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Income and happiness

Economics of Consumers and households
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Preface

In front of you is lying what supposed to be a four month project. In reality and cynically expressed, it took me some more time to develop and publish this bachelor thesis. Reality is often continuously projected on us, but fortunately reality can sometimes be a joke. Nevertheless the joke is not always easy to see or understand for everyone, but as I like to say: good work takes some time. Time can be expressed in monetary value, but as I am a regular student my opportunity costs should be relatively low, therefore I decided to take my time and learn how writing processes are completely different from verbal processes.

Fortunately I found a topic which interested me as long as I can remember: happiness. Of course it's not as simple as that and as I am developing myself as an economist I soon wanted to find out about a possible relationship between happiness and my second favorite topic: money. Shortly summarized I asked myself the question: 'Does money make people happy?'

The process of writing this thesis took me some efforts, but gave me a satisfying result. The main result is a thesis with an article enclosed. Analyses of literature and data where responsible for the conclusion which was interesting for me. This finished the project and gave me a satisfied feeling. An appendix is attached with the most relevant data used in all the analyses within the article.

To guide me, lead me in the right direction, but more important to help me making this thesis a success I found the best possible two gentlemen in my area to supervise me. I would therefore like to express my sincere gratitude to my leading supervisors Wim Heijman and Johan van Ophem. Without their advice and unique support this thesis would never had become a reality.

Finally, I wish to express my greatest thanks to my parents, friends and colleagues, who have supported me through the process.

Leo van der Stappen, September 2011

Abstract

This report analyses the relationship between real income per capita and happiness based on literature research and own empirical secondary data research. Firstly an introduction overview has been given to show the financial world situation changed due to a crisis and this caused a decrease in world value development. After, the main focus is happiness, defined in various variables and these are being related towards income per head on a national level from cross-sectional data. There is concluded that real GDP per head is positively related to happiness. People in richer countries are happier than people in poorer countries. Nevertheless there is a level off effect, so the more income rises the less extra happiness is being measured. For the European Union members, income distribution expressed in the Gini-coefficient has no influence on either happiness nor income per capita. GDP per capita and bundles of either private or public goods, are related to happiness, appear to be posively related to each other as well. These goods are Human Development Index (HDI), Environmental Performance Index (EPI), Gender Related Development Index (GDRI), Health expenditures (HE), Life Expectancy (LE), and Research and Development (RD). Finally a component analysis shows the representativeness of the decomposed formula of happiness.

Keywords: happiness, income per capita, gini-coefficient

1. Introduction

At this moment the EU is involved in the aftermath of the so called financial world crisis. This crisis arise due to lots of different processes which took place in mainly the United States of America, and has been considered by a lot of economists to be the worst financial crisis since the 'Great Depression' in the 30's. This current crisis affected the whole world. It had and still has impact and consequences for societies. In 2008 the real crisis began while worldwide economy slowed down and companies suffered large losses during the end of 2008 and in 2009. There are some important parameters which describe the macro economic situation in a country, but the Gross Domestic Product is perhaps the most common used.

Now, looking at the economic situation in the past and in this century we can see that there is a main central topic which is called: 'globalization'. Since the break-up of the former Soviet Union, borders are open to the east which causes a lot of opportunities for trading because of an increase in demand and supply, more trust in the capitalistic system and market economy. The world is globalizing due to more facts of course. To describe all the factors which are causing this globalization would be impossible, but if we look more generally we can say that this is happening because of growing political equality and policy between world states, technological developments and innovations which make it possible to communicate all over the world in an easy, fast and cheap way, growing welfare and higher living standards. (About Economics, 2011)

Since this project faces the relationship between income and happiness, the impact of the current financial world crisis is relevant because of changes in household income. This is not a special relationship being measured as a central topic, but it is in the research interest to see any impact.

In this research, the process of globalization and therefore the distributed impact on global economy, raises the question what influence does this entire have on the people's happiness. Generally happiness is considered to be the highest goal in life. It is defined in various ways. It can be the way people evaluate their life situation in general (Veenhoven, 1997), but also it can be considered as the affective aspect of subjective well-being. Therefore, the most commonly used method in economic research is measuring happiness.

Looking at the relationship between happiness, as subjective well-being, and income in a more global view, the Easterlin paradox can be observed. This paradox basically describes the fact that people with a higher income are more likely to be happy then in people with a lower income. But there seems to be no happiness differences between higher income countries and lower income countries, of course if there is enough income to meet the basic needs (Easerlin, 2001). Easterlin 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.

This research will focus on six goods which are expected to be positively related to income. These six goods consist of: the Human Development Index (HDI), Environmental Performance Index (EPI), Gender Related Development Index (GDRI), Health expenditures (HE), Life Expectancy (LE) and Research and Development (RD). These six goods are assumed to combine and describe happiness. Nevertheless these variables are not directly related to happiness.

Therefore, a special focus will be put on the 27 EU countries, by comparing their GDP per capita with the measured happiness in these countries, including income distribution, expressed in the well-known Gini-coefficient. This will be done to prove the positive relationship between income and happiness. After, the chosen indicators which compose happiness as the main outcome in this research, will be explained, and separately tested on their relationship towards income per capita.

Our first hypothesis is that happiness in not directly dependent on each of these six variables, but with income first. And as written just before, income and happiness are assumed and tested to be positively related in the first place. After the term happiness is going to be decomposed into the six variables as described before. They are assumed to be positively related to income. This is hypothesis two and will be tested in section 3.

So, as it should be clear by now, income as a main input topic is an important indicator to happiness. This central hypothesis is being tested in this research. But of course, happiness needs to be decomposed as described before. This will be done in the following chapters.

2. Happiness and per capita income at a national scale

Now it is interesting to come to a new section which is actually the main purpose of this research, namely the influence of money on happiness on a national level. In this part we will take a look at the hypothesis that happiness is related to income in a positive way. To do this, data need to be obtained and therefore the EU Commission has been consulted. They have a special Euro barometer which is called 'Mental Well-being'. In this project, people from the EU 27 countries, are being asked: Have you felt happy during the past four weeks? In the Netherlands for example 82% of the respondents answered 'all the time' or 'most of the time'. The lowest score was the country of Latvia. Here just 41% of the respondents answered with 'all the time' or 'most of the time'. Now we take the percentages of respondents answering these two options and compare them with the income per capita of the measured countries. This makes it possible to test the hypothesis that there is a positive relationship between happiness *(H)* and income as GDP per capita (*Y*). After the scatter diagram a table is shown in which the statistical values are shown. Therefore the regression equation is used to test the relation. This results in hypothesis 1 and can be equated as:

(1) $$H = \alpha Y + \beta$$

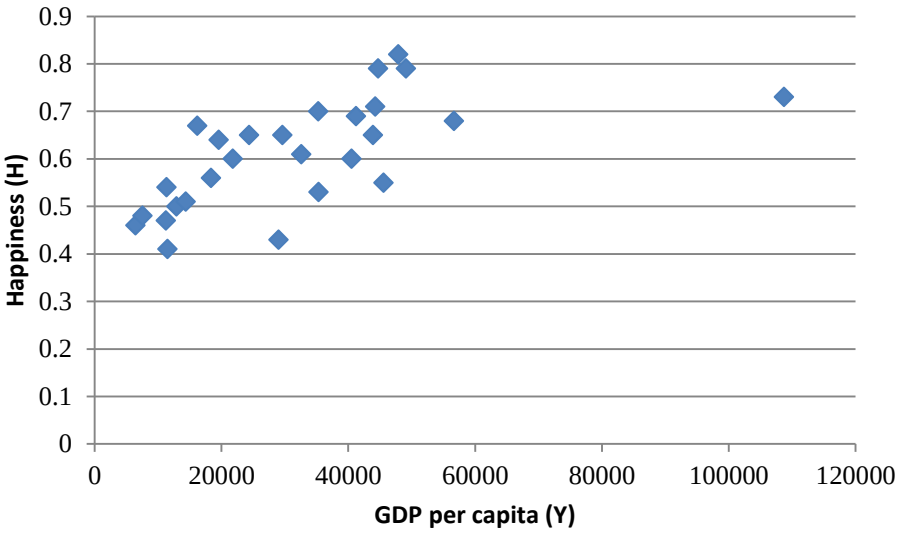

Figure 1. *Scatter diagram of the relation between income per capita in USD($) and happiness for the 27 EU member countries (EU commission, 2010).Netherlands scoring1, Latvia scoring 27.*

Table 1. *Happiness as a function of income per capita in a linear estimation.*

α	t-value α	β	t-value β	R^2	F-value
0.00000339	4.1573	0.500	16.083	0.409	17.284**

** significant against α <0.00

As clearly visible in Figure 1, we can see a positive relationship. The results are satisfactory and significant. In Table 1 the values are shown after analyzing the relation, thus regression. It is a significant linear relation.

The result of this analysis is satisfactory and the first hypothesis can be accepted. Nevertheless, some extra attention can be put on the so called leveling off-function. Because happiness in the measured scale, cannot exceed 100, it is interesting to see if the function happiness as dependent variable on income, 'levels off' from a certain point. In the scatter diagram it is already slightly visible that the most right score can cause a leveling off-function. Therefore the following equation 2 is tested as a derived natural logarithmic function of the exponential function, explaining the level off :

(2) $$H = \gamma Y^{\delta} \rightarrow \ln H = \ln \gamma + \delta \ln Y$$

Table 2. *Happiness as a function of income per capita as level off-function.*

$ln\,\gamma$	t-value $ln\,\gamma$	δ	t-value δ	R^2	F-value
-2.569	-6.544	0.202	5.245	0.524	27.505**

** significant against α <0.00

Assuming the leveling off effect, Table 2 proves the fact that the relationship between income growth and happiness has this effect. It is significant as well. The explained variance increases by using this function of leveling off compared with table 1, which doesn't assume this effect. In the end we can say that there is some leveling off effect, but this effect is not very big. The explained variance increased from 0.409 to 0.5245 which is a relative increase of about five percent. This is not spectacularly compared to the assumption that the level-off was expected to explain this scatterplot of happiness and income at a national level.

It is also interesting to measure if there is a significance between income per capita and income inequality for the same 27 EU member countries. Therefore the Gini-coefficients (*G*) of these countries are put in the formula as independent data and are analyzed with happiness (*H*) in Figure 3 as a dependent variable. This first results in Figure 2, visible underneath.

(3) $$G = \varepsilon Y + \eta$$

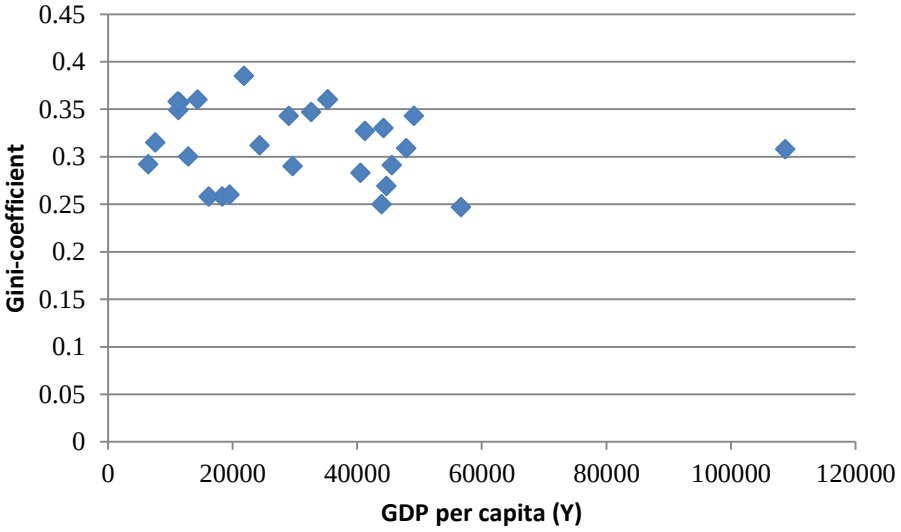

Figure 2. *scatterplot of the relation between income per capita (Y) and the Gini-coefficient (G) for the 27 EU member countries.*

Table 3. *Gini-coefficient as a function of GDP per capita.*

ε	t-value ε	η	t-value η	R^2	F-Value
-0.000000331	-0.8899	0.324	22.855	0.031	0.792

The relation between the income inequality and GDP per capita is statistically measured and found not significant. As the both Table 3 as well as Figure 2 show, there is no relation visible and proved. In the scatter we only see a cloud of dots without any consistency, and the table proves no significance due to the t-value and R-Square. The reason of this non-significance could be explained by Simon Kuznets. He states that economic inequality increases in a country which is developing over time, and then after a certain average income is obtained this income inequality starts to decrease. (Açemoglu and Robinson, 2002)

If we put the happiness data in the same figure, it is possible to see the influence of income inequality, the Gini-coefficient (*G*), on the happiness (*H*) which is visible on the Y-ax. Figure 3 shows that is almost no visible relation between countries with a low or a high Gini-coefficient and the influence of this on the measured happiness. Table 4 shows there is no statistical significance and therefore influence. This analysis can be explained with a formula by which the figure and attached table belong.

(4) $$H = \kappa G + \lambda$$

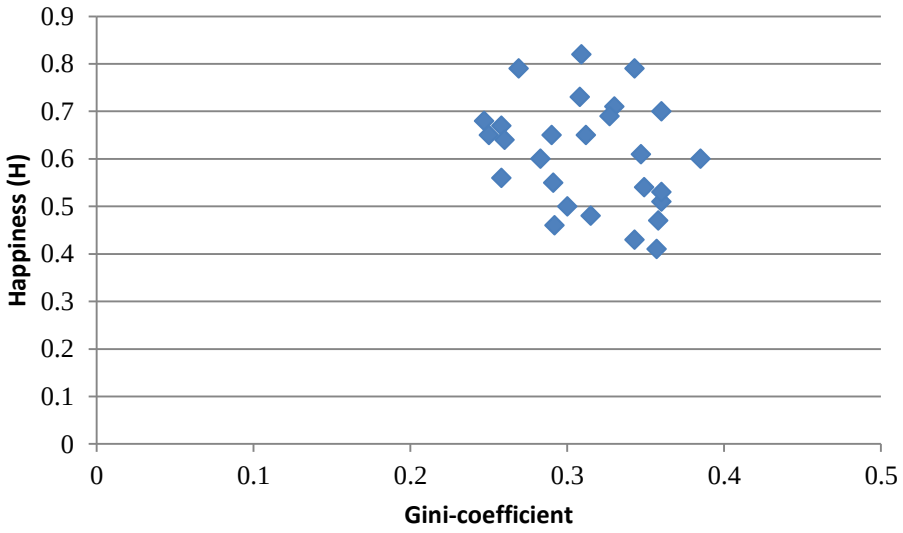

Figure 3. *Scatter diagram of happiness (H) and income inequality (Gini-coefficient) for the EU countries.*

Table 4. *Happiness as a function of the Gini-coefficient.*

κ	t-value κ	λ	t-value λ	R^2	F-value
-0.791	-1.468	0.856	5.028	0.079	2.155

3. The decomposition of happiness

As written before, the central topic is happiness. The composition can be done in different ways, but in this research there is chosen to use six different variables which bundle public and private goods as a utility function *H*.

These six variables are: Human Development Index (HDI), Environmental Performance Index (EPI), Gender Related Development Index (GDRI), Health expenditures (HE), Life Expectancy (LE), and Research and Development (RD).

Each of these, partly overlapping, variables are going to be tested against the GDP per capita for a selected database of countries. All of these variables are quite abstract, so to say 'composed' goods themselves. They contain public as well as private parts. The assumption for these bundled goods is that all of them separately are positively related, or contribute in a positive way to happiness. If these assumptions are proved accurate, the general utility function of happiness can be composed by all of the six variables. In this case the function can be equated as:

$$H = H\,(HDI\,(Y), EPI\,(Y), GRDI(Y), HE(Y), LE(Y), RD(Y))$$

In the end of the previous chapter we already proved that there is a positive relationship between happiness and per capita income in the EU 27 countries. This is proved by data from the European Commission and per capita income data from the IMF. Assuming there is a positive relationship between not only private goods, but also between public goods and per capita income (Calsamiglia, 1978), the hypothesis is going to be tested. Therefore every variable as equated in the Happiness function will be tested and these data all stem from the Pocket World in Figures (The Economist, 2011).

Firstly the Human Development Index, which is a knowledge variable consisting of average years of schooling and adult literacy. The Environmental Performance Index is an index based on a range of factors like biodiversity, air pollution, water use, methods in agriculture and how a country is dealing with climate change (CO2). The Gender related development index shows the disparity between men and women in every country; the lower the index, the greater the disparity. Health expenditures contain the expenditures for health per capita for every country as a percentage of GDP times the GDP per capita. Life expectancy is simply the age a baby is expected to reach in his/her life in expressed in years.
Finally the last variable is the percentage of the GDP per country which is invested in Research and Development per head. All of these variables which include per capita income are tested as $ in PPP. PPP obviously stands for Purchasing Power Parity.

Each of these variables are shown in separate figures which show the relation between income per capita and the variable. This results in six figures which will be analyzed respectively like described just above. After these scatter diagrams, tables will show statistical information about the model and the individual variables and their relation with the GDP per capita (*Y*).

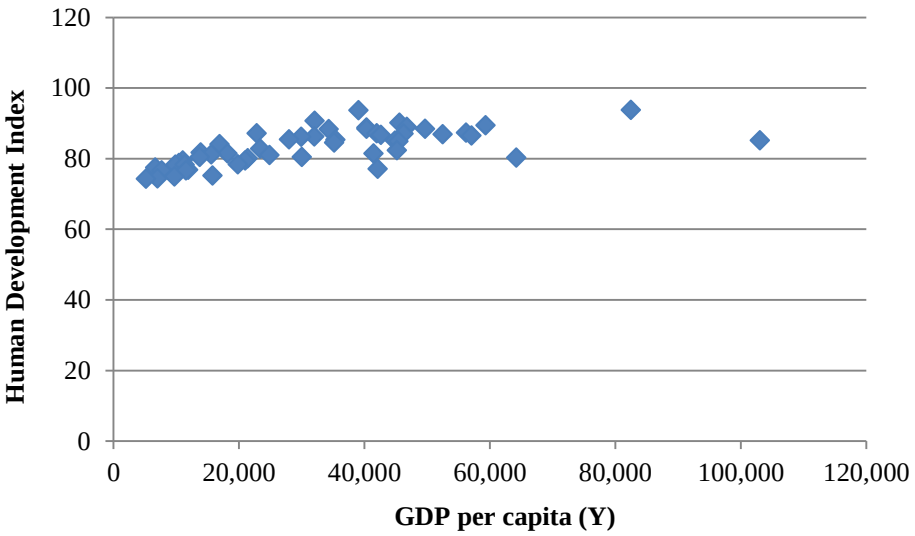

Figure 4. *Scatter diagram of HDI against GDP per capita (Y) in USD ($) in 2011. Norway ranking 1, Bulgaria ranking 52. (The Economist, 2011).*

So firstly Figure 4 can be observed. This shows the relation between the HDI and per capita income. It is visible that when income per capita rises, the Human Development Index rises as well. The relation is visible, but it is not a very strong one, maybe also due to the level of scale which is used, actually in every figure within this section, namely from 0 to 100. The relation seems to be linear.

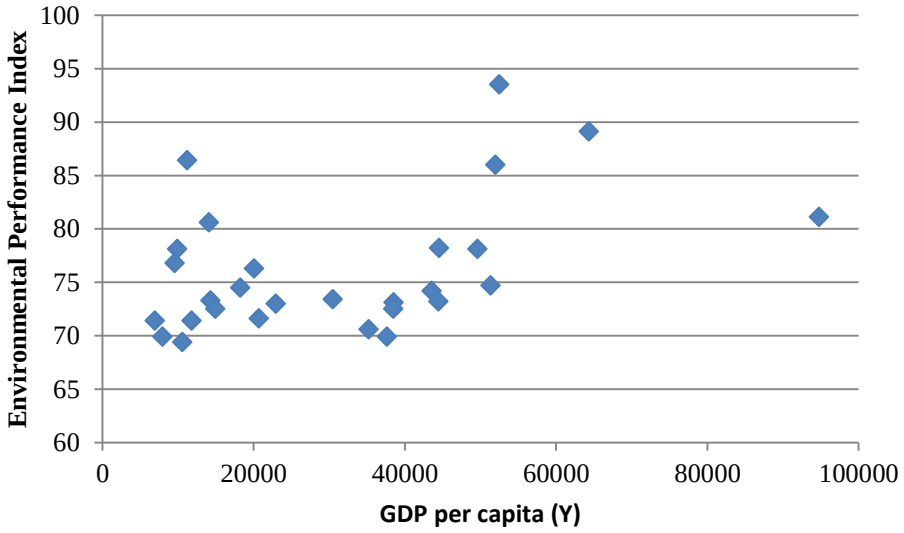

Figure 5. *Scatter diagram of Environmental Performance Index against GDP per capita (Y) in USD ($) in 2011 .Iceland ranking 1, Serbia ranking 28. (The Economist, 2011).*

The relation between the Environmental Performance Index and income shows a scattered set of points in the diagram. Some growth of this Index when income rises can be observed, but on the other hand the most right outliner actually is a decreased performance combined with the highest income per capita. Assumingly there is not a clear relationship between these two.

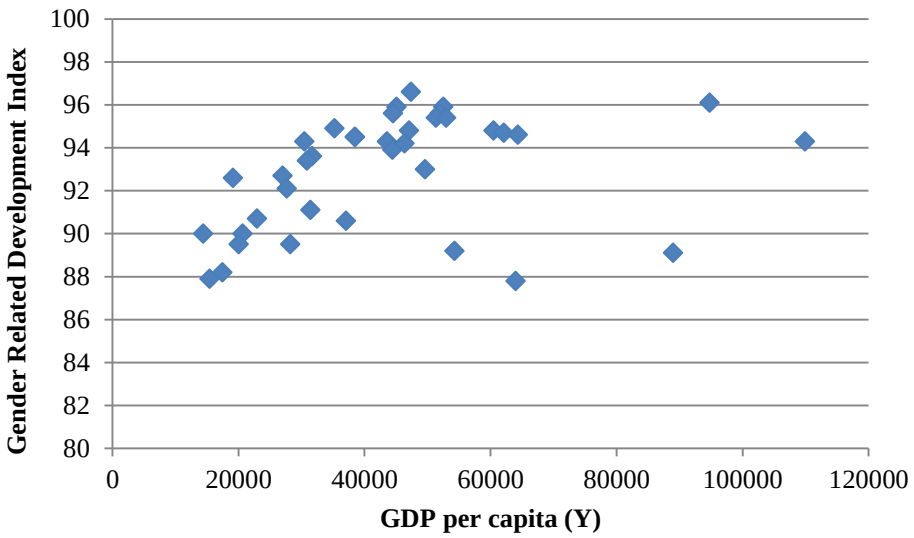

Figure 6. *Scatter diagram of the Gender Related Development Index against GDP per capita (Y) in USD ($) in 2011 .Australia ranking 1, United Arabian Emirates ranking 38. (The Economist, 2011).*

In Figure 6 the Gender Related Development Index shows an increase provided by a higher income per head. This means that gender inequality or disparity decreases when we look at countries with a higher average income per capita, compared with countries with a lower income per capita. The index counts for countries which scored between around 87 and 97. Some outliers are visible, but there is a clear relation in the diagram. Also this scatter, apart from some outliers, looks like a concave shaped one.

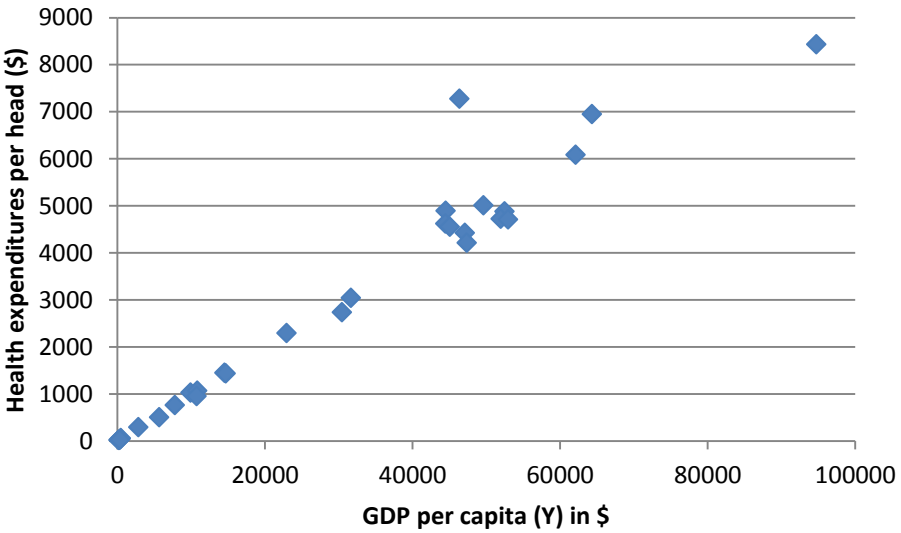

Figure 7. *Scatter diagram of the GDP per capita(Y) against the Health spending per head in USD ($) in 2011 . Norway ranking 1, Burundi ranking 30 (The Economist, 2011).*

As expected there is a relation between income per capita and health expenditures per head. Figure 7 shows this clear increase of expenditures on health by governments in countries when income per head is higher as well. There is one outlier which can be seen. This represents the USA. They have a relative higher percentage, of about 15 %, then other countries when it comes to health expenditures. Taking this into account, the effect of income per capita and health expenditures per head is linear.

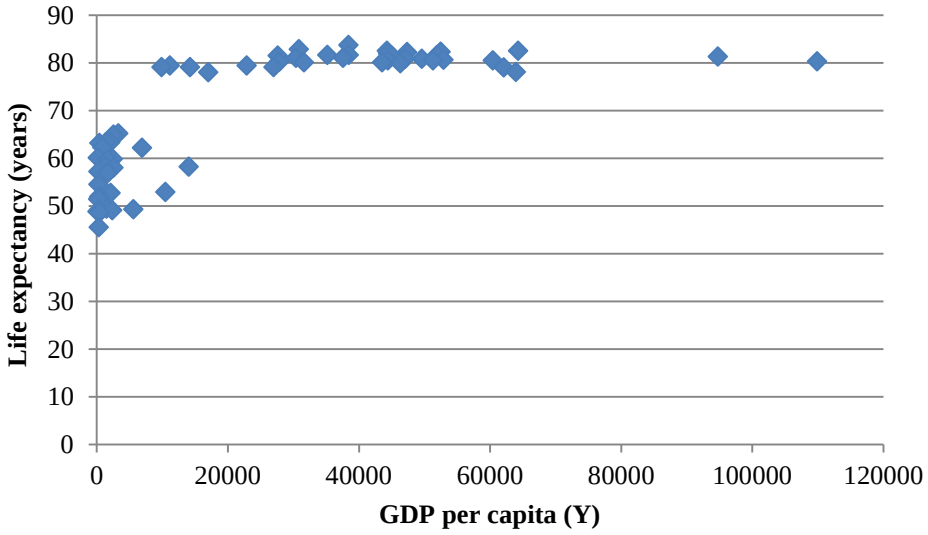

Figure 8. *Scatter diagram of the Life expectancy against the GDP per capita(Y) in years in 2011 . Japan ranking 1, Afghanistan ranking 64 (The Economist, 2011).*

Life expectancy increases when income per capita is higher. It is increasing rapidly between almost no income and reaching 15.000 $ per year, and levels off clearly after a certain income. There is a gap between 65 years and 75 of life expectancy. This gap creates a graph with a concave shape as well.

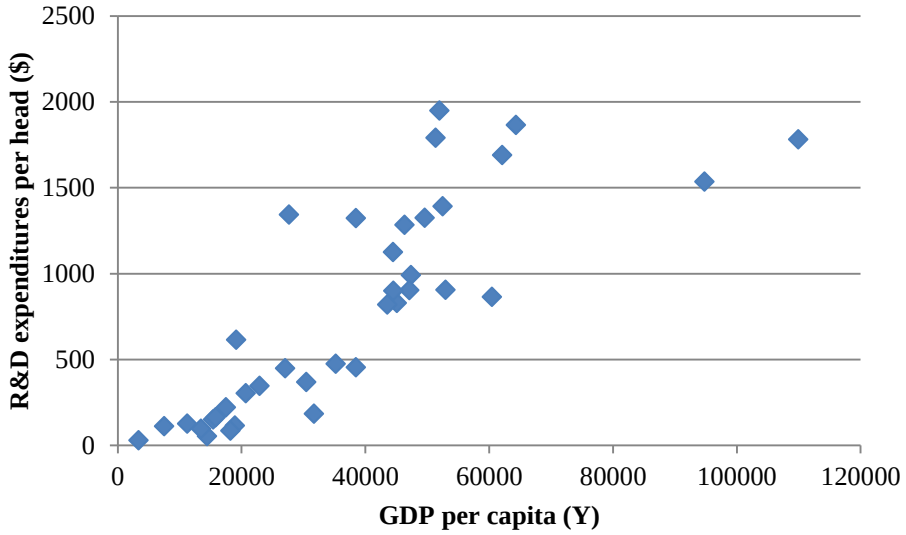

Figure 9. *Scatter diagram of the Research and Development expenditures per head in $ against the GDP per capita (Y) in $ in 2011 . Sweden ranking 1, India ranking 36 (The Economist, 2011).*

The last variable tested in this section is the R&D expenditures per head by governments and the income per head in these countries. The figure in which this relation can be observes is Figure 9. Apparently a linear effect between these two variables can be seen.

Altogether this section shows the results of six different analyses all related to income per capita. Six figures can be observed in forms of scatter plots and all of them show a relation. What is interesting is the exact statistical relationship and whether they are significantly related and in what way the model (R-Square) can be used to predict future outcomes. Therefore table 5 is made, in the same format as the other tables. It shows the regression coefficients and their t-values (μ_i), and the constants with their t-values (ν_i). Next to this information a column can be read with the R-square and the significance. This output which is named table 5, is based on the linear regression function counting for all six variables:

(5) $$X_i = \mu_i Y + \nu_i$$

As the equation says, the six variables are named X_i , respectively Human Development Index (HDI), Environmental Performance Index (EPI), Gender Related Development Index (GDRI), Health expenditures (HE), Life Expectancy (LE) and Research and Development (RD).

Table 5. *Statistical relation between all six variables and income per capita, based on linear regression.*

Variable	μ_i	t-value μ_i	ν_i	t-value ν_i	R^2	F-value
X_1 (HDI)	0.000167	6.369	77.847	78.195	0.4479	40.5636**
X_2 (EPI)	0.000128	2.482	72.194	37.489	0.1915	6.1594*
X_3 (GRDI)	0.00004419	2.3179	90.996	98.212	0.123	5.3730*
X_4 (HE)	0.098	22.662	63.290	0.3851	0.948	513.5395**
X_5 (LE)	0.000398	9.733	59.393	41.256	0.604	48.153 **
X_6 (R&D)	0.0218	8.388	-39.0628	-0.34202	0.6678	70.3650**

* significant against α<0.05
** significant against α<0.00

The results shown in Table 5 are convincing. All of the variables are significant against a 5 % significance level (one-tailed). This is the reason why the hypothesis in the beginning of this section can be accepted, and is supported by the table. It basically means that all of the variables, the so to say either private or public 'goods' or bundles of these goods, are dependent on the income per capita. They are positively related with income. But as the description says these analyses are based on linear regression. What might be forgotten is the detailed view on the figures, the scatter plots. There are some variables like Life Expectancy which show a clear level off just like the relation between happiness and income in the second section of this research. A closer look on all of the scatter plots forces to say there are more relations tending to 'level off'. To find out which of the relations are leveling off, Table 6 was calculated. In this table all of the six variables were tested on their exponential relationship which explains the level off in a better model. Of course the natural logarithm was calculated and this shows some interesting facts. The logarithmic function was derived from the exponential function giving the sixth equation of this research.

(6) $$X_i = \iota_i Y^{\omega_i} \rightarrow \ ln\, X_i = ln\, \iota_i + \ \omega_i\, ln\, Y.$$

Table 6. *Statistical relation between all six variables and income per capita, based logarithmic function.*

Variable	$ln\, \iota_i$	t-value $ln\, \iota_i$	ω_i	t-value ω_i	R^2	F-value
X_1 (HDI)	3.741	47.620	0.067	8.661	0.600	75.018**
X_2 (EPI)	4.042	18.931	0.024	1.124	0.031	1.26
X_3 (GRDI)	2.696	10.054	0.171	6.647	0.513	44.190**
X_4 (HE)	61.546	0.377	0.088	20.781	0.907	431.869**
X_5 (LE)	3.406	65.137	0.091	16.016	0.783	256.486**
X_6 (R&D)	-71.767	-0.736	0.022	9.614	0.703	92.420**

** significant against α<0.00

As Table 6 shows, there are more variables which can be explained in a better model using the logarithmic function. Almost all the explained variances per variable are majorly increasing. Now it is important to take a look at the ω_i values in Table 6. These represent the coefficients in the model. If these values are between 0 and 1 and most importantly if they are significant, we can say that there is a level off effect. To see whether a value is significant, the t-value of ω_i has to be larger than approximately 2.00, depending on the amount of observations. In this research a larger t-value of 2.00 means a significant ω-value. Implementing this shows that all variables except one are significant. X_2 (EPI), which is the Environmental Performance Index, shows a non-significant ω-value.

In the context of this macro study, the so called AGC is also an important indicator. AGC stands for Average Global Consumer. Now looked at the scores of the bundles of goods, the $ln\, \iota_i$-values in Table 6 show that R&D has a negative value only, but this value is not significant. This means that the Average Global consumer perceives this bundled good (R&D investment per capita) as an origin good. Therefore the income elasticity is 1. All the other goods have significant elasticity values between 0 and 1, which means these goods are considered as basic goods by the AGC. These elasticities are visible in Table 6 as well. The ω_i-values in the fourth column show the exact income elasticities of the six variables.

4. Socio-economic benchmarking and policy

The previous section focuses on a new way of composition of happiness. It was decomposed with a formula containing six new variables. These were described before and all of them were related to income per capita for a selected amount of countries per analysis. Table 7 shows plusses, minuses and question marks. This benchmarking table was calculated with the Engel's functions of all the six composed goods. The purpose of the table is to show whether the selected country over-, or underperforms on these goods. Question marks represent a lack of information on the scores for these goods. This was done by comparing the normative score of the countries with the actual score in the index, by using a linear regression between each variable and income per capita. If the normative score was lower than the actual score, the country is over performing. If the actual score was lower, a minus was given. This means all 27 countries of the EU are comparable with each other. Only Cyprus and Malta have a lack of information available on most variables. And as they are relatively small, their influence is marginal so they will be left out in the analysis.

Table7. *Socio-economic benchmarking for the EU countries showing the six composed goods. All EU are represented in this table except Cyprus and Malta, due to a lack of information.*

VARIABLES	HDI	EPI	GRDI	HE	LE	RD
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	+	+	+	-	+	+
UK	-	-	+	-	+	-

The use of this table could be for policy purposes. The results of the table show some interesting facts. Germany scores only plusses whereas Luxembourg only scores minuses. This is due to their extreme high income per capita. A country can see if it is over-, or underperforming according to the normative score, so it can either improve on a good or invest money in goods which are scoring too low. France could invest more in R&D per capita, and Finland more on Health expenditures, e.g.

5. Principle component analysis

Perhaps the most challenging part of this research is the fact if the decomposed happiness formula is actually giving a reliable representation of happiness as defined. Therefore this last section explains the so called Principle Component Analysis. This analysis is very closely related to Factor Analysis. It basically describes 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. Now what happened was that all of the six composed goods, which form the decomposed happiness function, were put in this analysis to see whether these six could be composed to one 'underlying' component. Calculating this gave the answer on this. After the analysis showed that there is one component with an eigenvalue of 4.043. This component explained 67.391% of the variance.

The variance explained is the most important indicator to what extend the component is representing all the variables that are put in the analysis. In this study the six composed goods are the input. As written above, there is one component, explaining approximately 67%. This means we can say that to a large extend component one can be called happiness. This happiness component is nevertheless not explaining the whole model, so there are still some other variables which have to be found on getting a higher explanation.

Since we proved there is one component, it is important to see the so called component matrix. This shows the impact or weight of every variable on this component. This means that the loadings of all the separate X_i on this component which we label happiness. Table 8 shows the loadings on the component, but also the relative score on the component. Because the total sum of loadings exceeds 1, the relative scores give a better explanation on what impact every variable has on the component happiness. The sum of these is obviously 1.

Table 8. *Component scores on component and relative component scores.*

Variable	Factor loading	Relative Component Score
X_1 (HDI)	0,904	0,19
X_2 (EPI)	0,493	0,10
X_3 (GRDI)	0,891	0,18
X_4 (HE)	0,813	0,17
X_5 (LE)	0,921	0,19
X_6 (R&D)	0,824	0,17
TOTAL	4,846	1,00

Having calculated the relative component scores, it is possible to create a new model. This new model is actually the same format as the benchmarking table, only here all the data of the EU-27 countries, again without Cyprus and Malta, are multiplied with the relative component score. This is the second last step in this section to check the representativeness of the six variables of this research as explaining happiness. This is the reason why section 2 is basically not only the literature part but also the starting point to compare the happiness score of the European Commission Euro barometer with a calculated score of our six variables multiplied by their weight on our component: happiness. Table 9 shows the last to columns putting these two scores versus each other. At last these two columns are put in a correlation to see whether the decomposed formula in section 3 correlates with the happiness researched by the European Commission.

Table 9. . *Decomposed happiness calculated scores of all EU countries. All EU are represented in this table except Cyprus and Malta, due to a lack of information.*

	HDI	x1	EPI	x2	GRDI	x3	HE	x4	LE	x5	RD	x6		Calculated Scores	Happiness
Austria	0.851	0.19	78.1	0.1	0.93	0.18	10.1	0.2	80.8	0.19	0.0267	0.17	=	25.212629	0.55
Belgium	0.867	0.19	58.1	0.1	0.948	0.18	9.4	0.2	80.8	0.19	0.0192	0.17	=	23.098634	0.71
Bulgaria	0.743	0.19	62.5	0.1	0.613	0.18	7.3	0.2	74	0.19	0.0049	0.17	=	21.803343	0.46
Czech Republic	0.841	0.19	71.6	0.1	0.9	0.18	6.8	0.2	77	0.19	0.0147	0.17	=	23.270289	0.56
Denmark	0.866	0.19	69.2	0.1	0.947	0.18	9.8	0.2	79	0.19	0.0272	0.17	=	23.935624	0.68
Estonia	0.812	0.19	63.8	0.1	0.882	0.18	5.4	0.2	74	0.19	0.0129	0.17	=	21.673233	0.51
Finland	0.871	0.19	74.7	0.1	0.954	0.18	8.2	0.2	80.5	0.19	0.0349	0.17	=	24.502143	0.79
France	0.872	0.19	78.2	0.1	0.956	0.18	11	0.2	81.9	0.19	0.0202	0.17	=	25.592194	0.69
Germany	0.885	0.19	73.2	0.1	0.939	0.18	10.4	0.2	80.5	0.19	0.0253	0.17	=	24.724471	0.6
Greece	0.855	0.19	60.9	0.1	0.936	0.18	9.6	0.2	80.1	0.19	0.0058	0.17	=	23.272916	0.43
Hungary	0.805	0.19	69.1	0.1	0.879	0.18	7.4	0.2	74	0.19	0.0097	0.17	=	22.540819	0.5
Ireland	0.895	0.19	67.1	0.1	0.948	0.18	7.6	0.2	80.5	0.19	0.0143	0.17	=	23.640121	0.79
Italy	0.854	0.19	73.1	0.1	0.945	0.18	8.7	0.2	81.6	0.19	0.0118	0.17	=	24.627366	0.53
Latvia	0.769	0.19	72.5	0.1	0.648	0.18	6.2	0.2	73	0.19	0.0061	0.17	=	22.437787	0.41
Lithuania	0.783	0.19	68.3	0.1	0.628	0.18	6.2	0.2	72.6	0.19	0.008	0.17	=	21.94117	0.47
Luxembourg	0.852	0.19	67.8	0.1	0.943	0.18	6.5	0.2	80.3	0.19	0.0162	0.17	=	23.476374	0.73
Netherlands	0.89	0.19	66.4	0.1	0.954	0.18	8.9	0.2	80.6	0.19	0.0171	0.17	=	23.810727	0.82
Poland	0.795	0.19	63.1	0.1	0.631	0.18	6.4	0.2	76.3	0.19	0.0061	0.17	=	22.160667	0.54
Portugal	0.795	0.19	73	0.1	0.907	0.18	10	0.2	79.4	0.19	0.0151	0.17	=	24.402877	0.6
Romania	0.767	0.19	67	0.1	0.521	0.18	4.7	0.2	73.8	0.19	0.0058	0.17	=	21.761496	0.48
Slovakia	0.818	0.19	74.5	0.1	0.663	0.18	7.7	0.2	75.5	0.19	0.0047	0.17	=	23.379559	0.67
Slovenia	0.828	0.19	65	0.1	0.927	0.18	7.8	0.2	79.1	0.19	0.0166	0.17	=	23.182002	0.65
Spain	0.863	0.19	70.6	0.1	0.949	0.18	8.5	0.2	81.6	0.19	0.0135	0.17	=	24.346085	0.61
Sweden	0.885	0.19	86	0.1	0.956	0.18	9.1	0.2	81.6	0.19	0.0375	0.17	=	25.997605	0.65
UK	0.849	0.19	74.2	0.1	0.943	0.18	8.4	0.2	80.1	0.19	0.0188	0.17	=	24.401246	0.7

X_i = *relative weights of variables on component happiness*

Right above, Table 9 shows the calculated scores of own secondary data analysis and the happiness scores from previous research by the EU. These last EU happiness data have been used in section 2 to see the relation between income and happiness. If there is a correlation between the two of these last columns from Table 9, this means the model developed from section 3 onwards could explain happiness. Therefore Table 10 is showing the correlation between the two of them.

Table 10. *Correlation matrix showing the relation between decomposed happiness and previous research on happiness.*

	Calculated Scores	Happiness
Calculated Scores	1	0,502557
Happiness	0,502557	1

The correlation matrix shows an approximately 50 % correlation between the two columns. This is a satisfying correlation, especially in social-economic research. Also because this proves the model created in this research is covering happiness to quite an extend. Of course there is still a lot to find out about what other variables are possibly increasing the correlation. These variables are not mentioned in this study, but could be interesting for future research on this topic.

From this section we can conclude that the decomposed happiness formula in this research from section 3 is explaining happiness as defined to a major extend. Unfortunately it is not completely covering, but the results shown in Table 10 are convincingly proving that the composed formula in this research is explaining happiness as defined by literature to an acceptable extend and supports the relationship between income and happiness.

6. Conclusion and Discussion

From this research certain conclusions can be drawn. In the first part there can be concluded that happiness at a national level is positively correlated with income per capita and that there is some leveling off effect when income grows, but this is not very big. Also the income inequality has been analyzed towards happiness and income per capita, and the both of them are not significant and don't show any relationship at all with happiness on a national scale.

After this part, a new formula for happiness was composed with six variables and in the third section the six variables and their relation to income are measured. All of them appeared to be positively related to income per capita in the scatter plots. From this statistical analysis it can clearly be concluded that the consumption of these six composed goods, or bundles of goods mentioned in the equation are dependent on income per head in USD ($), and therefore income and happiness are positively related. The income elasticity's still prove people consider all goods except Research and Development, as basic goods which means some countries could improve their economic policy based on the actual scores from the benchmarking procedure.

When we look at the difference between higher income and lower income countries in the EU, certain differences are visible. The effect of income rising on the consumption of goods, will be higher in lower income countries then in higher income countries. Also the leveling off effect would be less, due to the fact that relative higher income creates more effect in developing countries. Subsequently a relative income per capita in these countries will create a higher happiness.

Income is a necessary ingredient for happiness, but possibly not the only one. This research composed happiness with six goods and excluded countless other possible factors. All of the index data stem from the Economist 2011, and they sampled countries all over the world. Also the Gini-coefficients used in this research are not all up-to-date with the current time-period, simply because these data are not available for most of the countries. The income inequality index known as this Gini-coefficient doesn't change much within countries, especially the EU-27 one's in which they are used.

Same conclusions as in this research have been drawn by Heijman and van Ophem in 2010. Only they used data from 2006 and earlier. They as well found that overall one way or the other income is related to happiness in a positive way. If world income increases and income distribution doesn't change much, people's happiness is positively influenced.

Perhaps the most interesting finding is the level off effect which explains and answers the bottom line of this research. In section 3, data analysis proved that almost every bundled good has a leveling off effect, except Environmental Score, which could be due to the scattered and relatively small amount of data. This means that every good has a maximum utility just like the leveling off effect of income on happiness, measured by the European Commission. This finally brings the last section proving the representativeness of the bundles of goods, the six variables used in this research correlate in a positive way with earlier research by the European Commission. Unfortunately not completely covering, future research could be interesting expanding this new model by finding other factors improving the estimation of happiness based on income per head in countries.

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Appendix I Data EU Commission on happiness measured in EU-27 countries

	GDP per capita 2009	Happiness(h)	Gini-coefficients (most recent)	LN of income	LN of Happiness
Austria	45563,01	0,55	0,291	10,72685	-0,597837001
Belgium	44253,73	0,71	0,33	10,6977	-0,342490309
France	41225,78	0,69	0,327	10,62682	-0,371063681
Germany	40527,75	0,6	0,283	10,60974	-0,510825624
Luxembourg	108706,5	0,73	0,308	11,59641	-0,314710745
Netherlands	47889,17	0,82	0,309	10,77664	-0,198450939
Bulgaria	6457,915	0,46	0,292	8,773062	-0,776528789
Czech Republic	18343,65	0,56	0,258	9,817039	-0,579818495
Hungary	12885,86	0,5	0,3	9,463886	-0,693147181
Poland	11310,67	0,54	0,349	9,333502	-0,616186139
Romania	7572,787	0,48	0,315	8,932316	-0,733969175
Slovakia	16203,04	0,67	0,258	9,692954	-0,400477567
Denmark	56686,79	0,68	0,247	10,9453	-0,385662481
Estonia	14374,07	0,51	0,36	9,573181	-0,673344553
Finland	44687,9	0,79	0,269	10,70746	-0,235722334
Ireland	49115,46	0,79	0,343	10,80193	-0,235722334
Latvia	11504,75	0,41	0,357	9,350515	-0,891598119
Lithuania	11211,06	0,47	0,358	9,324656	-0,755022584
Sweden	43903,24	0,65	0,25	10,68974	-0,430782916
United Kingdom	35238,69	0,7	0,36	10,4699	-0,356674944
Greece	29005,98	0,43	0,343	10,27526	-0,84397007
Italy	35289,37	0,53	0,36	10,47134	-0,634878272
Malta	19542,94	0,64	0,26	9,880369	-0,446287103
Portugal	21806,88	0,6	0,385	9,989981	-0,510825624
Slovenia	24333	0,65	0,312	10,09959	-0,430782916
Spain	32605,09	0,61	0,347	10,39222	-0,494296322
Cyprus	29622,81	0,65	0,29	10,2963	-0,430782916

Appendix II Data composed variables on Human Development Index, Environmental Performance Index, Gender Related Development Index, Health expenditures, Life Expectancy, and Research and Development on selected countries

Human Development Index		GDP per capita	Environmental Index		GDP per capita	Gender RD Index		GDP per capita
Norway	0,938	82480	Iceland	93,5	52480	australie	96,6	47370
Australia	0,937	39070	Switzerlar	89,1	64330	norwegen	96,1	94760
New Zealand	0,907	32090	Costa Rica	86,4	11215	canada	95,9	45070
United States	0,902	45592	Sweden	86	51950	iceland	95,9	52480
Ireland	0,895	59320	Norway	81,1	94760	france	95,6	44510
Netherlands	0,89	46750	Mauritius	80,6	14096	sweden	95,6	51950
Canada	0,888	40330	France	78,2	44510	finland	95,4	51320
Sweden	0,885	49660	Austria	78,1	49600	nederland	95,4	52960
Germany	0,885	40320	Cuba	78,1	9900	spain	94,9	35220
Japan	0,884	34310	Colombia	76,8	9566	belgium	94,8	47090
Switzerland	0,874	56210	Malta	76,3	20030	ireland	94,8	60480
France	0,872	41970	Finland	74,7	51320	denmark	94,7	62120
Israel	0,872	22840	Slovakia	74,5	18210	switserland	94,6	64330
Finland	0,871	46260	UK	74,2	43540	italy	94,5	38490
Iceland	0,869	52480	New Zeala	73,4	30440	japan	94,5	38460
Belgium	0,867	42610	Chili	73,3	14288	luxembourgh	94,3	109900
Denmark	0,866	57050	Germany	73,2	44450	new zeelan	94,3	30440
Spain	0,863	32020	Italy	73,1	38490	UK	94,3	43540
Hong Kong, China (SAR)	0,862	29910	Portugal	73	22920	US	94,2	46350
Greece	0,855	28000	Japan	72,5	38460	germany	93,9	44450
Italy	0,854	35400	Latvia	72,5	14910	greece	93,6	31670
Luxembourg	0,852	103040	Czech Rep	71,6	20670	hong kong	93,4	30860
Austria	0,851	44880	Albania	71,4	6911	austria	93	49600
United Kingdom	0,849	45440	Panama	71,4	11797	slovenia	92,7	27020
Singapore	0,846	35160	Spain	70,6	35220	south korea	92,6	19120
Czech Republic	0,841	16930	Belize	69,9	7942	israel	92,1	27650
Slovenia	0,828	23380	Singapore	69,9	37600	cyprus	91,1	31410
Andorra	0,824	45190	Serbia	69,4	10563	portugal	90,7	22920
Slovakia	0,818	13890	Belgium	58,1	47090	brunei	90,6	37050
United Arab Emirates	0,815	41460	Bulgaria	62,5	6550	barbados	90	14430
Malta	0,815	18200	Cyprus	56,3		czech republi	90	20670
Estonia	0,812	15580	Denmark	69,2	62120	bahrain	89,5	28240
Cyprus	0,81	24900	Estonia	63,8	17450	malta	89,5	20030
Brunei Darussalam	0,805	30030	Greece	60,9	31670	kuwait	89,2	54260
Hungary	0,805	13770	Hungary	69,1	15410	qatar	89,1	88990
Qatar	0,803	64190	Ireland	67,1	60460	estonia	88,2	17450
Bahrain	0,801	21420	Lithuania	68,3	14100	hungary	87,9	15410
Portugal	0,795	21000	Luxembou	67,8	103400	United arab e	87,8	63970
Poland	0,795	11070	Netherlan	66,4	52960	bulgary	61,3	6550
Barbados	0,788	10430	Poland	63,1	13850	latvia	64,8	14910
Bahamas	0,784	19840	Romania	67	9300	lithuania	62,8	14100
Lithuania	0,783	11360	Slovenia	65	27020	poland	63,1	13850
Chile	0,783	9880				romania	52,1	9300
Argentina	0,775	6640				slovakia	66,3	18210
Kuwait	0,771	42100						
Latvia	0,769	11930						
Croatia	0,767	11560						
Romania	0,767	7700						
Saudi Arabia	0,752	15800						
Mexico	0,75	9720						
Malaysia	0,744	7030						
Bulgaria	0,743	5160						

Health expenditures	% of GDP for Health		GDP per capita		R&D	% of GDP i	RD%(/100	GDP per c	Expenditu
us	15,7	0,157	46350		Australia	2,09	0,0209	47370	990,033
burundi	13,9	0,139	140		Austria	2,67	0,0267	49600	1324,32
timor leste	13,6	0,136	450		Belgium	1,92	0,0192	47090	904,128
france	11	0,11	44510		Canada	1,84	0,0184	45070	829,288
switzerland	10,8	0,108	64330		Czech Republic	1,47	0,0147	20670	303,849
liberia	10,6	0,106	220		Denmark	2,72	0,0272	62120	1689,664
cuba	10,4	0,104	9900		Finland	3,49	0,0349	51320	1791,068
germany	10,4	0,104	44450		France	2,02	0,0202	44510	899,102
moldova	10,3	0,103	2823		Germany [1]	2,53	0,0253	44450	1124,585
rwanda	10,3	0,103	460		Greece	0,58	0,0058	31670	183,686
austria	10,1	0,101	49600		Hungary	0,97	0,0097	15410	149,477
canada	10,1	0,101	45070		Iceland	2,65	0,0265	52480	1390,72
argentina	10	0,1	14500		Ireland	1,43	0,0143	60460	864,578
portugal	10	0,1	22920		Italy	1,18	0,0118	38490	454,182
malawi	9,9	0,099	290		Japan [2]	3,44	0,0344	38460	1323,024
serbia	9,9	0,099	10830		Korea [3]	3,21	0,0321	19120	613,752
bosnia	9,8	0,098	7782		Luxembourg	1,62	0,0162	109900	1780,38
denmark	9,8	0,098	62120		Mexico	0,37	0,0037	14429	53,3873
malaysia	9,8	0,098	14669		Netherlands	1,71	0,0171	52960	905,616
greece	9,6	0,096	31670		New Zealand	1,21	0,0121	30440	368,324
belgium	9,4	0,094	47090		Norway	1,62	0,0162	94760	1535,112
iceland	9,3	0,093	52480		Poland	0,61	0,0061	18936	115,5096
sweden	9,1	0,091	51950		Portugal	1,51	0,0151	22920	346,092
new zealand	9	0,09	30440		Slovak Republic [4]	0,47	0,0047	18210	85,587
australia	8,9	0,089	47370		Spain	1,35	0,0135	35220	475,47
jordan	8,9	0,089	5644		Sweden [5]	3,75	0,0375	51950	1948,125
montenegro	8,9	0,089	10741		Switzerland	2,9	0,029	64330	1865,57
netherlands	8,9	0,089	52960		Turkey	0,72	0,0072	13463	96,9336
norway	8,9	0,089	94760		United Kingdom	1,88	0,0188	43540	818,552
zimbabwe	8,9	0,089	310		United States [6]	2,77	0,0277	46350	1283,895
bulgary	7,3	0,073	6550		Brazil [7]	1,13	0,0113	11239	127,0007
czech republic	6,8	0,068	20670		China [8]	1,49	0,0149	7518	112,0182
estonia	5,4	0,054	17450		Estonia	1,27	0,0127	17450	221,615
finland	8,2	0,082	51320		India [9]	0,88	0,0088	3339	29,3832
hungary	7,4	0,074	15410		Israel [10]	4,86	0,0486	27650	1343,79
ireland	7,6	0,076	60460		Russian Federation	1,03	0,0103	15836	163,1108
italy	8,7	0,087	38490		Slovenia	1,66	0,0166	27020	448,532
latvia	6,2	0,062	14910		Bulgaria	0,49	0,0049	6550	32,095
lithuania	6,2	0,062	14100		Latvia	0,61	0,0061	14910	90,951
luxembough	6,5	0,065	103040		Lithuania	0,08	0,008	14100	112,8
Poland	6,4	0,064	13850		Romania	0,58	0,0058	9300	53,94
Romania	4,7	0,047	9300						
Slovakia	7,7	0,077	18210						
Slovenia	7,8	0,078	27020						
Spain	8,5	0,085	35220						
UK	8,4	0,084	43540						

Life Expectancy		GDP per capita		Life Expectancy		GDP per capita
afghanista	45,5	370		liberia	60,1	220
andorra	82,5	44290		luxembou	80,3	109900
angola	49,3	5632		madagask	62,3	911
australia	82,2	47370		martiniqu	80,2	27900
austria	80,8	49600		mauritius	58,2	14096
belgium	80,8	47090		mozambic	49,2	440
benin	63,3	1450		namibia	62,2	6952
cambodia	63,3	2112		netherlan	80,6	52960
cameroon	52,7	2170		new zeala	81	30440
canada	81,4	45070		nigeria	49,1	2421
central afr	48,6	460		norway	81,3	94760
chile	79,1	14288		portugal	79,4	22920
congo	54,5	328		rwanda	52	460
congo kins	48,8	180		senegal	57,1	1819
costa rica	79,4	11215		sierra leor	48,9	350
cote d'ivo	59,6	1680		singapore	81	37600
cuba	79,1	9900		slovenia	79,1	27020
denmark	79	62120		somalia	51,5	300
ethiopia	57,2	320		south afri	52,9	10497
Finland	80,5	51320		spain	81,6	35220
france	81,9	44510		sudan	59,8	2491
germany	80,5	44450		sweden	81,6	51950
ghana	58	2615		switzerlar	82,5	64330
greece	80,1	31670		taiwan	78	17050
hong kong	82,8	30860		tanzania	58,3	1413
iceland	82,3	52480		timor-lest	63,2	450
india	65,2	3339		UK	80,1	43540
ireland	80,5	60460		United em	78,1	63970
israel	81,5	27650		us	79,9	46350
italy	81,6	38490		yemen	64,9	2598
japan	83,7	38460		zambia	49,4	1511
kenia	56,9	1661		zimbabwe	51,4	310
				bulgaria	74	6550
				czech repu	77	20670
				hungary	74	15410
				Estonia	74	17450
				Latvia	73	14910
				Lithuania	72,6	14100
				Malta		
				Poland	76,3	13850
				Romania	73,8	9300
				Slovakia	75,5	18210