
	Coefficient	P-value
Constant	-1,83	0,150
Pop	0,72	0,000

Note: N = 29, R^2 = 0,940, D-W = 0,477 and homoscedasticity = yes.

Source: [OECD Health Data, 2009] and [World Development Indicators Online, 2010].

6% unexplained variation. The P-value of aging of the population is 0,000. Since this is below the significance level[1], the null hypothesis[2] should be rejected. This thus means the correlation is statistically significant. The extent to which a population is aging is directly correlated to the health care expenditures.

Rather than evidence of an actual economic correlation, a probably important explanation for the finding of such a significant result between aging of the population and health care expenditures is that the two variables might have a unit root; they could be non-stationary. Both variables have a time trend, since they increase upward as time changes and this might explain the previously found significant correlation. To truly be able to find a possible correlation, this time trend has to be corrected for. The results of the regression analysis might be considerably altered because of this.

To check for stationarity, the Augmented Dickey Fuller (ADF) test is performed. The null hypothesis is that there is a unit root. Table 3.2 shows health care expenditures is indeed a non-stationary variable since the t-statistic of 0,413 is greater than the critical values at all significance levels. Thus, the null hypothesis cannot be rejected. Table B.1 (see Appendix B) shows the same outcome for aging of the population. This is also a non-stationary variable, since the t-statistic of 1,961 exceeds all critical values.

Unit roots can generally be corrected for by taking the first differences[3] of the variables. Taking the first differences of the variables will probably resolve the non-

[1]The significance level is the minimum amount of evidence needed to reject the null hypothesis; the commonly accepted level of 0,05 is used.

[2]The null hypothesis hypothesizes that an event has occurred by chance and that there is thus no relationship between the variables.

[3]The first difference is the change from one period to the next; it is calculated by subtracting the value of the previous period from that of one period later.

Table 3.2.: Health care expenditures: a non-stationary variable.

	T-statistic	P-value
Augmented Dickey Fuller test statistic	0,413	0,980
Critical value 1% level	-3,689	
Critical value 5% level	-2,972	
Critical value 10% level	-2,625	

Source: [OECD Health Data, 2009].

Table 3.3.: Health care expenditures and aging of the population in the OECD countries.

Hce = Constant + x * Pop		
	Coefficient	P-value
Constant	0,09	0,083
Pop	-0.42	0,913

Note: N = 28, R^2 = 0,000, D-W = 1,318, J-B = 1,090 and homoscedasticity = yes.

Source: [OECD Health Data, 2009] and [World Development Indicators Online, 2010].

stationarity problem [Gupta, 1999]. When the ADF test is repeated with the first differences of the variables, it is shown these first differences are indeed stationary variables.

To be able to draw conclusions from a possible correlation, the same regression analysis as in Table 3.1 is repeated, only now the first differences of the variables are used. Table 3.3 shows the results. After taking the first differences, the stationarity problem is controlled for. The P-value of aging of the population has increased to 0,913. This means that after the correction there is no longer a statistically significant correlation between health care expenditures and aging of the population. The fact that both variables were non-stationary was a major reason for finding a statistically significant correlation previously. Correspondingly, the R^2 of this correlation is 0,000. This means 0% of the variation in health care expenditures can be explained by aging of the population.

In this regression analysis, the unit roots have been controlled for. To be able to draw general conclusions from this analysis based on such a sample as the OECD countries, a few assumptions have to be true though. Among these assumptions are non-zero variance, multicollinearity, linearity, homoscedasticity, independent errors and normally

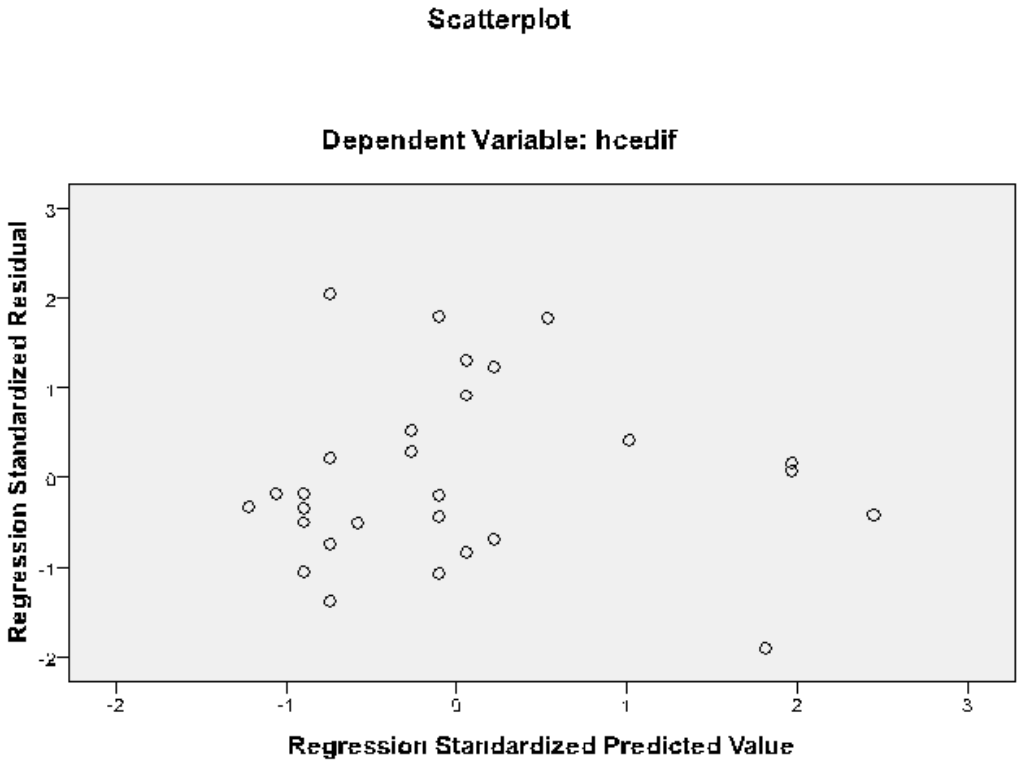

Figure 3.3.: Health care expenditures and aging of the population: homoscedasticity.

Source: [OECD Health Data, 2009] and [World Development Indicators Online, 2010].

distributed errors, [Field, 2009]. The latter three are the most important ones and thus these will be researched.

In Figure 3.3 it is shown that the assumption of homoscedasticity[4] amongst the residuals is met for this regression analysis. It also does not show any sign of non-linearity. The points are randomly and evenly distributed throughout the plot. If the plot would have shown the shape of a funnel, thus becoming more spread out across the plot, this would have been a strong indication for heteroscedasticity. The variance would have been increasing across the residuals and thus would have violated the assumption of homoscedasticity [Field, 2009].

[4]Homoscedasticity means that the residuals at each level of the predicting variable(s), thus the independent variable(s), should have the same variance.

Table 3.4.: Health care expenditures and aging of the population: normality of the residuals.

	Chi^2-statistic	P-value
Jarque-Bera test statistic	1,090	0,580

Source: [OECD Health Data, 2009] and [World Development Indicators Online, 2010].

The assumption of independent errors[5] of the residuals is also met for this regression analysis. This assumption is tested with the Durbin-Watson test, which tests for correlation between errors. The test statistic has a range of 0 to 4. A value of 2 means the residuals are not correlated. A value above 2 indicates a negative correlation and a value below 2 a positive one. As a rule of thumb, a value below 1 or above 3 strongly indicates the residuals are correlated [Field, 2009]. The Durbin-Watson statistic for the regression analysis between health care expenditures and aging of the population, using the first differences, is 1,318. It can thus be concluded there is no correlation between the residuals and the assumption of independent errors has been met.

To test for the normal distribution of errors[6] the Jarque-Bera test is used. The null hypothesis of this test is that the residuals are normally distributed. The critical value of the statistic at a significance level of 5% is 5,99. This means that if the test statistic exceeds this value, the null hypothesis should be rejected. Similarly, if the P-value corresponding to the Jarque-Bera statistic is lower than the significance level of 0,05 the null hypothesis should be rejected. In Table 3.4 is shown the residuals of the regression analysis from Table 3.3 are normally distributed. The Jarque-Bera statistic of 1,090 is lower than the critical value of 5,99. The null hypothesis can not be rejected and thus it can be concluded that the residuals are normally distributed.

As shown previously, aging of the population is often seen as the main cause for the rise in health care expenditures. It is not so evident at all though, that this is true. Aging of the population is a too gradual a process to consider it to be the major cost driver of health care expenditures [Reinhardt, 2003]. There are non-demographic variables that are of equal significance when it comes to explaining the rise in health care expenditures.

[5]Independent errors means the residuals should be uncorrelated and independent for any two observations: they should not be auto-correlated.

[6]Normal distribution of errors means the residuals in a model should be randomly, normally distributed variables with a mean of 0.

Using a sensitivity analysis, it is shown these variables include wages, investments in physical capital, pharmaceutical spending, the general health status of the population, costs related to death, income and decisions made by the government. The main drivers are policy decisions to improve the access to and quality of health care and technological development. [European Commission, 2009]. Another research also shows the largest part of health care expenditures are caused by technology. The reason for this is that advancements are made in the medical field, in this paper also referred to as the 'march of science' [Jones, 2002]. At a certain point, one has to wonder whether or not adding extra time to someone's life is worth the cost, especially if the extra time means living with a considerably lower state of health, i.e. a lower quality of life. Next to technology, some other factors to consider when it comes to explaining health care expenditures are workforce shortages and market power in the health care industry [Reinhardt, 2003]. When only taking into account the aging of the population, health care expenditures are not expected to increase significantly more than what can be expected due to normal economic growth. Health care expenditures can only be expected to rise above this level when the rate of utilization by the elderly increases faster than for the general population [Barer et al., 1987].

Some researches even show the significance of the relationship between aging of the population and health care expenditures will decrease considerably when other variables are included into the analysis. For instance, using cross-sectional and time series analyses it is shown that when inflation and GNP are controlled for, there is no longer an apparent association between aging of the population and health care expenditures [Getzen, 1992]. Another example; when remaining time to death is controlled for in a regression analysis, there is practically no effect left of aging of the population on the demand for health care. This because the largest share of health care costs are made in the last two years of life. Thus, shown using polynomial regression, the last phase of life is costly independently of whether it occurs at age 60 or at age 90. The positive correlation may simply be caused by the fact that there are more people in the last phase of their life at age 90 than at age 65. Aging of the population shifts health care expenditures to a higher age, but the health care expenditures per capita remain unchanged [Zweifel et al., 1999]. Another research also shows that age has a negligible effect on health care expenditures on the individual level. It is the proximity to death that is strongly related to an individual's health care expenditures. If this is controlled for, a person's age does not have a significant effect on his or hers health care expenditures any longer [Werblow et al., 2007]. It is also shown a large share of health care expenditures can be accounted for by those people in the last phase of their life or with chronic illnesses [Wennberg et al., 2002]. As a population ages

and as people with chronic illnesses live longer nowadays, the number of people with a chronic illness will increase. This does not necessarily mean health care expenditures will rise though, since major chronic illnesses such as hypertension, depression, diabetes and heart failure can be treated more effectively due to recent progress made in this field. So, more people might have a chronic illness, but the total costs of treating chronic illnesses are not necessarily rising because of it [Wagner et al., 2001].

Using a simulation, it is shown that cumulative health care expenditures for healthier elderly persons are, despite the fact that healthier persons have a higher life expectancy, practically similar to those for less healthy persons [Lubitz et al., 2003]. An explanation for this is that from the age of 70 until death healthier persons have a lower annual expenditure on health care than do less healthy persons. Healthier persons do require a higher number of years of health care, but the lower annual spending compensates for this extra time, resulting in nearly equal health care expenditures for healthier compared to less healthy persons [Lubitz et al., 2003]. Higher spendings on health care do not significantly result into more effective care or better health in general [Wennberg et al., 2002]. The slightly higher costs for less healthier persons can only be accounted for by costs for long term care, where aging matters regardless of the remaining time to death. These costs include costs related to prescription drugs, hospitalization and nursing homes, all on a long term basis [Werblow et al., 2007].

Other researches even show health care expenditures are reduced by aging of the population. One research for instance shows that most health care costs are made in the last two years of life. A higher life expectancy, which is directly related to aging of the population, means a smaller share of the elderly is in this last phase. Health care expenditures are postponed further into the future. This thus means current health care expenditures are decreased by aging of the population. Furthermore, people are expected to die at an older age, when costs of dying are typically lower than at a younger age. Also, disability rates have been declining. If sustained, this will also reduce health care expenditures. Even though these trends reduce the average medical spendings on the elderly, the total health care expenditures are likely to increase mostly due to technological developments [Cutler and Sheiner, 1998]. Also, using a generational accounting model[7] it is shown that a higher life expectancy results in an increase in health care expenditures. It is accompanied by a better health status though, which

[7]Generational accounting is a method designed to show the revenue and expense of the government for an average citizen over his or her life time.

in turn decreases health care expenditures. When both trends are taken into account, total health care expenditures are actually reduced [Westerhout and Pellikaan, 2005].

In the next sections the following variables will be introduced which might be causes for the rise in health care expenditures as well: inflation, gross domestic product, government expenditures and research & development expenditures. Furthermore, it will be investigated whether or not these variables have an impact on the significance of the correlation between aging of the population and health care expenditures, which was found before. Since it will be shown these variables have a time trend as well and thus are non-stationary, all regression analyses will be performed using the first differences of the variables.

3.1. Inflation

Inflation is defined as a rise in the general level of prices in the economy as a whole. Goods and services become more expensive in the course of time. With the same amount of money, less goods and services can be acquired than before. Figure 3.4 shows the general level of prices in the economy in the OECD countries has indeed risen every year. The increase has become less though over the past couple of years and inflation is expected to stabilize around an annual 2% increase in the coming years.

The rise in health care expenditures might be explained by goods and services becoming structurally more expensive every year. The rise in health care expenditures might be a direct result of the simple fact that prices in the whole economy are rising. Figure 3.5 does show this positive relationship between inflation and health care expenditures in the OECD countries from 1980-2008. Inflation should be seen as a cause for the rise in health care expenditures [Getzen, 1992].

Table B.2 (see Appendix B) shows inflation is a non-stationary variable, since the Augmented Dickey Fuller test statistic of 1,957 is higher than all critical values. Thus, the first differences will be used in the regression analysis.

Table 3.5 shows the results of a regression analysis between inflation and health care expenditures in the OECD countries in the last few years (1980-2008). Health care expenditures as a % of GDP (Hce) is the dependent variable and inflation, consumer

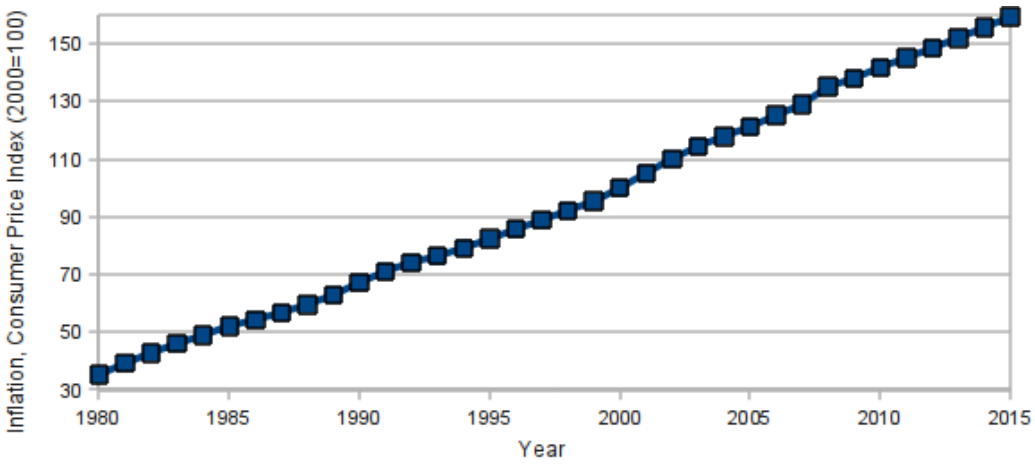

Figure 3.4.: Inflation in the OECD countries.

Source: [International Monetary Fund World Economic Outlook Database, 2010].

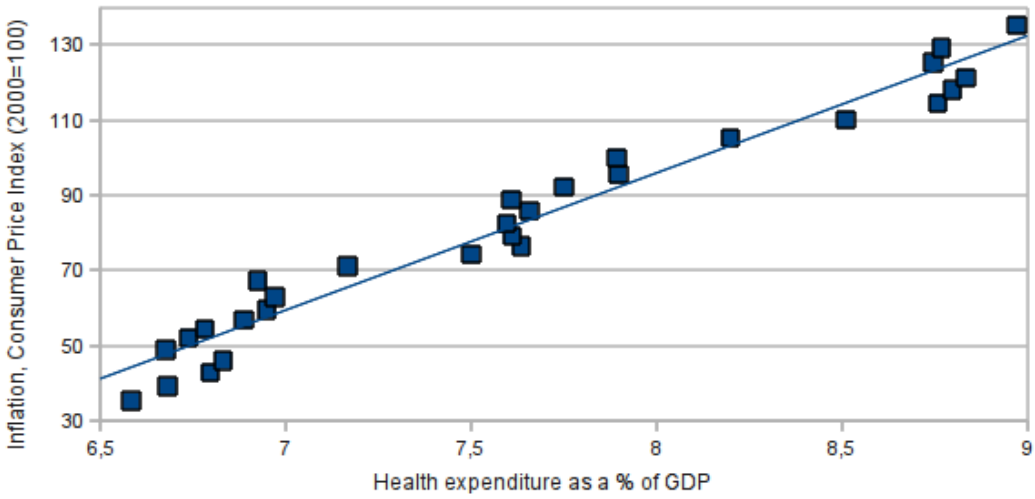

Figure 3.5.: Health care expenditures and inflation in the OECD countries.

Source: [OECD Health Data, 2009] and [International Monetary Fund World Economic Outlook Database, 2010].

Table 3.5.: Health care expenditures and inflation in the OECD countries.

Hce = Constant + x * Inf		
	Coefficient	P-value
Constant	-0,106	0,257
Inf	0,054	0,041

Note: N = 28, R^2 = 0,151, D-W = 1,472, J-B = 0,291 and homoscedasticity = yes.

Source: [OECD Health Data, 2009] and [International Monetary Fund World Economic Outlook Database, 2010].

price index (2000=100) (Inf) is the independent variable. The corresponding formula is:

$$Hce = Constant + x * Inf \tag{3.2}$$

The R^2 of the correlation between inflation and health care expenditures is 0,151, which means 15,1% of the variation of health care expenditures can be explained by inflation. The P-value corresponding to inflation is 0,041, which means the correlation is statistically significant. The level of inflation in a country is directly correlated to its health care expenditures.

The Durbin-Watson statistic for this regression analysis is 1,472, which indicates the error terms are not auto-correlated. The assumption of independent errors has thus been met. In Figure A.1 (see Appendix A) it is shown that the assumption of homoscedasticity is met for this regression analysis. It also does not show any sign of non-linearity. Table B.3 (see Appendix B) shows the residuals from this regression analysis are normally distributed since the P-value corresponding to the Jarque-Bera test is 0,865. This is higher than the significance level of 0,05.

3.2. Income

Gross domestic product (GDP) or gross domestic income measures the market value of all goods and services in a given country per year. It is a measure of income. Usually, GDP rises every year. Figure 3.6 also shows this rise in GDP in the last few decades in the OECD countries.

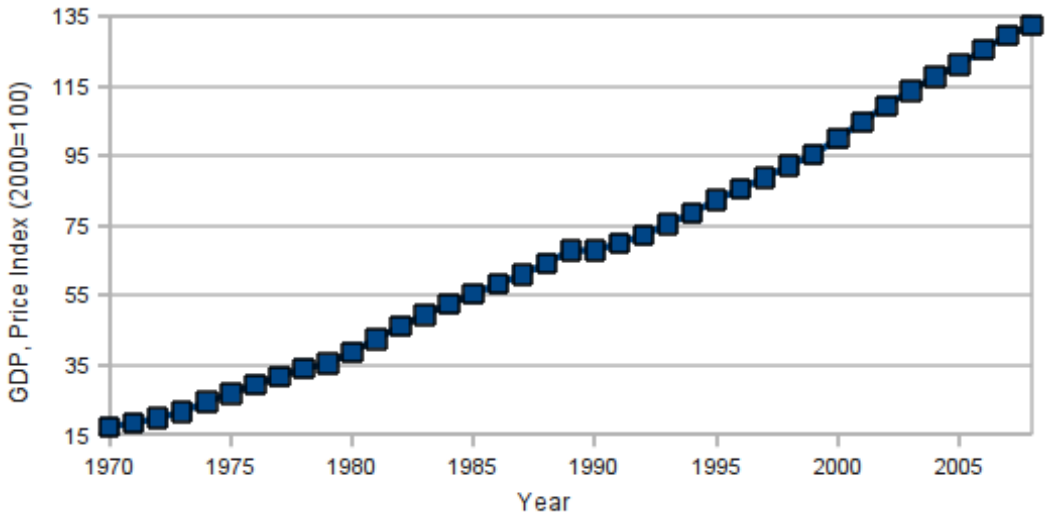

Figure 3.6.: Gross domestic product in the OECD countries.

Source: [OECD Health Data, 2009].

Based on panel data it is shown that as income rises expenditures on goods and services, such as health care, will generally rise [Ligthart, 2006]. Differences in health care expenditures between countries can mainly be explained by differences in average income. A rising income enables people to have higher standards when it comes to health care. Also, more money can be spend on enhancing health care [Sociaal Cultureel Planbureau, 2004]. Income is one of the most important variables when it comes to explaining health care expenditures. The income elasticity reaches such a level that it is indicated that health care is a luxury good. This means the extent to which health care can be utilized depends on the level of income. The demand for health care increases more than proportionally when income rises [Gerdtham and Jönsson, 2000]. Again, another research shows the rise in income levels is one of the main causes for the rise in health care expenditures. Rising income forces governments to provide a higher quantity and quality of health care. Income is one of the main indicators of living standards. When these living standards rise because of a rising income, people raise their expectations when it comes to health care. Also, a higher income means more can be invested in medical research and implementing new technologies [European Commission, 2009]. Figure 3.7 shows a positive relationship between GDP and health care expenditures in the OECD countries from 1970-2008.

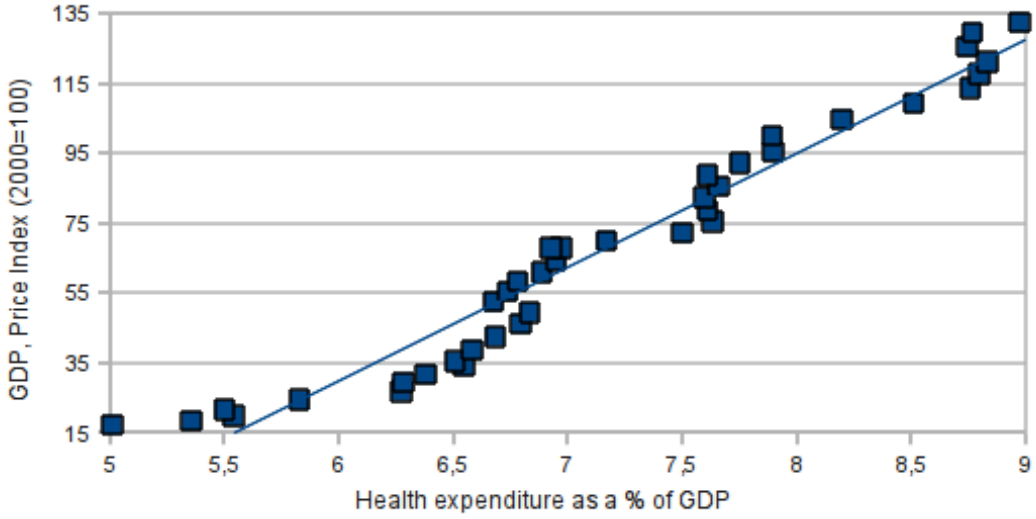

Figure 3.7.: Health care expenditures and gross domestic product in the OECD countries.

Source: [OECD Health Data, 2009].

Table B.4 (see Appendix B) shows gross domestic product is a non-stationary variable. The t-statistic of 2,213 exceeds all of the critical values. Consequently, the first differences will be used in the regression analysis.

Table 3.6 shows the results of a linear regression analysis between the data on GDP and health care expenditures in the OECD countries (1980-2008). Health care expenditures as a % of GDP (Hce) is the dependent variable and GDP, price index (2000=100) (Gdp) is the independent variable. This gives the following formula:

$$Hce = Constant + x * Gdp \tag{3.3}$$

The R^2 is 0,022. This means 2,2% of the variation of health care expenditures can be explained by the level of GDP. The P-value of GDP is 0,447, which means the relationship is not statistically significant. The level of GDP seems to have no significant effect on the level of health care expenditures.

This regression analysis meets both the assumptions of independent errors and of homoscedasticity. The Durbin-Watson statistic is 1,337, indicating no auto-correlation among the residuals. Figure A.2 (see Appendix A) shows no sign of heteroscedasticity.nor of non-linearity. The assumption of normality of the residuals is also met. Table B.5 (see Appendix B) shows the P-value corresponding to the Jarque-Bera statistic is 0,583, which exceeds the significance level of 0,05.

Table 3.6.: Health care expenditures and gross domestic product in the OECD countries.

Hce = Constant + x * Gdp		
	Coefficient	P-value
Constant	0,02	0,824
Gdp	0,019	0,447

Note: N = 28, R^2 = 0,022, D-W = 1,337, J-B = 1,080 and homoscedasticity = yes.

Source: [OECD Health Data, 2009].

3.3. Government expenditures

Government expenditures are defined as those expenditures, including expenditures done on behalf of another, which are done by the general government of a country on individual and collective consumption goods and services. As generally over time the amount of money a government has to spend rises, it is a global trend government expenditures rise as well. Figure 3.8 also shows this trend in the OECD countries in the last few decades. Even though government expenditures as a % of GDP show an increase over time, on the short term this variable seems to be fairly volatile.

In any country, it is generally the government that decides how much money is spend in any particular field, including health care. Health care expenditures actually are a significant part of public expenditures. It generally is a common standard for all highly developed countries that at least basic health care is provided to every member of its society by the public sector, so free of any charge [Dybczak and Przywara, 2010]. In another research it is shown that even though the health care sector is financed by both public as well as private parties, in almost the entire European Union governments cover the largest part of health care expenditures. So, government expenditures are a factor of interest when it comes to explaining health care expenditures [European Commission, 2009]. Another research shows a large and growing part of the government expenditures in the United States can be ascribed to health care. Through a data study, it is shown public spendings on health care are increasing and private spendings are decreasing in the United States [Jenson, 2008]. The amount of money governments spend on individual and collective goods and services rises. This means there is a bigger budget available to spend on goods and services, including health care. As a result of this, the expenditures on health care rise. Figure 3.9 shows this positive relationship in the OECD countries

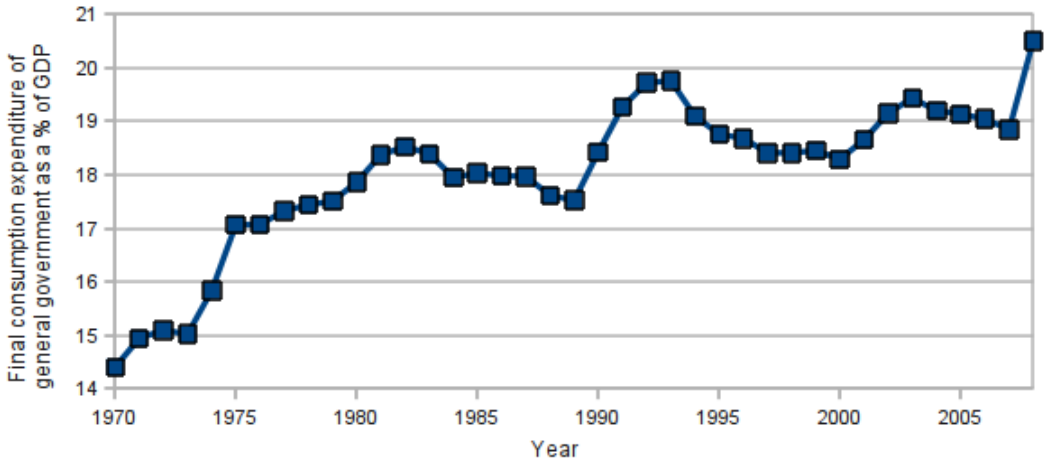

Figure 3.8.: Government expenditures in the OECD countries.

Source: [OECD Health Data, 2009].

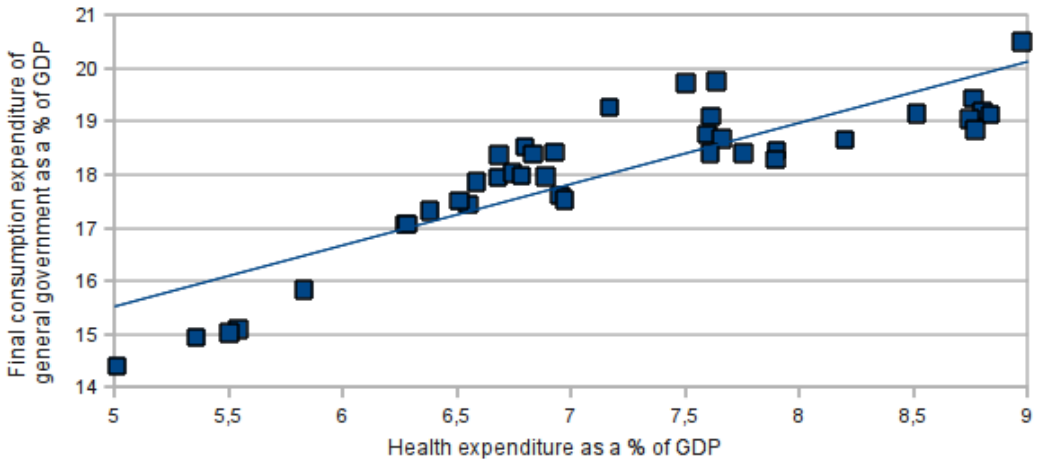

Figure 3.9.: Health care expenditures and government expenditures in the OECD countries.

Source: [OECD Health Data, 2009].

from 1970-2008. The more money a government has to spend, the higher health care expenditures are.

The Augmented Dickey Fuller test shows a t-statistic of -1,393 for government expenditures. In Table B.6 (see Appendix B) it can be observed that this is higher than all critical values. Thus, government expenditures has a unit root; it is a non-stationary variable. The first differences will be used in the regression analysis.

Table 3.7 shows the results of a linear regression analysis based on the data of government expenditures and health care expenditures in the OECD countries (1980-2008).

Table 3.7.: Health care expenditures and government expenditures in the OECD countries.

Hce = Constant + x * Gve		
	Coefficient	P-value
Constant	0,071	0,001
Gve	0,147	0,002

Note: N = 28, R^2 = 0,321, D-W = 1,430, J-B = 0,700 and homoscedasticity = yes.

Source: [OECD Health Data, 2009].

Health care expenditures as a % of GDP (Hce) is the dependent variable and final consumption expenditure of general government as a % of GDP (Gve) is the independent variable. The corresponding formula is:

$$Hce = Constant + x * Gve \tag{3.4}$$

The R^2 of this regression analysis is 0,321, which means 32,1% of the variation in health care expenditures can be explained by the level of government expenditures. This is a considerably higher percentage than previously found with the level of inflation and the level of income. The P-value of government expenditures is 0,002, which means the correlation is statistically significant. As government expenditures rise, health care expenditures do too.

This regression analysis meets both the assumption of independent errors of the residuals as well as homoscedasticity among the residuals. The Durbin-Watson statistic is 1,430, which does not indicate a clear sign of auto-correlation. Figure A.3 (see Appendix A) shows homoscedasticity and linearity amongst the residuals. Also, Table B.7 (see Appendix B) shows the residuals are normally distributed, since the P-value of the Jarque-Bera test statistic is 0,705. This is higher than the critical 0,05.

3.4. Technology

Technology is defined as the application of science in the design, production, utilization and organization of goods and services, mainly for fields such as commerce or industry. Innovations are done continuously. For innovations to become viable, they have to go through the process of research & development. Research & development is concerned

with discovering new knowledge, the research part, and then applying that knowledge to create new and improved goods and services which meet the market needs, the development part. Thus, research & development expenditures are an indicator for how much is being spent in the technology sector. Since the usage and knowledge of technology is increasing, research & development expenditures are rising as well. Figure 3.10 also shows this trend in the OECD countries in the last few decades.

In the field of medical science, technology is an important factor. When referred to in this particular field, technology is defined as follows by [OECD, 1998]: 'the drugs, medical equipment, health-care procedures, supportive systems, and the administrative systems that can tie all these disparate elements together'. Technology helps to prevent diseases and to improve the mobility of the elderly and health in general [OECD, 1998]. Medical technology is an important factor in the process of development, production, delivery and finance of health care. Moreover, it is shown that the largest part of health care expenditures in industrialized countries is caused by technological growth [Dybczak and Przywara, 2010]. Technological progress allows for medical advancements. These advancements make it possible to cure diseases which were not possible to cure in the past. Because of this, life can be extended. This progress does come at a cost, though, which is one of the causes for the rise in health care expenditures. The actual investments in the technology are costly. Furthermore, if life expectancy increases, people will live to face more serious and probably more costly health problems [Jones, 2002]. These researches all clearly show technology has a cost-increasing effect. This is mostly due to the costs of implementing new technologies and the costs of treating previously incurable or unknown diseases. Technology can also have a cost-decreasing effect though, since it can result in health care being provided more efficient and less invasive [European Commission, 2009]. This is intuitively appealing since technology provides specialists with more and better knowledge of treating specific medical conditions. Another research using panel data also shows technological advancements lead to more efficient and thus to less costly health care. The cost-increasing effect does seem to dominate the cost-decreasing effect though, which means expenditures on technology have a positive net effect on health care expenditures [Ligthart, 2006]. As more is spent on technology, for which research and development is an important indicator, the more health care expenditures will rise. This positive relationship is also shown in Figure 3.11 for the OECD countries from 1980 to 2008.

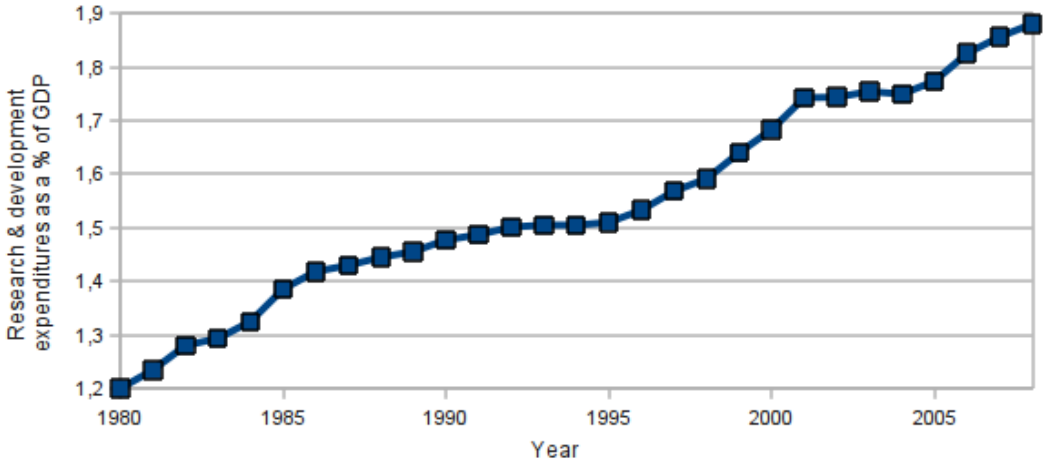

Figure 3.10.: Research & development expenditures in the OECD countries.

Source: [Source OECD Science and Technology Database, 2010].

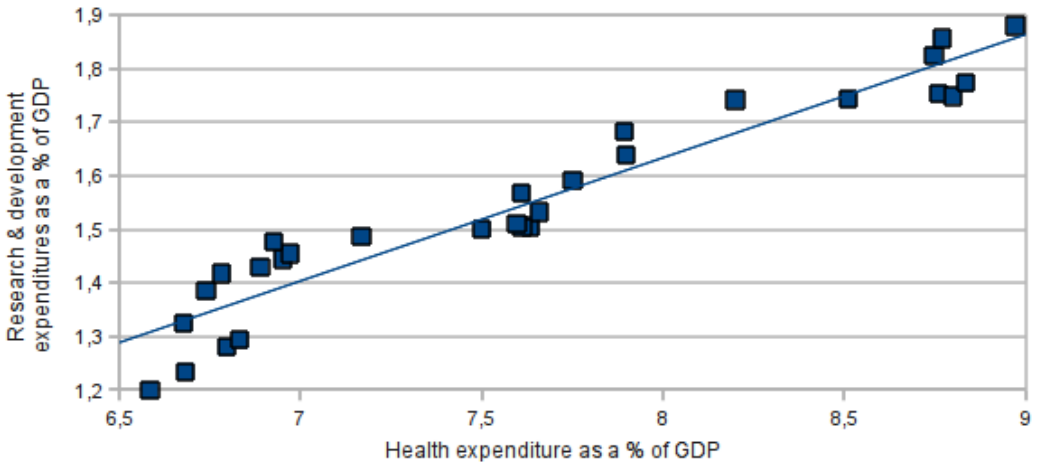

Figure 3.11.: Health care expenditures and research & development expenditures in the OECD countries.

Source: [OECD Health Data, 2009] and [Source OECD Science and Technology Database, 2010].

Table 3.8.: Health care expenditures and research & development expenditures in the OECD countries.

Hce = Constant + x * R&D		
	Coefficient	P-value
Constant	0,107	0,010
R&D	-0,929	0,484

Note: N = 28, R^2 = 0,019, D-W = 1,371, J-B = 1,331 and homoscedasticity = yes.

Source: [OECD Health Data, 2009] and [Source OECD Science and Technology Database, 2010].

In Table B.8 (see Appendix B) it is shown research & development expenditures is a non-stationary variable, since the t-statistic of -0,429 is higher than all of the critical values. In the regression analysis the first differences will be used.

Table 3.8 shows the results of a linear regression analysis performed with the data of research & development expenditures and health care expenditures in the OECD countries (1980-2008). Health care expenditures as a % of GDP (Hce) is the dependent variable and research & development expenditures as a % of GDP (R&D) is the independent variable. The formula that results from this is:

$$Hce = Constant + x * R\&D \tag{3.5}$$

The R^2 of this regression analysis is 0,019, which means 1,9% of the variation in health care expenditures can be explained by the level of research & development expenditures. The P-value corresponding to research & development expenditures is 0,484, which means the correlation is not statistically significant. The level of research & development expenditures does not have a significant effect on the level of health care expenditures.

Again, for this regression analysis both the assumptions of independent errors and homoscedasticity have been met. There is no indication of auto-correlation between the residuals since the Durbin-Watson statistic is 1,371. There is also no indication of heteroscedasticity amongst the residuals since Figure A.4 (see Appendix A) shows no sign of this. The residuals are normally distributed. The P-value corresponding to the Jarque-Bera statistic in Table B.9 (see Appendix B) is 0,514 and this exceeds 0,05. Thus, the null hypothesis of normality amongst the residuals can not be rejected.

3.5. Macroeconomic variables

Some of the previously researched variables have shown to have a significant effect on the level of health care expenditures. In this section, it will be researched whether or not adding these variables in the regression analysis has in impact on the correlation between aging of the population and health care expenditures.

Intuitively, if inflation is compensated for, the rise in health care expenditures might be nothing more than a direct result of the fact that prices are simply always rising. If inflation is added into the analysis, this might make the extent to which a population is aging even less important when it comes to explaining the rise in health care expenditures. It is indeed shown that after controlling for inflation and rising income, which are said to be the most important causes for explaining the rise in health care expenditures, the aging of the population becomes a less important factor [Getzen, 1992].

If GDP is compensated for, this might diminish the significance of aging of the population when it comes to explaining health care expenditures. If income is higher in a certain country, there is simply more money to spend. This includes health care expenditures. Correspondingly, if there is no rise in the income levels in a certain country, spendings can not significantly be increased regardless of the extent to which the population is aging. The rise in income might be a more important explanation for the rise in health care expenditures than aging of the population and it might even diminish the previously found significance level of aging of the population. Since it was shown in Table 3.6 though that gross domestic product was not a significant correlated with health care expenditures, it probably will not have a major role in diminishing the significance of aging of the population as a cause for the rise in health care expenditures either.

Similar to the level of income, if the government does not have any more money to spend, it does not matter whether or not the population is aging; health care expenditures can not be increased either way. Consequently, adding government expenditures into the analysis might decrease the importance of aging of the population as a factor.

The fact that health care expenditures are rising might be the simple result of rising expenditures on research and development, mainly consisting of discovering and developing new products and services and of improving already existing ones, and might thus be independent of aging of the population.

Table 3.9.: Health care expenditures, aging of the population, inflation, gross domestic product, government expenditures and research & development expenditures in the OECD countries.

Hce = Constant + x_1 * Pop + x_2 * Inf + x_3 * Gdp + x_4 * Gve + x_5 * R&D			
	Coefficient	P-value	VIF
Constant	0,027	0,792	
Pop	0,125	0,658	1,035
Inf	-0,072	0,059	3,543
Gdp	0,089	0,003	2,045
Gve	0,298	0,000	3,638
R&D	-1,013	0,311	1,077

Note: N = 28, R^2 = 0,570, D-W = 1,765, J-B = 0,926 and homoscedasticity = yes.

Source: [OECD Health Data, 2009], [World Development Indicators Online, 2010], [International Monetary Fund World Economic Outlook Database, 2010] and [Source OECD Science and Technology Database, 2010].

Table 3.9 shows the linear regression results from an analysis performed with data from the OECD countries from 1980-2008 where all previously mentioned variables are included. Once again, the first differences are used since all variables have shown to be non-stationary. In this analysis health care expenditures as a % of GDP (Hce) is the dependent variable. Population aged 65 and over as a % of total population (Pop), inflation, consumer price index (2000=100) (Inf), GDP, price index (2000=100) (Gdp), final consumption expenditure of general government as a % of GDP (Gve) and research & development expenditures as a % of GDP (R&D) are the independent variables. The corresponding formula is:

$$Hce = Constant + x_1 * Pop + x_2 * Inf + x_3 * Gdp + x_4 * Gve + x_5 * R\&D \qquad (3.6)$$

The R^2 of this total regression analysis is 0,570. This means 57% of the variation of health care expenditures can be explained by the independent variables, leaving only 43% unexplained variation. Clearly, when all variables are combined, a lot more of the variation of health care expenditures can be explained than any single factor could. This indicates most of the variables do have a significant impact.

The P-value of inflation is 0,059. This is just above the significance level of 0,05, which means inflation is no longer a significant factor if all other variables are included in the

analysis. If the less strict significance level of 10% is used though, it is still significant. The P-value is higher than the one that was shown for inflation in Table 3.5. The P-value of GDP is 0,003, which means this is now a significant factor when it comes to explaining the level of health care expenditures. This is also valid for government expenditures, with a P-value of 0,000. The P-value corresponding to research & development expenditures is 0,311 though, which is a lower value than was found when research & development expenditures was the only factor taken into account.

The P-value of aging of the population is 0,658. Since this exceeds the significance level there is no reason to reject the null hypothesis. There is still no statistically significant relationship between aging of the population and health care expenditures. The P-value has come closer to significance though, comparing to the P-value of 0,913 that was found when aging of the population was the only independent variable in the analysis. This can be explained by the limited number of observations of only 28. Since aging of the population is only just a recent trend, there is not much data available yet. Consequently, there is little variation in the numbers, making it hard to draw conclusions from the results.

This analysis does meet the assumptions of independent errors and homoscedasticity amongst the residuals. The Durbin-Watson statistic is 1,765, indicating that there is no auto-correlation amongst the residuals. This number is considerably higher than the number of the analyses where only one single factor was included. Figure A.5 (see Appendix A) indicates homoscedasticity and linearity amongst the residuals. Also, the assumption of normality of the residuals is met since the P-value corresponding to the Jarque-Bera statistic in Table B.10 (see Appendix B) of 0,630 exceeds the significance level of 0,05.

Some of the P-values of this regression analysis are very different from the results found in the regression analyses with the individual factors. Some of the results from this regression analysis might be misleading. This is probably because some of the variables are intertwined. For instance, if GDP rises significantly, inflation will probably do so too. Or, as government expenditures rise, more money is available to spend on research & development expenditures. To test for such relationships, the variance inflation factor (VIF) is investigated. This shows whether or not multicollinearity between the variables is present. It measures to what extent the variances of the coefficients are influenced by each other. There is no critical value for the VIF, but as a rule of thumb values higher than 5 or 10 should be reason for concern [Stine, 1995]. Since there is no critical value for the VIF, the highest values will be researched anyway. Both the variance inflation

Table 3.10.: Health care expenditures, aging of the population, gross domestic product, government expenditures and research & development expenditures in the OECD countries.

Hce = Constant + x_1 * Pop + x_2 * Gdp + x_3 * Gve + x_4 * R&D			
	Coefficient	P-value	VIF
Constant	-0,102	0,239	
Pop	0,156	0,604	1,031
Gdp	0,055	0,015	1,168
Gve	0,184	0,000	1,147
R&D	-1,372	0,192	1,041

Note: N = 28, R^2 = 0,493, D-W = 1,596, J-B = 0,707 and homoscedasticity = yes.

Source: [OECD Health Data, 2009], [World Development Indicators Online, 2010] and [Source OECD Science and Technology Database, 2010].

factors of inflation and government expenditures exceed 3,5. The analysis will thus be repeated twice: the first will be performed with inflation kept out of the analysis, the second will be performed with government expenditures kept out. The corresponding formulas will become as follows:

$$Hce = Constant + x_1 * Pop + x_2 * Gdp + x_3 * Gve + x_4 * R\&D \tag{3.7}$$

$$Hce = Constant + x_1 * Pop + x_2 * Inf + x_3 * Gdp + x_4 * R\&D \tag{3.8}$$

Table 3.10 shows the results of the linear regression analysis without inflation. After inflation has been removed from the analysis, the R^2 has dropped from 0,570 to 0,493. The VIF-values are all more near one, so the multicollinearity problem has become less. The significance levels of the various variables have not changed much. All assumptions are still met, since the Durbin-Watson statistic is 1,596, the Jarque-Bera statistic from Table B.11 (see Appendix B) is 0,707 and Figure A.6 (see Appendix A) shows no sign of heteroscedasticity.

Table 3.11.: Health care expenditures, aging of the population, inflation, gross domestic product and research & development expenditures in the OECD countries.

Hce = Constant + x_1 * Pop + x_2 * Gdp + x_3 * Gve + x_4 * R&D			
	Coefficient	P-value	VIF
Constant	-0,132	0,309	
Pop	0,076	0,893	1,033
Inf	0,057	0,045	1,117
Gdp	0,012	0,643	1,087
R&D	-1,584	0,242	1,060

Note: N = 28, R^2 = 0,206, D-W = 1,593, J-B = 0,711 and homoscedasticity = yes.

Source: [OECD Health Data, 2009], [World Development Indicators Online, 2010], [International Monetary Fund World Economic Outlook Database, 2010] and [Source OECD Science and Technology Database, 2010].

In the regression analysis in Table 3.11, government expenditures has been removed from the analysis. The R^2 has dropped to 0,206. The independent variables can only explain 20,6% of the variation in health care expenditures now. Clearly, government expenditures was being influenced by the other independent variables. In other words, the high R^2 was not the result of independent variables. The variables were dependent on one another. Gross domestic product is now not a significant variable any longer. Probably the only reason for the previously found significance was that gross domestic product and government expenditures were correlated: as GDP rises, governments have more money to spend. Also, aging of the population has become a less important factor. Apparently, as populations age, governments spend more on health care. All of the VIF-values have come even closer to one, indicating that the multicollinearity problem is near to gone. Government expenditures can thus better be eliminated and avoided when this regression analysis is being performed. In this way, the results are more reliable. The assumptions of independent, normally distributed and homoscedastic residuals are still met, since the Durbin-Watson statistic is 1,593, the Jarque-Bera statistic from Table B.12 (see Appendix B) is 0,711 and Figure A.7 (see Appendix A) shows there is homoscedasticity amongst the residuals

Chapter 4.

The Red Herring

In [Meerding et al., 1998] and [Mendelson and Schwartz, 1993] mentioned in Chapter 3 it was argued that aging of the population is one of the main drivers of the rise in health care expenditures. Among others, [Getzen, 1992], [Zweifel et al., 1999], [Werblow et al., 2007], [Wennberg et al., 2002], [Lubitz et al., 2003], [Cutler and Sheiner, 1998] and [Westerhout and Pellikaan, 2005] have shown this is not so straightforward though. From the results of the regression analysis can also be concluded that other variables are of a bigger importance when it comes to explaining the level of health care expenditures. The attempt to emphasize the positive correlation between aging of the population and health care expenditures is often referred to as a 'red herring'. Aging of the population is an external factor that is uncontrollable. If this is seen as the only cause for the rise in health care expenditures; there is no one to blame and policy decisions seem to be dictated. Emphasizing this variable while others, many of which controllable, are of bigger importance diverts attention away from the true causes of the rise in health care expenditures. Aging of the population is an uncontrollable demographic trend. It should be recognized that the rise in health care expenditures is not solely the outcome of such a trend. Health care expenditures are rather a corollary of political and professional choices than the consequence of uncontrollable trends [Getzen, 1992].

Continuing down the current path means higher tax rates, inflation, unemployment and political instability [Kotlikoff and Burns, 2004]. If health care expenditures keep rising and the main view remains there is nothing that can be done about it, at some point choices will have to be made about what part of the health care system should remain available for free to anyone and what part should be left to the free market [Wetenschappelijke Raad voor het Regeringsbeleid, 1997]. Since then richer people would be able to 'buy' more and better health care than poorer people, the outcome of this debate is

expected to be morally questionable. Because of the focus on aging of the population, attention is drawn away from the appropriateness, effectiveness and efficiency of current health care systems and the income levels it generates [Evans et al., 2001].

The choices that should be made, in particular with respect to new costly medical technology, are overlooked by emphasizing health care costs are inevitable. Attention is therefore diverted away from the true causes for the rise in health care expenditures and thus a 'red herring' is created [Zweifel et al., 1999]. The rise in health care expenditures is not caused by aging of the population or other uncontrollable variables, but by how a particular health care system responds. Thinking an uncontrollable variable such as the aging of the population is the cause for the rise in health care expenditures appeals intuitively. An illusion is created that the rise in health care expenditures is inevitable, in order to justify political and professional choices. This 'illusion of necessity' is generally chosen over the reality of choices that ought to be made [Evans, 1985].

Chapter 5.

Policy Implications

In Chapter 4, the increase of health care expenditures has shown to be more of a policy and cost management problem than a demographic problem. In another research, this conclusion was also drawn [Getzen, 1992]. By creating this 'red herring', attention is diverted away from the true causes for the rise in health care expenditures. The findings presented in this paper, which reinforce the view that aging of the population is not the sole cause for the rise in health care expenditures at least in the OECD countries, may have important policy implications. The rise in health care expenditures is for an important part due to policy decisions to improve the quality and access to health care. This is the result of a growing pressure of populations that have higher expectations for health care since the living standards have risen over the past few decades [European Commission, 2009]. Governments should choose to take responsibility for their actions and should no longer remain in the status quo while hiding behind the 'illusion of necessity'. Different choices might have a negative effect on the interests of the providers of health care and broader beliefs and principles [Zweifel et al., 1999]. This is probably one of the main reasons why these parties are hesitant to revise existing policies.

The rise in health care expenditures has shown to be not so inevitable at all. Thus, by making the right decisions, this rise can be reduced. For instance, freezing health care budgets or cutting health care expenditures by governments will have a slower growth rate than the current situation as a result. This would probably harm those people who are not wealthy enough to have a health care insurance and thus depend on the provision of health care services as a public good. It will thus come at the expense of the current generation, but it will come to the benefit of future ones. Since Section 3.5 showed that government expenditures have a significant impact on the level of health care expenditures, this is a policy that will probably have a considerable effect. Another

solution might be to promote competition in the market of health care. If private insurers will have to negotiate with health care providers about the quantity, quality and price of health care, the level of health care expenditures are probably reduced. This way though, insurers will be more inclined to select their clients based on the risk they will actually have a health problem in the future or ask a higher fee from those people with a higher risk. This is morally questionable since health care insurance should be available to anyone unconditionally, without making any distinctions [Westerhout and Pellikaan, 2005].

Health care is becoming more expensive partly as a result of income levels (Section 3.5). Income levels can be decreased, or at least the taxes paid on those income levels can be heightened. That way, people will have less money to spend on health care and thus health care expenditures will decrease. Another advantage of this is that governments will collect more tax money which they can spend on sectors other than health care. A disadvantage is that any form of taxation generally leads to a distortion of the market and thus to economic inefficiency. Since it was shown in Section 3.5 though that the level of GDP did not have a significant impact on the level of health care expenditures, the impact of this policy will probably not be significant either.

Another way to reduce health care costs is to invest in technology, such as in new machines or in research & development. Even though these investments might be costly at first, in the long run they can result in a reduction of health care expenditures. This is because investing in technology improves the effectiveness of health care. The overall health status will be improved, which has a lot of benefits for the society many of which can not be translated into a monetary value. The impact of this policy will be moderate though since Section 3.5 showed that the research & development expenditures did not have a significant impact on the level of health care expenditures. Other solutions might be to raise the age at which people are allowed to retire or to stimulate mothers to work more. This way, more money becomes available for these people to spend, which reduces the number of people that is not wealthy enough to buy health care insurance. This in turn mitigates the problem identified earlier.

Health care systems are producing inefficiently. Too much money is spend on services that are not really needed, while too little is spend on other services that would be valuable. Traditionally, payments for medical care have been based on the quantity of the services provided. The more services are available, the more incentives people have to use them, which leads to higher health care expenditures. Providers of health care get paid for certain services and thus these services are provided massively. Services that

yield a smaller reward are not provided as much. Needless to say, a high quantity does not always correspond with a high quality. A more efficient system would be to base the payments for medical care on quality. A higher quality would for instance mean expanding access, investing in technology or training personnel. Providers of health care should be rewarded more when measures are taken that result in an improvement of overall health after the service has been provided than providers that do not do this. The research by [Cutler, 2006] shows that such payment incentives do have an effect on the quality of the care that is provided. It is difficult to measure an increase of quality though. A trade-off usually does have to be made between costs and quality. The spendings for health care should be on such a level that spending more money does not result in a significant raise of the quality of health care any longer [Cutler, 2006]. Doctors, hospitals and governments in general are not so much focused on maximizing the number of patients helped any longer, but more on the quality of the service provided to these patients. When the quality of the service improves, it is also more likely patients will not have to return to be helped again, which decreases total health care expenditures. If both performance and improvement were to be rewarded, the productivity of health care systems will increase and better outcomes will be achieved [Rosenthal et al., 2005].

In a few researches it is actually shown that trying to limit the rise in health care expenditures does not necessarily have to have a negative effect on the level and quality of health care. In a research it is shown that the actual health status is practically the same in different cities in the United States, while in one city health care expenditures are relatively considerably lower than in another [Wennberg et al., 2002]. This same phenomenon can be observed when comparing the overall level of health care expenditures of the United States to that of Canada. In Canada the growth of health care expenditures has been considerably lower than in the United States, while not showing a significant difference in the health status of the populations [Evans, 1985].

In Section 3.5 inflation has shown to be a significant factor when it comes to explaining the level of health care expenditures. Inflation is a factor that can hardly be influenced by individual governments. Only large institutions such as the U.S. Federal Reserve or the European Central Bank can have an impact on the level of inflation [Canzoneri et al., 2002]. It is not to be expected though, that these institutions will revise their policy based solely on implications for the health care sector. Even if such institutions would decide to try to limit inflation, one can only wait and see whether or not the methods these institutions have to their disposal will have the desired impact. Thus, it can be seen as a generally inevitable trend that prices will rise, also for the health

care sector. All of the other possible policy alterations will have to mitigate this effect if governments are truly set on limiting the rise in health care expenditures.

Thus, by recognizing the rise in health care expenditures is not solely the result of external uncontrollable forces it should be acknowledged that the rise in health care expenditures might be limited by adjusting policies in this sector.

Chapter 6.

Conclusion

Aging of the population, mainly driven by an increase in longevity and a decrease in fertility, is a worldwide phenomenon. It is expected to continue on in the future. This research confirms this trend is indeed also present in the OECD countries. In general, aging of the population is expected to cause a rise in the health care expenditures as the elderly usually require more and more intense health care than the average of the total population. [Meerding et al., 1998] and [Mendelson and Schwartz, 1993] support this view. Initially, this research also showed such a strong relationship between aging of the population and health care expenditures. After correcting for the unit roots this correlation was no longer so strongly existent though. This implies there are other macro-economic variables that might be of more importance when it comes to explaining the level of health care expenditures.

One of these variables is inflation. As general price levels rise, health care expenditures are expected to rise as well. [Getzen, 1992] also shows inflation should be seen as a cause for the rise in health care expenditures. The results of this research confirm the correlation between the level of inflation and of health care expenditures in the OECD countries is statistically significant.

A rising income results in a rising amount of money to spend. As income rises, there is thus more money available to spend on health care. [Ligthart, 2006], [Sociaal Cultureel Planbureau, 2004], [Gerdtham and Jönsson, 2000] and [European Commission, 2009] show that the level of income is indeed a determinant for the level of health care expenditures. This research shows that this is not valid in the OECD countries in the last few decades though. The level of income does not seem to have a significant impact on the level of health care expenditures

Governments spend money on health care. Depending on how large their budget is, governments can decide how much to spend on health care. Thus, the level of government expenditures should be a good indicator for the level of health care expenditures. [Dybczak and Przywara, 2010], [European Commission, 2009] and [Jenson, 2008] show that the amount of money a government spends on health care is an important factor when it comes to explaining the level of health care expenditures. The results of this research also show a statistically significant correlation between these two variables in the OECD countries.

In health care, a lot of money is spend on research & development. This simple fact might be a main reason for the increase of health care expenditures. [Dybczak and Przywara, 2010], [Jones, 2002] and [Ligthart, 2006] show spendings on technology indeed increase health care expenditures. The results of the regression analysis do not imply a statistically significant correlation in the OECD countries though.

When all variables are analyzed together for the OECD countries, the results show aging of the population is not a statistically significant factor. The correlation between aging of the population and health care expenditures is altered by adding these variables. Inflation, government expenditures and gross domestic product are significant, whereas research & development expenditures is not. Surprising is that gross domestic product became statistically significant. When multicollinearity is controlled for though by removing government expenditures from the analysis since this variable was so clearly influence by the others, gross domestic product is not statistically significant anymore, leaving inflation as the only variable that has a considerable impact on the level of health care expenditures. This is sadly probably the hardest variable to control by individual governments, making it difficult to considerably decrease health care expenditures.

There is often a fixation on the correlation between aging of the population and health care expenditures. This is often referred to as a 'red herring'. By emphasizing aging of the population attention is diverted away from other possible causes. Aging of the population is an uncontrollable demographic factor. Recognizing that this is not the sole cause of the rise in health care expenditures, whereas other many of which controllable variables are, results into some important policy implications. Governments should decide to recognize that the rise of health care expenditures is not uncontrollable nor necessary. New policies should be adopted to try and reduce the rise in health care expenditures, such as cutting in health care budgets by governments, raising the level of taxes, reducing expenditures on technology or trying to influence the level of inflation.

Appendix A.

Figures

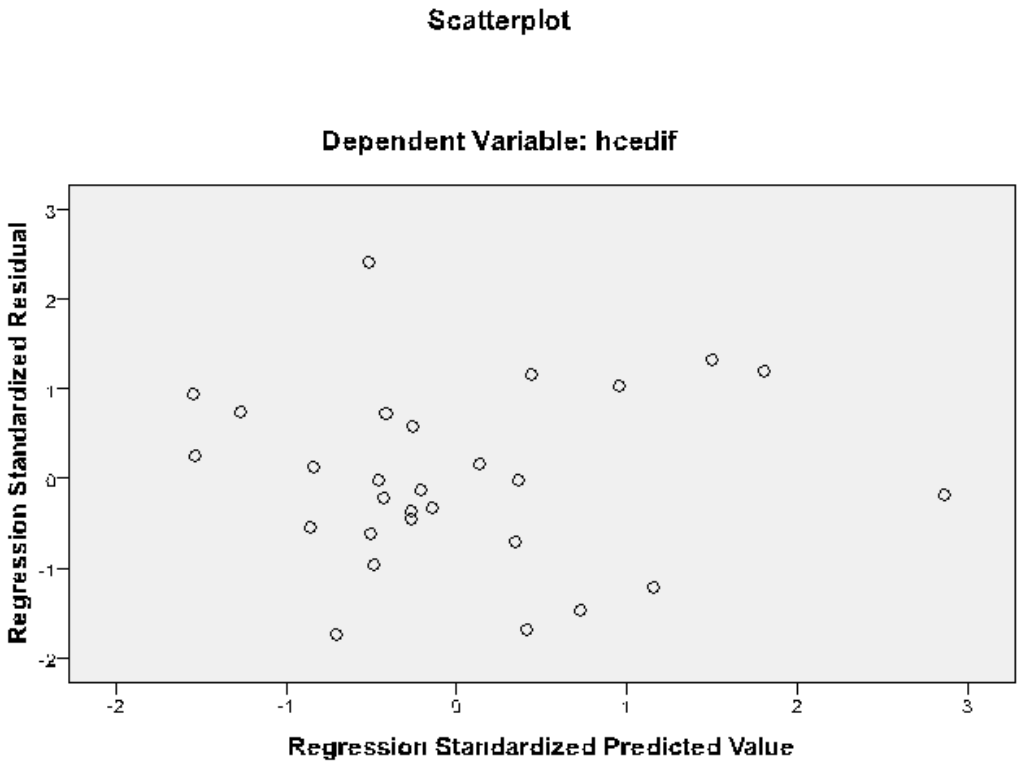

Figure A.1.: Health care expenditures and inflation: homoscedasticity.

Source: [OECD Health Data, 2009] and [International Monetary Fund World Economic Outlook Database, 2010].

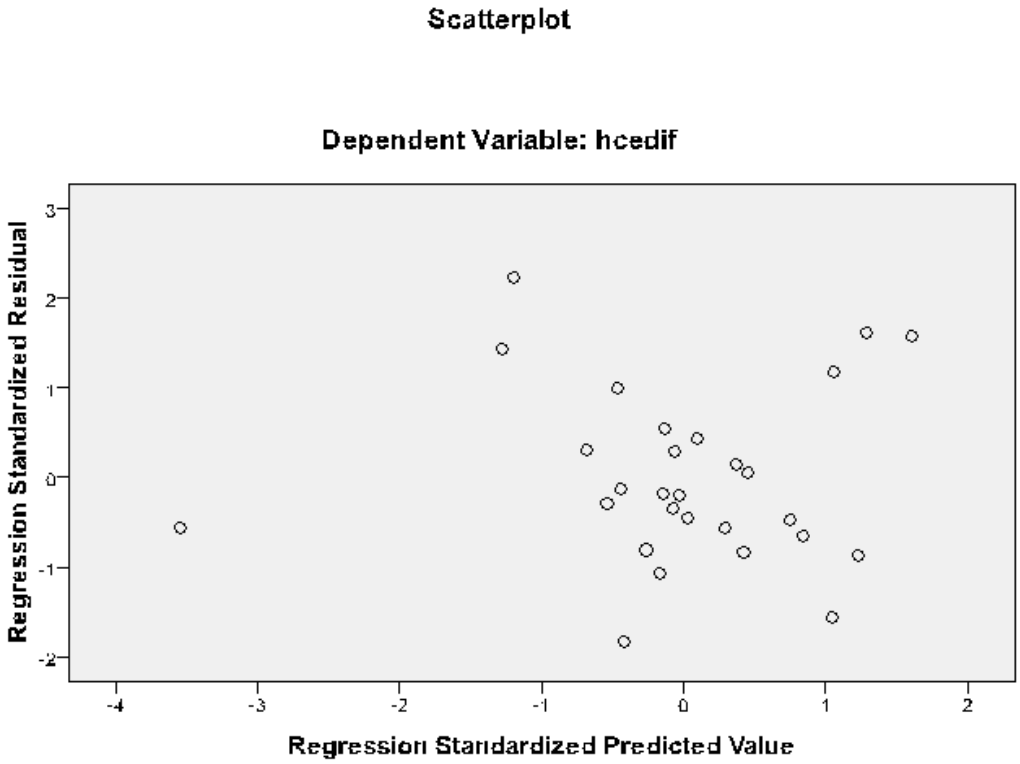

Figure A.2.: Health care expenditures and gross domestic product: homoscedasticity.

Source: [OECD Health Data, 2009].

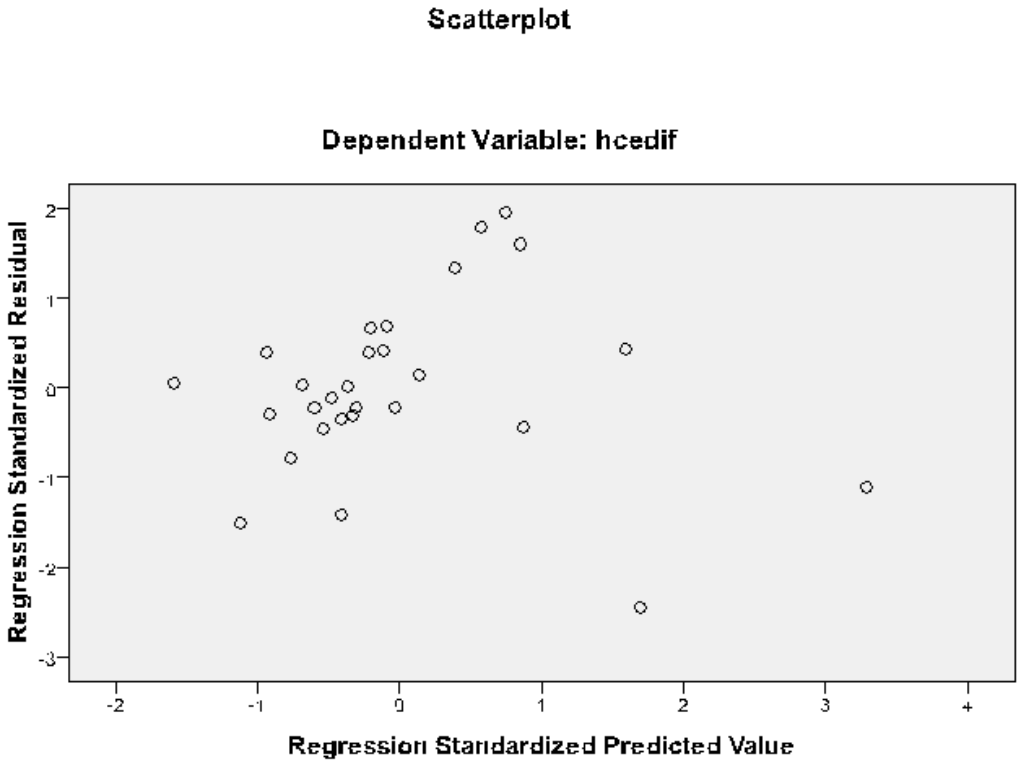

Figure A.3.: Health care expenditures and government expenditures: homoscedasticity.

Source: [OECD Health Data, 2009].

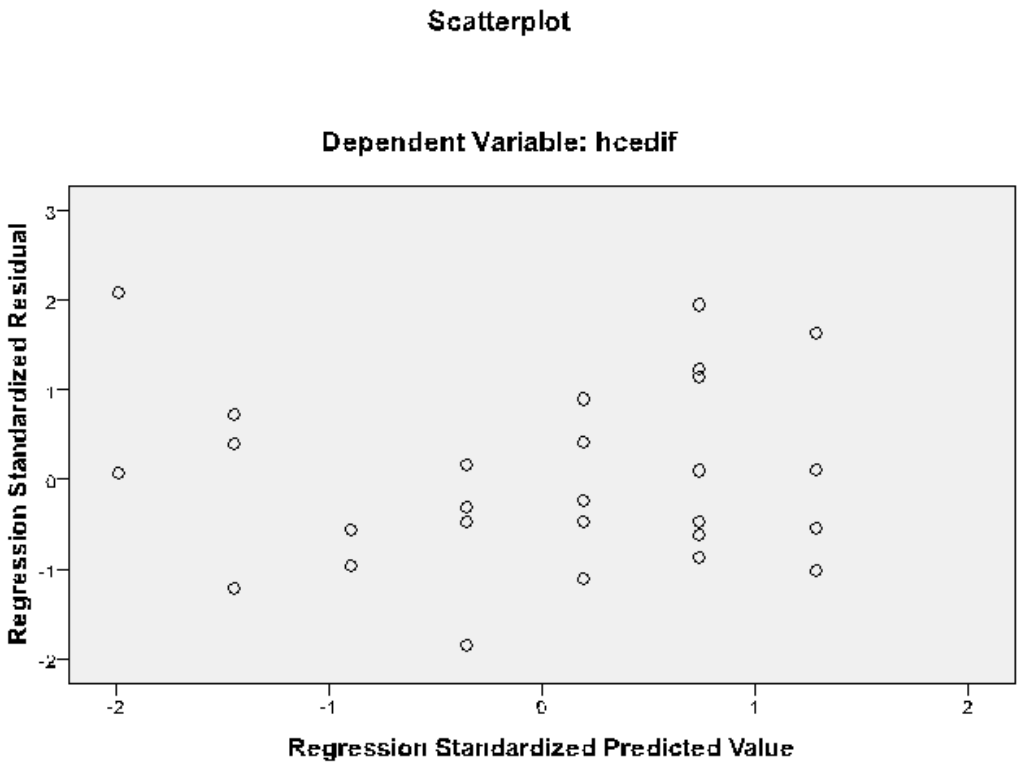

Figure A.4.: Health care expenditures and research & development expenditures: homoscedasticity.

Source: [OECD Health Data, 2009] and [Source OECD Science and Technology Database, 2010].

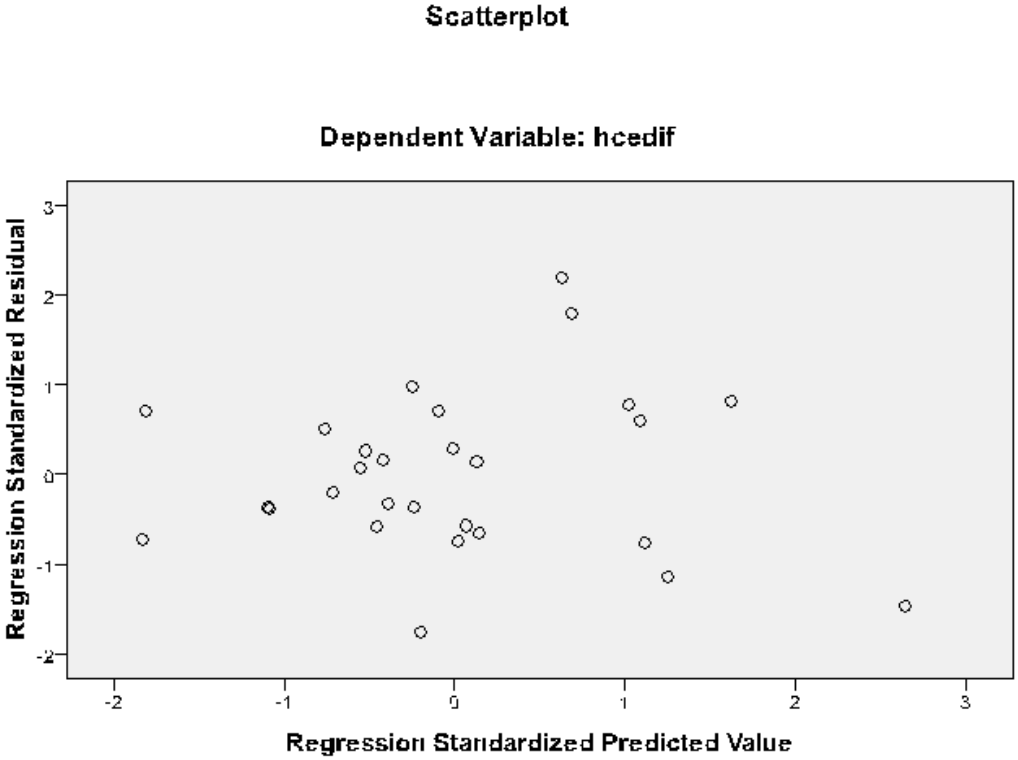

Figure A.5.: Health care expenditures, aging of the population, inflation, gross domestic product, government expenditures and research & development expenditures: homoscedasticity.

Source: [OECD Health Data, 2009], [World Development Indicators Online, 2010], [International Monetary Fund World Economic Outlook Database, 2010] and [Source OECD Science and Technology Database, 2010].

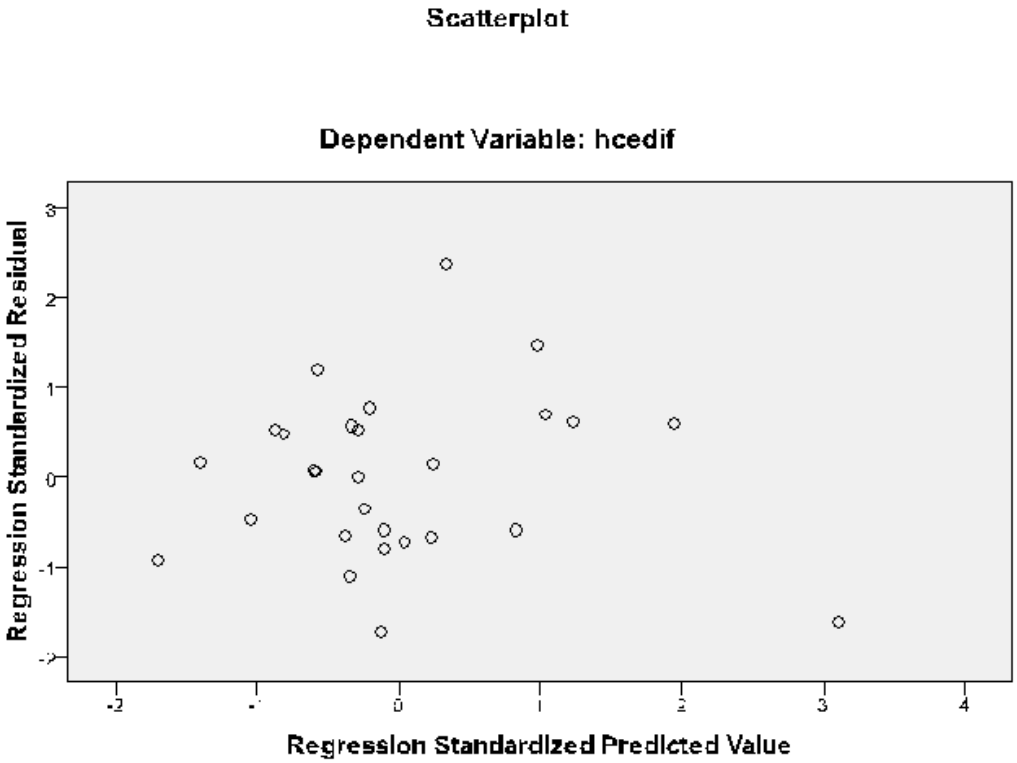

Figure A.6.: Health care expenditures, aging of the population, gross domestic product, government expenditures and research & development expenditures: homoscedasticity.

Source: [OECD Health Data, 2009], [World Development Indicators Online, 2010], and [Source OECD Science and Technology Database, 2010].

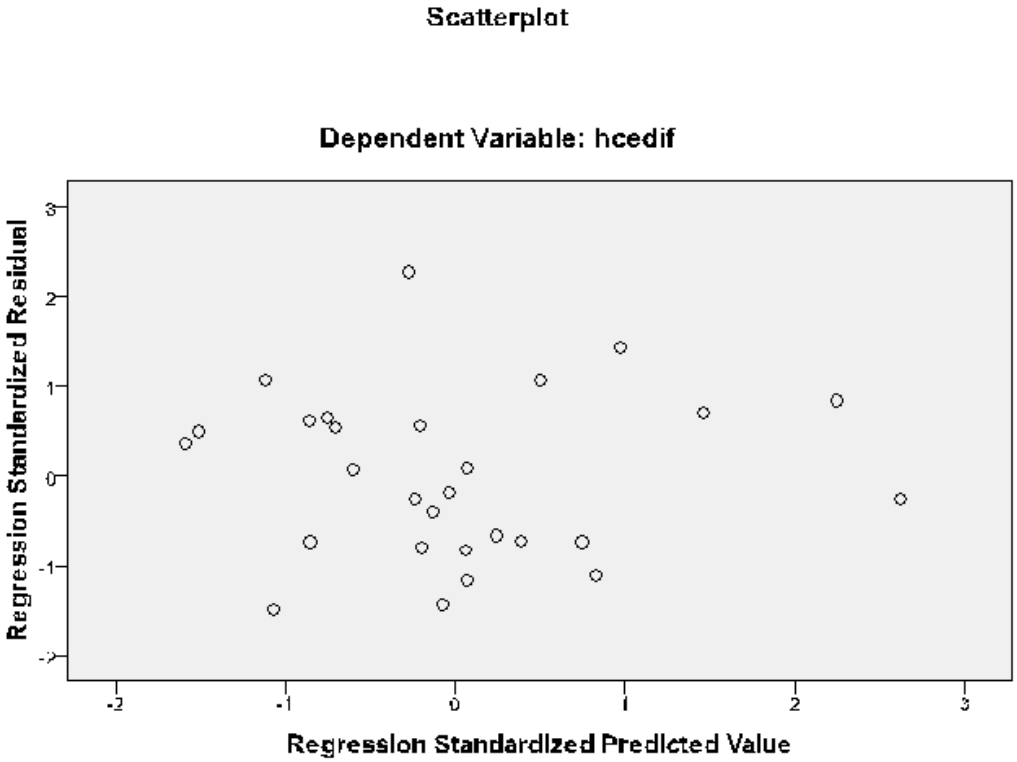

Figure A.7.: Health care expenditures, aging of the population, inflation, gross domestic product and research & development expenditures: homoscedasticity.

Source: [OECD Health Data, 2009], [World Development Indicators Online, 2010], [International Monetary Fund World Economic Outlook Database, 2010] and [Source OECD Science and Technology Database, 2010].

Appendix B.

Tables

Table B.1.: Aging of the population: a non-stationary variable.

	T-statistic	P-value
Augmented Dickey Fuller test statistic	1,961	0,9997
Critical value 1% level	-3,689	
Critical value 5% level	-2,972	
Critical value 10% level	-2,625	

Source: [World Development Indicators Online, 2010].

Table B.2.: Inflation: a non-stationary variable.

	T-statistic	P-value
Augmented Dickey Fuller test statistic	1,957	0,9998
Critical value 1% level	-3,633	
Critical value 5% level	-2,948	
Critical value 10% level	-2,613	

Source: [International Monetary Fund World Economic Outlook Database, 2010].

Table B.3.: Health care expenditures and inflation: normality of the residuals.

	Chi^2-statistic	P-value
Jarque-Bera test statistic	0,291	0,865

Source: [OECD Health Data, 2009] and [International Monetary Fund World Economic Outlook Database, 2010].

Table B.4.: Gross domestic product: a non-stationary variable.

	T-statistic	P-value
Augmented Dickey Fuller test statistic	2,213	0,9999
Critical value 1% level	-3,689	
Critical value 5% level	-2,972	
Critical value 10% level	-2,625	

Source: [OECD Health Data, 2009].

Table B.5.: Health care expenditures and gross domestic product: normality of the residuals.

	Chi^2-statistic	P-value
Jarque-Bera test statistic	1,080	0,583

Source: [OECD Health Data, 2009].

Table B.6.: Government expenditures: a non-stationary variable.

	T-statistic	P-value
Augmented Dickey Fuller test statistic	-1,393	0,571
Critical value 1% level	-3,700	
Critical value 5% level	-2,976	
Critical value 10% level	-2,627	

Source: [OECD Health Data, 2009].

Table B.7.: Health care expenditures and government expenditures: normality of the residuals.

	Chi^2-statistic	P-value
Jarque-Bera test statistic	0,700	0,705

Source: [OECD Health Data, 2009].

Table B.8.: Research & development expenditures: a non-stationary variable.

	T-statistic	P-value
Augmented Dickey Fuller test statistic	-0,429	0,891
Critical value 1% level	-3,689	
Critical value 5% level	-2,972	
Critical value 10% level	-2,625	

Source: [Source OECD Science and Technology Database, 2010].

Table B.9.: Health care expenditures and research & development expenditures: normality of the residuals.

	Chi^2-statistic	P-value
Jarque-Bera test statistic	1,331	0,514

Source: [OECD Health Data, 2009] and [Source OECD Science and Technology Database, 2010].

Table B.10.: Health care expenditures, aging of the population, inflation, gross domestic product, government expenditures and research & development expenditures: normality of the residuals.

	Chi^2-statistic	P-value
Jarque-Bera test statistic	0,926	0,630

Source: [OECD Health Data, 2009], [World Development Indicators Online, 2010], [International Monetary Fund World Economic Outlook Database, 2010] and [Source OECD Science and Technology Database, 2010].

Table B.11.: Health care expenditures, aging of the population, gross domestic product, government expenditures and research & development expenditures in the OECD countries: normality of the residuals.

	Chi^2-statistic	P-value
Jarque-Bera test statistic	0,707	0,702

Source: [OECD Health Data, 2009], [World Development Indicators Online, 2010] and [Source OECD Science and Technology Database, 2010].

Table B.12.: Health care expenditures, aging of the population, inflation, gross domestic product and research & development expenditures in the OECD countries: normality of the residuals.

	Chi^2-statistic	P-value
Jarque-Bera test statistic	0,711	0,701

Source: [OECD Health Data, 2009], [World Development Indicators Online, 2010], [International Monetary Fund World Economic Outlook Database, 2010] and [Source OECD Science and Technology Database, 2010].

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