MSc Thesis

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quality life

[HAPPINESS AND QUALITY OF LIFE]

An empirical study for the EU-25

Abstract

This thesis tries to build on existing knowledge on happiness measured as subjective well-being and its relationship with secondary quality of life indicators in the form of indices and numbers. It is based on literature research and own empirical data. The objective of this research is to find out in what way happiness as a score given by citizens relates to objective indicators measuring quality of life. This includes the 25 biggest member states of the European Union. Literature studies prove the existing positive relationship between income per capita and happiness between countries. This research proves again that this relationship exists by using the most recent data. Also the relation between public GDP per capita and private GDP per capita towards happiness are analysed and show a positive effect. After proving this fact an optimum ratio between public and private GDP has been found. The happiness scores are measured every few years by the European Commission. These secondary data are used as an anchor.The aim of this thesis is to define happiness by quality of life indicators and therefore to create a model which can be used to measure happiness between the EU member states much more efficient. Therefore the analyses in this thesis focuses on the relationship between happiness and the chosen Quality of Life variables. First individually the indicators are tested towards their relationship with happiness, followed by a total model including a bundle of six indicators. Finally an optimal amount of indicators has been found to explain happiness.

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Preface

This thesis is written out of pure interest in how socio-economic indicators can be used to measure the quality of life in countries. Because we are currently in a world crisis, trust in the classic economic system is decreasing rapidly. Old values in terms of pure finance are measured by companies and governments. This last party however is responsible for its citizens and has therefore the responsibility to adapt whenever necessary. This transition in how to explain human welfare in terms of quality of life instead of pure income was the main reason for me to investigate how this is related. Not only was this research an interesting topic to me, it is a thesis which fits in the credo of this university perfectly: 'For quality of life'. On the person development field, this project has been a very good learning experience for me. It would have not been that good my development without the help and support of some important people. Therefore I would sincerely like to thank my supervisors Wim Heijman and Johan van Ophem for their support, believe and trust in my capacities to fulfil this Msc thesis according to the academic standards. Without them it would not have been possible to write this thesis. Also I would like to thank my family and friends, in special my parents who have supported me all along the way. It wasn't always easy for me to focus on this project but they kept supporting me in the back. I finally hope that this research contributes in the field of welfare economics and especially for policy purposes. Rest to say that I hope you enjoy reading this work and never forget like a wise man once told me: 'Don't break a leg to start reading'.

Leo van der Stappen

June, 2012

1. Introduction

Since time immemorial people's highest priority in life is to be happy. There is perhaps no issue in society with that much consensus among people. (Frey & Stutzer, 2002) Nevertheless it makes it an interesting topic for research. Not only because a lot of consensus, but also because the different angles in which it can be explained. Also all kinds of relationships with other topics can be investigated. Although a lot of previous research has been conducted in this field, not so much is published about the relationship with income. Happiness is studied more and more by economists the past decade though and the interest in happiness studies keeps increasing (Clark, Frijters, & Shields, 2008). Economics of happiness might not only be relevant for economists, but for policy makers as well (Di Tella & MacCulloch, 2006). Happiness, life satisfaction, subjective well-being or quality of life are all terms used in this thesis interchangeably but they cover the same topic. Later on in the second chapter of this thesis, the theoretical framework will give more explanation of the use of happiness and how it is defined. All kinds of concepts can explain life satisfaction like health, education, employment. The quality of life, where this study is trying to focus on should in some way be related to subjective well-being. Now, the economy within the European Union has majorly changed and got into a recession since the financial crisis in 2008. Studying economics in these times is not only interesting but also a challenge. Combining it with people's well-being could give new insights for improving society and citizen's happiness. Although in general still a lot of people suggest that income and happiness are not correlated, this study wants to prove it does.

The purposes of this thesis are therefore to find out if there is a relationship between money formulated as income per head (GDP per capita), happiness defined in quality of life indicators and measured subjective well-being. Quality of life is split up in six indicators. They consist out of the Human Development Index, Gender Inequality Index, Life expectancy, Environmental Performance Index, Health expenditures per capita by government and the Research and Development per capita spent by government. The income per head (GDP per capita) is the last independent variable.

The indicators are indexes measured by all kinds of organisations like UN, EU commission, etcetera. If there is a relationship between the chosen indicators and subjective happiness measured in countries, it could become possible to make this happiness indicator valid. The focus of this thesis lies on the European Union member states to find out in how far and in what way Quality of life is correlated with measured subjective well-being in these member states. The reason for doing this is for public interest and policy makers (Ott, 2008). The EU is a highly developed region globally seen. It is the richer part of the world. Nevertheless lots of regional differences can be observed. The EU is a unified zone of countries started 1957 with the Rome treaty. Nowadays it has 27 member states with all kinds of differences. A lot of data are available for the countries in the EU and that is what makes it not only interesting but also possible to measure. One of the EU goals is to reduce the biggest differences and to become a more stable union. Culturally, economically but also politically (www.europa.eu).

To contribute to this challenge the study of happiness data in this research is of importance as a start. After this has been done, the quality of life data will be analysed. The EU commission measures subjective well-being within their member states by the use of a Eurobarometer every few years. This measurement takes a lot of time and is very cost inefficient. All members states get average scores with random sampling and this is time consuming research (European Commission, 2010). If it would be possible to explain well-being within countries by the use of secondary data this time and money consuming research can be substituted with a happiness indicator.

Measuring income per capita is done every year by lots of different organisations. Using this indicator as a welfare indicator is perhaps the most easy way but can give a very poor insight in real welfare (England, 1998). Although different studies in the past proved that money increases subjective well-being (Heijman and van Ophem, 2010, Diener, Sandvik, Seidlitz and Diener, 1993), the model with this single indicator is ready for extension. Therefore it is interesting to see if subjective well-being is not only explained with private goods such as income, but could also be explained with public goods. The combination of private and public goods on subjective well-being is already proved to have a positive effect (Caslamiglia, 1978). Although income per capita is often be considered as a private good, it can definitely be seen as a public good as well. Later on in the theoretical framework this combination of public and private side of GDP per capita will be further explained.

The so called quality of life variables already mentioned are bundles of mainly public goods in a country. Similar to income, they will be used to make a model in which happiness of people can be explained. The happiness data based on subjective well-being are the third important indicator. Therefore these happiness data form a group as well. Although already some studies in the past proved that there is a relationship (Veenhoven, 1991), not much literature has been written about the concept of explaining happiness (as subjective well-being) with quality of life indictors. Knowing about the proven positive relation between income and subjective well-being this thesis is focussing on this subjective well-being as a dependent variable which should be explained by the quality of life variables. These are supposed to be independent. After this can be proved a happiness indicator can be built. By bundling the quality of life variables and analyze if they might be reduced to one factor, the happiness of people could be explained. So basically a happiness indicator of a country explained with certain quality of life indicators covering a combination of private and public goods, is the main purpose of this study. If this study can give more evidence of the positive relation between public and private goods (quality of life indicators) on people's well-being, it could be used to make better and proper public policy. This way society can benefit from a higher quality of life and more people can be happy.

This makes the following research questions of this study:

(1) ‘To what extent are Happiness, Quality of life and Income interrelated?’

If this relationship is found and explained, the second research question can be answered:

(2) ‘To what extent is Happiness explained by private and public goods?’

This study has some objectives which can be used for either policy or further research. Firstly scientific evidence that there is a relationship between income per capita and human well-being in the European Union member states. Secondly a happiness indicator for measuring human well-being explained with quality of life indicators. And finally to assess the socio-economic situation in every EU member state for each indicator by the use of socio-economic benchmarking.

To reach these stated objectives this thesis has the following structure: at first a literature framework will follow in the next chapter. The Quality of life indicators, happiness and income are the most important topics. They will be elaborated. Quite some existing evidence shows the positive income effect on peoples well-being but this will be further discussed, leading to some hypotheses. This literature study will be followed by a data and method chapter. There will be explained what data and method are used and how. In chapter four the results of the analyses will be visible. Conclusions are drawn after these analyses and will be written in chapter six. Finally a discussion will highlight the most important limitations which this study has faced along with recommendations for future research in this field of studies.

2. Theoretical framework

This chapter will provide a theoretical framework in order to design the qualitative theoretical research which can be followed by quantitative part, using secondary data. Therefore this framework is separated into different sub parts: Happiness, the Easterlin paradox, Income, the Quality of life indicators and finally the combination of public and private goods on happiness. It will finish with some hypotheses.

2.1 Economics, Happiness and a short historical approach

Economic growth is continuously being measured and exposed by all kinds of media tools to the world nowadays. It is important to measure economic situations and growth to get insights in how a country is performing in contrast to other countries. Measuring a country's happiness and well-being level seems to get more important for policymaking purposes as well (Hagerty and Veenhoven, 2002). Earlier research has been conducted in the field of happiness studies. Although from the 1960's until nowadays interest in peoples happiness as a consequence of economic and wealth has increased in academic research. In the period of the Enlightenment Jeremy Bentham created the Greatest Happiness principle. He said that the best society is the one inwhich the cizitens are the happiest. That is why the best public policy could be producing the greatest happiness for the greatest number of people. Also an Italian named Muratori published a book in 1749 in which he introduced the term of 'public happiness'. In this book he already thought that public policy would lead to public happiness. After Muratori all kinds of neo-classical economists would rather use a utilitarian view to explain satisfaction of people. This utility was seen as something with which certain satisfaction arise and could somehow predict future outcomes in choices. However since after the second world war question marks were placed by this utilitarian approach because satisfaction or happiness are subjective (Dixon, 1997).

The Greatest Happiness principle has affected much social progress since the Enlightenment. Nevertheless applying or implementing this principle has been difficult. Because it is difficult to define happiness or even knowing about the nature and causes which drive happiness. It is a combination of sociology, psychology and philosophy from a traditional kind of view. But due to the modernisation and globalisation since the 1950's people started to become more individual, and individualism was born. The so called Maslow's pyramid gives the theory of hierarchy of needs. On the next page this pyramid is shown. To pick a starting point for the aim of this thesis, the theory of Maslow is chosen as a starting framework. Because happiness and subjective well-being are interchangeable key elements of this thesis, is it a hard task to define them. From a historical approach not so much is written about this in terms of theory or frameworks, so that is another reason for starting with Maslow. The pyramid exists out of five steps starting from the bottom. It basically describes people's basic needs to survive, and the steps onwards. This is where happiness research comes in. The last step is self-actualization and mental health is a key element in reaching this step.Although it could be seen that happiness plays a role in every step, it is interesting to find out what the underlying reasons and factors are.

Figure 1 Maslow's pyramid of the hierarchy of needs. Source: Maslow (1943)

The last step of this pyramid is the self-actualization. Unfortunately this last step doesn't seem to improve happiness over people's lives. Because the pure self-realization concept creates friction, this makes people too scared about what they need for themselves. That is why the call for a common good which everyone contributes to has risen. The greatest happiness for the greatest number of people could perhaps be that good. As later on in this report happiness will be explained in subjective well-being and objective well-being, the focus will be on the objective approach mainly. Indicators in this field could be related to income, and compared with subjective well-being scores. If the relationship can be proved, the exact bundles of goods which are responsible for an increase of happiness, or life satisfaction, can be improved by policy makers to fullfill this goal of a happy society. Looking at the pyramid in figure 1 the objective well-being might be seen as the first two steps forming the bottom. They are rather material and objective measurable. As the people rise in their needs the third step and further steps form a subjective needs which might be different for everyone. The combination of objective and subjective needs form the pyramid and seem to be responsible for peoples well-being.

So why study happiness? Happiness is more than often considered to be the most important thing in human life. The first studies which compared happiness between countries took place in 1948. This study covered nine countries. The second study comparing 14 countries took place in 1960, followed by a third study in 1975 covering all parts of the world. Since the 1980's much more research in the field of happiness studies have been done. Interest in this topic is rapidly growing also because of the fact that policy makers see a high value in using happiness and well-being data for policy purposes. Infinite amount of research has shown that happiness is of high importance in human life (Veenhoven, 2005a).

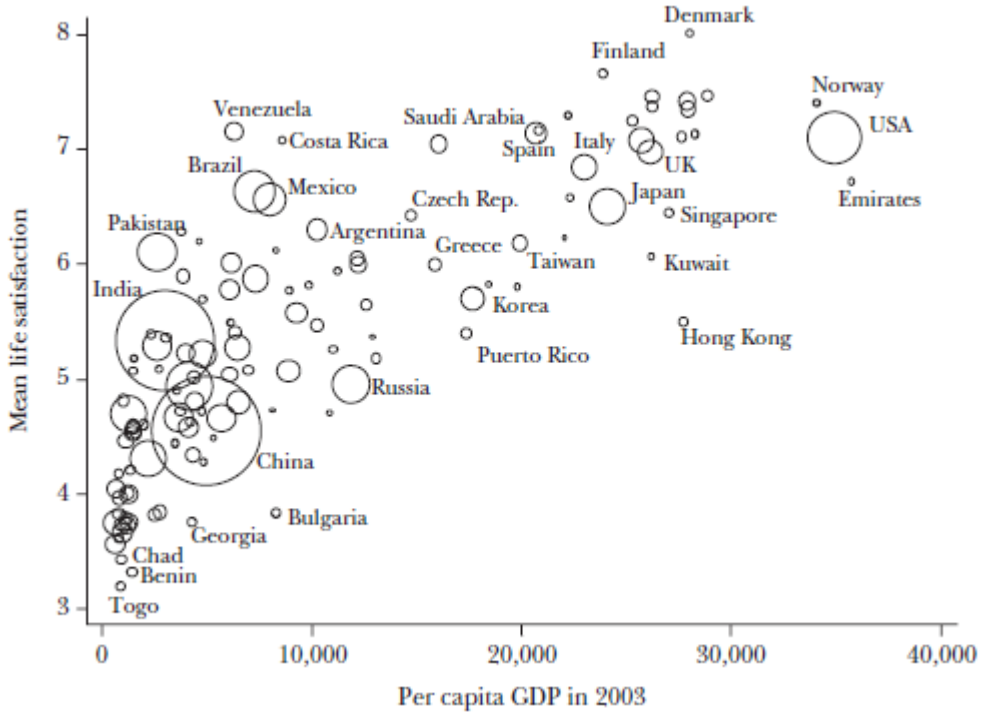


Figure 2 Income and Life satisfaction. Source: Deaton (2008)

Also findings in the domain of Subjective well-being have established the relationship between income and well-being. As visible in figure 2, there are correlations between nations in the measured subjective well-being and the increase of income. The evidence in this figure shows that There are also findings proving a smaller correlation between income and well-being within nations. This is overlapping with the Easterlin paradox, but states that there are major differences between countries with a different income per capita. (Diener and Biswas-Diener, 2002)

2.2 Easterlin Paradox

One of the most prominent critics in the field of happiness economics is perhaps Richard Easterlin. He first published in 1973 about his findings that income and life satisfaction were not significantly related to each other. Later in 2004 he published again, when comparing scores over time measuring subjective well-being and income per capita. Easterlin is inextricably linked with this finding which is called the Easterlin paradox. This paradox points out that average happiness has remained constant over time despite sharp rises in GNP per head. Nevertheless it has to be possible to solve this paradox with strong arguments. Easterlin himself solves this paradox by explaining that aspirations especially for material goods seem to rise with increasing income, but where high aspirations make people unhappy the effect of income on happiness levels off.At the same time, a micro literature has typically found positive correlations between individual income and individual measures of subjective well-being. Income may be evaluated relative to others known as social comparison or to oneself in the past which can be called habituation. (Easterlin, 1974, updated in 1995)

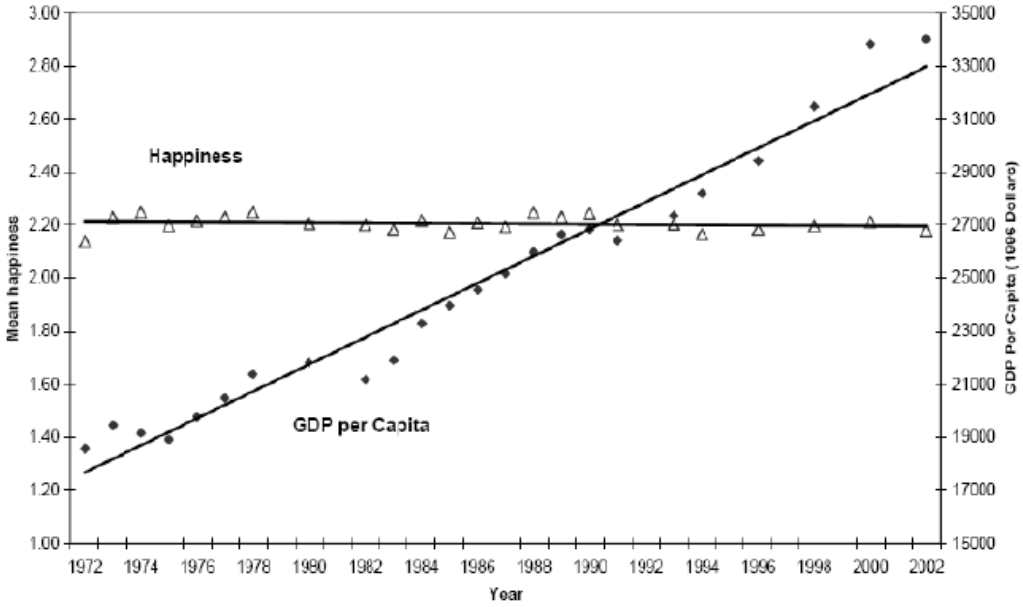


Figure 3 The Easterlin Paradox. Source: Easterlin and Angelescu (2009)

As figure 3 shows, happiness measured in Western Europe between 1973 and 2004 remained constantly the same, maybe they show a little increase. But there are some strong arguments how this paradox could be explained and/or solved. Firstly this figure uses a time series data scatter plot. This means in time aspirations might grow simultaneously with a rise of income. Relatively happiness wouldn't increase that much. Later on in figure 4 this will be visualized. The second and strongest argument is the fact that this approach is average of a mix of countries. This means that it is not possible to see if in lower income countries with a high rise in income, happiness increased more than in countries which had already higher incomes. The comparison is not between countries, but between time. Also the scale of measuring life satisfaction is an important factor. Figure 3 shows a scale from 1 to 3, but depending on the methodology of research this can vary. It could be that people who claim to be happy or very happy vary or switch between these answers, so stay the same on average. While people who were unhappy increased to happy. What this tries to say is people who are already a normal or high score on happiness stay 'happy', where a major shift from unhappy to happy could have taken place. The Easterlin paradox doesn't show this in its scatter plot.

Nevertheless it remains hard to solve this pardoxal findings of Easterlin. Focussing on different kinds of judgement it is possible to separate absolute income and relative income of citizens in a country. It has been shown that people are judging life satisfaction more on with relative income instead of absolute income. They want to compare with others and keep up with the Joneses or even rise above them if possible. For some, absolute income could be an important predictor of happiness but also this, has been found only counts up to a certain income level. If income rises above approximately $ 15.000,- per year, happiness doesn't significantly seem to increase (Stevenson and Wolfers, 2008).
We can therefore conclude that relative income plays a role in social comparison between people in a country and if this stays the same, overall happiness could be remain constant over time (Layard, 2005)

Figure 4 underneath shows an explanation that has not previously been described. In this figure income and aspiration level are dependent where time is the independent factor. It basically shows, like shortly written before, that within time income increases. So do the aspirations of people increase at the same time. If someone has an increase of either absolute or relative income his/her aspiration level will increase simultaneously. We can assume that for lower and higher income groups this is equal. In figure 4, two income groups with their aspirations are separated. First the high income group (Y_t^h), with their related high aspiration A_t^h levels. Secondly the lower income group (Y_t^l) with lower aspiration levels (A_t^l). Both of them grow over time (t) within and between the two groups. Happiness is dependent inversely with the difference between aspiration level and income. Obviously there are differences between poor and rich. The two bundled slopes represent two countries over time. The upper two slopes are a rich country and the lower are low income countries, basically a poor and a rich country e.g. Over time aspirations rise just like income, but as this figure shows low income countries have a higher income at a certain time than higher income countries in an earlier stage.

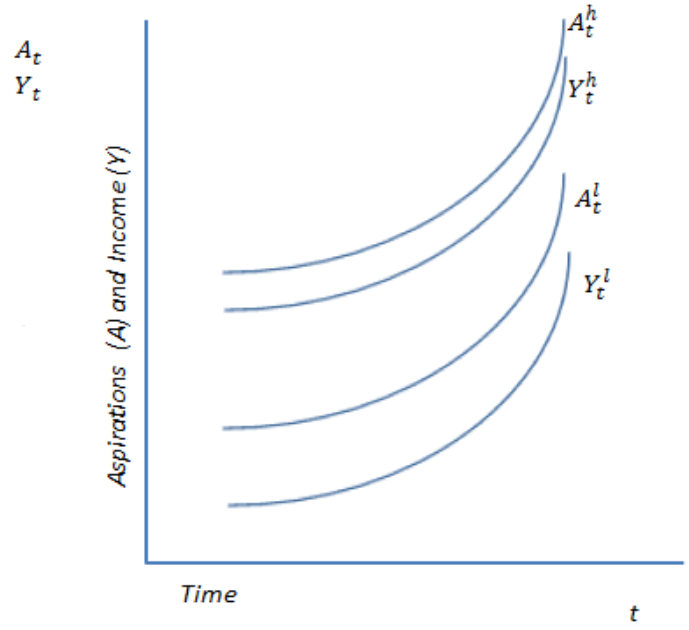


Figure 4 A possible solution for the Easterlin Paradox

So now it is visible that over time income and aspirations grow for all groups of income, the focus can be put on the differences. A closer look tells that there is a gap between the level of aspirations and the income. The gap however is larger for the lower compared with the higher income group.If citizens with a lower income experience a larger gap to reach their aspirations and this gap remains constant over time, their evaluation or judgement on subjective well-being will remain constant as well. So does this count for higher income people. Because they start with a higher income, their aspirations are ‘less far away’ from their income level. Their income and aspirations increase over time keeping their gap as well, only smaller. Thus on average it can be stated that happiness over time remains constant because of the gap between income and aspiration level of citizens in a country. This solution could be an critical argument towards Easterlin.

Another argument why happiness over time doesn't seem to increase while income does, could be the fact that within countries income increases, but the differences between countries stay the same. The gap between countries relative incomes remained the same, and so average aggregated happiness remains constant as well. Figure 5 underneath clarifies this argument.

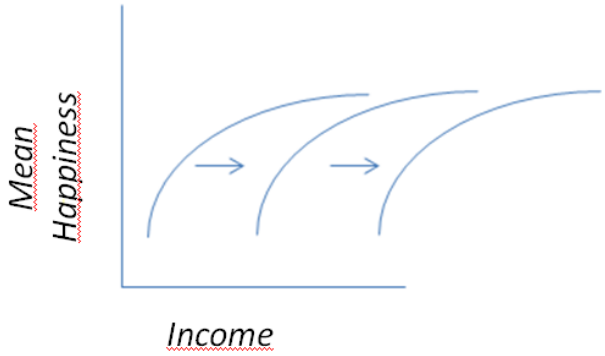


Figure 5 Constant mean happiness over time

Like previous studies already proved the positive relationship between income and happiness e.g. figure 2, a same kind of shape of the slope in figure 5 can be observed. Income seems to 'level off' the effect on happiness passing a certain point. It is clear from figure 3 that income increased majorly the past 30 years. The Easterlin paradox states that happiness remained constant over time, but this happiness is mean happiness. Figure 5 shows that the line moves to the right which means an increase in income. The shape stays intact because this is the way income relates to happiness. This slope is the outcome of cross-section analysis of countries on a certain time. Whenever happiness is measured this slope seems to occur with the same mean happiness scores. That is why the slope moves to the right side only. The aggregated happiness stays the same if a situation like this occurs. The most likely explanation for the Easterlin paradox would be a combination of all kinds of factors explained in this chapter. Whatever different kind of arguments trying to solve the Easterlin paradox, one phenomena has become clear from this paragraph. Income and happiness are positively related despite of differences measured by Easterlin.

2.3 Income per capita (GDP)

Gross Domestic Product is perhaps one of the most common indicators in economy. This indicator is standard used to describe the total economic activity. The GDP focuses on domestic activity whereas the GNI includes net investments from other other countries. In this thesis the GDP will be used focussing on the domestic total level of production. The GDP is regularly published quarterly and annually. In this research the annual most recent GDP will be used. To measure what is produced averagely per person in a country, the income per capita is often considered to be an important economic indicator. This basically divides the GDP in a country by its population size. Therefore population size is taken into account so that big differences in country size are included in the calculation. GDP per capita allows to compare countries with each other. This indicator is regularly used for macro-economic research and has been used for happiness economics as well (Di Tella et al, 2003).
In the previous paragraph the GDP per capita has already been used to show the effect of income on happiness. Although GDP per head is often seen as a private good of citizens living in a country, it has a public function as well. An important part of society is paid by governmental expenditures which include mainly taxes. These expenditures are being used to run a countries economy. What is important to see in table 1 underneath are governmental expenditures as a part of the GDP per capita.

Table 1 Governmental expenditures as a percentage of GDP per capita

Country/Time	2010	2009	2008
European Union (27 countries)	50,3	50,8	46,9
Euro area (17 countries)	50,4	50,8	47,0
Austria	45,7	44,5	43,2
Belgium	37,7	40,7	37,6
Bulgaria	45,2	45,9	42,9
Czech Republic	58,2	58,4	51,9
Denmark	46,6	47,5	43,8
Germany	40,0	45,2	39,9
Estonia	67,0	48,2	42,8
Ireland	49,5	52,9	49,7
Greece	45,0	45,8	41,3
Spain	56,2	56,2	52,9
France	50,3	51,8	48,8
Italy	42,9	44,2	38,8
Latvia	41,3	44,0	37,4
Lithuania	41,2	42,2	36,9
Luxembourg	48,9	50,5	48,8
Hungary	51,2	51,4	46,0
Netherlands	53,0	53,0	49,3
Poland	50,7	49,8	44,7
Portugal	40,8	40,6	38,3
Romania	49,0	49,0	44,1
Slovenia	41,0	41,5	35,0
Slovakia	55,1	56,3	49,3
Finland	53,0	55,2	51,7
Sweden	50,9	51,4	47,4
United Kingdom	50,0	50,9	57,8

What is visible in table 1 are all EU countries with their expenditures per year as a part of GDP including past 3 years. It is interesting to see that on average in the EU more than 50% are public expenditures which means GDP can be seen as an ideal bundle of public and private goods. Logically the part of private expenditures can be seen as the remaining percentages to fill 100% (EuroStat).

2.4 Quality of life indicators

As the scope of this thesis is basically quality of life, the varies aspects of quality of life have to be separately discussed. Therefore figure 6 shows a framework which emphasizes the aspects of this research (Schyns, 2003).

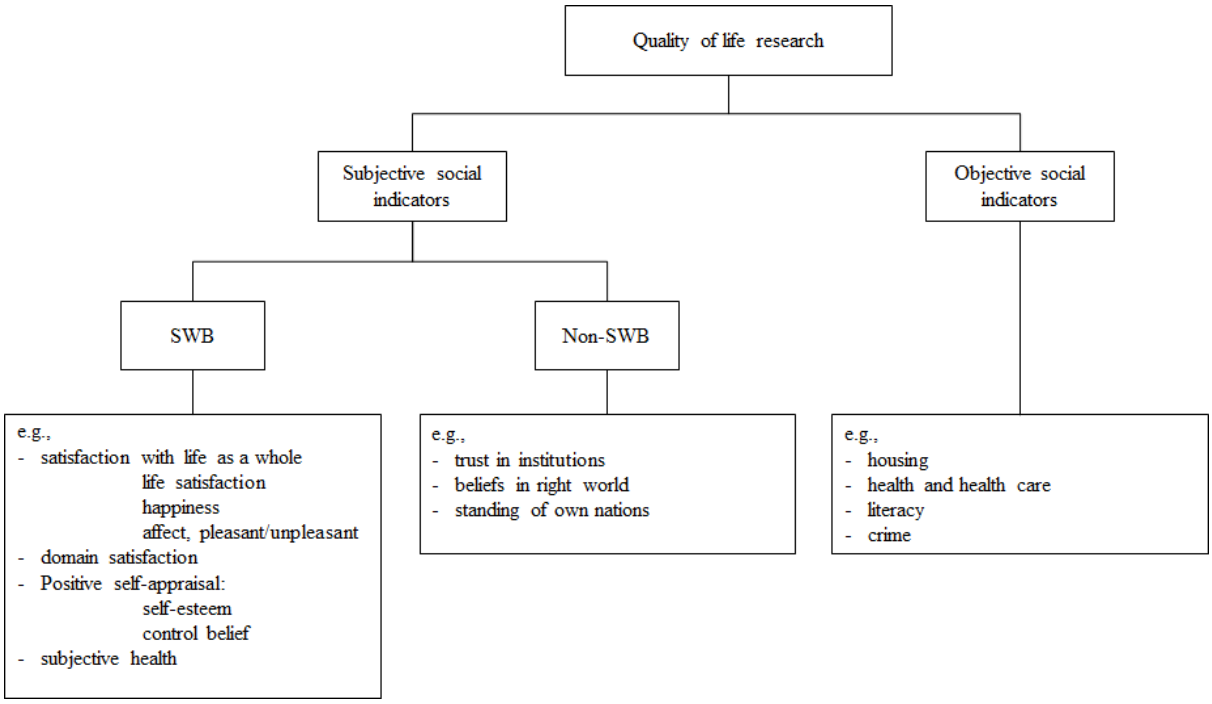


Figure 6 Quality of life framework

Like the framework shows Q.O.L. (quality of life) research can be split up in two kind of indicators. First the subjective indicators. For these, this thesis will make use of happiness data covering the SWB (subjective well-being). The second way of measuring Q.O.L. is with the use of objective indicators. Therefore the following paragraphs will discuss these separately. The previous paragraph already discussed the first one: income per head.

2.4.1 Human Development Index

The United Nations Development Programme introduced a new way of measuring human development in their first Human Development Report. This report came with the Human Development Index. As figure 7 shows, it combines indicators like life expectancy, educational attainment and income into a composite human development index, the HDI. The most important thing about this index is the fact that it shows not only an economic, but also a social indication of development in countries by this way of composing it. The range of this index varies between 0 and 1, which means 0 as a minimum point and 1 as a maximum score for a country. Nevertheless income per capita is already covered with this index.

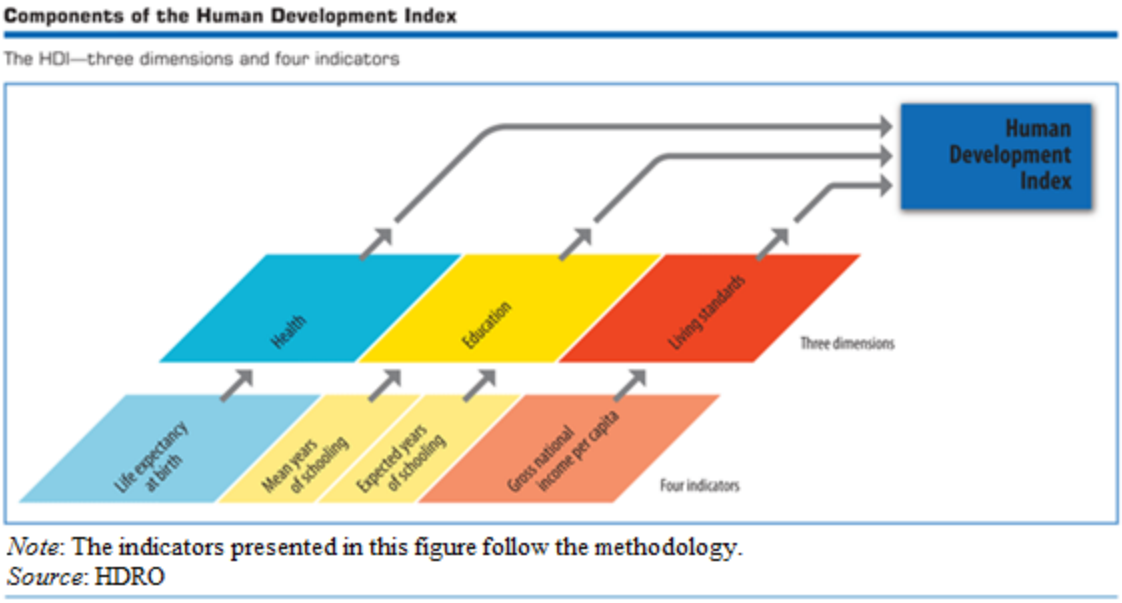


Figure 7 The Human Development Index. (Source: UNDP)

As for the educational component of this index, it is measured by mean of years of schooling for adults aged 25 years and expected years of schooling for children of school entering age. The mean years of schooling are estimated by the UNDP based on educational attainment data which they let been carried out with censuses and surveys available in the UNESCO Institute for Statistics database and with a methodology created by Barro and Lee. Expected years of schooling estimates are based on enrolment by age at all levels of education and population of official school age for each level of education. The life expectancy at birth component of the HDI is calculated by using a minimum value of 20 and maximum value of 83.4. Obviously this stands for the age. These data are minimum and maximum values as well, and are taken from the average minimum and maximum from the past 30 years. This time period is between 1980–2010. This basically means that the life expectancy for example in a certain country is 47, the value for this index will be 47.

2.4.2 Gender Inequality Index

The disadvantages known as gender discrimination, which faces women and girls are a major source of inequality. This inequality or discrimination is assumed to be an important indicator for well-being in country, especially because the well-being is measured for both male and female mixed in society. Feminism could explain a smaller difference in western states, like the European Union, between male and female in society. Since the first wave of feminism is already more than 100 years ago, at the end of the nineteen century and beginning of the twentieth century, women's right to vote became a first step in more equality between gender. The second feministic wave took place in the 1960 with the liberation movement. The third movement can be seen as an continuation nowadays where women still keep fighting for more equal rights on working in management functions in for example business and politics. (Botting, 2006)

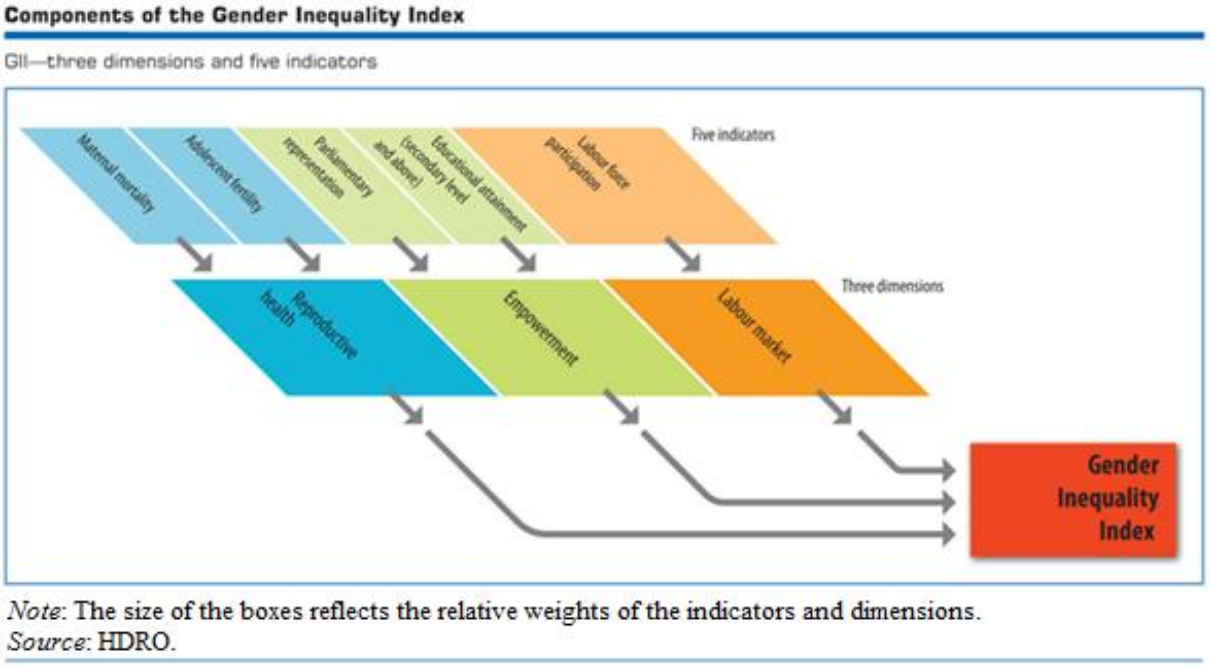


Figure 8 The Gender Inequality Index. (Source: HDRO, 2012)

The HDRO calculates an index which shows the inequality between the gender in countries, which can be tested against income in a country. This index is being explained by figure 8. It exists out of different components measuring inequality like discrimination in health, education but also the labour market. Although thoughts are getting more common about a disappearance of discrimination between gender at for example the labour market, the index shows completely different. The index varies between 0 and 1, again with 0 as a minimum and 1 as a maximum. This means the lower the percentage (index), the lower the inequality. The expectation therefore is that countries with a high income tend to lower inequality indices.

2.4.3 Environmental Performance Index

Environment is an important factor of people's well-being in a country. It plays a very important role in our everyday lives. Taking in account that that quality of life consists out of a lot of factors, the environment is an important indicator (Dascupta, 2001). This indicator is called the EPI, abbreviation for Environmental Performance Index. It is being measured every year for the past years to gain insights in how well countries perform on their environment. This indicator ranks all involved countries from a scale of 0 to 1. The higher the score, the higher that particular country scores on its environment. Of course according to the standards with which it has been measured. These are shown in figure 9 on the next page. As also visible from this figure, this index is bundle of different objectives. Not only environmental health, but also vitality of the ecosystem is taken into account. This index can therefore be seen as a bundled good as well.

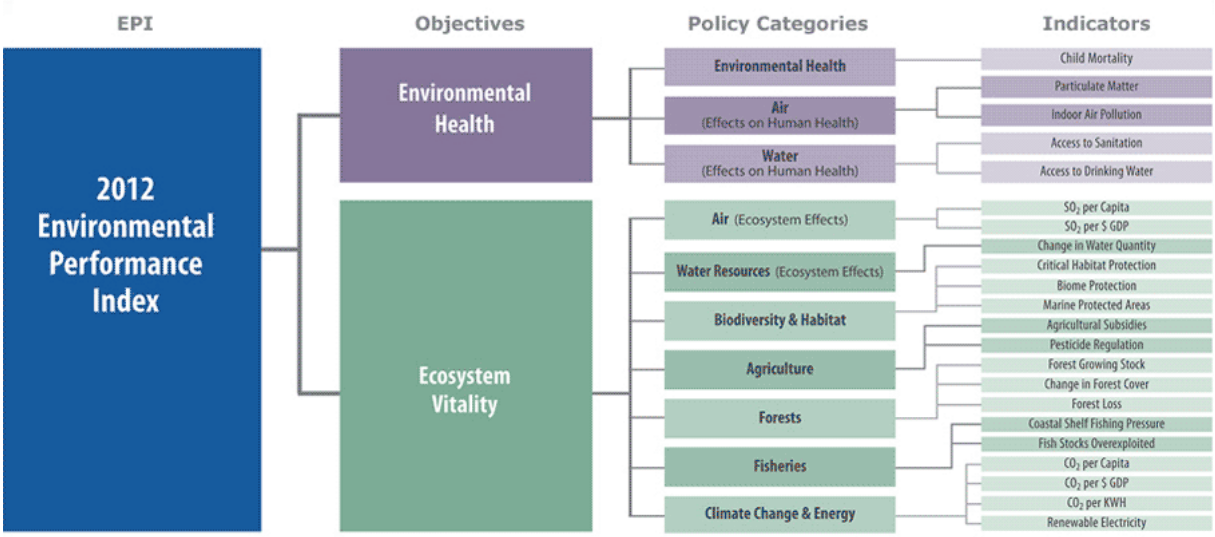


Figure 9 The Environmental Performance Index. (Source: Yale University, 2012)

As figure 9 shows this index consists out of different sub-parts and categories. The indicators are the ones being measures in the most right column. They can be clustered in policy categories which form the objectives. The two objectives environmental health and ecosystem vitality form the Environmental Performance index. It is assumed that if a country performs well on its environment the citizens will experience and report a higher quality of life. As this quality of life gets evaluated higher, so might subjective well-being.

2.4.4 Life expectancy at birth

The indication of life expectancy at birth can be seen as an important individual indicator of quality of life in a country. It is a good indicator of health in a country. The longer a newborn is expected to live in a country indicates the possibilities to grow that old. All kind of studies already proved the positive relationship between income per capita and life expectancy. Life expectancy describes the age of expected living years in a country prevailing mortality rates. Not only the overall health indication for a country can be described with the life expectancy. The role of economics in life expectancy has been proven important in earlier studies as well. People in higher income countries tend to live approximately 23 years longer compared with people living in lower income countries (WHO, 2008).

2.4.5 Health expenditures per capita by government

This indicator shows the expenditures of government in all involved countries as a percentage of the national GDP. This way it is visible to what extend countries care about health care or anything related to this factor, within the country itself. This can be seen as a public good from the governmental view. It can be assumed that the more expenditures towards health, the higher the life expectancy gets. If this is the case the higher well-being and quality of life will get for citizens in a country. It might seem overlapping to measure health expenditures by government, but if relative percentages of different EU countries can be compared, this might give new insights of this quality of life indicator.

2.4.6 Research and Development expenditures per capita by government

As this subtitle already suggests, the last of the quality of life variables is the amount of money spent by governments of all involved countries for research and development purposes. This indicator is provided as a percentage of the GDP per country and includes "Research and experimental development comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society and the use of this stock of knowledge to devise new applications" Research and Development is an activity where there are significant transfers of resources between units, organisations and sectors and it is important to trace the flow of R&D funds. (Frascati Manual, 2002) It is of importance for economic growth as well. Studies in the past have proven the positive effect of investments in R&D and their returns on society. R&D expenditures do related to GDP in a country and therefore as GDP increases so does R&D expenditures. Nevertheless it mainly depends on the economic situation. Also foreign demand influences the expenditures, depending on the trade between countries (Lichtenberg, 1992). Figure 10 on the next page shows like stated just before, that income per capita and R&D expenditures are positively related.

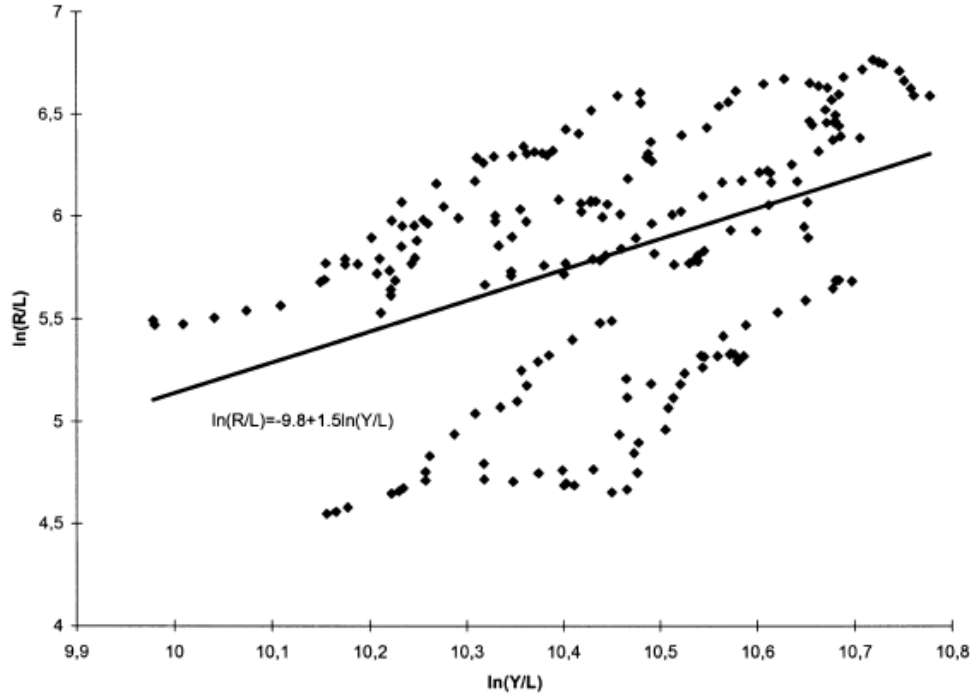


Figure 10 Real R&D per Capita Expenditure and GDP per Capita for 10 OECD Countries, between 1973–92

Like logarithmical measured the R&D expenditures seem to increase with the income per head over time. Few reasons can be pointed to explain this relationship. If economy grows, consumers tend to spend more money. They demand more differentiation on the product market so R&D is necessary to create new supply. On a more macro scale, government and companies in a country want to keep up with their economic growth, and investments like R&D are a protection against competitors from either within their country, as well as between trading countries (Braconier, 2000).

2.5 Public and private goods

Considering the scope of this thesis being the quality of life, the previous paragraphs showed six indicators which from earlier research tend to be related to income per capita and quality of life. Although the quality of life index already exists, this thesis is reconstructing it (The Economist, 2005). Better measuring because of bundled variables of goods, might give a more reliable and valid information. A societal point of view shows that these indicators are combinations of public and private goods. All of them tend to be positively related to income so assuming there is a positive relationship between not only private goods, but also between public goods and per capita income (Calsamiglia, 1978), it is important to see what kind of public goods are responsible for the increase of happiness as quality of life. But not only public goods also private goods play a big part in citizens well-being. As it is difficult in socio-economic terms to distinguish public and private goods, the assumption can be made that the combination of the both of them play the biggest part in well-being. So first starting with the GDP per capita, it is proven to have a positive effect on citizens well-being in and in between countries. As explained in this chapter, income per head can be seen as private as well as a public good. The Human Development Index however is a typical combination of a private and public good. It includes income party, which is private, but also education and health. These two can be seen as public goods. The equality between men and women is a public cultural good and very hard to concretely define. However like paragraph 2.4.2 explains, an index is measured including all kinds of factors visible in figure 8. This public good is expected to have a positive effect on reported happiness in a country. Also several studies proved the environment is of importance in a country, and it is assumed to have a positive effect on peoples wellbeing. (Rehdanz and Maddison, 2003)
However now the prove is there that public goods are of importance to create more well-being in society it is a major challenge for policymakers to do so. Creating the right model to supply every citizen in its optimal is a hard task. Policy makers have been busy with this since the role of public goods are researched towards their effect on well-being. It is a challenge to combine classical economic theory with this new insight in welfare economics (Frey and Stutzer, 2004).

2.6 Hypotheses

Therefore the first hypothesis can be stated that:

(1) Subjective well-being and income per capita are positively related within the EU

Because of the expected positive relationship between subjective well-being and income, it is interesting to see whether the Human Development Index gives a better explanation of subjective well-being than only income per capita does. As figure 7 shows, the HDI consists out of income already. It contains two extra factors, so one can expect a better explanation with using the HDI for measuring happiness, instead of income per capita. Therefore the second hypothesis can be tested:

(2) Public GDP and private GDP are both together positively related with Happiness

(3) Happiness and Human Development are positively related

To measure happiness in separate variables, the third and fourth hypothesis is going to be tested. Like the main hypothesis, there should be a relationship between Quality of Life as constructed in this research and subjective well-being measured by the European Union (Nation Ranking). The assumption that the Human Development Index is an important indicator for well-being in countries, this is tested as a separate hypothesis 3. The fourth hypothesis is a separate indicator as well. Because of the assumption that gender equality is of importance an extra hypothesis is made underneath.

(4) Gender equality and happiness are positively related

The last hypothesis is actually the basis of this research. The six indicators which are chosen after a literature study, should all be related to happiness. First at separate, but in the end they all have to contribute in a model, where an increase of an indicator creates an increase in measured happiness.

(5) Quality of life indicators are positively related to subjective well-being within the European Union member states.

3. Methodology

At first a literature study in the previous chapter has been conducted on the study objectives in this research. These issues concern the happiness of human beings and the quality of life indicators as defined. This study was performed to explain the exact indicators which are going to be measured in the next chapter and to create a framework with which alternative socio-economic performance of European countries can be measured, or expressed. Since the focus is on Europe, it is important to mention the exact countries involved in the analysis. For this research the European Union member states are going to be analyzed. They will be tested for their scores on subjective well-being from the Euro barometer, and for all their quality of life indicators against income per capita. Countries involved contain:

- Austria
- Belgium
- Bulgaria
- Czech Republic
- Denmark
- Estonia
- Finland
- France
- Germany
- Greece
- Hungary
- Ireland
- Italy
- Latvia
- Lithuania
- Luxembourg
- Netherlands
- Poland
- Portugal
- Romania
- Slovakia
- Slovenia
- Spain
- Sweden
- United Kingdom

As clearly visible right above, only 25 EU member states are picked. This means Cyprus and Malta are left out of this research because of two reasons. They have a lack of data involving some indicators. Furthermore the indicators which are available for research, their contribution towards the whole EU, is negligible.

Like explained in the theoretical framework, several indicators will be analysed. The data for these analyses stem from different sources. This can be strongly argued in terms of validity, reliability and objectivity. To cover these as much as possible, the most up-to-date data sources were used. For some data this was the same source, for other they stem from different organizations. First the variables will be discussed separately including their source. In section 3.2 the exact analytical procedure will be described.

3.1 Data variables collection

The variables used in this research will now separately be distinguished and the source of the data will be described.

The income per capita data stem from the World Bank. Every year they publish economic world facts in an objective and professional way. The income per capita of the 25 EU member states, which are subject in this research, stem from 2010. In the analyses the income per capita is used as an independent variable and against PPP, which stands for power purchase parity (www.data.worldbank.org). The percentages of public expenditures are taken from EuroStat. Therefore table 1 is used. This data bundle can be found in Appendix I containing all original data as taken from the source.

Subjective well-being research is being done in the European Union every few years by the European Committee. In this report they publish several social, psychological, environmental, and economical findings conducted in that year. The most recent report was published in 2010. In this report TNS Opinion & Social network have provided the data for the European Commission (European Commission, 2010). They carried out interviews and questionnaires among 26.800 citizens in the EU member states. One of their questionnaires asked about their mental well-being at the present moment and these data are used in this research for the analyses in the next chapter. These data consist out of percentages written in numbers from 0 to 1. They cover the amount of people who claim to felt happy ‘all the time’ plus ‘most of the time’ the past weeks, during the period of questioning. They can be found in the appendix as well.

The quality of life indicators that are used in this research stem from different sources as well. The Human Development Index , the Gender Inequality Index and the Life Expectancy at birth are being taken from the dataset of United Nations Development Programme. They publicate a Human Development Report every year containing lots of information and indices about the 192 United Nations member states (UNDP, 2011). All three of these indicators are taken from the year 2010. The Environmental Performance Index is calculated by the Yale University in the United States. Yale Center for Environmental Law and Policy and The Center for International Earth Science Information Network (CIESIN), (Yale University). Calculated numbers from this index are being published in 2012, but stem from 2010/2011. Research and Development data were calculated by Eurostat. As well as the data from UNDP, index numbers from this indicator are taken from the year 2010. (Eurostat, 2012) Health expenditures data stem from 2010 which were published in 2011 by the OECD. (OECD, 011)

3.2 Data analysis procedure

The data analysis procedure will be done according to the expectations of this research. Like the hypothesis and literature research suppose, a concave shape might be logical to appear between the analysis of income and happiness in countries. Because of this levelling off effect, the expectation is that the relationship between the quality of life indicators and happiness levels off as well. Nevertheless at first a single linear regression will be done using Microsoft Excel. For the first analysis, which consists out of the happiness data related to income per capita in the EU member states a linear regression will be carried out. After the scatter plot will be analyzed and reported. If in case this plot shows a concave shape, the regression coefficient will be checked as well as the explained variance. After applying this, the explained variance of the logarithmical model will be checked to select the model with the highest variance.

After literature has proved the composition of the Human Development Index, containing factors like income per capita, health and living standards already, this will be tested with the same procedure as the first analysis. The relation between Happiness as a function of HDI is assumed to be positive.

Same story counts for the Quality of life indicators. They will be first analyzed by the use of a linear model. If concave scatter plots appear, logarithmic modelling will be used as well. After the plots are discussed the next important step will be taken to prove the main hypothesis. Therefore a so called Principle Component Analysis will be carried out. This analysis is very closely related to Factor Analysis. This analysis basically calculates the variability among the observed variables to determine less variables and actually reduces the variables back to one or just a few. These reduced variables are the so called components. If they can be reduced, this means that well-being can be described by the Quality of life indicators used in this research.

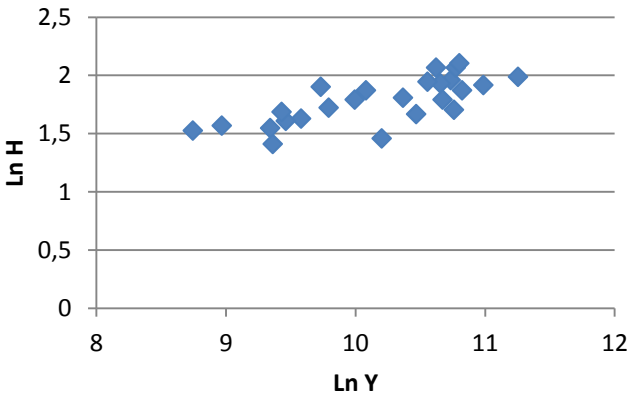
4. Results

In this chapter the result of all analyses will be presented. In the introduction part two research question were formulated, and after the literature study in chapter two five hypotheses are made as a tool to answer the question. Like explained in the previous chapter all analyses are logarithmical functions, because of the exponential relationship between income, happiness and all Quality of life indicators. Also elasticities can be measured this way. By looking at the coefficient the elasticity can be read. The logarithmic function is therefore used to explain the relationship. Firstly happiness and income per capita is going to be analysed. After this analysis the income per head will be split into public GDP per capita and private GDP per capita according to literature the both of them have an effect on happiness. This will be done by the use of a Cobb-Douglas function. Happiness is assumed to be explained by a combination of public and private income in a country. This will be tested in the second analysis. After these results all six quality of life indicators will be tested as independent variables on happiness being the dependent variable. It is there to see whether each indicator positively relates to happiness, and if therefore happiness can be explained with the use of all six indicators and to what extent. These six analyses will be shown with scatter plots also with the use of logarithmic regression. The model specifications of all these six analyses will be given in a table in the end.

4.1 Happiness and GDP per capita

The first analysis is shown in figure 11 underneath. It shows the relationship between happiness and income per capita. Like explained before this is based on the logarithmic values of happiness and income per capita. The logarithmic function can be derived from the exponential relationship. Where H stands for Happiness, the α can be seen as a constant and the β as the coefficient, Y represents the GDP per capita. This can be formulated as:

(1) $$H = \alpha Y^{\beta} \quad \rightarrow \quad ln\, H = ln\, \alpha + \beta\, ln\, Y$$



R^2	0,55
Ln α	-0,39
T-value α	-0,97
β	0,214
T-value β	5,53
Significance of the model	0,0000019

Figure 11 Ln Happiness and Ln GDP per capita

As visible in the scatter plot figure 11 and the table attached at its right side, there is a positive relation visible between income and happiness between the 25 EU countries. Some small outliners are visible, especially the most right one. This represents Luxembourg with its high income per capita. It is important to mention that the coefficient β is significant and at the same time represents the elasticity. The R^2 is satisfying for this model as well, the explained variance is acceptable. The bottom row of the table next to figure 11 shows the model is significant as well. Finally given all this information is it possible to accept the first hypothesis: Happiness and GDP per capita are positively related.

4.2 Happiness and Public and Private GDP per capita

As figure 11 shows that total GDP per capita has a positive effect on happiness , it is to see if happiness (*H*) can be explained by a combination of public GDP per capita and private GDP per capita. Therefore a Cobb-Douglas function will used to see if the combination of these two parts of GDP per capita have a positive influence on happiness and to what extent. From the literature review it can be assumed that the both explain Happiness (*H)* to a higher extend. If the GDP per capita gets split into this private and public part, the combination which is modelled by the Cobb-Douglas function, should give a better prediction of happiness. In this function the H is the happiness variable, where the *a* represents a constant. The *β* is the coefficient for Public GDP and the γ is the coefficient for private GDP. This Cobb-Douglas function is converted to a linear logarithmic function as well, to see again if the coefficients are significant the T-values of these coefficients are being used. Therefore the second formula will be tested and results will be shown in table 2 underneath.

(2) $$H = \alpha Y_{Pub}^{\beta} Y_{Priv}^{\gamma} \quad \rightarrow \quad ln\, H = ln\, \alpha + \beta\, ln\, Y_{Pub} + \gamma\, ln\, Y_{Priv}$$

Table 2 Public and private GDP per capita and Happiness using logarithmic regression

R^2	$ln\ \alpha$	T-value α	β	T-value β	γ	T-value γ
0,57	0,102	0,203	0,221	1,92	-0,043	-0,29

The results in table 2 are remarkable. Looking at the T-values of both coefficients it can be stated that the both are not significant. This means that the model cannot be used to predict happiness in a convincing and acceptable way. Firstly looking at the R^2 the model with the two predictors GDP public and GDP private, is only a little higher than the model used in the previous section figure 11, where GDP as a total is used. Then again, the coefficients are not significant, because the T-values are too low. The next step for now is to see why this model is not explaining happiness in a better and more acceptable way. This can be done with the use of a correlation between public GDP per capita and private GDP per capita. Table 3 on the next page will give the correlation matrix of these two indicators.

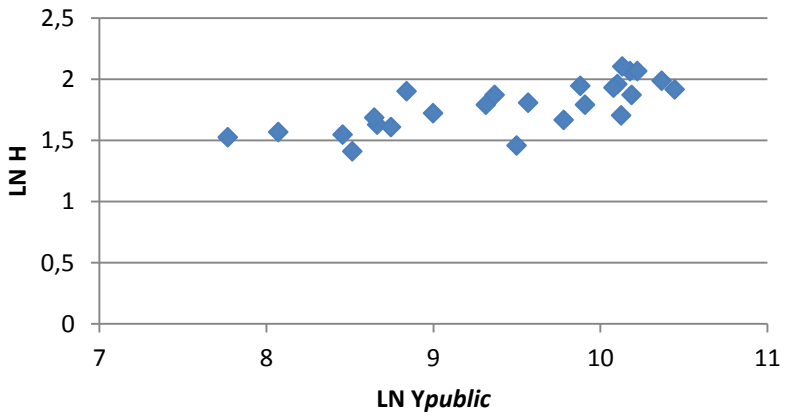
Table 3 Correlation matrix showing the interrelation of Public GDP per capita and Private GDP per capita

	GDP Public	GDP Private
GDP Public	1	0,952
GDP Private	0,952	1

It is clearly visible from table 3 that private and public GDP per capita are strongly correlated. This can be seen as a fixed ratio between the two parts of income per head, which are heavily intercorrelated. This might explain the reason for remarkable non-significant coefficients in table 2. Therefore the model with the total GDP per capita used by formula 1 and explained by figure 11 should be regarded as the most suitable model.

Nevertheless the results from table 2 and table 3, it is interesting to see what the influence of the separate GDP's on happiness is. Therefore public GDP and private GDP are individually measured on their influence on happiness *(H)*. Both of these analyses are to what extent happiness can be explained by public respectively private GDP. For the both the exponential function will be transformed into logarithmic to see the elasticity. At first happiness *(H)* will be explained by public GDP expressed by Y_{Public}, giving the α is a constant and β being the coefficient, using the formula:

(3) $$H = \alpha Y_{Public}^{\beta} \rightarrow \quad ln\, H = ln\, \alpha + \beta\, ln\, Y_{Public}$$



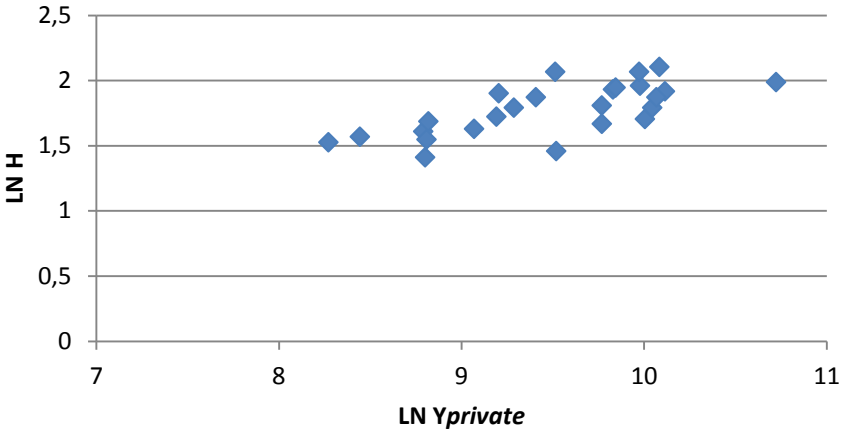
R^2	0,57
Ln α	-0,005
T-value α	-0,015
β	0,19
T-value β	5,48
Significance of the model	0,00000143

Figure 12 LN Happiness and LN Public GDP per capita

The relationship between public GDP and happiness for the 25 countries involved in this thesis are shown in the scatter in figure 12. An increase public GDP seems to create a higher reported happiness score. The model shows an explained variance of 0,57 which is significant. Also the coefficient β is significant. This total model is highly significant as well, therefore happiness can be explained by public GDP per capita. Secondly it is the question if private GDP per capita has a positive effect on Happiness as well, and how well this model can explain happiness.

Therefore the same procedures will be used as before with happiness *(H)* explained by private GDP expressed by $Y_{Private}$, again with the α as a constant and β being the coefficient, gives formula 4:

(4) $$H = \alpha Y_{Private}^{\beta} \rightarrow \quad ln\, H = ln\, \alpha + \beta\, ln\, Y_{Private}$$



R^2	0,50
Ln α	-0,38
T-value α	-0,84
B	0,23
T-value β	4,75
Significance of the model	0,0000086

Figure 13 LN Happiness and LN Private GDP per capita

Figure 13 shows the private GDP per capita in all countries related to happiness. Also in this figure a positive relationship exists. Again the outliner is Luxembourg. The R-square of this private GDP model is a little less than the one where happiness gets explained by public GDP. Again the model is significant as well as the coefficient β.

To finalize this section it is important to see, like table 2 shows, the combination of public and private GDP per capita is not significant in a logarithmic model. Therefore the same combination of Public and Private GDP is tested but without logarithmic regression giving:

(5) $$H = \alpha + Y_{Pub}^{\beta} + Y_{Priv}^{\gamma}$$

Table 4 Public and private GDP per capita and Happiness

R^2	α	T-value α	β	T-value β	γ	T-value γ
0,57	4,7	14,3	0,0001	2,99	-0,000013	-0,36

Like table 4 shows, the only coefficient which is significant is the β. This means that Public GDP is of only significant influence on happiness when using a normal linear regression. Therefore the second hypothesis has to be rejected: Public and Private GDP per capita are not positively related to happiness. The model is not significant. However separately they are showing strong positive effects on happiness.

As from now it is clear that the combination of public and private GDP per capita when using the both to explain happiness, the model is not significant. Only public GDP seems to have a significant value. Like table 2 shows the Cobb-Douglas function with using both GDP public and GDP private as substitutes, it is interesting to see if they are related with each other independent as well. Because a Cobb-Douglas function suggests that the two incomes (GDP public and GDP private) are substitutable it is also important to see wheter they are not only substitutable, but mainly complementary, or supplements. Therefore we have to put GDP public as the independent variable and GDP private as the dependent, with keeping a constant at 0. This way it can be checked if they can be used as supplements to estimate an optimal ratio between public and private GDP for an average EU-25 country. This function can be formulated as:

$$(6) \qquad GDP_{pub} = \alpha\, GDP_{Priv} \qquad \rightarrow \qquad ln\, GDP_{pub} = \alpha\, ln\, GDP_{Priv}$$

Underneath in table 5 the explained variance of each of the two forms of testing this relations, respectively linear and logarithmic linear as visible in formula 6 is shown. Also the coefficient α is presented. If both models are significant this coefficient is the most interesting part.

Table 5 GDP public as a function of GDP private

	R2	α
Linear	0.931333	1.0007
Logarithmic linear (Ln)	0.999174	0.994747

Like table 5 shows, the both models have high explained variances, but the logarithmic model explains the best with a very high score of 0,999. This means this is by far the most suitable model and the relation between public and private income can be seen as exponential. Now the coefficient α of this model is 0,9947. Approximately this can be estimated as 1. Therefore the relation between public GDP and private GDP is exactly equally distributed. They both add 50% towards each other. If GDP public increases with one percent, so does private GDP. Therefore the optimum distribution of public and private GDP of the total GDP can therefore be concluded as 50-50. This means the ratio can be stated 1:1. The data used for this analysis are visible in Appendix II the logarithmic data.

4.3 Happiness and Quality of Life

This section shows the results of the six different Quality of Life indicators all related to happiness. Six figures can be observed where happiness is related with the Quality of life indicators. They are shown in forms of scatter plots as well. It is of importance what the exact statistical relationship is and whether they are significantly related and in what way the model (R^2) can be used to predict future outcomes. Because a exponential relationship is expected the function is linearized into logarithmic regression to give a better outcome and elasticities. In the end of this part the hypothesis is going to be either accepted or rejected. This hypothesis was: *Quality of life indicators are positively related to subjective well-being within the European Union member states.*

The main formula used for this logarithmic regression is:

$$(7) \qquad H = \alpha_i X_i^{\beta i} \quad \rightarrow \quad ln\, H = ln\, \alpha_i + ln\, \beta_i\, X_i$$

Where H = Happiness and the X_i = the Quality of Life indicators, respectively from $X_{1\ to}\ X_6$: Human Development Index, Gender Inequality Index, Life Expectancy, Health Expenditures per capita, Environmental Performance Index and the R&D expenditures per capita, α_i a constant and β_i the coefficient of each variable.
At the end of this paragraph, a table will show the exact coefficients and other important statistical information of the analyses where the corresponding scatter plots are preceded. This One table will explain H related to the six indicators and will give all statistical information of the indicators on happiness.

The first plot is figure 14 and shows the logarithmic relation of happiness and the Human Development Index, which is the first Quality of Life indicator.

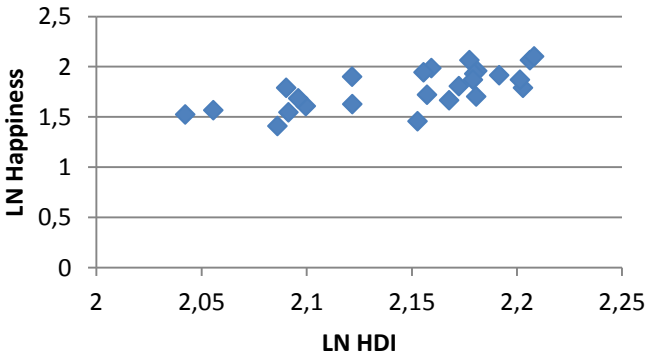


Figure 14 LN Happiness and Human Development Index

As visible a slight increase of happiness when HDI rises is the main outcome of this plot. Although some outliners are visible, some don't show an increasing effect. As a whole though this regression model with its coefficients is emphasized in table 6, just as the following five indicators expressed by scatter plots figures 15 up to and including figure 19. Looking at this table, again the third hypothesis can be accepted, and is proven: Human Development Index and happiness are positively related.

The second indicator is the Gender Equality Index. To what extent does Gender Equality have an increasing effect on happiness in European countries can be seen in figure 15.

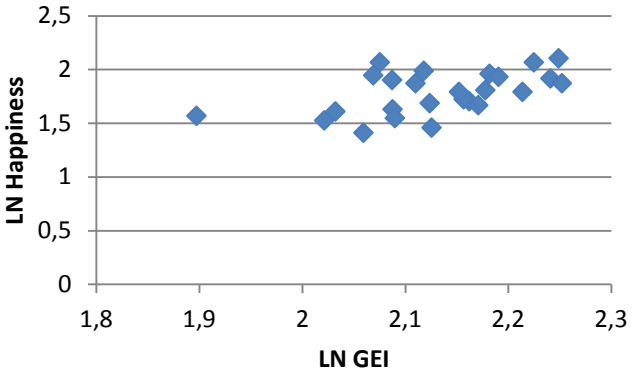


Figure 15 LN Happiness and LN Gender Equality Index

Also when it comes to Gender Equality some countries seem to have higher equality but not higher reported happiness, the majority of countries experience an increasing and positive effect of Gender Equality on their citizens happiness. Hypothesis four was set to see wheter gender equality between countries has a positive effect on happiness. This model is significant and shows like assumed a positive effect. Therefore this hypothesis can be accepted: Gender Equality Index is positively related to happiness.

The third indicator which is going to be tested is life expectancy. Figure 16 shows the scatter plot in which the relation between an increase in age in countries effects the happiness.

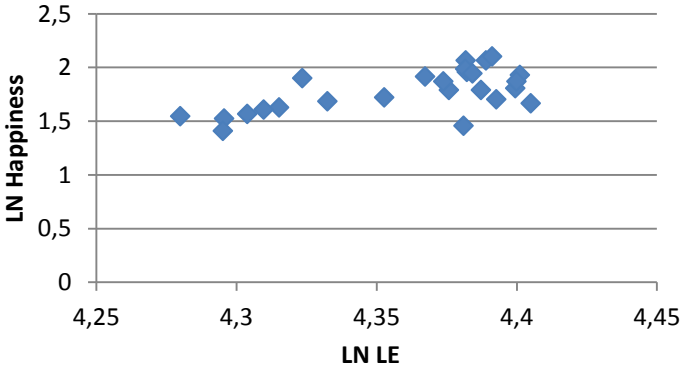


Figure 16 LN Happiness and LN Life Expectancy

At first sight Happiness seems to increase when life expectancy increases, but a closer look learns that this effect is not that strong. The values of the coefficients and the explained variance (R^2)of this analysis can be used to see whether this indicator plays a big role in how happiness can be defined.

The fourth relation is measuring the effect of Health Expenditures on reported Happiness. This gives figure 17, showing the effect between all countries.

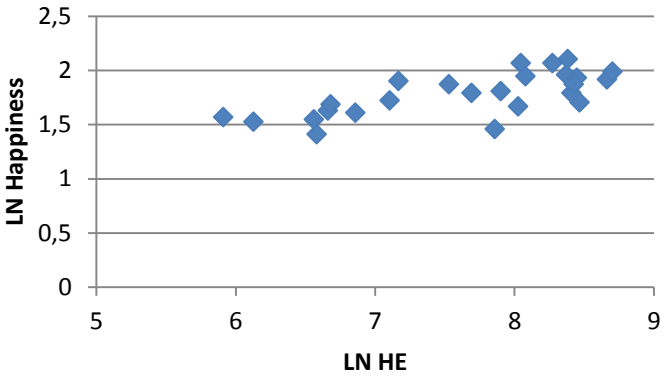


Figure 17 LN Happiness and LN Life Expectancy

Like expected this logarithmic relation is positive because it is clearly visible that an increase of Expenditures on Health provide an increasing feeling of happiness. Approximately for only three or four countries an increase of expenditures don't show an increase of happiness compared with all other countries.

Second last model which is supposed to have a contribution to increasing happiness is the Environmental Performance Index. Like described in the literature this indicator is an independent index covering all kinds of environmental factors. Figure 18 shows this relation with a scatter plot as well.

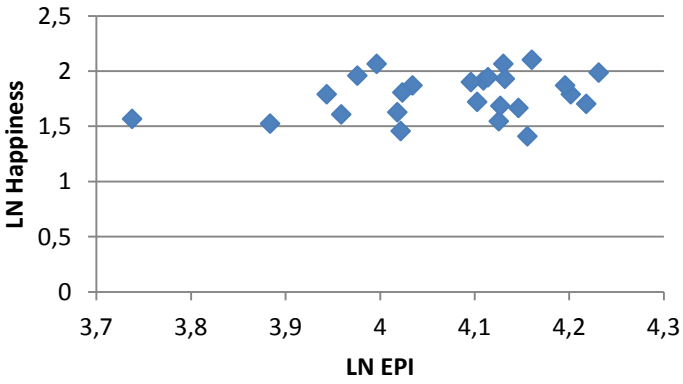


Figure 18 LN Happiness and LN Environmental Performance Index

This Environmental Performance Index does not show a strong relation with happiness in a positive way. The regression line seems to be flat except for a small number of countries an increase of this index contributes to a higher happiness score. It is therefore extra important to see if table 6 shows an acceptable *(R^2).* As for the last analysis the Quality of Life indicator Research and Development is analyzed on its effect towards happiness. Therefore figure 19 was made on the next page.

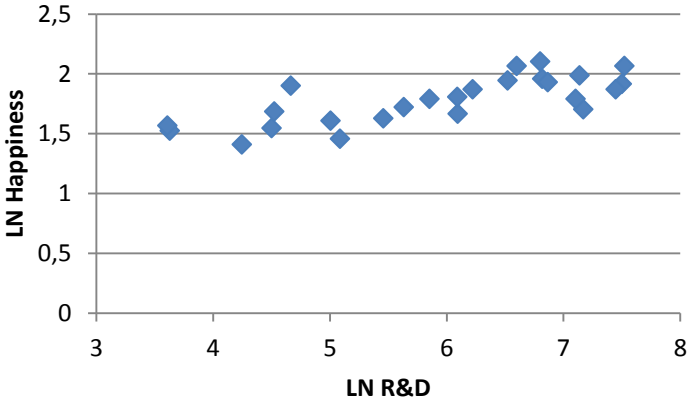


Figure 19 LN Happiness and LN Research and Development

The R&D expenditures in a country might seem to have the strongest effect on happiness between countries, compared with all five previous indicators. Almost all countries with a higher income score a higher happiness value. Table 6 underneath gives all important information on all six logarithmic regressions between Happiness and the Quality of Life indicators.

Table 6 Happiness and the Quality of Life indicators on their logarithmic relationship

	HDI	GEI	LE	HE	EPI	R&D
R^2	0,50	0,28	0,42	0,51	0,09	0,57
Ln α	-4,3	-0,92	-12,1	0,53	-0,3	1,06
T-value α	-3,36	-1,02	-3,52	2,02	-0,2	8,02
B	2,83	1,27	3,19	0,16	0,51	0,12
T-value β	4,75	3,00	4,04	4,85	1,50	5,57
Significance of the model	0,00009	0,006	0,0005	0,00007	0,15	0,00001

HDI = Human Development Index

GEI = Gender Equality Index

LE = Life Expectancy

HE = Health Expenditures

EPI = Environmental Performance Index

R&D = Research & Development Expenditures

A closer look at table 6 above shows all relations of the Quality of Life indicators and Happiness. All these results show positive relations between each of them. First looking at the explained variance (R^2) of six indicators, it is visible that there are some extreme low scores. Apparently these models don't explain well enough what the effect of the indicator on Happiness is. The Environmental Performance Index has a very low score of 0,09. Looking at the significance of this model, the 0,15 means it is not significant. Therefore this indicator can be seen as not significant and has therefore no added value to the bundle of Indicators we are looking for, to explain Happiness. All the other indicators have significance levels which are satisfying so they all can be seen as indicators of happiness. Therefore the last hypothesis has to be rejected: All quality of life indicators are positively related to happiness. As described only five of them are positively related, so the bundle of six indicators as a whole is not positively related.

Now, since all of the indicators individually are tested to be positively related with happiness it is important to see whether all indicators together explain happiness. To find out if they explain happiness, a principle component analysis will be conducted. Like described in chapter three, this analysis is closely related with factor analysis. It basically reduces the indicators to find if there is an underlying factor, or in this case component. All six indicators are being put in this analysis to see in how far, as a bundle together, explain hopefully one component. This, in turn, depends on the explained variance of this bundle. If this is high enough and one component comes out as a result, this component can be labelled as Happiness. Table 7 underneath shows the outcome of this analysis.

Table 7 Principle Component Analysis and the explained variance for all indicators

Component number	Eigenvalue	% Variance	% Cumulative Variance
1	4,755	79,26	79,26
2	0,69	11,47	90,73

As table 6 shows, one component comes out of this test. Not only the explained varience of almost 79,26%, but also the eigenvalue of 4,755 proves that this is one component. In order to form a component, the eigenvalue has to be at least more than one. Component number two shows much lower values, so this is the confirmation that there exists only one underlying component. This is a very satisfying result, because from this point it is possible to built onwards to a model which explains Happiness. However the component in table 7 includes all six indicators. Like explained before, some indicators might not be equally relevant to the component happiness. It is therefore to find out which indicators together explain happiness as the most valid bundle. After three new Principal component analyses table 8 underneath gives the highest explanation and again one component comes out. For all analyses in between see the Appendix IV. This component exists out of three indicators, respectively the Human Development Index, Health expenditures and R&D expenditures.

Table 8 Principle Component Analysis and the explained variance for HDI, HE and R&D

Component number	Eigenvalue	% Variance	% Cumulative Variance
1	2,81	93,79	93,79
2	0,129	4,29	98,09

The three indicators used in the last principle component analysis show a very high explained variance. This means it is possible to explain the component happiness with the three indicators Human Development Index, Health Expenditures and Research and Development expenditures. Again this only gives insight in how far the bundle explains the underlying component happiness. The last step is to see how far each of the three individual indicators contribute to happiness and in what proportion. Therefore the so called component scores of these three indicators on the component happiness have to calculated and their relative weight on happiness. Adding up the relative weight the sum has to be one.

Giving all three indicators their relative weight, these can be multiplied with the scores of every country giving a sum of scores. This basically gives every country a score which exists out of three indicators multiplied with their relative weights. All countries' scores are outcomes of the model explained by formula 6 in the beginning of this chapter, but after reducing to three indicators, the final model with relative weights can be described by formula 8:

(8) $$H = \alpha_i X_i^{\beta i} \quad \rightarrow \quad H = 0{,}33X_{HDI} + 0{,}33X_{HE} + 0{,}34X_{R\&D}$$

Where again H = Happiness and the X_i = the Quality of Life indicators, respectively from X_1 *to* X_3 : Human Development Index, Health Expenditures per capita and the R&D expenditures per capita, where α_i stays a constant and β_i the coefficient of each variable. After the regression scores are correlated with the happiness scores it is to see in how far they relate. The bundle of indicators which has the highest correlation with Happiness (Happiness by Quality of life, HQL), is the model which can be used to predict future outcomes of happiness in countries. Table 9 underneath shows the correlation of the scores from the final model with the existing Happiness scores.

Table 9 Correlation matrix of Happiness and Happiness defined by Quality of Life indicators

	Happiness	Happiness by Quality of Life
Happiness	1	0,678
Happiness by Quality of Life	0,678	1

Now the correlation is proved the model described by formula 8 can be transformed in a final regression formula. Either logarithmic or single linear this formula can be used. Formula 9 gives the linear regression model and formula 10 shows the exact values of the estimated logarithmic regression model.

(9) $$H = \alpha + \beta HQL \rightarrow \quad H = 4{,}881 + 0{,}00102\, HQL$$

With an explained variance (R^2): 0,46

(10) $$ln\, H = \alpha + ln\, HQL \rightarrow \quad ln\, H = 0{,}7068 + ln\ 0{,}159\, HQL$$

With an explained variance (R^2): 0,53

To finish this results chapter all stated hypotheses from section 2.6 will separately be discussed. After a literature research this thesis stated five hypotheses which are expected to be acceptable. After choosing the right method to analyze data which can confirm the hypotheses, this last part is made. This chapter discussed every single analysis including the fact if the stated fitted hypotheses can either be accepted, or rejected. But to finalize is it important to have a finishing overview of all hypotheses and their acceptance or rejection. Not only for the overview, but also because all hypotheses are related in some way. Appendix III gives all the intercorrelations between the six indicators to prove this fact. Starting with the first hypothesis we can state that this can be accepted.

(1) Subjective well-being and income per capita are positively related within the EU

Accepted: as proven in the first analysis happiness and income per capita between the 25 EU countries are positively related. The model is proven significant and the logarithmical linear relationship is can clearly be stated.

(2) Public GDP and private GDP are both together positively related with Happiness

Rejected: the second analysis in this chapter was testing whether public and private GDP per capita together are positively related to happiness. The suited regression model was proven insignificant and therefore this hypothesis has to be rejected. However public GDP and private GDP separately are strongly positive related with happiness. Public GDP is shows the strongest positive relation.

(3) Happiness and Human Development are positively related

Accepted: the Human Development Index and happiness are positively related with each other. The third hypothesis can be accepted because the model is highly significant and gives a positive coefficient. Therefore if the Human Development in a country is higher, so does happiness increase to a higher level.

(4) Happiness and Gender equality are positively related

Accepted: within the field of social welfare this hypothesis was tested. Given the fact that there is more equality between men and women in a country, reported happiness is proven to be higher. Therefore this hypothesis can be accepted. Again a significant model underlines this fact.

(5) Quality of life indicators are positively related to Happiness within the European Union member states

Rejected: not all indicators are related to happiness is the reason for rejection. The EPI is not not significant and shows no or a very weak relation with happiness. However all five other indicators are strongly related. The bundle of six indicators has therefore to be reduced.

5. Conclusion and Discussion

This research started with the problem statement that happiness and money are positively related between countries. The European Union has a way of measuring subjective well-being of citizens in all their member states every few years. They can be compared and show major differences between each other if they are related with the income per head in these countries. An attempt has been made not only to define happiness by Quality of life indicators with literature, but also using all kinds of indices to create a model which can be used to measure happiness in countries of the EU. To start with this two research questions were made, namely: 'To what extent are Happiness, Quality of life and Income interrelated?', and 'To what extent is Happiness explained by private and public goods?'.

To answer and solve these questions five hypotheses were posited. As extensively discussed in the results chapter, not all of them could be accepted. A lot of data were used to try to prove the hypotheses correct. All these data were taken from all kinds of sources to create a higher external validity. After analysing all data three of five hypotheses were proven correct and could be accepted. Two of them had to be rejected, however they added a lot of value in answering the research questions.

Therefore it can be stated that happiness and income are strongly positive related. If a country has a higher income per capita, so does its reported well-being from their citizens. A very interesting fact came out when splitting income per head into a public part which was labelled public expenditures as a percentage of the GDP per capita. With subtracting this public part of the GDP per head another part was left and this was labelled private GDP per capita. They were both tested in relation with happiness, and again the both scored a positive effect. The most notable fact that here, public GDP scored a higher and stronger relationship with happiness then private GDP. When putting these two GDP's separately in a model with happiness, the total model was insignificant. Therefore it can be concluded that they are not substitutable. When focussing on the possibility of being complementary a strong model came out. Happiness depends on a combination of public and private income within a country, giving an optimal ratio of 1:1 in the EU member states. This answers the question that happiness is highly dependent on a combination of public and private goods.

Happiness and Quality of life are strongly positive related with each other as well. Every indicator except the Environmental Performance Index showed a positive effect on well-being. Finally a model was built giving the Human Development Index, Health expenditures and R&D expenditures giving the best answer to measured happiness in countries. With this model it is possible to measure with existing indices being made every year by several organisations what the happiness or well-being level for European countries is to a high extend. The fact that all indicators are related makes it possible to do so.

However it is important to mention the debatable parts and facts of this research. Like every research some limitations have to be faced and the better they are described the better opportunities for future research can be made as well.

Starting with the fact that this thesis focuses on happiness of citizens within 25 different European countries the data which describe this well-being can be seen as rather abstract. These data are average scores of a percentage of people answering to be happy all the time or most of the time during the past four weeks. This is however done with a representative sample of every states society. It gives an indication of the wellbeing in these countries reported by their citizens, but not every citizen is measured this way. Imaginable there is no other way of measuring all wellbeing of everyone individually this dataset is used, realizing it is the most suitable for this research.

Another important fact emerged namely that all Quality of Life indicators used in this research are intercorrelated. This might explain the fact that it is hard to add up every indicator and implying they are completely independent. Appendix III at the end of this thesis shows the matrix in which all indicators are measured on their internal correlation.

To come back to the abstraction level of this research a reason and limitation can be mentioned including every used dataset. This is always the case when using secondary data. All data used are not measured in this exact period by the researcher himself, but are taken from secondary data sources, which are picked on their highly expected reliability.

To finalize this discussion part it is interesting to see what conclusions are drawn from this research and which new future research opportunities this gives. Happiness can be measured with using secondary data which makes it very much easier and cheaper for governments to get an indication of what factors they can invest in. This policy purpose is getting more important for future decisions and the model built in this thesis has an add value in that field. However it is not completely covering happiness. There is a big challenge to find more indicators in society which are already measured in some way, and increase the level of explanation of happiness. Another research opportunity can be to compare all countries on their scores and see whether they overinvest or under invest on some indicators and how to adapt their policy in order to create a happier society. The last research recommendation would be to expand this whole happiness research to other parts of the world, for example developing countries. So they can get insight in where to invest and in what ratio to create not only a higher welfare but also well-being in their societies.

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Appendix I All original data from sources

The first appendix shows all the countries in order of alphabet in the first column. Every column represents a used indicator in this thesis. Every used number in this thesis can be found in this table, in the original form. The labels on the first row explain which the indicator is represented in the accompanying column .

EU country	Income	%GDP	GDP	GDP	Happiness	Human Development Index	Gender Equality index	Life	Health expenditures	Environmental Performance Index	R&D per capita
	per capita	Public	public	private				Expectancy	per capita ($)		**in $**
Austria	47060	0.53	24,941.80	22118.20	0.55	0.885	0.869	80.9	4753.06	67.9	1299
Belgium	45910	0.531	24,378.21	21531.79	0.71	0.886	0.886	80.0	4315.54	53.3	913.6
Bulgaria	6270	0.377	2,363.79	3906.21	0.46	0.771	0.755	73.4	457.71	48.6	37.62
Czech Republic	17890	0.452	8,086.28	9803.72	0.56	0.865	0.864	77.7	1216.52	60.5	279.1
Denmark	59050	0.582	34,367.10	24682.90	0.68	0.895	0.940	78.8	5786.9	60.9	1807
Estonia	14460	0.4	5,784.00	8676.00	0.51	0.835	0.806	74.8	780.84	55.6	234.3
Finland	47720	0.551	26,293.72	21426.28	0.79	0.882	0.925	80.0	3913.04	62.2	1847
France	42390	0.562	23,823.18	18566.82	0.69	0.884	0.894	81.5	4662.9	62.3	958
Germany	43110	0.466	20,089.26	23020.74	0.6	0.905	0.915	80.4	4483.44	66.8	1216
Greece	26940	0.495	13,335.30	13604.70	0.43	0.861	0.838	79.9	2586.24	55.8	161.6
Hungary	12850	0.489	6,283.65	6566.35	0.5	0.816	0.763	74.4	950.9	52.4	149.1
Ireland	41000	0.67	27,470.00	13530.00	0.79	0.908	0.797	80.6	3116	54.4	733.9
Italy	35150	0.503	17,680.45	17469.55	0.53	0.874	0.876	81.9	3058.05	63.2	442.9
Latvia	11620	0.429	4,984.98	6635.02	0.41	0.805	0.784	73.3	720.44	63.8	69.72
Lithuania	11390	0.413	4,704.07	6685.93	0.47	0.810	0.808	72.2	706.18	61.9	89.98
Luxembourg	77160	0.412	31,789.92	45370.08	0.73	0.867	0.831	80.0	0	68.8	1258
Netherlands	49050	0.512	25,113.60	23936.40	0.82	0.910	0.948	80.7	4365.45	64.1	897.6
Poland	12440	0.457	5,685.08	6754.92	0.54	0.813	0.836	76.1	796.16	62	92.06
Portugal	21880	0.507	11,093.16	10786.84	0.6	0.809	0.860	79.5	2188	51.6	347.9
Romania	7840	0.408	3,198.72	4641.28	0.48	0.781	0.667	74.0	368.48	42	36.85
Slovak Republic	16830	0.41	6,900.30	9929.70	0.67	0.834	0.806	75.4	1295.91	60.1	106
Slovenia	23860	0.49	11,691.40	12168.60	0.65	0.884	0.825	79.3	1861.08	56.5	503.4
Spain	31750	0.45	14,287.50	17462.50	0.61	0.878	0.883	81.4	2698.75	55.9	441.3
Sweden	50110	0.53	26,558.30	23551.70	0.65	0.904	0.951	81.4	4560.01	66.4	1714
United Kingdom	38370	0.509	19,530.33	18839.67	0.7	0.863	0.791	80.2	3223.08	61.2	679.1

Appendix II All data in Logarithmic form

This appendix shows all the data which are used in this thesis in a logarithmic form. Appendix I on the previous page shows the original data from their source, this table gives an overview of all these data transformed in to logarithmic data. These are used for all regression analysis in this thesis. All countries are represented in order of alphabet in the first column. The columns after are total GDP and then public GDP, private GDP. Happiness scores and all other six indices are abbreviated. Their full label can be seen in Appendix I, of the legend of Appendix III.

	LN total GDP	LN public	LN private	LN Happiness	LN HDI	LN GEI	LN LE	LN HE	LN EPI	LN R&D
Austria	10,75917866	10,12430039	10,00415608	1,704748092	2,18061778	2,161989369	4,392645059	8,4665439	4,218036035	7,169239
Belgium	10,73443824	10,10144498	9,977285727	1,960094784	2,181126689	2,181691477	4,382139128	8,369977741	3,975936331	6,817403
Bulgaria	8,743531634	7,768021542	8,270322873	1,526056303	2,042208006	2,021177609	4,295528762	6,126235796	3,883623531	3,627536
Czech Republic	9,791997177	8,997924077	9,190517184	1,722766598	2,157214723	2,156533821	4,352662189	7,103749603	4,102643365	5,631513
Denmark	10,98613982	10,44485499	10,11386598	1,916922612	2,191553989	2,240810412	4,367242892	8,663352021	4,109233175	7,499385
Estonia	9,579141496	8,662850764	9,068315872	1,62924054	2,121680479	2,087494596	4,315152054	6,660370263	4,018183201	5,456397
Finland	10,77310588	10,17708541	9,972373485	2,066862759	2,177397511	2,224693467	4,381739093	8,272069844	4,130355	7,52119
France	10,65466776	10,07841434	9,829131396	1,931521412	2,179695127	2,190403326	4,401081433	8,447392851	4,131961426	6,864862
Germany	10,67151027	9,907940623	10,04415083	1,791759469	2,202864776	2,213717256	4,38718829	8,408145888	4,201703081	7,103077
Greece	10,20136745	9,498169934	9,5181706	1,458615023	2,152711029	2,125392101	4,38096357	7,857960362	4,021773869	5,085372
Hungary	9,46109909	8,745706301	8,789713402	1,609437912	2,099568896	2,031994136	4,309644096	6,857408905	3,958906591	5,004349
Ireland	10,62132735	10,22084978	9,512664721	2,066862759	2,206173178	2,075133913	4,388965008	8,044305407	3,996364154	6,598373
Italy	10,4673799	9,780214788	9,768214644	1,667706821	2,16773485	2,170740007	4,404949389	8,025532737	4,146304301	6,093321
Latvia	9,36048303	8,51418467	8,800116961	1,410986974	2,086056454	2,059240391	4,295092527	6,579862136	4,15575319	4,244487
Lithuania	9,340491056	8,45618337	8,807760597	1,547562509	2,09129619	2,089744556	4,279869317	6,559870163	4,12552018	4,499599
Luxembourg	11,25363647	10,36690454	10,72260814	1,987874348	2,159296408	2,117837714	4,381564028	8,702590015	4,231203745	7,137046
Netherlands	10,80059546	10,13116481	10,08315559	2,104134154	2,208178448	2,248746132	4,3911598	8,381476556	4,160444364	6,799741
Poland	9,428672366	8,645600478	8,818026407	1,686398954	2,095955848	2,123594986	4,332389862	6,679800171	4,127134385	4,522397
Portugal	9,993328257	9,314083981	9,286082152	1,791759469	2,090229436	2,15197702	4,375744443	7,690743164	3,943521672	5,851892
Romania	8,966994113	8,070506009	8,442745469	1,568615918	2,055564567	1,897075163	4,303781269	5,909386436	3,737669618	3,606801
Slovak Republic	9,730918287	8,839320168	9,203285545	1,902107526	2,121589931	2,087070498	4,323417169	7,16696843	4,096009842	4,663713
Slovenia	10,0799587	9,366608808	9,406614142	1,871802177	2,179070976	2,109802306	4,373755019	7,528912243	4,034240638	6,221476
Spain	10,365648	9,567140308	9,767811004	1,808288771	2,172368268	2,177590396	4,399424412	7,900543982	4,02356438	6,089782
Sweden	10,82197587	10,1870976	10,06695328	1,871802177	2,201426594	2,251992904	4,399854274	8,425080095	4,195697056	7,446446
United Kingdom	10,55503118	9,879723921	9,843720032	1,945910149	2,155567876	2,06873144	4,38414938	8,078092703	4,11414719	6,520841

Appendix III Intercorrelation matrix

This appendix shows the intercorrelation matrix of all the six Quality of Life indicators. Like explained in this thesis they are all correlated with each other, varying from medium correlations to heavy correlations. In this table the coefficients are clearly visible. Underneath the table a legend will give the names of all indicators, which are abbreviated in the table.

	HDI	GEI	LE	HE	EPI	R&D
HDI	1	0,765	0,847	0,883	0,564	0,896
GEI	0,765	1	0,699	0,783	0,664	0,788
LE	0,847	0,699	1	0,898	0,406	0,837
HE	0,883	0,783	0,898	1	0,584	0,942
EPI	0,564	0,664	0,406	0,584	1	0,573
R&D	0,896	0,788	0,837	0,942	0,573	1

HDI = Human Development Index

GEI = Gender Equality Index

LE = Life Expectancy

HE = Health Expenditures

EPI = Environmental Performance Index

R&D = Research & Development Expenditures

Appendix IV Principle Component Analysis

In this last appendix the steps in reducing the created Happiness formula in terms of Quality of Life indicators is shown. First it started with including all six indicators in the analysis. This give a medium satisfied explained variance, so after reducing into less indicators it finally ended with three. These three indicators are already discussed in the results chapter and conclusion, but include the Human Development Index, Health expenditures and Research and Development expenditures. The way of reducing was to see first with all six indicators which one had a very low contribution to the component. This indicator was excluded and the next step the same was done with five indicators. Finally an overview of all these data reduction steps including the relative weights of them are shown underneath. It starts with all six indicators and goes down to finish with three indicators. All these steps will be explained with the tables. On the following pages. Important to mention is the fact that in every column after an indicator its relative weight has been put. This obviously changes every time an indicator gets deleted from the bundle.

EU country		HDI		GEI		Life		HE in $		EPI		R&D in $		Xi indicator	Happiness
				index		Expectancy								composed	
Austria		8,85177302	0,18	8,688404924	0,17	80,854	0,17	4753,06	0,18	67,9	0,13	1298,856	0,18	1114,987408	5,5
Belgium		8,85627891	0,18	8,861282242	0,17	80,009	0,17	4315,54	0,18	53,3	0,13	913,609	0,18	964,8778982	7,1
Bulgaria		7,707608869	0,18	7,54720736	0,17	73,371	0,17	457,71	0,18	48,6	0,13	37,62	0,18	110,6208648	4,6
Czech Republic		8,647019739	0,18	8,641133972	0,17	77,685	0,17	1216,52	0,18	60,5	0,13	279,084	0,18	293,3056263	5,6
Denmark		8,949109129	0,18	9,400946839	0,17	78,826	0,17	5786,9	0,18	60,9	0,13	1806,93	0,18	1391,415821	6,8
Estonia		8,345149562	0,18	8,06468454	0,17	74,825	0,17	780,84	0,18	55,6	0,13	234,252	0,18	205,5379333	5,1
Finland		8,823313777	0,18	9,25064674	0,17	79,977	0,17	3913,04	0,18	62,2	0,13	1846,764	0,18	1061,607616	7,9
France		8,84360967	0,18	8,938817649	0,17	81,539	0,17	4662,9	0,18	62,3	0,13	958,014	0,18	1036,836599	6,9
Germany		9,050905214	0,18	9,149664901	0,17	80,414	0,17	4483,44	0,18	66,8	0,13	1215,702	0,18	1051,384546	6
Greece		8,608163773	0,18	8,376181151	0,17	79,915	0,17	2586,24	0,18	55,8	0,13	161,64	0,18	518,4313703	4,3
Hungary		8,162650199	0,18	7,629285031	0,17	74,414	0,17	950,9	0,18	52,4	0,13	149,06	0,18	220,2214355	5
Ireland		9,080898831	0,18	7,965613087	0,17	80,557	0,17	3116	0,18	54,4	0,13	733,9	0,18	716,737406	7,9
Italy		8,738467661	0,18	8,764767633	0,17	81,855	0,17	3058,05	0,18	63,2	0,13	442,89	0,18	655,3634847	5,3
Latvia		8,053094714	0,18	7,840012202	0,17	73,339	0,17	720,44	0,18	63,8	0,13	69,72	0,18	165,7727891	4,1
Lithuania		8,095401545	0,18	8,082850184	0,17	72,231	0,17	706,18	0,18	61,9	0,13	89,981	0,18	166,4665068	4,7
Luxembourg		8,665038865	0,18	8,313142647	0,17	79,963	0,17	6018,48	0,18	68,8	0,13	1257,708	0,18	1335,224491	7,3
Netherlands		9,099126757	0,18	9,47584692	0,17	80,734	0,17	4365,45	0,18	64,1	0,13	897,615	0,18	972,6582168	8,2
Poland		8,133211371	0,18	8,36114171	0,17	76,126	0,17	796,16	0,18	62	0,13	92,056	0,18	183,7656721	5,4
Portugal		8,086770344	0,18	8,60184762	0,17	79,499	0,17	2188	0,18	51,6	0,13	347,892	0,18	479,6013228	6
Romania		7,811246599	0,18	6,666367858	0,17	73,979	0,17	368,48	0,18	42	0,13	36,848	0,18	93,53477692	4,8
Slovak Republic		8,344393954	0,18	8,061265049	0,17	75,446	0,17	1295,91	0,18	60,1	0,13	106,029	0,18	275,860246	6,7
Slovenia		8,838091644	0,18	8,246610817	0,17	79,341	0,17	1861,08	0,18	56,5	0,13	503,446	0,18	449,4404303	6,5
Spain		8,779050583	0,18	8,825015828	0,17	81,404	0,17	2698,75	0,18	55,9	0,13	441,325	0,18	589,3996618	6,1
Sweden		9,03789772	0,18	9,506662841	0,17	81,439	0,17	4560,01	0,18	66,4	0,13	1713,762	0,18	1154,998544	6,5
United Kingdom		8,632791146	0,18	7,914776375	0,17	80,17	0,17	3223,08	0,18	61,2	0,13	679,149	0,18	726,8855344	7

The column on the right shows the correlation between the composed indicator including all six Q.O.L. indicators and their relative weights with happiness

	Kolom 1	*Kolom 2*
Kolom 1	1	
Kolom 2	0,677795	1

EU country	HDI		Gender Equality		Life		HE in $		R&D in $		Xi indicator	Happiness
			Index		Expectancy						composed	
Austria	8,85177302	0,203	8,688405	0,185	80,854	0,198	4753,06	0,208	1298,856	0,206	1275,614173	5,5
Belgium	8,85627891	0,203	8,861282	0,185	80,009	0,198	4315,54	0,208	913,609	0,206	1105,114718	7,1
Bulgaria	7,707608869	0,203	7,547207	0,185	73,371	0,198	457,71	0,208	37,62	0,206	120,441736	4,6
Czech Republic	8,647019739	0,203	8,641134	0,185	77,685	0,198	1216,52	0,208	279,084	0,206	329,2630488	5,6
Denmark	8,949109129	0,203	9,400947	0,185	78,826	0,198	5786,9	0,208	1806,93	0,206	1595,066172	6,8
Estonia	8,345149562	0,203	8,064685	0,185	74,825	0,198	780,84	0,208	234,252	0,206	228,672014	5,1
Finland	8,823313777	0,203	9,250647	0,185	79,977	0,198	3913,04	0,208	1846,764	0,206	1213,683652	7,9
France	8,84360967	0,203	8,938818	0,185	81,539	0,198	4662,9	0,208	958,014	0,206	1186,82774	6,9
Germany	9,050905214	0,203	9,149665	0,185	80,414	0,198	4483,44	0,208	1215,702	0,206	1202,442126	6
Greece	8,608163773	0,203	8,376181	0,185	79,915	0,198	2586,24	0,208	161,64	0,206	590,3559808	4,3
Hungary	8,162650199	0,203	7,629285	0,185	74,414	0,198	950,9	0,208	149,06	0,206	246,2959677	5
Ireland	9,080898831	0,203	7,965613	0,185	80,557	0,198	3116	0,208	733,9	0,206	818,5787469	7,9
Italy	8,738467661	0,203	8,764768	0,185	81,855	0,198	3058,05	0,208	442,89	0,206	746,9124209	5,3
Latvia	8,053094714	0,203	7,840012	0,185	73,339	0,198	720,44	0,208	69,72	0,206	181,8201425	4,1
Lithuania	8,095401545	0,203	8,08285	0,185	72,231	0,198	706,18	0,208	89,981	0,206	182,8619578	4,7
Luxembourg	8,665038865	0,203	8,313143	0,185	79,963	0,198	6018,48	0,208	1257,708	0,206	1530,061296	7,3
Netherlands	9,099126757	0,203	9,475847	0,185	80,734	0,198	4365,45	0,208	897,615	0,206	1112,507776	8,2
Poland	8,133211371	0,203	8,361142	0,185	76,126	0,198	796,16	0,208	92,056	0,206	202,8356171	5,4
Portugal	8,086770344	0,203	8,601848	0,185	79,499	0,198	2188	0,208	347,892	0,206	545,7435102	6
Romania	7,811246599	0,203	6,666368	0,185	73,979	0,198	368,48	0,208	36,848	0,206	101,7013311	4,8
Slovak Republic	8,344393954	0,203	8,061265	0,185	75,446	0,198	1295,91	0,208	106,029	0,206	309,514808	6,7
Slovenia	8,838091644	0,203	8,246611	0,185	79,341	0,198	1861,08	0,208	503,446	0,206	509,8437896	6,5
Spain	8,779050583	0,203	8,825016	0,185	81,404	0,198	2698,75	0,208	441,325	0,206	671,7857172	6,1
Sweden	9,03789772	0,203	9,506663	0,185	81,439	0,198	4560,01	0,208	1713,762	0,206	1321,2354	6,5
United Kingdom	8,632791146	0,203	7,914776	0,185	80,17	0,198	3223,08	0,208	679,149	0,206	829,3956842	7

The column on the right shows the correlation between the composed indicator including five Q.O.L. indicators and their relative weights with happiness

	Kolom 1	*Kolom 2*
Kolom 1	1	
Kolom 2	0,677953	1

EU country	HDI		Life		HE in $		R&D in $			Xi indicator	Happiness
			Expectancy							composed	
Austria	8,851773	0,248	80,854	0,245	4753,06	0,255	1298,856	0,252		1561,346482	5,5
Belgium	8,856279	0,248	80,009	0,245	4315,54	0,255	913,609	0,252		1352,49073	7,1
Bulgaria	7,707609	0,248	73,371	0,245	457,71	0,255	37,62	0,252		146,083672	4,6
Czech Republic	8,64702	0,248	77,685	0,245	1216,52	0,255	279,084	0,252		401,7190539	5,6
Denmark	8,949109	0,248	78,826	0,245	5786,9	0,255	1806,93	0,252		1952,537609	6,8
Estonia	8,34515	0,248	74,825	0,245	780,84	0,255	234,252	0,252		278,5474261	5,1
Finland	8,823314	0,248	79,977	0,245	3913,04	0,255	1846,764	0,252		1484,992275	7,9
France	8,84361	0,248	81,539	0,245	4662,9	0,255	958,014	0,252		1452,629298	6,9
Germany	9,050905	0,248	80,414	0,245	4483,44	0,255	1215,702	0,252		1471,580158	6
Greece	8,608164	0,248	79,915	0,245	2586,24	0,255	161,64	0,252		721,9384796	4,3
Hungary	8,16265	0,248	74,414	0,245	950,9	0,255	149,06	0,252		300,2983872	5
Ireland	9,080899	0,248	80,557	0,245	3116	0,255	733,9	0,252		1001,511328	7,9
Italy	8,738468	0,248	81,855	0,245	3058,05	0,255	442,89	0,252		913,632645	5,3
Latvia	8,053095	0,248	73,339	0,245	720,44	0,255	69,72	0,252		221,2468625	4,1
Lithuania	8,095402	0,248	72,231	0,245	706,18	0,255	89,981	0,252		222,4553666	4,7
Luxembourg	8,665039	0,248	79,963	0,245	6018,48	0,255	1257,708	0,252		1873,394681	7,3
Netherlands	9,099127	0,248	80,734	0,245	4365,45	0,255	897,615	0,252		1361,425143	8,2
Poland	8,133211	0,248	76,126	0,245	796,16	0,255	92,056	0,252		246,8868184	5,4
Portugal	8,08677	0,248	79,499	0,245	2188	0,255	347,892	0,252		667,091558	6
Romania	7,811247	0,248	73,979	0,245	368,48	0,255	36,848	0,252		123,3101402	4,8
Slovak Republic	8,344394	0,248	75,446	0,245	1295,91	0,255	106,029	0,252		377,7300377	6,7
Slovenia	8,838092	0,248	79,341	0,245	1861,08	0,255	503,446	0,252		623,0741837	6,5
Spain	8,779051	0,248	81,404	0,245	2698,75	0,255	441,325	0,252		821,5163345	6,1
Sweden	9,037898	0,248	81,439	0,245	4560,01	0,255	1713,762	0,252		1616,864528	6,5
United Kingdom	8,632791	0,248	80,17	0,245	3223,08	0,255	679,149	0,252		1014,81353	7

The column on the right shows the correlation between the composed indicator including four Q.O.L. indicators and their relative weights with happiness

	Kolom 1	*Kolom 2*
Kolom 1	1	
Kolom 2	0,677937	1

EU country	HDI		HE in $		R&D in $		Xi indicator	Happiness
							Composed	
Austria	8,85177302	0,328974535	4753,06	0,334824501	1298,856	0,336200964	2031,029589	5,5
Belgium	8,85627891	0,328974535	4315,54	0,334824501	913,609	0,336200964	1755,018244	7,1
Bulgaria	7,707608869	0,328974535	457,71	0,334824501	37,62	0,336200964	168,4360097	4,6
Czech Republic	8,647019739	0,328974535	1216,52	0,334824501	279,084	0,336200964	503,993661	5,6
Denmark	8,949109129	0,328974535	5786,9	0,334824501	1806,93	0,336200964	2548,031541	6,8
Estonia	8,345149562	0,328974535	780,84	0,334824501	234,252	0,336200964	342,9454532	5,1
Finland	8,823313777	0,328974535	3913,04	0,334824501	1846,764	0,336200964	1933,968147	7,9
France	8,84360967	0,328974535	4662,9	0,334824501	958,014	0,336200964	1886,247718	6,9
Germany	9,050905214	0,328974535	4483,44	0,334824501	1215,702	0,336200964	1912,863262	6
Greece	8,608163773	0,328974535	2586,24	0,334824501	161,64	0,336200964	923,111908	4,3
Hungary	8,162650199	0,328974535	950,9	0,334824501	149,06	0,336200964	371,1840377	5
Ireland	9,080898831	0,328974535	3116	0,334824501	733,9	0,336200964	1293,038417	7,9
Italy	8,738467661	0,328974535	3058,05	0,334824501	442,89	0,336200964	1175,684843	5,3
Latvia	8,053094714	0,328974535	720,44	0,334824501	69,72	0,336200964	267,3101578	4,1
Lithuania	8,095401545	0,328974535	706,18	0,334824501	89,981	0,336200964	269,361246	4,7
Luxembourg	8,665038865	0,328974535	6018,48	0,334824501	1257,708	0,336200964	2440,827782	7,3
Netherlands	9,099126757	0,328974535	4365,45	0,334824501	897,615	0,336200964	1766,432027	8,2
Poland	8,133211371	0,328974535	796,16	0,334824501	92,056	0,336200964	300,1988101	5,4
Portugal	8,086770344	0,328974535	2188	0,334824501	347,892	0,336200964	852,2179754	6
Romania	7,811246599	0,328974535	368,48	0,334824501	36,848	0,336200964	138,3341665	4,8
Slovak Republic	8,344393954	0,328974535	1295,91	0,334824501	106,029	0,336200964	472,2945642	6,7
Slovenia	8,838091644	0,328974535	1861,08	0,334824501	503,446	0,336200964	795,3017198	6,5
Spain	8,779050583	0,328974535	2698,75	0,334824501	441,325	0,336200964	1054,869596	6,1
Sweden	9,03789772	0,328974535	4560,01	0,334824501	1713,762	0,336200964	2105,944747	6,5
United Kingdom	8,632791146	0,328974535	3223,08	0,334824501	679,149	0,336200964	1310,336669	7

The column on the right shows the correlation between the composed indicator including three Q.O.L. indicators and their relative weights with happiness. This was the last step towards a composed indicator with only three Quality of Life Indicators.

	Kolom 1	*Kolom 2*
Kolom 1	1	
Kolom 2	0,677892	1