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The Effect of the Economy on Health Risks

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Μεταπτυχιακή Διατριβή

The Effect of the Economy on Health Risks

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Η παρούσα μεταπτυχιακή διατριβή υποβλήθηκε προς μερική εκπλήρωση των απαιτήσεων για απόκτηση μεταπτυχιακού τίτλου σπουδών
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ABSTRACT

Theories suggest that there is long term impact of growing economies to population's health since the people live longer and healthier. There are also some theories supporting that in the short term, the economic boom can boost mortality rates and busts can reduce them. Greece is an excellent example to review the impact of economy conditions to health risks and mortality, since Greek economy over a period of 40 years has expanded drastically from 1980 to 2008 but it has also faced a great recession from 2009 onwards.

In the thesis we have examined the impact of the economy to the mortality by considering the relation on the changes in mortality indices to the changes in GDP for the same period.

The mortality in Greece had a procyclical trend till the recession of 2009, as it has increased over a period of 26 years, when the economy expanded, and the GDP became more than three times higher. The mortality trend showed an increase of 0,2% but it is not as significant as the GDP increase of more than 300%.

The mortality rate after 2009 that the Greek economy face a sizable recession, increase and this is in contract with theories that claim the mortality rate during recession decrease. It is important to note that the age group 20-29, 30-39 and 40-49 show an accelerated decrease in the mortality rate at this period but there is an increase in the actual mortality of the group 80-above that move the trend of the total population upwards.

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Introduction

There are theories that suggest there is long term impact of growing economies to population's health since the people live longer and healthier (A. Deaton, 2003). There are also some theories supporting that in the short term, the economic boom can boost mortality rates and busts can reduce them.

Historically, economic growth produces long-run improvements in health through:

1. better nutrition

2. enhancements in public health infrastructure (such as sanitation and cleanliness of water supply)

3. more effective medical technology (such as antibiotics and vaccines).

There are studies (D. Weil, 2014) that exhibit the familiar wealth to health connection across nations. People with higher average income tend to live longer and experience fewer years of disability.

Also, similar effects within the countries, can be reviewed, since there are people that leave longer when their income levels are increasing.

In response to these theories, there are also researches that claim in the short run mainly, economic expansions can be detrimental to health. This can also be rephrased, so it could be suggested that the recessions can improve the health of some.

The relationship between economic conditions and health dependents on

- time
- short-term vs long-term
- the nature of the economy (such as agrarian vs industrial vs service)
- the depth of recessions
- the strength of economic surges
- the composition of the population since different types of individuals are susceptible to the effects of economic changes to different degrees.

There are two terms which are widely used to describe the relation between economic conditions and variables such as mortality, morbidity, unemployment, energy consumption etc

- 'procyclical' describes the relation when the variables like mortality & morbidity increase in economic expansions and decrease in recessions

- 'countercyclical' when the variables like mortality & morbidity rise in recessions and fall in expansions.

This thesis is drafted after considering that Greece is an excellent example to review the impact of economy conditions to health risks and mortality, over a period of 30 years, that Greek economy has expanded but simultaneously faced a great recession from 2009 onwards.

There are studies that were performed for the EU countries considering the impact of the great recession of 2009 to the mortality. Most of these studies have analyzed the mortality rate considering the increase of the unemployment rate during the recession period. Further analysis on these studies will be provided to the Literature Review chapter.

The impact of Greek economy to health risks and mortality can be reviewed for

- Long term impact: consider if the trend of a procyclical fluctuation that is found by other studies is applicable also in Greece
- Short term impact: consider if the 2009 recession have a countercyclical fluctuation
- Review if the similar effects within the country, independently by county, follow up country's trend.

To analyze this relationship of Greek economic conditions and mortality, the following are presented in this paper

1. Literature review
2. Methodology
3. Results
4. Discussion
5. Conclusion

The results of this thesis show that the overall mortality in Greece has a procyclical trend for the period of 1982 to 2009, so it increases as the economy expands, but during the recession of 2009 onwards it appears a countercyclical trend, since the mortality rate increase when the economy slow down.

The mortality rate of all the age groups when they were studied independently, they were shown a reducing mortality rate while the aggregate shown a slight increase for the period 1982 to 2009. This paradox is created because the age group 80 & above represents a far bigger population than before and the actual deaths on this age group have increased but this increase is not proportional to the group increase.

In recession, there are studies that support the mortality rate will decrease, on the contrary of the belief that higher income correlates with better health. We have observed that the total mortality rate has increased for the total population from 2009 onwards. It is important to note, that there is an *accelerated* declining trend for the mortality of the age groups 20-29, 30-39 and 40-49 for this period, when these are the groups affected more from the recession due to increased unemployment. The impact of age group 80 & above, change the trend of the total mortality rate to an increasing one as the effects of the unproportionally increase of group population over group mortality were the cause to produce this result.

Literature Review

There is a perception that health deteriorates when the economy weakens and improves when it strengthens. Analyses were made from early 1920s which have revealed a positive relationship between economic activity and total mortality.

Long term relation

Procyclical studies

In 1922, a research (Ogburn, William F and Dorothy S Thomas, 1922) was produced for the influence of macroeconomic fluctuations on social conditions. It was highlighted that changes in the economic system are accompanied by social changes.

The researchers produced an index of economic conditions in the USA for 1870–1920 and correlated it with the rates of marriages, divorces, deaths, and births. They concluded that during periods of economic expansion, there are relatively more births, marriages, divorces, and deaths than in periods of economic recession. The de-trended rates of mortality show an increase in prosperity and decrease in depression.

A research by D S Thomas, on 1927, issued based on data from US and Britain for the impact of economic conditions to the mortality. It was found that there is a connection between periods of prosperity and increasing deaths in both countries, while there is a tendency death to diminish with recession.

Another research by J Eyer on 1977, examined the relation between mortality rates and conditions of the US economy, considering as a variable the unemployment for the years 1875–1975. It was noticed that there was a negative relationship between the two, so peaks in the unemployment rate lead to lower of mortality rates and vice versa. The explanations provided were that increased mortality in economic expansion might result from

- higher levels of stress at work
- declines in networks of social support
- increasing overwork, overtime,
- increasing migration
- higher consumption of harmful substances

In a research by Tapia Granados, on 2005, was examined the relationship between economic fluctuations and mortality in Spain for the period 1980–1997, when unemployment rate range between 7% to 24%. It was found that there is a negative relation of unemployment and mortality, so the death rate increase procyclical in an economic expansion as unemployment diminishes. The female population suicides were only weakly related to economic fluctuations, in contrary to male population suicides that escalate countercyclically during economic recession.

Countercyclical studies

Some studies (Harvey Brenner 1971, 1973, 1975, 1979, 1987) show that recessions and other sources of economic instability increased mortality. These studies were criticized for the technical methods used to substantiate the results, and subsequent researched have not provided clear results.

The explanations were given that recessions raise mortality because there is increase in unemployment, reduction of income and raise of social stress.

Also, it was noted that the correlation between expansions and higher mortality, is a result from the lagged effects of earlier recessions. The unemployment and business failure maybe associated with an increase in mortality, after two to three years from the lowest point in the business cycle and up to 10-15 years. Considering the average business cycles tend to be 4–5 years in length and there is a 2-3 year lag in mortality, so peak in mortality following recession approximately coincides with the subsequent peak in the business cycle. It should be considered that the zero lag relationship between unemployment and mortality rates is actually inverse.

Short term relation - Recessions

A study by Christopher J. Ruhm, on 2000, investigated the relationship between economic conditions and health. It was examined the total mortality and some sources of fatalities. It found a procyclical fluctuation, with an important exception the suicides representation. For the suicides, the study shows similar results to the studies of Ogburn on 1922, Thomas on 1927 and Eyer on 1977, that suicide rate has a negative relationship to total mortality, so it is rising in recessions and falling in expansions.

There is some evidence that the unfavorable health effects of temporary upturns are partially or fully offset if the economic growth is long-lasting. Also, an analysis of micro data indicates that smoking and obesity increase when the economy strengthens, whereas physical activity is reduced, and diet becomes less healthy.

During the recession of 2007–2012 the unemployment increased but the effect was different in each country. Considering this, one study by J. Tapia Granados & E. Ionides, on 2014, analyze the evolution of mortality, based on health indicators in 27 European countries, before and after the start of the Great Recession. They found that 1 percentage point increase in the unemployment rate associated with a half percent decline in the mortality rate. A similar relationship has been observed in the United States. There is a study by Erin C Strump, Thomas J Charters, Sam Harper & Arijit Nandi on 2016, that shows one percentage point increase in the metropolitan area unemployment rate was associated with a decrease in all-cause mortality of 3.95 deaths per 100,000 persons.

A research from Toffolutti and Suhcke on 2014, examine the short-term impact of macroeconomic decline during the recession of 2008 on a range of health and health behavior indicators utilizing data from 23 EU countries. It was found that during this recession, an increase of one percentage point in the standardized unemployment rate has been associated with a decrease in all-cause-mortality rate by 3.4%, cardiovascular diseases by 3.7%, cirrhosis- and chronic liver disease-related mortality by 9.2%, motor vehicle accident-related mortality by 11.5%, parasitic infection-related mortality by 4.1%, but an increase in the suicide rate by 34.1%. This produce a procyclical result so an increase in the unemployment rate during the recession has had a beneficial health effect on average across EU countries, except for suicide mortality which the results were countercyclical.

A study by Enrique Regidor, Elena Ronda, José A Tapia Granados, Francisco Viciana, Luis de la Fuente & Gregorio Barrio, on 2019, examined the trend in all-disease mortality and mortality due to specific diseases before and during the recession of 2008 in individuals who were employed in 2001, in Spain. The results show that all-disease mortality increased from 2003 to 2007 in both men and women but then between 2008 and 2011, all-disease mortality decreased in men and reached a plateau in women. In men, the all-disease mortality rate dropped from 1.6 in 2003-07 to -1.4 in 2008-11, while for women was 2.5 for the period 2003-07 and dropped to -0.3 in 2008-11. The mortality due to other chronic diseases followed similar trends.

There are other researches that investigate the relationship of recession to health effects and mortality after considering the health care use, the air pollution, driving and the health of the elderly. Below there is a brief description of some of these researches and their results.

Health & health care use

A research by Van Gool and Pearson on 2014, examined the impact of economic crisis started on 2008 to health and health care. The economic crisis had a direct impact to many people since they lost their job, their savings lost and experienced a prolonged financial difficulty. Meanwhile, many countries introduced austerity measures to reduce public deficits. So, the health sector was among the other social welfare programs, that spending cutting measures applied.

The relationship between unemployment and health care use was examined. The results show that a higher rate of unemployment is strongly linked to lower health care use. But it cannot be assumed that the lower health care use is directly linked with less medical problems or that unemployed do not highly prioritize their health care use.

The research examined the relationship between unemployment and mortality. The results show that higher unemployment is associated with lower mortality rates, but suicide rates appear to increase. But, the evidence for this relationship had weak statistical significance level. Considering the relation of transport accident and deaths to unemployment, was found the when unemployment rate increase mortality rate due to traffic accident decrease.

A study by Mr C. Ruhm on 2003, has used microdata from the 1972–1981 National Health Interview Surveys (NHIS) to examine how health status and medical care utilization fluctuate with economic conditions, where unemployment was the variable. It was found that during economic expansion the physical health for individuals becomes worse, specifically males with a newly career. These negative health effects of economic expansions accumulate over time and occur even if there is increase of the medical care use and additional income. The mental health may be procyclical and this might be related to the decrease of unemployment rate during economic expansion. The results show that 1 percentage reduction in unemployment rate provides raise to medical problems, acute morbidities, restricted-activity days, bed-days, ischemic heart disease, and intervertebral disk disorders by 1.5, 3.9, 1.2, 1.6, 4.3, and 8.7%. The health issues are observed more to persons of prime working age, employed individuals under the age of 65, and men.

Air pollution

One theory is that during economic booms, an industrial economy produces more air pollution, which results to some diseases and increases of mortality. The study of José A Tapia Granados & Edward L Ionides, "Population health and the economy: Mortality and the Great Recession in Europe" shown that the unemployment rate increase during the recession was associated with reduced mortality for respiratory illnesses, cardiovascular disease, and heart conditions, which are all sensitive to air pollution.

By one estimate produced by David M. Cutler, Wei Huang & Adriana Lleras-Muney on 2016, the two-thirds of the short run, mortality-increasing effect of a strong economy can be attributed to air pollution.

Lleras-Muney, David Cutler and Wei Huang on 2016, analyzed over 200 years of data from 32 countries. They have confirmed that when a country's economic output, GDP, is higher than expected, mortality rates are also higher than expected. The relationship was clear but the effect was modest, so when the GDP is about 5 percent above trend, the mortality to adults is about 1 percent more. They suggest that the turning point is when the wealth of societies depends more on factory output. They used data on carbon dioxide emissions, which are correlated with industrial activity and air pollution. The data show that when economies are expanding fast, emissions and pollution are also growing. They found that economic growth doesn't seem to impact death rates as much when they control the changes in air quality.

Driving

Another source of mortality is driving, which is affected by economic conditions in the short run. In recession periods, people drive less, since there is less consumption for any products (food, clothing, toy, electronics etc) and fewer people driving to their works as unemployment is increased, consequently, there are fewer deaths due to automobile accidents. Also, as per a study of Vikram Maheshri & Clifford Winston, 2016, those who do drive during recessions tend to be safer drivers.

A paper by C. Cotti, & N. Tefft on 2011, examines the relation of economic recession of 2007-2008 recession and the reduced fatal crashes. There is a hypothesis that the reduction in fatal car accidents are a result of reduced driving and changes in behavior associated with driving. The results suggest that at the recession period the fatal car accidents were reduced.

Another study M. French & G. Gumus on 2014, examines the impact of economic activity on fatal car accidents in USA. The results show that traffic fatality rates are pro-cyclical.

It was found that a 10% increase in real income per capita is associated with a 10.4% rise in the total motorcycle fatality rate.

Elderly

The financial effects are affecting to differently the people and may produce an impact that can be identified as a health effect. There is a study by Stevens, Ann H., Douglas L. Miller, Marianne E. Page, and Mateusz Filipski, on 2015, that they found the increases in mortality during strong economic conditions are concentrated among the elderly, particularly older women living in nursing homes. This phenomenon appears, since the employment levels in skilled nursing facilities (ie nursing staff) go down when the unemployment rate falls. This may take place because nurses who would otherwise work in those facilities are able to find better jobs elsewhere.

Other study by Miller, Douglas L., Marianne E. Page, Ann Huff Stevens, and Mateusz Filipski. On 2009, resulted to similar findings, since found that the increased mortality concentrated in the elderly during strong economic conditions showed that it is driven by deaths from cardiovascular, respiratory, and degenerative brain diseases, as well as infections.

These studies help reconcile the facts that higher incomes are broadly good for health, but booming economies can increase mortality.

Nature of the Economy

In less-developed countries that farming is still the main economic activity, growth is associated with better, not worse health. Fidel Gonzalez & Troy Quast, 2010, investigate the relationship between mortality and economic cycles within Mexico, for the period 1993-2004. Since the development varies significantly within Mexico, they have separately analyze the top ten and bottom ten developed states. They have found that overall mortality, countrywide, is procyclical, like the top ten states, but it is countercyclical in the bottom ten. Also, they have shown that in the top ten states mortality due to non-communicable conditions is procyclical, while in the bottom ten mortality due to non-communicable conditions and infectious and parasitic diseases are countercyclical. Their results proposed that the relationship between mortality and economic conditions may vary by level of development.

Similar effects could be observed if review the history before the countries were fully industrialized. José Granados & Edward Ionides on 2008, have shown that in the Sweden of the 1800s, economic growth was associated with longer lives, while in the 1900s, the relationship reversed, and growth became associated with mortality.

Methodological approaches

There are two broad methodological approaches where the studies can be classified to.

a. Use of individual level data to examine the health consequences of a person (or household) who has suffered an economic shock (i.e. job loss). The health impact is then compared with those who did not had loss.

b. Use aggregate data to examine the relationship between economic variables and health outcomes at a regional/country/multi-country level. Economic variables can be the unemployment or GDP in comparison with the mortality rates.

Both these approaches have strengths and weaknesses. The first one is limited to a small set of health outcomes and often relies on self-reported evidence. So, there is a difficulty to identify potential indirect effects of recessions on people who have not been directly affected by the economic downturn. The second one can only estimate a net impact of an economic recession, because the data cannot identify who has been affected and who has not.

The individual level studies generally show that economic downturns are linked to worse mortality outcomes. This results a procyclical fluctuation between unemployment and mortality, while if consider the economic fluctuation then it is countercyclical, so when there is an economic expansion the mortality decreases.

Individual Level Studies - Unemployment

A research by U. Gerdtham & M. Johannesson, on 2003, examine if unemployment has an effect on mortality utilizing an individual level data set of nearly 30,000 people in Sweden aged 20–64 years followed-up for a period of 10–17 years. The people had the same health state, but differ only if they are employed or not. The result show that unemployment significantly increases the mortality risk by nearly 50% (from 5.36 to 7.83%). In the cause-specific mortality analysis, found that unemployment significantly increases the risk of suicides and the risk of dying from all diseases except cancer and cardiovascular.

An extensive meta-analysis and meta-regression designed by Roelfs, D. J., Shor, E., Davidson, K. W., & Schwartz, J. E, 2011, to assess the association between unemployment and mortality among working persons. They have considered 235 mortality risk estimates from 42 studies. The unemployment was associated with an increased mortality risk for those in their early and middle careers, but less for those towards the end of their career. It was resulted that the risk of death for unemployed persons was 63% higher than the risk of death for employed persons. Also, the relative mortality risk associated with unemployment was 37% higher for men than for women and was significantly lower for workers approaching retirement age.

There are some shortcomings on these analyses:

a. Controlling for health conditions may reduce the excess mortality risk from these who are unemployed. Those who become unemployed may have pre-existing health conditions and are already at higher risk of death.

A research by Lundin, Lundberg, Hallsten, Ottosson, & Hemmingsson, on 2010, to investigate the association between unemployment and all-cause based on a cohort of 49321 Swedish males, has shown that an increased risk of mortality during the period 1995-2003 for those who experienced 90 days or more of unemployment during the period 1992-4 compared with those still employed. So, substantial part of the increased relative risk of mortality associated with unemployment may be attributable to confounding by individual risk factors.

b. Examine the relative risk of mortality between the unemployed and employed. There is possibility that some difference is due to the reduced risk among those who remain employed, particularly during times of economic crisis and not just due to mortality risk among the unemployed only.

There are different results between the individual and aggregate level studies when consider the impact of unemployment on mortality. Individual level studies show that unemployment is linked to higher mortality, while most of aggregate level studies show the opposite.

The contradictory results between the individual and aggregate level studies can be reconciled if

a. those who are directly affected by economic recession suffer direct negative health consequences, but that those who are not directly affected benefit indirectly from recessions.
b. the gains among those who benefit must be greater than the losses among those who are adversely affected.

One important difference of these two methodologies is that aggregate-level studies examine the relationship between unemployment and mortality for a short period, while the individual-level studies examine the relationship over a longer period.

It is worth to consider some aggregate level studies and their results to demonstrate that an increase in unemployment rate has a reverse impact to mortality. The aggregate level studies show a countercyclical fluctuation between mortality and unemployment, while if consider the economic fluctuation, then it is procyclical, so the mortality rate increases when the economy expands.

Aggregate Level Studies - Unemployment

As already mentioned earlier, Mr C. Ruhm on 2000, has shown that a 1% increase in the unemployment rate is associated with a 0.54% decline in the overall mortality rate. This relationship is consistent with major causes of mortality including cardiovascular disease, respiratory disease, and motor vehicle traffic accidents. Exception is mortality due to suicide which is shown to rise when unemployment rate increase.

A research by Gerdtham and Ruhm, on 2006, used data from 23 Organization for Economic Cooperation and Development (OECD) countries for the period 1960–1997 to examine the relationship of economic conditions (unemployment rate) and deaths. It was found that the total mortality rises when labor markets strengthen. A decrease by one percent in unemployment rate is associated with growth of 0.4% in total mortality.

A study by Neumayer, on 2004, analyze the effect of unemployment and economic growth rates on mortality in Germany for the period 1980-2000. There was evidence that aggregate mortality rates in total (all age groups), as well as for most of specific age groups, are lower in recessions when the unemployment is increased. The same evidence found for mortality from cardiovascular diseases, pneumonia and influenza, motor vehicle accidents and suicides. It was confirmed that recessions lower some mortality rates in the case of Germany.

Another research by José A Tapia Granados & Edward L Ionides, on 2011, examine the relationship of economic fluctuation and mortality in Sweden for the period 1968-2003. The mortality rate moved procyclical. The macroeconomic effects on annual mortality tend to appear lagged 1 year. Also the traffic mortality rises in expansions and declines in recessions when the unemployment rates are uncreased. The total cardiovascular mortality has similar trends.

A paper by Ariizumi, Hideki, Schirle and Tammy, on 2012, examined the relationship between business cycle fluctuations and health in the Canada, for the period 1977–2009. The relationship examined after studying the effect of economic expansion (variable is the unemployment rate) on Canadian age and gender specific mortality rates. The results show some evidence of a strong procyclical pattern in the mortality rates of middle-aged Canadians, since one percentage increase in the unemployment rate (recession period) leads to lower mortality rate by 2 percent for individuals in their 30s. It was not found any significant cyclical pattern in the mortality rates of infants and seniors.

A study of Jose A Tapia Granados, Edward L Ionides, James S House & Sarah A Burgard, on 2014, examined whether at the recession periods that unemployment rates increase, the population mortality declines. They have used data from the US Department of Labor for the period 1979-1997. They analyzed how the death hazard depends on individual unemployment and state unemployment rates. The results show that in comparisons of employed with unemployed, the death hazard of the second group (unemployed) was increased by an amount equivalent to 10 extra years of age. Also, for each one percentage increase in the unemployment rate the reduced the mortality for all individuals was equivalent to a reduction of 1 year of age. So, they have provided evidence that joblessness strongly and significantly raises the risk of death and at recession periods, when the unemployment rates increase, there is a reduction in the risk of death.

In contrary to the above studies there were some researches unveil that unemployment rates are positively related to mortality.

A study by A. Economou, A. Nikolaou and I. Theodossiou, on 2008, investigate the effects of unemployment rates on overall age and cause-specific mortality rates in 13 EU countries. The results show that there is a strong, positive relationship between adverse economic conditions (unemployment rates) and mortality.

Another study by P. N. Junankar, found a positive relationship between unemployment and mortality after examining it in England and Wales. There was a criticism that the method may be is biased if the demographic group unemployment rates are correlated with unobservables that may influence mortality. So, the unskilled blue-collar employees are likely to experience more joblessness but also to have relatively higher mortality rates due to factors as unhealthy lifestyle or lack of education.

A paper by M. McInerney & J. Mellor, on 2012, examine the elderly mortality rates against the economic conditions for the period of 1994 to 2008 (recession), used data from the Medicare Current Beneficiary Survey. They found that the elderly mortality s countercyclical during the period 1994-2008. When the unemployment rates rise, seniors report worse mental health and unhealthy behavior.

Also, it is worth to mention that there are other studies which to a statistically insignificant relationship between overall mortality and unemployment even though they use similar methodologies.

A study by David Stuckler, Sanjay Basu, Marc Suhrcke, Adam Coutts & Martin McKee on 2009, examined how economic changes have affected mortality rates over a period of almost 30 years (1970-2007) in 26 EU countries and identified how governments might reduce adverse effects. The results show that every 1% increase in unemployment was associated with a 0,79% rise in suicides at ages younger than 65 years and 0·79% rise in homicides. In contrary, road-traffic deaths decreased by 1,39%. It was mentioned that no consistent evidence across the EU that all-cause mortality rates increased when unemployment rose.

A paper by C. Ruhm, on 2013, examined the relation of macroeconomic conditions and mortality for a period from 1976-2009. The results show that total mortality has shifted over time from strongly procyclical to being essentially unrelated to macroeconomic conditions. The mortality from cardiovascular disease and transport accidents was found procyclical, while the mortality due cancer and accidental poisoning was strong countercyclical. The researcher estimated that the observation for the cancer deaths maybe is due better medical treatments, while for the accidental poisoning maybe the due to declines of mental health at economic downturns are associated with the use of prescribed or illicitly obtained medications that carry risks of fatal overdoses.

A research by C. Coile, P. Levine and R. McKnight, on 2014, test if the workers that reaching the retirement age may experience reduced longevity attributable to lengthy unemployment and lost health insurance. They have utilized age-specific cohort survival probabilities for the period 1965-2008 and link them to labor market conditions. The results show that experiencing a recession at the age of late 50s reduces longevity. Also the lower long-term likelihood of survival maybe is related to several years of reduced employment, health insurance coverage and health care utilization.

Alcohol Consumption

Many papers published by utilizing aggregate data have shown that the increase of unemployment rates is linked to lower per capita alcohol consumption and traffic fatalities.

A review by D Henkel on 2001, of the existing researches for the period 1990 to 2010, for the use of substances among the unemployed and employed, the effect of unemployment on alcohol and drug addiction treatment, smoking cessation, and the relationship between unemployment rate and substance use. Approximately 135 researched were reviewed and the results were that

a. Alcohol consumption is higher to the unemployed population. Also, it is more likely to be smokers, to use illicit and prescription drugs, and to have alcohol and drug disorders.

b. Drinking and smoking patterns appear to be procyclical. A decrease in both when the economy declines, and the unemployment rate increases. In contrary, there was countercyclical trend for drug users.

Methodology

Research Analysis & Question

On this thesis, there is an examination of the impact to the Greek population health from the economic cycle over a period of 30 years. Since there are many factors that can affect the populations' health, the thesis will consider only the relation of country's economy (ie change in GDP) to change in mortality indices for the same period.

Examine the following relationships:

- Effect of GDP in mortality
- Effects of GDP in mortality within the country.
  It is important to note that for the specific relationship, smaller time interval is considered and importance to the economic depression will be given since from 2009 as it affected Greece after 2009.

Basic research questions

How health indices of mortality change over a period of 30 years?

Is there a relation of the subject change with the country's economic cycle?

Data Collection

There are different resources that were data were requested from. Hellenic Statistic Authority (ELSTAT) has assisted and provided data necessary for this research. From the data requested they could provide mortality tables (age/sex/geographical area) from 1980 till 2018, while for the GDP (in EURO's) they could provide data only from 1995 and then. Also, it can be noted that for the GDP analysis per geographical area is available only after 2000, as they were needed to graphically represent and check if people leave longer when their income levels are increasing.

Requested data for Greece from ELTAT and they have provided:

1. The mortality tables per sex, age group, area from 1980 till 2018.
2. The GDP in EUROs per are geographical from 2000 till 2017
3. The GDP (in EURO's) per capital and geographical from 2000 till 2017
4. Total population in the middle of the year from 1995 till 2019
5. GDP at market prices in EUROs from 1995 till 2019
6. GDP per capital at market prices in EURO from 1995 till 2019

Since, the data provided from ELSTAT regarding the GDP was not enough as they were not covering the complete timeframe for this research, additional data were collected from International Monetary Fund (IMF) databases. It is important to note that the data collected from IMF databases for GDP were in USD while the data provided from ELSTAT for the GDP were in EURO.

From IMF databases found:

1. GDP in current prices in billions of USD (1980 2019)
2. GDP per capita in current prices in USD (1980 2019)
3. GDP in current prices in billions of international dollars considering the purchasing power parity (1980 2019)
4. GDP per capita in current prices in billions of international dollars considering the purchasing power parity (1980 2019)
5. Population in millions (1980 2019)
6. Un-employment rate (percentage) (1980 2019)

The figures of GDP were compared with the mortality rates.

Methodology

To review the relationship of GDP and mortality, the following were examined:

1. Graphical presentation of mortality per age group & GDP over a period of 30 years
2. Graphical presentation of mortality per sex over a period of 30 years
3. Examine if there is correlation between GDP (all indices) & mortality
4. Examine the linear relationship of economic conditions and mortality
5. Trend analysis
    a. GDP per capita time series regression
    b. Mortality time series regression
    c. Mortality time series regression per age group
6. Graphical presentation of GDP and the mortality per age group above 50 years old per county in Greece for the period 2000 to 2017

We have run the below statistical tests (please see **APPENDIX 1**) for testing:

1. Linearity
2. Homoscedasticity
3. Normality

These tests were produced because there are four principal assumptions which justify the use of linear regression models for purposes of inference or prediction:

(i) **linearity and additivity** of the relationship between dependent and independent variables:
    a. The expected value of dependent variable is a straight-line function of each independent variable, holding the others fixed.
    b. The slope of that line does not depend on the values of the other variables.
    c. The effects of different independent variables on the expected value of the dependent variable are additive

(ii) **statistical independence** of the errors (in particular, no correlation between consecutive errors in the case of time series data)

(iii) **homoscedasticity** (constant variance) of the errors

a. versus time (in the case of time series data)
b. versus the predictions
c. versus any independent variable

(iv) **normality** of the error distribution.

Violations of linearity or additivity: fitting a linear model to data which are nonlinearly or non-additively related, then the predictions are likely to be seriously in error, especially when this extrapolate beyond the range of the sample data

Violations of independence are potentially very serious in time series regression models since if there is autocorrelation then there is room for improvement in the model, and extreme serial correlation is often a symptom of a non-correctly specified model.

Violations of homoscedasticity make it difficult to gauge the true standard deviation of the forecast errors, usually resulting in confidence intervals that are too wide or too narrow.

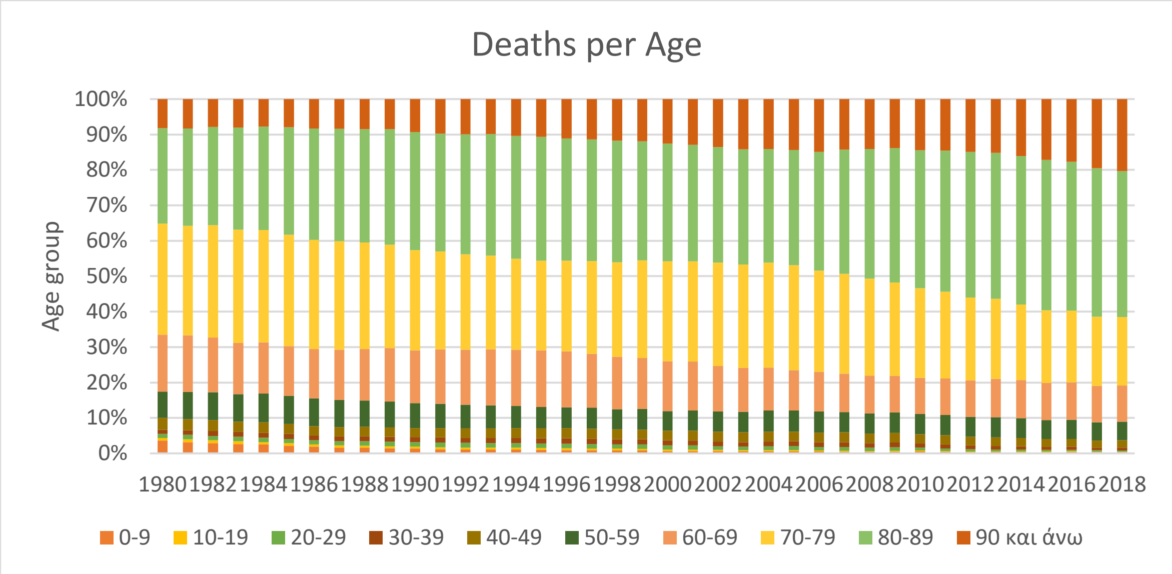
Violations of normality create problems for determining whether model coefficients are significantly different from zero and for calculating confidence intervals for forecasts. If the error distribution is significantly non-normal, confidence intervals may be too wide or too narrow.

The results of these tests are listed in the **chapter Results** and **paragraph Summary**.

Results

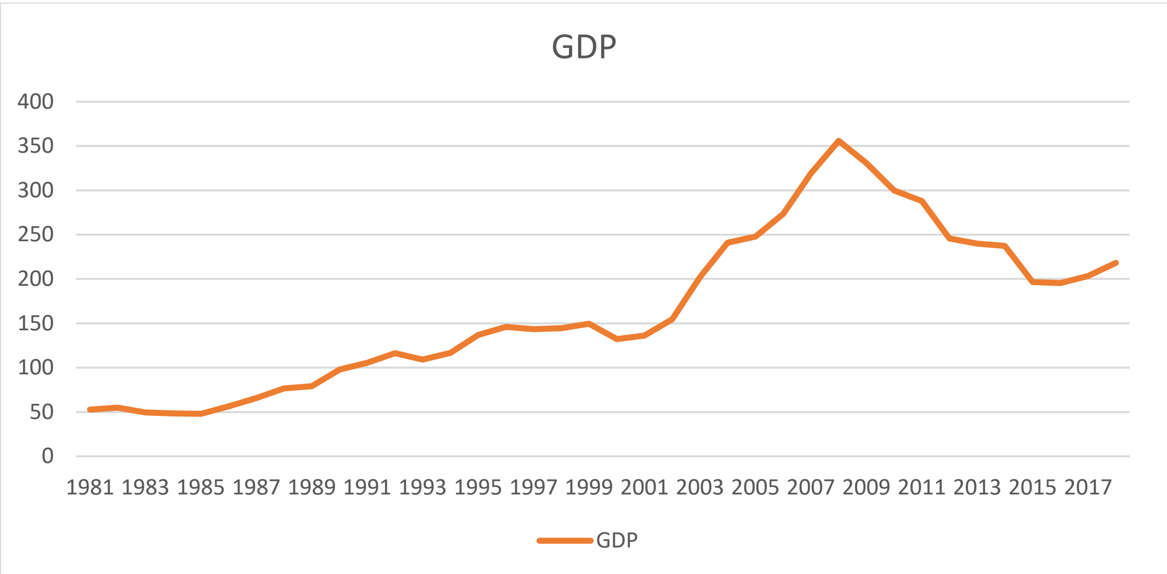
Mortality in Greece

Analysis of the mortality percentage per age group

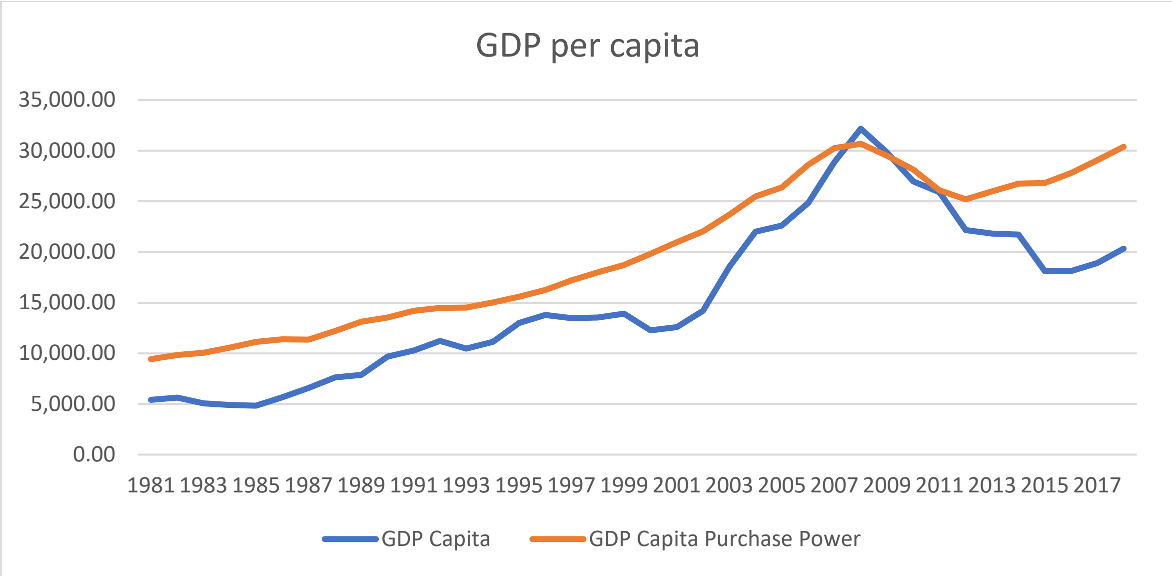


It is obvious that the mortality rate of the is increased by age.

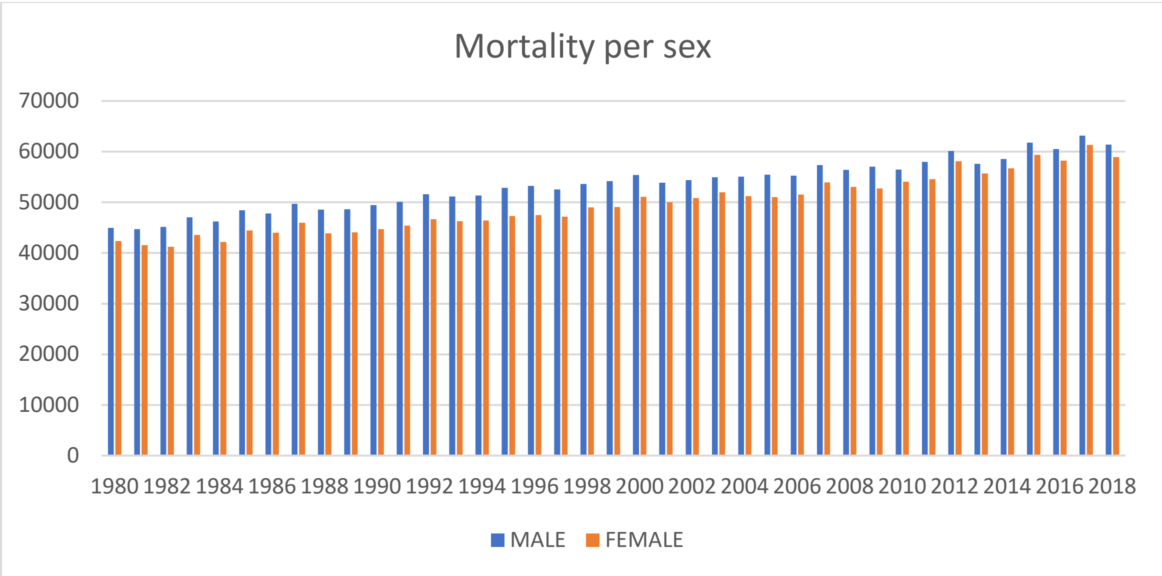
Also, it can be noted that the mortality rate of the population below 79 years old is decreasing from 1980 to 2018 from 65% to 38% and there is a relative increase to the mortality of the population above 80 years old. It could be understood that the average expectancy of life has increased the last 30 years, so a bigger percentage of the population is expected to pass away after 80 years old than what was estimated in 1980.



Simultaneously, the GDP is increasing as well as the GDP per capita and the GDP per capita considering the purchasing power parity.

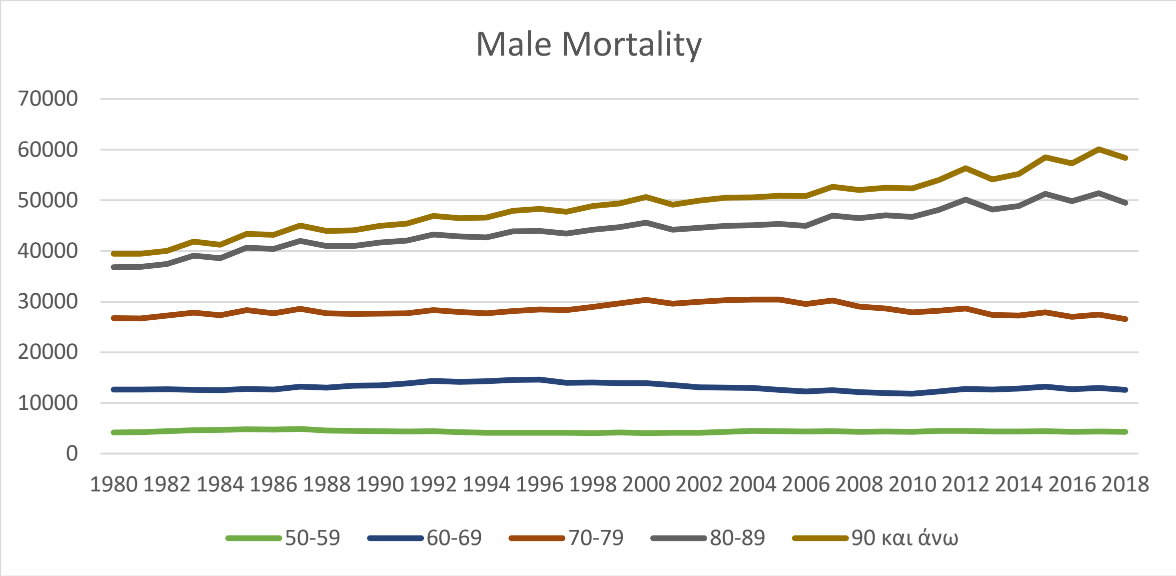


Analysis of the mortality per sex

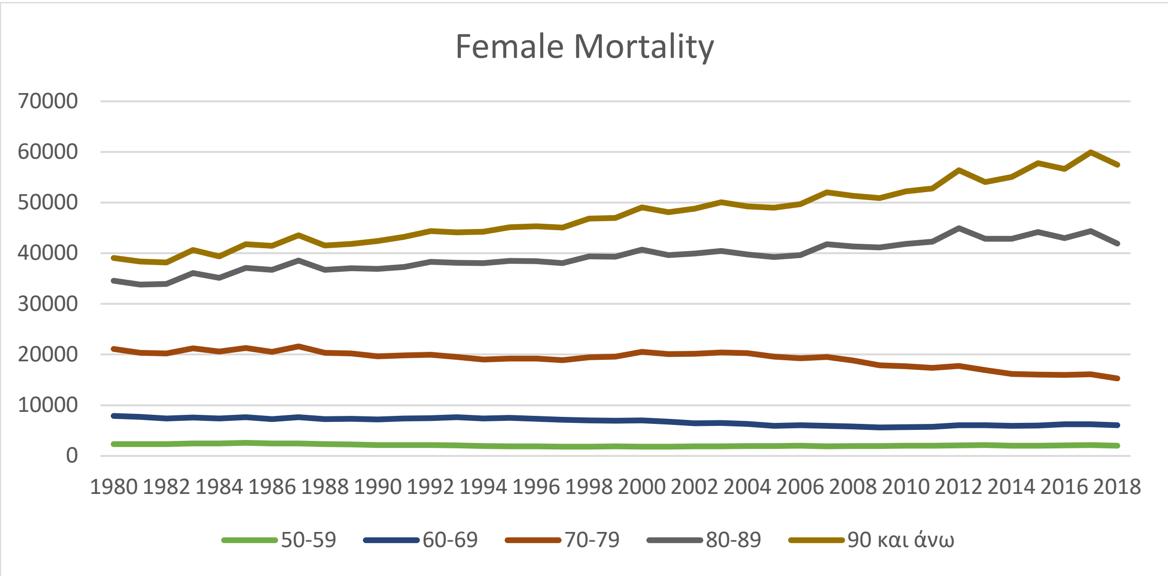


There is a slight variance in the mortality rate of the male as it is higher than the female one, considering all the population.

Male mortality after considering the population that has passed away with an age of 50 and above.



Female mortality after considering the population that has passed away with an age of 50 and above.



Correlation

There is a correlation between the mortality and GDP & GDP per capita (both in current prices). Also check if there is a stronger the correlation with GDP & GDP per capita (both adjusted with purchasing power parity) and as it is expected there is a stronger correlation. Also there is a strong correlation of mortality with the population, as it is expected since the population of Greece is increasing drastically. Finally, checked the correlation of mortality with unemployment and also found that there is a correlation between the two.

	GDP, current prices *(Billions of U.S. dollars)*	***GDP per capita, current prices*** *(U.S. dollars per capita)*	***GDP, current prices*** *(Purchasing power parity)*	***GDP per capita, current prices*** *(Purchasing power parity)*	***Population*** *(Millions of people)*	***Unemployment*** *rate (Percent)*	***Deaths***
GDP, current prices (Billions of U.S. dollars)	1						
GDP per capita, current prices (U.S. dollars per capita)	0,999835	1					
GDP, current prices (Purchasing power parity; billions of international dollars)	0,947433	0,947696	1				
GDP per capita, current prices (Purchasing power parity; international dollars per capita)	0,94053	0,941166	0,999521	1			
Population (Millions of people)	0,901334	0,899311	0,924553	0,91601	1		
Unemployment rate (Percent)	0,463825	0,463314	0,616245	0,620985	0,579712	1	
Deaths	0,790905	0,792054	0,917236	0,921314	0,857063	0,822652	1

Linear regression

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0,79
R Square	0,63
Adjusted R Square	0,62
Standard Error	6.455,61
Observations	39,00

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1,00	2.575.778.348,83	2.575.778.348,83	61,81	2,0823E-09
Residual	37,00	1.541.971.666,86	41.674.909,92		
Total	38,00	4.117.750.015,69			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	88.083,10	2.173,42	40,53	2,9208E-32	83.679,34	92.486,86	83.679,34	92.486,86
GDP, current prices (Billions of U.S. dollars)	91,99	11,70	7,86	2,0823E-09	68,28	115,69	68,28	115,69

Time Series regression

For both GDP and Mortality, used a log-linear regression equation to estimate the long-term trend of the variables. After estimating the equations, computed the antilog of the fitted values.

GDP time series regression

```
Time series regression with "numeric" data:
Start = 1, End = 39

Call:
dynlm(formula = log(GDP_per_capita) ~ Year)

Residuals:
    Min       1Q     Median     3Q        Max
-0.45258 -0.13674  0.04767  0.16533  0.48915

Coefficients:
               Estimate     Std. Error  t value   Pr(>|t|)
(Intercept) -81.527176   7.046548  -11.57    7.46e-14 ***
Year           0.045526   0.003525   12.91     2.80e-15 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.2478 on 37 degrees of freedom
Multiple R-squared:  0.8185,      Adjusted R-squared:  0.8135
F-statistic: 166.8 on 1 and 37 DF,  p-value: 2.8e-15
```

1. Long-term trend of GDP
2. Actual values dotted line
3. Vertical distance from the dotted line to solid line are the variations from the long-term trend.
4. Dependent variable is the log GDP per Capita
5. Independent variable is time
6. Regression

$$Y=-81+0,04X$$

7. Run the regression the for every year
8. The results come in the form of log value
9. Convert the results by using the e (natural log), so the actual results per GDP/yearly to derive

Mortality time series regression

It represents the mortality rate over time period. Mortality rate is considered the actual number of deaths divided by the total population number.

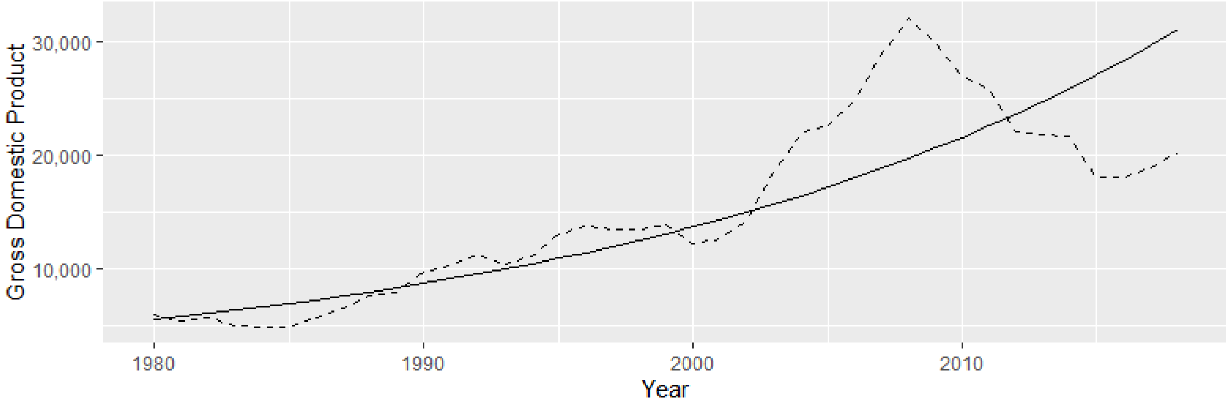
```
Time series regression with "numeric" data:
Start = 1, End = 39

Call:
dynlm(formula = log(mortality) ~ Year)

Residuals:
     Min         1Q         Median      3Q          Max
-0.038859 -0.020027 -0.005475  0.011423  0.079594

Coefficients:
              Estimate     Std. Error    t value  Pr(>|t|)
(Intercept) -1.489e+01  7.942e-01  -18.75    < 2e-16 ***
Year           5.131e-03  3.973e-04   12.91     2.8e-15 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02792 on 37 degrees of freedom
Multiple R-squared:  0.8185,      Adjusted R-squared:  0.8135
F-statistic: 166.8 on 1 and 37 DF,  p-value: 2.801e-15
```

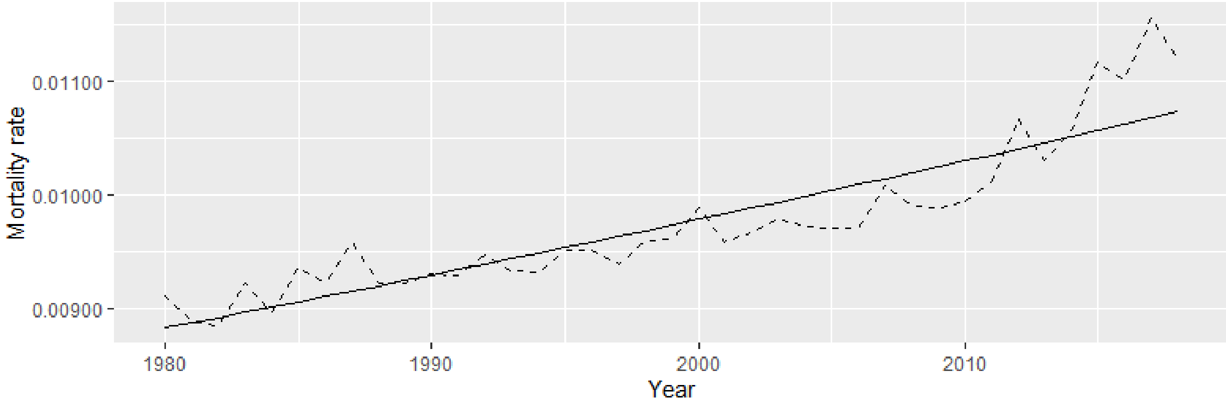
1. Long-term trend of mortality
2. Actual values dotted line
3. Vertical distance from the dotted line to solid line are the variations from the long-term trend.
4. Dependent variable is the mortality
5. Independent variable is time
6. Regression

$$Y=-14,89 + 0,005\ X$$

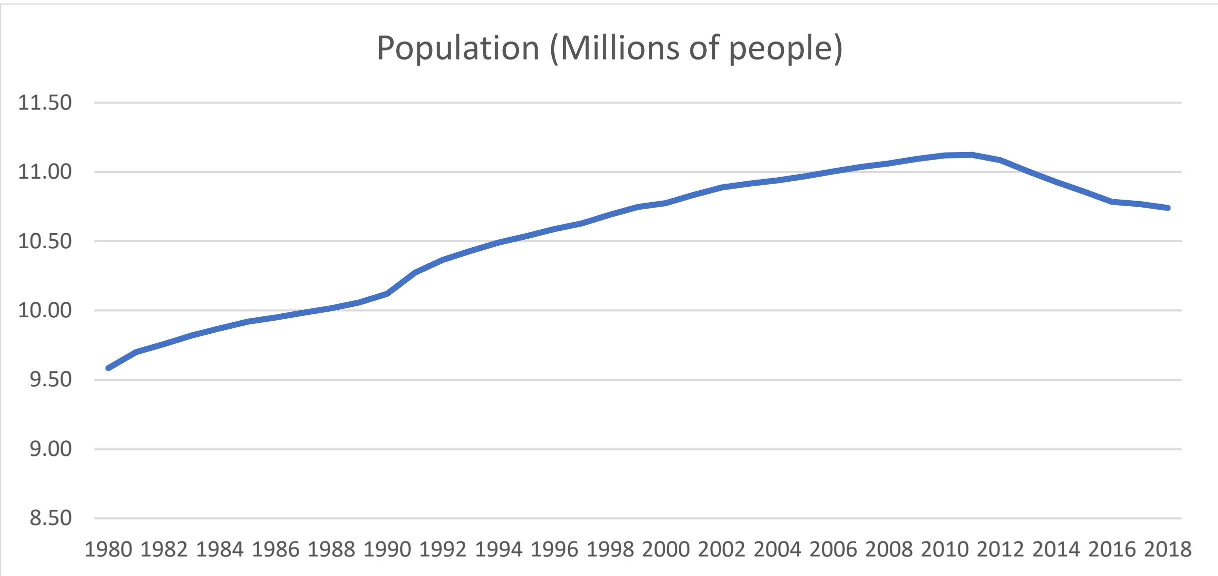
7. Run the regression the for every year
8. The results come in the form of log value
9. Convert the results by using the e (natural log), so the actual results per mortality/yearly to derive

Graphical presentation of GDP & Mortality





The mortality rate is increased at a slower rate than the GDP one, which has increased significantly. The mortality rate has increased by less than 0,2% while the GDP has almost been three times higher. Considering the population in Greece has also increased by 12%, this may explain that the population of Greece is ageing older than before as GDP is increasing in the long term.

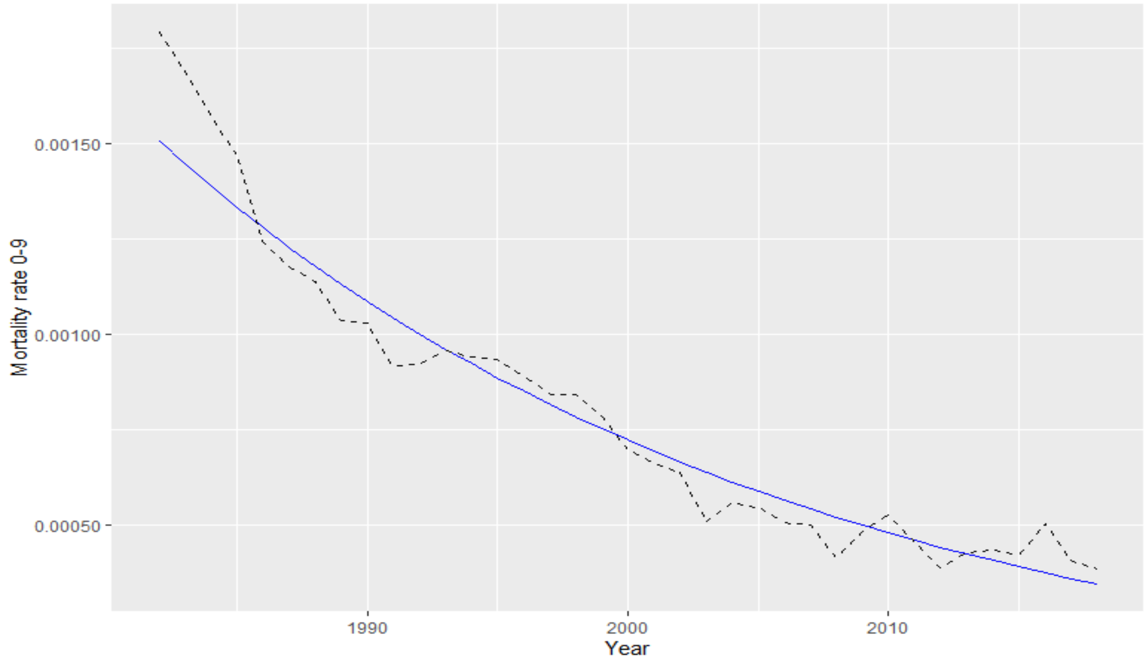


Mortality time series regression per age group

Age group 0-9

It represents the mortality rate over time period. Mortality rate is considered the actual number of deaths for the age group 0-9 divided by the population number of the age group.

```
Time series regression with "numeric" data:
Start = 1, End = 37

Call:
dynlm(formula = log(mortality0) ~ Year)

Residuals:
    Min        1Q         Median      3Q       Max
-0.22975 -0.07326 -0.01678  0.07003  0.29317

Coefficients:
               Estimate    Std. Error   t value Pr(>|t|)
(Intercept) 74.258438   3.369073   22.04   <2e-16 ***
Year           -0.040745   0.001685  -24.19   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1094 on 35 degrees of freedom
Multiple R-squared:  0.9436,       Adjusted R-squared:  0.9419
F-statistic: 585.1 on 1 and 35 DF,  p-value: < 2.2e-16
```



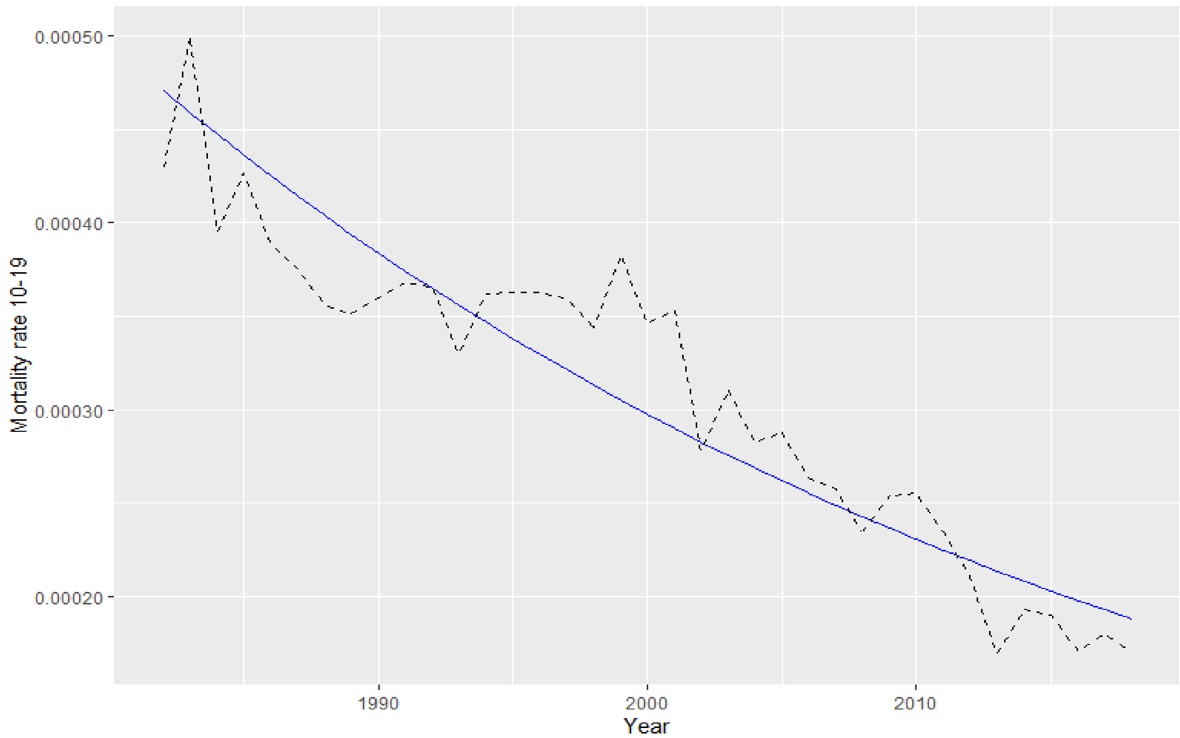
As per the trend the mortality rate for the age group 0-9 has a decrease over a period 30 years. At this period the GDP has increase drastically.

Regression $Y = 74{,}25 - 0{,}04\, X$

Age group 10-19

It represents the mortality rate over time period. Mortality rate is considered the actual number of deaths for the age group 10-19 divided by the population number of the age group.

```
Time series regression with "numeric" data:
Start = 1, End = 37

Call:
dynlm(formula = log(mortality10) ~ Year)

Residuals:
    Min        1Q      Median      3Q        Max
-0.23358 -0.07607 -0.01741  0.08458  0.22521

Coefficients:
              Estimate    Std. Error t value    Pr(>|t|)
(Intercept) 42.84633    3.24068   13.22     3.58e-15 ***
Year         -0.02548     0.00162  -15.73     < 2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.1052 on 35 degrees of freedom
Multiple R-squared:  0.876,       Adjusted R-squared:  0.8725
F-statistic: 247.3 on 1 and 35 DF,  p-value: < 2.2e-16
```



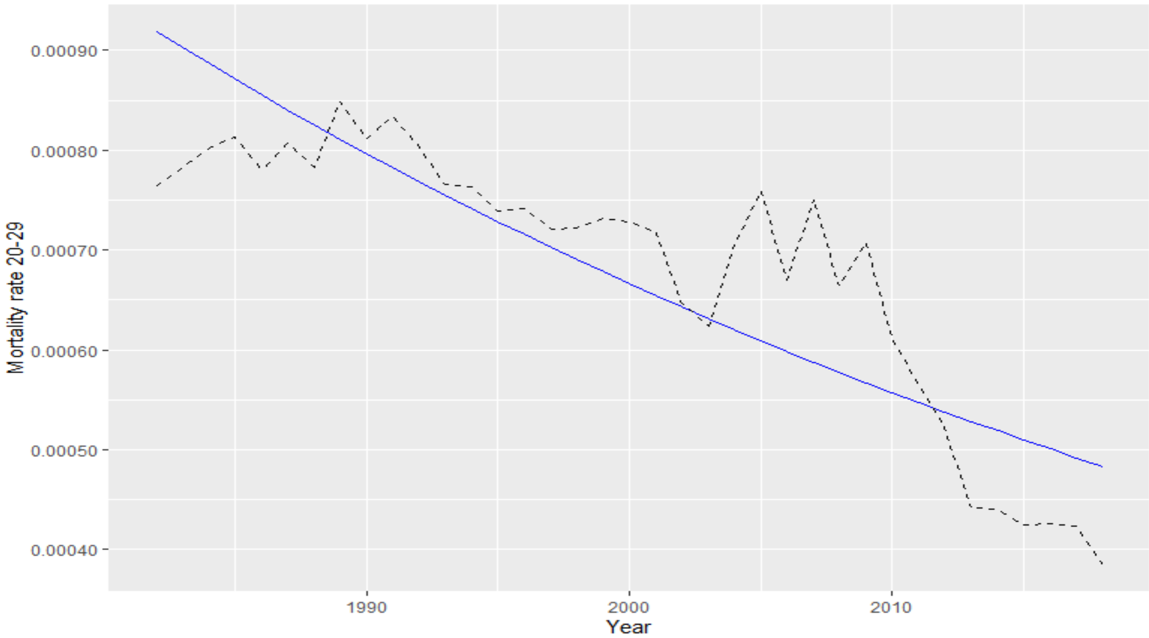
As per the trend the mortality rate for the age group 10-19 has a decrease over a period 30 years. At this period the GDP has increase drastically.

Regression $Y = 42{,}85 - 0{,}025\ X$

Age group 20-29

It represents the mortality rate over time period. Mortality rate is considered the actual number of deaths for the age group 20-29 divided by the population number of the age group.

```
data:
Start = 1, End = 37

Call:
dynlm(formula = log(mortality20) ~ Year)

Residuals:
    Min        1Q     Median      3Q      Max
-0.22787 -0.09201  0.01885  0.07641  0.24297

Coefficients:
             Estimate    Std. Error   t value  Pr(>|t|)
(Intercept) 28.427986   3.771425   7.538   7.84e-09 ***
Year        -0.017871    0.001886  -9.477   3.39e-11 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.1225 on 35 degrees of freedom
Multiple R-squared:  0.7196,     Adjusted R-squared:  0.7116
F-statistic: 89.82 on 1 and 35 DF,  p-value: 3.39e-11
```



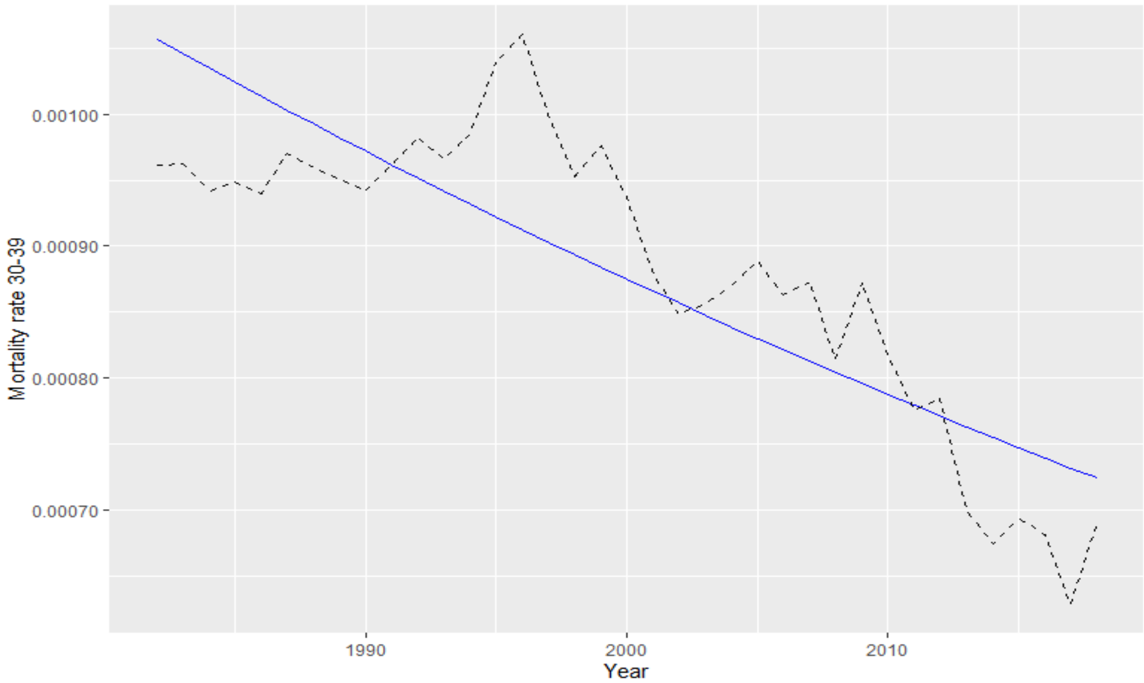
As per the trend the mortality rate for the age group 20-29 has a decrease over a period 30 years. At this period the GDP has increase drastically.

Regression $Y= 28,43 - 0,018\ X$

Age group 30-39

It represents the mortality rate over time period. Mortality rate is considered the actual number of deaths for the age group 30-39 divided by the population number of the age group.

```
Time series regression with "numeric" data:
Start = 1, End = 37

Call:
dynlm(formula = log(mortality30) ~ Year)

Residuals:
     Min         1Q       Median        3Q      Max
-0.152595 -0.073858  0.009677  0.055681  0.150654

Coefficients:
              Estimate     Std. Error   t value   Pr(>|t|)
(Intercept) 13.949058   2.285603   6.103     5.65e-07 ***
Year         -0.010495    0.001143  -9.184    7.49e-11 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.07422 on 35 degrees of freedom
Multiple R-squared:  0.7067,      Adjusted R-squared:  0.6984
F-statistic: 84.34 on 1 and 35 DF,  p-value: 7.492e-11
```



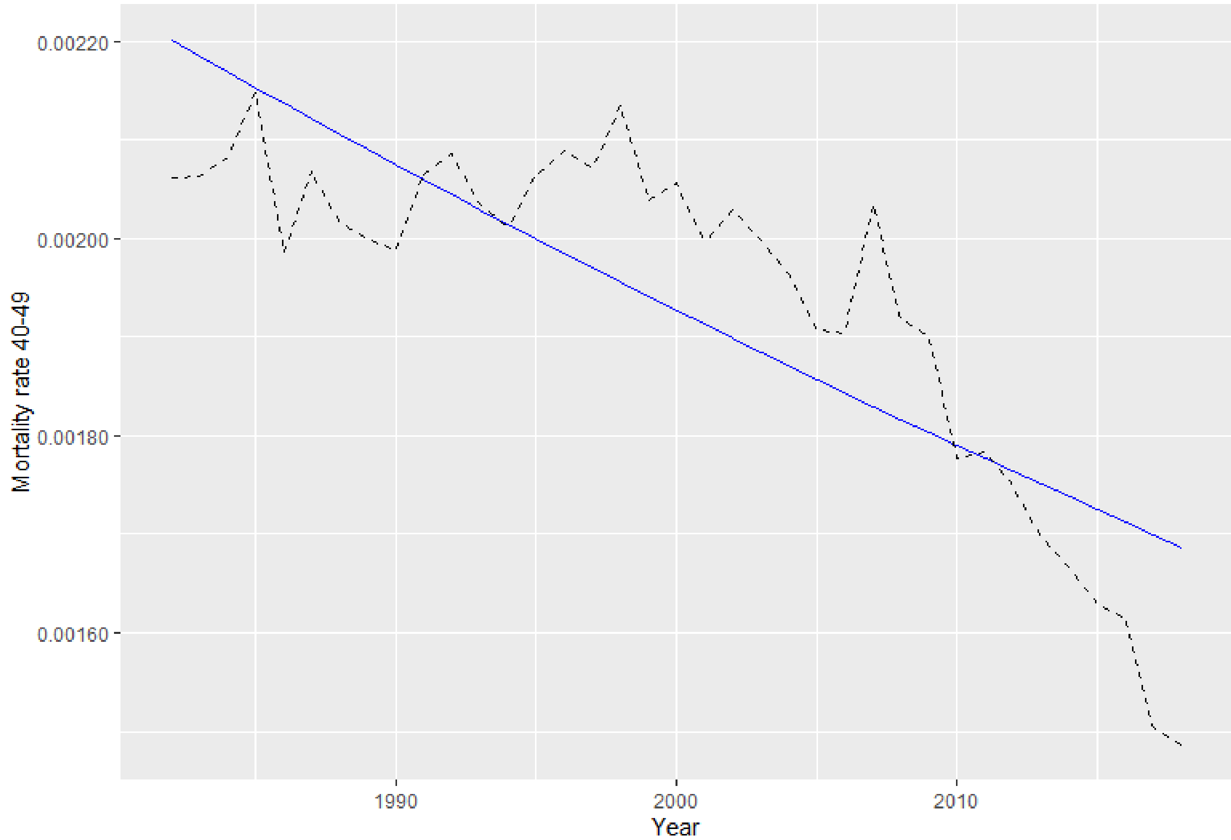
As per the trend the mortality rate for the age group 30-39 has a decrease over a period 30 years. At this period the GDP has increase drastically.

Regression $$Y= 13,95 - 0,01 X$$

Age group 40-49

It represents the mortality rate over time period. Mortality rate is considered the actual number of deaths for the age group 40-49 divided by the population number of the age group.

```
Time series regression with "numeric" data:
Start = 1, End = 37

Call:
dynlm(formula = log(mortality40) ~ Year)

Residuals:
     Min        1Q    Median        3Q       Max
-0.126490 -0.042932  0.002601  0.048933  0.105475

Coefficients:
             Estimate   Std. Error  t value  Pr(>|t|)
(Intercept)  8.5403243  1.7497590   4.881   2.30e-05 ***
Year        -0.0073960  0.0008749  -8.454   5.66e-10 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.05682 on 35 degrees of freedom
Multiple R-squared:  0.6713,	Adjusted R-squared:  0.6619
F-statistic: 71.47 on 1 and 35 DF,  p-value: 5.657e-10
```



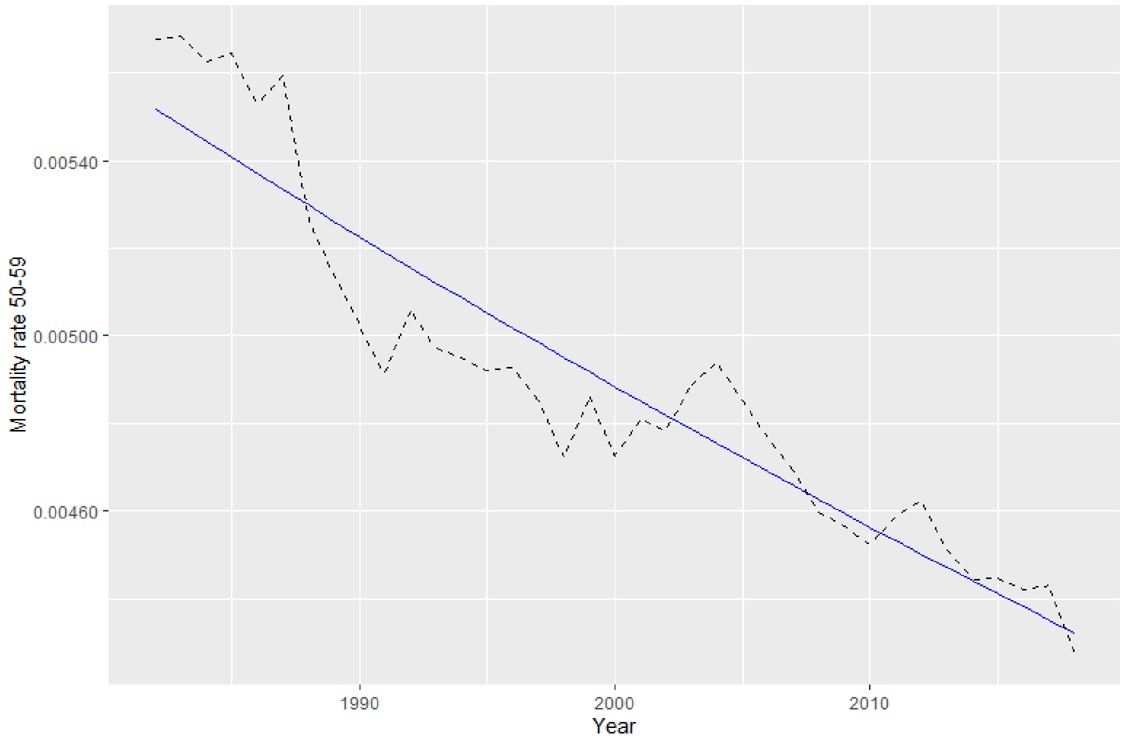
As per the trend the mortality rate for the age group 40-49 has a decrease over a period 30 years. At this period the GDP has increase drastically.

Regression $Y= 8{,}54 - 0{,}007\ X$

Age group 50-59

It represents the mortality rate over time period. Mortality rate is considered the actual number of deaths for the age group 50-59 divided by the population number of the age group.

```
Time series regression with "numeric" data:
Start = 1, End = 37

Call:
dynlm(formula = log(mortality50) ~ Year)

Residuals:
     Min        1Q    Median       3Q      Max
-0.054401 -0.019069 -0.005939  0.021364  0.047777

Coefficients:
             Estimate    Std. Error  t value    Pr(>|t|)
(Intercept)  8.2445801   0.8268073   9.972    9.13e-12 ***
Year        -0.0067832   0.0004134  -16.408   < 2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02685 on 35 degrees of freedom
Multiple R-squared:  0.885,	Adjusted R-squared:  0.8817
F-statistic: 269.2 on 1 and 35 DF,  p-value: < 2.2e-16
```



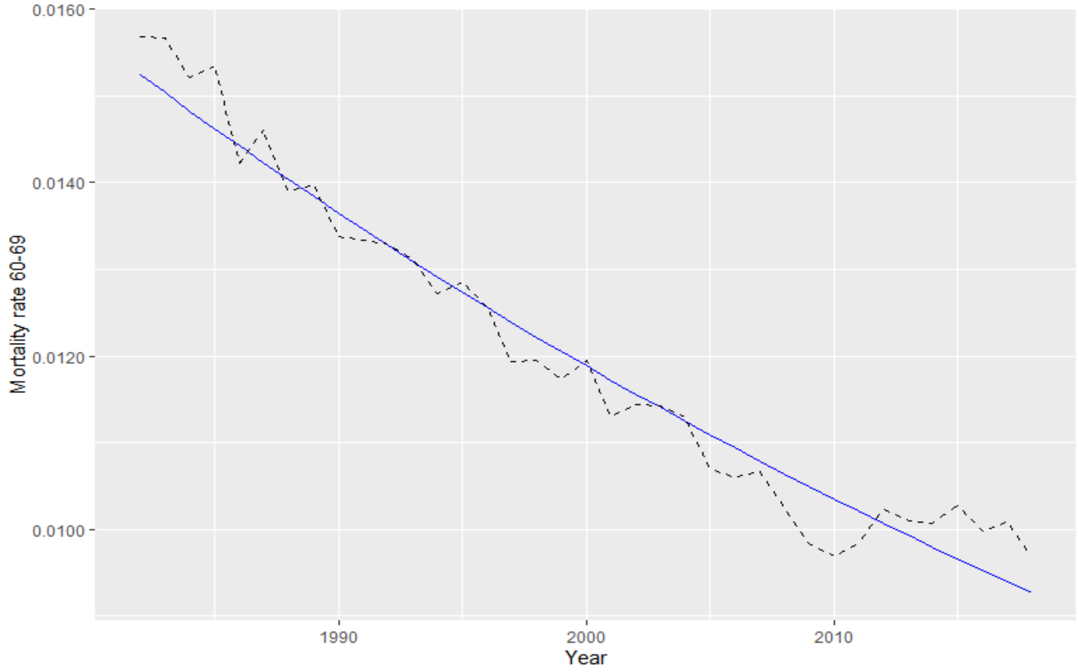
As per the trend the mortality rate for the age group 50-59 has a decrease over a period 30 years. At this period the GDP has increase drastically.

Regression $$Y = 8{,}24 - 0{,}007\,X$$

Age group 60-69

It represents the mortality rate over time period. Mortality rate is considered the actual number of deaths for the age group 60-69 divided by the population number of the age group.

```
regression with "numeric" data:
Start = 1, End = 37

Call:
dynlm(formula = log(mortality60) ~ Year)

Residuals:
     Min        1Q    Median        3Q       Max
-0.066462 -0.022244  0.001335  0.025739  0.070110

Coefficients:
             Estimate  Std. Error t value  Pr(>|t|)
(Intercept) 23.2183657  1.0302104   22.54  <2e-16 ***
Year        -0.0138254  0.0005151  -26.84  <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.03345 on 35 degrees of freedom
Multiple R-squared:  0.9537,	Adjusted R-squared:  0.9523
F-statistic: 720.4 on 1 and 35 DF,  p-value: < 2.2e-16
```



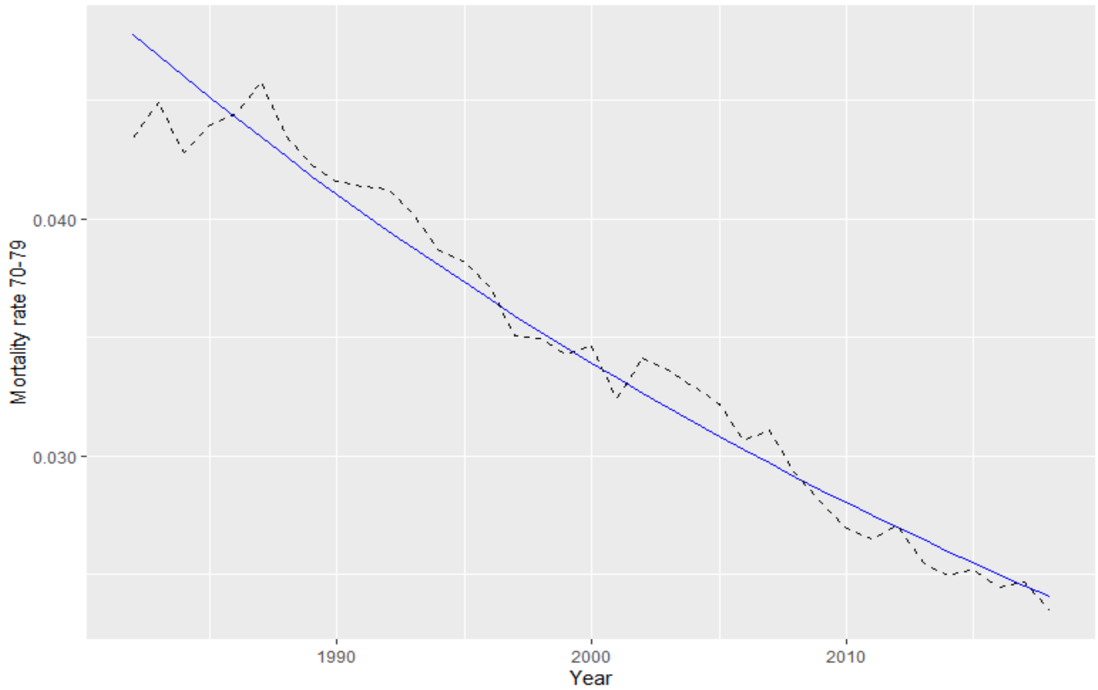
As per the trend the mortality rate for the age group 60-69 has a decrease over a period 30 years. At this period the GDP has increase drastically.

Regression $$Y= 23{,}22 - 0{,}014\ X$$

Age group 70-79

It represents the mortality rate over time period. Mortality rate is considered the actual number of deaths for the age group 70-79 divided by the population number of the age group.

```
Time series regression with "numeric" data:
Start = 1, End = 37

Call:
dynlm(formula = log(mortality70) ~ Year)

Residuals:
     Min         1Q      Median        3Q         Max
-0.096103 -0.025418  0.004352  0.021941  0.052337

Coefficients:
              Estimate   Std. Error  t value  Pr(>|t|)
(Intercept) 34.6656826  1.1033766   31.42  <2e-16 ***
Year        -0.0190248  0.0005517  -34.48  <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.03583 on 35 degrees of freedom
Multiple R-squared:  0.9714,     Adjusted R-squared:  0.9706
F-statistic:  1189 on 1 and 35 DF,  p-value: < 2.2e-16
```



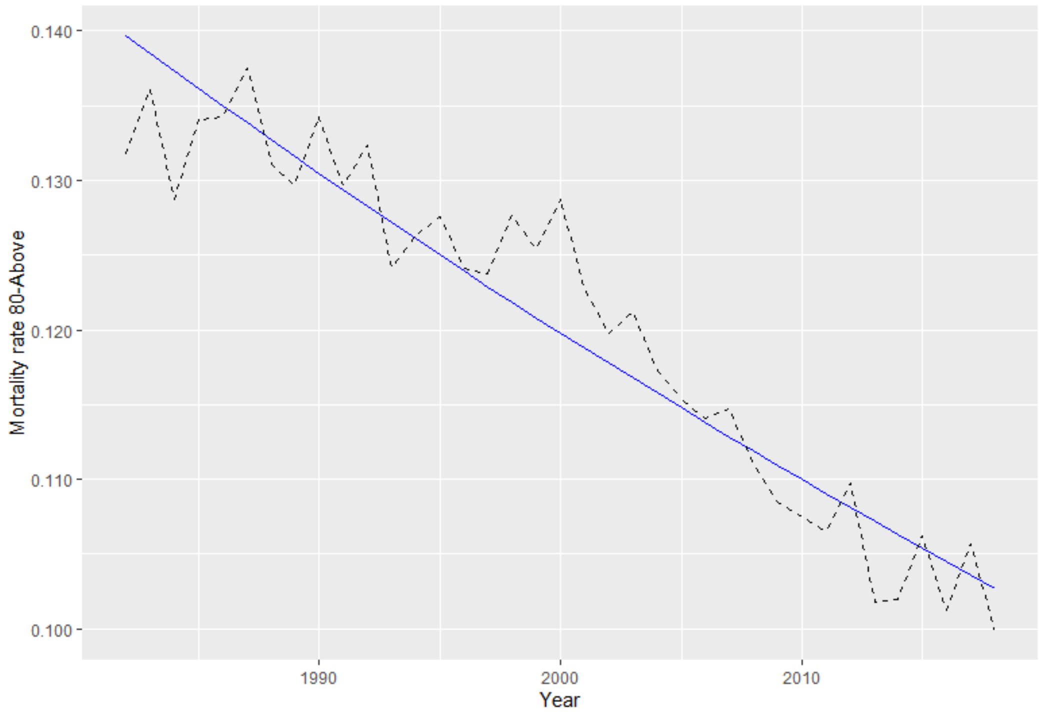
As per the trend the mortality rate for the age group 70-79 has a decrease over a period 30 years. At this period the GDP has increase drastically.

Regression Y= 34,66 - 0,019 X

Age group 80 - above

It represents the mortality rate over time period. Mortality rate is considered the actual number of deaths for the age group 80-above divided by the population number of the age group.

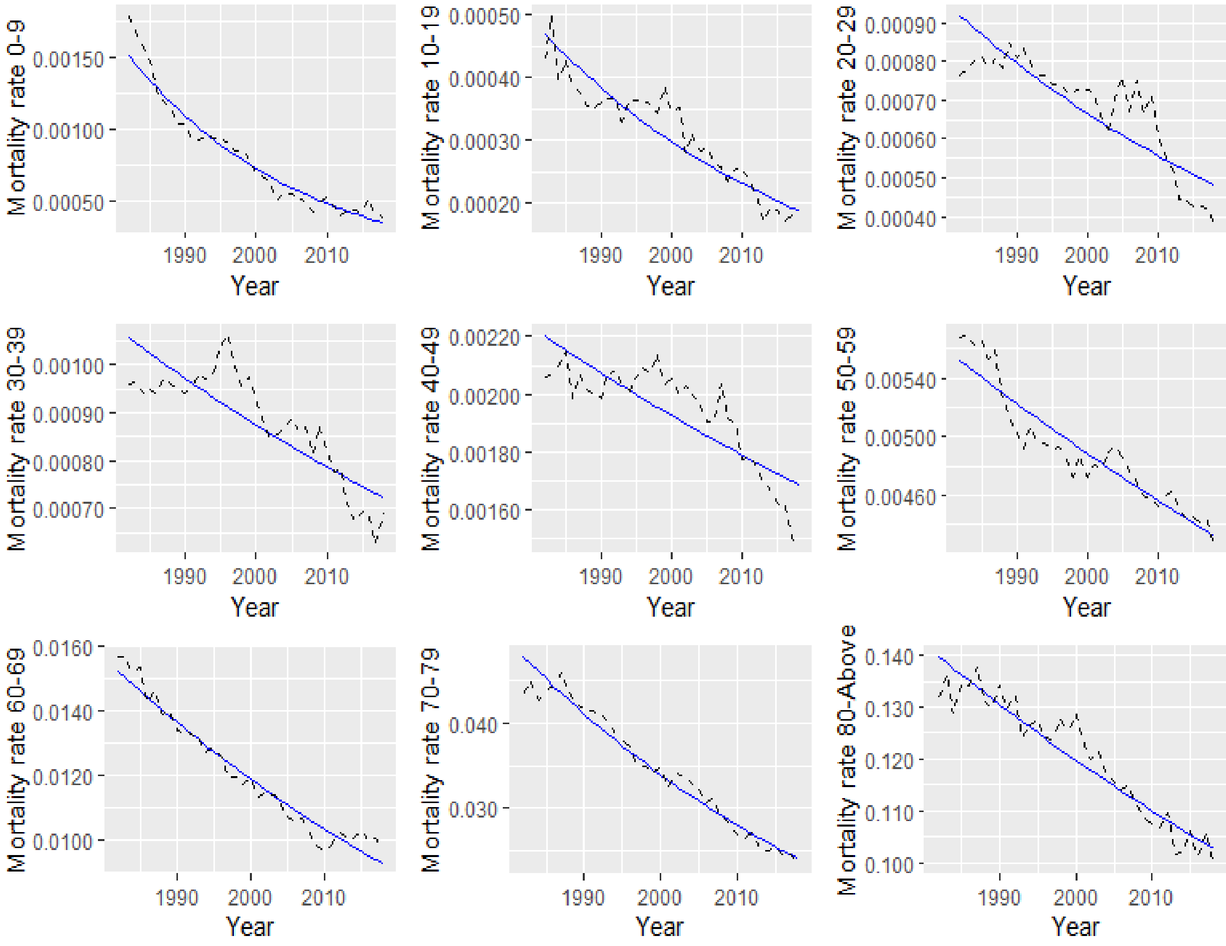
```
Time series regression with "numeric" data:
Start = 1, End = 37

Call:
dynlm(formula = log(mortality80Above) ~ Year)

Residuals:
     Min         1Q     Median        3Q       Max
-0.064643 -0.022158  0.002335  0.020014  0.071790

Coefficients:
              Estimate  Std. Error t value Pr(>|t|)
(Intercept) 14.9641333  0.9410221   15.90  <2e-16 ***
Year        -0.0085431  0.0004705  -18.16  <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.03056 on 35 degrees of freedom
Multiple R-squared:  0.904,	Adjusted R-squared:  0.9013
F-statistic: 329.7 on 1 and 35 DF,  p-value: < 2.2e-16
```



As per the trend the mortality rate for the age group 80- above has a decrease over a period 30 years. At this period the GDP has increase drastically.

Regression $Y = 14{,}96 - 0{,}008\ X$

SUMMARY



There is a paradox that while the mortality over thirty years increased by 0,2% each independent age group seems to have a negative trend, so mortality for each age group considering the population of the group is reducing. The total actual mortality considering the population has increased from 0,88% to 1,12%.

Considering the group 80 and above, the trend is a reducing mortality rate but there is the effect of the aging population which can be considered. Nowadays, this age group represents higher percentage rate on the total population, which increased over the period of time and the deaths of the similar group have not followed the trend at the same rate, so it actually compensates the decreasing trend of the group to the total population.

MORTALITY PER AGE GROUP	1982	1990	2000	2010	2018	Change from 1982 to 2018
TOTAL	**0,88%**	**0,93%**	**0,99%**	**0,99%**	**1,12%**	26,56%
0-9	0,18%	0,10%	0,07%	0,05%	0,04%	78,34%
10-19	0,04%	0,04%	0,03%	0,03%	0,02%	60,41%
20-29	0,08%	0,08%	0,07%	0,06%	0,04%	49,71%
30-39	0,10%	0,09%	0,09%	0,08%	0,07%	28,11%
40-49	0,21%	0,20%	0,21%	0,18%	0,15%	27,89%
50-59	0,57%	0,50%	0,47%	0,45%	0,43%	24,71%
60-69	1,57%	1,34%	1,20%	0,97%	0,97%	38,26%
70-79	4,34%	4,16%	3,46%	2,70%	2,35%	45,89%
80-above	13,18%	13,43%	12,87%	10,75%	9,99%	24,19%
PERCENTAGE POPUATION	**1982**	**1990**	**2000**	**2010**	**2018**	**Change from 1982 to 2018**
TOTAL	**100,00%**	**100,00%**	**100,00%**	**100,00%**	**100,00%**	-
0-9	14,44%	12,19%	9,46%	9,78%	9,42%	34,74%
10-19	15,38%	14,86%	11,94%	10,14%	10,02%	34,87%
20-29	14,11%	14,66%	15,93%	13,09%	10,53%	25,35%
30-39	12,89%	13,56%	14,74%	15,27%	13,21%	2,48%
40-49	13,44%	12,15%	13,16%	14,50%	15,08%	12,21%
50-59	12,18%	12,92%	11,51%	12,53%	13,81%	13,39%
60-69	8,70%	10,38%	11,69%	10,42%	11,81%	35,65%
70-79	6,46%	6,32%	8,05%	9,35%	9,22%	42,71%
80-above	2,39%	2,95%	3,52%	4,94%	6,90%	188,31%
MORTALITY PER POPULATION	**1982**	**1990**	**2000**	**2010**	**2018**	**Change from 1982 to 2018**
TOTAL	**0,88%**	**0,93%**	**0,99%**	**0,99%**	**1,12%**	26,58%
0-9	0,03%	0,01%	0,01%	0,01%	0,00%	85,86%
10-19	0,01%	0,01%	0,00%	0,00%	0,00%	74,22%
20-29	0,01%	0,01%	0,01%	0,01%	0,00%	62,46%
30-39	0,01%	0,01%	0,01%	0,01%	0,01%	26,33%
40-49	0,03%	0,02%	0,03%	0,03%	0,02%	19,08%
50-59	0,07%	0,06%	0,05%	0,06%	0,06%	14,62%
60-69	0,14%	0,14%	0,14%	0,10%	0,11%	16,25%
70-79	0,28%	0,26%	0,28%	0,25%	0,22%	22,78%
80-above	0,32%	0,40%	0,45%	0,53%	0,69%	118,57%

Considering each group separately we can observe that the actual mortality per age group considering the population of each age group, shows a decrease but the age group of 80 – above shows an increase from 0,32% to 0,69%, so the difference is 118,57%. But the population of this age group has increase by 188,31% over a 37 years period.

Statistical Tests

In APPENDIX 1 there are statistical tests for testing

1. Linearity
2. Homoscedasticity
3. Normality

Homoscedasticity

White Test

An important assumption for a regression model is that the variance of the error term is constant across observations.

- If the error has a constant variance, then the errors are called homoscedastic

- If the error does not have a constant variance, then the errors are heteroscedastic.

The White test is a statistical test to review if the variance of the errors in a regression model is constant (is homoscedastic). If the White test statistic is statistically significant, heteroskedasticity may not necessarily be the cause but instead the problem could be a specification error. So, this test can be a test of heteroskedasticity or specification error or both, depends if cross product terms are included in the White test procedure.

Test for constant variance one undertakes an auxiliary regression analysis:

a. Regresses the squared residuals from the original regression model to a set of regressors that contain the original regressors along with their squares.

b. inspect the R^2.

The Lagrange multiplier (LM) test statistic is the product of the R^2 value and sample size:

$$LM = n R^2$$

This statistic is produced by Chi square distribution by 2 df (k-1)

The null hypothesis for this test is that the error variances are all equal. The alternate hypothesis is that the error variances are not equal.

If p-value less that a significance level of 0.05, therefore we can reject the null hypothesis that the variance of the residuals is constant, so the heteroscedasticity is present.

The logic of the test

a. the squared residuals from the original model serve as a proxy for the variance of the error term at each observation.

b. The error term is assumed to have a mean of zero, and the variance of a zero-mean random variable is just the expectation of its square.

c. The independent variables in the auxiliary regression account for the possibility that the error variance depends on the values of the original regressors in some way (linear or quadratic).

Heteroscedastic

An assumption of the linear regression model is that there is no heteroscedasticity. Breaking this assumption means that the Gauss–Markov theorem does not apply, meaning that ordinary least squares (OLS) estimators are not the best linear unbiased estimators (BLUE) and their variance is not the lowest of all other unbiased estimators.

Heteroscedasticity does not cause OLS coefficient estimates to be biased, although it can cause ordinary least squares estimates of the variance of the coefficients to be biased.

If the presence of heteroscedasticity is ignored and the model is estimated by OLS, using a standard regression package, then the t and F statistics calculated by the software can be very misleading and are of no help in deciding whether to accept or reject null hypotheses.

OLS ignores information when the dependent variable has variable variance. Weighted least squares, however, attaches more importance to observations from populations with less variability and less importance to observations from populations with higher variability. WLS attaches more weight to those observations likely to contain more information about the relationship between the variables.

Weighted least squares

White's method yields estimate of the variances which are consistent but the associated parameter estimates are not the most efficient, instead Weighted least squares (WLS) estimation should be used.

Weighted least squares (WLS) regression when treat each observation as more or less informative about the underlying relationship between variable and the outcome. So for those points that are more informative are given more 'weight', while for those that are less informative are given less weight. The weighted least squares (WLS) regression is technically only valid if the weights are known a-priori. In our case this is not relationship known. Another technic would be to run a Monte Carlo simulation for these variables and build this relationship based on the accessed results of the Monte Carlo simulation, so even though the relationship was not known then we could produce it from the beginning. This is an extensive exercise and it is not within the scope of this thesis.

White Heteroscedasticity – adjusted errors

Since the heteroskedasticity is present in our data sample, the OLS estimator will still be unbiased and consistent, but it will not be efficient. Estimated standard errors will be biased and this issue cannot be resolved a larger sample size. Heteroskedasticity leads to a bias in the variance-covariance matrix, so the standard model testing methods such as t tests or F tests cannot be relied on any longer.

To correct for this bias, it may make sense to adjust your estimated standard errors. Two popular ways to tackle this are to use:

- *"Robust" standard errors (White's Standard Errors)*
  An approach to treat heteroskedasticity is based on using an estimator for the standard errors that is robust to heteroskedasticity rather than doing all these investigations and then correct for it assuming a specific structure of the variance.
  The variance of the OLS estimator should look like for the simple linear regression model:

$$V(b_1) = \frac{\sum_{i=1}^{n}(X_i - \bar{X})^2 \ \sigma_i^2}{\{\sum_{i=1}^{n}(X_i - \bar{X})^2\}^2} = \frac{\sigma_i^2}{\sum_{i=1}^{n}(X_i - \bar{X})^2} = \frac{\sigma_i^2}{\sum_i x_i^2}$$

$$se(b_1) = \frac{\sigma}{\sqrt{\sum_i x_i^2}}$$

And
$$se(b_0) = \sqrt{\frac{\sum X_i^2}{n \sum x_i^2}}\,\sigma$$

Halbert White showed that the unknown population variance could be replaced by the corresponding squared least square residual e1. By doing that one would receive consistent estimates of the true standard errors which provide a basis for inference in large samples. Hence, a heteroskedasticity-consistent variance estimator could be estimated using the following formula:

$$S_{b_1}^2|_{Robust} = \frac{\sum_{i=1}^{n}(X_i - \bar{X})^2 e_i^2}{\{\sum_{i=1}^{n}(X_i - \bar{X})^2\}^2} = \frac{e_i^2}{\sum_{i=1}^{n}(X_i - \bar{X})^2}$$

It is a large sample estimator it is only valid asymptotically, and test based on them are not exact and when using small samples, the precision of the estimator may be poor. There is a small sample adjustment factor that could improve the precision considerably by multiplying the variance estimator given by n/(n-k). If the robust standard errors, which are heteroskedasticity consistent standard errors, are bigger than the OLS, we check the significance of the parameter. If the OLS model is true, the residuals should be uncorrelated with the x's. Indeed, if all the assumptions of the OLS model are true, then the expected values of the OLS estimator and the robust estimator are approximately the same when the default multiplier is used.

We can conclude that the estimated standard deviation of the error term does not change very much, while the intercept remain constant, therefore conclude that the model is not very sensitive to heteroskedasticity.

- *Clustered Standard Errors*
  The variance of the clustered estimator is less than the robust (unclustered) estimator, it means that the cluster sums have less variability than the individual. That is, when within a cluster, some of the variation gets canceled out, and the total variation is less. This means that a big positive is summed with a big negative to produce something small—there is negative correlation within cluster.

Linearity

Pearson correlation (r), measures the linear dependence between two variables (x and y). It is a parametric correlation test because it depends to the distribution of the data. It can be used only when x and y are from normal distribution. The plot of y = f(x) is named the linear regression curve.

Correlation formula

In the formula below,

- **x** and **y** are two vectors of length **n**
- m_x and m_y corresponds to the means of x and y, respectively.

Pearson correlation formula

$$r = \frac{\sum(x - m_x)(y - m_y)}{\sqrt{\sum(x - m_x)^2 \sum(y - m_y)^2}}$$

mx and *my* are the means of x and y variables.

The p-value of the correlation is determined by calculating the **t value** for $df = n - 2$

$$t = \frac{\mathrm{r}}{\sqrt{1 - \mathrm{r}^2}} \sqrt{n - 2}$$

The null hypothesis for the test is that the coefficient correlation is zero, while the alternative hypothesis is that the true correlation is not equal to zero.

If the p-value is < 5%, then the correlation between x and y is significant since we reject the null hypothesis.

Normality

The Jarque-Bera Test is a test for normality (Lagrange multiplier type).

The null hypothesis for the test is that the data is normally distributed, while the alternate hypothesis is that the data does not come from a normal distribution.

If the p-value is > 5%, then we cannot reject the null hypothesis.

Also, as per the Central Limit Theorem (CLT) the variables tend toward a normal distribution, even if the original variables themselves are not normally distributed when large random samples from the population are considered. We have considered more than 37 observations (>30), so we have an approximately normal distribution.

Results Summary of the Statistical Tests

Regression GDP per Capita per year

White Test: Heteroscedastic

White's heteroscedasticity: p value significant

(adjusted errors)

Linearity: reject null hypothesis – there is linear correlation

Normality: cannot reject null hypothesis -normal distribution

Regression Mortality per year

White Test: Heteroscedastic

White's heteroscedasticity: p value significant

(adjusted errors)

Linearity: reject null hypothesis – there is linear correlation

Normality: cannot reject null hypothesis -normal distribution

Regression Mortality age group 40-49 per year

White Test: Heteroscedastic

White's heteroscedasticity: p value significant

(adjusted errors)

Linearity: reject null hypothesis – there is linear correlation

Normality: cannot reject null hypothesis -normal distribution

Regression Mortality age group 50-59 per year

White Test: Heteroscedastic

White's heteroscedasticity: p value significant

(adjusted errors)

Linearity: reject null hypothesis – there is linear correlation

Normality: cannot reject null hypothesis -normal distribution

Regression Mortality age group 60-69 per year

White Test: Heteroscedastic

White's heteroscedasticity: p value significant

(adjusted errors)

Linearity: reject null hypothesis – there is linear correlation

Normality: cannot reject null hypothesis -normal distribution

Regression Mortality age group 70-79 per year

White Test: Heteroscedastic

White's heteroscedasticity: p value significant

(adjusted errors)

Linearity: reject null hypothesis – there is linear correlation

Normality: cannot reject null hypothesis -normal distribution

Regression Mortality age group 80-above per year

White Test: Homoscedastic

Linearity: reject null hypothesis – there is linear correlation

Normality: cannot reject null hypothesis -normal distribution

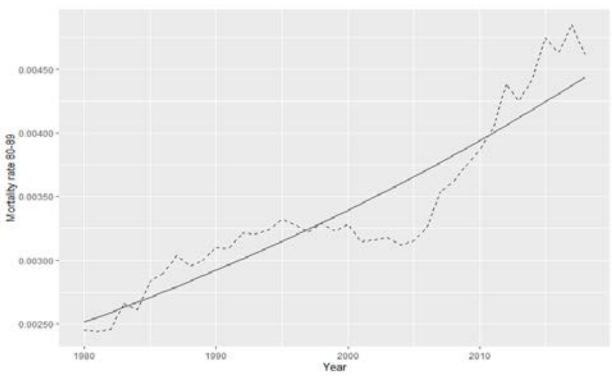
Discussion

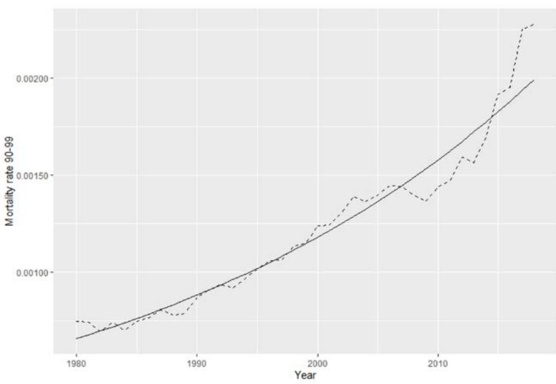
The procyclical trend of mortality had been found by many researchers as we have already explained above (Eyer, 1977; Ogburn & Thomas, 1922; Ruhm, 2000; Tapia Granados & Diez Roux, 2009). Also, there were some cases that the trend is not clearly defined, specially on studies of recent years (McInerney & Mellor,2012; Ruhm, 2015). Meanwhile, it is worth to mention, that at most of the studies for the short term impact of economic crisis, shows that mortality is reduced when economy deteriorates and unemployment increases except the suicide mortality.

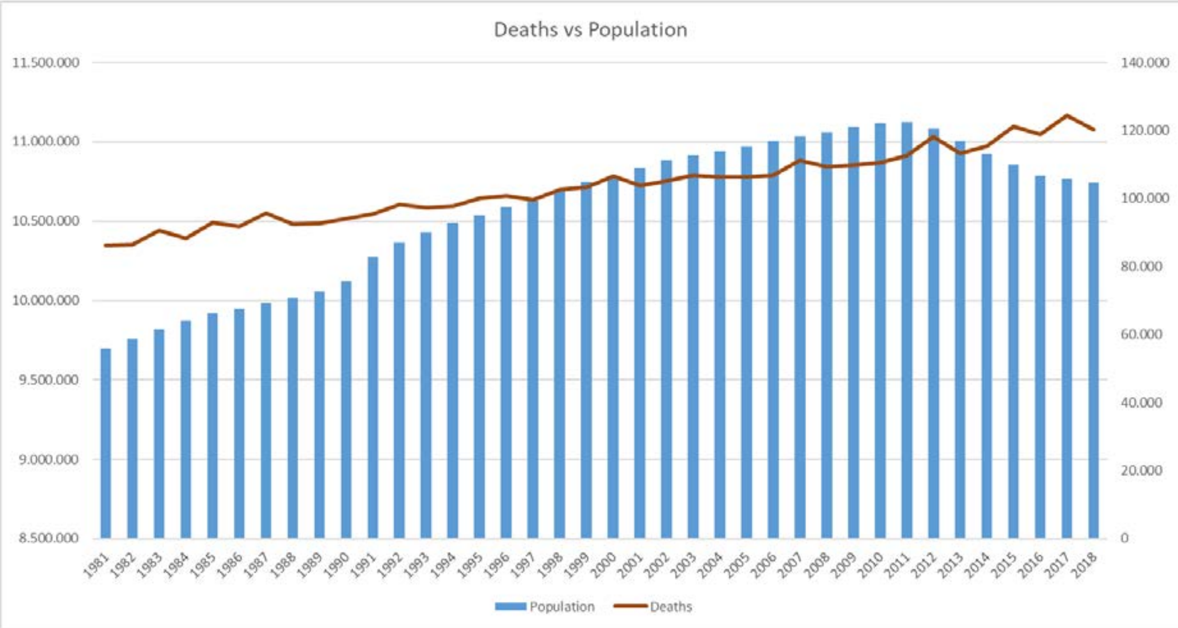
The results of this thesis show that the overall mortality in Greece had a procyclical trend for the period of 1982 to 2009, since it increased as the economy expanded. From 2009 onwards, as a great recession appeared in the Greek economy, the mortality should have decreased if there was a procyclical trend but instead it keeps increasing. We have produced an analysis of the mortality trend per age group and we found that the mortality rate per age group is reducing, for the total period from 1982 to 2018.

As we have already explained the mortality rate from 1982 to 2009 was found that was increasing while the analysis per aggroup was so a reducing rate. This paradox is created due to the group 80 and above, since the trend shows a reducing mortality rate but there is the effect of the aging population which can be considered. Over the period of 37 years that this thesis is reviewing the mortality trend, this age group percentage rate on the total population is increased and represents a bigger population than before. This increase over the period and the deaths of the similar group have not followed the trend at the same rate, so it actually compensates the decreasing trend of the group to the total population. A possible reason for this paradox is the lag of time between the accelerated rate of the increase for the population of the specific age group and the mortality rate of this age group that do not follow at the same rate. We have produced an analysis for the same age group but instead of considering the death rate of the specific group over the group's population, we consider the death rate of the specific group over the total population (as it has a small fluctuation over 37 years) then the mortality trend is increasing.

Please see below the trend of this group but it was reviewed in two subgroups 80-89 and 90 – above. This analysis was produced for the death trend over total population.







The overall mortality is increased over the period of time as GDP has increased. It is worth to mention that even though there is decrease in the population the mortality is still increased in actual numbers.

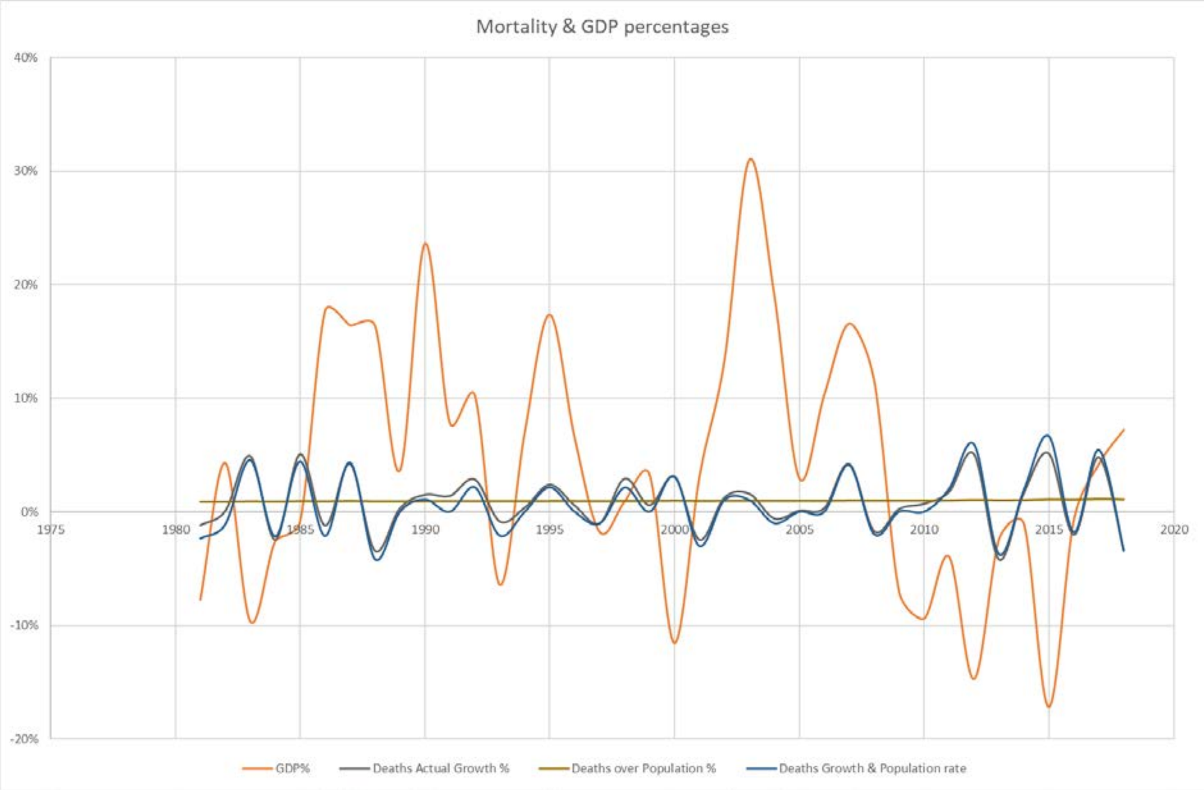
The pattern that the mortality is rising in periods of economic expansion and falling in recessions, has been found in many studies of high-income market economies, such asOgburn & Thomas, 1922; Tapia Granados & Diez Roux, 2009; Eyer, 1977a; Ruhm, 2000; Gerdtham & Ruhm, 2006; Haaland & Telle, 2015; Tapia Granados, 2005; Tapia Granados & Ionides, 2008, 2011; Neumayer, 2004; Rolden, 2014; Lindo, 2015, as well as some middle-income economies Abdala, 2000; Gonzalez & Quast, 2010a, 2010b; Lin, 2009. In many of studies the total mortality is found to have a procyclically trend, while there is a countercyclical trend on suicide rates, which usually rise when the economy deteriorates.

Also from the diagram below there could be understood that

1. The mortality over the population is almost stable. There is only a small difference due to recession of 2009 that the mortality over the population number increase slightly, so before the 2009 the deaths were less than 1% (0,90% on 1981) of the population while after 2009 the deaths were representing 1,1% of the population.
2. The growth of the mortality rate after considering the population rate, increased additionally by 4% more that the above mentioned rate for the period 2009 to 2018 when the economic recession affect Greece.

There are controversial results after studying health effects of recession, specially in Europe. The harmful effects of the recession on health and health care, were supported by Kentikelenis, 2014; Karanikolos, 2013; Simou & Koutsogeorgou, 2014, but also they were authors that questioned these effects, such as Liaropoulos, 2012; Tapia Granados & Rodriguez, 2015, and there are several authors support, that the recession is having beneficial effects on health, such as Fuente, 2014, particularly on major indicators of population health, including general mortality, as it was supported by Regidor, 2016; Toffolutti & Suhrcke, 2014.

On this thesis, the results show that the mortality rate during the recession period in Greece actually increase. Further analysis is provided on the graph below.



Consideirng that the total mortality has shown an actual increase on the period 2009 and afterwards, we have analyzed the effects of the mortality trend per age group.

The mortality rate of the age group 0-9 is steadily decline since 1981. The recession of 2009 and afterwards show that the decline rate is reduced considering the previous trend but this takes place at very low mortality rates. Similar trend follows also the mortality of the age group 10-19.

The mortality rate of the age group 20-29 is steadily decline since 1981. The recession of 2009 and afterwards show an accelerated decline rate as it will be expected according to the theory that during economic recession the mortality rate show the trend to decrease. Similar, results observed in the mortality rate of the age group 30-39, where the mortality rate show an accelerated decline rate after 2009 while the decline till this period was at a smaller rate.

The mortality rate of the age group 40 – 49 does not show any significant decrease prior the recession of 2009, but after this there is an accelerated decrease considering the previous trend.

The mortality rate of the age group 50 – 59 shows a small decrease over the 37 year period and there is no major fluctuation on the decrease trend resulted due to recession of 2009.

The mortality rate of the age group 60 – 69 shows a decrease over the period till the recession of 2009. Then it shows a stability on the trend and no significant decrease after the recession arise.

The mortality rate of the age group 70 – 79 show a decrease over the period of 37 years. There is no major fluctuation due to recession.

Summarizing the above, we have found that the age groups 20-29, 30-39 and 40-49 present an accelerated decrease in mortality from 2009 and afterwards, as the recession affect the economy and the GDP per capita. This finding is in accordance to the literature review as it has appeared to other researchers models, such as T. Granados & E. Ionides, 2017, that the mortality at ages 30–44 is more responsive to macroeconomic change, and the effect appears systematically in many models. For all the other age groups there is no significant impact of the recession, while for some age groups such as 0-9, 10-19 and 50-59, shows that the recession do not affect and actually a stability to low mortality rates has appeared.

The actual increase of the mortality rate during the recession period is produced from the age group 80 – above. There we could observe that the actual mortality rate over the population rate was 0,32% on 1982, then increase to 0,53% on 2010, an actual increase of 0,21% within 28 years and then reach to 0,69% on 2018, so the increase during the recession period is actually 0,16%.

The present investigation is focused on time series, so we did not study lagged effects. There are findings of lagged harmful effects of recessions on health reported by Brenner, 1983, but they were not confirmed by other researchers, such as Tapia Granados, 2012; Tapia Granados & Ionides, 2008; Wagstaff, 1985; Winter, 1983. Also, Brenner's studies have received a variety of criticisms by many researchers about Brenner's data and conclusions.

The long-run trend since the 19th century was that the age-specific mortality rates have declined, whereas GDP per capita has increased. The higher levels of GDP per capita are generally associated with lower levels of mortality, which promoted the view that "wealthier is healthier" (Pritchett & Summers, 1996), that increasing levels of income are always associated to increased levels of health and life expectancy at birth. However, Samuel Preston (Preston 1996) supported that only a minor part of the increased life expectancy could be attributed to rising income.

There are cross-country analyses (Cutler, 2006) that provide almost no relation between changes in life expectancy and economic growth over different time periods, from 10 to 40-year period, so it has been claimed that in many countries, there have been improvements in health while there was small economic growth. A researcher (Sen, 2001) found that the rate of decline of mortality in Britain between 1900 and 1970 revealed an inverse relationship with economic growth. Also T. Granados, on 2012 conclude to a relation that high-economic growth associated with low increases in life expectancy on a 20th century in a year-to-year analysis. This idea that in the short run, economic recessions are rather beneficial for a variety of health outcomes, has been reported to be weakening as per some studies in recent years of Ruhm on 2013 and Tapia Granados on 2008 & 2012.

The relation of reductions in mortality, in recession when there is rising unemployment is counterintuitive because it is at odds with research, since the unemployed individuals (compared with employed ones) have worse health outcomes, and that there is a strong health gradient by social class, so that higher income correlates with better health. In recession, we would expect the mortality to increase or at least to be stable but most of the studies conclude that there is an opposite effect, so the mortality declines when unemployment increases and economy declines.

We observe that mortality accelerates its declining trend when the economy slows down, especially for the age groups 20-29, 30-39 and 40-49, that actually are within the groups that affected more from the recession due to increased unemployment.

The explanation must be that there are some other important determinants of ill health and death which are correlated with economic activity. The traffic-related mortality, could be one determinant since in economic downturns there is reduced industrial and commercial traffic, as well as commuting and recreational driving. In economic expansion period may be there is a possibility of industrial injuries since there are overtime hours, higher intensity of work and recruitment of new workers who are inexperienced. Another explanation can be given to the reduced atmospheric pollution in the recessions but maybe there is lagged time effect in order the reduced air pollution to have effects in health. Also, there are some cases that air pollution actually may increase if the people turn to traditional methods for warming up their houses or cooking in order to save for the utility bills.

Determinants could be provided from changing in work environment factors, such as slower rhythms of work and less overtime, which may lead to less occupational stress and more time for sleep, physical activity, and social interaction. Changing of habits and norms can be another determinant, such as walking more and reduce smoking.

Another determinant that could be considered is immigration, since it cause changes in the aging of the national population and it can change mortality rates.

In APPENDIX 2, there is a presentation of the geographical GDP per capita which is compared with the deaths per age group after 50 years old for 20 randomly selected Greek counties from year 2000 to 2017, in order to examine through the graphical representation of the data

i. If within one country, people leave longer when their income levels are increasing

ii. How the economic depression has affected the mortality per age group category

In all the cases is found that for the age groups 50-59, 60-69 and 70-79 there is no important fluctuation or the actual deaths decrease over this period. for the age group 80-above (subgroups 80-89 & 90-above) the actual deaths increase but as we have already explained the actual population of this group is increased since there is an aging phenomenon in Greece ie the life expectancy is increased.

There are no significant variances traced, and the mortality trend within the country was almost similar among different counties. To develop a model for such an analysis in order to examine the uniformity across different geographical areas over time is not within the scope of this thesis. It would need further research to determinants such as medical facilities & among geographical areas, lifestyle, education & culture.

In APPENDIX 3 there is a graphical presentation of the actual mortality per sex and age group. It has been observed that the female mortality is less than the male mortality in all the groups. Moreover, it can be observed that the actual mortality after 2009 in the age group 50-59 was not affected by the crisis, while for the age group 60-69 the male mortality slight increased. For the age group 70-79, the actual mortality is decreasing for both sexes after the crisis of 2009, while for the group 80-above (subgroup 80-89 & 90-above) the actual mortality for both sexes increase. This is an increase at the actual figures without considering the actual population of the group which has increased due to aging effect.

Conclusion

We have already mentioned in the introduction that there are theories that suggest there is long term impact of growing economies to population's health since the people live longer and healthier (A. Deaton, 2003). In this thesis, we have seen that the population in Greece tend to live longer and possibly healthier, which resulted to the aging population phenomenon.

The mortality in Greece had a procyclical trend till the recession of 2009, as it has increased over a period of 26 years, when the economy expanded, and the GDP became more than three times higher. The mortality trend showed an increase of 0,2% but it is not as significant as the GDP increase of more than 300%.

The mortality rate after 2009 that the Greek economy face a sizable recession, increase and this is in contract with theories that claim the mortality rate during recession decrease. Also, the results of this thesis cannot verify that the mortality follow a procyclical trend during all the period since the rise of the mortality rate on the recession proved exactly the opposite, the countercyclical trend. It is important to note that the age group 20-29, 30-39 and 40-49 show an accelerated decrease in the mortality rate at this period but there is an increase in the actual mortality of the group 80-above that move the trend of the total population upwards.

Further researches can be produced to examine the mortality per region or examine the causes of death, to provide important explanations to the results were found.

APPENDIX 1 - Statistical Tests

REGRESSION LOG(GDP) vs YEAR

INITIAL REGRESSION

```
Time series regression with "numeric" data:
Start = 1, End = 39

Call:
dynlm(formula = log(GDP_per_capita) ~ Year)

Residuals:
     Min       1Q   Median       3Q      Max 
-0.45258 -0.13674  0.04767  0.16533  0.48915 

Coefficients:
             Estimate Std. Error t value Pr(>|t|)    
(Intercept) -81.527176   7.046548  -11.57 7.46e-14 ***
Year          0.045526   0.003525   12.91 2.80e-15 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.2478 on 37 degrees of freedom
Multiple R-squared:  0.8185,    Adjusted R-squared:  0.8135 
F-statistic: 166.8 on 1 and 37 DF,  p-value: 2.8e-15
```

HETEROSCEDASTICITY TEST

RESIDUALS PLOT

WHITE TEST

```
        studentized Breusch-Pagan test

data:  lgdp_c_year
BP = 14.524, df = 2, p-value = 0.0007016
```

HETEROSCEDASTIC!!!

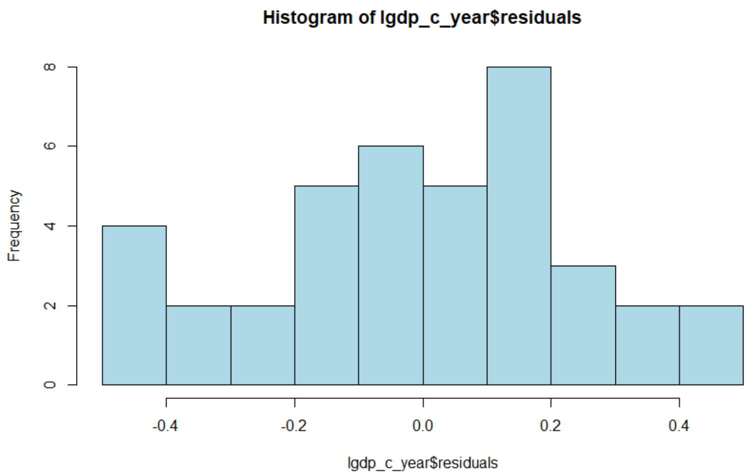
White's heteroscedasticity-adjusted errors

```
t test of coefficients:

               Estimate  Std. Error t value  Pr(>|t|)    
(Intercept) -81.5271761   8.6111744 -9.4676 1.995e-11 ***
Year          0.0455264   0.0043185 10.5421 1.067e-12 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

LINEARITY TEST

```
        Pearson's product-moment correlation

data:  log(GDP$GDP_per_capita) and GDP$Year
t = 12.915, df = 37, p-value = 2.8e-15
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.8245227 0.9492460
sample estimates:
     cor 
0.904685 
```

NORMALITY TEST




```
Title:
 Jarque - Bera Normalality Test

Test Results:
  STATISTIC:
    X-squared: 0.7488
  P VALUE:
    Asymptotic p Value: 0.6877
```

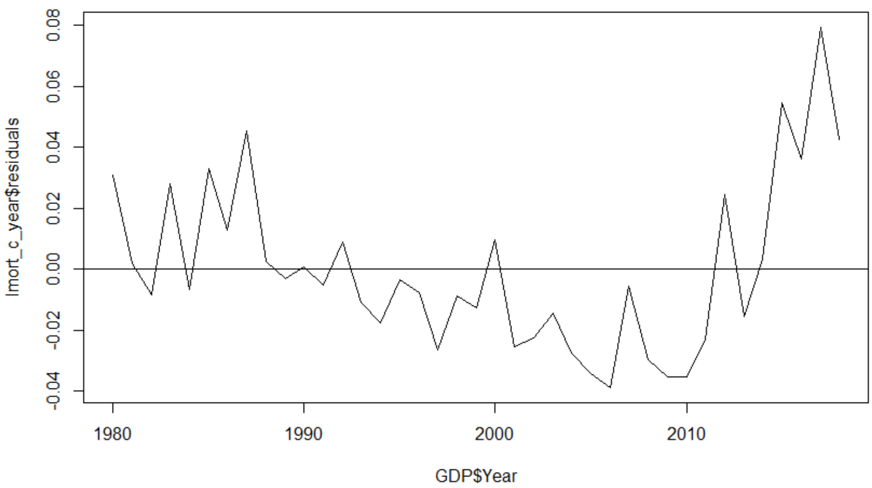
REGRESSION LOG(MORTALITY) vs YEAR

INITIAL REGRESSION

```
Call:
dynlm(formula = log(mortality) ~ Year)

Residuals:
      Min        1Q    Median        3Q       Max
-0.038859 -0.020027 -0.005475  0.011423  0.079594

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -1.489e+01  7.942e-01  -18.75  < 2e-16 ***
Year         5.131e-03  3.973e-04   12.91  2.8e-15 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02792 on 37 degrees of freedom
Multiple R-squared:  0.8185,	Adjusted R-squared:  0.8135
F-statistic: 166.8 on 1 and 37 DF,  p-value: 2.801e-15
```

HETEROSCEDASTICITY TEST

RESIDUALS PLOT



WHITE TEST

```
	studentized Breusch-Pagan test

data:  lmort_c_year
BP = 14.026, df = 2, p-value = 0.0009003
```

HETEROSCEDASTIC!!!

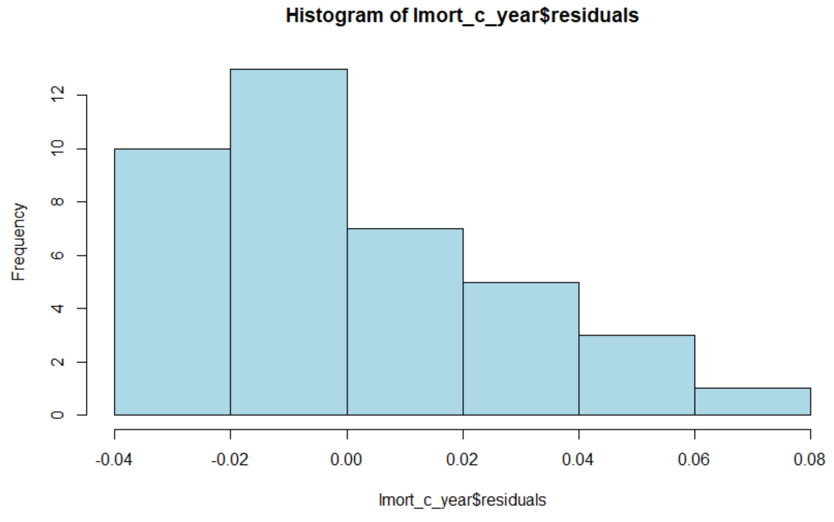
White's heteroscedasticity-adjusted errors

```
t test of coefficients:

               Estimate  Std. Error t value  Pr(>|t|)    
(Intercept) -1.4890e+01  1.0508e+00 -14.169 < 2.2e-16 ***
Year         5.1313e-03  5.2694e-04   9.738 9.414e-12 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

LINEARITY TEST

```
        Pearson's product-moment correlation

data:  log(GDP$mortality) and GDP$Year
t = 12.915, df = 37, p-value = 2.801e-15
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.8245206 0.9492453
sample estimates:
      cor 
0.9046839
```

NORMALITY TEST




```
Title:
 Jarque - Bera Normalality Test

Test Results:
  STATISTIC:
    X-squared: 5.1593
  P VALUE:
    Asymptotic p Value: 0.0758
```

REGRESSION LOG(MORTALITY 40-49) vs YEAR

INITIAL REGRESSION

```
Time series regression with "numeric" data:
Start = 1, End = 37

Call:
dynlm(formula = log(mortality40) ~ Year)

Residuals:
      Min        1Q    Median        3Q       Max 
-0.126490 -0.042932  0.002601  0.048933  0.105475 

Coefficients:
              Estimate Std. Error t value Pr(>|t|)    
(Intercept)  8.5403243  1.7497590   4.881 2.30e-05 ***
Year        -0.0073960  0.0008749  -8.454 5.66e-10 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.05682 on 35 degrees of freedom
Multiple R-squared:  0.6713,	Adjusted R-squared:  0.6619 
F-statistic: 71.47 on 1 and 35 DF,  p-value: 5.657e-10
```

HETEROSCEDASTICITY TEST

RESIDUALS PLOT

WHITE TEST

```
	studentized Breusch-Pagan test

data:  mort_c_year40
BP = 8.3589, df = 2, p-value = 0.01531
```

HETEROSCEDASTIC!!!

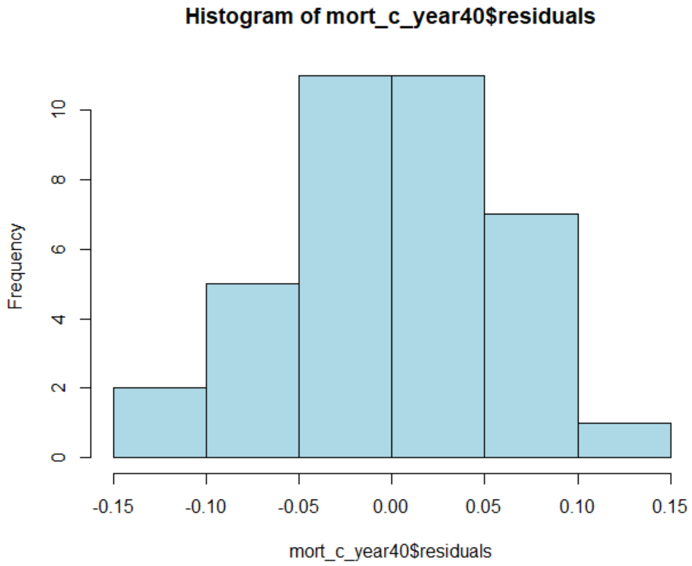
White's heteroscedasticity-adjusted errors

```
t test of coefficients:

              Estimate Std. Error t value  Pr(>|t|)    
(Intercept)  8.5403243  2.1782316  3.9208 0.0003924 ***
Year        -0.0073960  0.0010909 -6.7799 7.362e-08 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

LINEARITY TEST

```
        Pearson's product-moment correlation

data:  log(Dat$mortality40) and Dat$Year
t = -8.4539, df = 35, p-value = 5.657e-10
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 -0.9034788 -0.6742939
sample estimates:
       cor 
-0.8193073 
```

NORMALITY TEST




```
        Jarque-Bera Normality Test

data:  resid(mort_c_year40)
JB = 1.0208, p-value = 0.6003
alternative hypothesis: greater
```

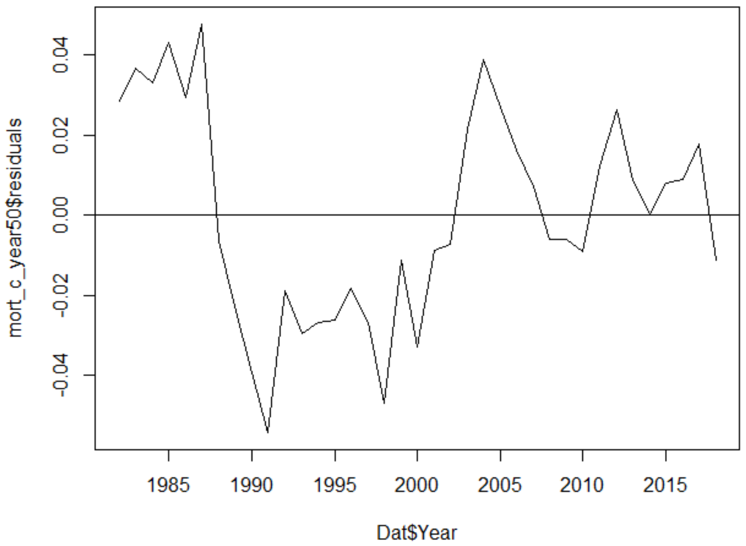
REGRESSION LOG(MORTALITY 50-59) vs YEAR

INITIAL REGRESSION

```
Time series regression with "numeric" data:
Start = 1, End = 37

Call:
dynlm(formula = log(mortality50) ~ Year)

Residuals:
      Min        1Q    Median        3Q       Max 
-0.054401 -0.019069 -0.005939  0.021364  0.047777 

Coefficients:
              Estimate Std. Error t value Pr(>|t|)    
(Intercept)  8.2445801  0.8268073   9.972 9.13e-12 ***
Year        -0.0067832  0.0004134 -16.408  < 2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.02685 on 35 degrees of freedom
Multiple R-squared:  0.885,	Adjusted R-squared:  0.8817 
F-statistic: 269.2 on 1 and 35 DF,  p-value: < 2.2e-16
```

HETEROSCEDASTICITY TEST

RESIDUALS PLOT



WHITE TEST

```
	studentized Breusch-Pagan test

data:  mort_c_year50
BP = 11.77, df = 2, p-value = 0.00278
```

HETEROSCEDASTIC!!!

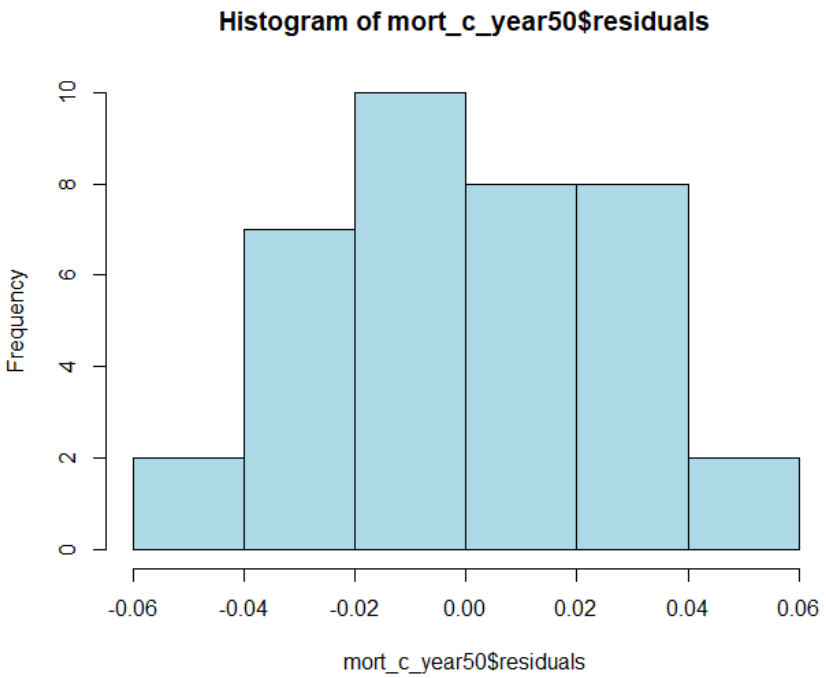
White's heteroscedasticity-adjusted errors

```
t test of coefficients:

              Estimate  Std. Error  t value  Pr(>|t|)
(Intercept)  8.24458010  0.87020822   9.4743 3.417e-11 ***
Year        -0.00678319  0.00043371 -15.6398 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

LINEARITY TEST

```
        Pearson's product-moment correlation

data:  log(Dat$mortality50) and Dat$Year
t = -16.408, df = 35, p-value < 2.2e-16
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 -0.9692898 -0.8871016
sample estimates:
       cor
-0.9407217
```

NORMALITY TEST




```
        Jarque-Bera Normality Test

data:  resid(mort_c_year50)
JB = 1.1625, p-value = 0.5592
alternative hypothesis: greater
```

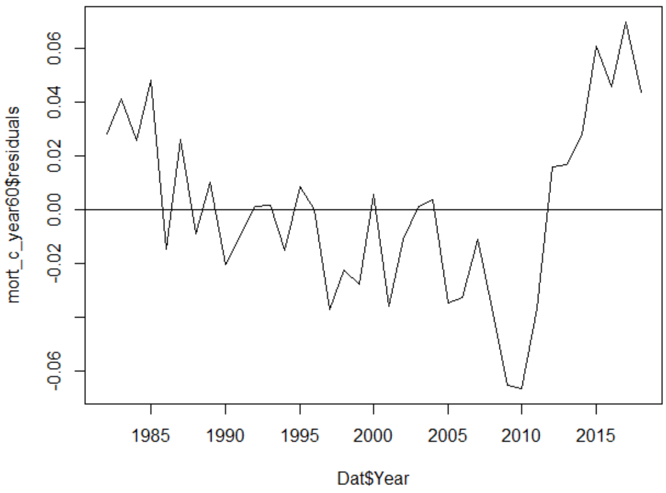
REGRESSION LOG(MORTALITY 60-69) vs YEAR

INITIAL REGRESSION

```
Time series regression with "numeric" data:
Start = 1, End = 37

Call:
dynlm(formula = log(mortality60) ~ Year)

Residuals:
      Min        1Q    Median        3Q       Max
-0.066462 -0.022244  0.001335  0.025739  0.070110

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept) 23.2183657  1.0302104   22.54   <2e-16 ***
Year        -0.0138254  0.0005151  -26.84   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.03345 on 35 degrees of freedom
Multiple R-squared:  0.9537,    Adjusted R-squared:  0.9523
F-statistic: 720.4 on 1 and 35 DF,  p-value: < 2.2e-16
```

HETEROSCEDASTICITY TEST

RESIDUALS PLOT



WHITE TEST

```
        studentized Breusch-Pagan test

data:  mort_c_year60
BP = 13.544, df = 2, p-value = 0.001145
```

HETEROSCEDASTIC!!!

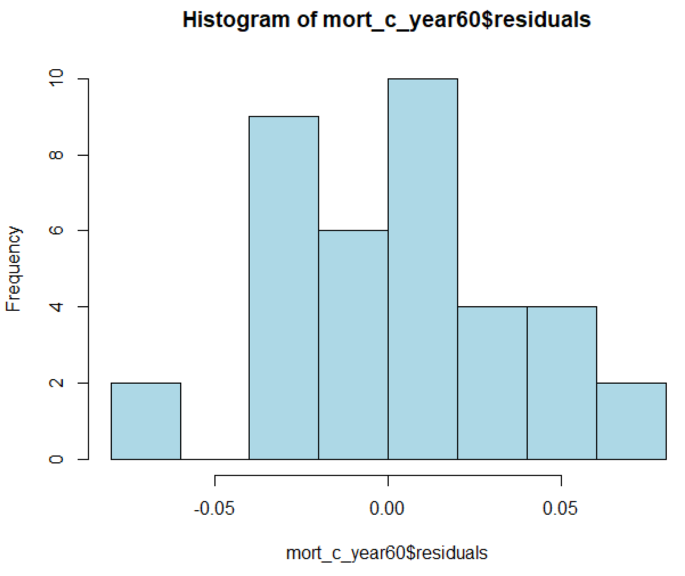
White's heteroscedasticity-adjusted errors

```
t test of coefficients:

             Estimate    Std. Error t value  Pr(>|t|)
(Intercept) 23.21836567  1.31260711  17.689 < 2.2e-16 ***
Year        -0.01382538  0.00065761 -21.023 < 2.2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

LINEARITY TEST

```
        Pearson's product-moment correlation

data:  log(Dat$mortality60) and Dat$Year
t = -26.84, df = 35, p-value < 2.2e-16
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 -0.9879630 -0.9545967
sample estimates:
       cor
-0.9765588
```

NORMALITY TEST




```
        Jarque-Bera Normality Test

data:  resid(mort_c_year60)
JB = 0.4026, p-value = 0.8177
alternative hypothesis: greater
```

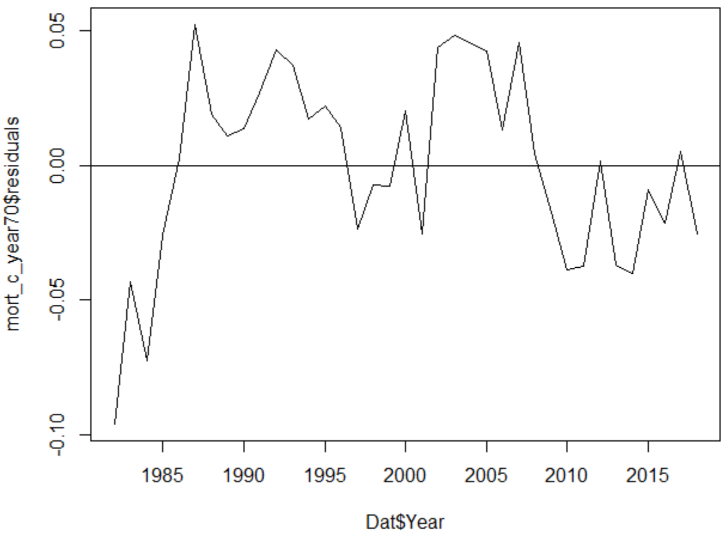
REGRESSION LOG(MORTALITY 70-79) vs YEAR

INITIAL REGRESSION

```
Time series regression with "numeric" data:
Start = 1, End = 37

Call:
dynlm(formula = log(mortality70) ~ Year)

Residuals:
      Min        1Q    Median        3Q       Max 
-0.096103 -0.025418  0.004352  0.021941  0.052337 

Coefficients:
              Estimate Std. Error t value Pr(>|t|)    
(Intercept) 34.6656826  1.1033766   31.42   <2e-16 ***
Year        -0.0190248  0.0005517  -34.48   <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.03583 on 35 degrees of freedom
Multiple R-squared:  0.9714,	Adjusted R-squared:  0.9706 
F-statistic:  1189 on 1 and 35 DF,  p-value: < 2.2e-16
```

HETEROSCEDASTICITY TEST

RESIDUALS PLOT



WHITE TEST

```
	studentized Breusch-Pagan test

data:  mort_c_year70
BP = 8.7873, df = 2, p-value = 0.01236
```

HETEROSCEDASTIC!!!

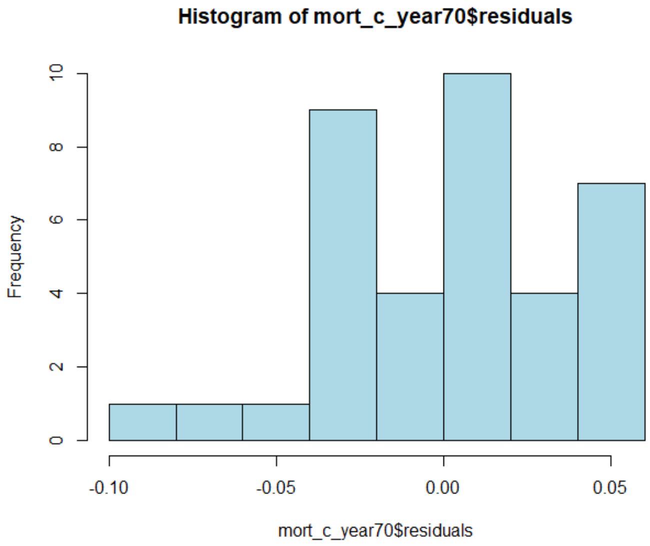
White's heteroscedasticity-adjusted errors

```
t test of coefficients:

              Estimate   Std. Error t value  Pr(>|t|)
(Intercept) 34.66568264  1.40897331  24.604 < 2.2e-16 ***
Year        -0.01902476  0.00070315 -27.056 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

LINEARITY TEST

```
        Pearson's product-moment correlation

data:  log(Dat$mortality70) and Dat$Year
t = -34.485, df = 35, p-value < 2.2e-16
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 -0.9926228 -0.9719916
sample estimates:
       cor
-0.9856016
```

NORMALITY TEST




```
        Jarque-Bera Normality Test

data:  resid(mort_c_year70)
JB = 1.8636, p-value = 0.3938
alternative hypothesis: greater
```

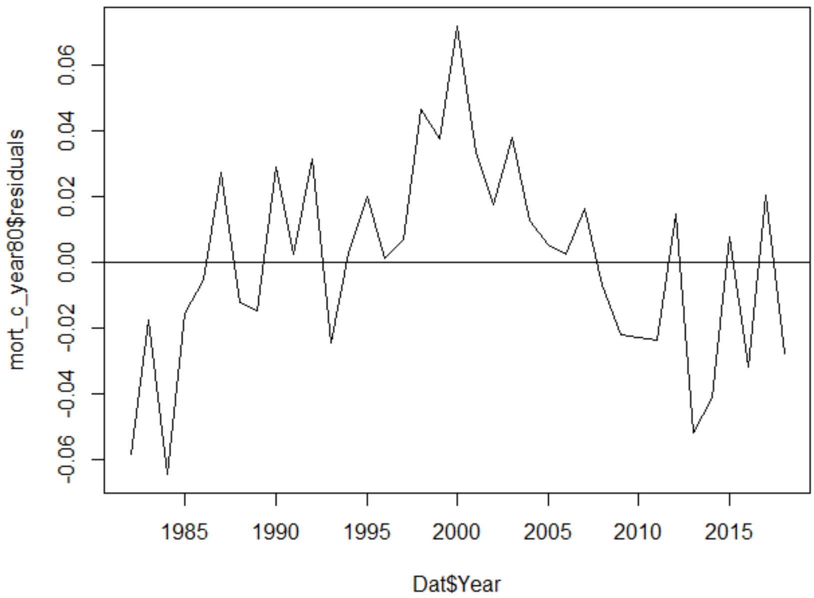
REGRESSION LOG(MORTALITY 80-above) vs YEAR

INITIAL REGRESSION

```
Time series regression with "numeric" data:
Start = 1, End = 37

Call:
dynlm(formula = log(mortality80Above) ~ Year)

Residuals:
      Min        1Q    Median        3Q       Max 
-0.064643 -0.022158  0.002335  0.020014  0.071790 

Coefficients:
              Estimate Std. Error t value Pr(>|t|)    
(Intercept) 14.9641333  0.9410221   15.90   <2e-16 ***
Year        -0.0085431  0.0004705  -18.16   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.03056 on 35 degrees of freedom
Multiple R-squared:  0.904,	Adjusted R-squared:  0.9013 
F-statistic: 329.7 on 1 and 35 DF,  p-value: < 2.2e-16
```

HETEROSCEDASTICITY TEST

RESIDUALS PLOT



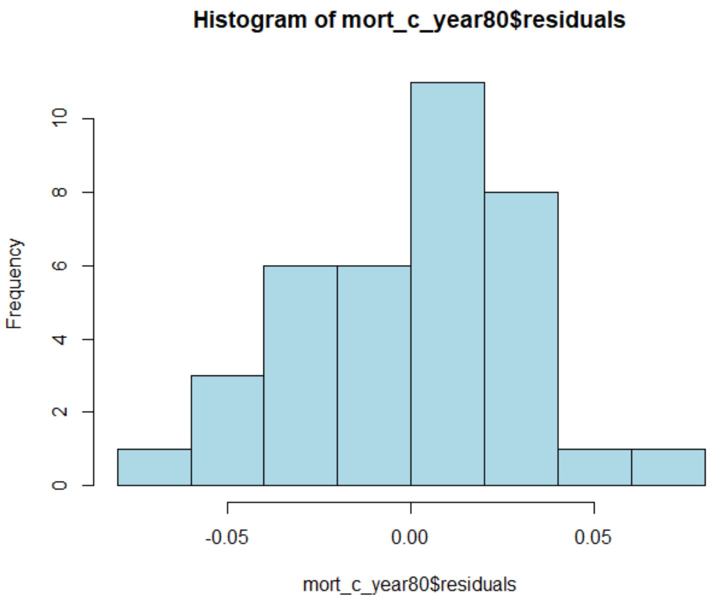
WHITE TEST

```
	studentized Breusch-Pagan test

data:  mort_c_year80
BP = 1.2438, df = 2, p-value = 0.5369
```

LINEARITY TEST

```
        Pearson's product-moment correlation

data:  log(Dat$mortality80Above) and Dat$Year
t = -18.157, df = 35, p-value < 2.2e-16
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 -0.9745766 -0.9058609
sample estimates:
       cor
-0.9508037
```

NORMALITY TEST




```
        Jarque-Bera Normality Test

data:  resid(mort_c_year80)
JB = 0.090759, p-value = 0.9556
alternative hypothesis: greater
```

APPENDIX 2 - Mortality by Region

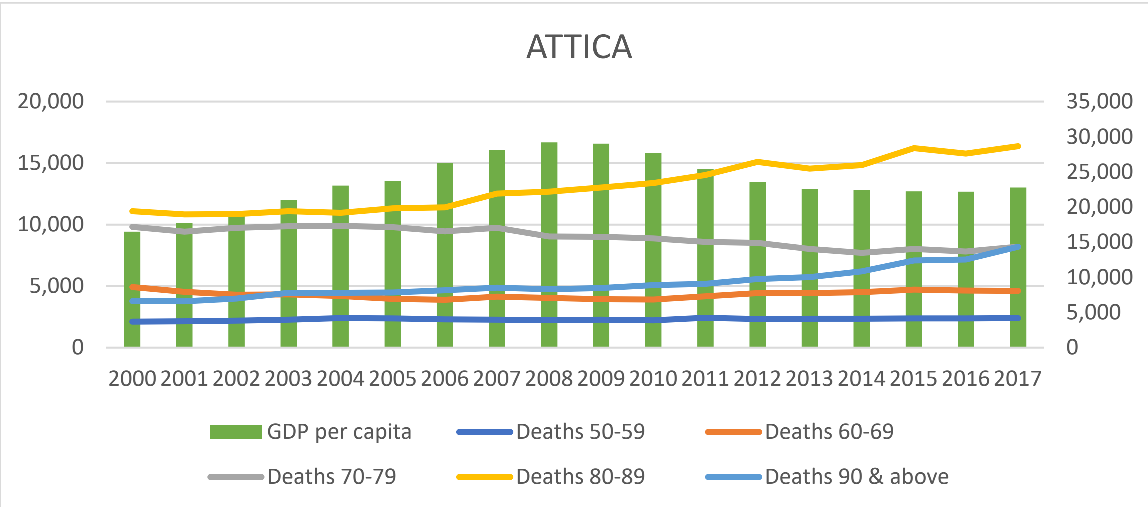
In Greece, there was an economic depression that originally appeared in 2009 and its effects have not completely overcome yet. Data regarding the geographical GDP per capita were compared with the deaths per age category group after 50 years old, to examine through the graphical representation of the data

i. If within one country, people leave longer when their income levels are increasing

ii. How the economic depression has affected the mortality per age group category

There are many constraints & variables to develop a model for such analysis since there is not a uniformity across the geographical areas over time ie medical facilities & technologies may differ among different geographical areas, as well as the lifestyle, education & culture. Another important factor that has not been considered is the migration flows, as usually movers are relatively healthy and relocate in areas with robust economies.

Below is the graphical representation of mortality per age segment and GDP for 20 randomly selected Greek counties.



GDP per capita: High increase from 2000 till 2008, while for 2009 till 2015 there was a steep decrease.

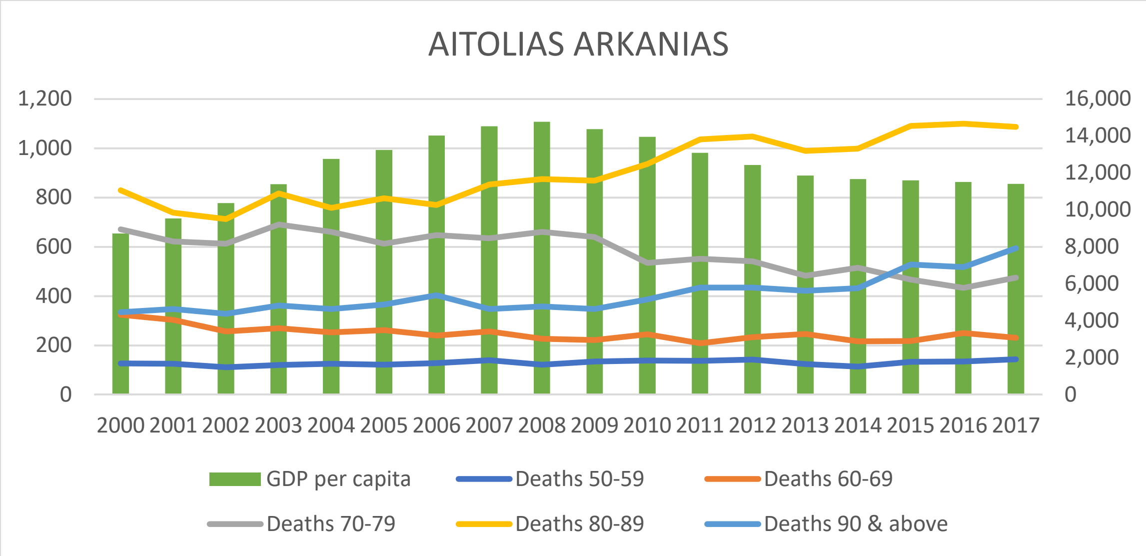
Mortality 50 – 59: there is no important fluctuation

Mortality 60 – 69: there is no important fluctuation

Mortality 70 – 79: there is a decrease in actual mortality numbers

Mortality 80 – 89: there is an increase in the mortality numbers

Mortality 90 – above: there is an increase in the mortality numbers



GDP per capita: High increase from 2000 till 2008, while for 2009 till 2015 there was a steep decrease.

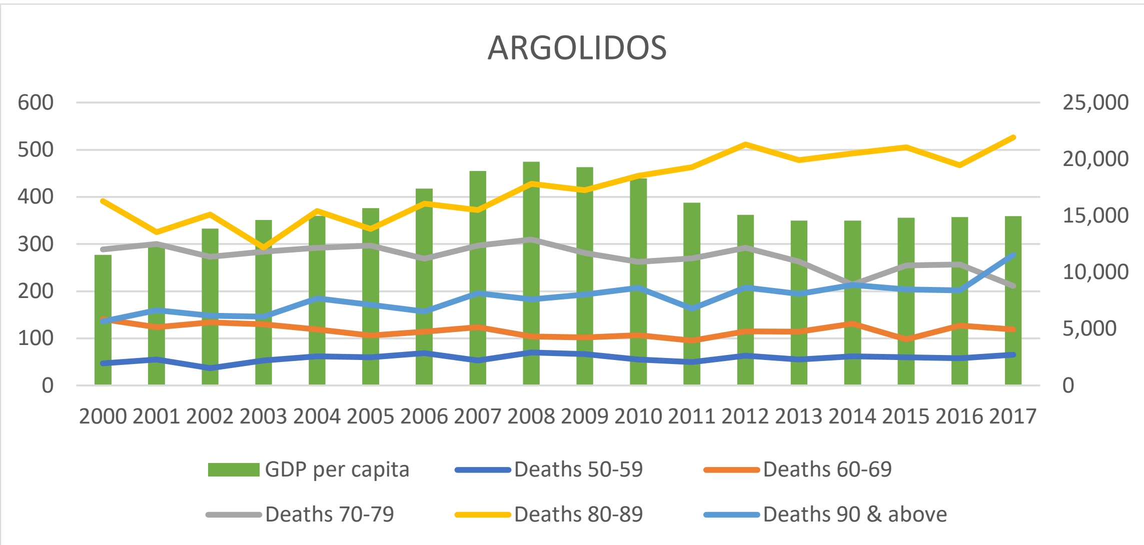
Mortality 50 – 59: there is no important fluctuation

Mortality 60 – 69: there is a decrease in actual mortality numbers

Mortality 70 – 79: there is a decrease in actual mortality numbers

Mortality 80 – 89: there is an increase in the mortality numbers

Mortality 90 – above: there is an increase in the mortality numbers



GDP per capita: High increase from 2000 till 2008, while for 2009 till 2015 there was a steep decrease.

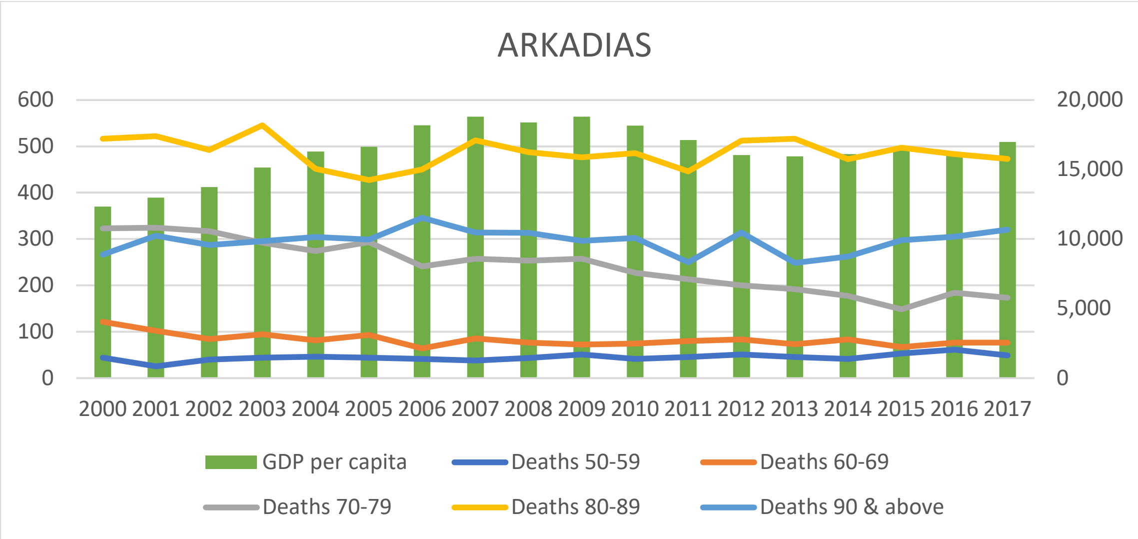
Mortality 50 – 59: there is no important fluctuation

Mortality 60 – 69: there is no important fluctuation

Mortality 70 – 79: there is a decrease in actual mortality numbers

Mortality 80 – 89: there is an increase in the mortality numbers

Mortality 90 – above: there is an increase in the mortality numbers



GDP per capita: High increase from 2000 till 2008, while from 2009 to 2012 there was a decrease and after that there a slight increase.

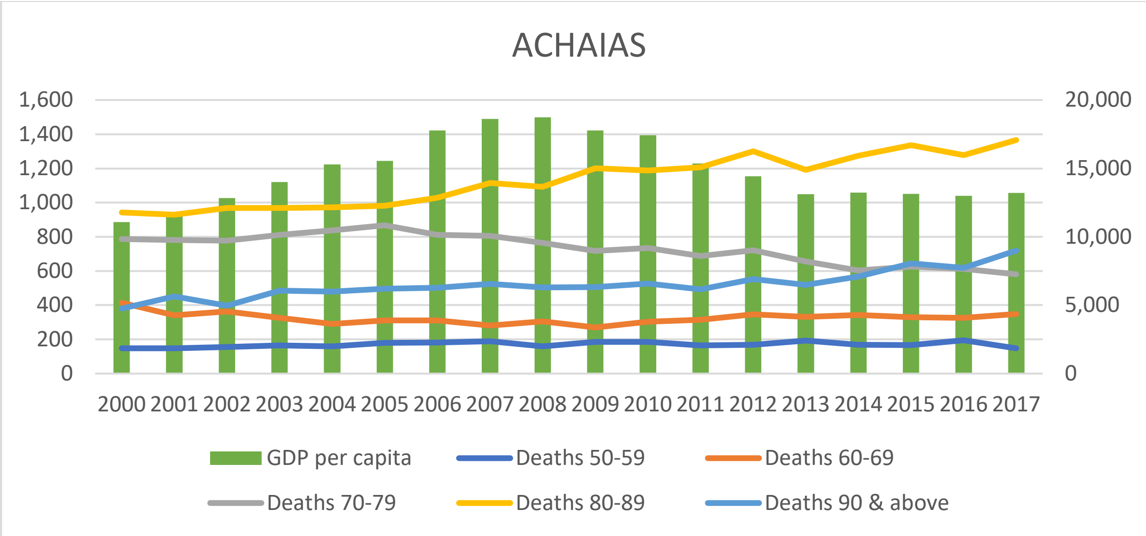
Mortality 50 – 59: there is no important fluctuation

Mortality 60 – 69: there is no important fluctuation

Mortality 70 – 79: there is a decrease in actual mortality numbers

Mortality 80 – 89: there is no important fluctuation

Mortality 90 – above: there is no important fluctuation



GDP per capita: High increase from 2000 till 2008, while for 2009 till 2015 there was a steep decrease.

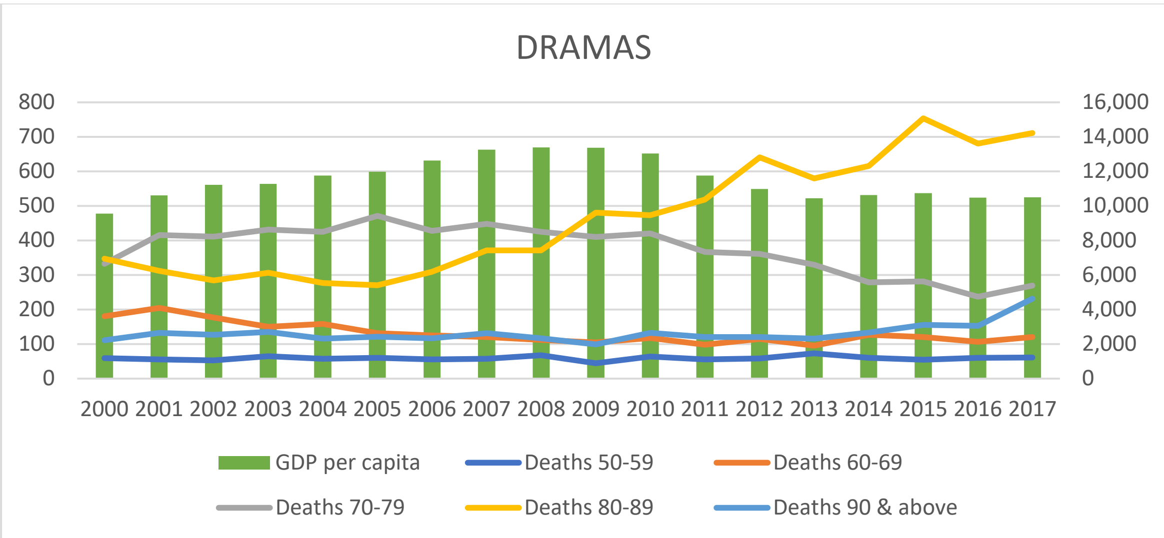
Mortality 50 – 59: there is no important fluctuation

Mortality 60 – 69: there is no important fluctuation

Mortality 70 – 79: there is a decrease in actual mortality numbers

Mortality 80 – 89: there is an increase in the mortality numbers

Mortality 90 – above: there is an increase in the mortality numbers



GDP per capita: High increase from 2000 till 2008, while for 2009 till 2015 there was a steep decrease.

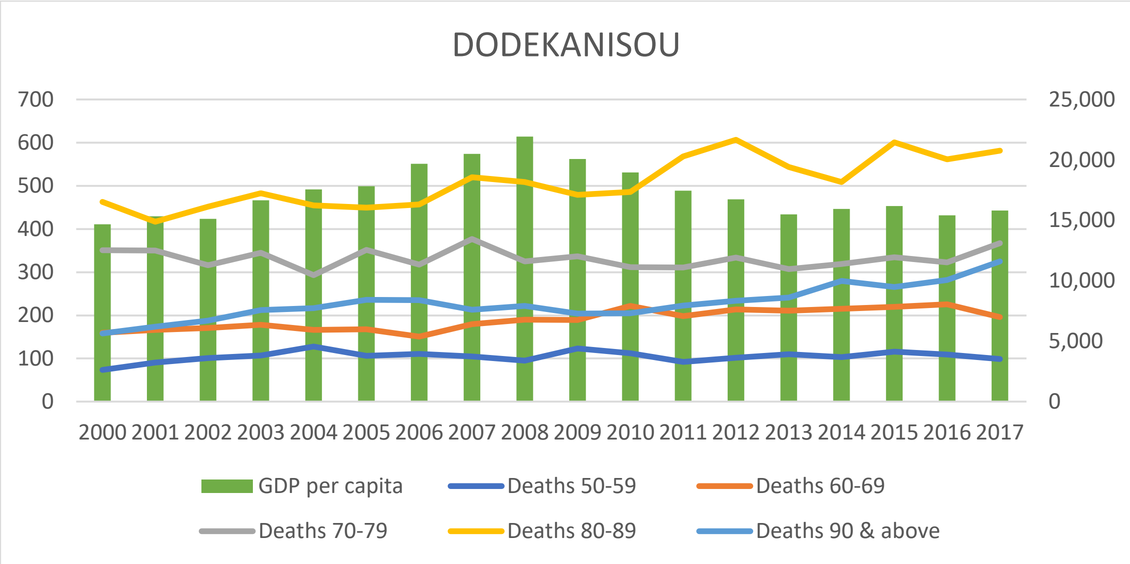
Mortality 50 – 59: there is no important fluctuation

Mortality 60 – 69: there is a decrease in actual mortality numbers

Mortality 70 – 79: there is a decrease in actual mortality numbers

Mortality 80 – 89: there is an increase in the mortality numbers

Mortality 90 – above: there is an increase in the mortality numbers



GDP per capita: High increase from 2000 till 2008, while for 2009 till 2015 there was a steep decrease.

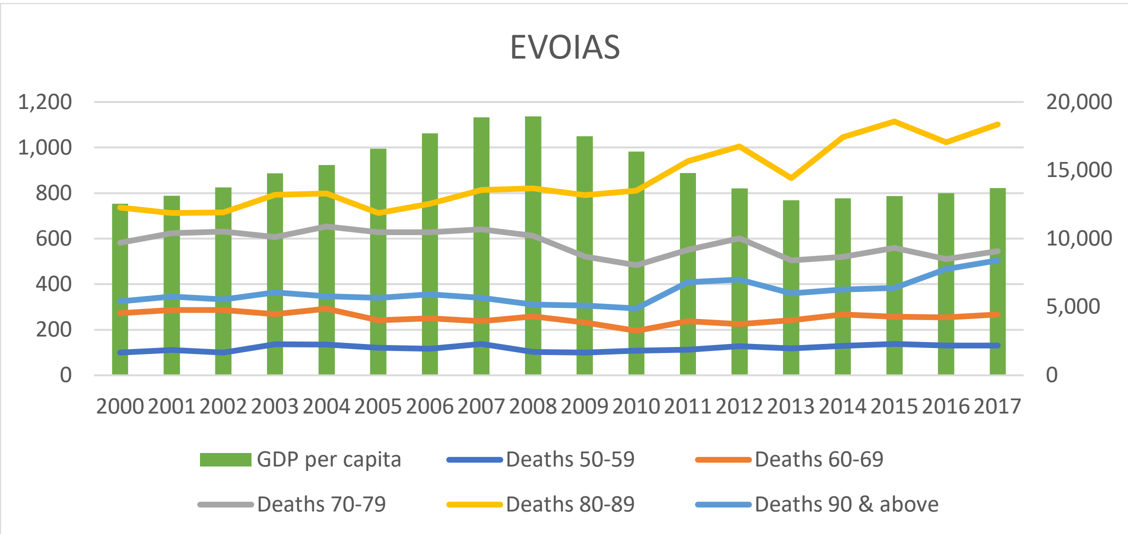
Mortality 50 – 59: there is no important fluctuation

Mortality 60 – 69: there is no important fluctuation

Mortality 70 – 79: there is no important fluctuation

Mortality 80 – 89: there is an increase in the mortality numbers

Mortality 90 – above: there is an increase in the mortality numbers



GDP per capita: High increase from 2000 till 2008, while for 2009 till 2015 there was a steep decrease.

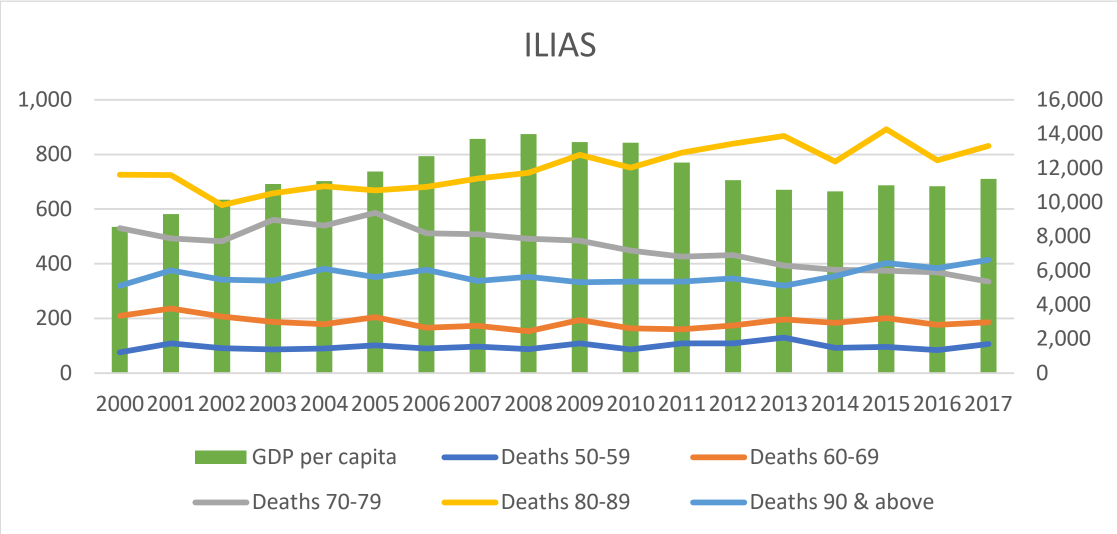
Mortality 50 – 59: there is no important fluctuation

Mortality 60 – 69: there is no important fluctuation

Mortality 70 – 79: there is a decrease in the mortality numbers

Mortality 80 – 89: there is an increase in the mortality numbers

Mortality 90 – above: there is an increase in the mortality numbers



GDP per capita: High increase from 2000 till 2008, while for 2009 till 2013 there was a steep decrease. After that there was slight increase in the income.

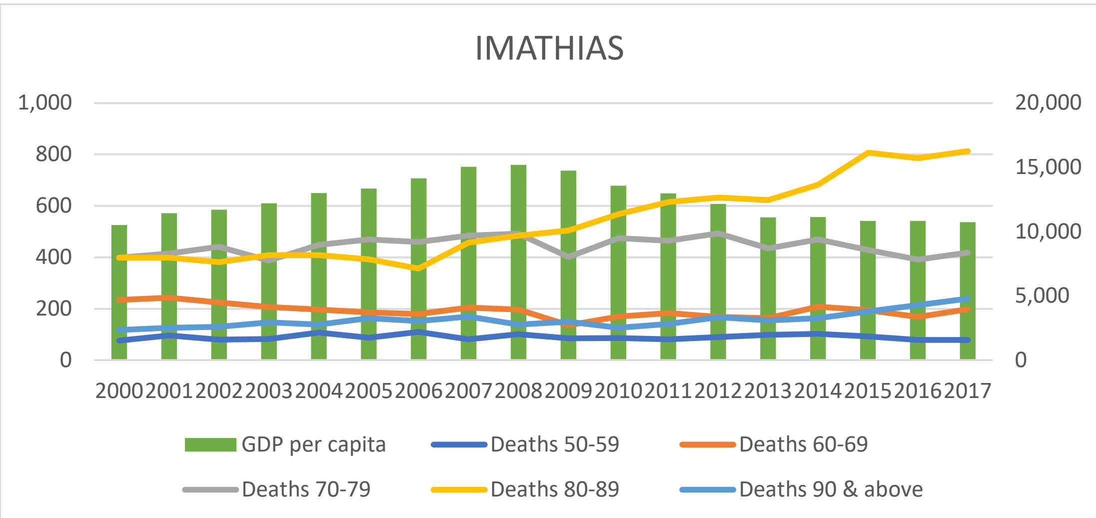
Mortality 50 – 59: there is no important fluctuation

Mortality 60 – 69: there is no important fluctuation

Mortality 70 – 79: there is a decrease in actual mortality numbers

Mortality 80 – 89: there is an increase in the mortality numbers

Mortality 90 – above: there is a small increase in the mortality numbers



GDP per capita: High increase from 2000 till 2008, while for 2009 till 2013 there was a steep decrease.

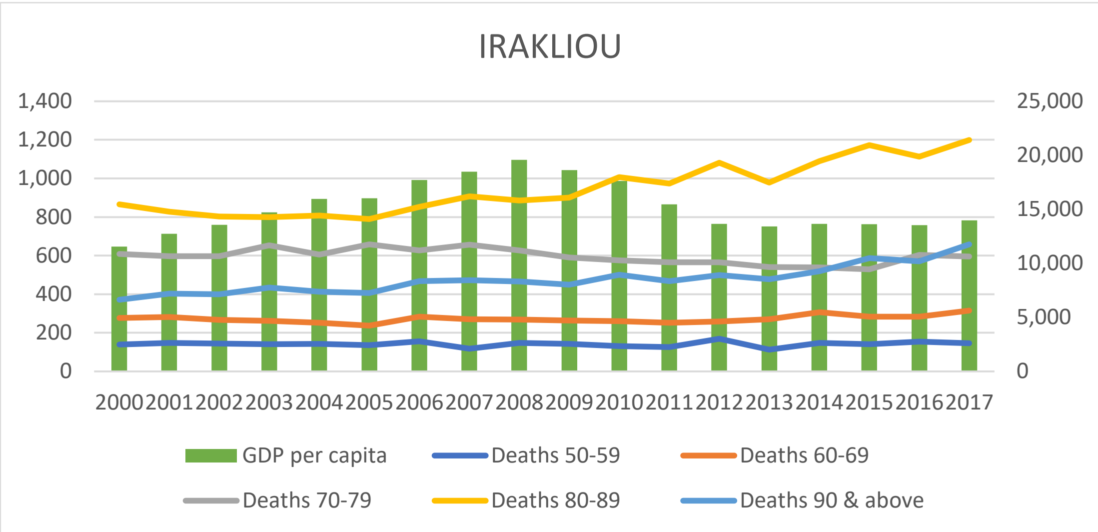
Mortality 50 – 59: there is no important fluctuation

Mortality 60 – 69: there is no important fluctuation

Mortality 70 – 79: there is no important fluctuation

Mortality 80 – 89: there is an increase in the mortality numbers

Mortality 90 – above: there is an increase in the mortality numbers



GDP per capita: High increase from 2000 till 2008, while for 2009 till 2012 there was a steep decrease.

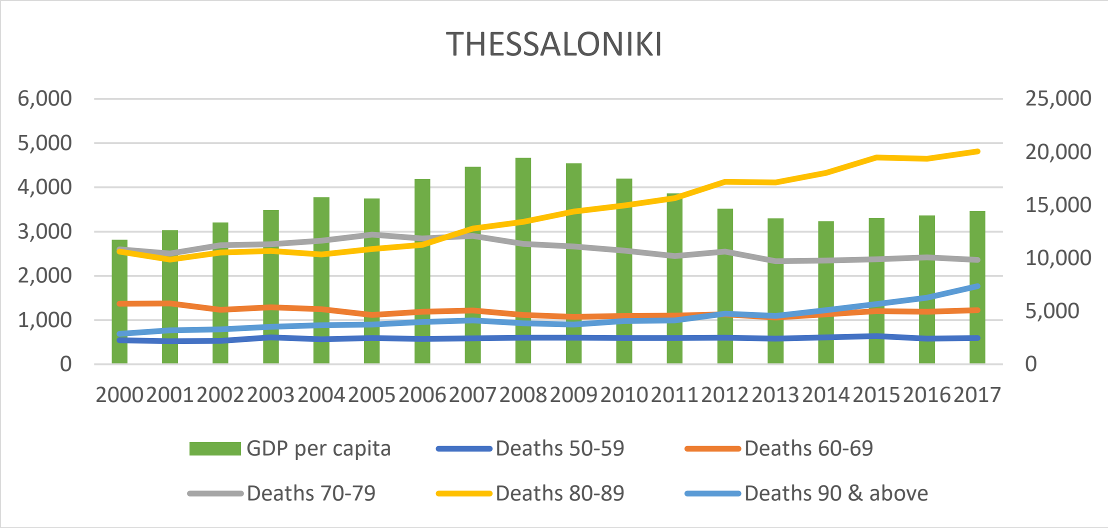
Mortality 50 – 59: there is no important fluctuation

Mortality 60 – 69: there is no important fluctuation

Mortality 70 – 79: there is no important fluctuation

Mortality 80 – 89: there is an increase in the mortality numbers

Mortality 90 – above: there is an increase in the mortality numbers



GDP per capita: High increase from 2000 till 2008, while for 2009 till 2013 there was a steep decrease.

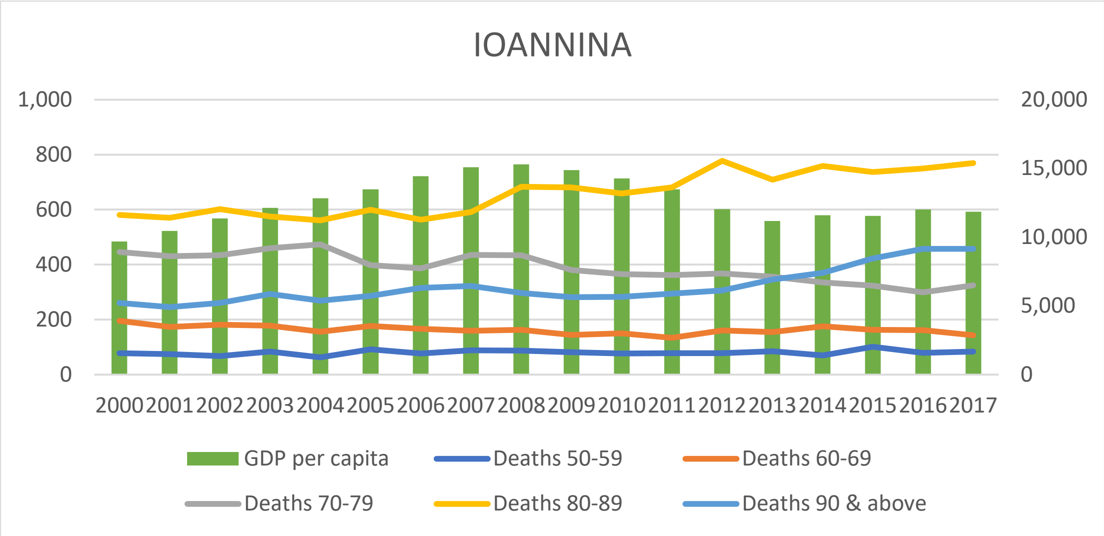
Mortality 50 – 59: there is no important fluctuation

Mortality 60 – 69: there is no important fluctuation

Mortality 70 – 79: there is no important fluctuation

Mortality 80 – 89: there is an increase in the mortality numbers

Mortality 90 – above: there is an increase in the mortality numbers



GDP per capita: High increase from 2000 till 2008, while for 2009 till 2013 there was a steep decrease.

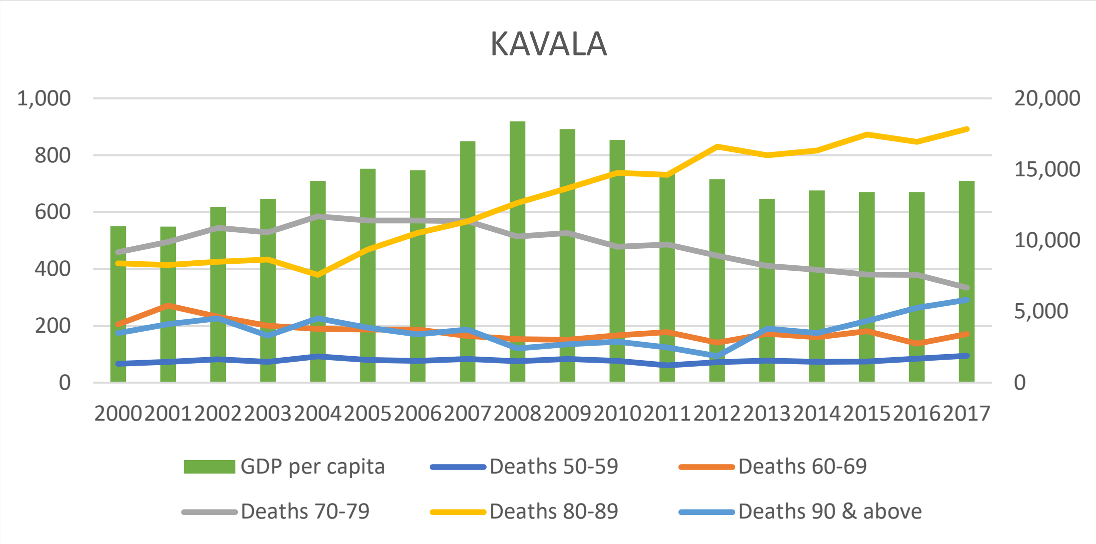
Mortality 50 – 59: there is no important fluctuation

Mortality 60 – 69: there is no important fluctuation

Mortality 70 – 79: there is a decrease in the mortality numbers

Mortality 80 – 89: there is an increase in the mortality numbers

Mortality 90 – above: there is an increase in the mortality numbers



GDP per capita: High increase from 2000 till 2008, while for 2009 till 2013 there was a steep decrease.

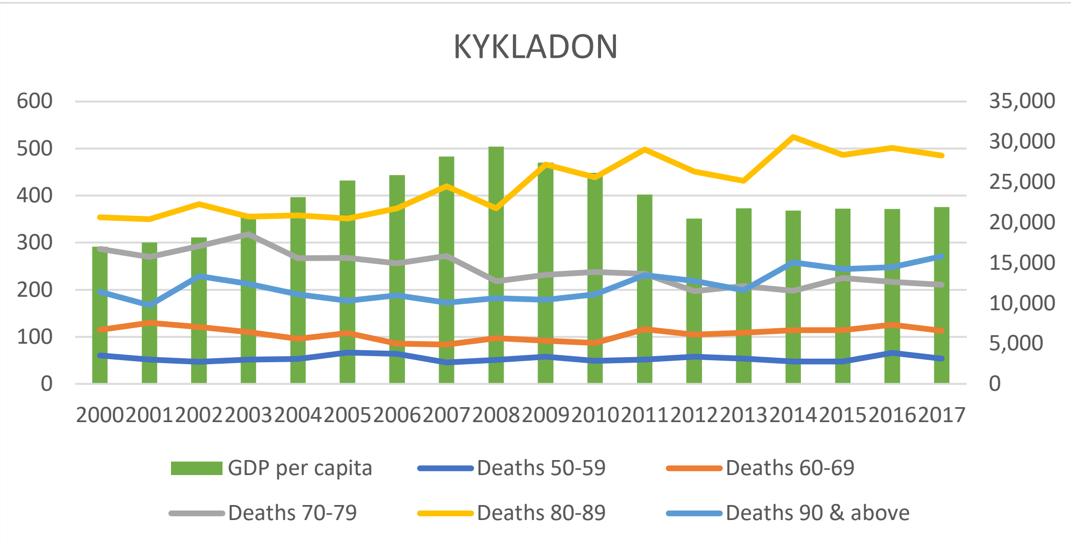
Mortality 50 – 59: there is no important fluctuation

Mortality 60 – 69: there is no important fluctuation

Mortality 70 – 79: there is a decrease in the mortality numbers

Mortality 80 – 89: there is an increase in the mortality numbers

Mortality 90 – above: there is an increase in the mortality numbers



GDP per capita: High increase from 2000 till 2008, while for 2009 till 2012 there was a steep decrease.

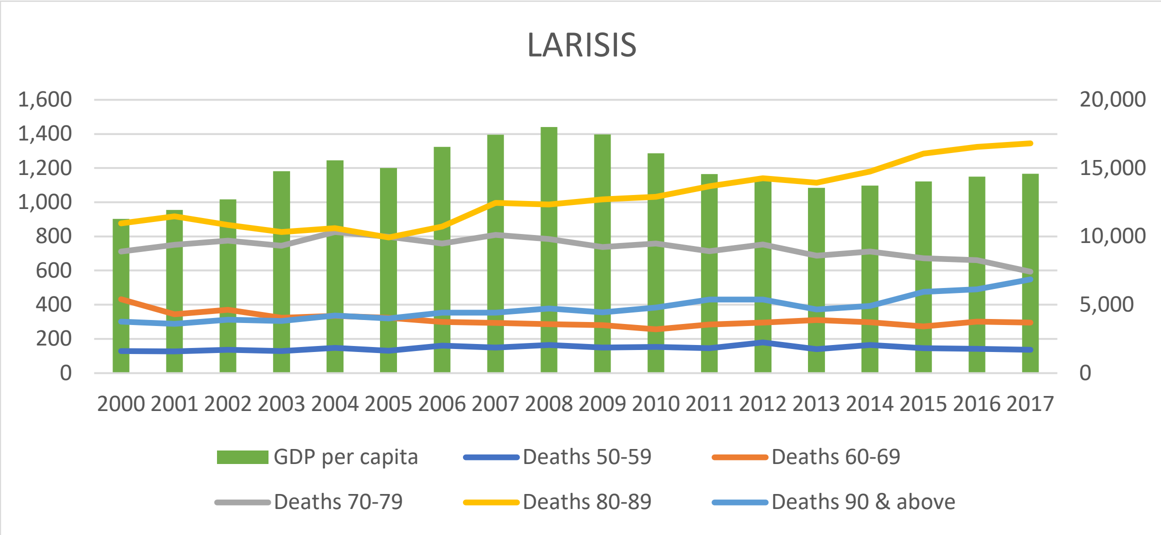
Mortality 50 – 59: there is no important fluctuation

Mortality 60 – 69: there is no important fluctuation

Mortality 70 – 79: there is a decrease in the mortality numbers

Mortality 80 – 89: there is an increase in the mortality numbers

Mortality 90 – above: there is an increase in the mortality numbers



GDP per capita: High increase from 2000 till 2008, while for 2009 till 2013 there was a steep decrease.

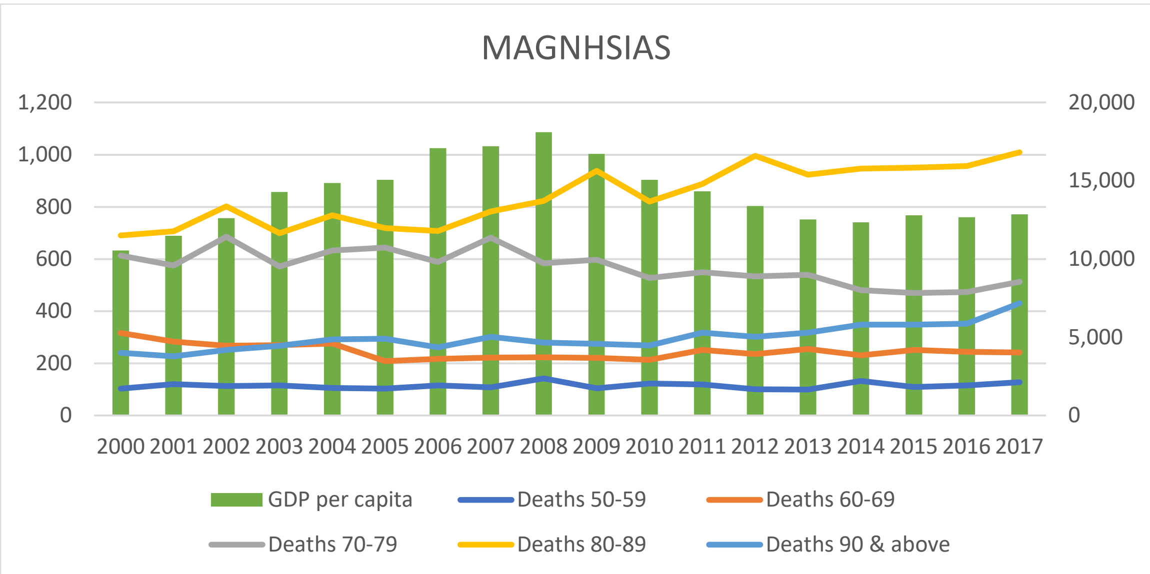
Mortality 50 – 59: there is no important fluctuation

Mortality 60 – 69: there is no important fluctuation

Mortality 70 – 79: there is a decrease in the mortality numbers

Mortality 80 – 89: there is an increase in the mortality numbers

Mortality 90 – above: there is an increase in the mortality numbers



GDP per capita: High increase from 2000 till 2008, while for 2009 till 2013 there was a steep decrease.

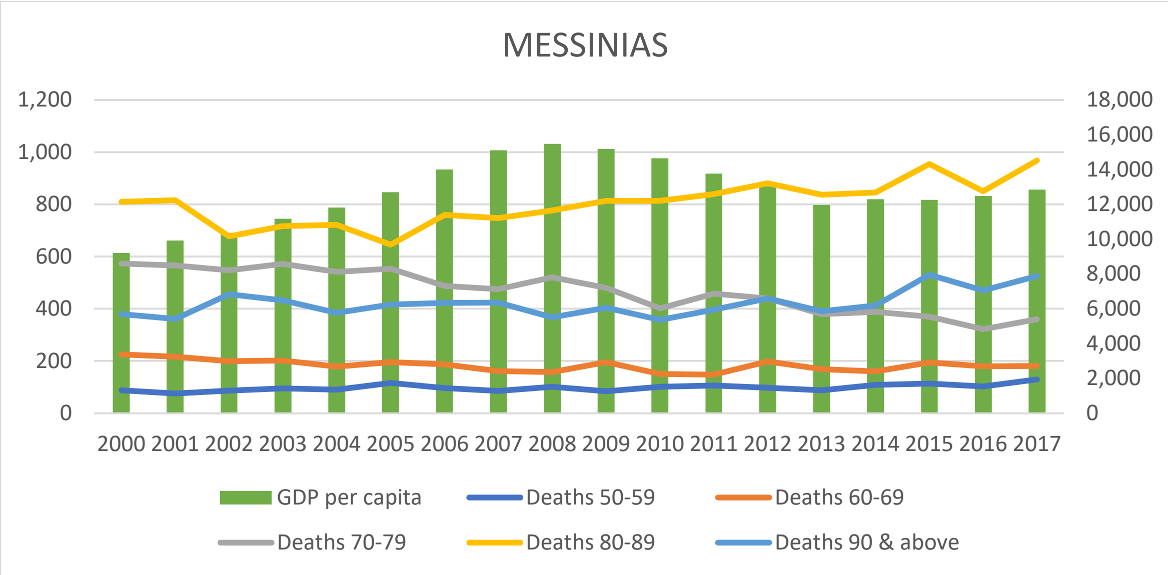
Mortality 50 – 59: there is no important fluctuation

Mortality 60 – 69: there is no important fluctuation

Mortality 70 – 79: there is a decrease in the mortality numbers

Mortality 80 – 89: there is an increase in the mortality numbers

Mortality 90 – above: there is an increase in the mortality numbers



GDP per capita: High increase from 2000 till 2008, while for 2009 till 2013 there was a steep decrease.

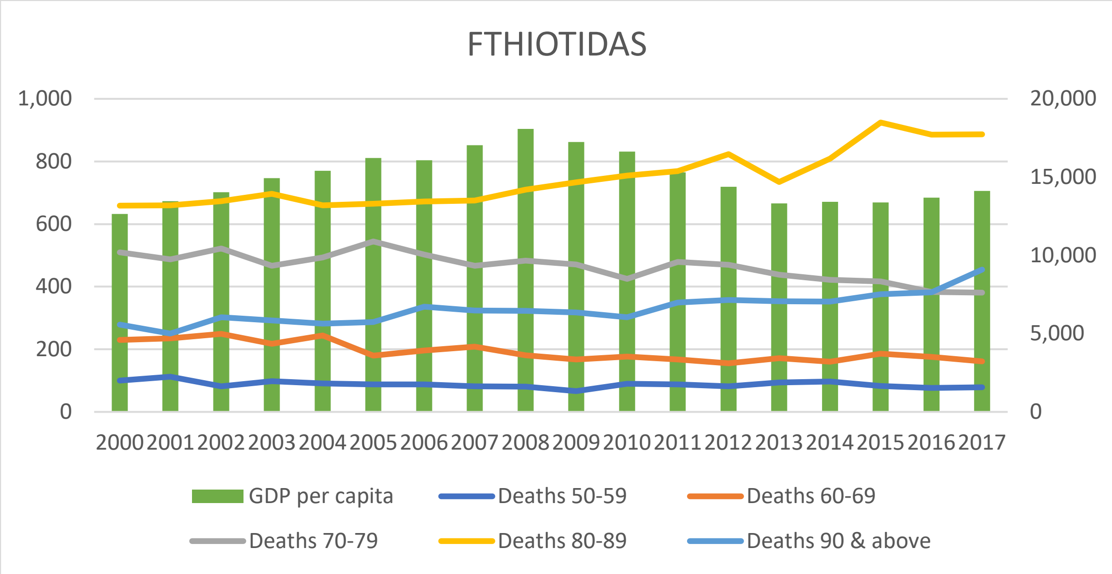
Mortality 50 – 59: there is no important fluctuation

Mortality 60 – 69: there is no important fluctuation

Mortality 70 – 79: there is a decrease in the mortality numbers

Mortality 80 – 89: there is an increase in the mortality numbers

Mortality 90 – above: there is an increase in the mortality numbers



GDP per capita: High increase from 2000 till 2008, while for 2009 till 2013 there was a steep decrease.

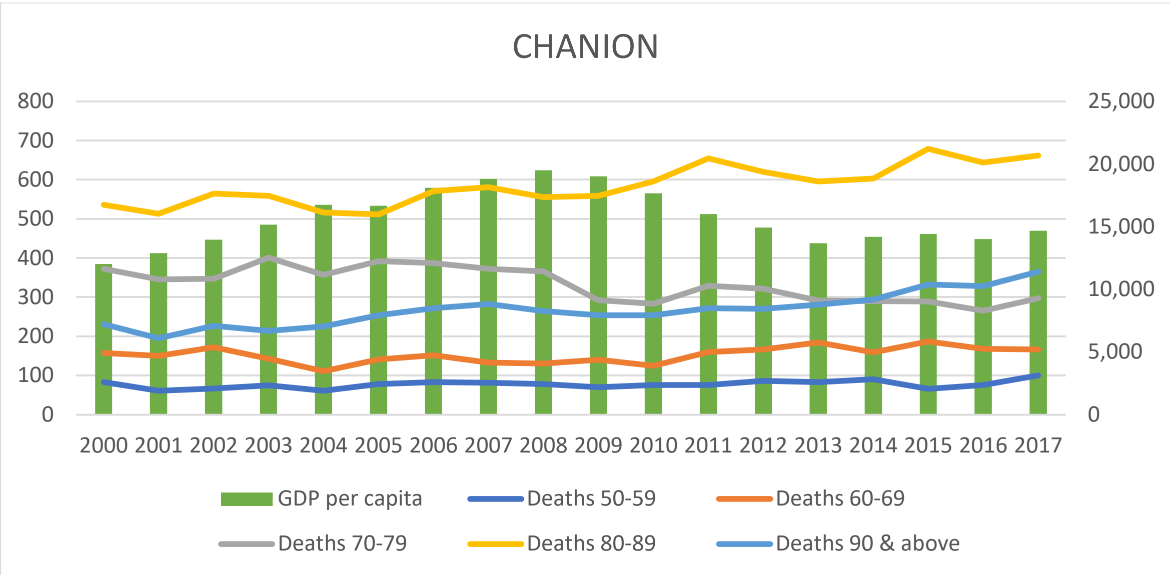
Mortality 50 – 59: there is no important fluctuation

Mortality 60 – 69: there is no important fluctuation

Mortality 70 – 79: there is a decrease in the mortality numbers

Mortality 80 – 89: there is an increase in the mortality numbers

Mortality 90 – above: there is an increase in the mortality numbers



GDP per capita: High increase from 2000 till 2008, while for 2009 till 2013 there was a steep decrease.

Mortality 50 – 59: there is no important fluctuation

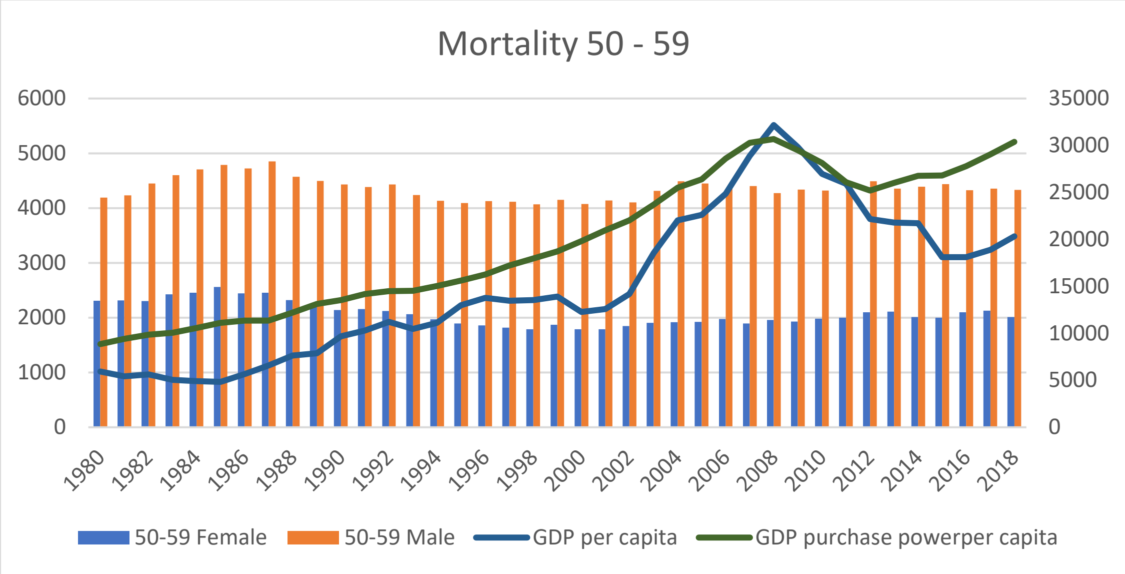
Mortality 60 – 69: there is no important fluctuation

Mortality 70 – 79: there is a decrease in the mortality numbers

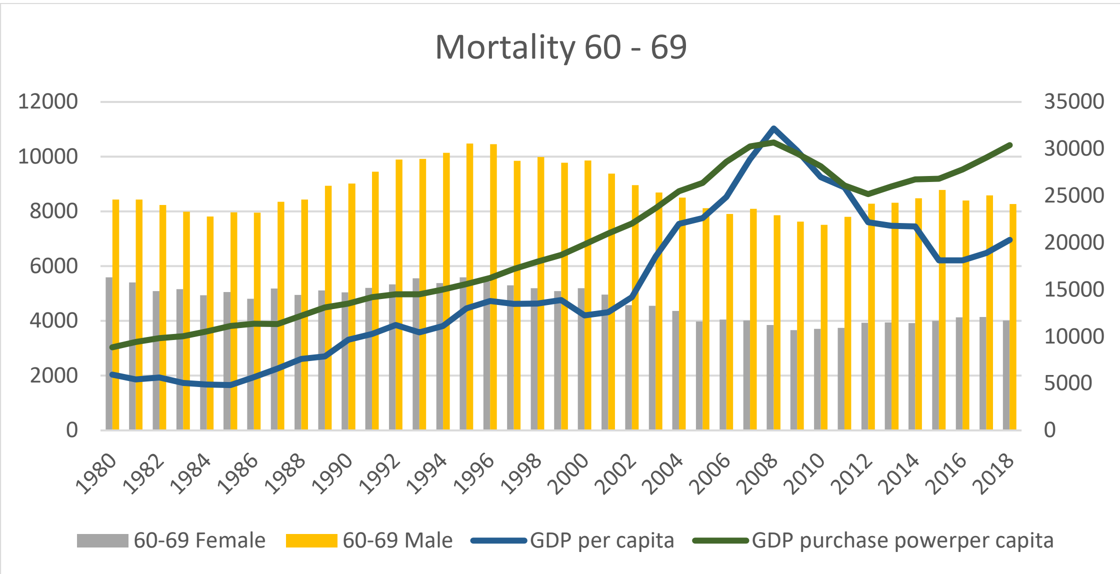
Mortality 80 – 89: there is an increase in the mortality numbers

Mortality 90 – above: there is an increase in the mortality numbers

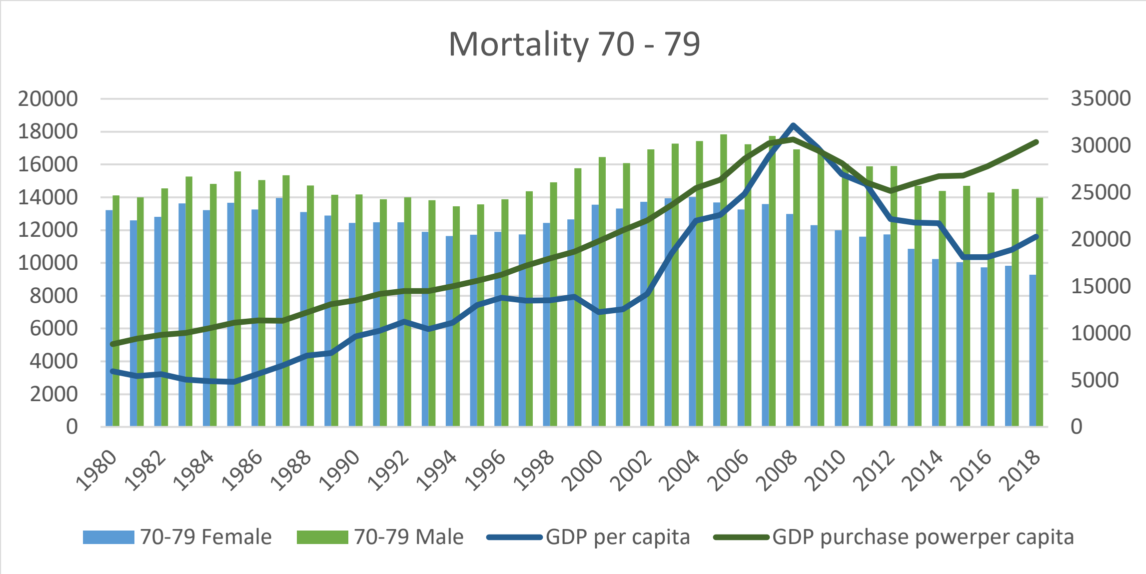
APPENDIX 3 - Mortality by Sex & Age group



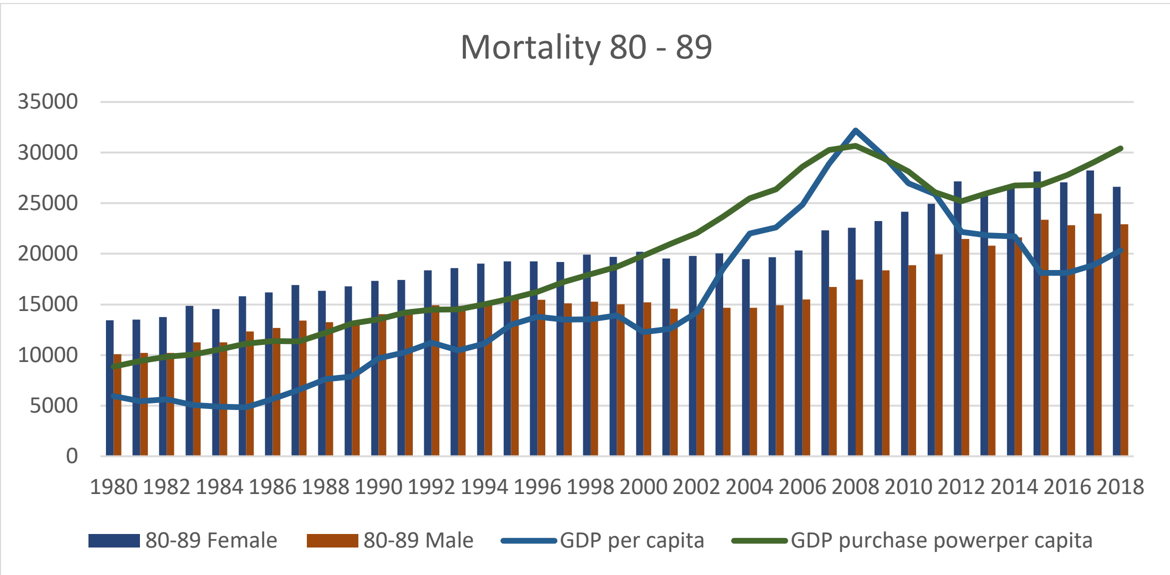
For the age group 50 – 59 the mortality of the men is higher than the women (almost double) and it seems that is not affected by the increase in the GDP per capita or the GDP per capita (purchase power parity) which was almost triple in less than thirty years. The mortality for the women is almost stable in actual numbers while for the men has a small fluctuation.



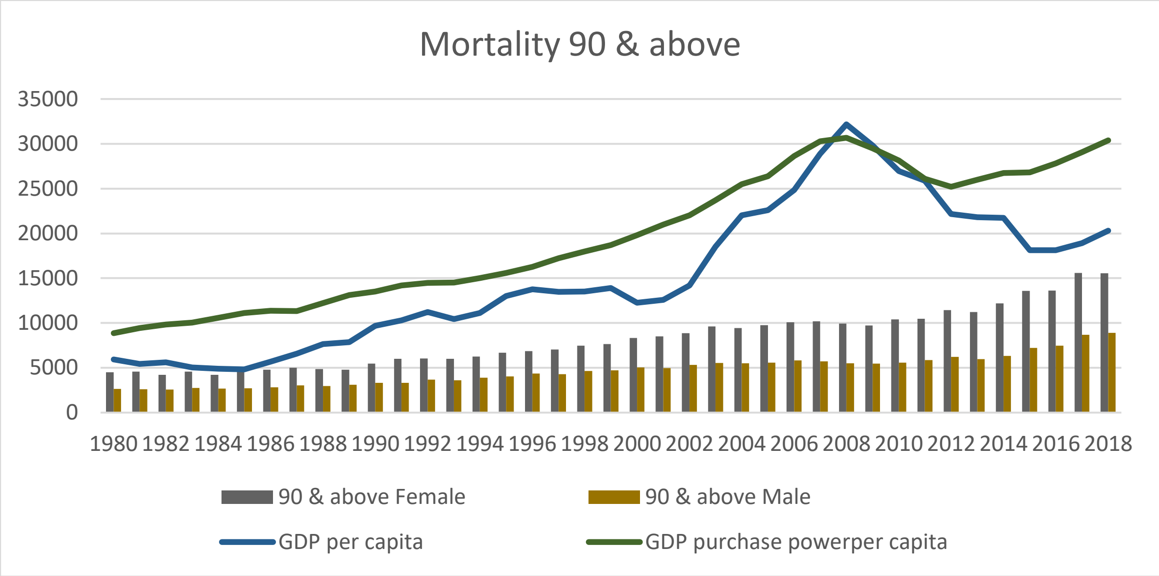
For the age group 60 – 69 the mortality of the men is higher than the women. It seems that is not affected by the increase in the GDP per capita or the GDP per capita (purchase power parity). The mortality for the women is almost stable and gradually decreasing in actual numbers while for the men has a small fluctuation.



For the age group 70 – 79 the mortality of the men is slightly higher than the women. It seems that is not significantly affected by the increase in the GDP per capita or the GDP per capita (purchase power parity). It can be noted that after 2000 the difference between the mortality of the two sexes is increasing. The mortality for the women is gradually decreasing in actual numbers while for the men has a small fluctuation but is stable overall.



For the age group 80 – 89 the mortality of the female is higher than the male. It seems that the mortality is affected by the increase in the GDP per capita or the GDP per capita (purchase power parity). This can be also interpreted that the average expectancy of living years has been increased as GDP per capita is increased.



For the age group 90 & above the mortality of the female is higher than the male. It seems that the mortality is affected by the increase in the GDP per capita or the GDP per capita (purchase power parity). This can be also interpreted that the average expectancy of living years has been increased as GDP per capita is increased.

APPENDIX 4 – ELSTAT Correspondence

Gmail

kiri vougi <kvougiklakis@gmail.com>

Response
2 μηνύματα

portal.noreply@statistics.gr <portal.noreply@statistics.gr> 21 Οκτωβρίου 2020 - 1:21 μ.μ.
Προς: kvougiklakis@gmail.com

ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ

ΕΛΛΗΝΙΚΗ ΣΤΑΤΙΣΤΙΚΗ ΑΡΧΗ

ΓΕΝΙΚΗ ΔΙΕΥΘΥΝΣΗ ΔΙΟΙΚΗΣΗΣ ΚΑΙ ΟΡΓΑΝΩΣΗΣ
ΔΙΕΥΘΥΝΣΗ ΣΤΑΤΙΣΤΙΚΗΣ ΠΛΗΡΟΦΟΡΗΣΗΣ ΚΑΙ ΕΚΔΟΣΕΩΝ
ΤΜΗΜΑ ΠΑΡΟΧΗΣ ΣΤΑΤΙΣΤΙΚΗΣ ΠΛΗΡΟΦΟΡΗΣΗΣ (Β31)
Θέμα: Παροχή Στατιστικών Στοιχείων
Αγαπητέ κ. Βουγικλάκη

Σε απάντηση του e-mail σας με ημερομηνία_12.10.2020, σας παραθέτουμε το link με τα διαθέσιμα στοιχεία.

Θάνατοι

https://www.statistics.gr/el/statistics/-/publication/SPO09/2017

Νοσηλευτική Κίνηση

https://www.statistics.gr/el/statistics/-/publication/SHE12/2014-M01

ΑΕΠ

https://www.statistics.gr/el/statistics/-/publication/SEL48/2017

Σας πληροφορούμε ότι μπορείτε να επισκέπτεστε και την ψηφιακή βιβλιοθήκη της ΕΛΣΤΑΤ στην ηλεκτρονική διεύθυνση: http://dlib.statistics.gr/portal/page/portal/ESYE/ όπου παρέχονται δωρεάν όλες οι στατιστικές εκδόσεις.

Προκειμένου δε, να ενημερώνεστε για την ανάρτηση των νέων ψηφιοποιημένων δημοσιευμάτων, μπορείτε να εγγραφείτε στα **«Νέα – Ανακοινώσεις»** της ψηφιακής βιβλιοθήκης.

Παρακαλούμε να αναγράφεται «Πηγή: ΕΛΣΤΑΤ» σε οποιαδήποτε εργασία σας, στην οποία περιέχονται στοιχεία της Υπηρεσίας μας.

Τέλος, σας πληροφορούμε ότι, ταυτόχρονα με τα αιτούμενα στοιχεία, αποστέλλεται αυτόματα ο σύνδεσμος (link) του δελτίου της έρευνας ικανοποίησης χρηστών και παρακαλούμε για την έγκαιρη συμπλήρωση και αποστολή του.

Σας ευχαριστούμε εκ των προτέρων για τη συνεργασία.

Είμαστε στη διάθεσή σας για οποιεσδήποτε διευκρινίσεις ή πληροφορίες.

Ελισάβετ Βρόντου
Υπάλληλος Τμήματος Παροχής Στατιστικής Πληροφόρησης
Πειραιώς 46 & Επονιτών
ΤΚ 18510 ΠΕΙΡΑΙΕΥΣ
Τηλ: 2131352310
Fax: 2131352312
Email: e.vrontou@statistics.gr

Ακολουθήστε τον παρακάτω σύνδεσμο για τη συμπλήρωση και αποστολή της φόρμας ικανοποίησης.

http://www.statistics.gr/workflow/feedback/evaluation2016.jsf?lang=el&code=e258c356-ddef-4380-b335-8a18bb7198d5

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kiri vougi <kvougiklakis@gmail.com> 25 Οκτωβρίου 2020 - 2:36 μ.μ.
Προς: kyriakos.vougiklakis@st.ouc.ac.cy

[Κρυμμένο αναφερόμενο κείμενο]

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