CHARLES UNIVERSITY

FACULTY OF SOCIAL SCIENCES

Institute of Economic Studies

Cross-Country Analysis of Life Satisfaction

Bachelor thesis

2018 **Zuzana Stehlíková**

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Abstract

This thesis examines the relations between subjective well-being and economic, politic and social characteristics of individual countries. We study the link between three components of subjective well-being – life satisfaction, positive affect and negative affect and other country characteristics. First, we use the dataset containing countries from almost all countries of the whole world and then with a more detailed European dataset. For the analysis of life satisfaction, panel data models are used. The results indicate that we are able to explain better variation in life satisfaction by our set of explanatory variables in comparison with positive affect and negative affect. In the former dataset, we discovered that the most important determinants of life satisfaction are GDP per capita, health, freedom to make life choices, political conditions and social support. In the latter, European dataset revealed a strong negative correlation between tertiary education attainment and happiness. The results also indicate that female representation in national parliament is an important predictor of life satisfaction in European countries. This supports the idea that equality between men and women plays an important role in developed societies.

Keywords

Subjective well-being, Happiness, Life satisfaction, Positive affect, Negative affect, Economics

Abstrakt

Táto bakalárska práca študuje závislosti medzi subjektívne vnímaným blahobytom a ekonomickými, politickými a sociálnymi charakteristikami jednotlivých krajín. Študujeme ich vplyv na tri zložky subjektívne vnímaného blahobytu – spokojnosť do životom, pozitívne emócie a negatívne emócie. Najprv s pomocou dát, ktoré obsahujú skoro všetky krajiny sveta a potom použijeme podrobnejšie Európske dáta. Na štúdium oboch dát využívame panelové modely. Výsledky ukazujú, že sme viac schopní vyjadriť pomocou nezávislých premenných zmeny v závislej premennej spokojnosť so životom v porovnaní s premennými pozitívne emócie a negatívne emócie. V prvom dátasete sme zistili, že najdôležitejšími determinantami spokojnosti so životom sú HDP na obyvateľa, zdravie, sloboda, politická situácia a sociálna podpora. Ďalej, pomocou Európskych dát sme zistili, že univerzitné vzdelanie a šťastie sú negatívne korelované. Výsledky taktiež poukázali na fakt, že ženské zastúpenie v národnom parlamente je dôležitým determinantom spokojnosti so životom. Teda, rovnosť medzi pohlaviami hrá dôležitú úlohu v rozvinutých krajinách.

Klíčová slova

Subjektívne vnímaný blahobyt, Šťastie, Spokojnosť so životom, Pozitívne emócie, Negatívne emócie, Ekonómia

Range of thesis: 129 004 symbols

Declaration of Authorship

1. The author hereby declares that he compiled this thesis independently, using only the listed resources and literature.

2. The author hereby declares that all the sources and literature used have been properly cited.

3. The author hereby declares that the thesis has not been used to obtain a different or the same degree.

Prague

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BACHELOR THESIS PROPOSAL

Author: Zuzana Stehlíková

Supervisor: PhDr. Radek Janhuba, M.A.

Proposed topic : Cross-country Analysis of Life Satisfaction

Preliminary scope of work:

Research question and motivation

Life satisfaction is the way how people evaluate their lives and how they feel about their decisions about future. Life satisfaction is characterized by measure of well-being, relations with other people, achievement of goals and attitude toward life. Life satisfaction is usually measured in relation to amount of money, education, type of dwelling. There is well-established positive correlation between life satisfaction and income in population. The aim of the bachelor thesis is to find out which other variables can influence happiness of people. We are interested in the effect of general macroeconomic determinants such as GDP, inflation, unemployment but also in effect of number of children, education, age, life expectancy, security and criminality in the country, living space and the other variables. The definition of well-being has been changing over the past few years and life goals of people have been modified by new technologies, new-established morals, new models and idols. Therefore it is very important to study what people perceive as happy life in today's world.

Contribution

The bachelor thesis will bring a new perspective on life satisfaction of people.
We will recover this question on newer and actual data and find out correlation of variables that have not been already studied but can influence individual happiness.

Methodology

In empirical analysis, we will use data from OECD from years 2013- 2016 which describe level of happiness in all OECD countries. Data about level of happiness in these countries will be collected and compared with data for explanatory variables from OECD and additional sources.

Outline

Introduction
Theoretical review
Description of determinants of life satisfaction
Determinantion and explication of data and data sample
Econometric model
Analysis of the results
Conclusion

List of academic literature:

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Introduction

In last decade, the topic of economics of happiness has become a matter of major significance because everyone wants to be happy and policy makers try to maximize our happiness as well. For philosophers, psychologists and also economists, it is not easy to define what happiness means. It can be described as a state of well-being that encompasses living a good life with a sense of meaning and deep satisfaction. But to understand the causes, effects and determinants of happiness, researchers needed to define it. Many of them use the term interchangeably with "subjective well-being" which can be measured and thus compared. This is studied by the specific part of economics – happiness economics, which attempts to evaluate factors affecting well-being, quality of life, and self-reported happiness.

This paper will contribute to this knowledge and it will also discover some new phenomena and relations between happiness and its determinants. In order to become a happy person, it is important to understand which determinants can influence happiness. It is also important for politicians and the whole society because together we can make life happier.

The objective of this paper is to confirm the results of previous similar studies with newer and detailed data and find out new relations between happiness and some unusual microeconomic and macroeconomic variables. We are interested in the effect of economic, political, social and other characteristics of the countries. We will analyze two different datasets. The first contains data for almost the whole world with some general explanatory variables and the second contains European detailed data. This dataset contains many characteristics of the countries whose impact on subjective well-being has not been studied yet. In each of these datasets we will study the impact of different characteristics of a country on three components of subjective well-being; life satisfaction, positive affect and negative affect.

This paper is structured as follows: Firstly, we will explain the different notions related to happiness and state which type of happiness we will study in this thesis because this term can be ambigous and it can mean something else to everybody. We will try to generalize it in order to conduct analysis and comparison properly. Secondly, we will introduce the previous studies conducted in this area of economics. Thirdly, we will discuss the methodology and econometric methods that will be used in this research. And finally, we will analyze our two datasets. The first contains the information about happiness and its contributors from almost whole world. The second contains the data from the European countries but this dataset is more detailed and it contains many usual and also unusual variables that describe given countries. In

both of these datasets, we want to discover the contributors to different elements of happiness and then we will interpret and compare the results.

1. Subjective Well-Being Measures

First of all, it is necessary to understand all the notions related to this topic. Thus in this part, different subjective well-being measures will be explained.

It is not easy to define what happiness means. Generally, a happy person is a person who feels positive emotions frequently and negative emotions rarely. However, in order to be able to analyze happiness and deal with it on national or regional level, researchers needed to define it. Majority of them use the term "subjective well-being".

1.1. Subjective Well-Being

"Subjective well-being is defined as a person's cognitive and affective evaluations of his or her life" (Diener, Lucas, & Oshi, 2002, p. 63).

It reflects cognitive components which contain overall evaluation and judgement of life quality, for example related to work or relations. This cognitive part is often called "life satisfaction". The second component is the emotional part. It is characterized by moods, emotions and feelings of the individual. It can be either positive affect or negative affect. These three parts of subjective well-being are independent and can be studied separately. If an individual has a low positive affect, it does not necessarily mean that he or she has a high negative affect. In order to be able to compare and analyze subjective well-being, it is necessary to measure it. Life satisfaction is usually measured by questionnaires with more possible answers varying from "very satisfied" to "not satisfied". Positive affect and negative affect are measured by so called PANAS, which means positive affect negative affect schedule. It is a self-reported questionnaire which contains two 10-item scale used to measure positive and negative affect. Each of them is rated on a scale from 1 "not at all" to 5 "very much". It was developed in 1988 by scientists from the University of Minnesota and Southern Methodist University. It has many forms which are widely used. Both measurements of positive and negative affect and life satisfaction are self-reported by individuals so it is important to realize that these measures are subjective.

1.1.1. Life Satisfaction

Life satisfaction is a complex term for overall assessment of feelings, emotions, moods and beliefs. Neugarten understood this notion as "an operational definition of successful aging" (Neugarten, Havighurst, Tobin 1961). The others perceived it as "individual's cognitive

judgment about comparisons based on the compatibility of their own living conditions with the standards" (Diener, Emmons, Larsen, Griffin 1985). Veenhoven defined life satisfaction as "the degree to which a person positively evaluates the overall quality of his or her life as-a-whole" (Veenhoven 1991). Thus, it is not easy to understand this notion but generally it measures all cognitive components contributing to subjective well-being. High life satisfaction means that an individual has a high quality of life and he or she attains the personal goals in life.

1.1.2. Positive Affect

Positive affect means experiencing positive and pleasurable emotions such as joy, contentment, interest, and alertness. It is highly connected to current mood and psychical state of an individual. When people fill PANAS questionnaires, they rate each of these emotions according to how they feel in that particular moment. Number 1 means "very slightly or not at all" and 5 "extremely". Usually, people with high level of positive affect are full of energy, enthusiastic, active and confident.

1.1.3. Negative Affect

To the contrary, negative affect measures the level at which an individual experiences negative emotions such as sadness, anger, guilt, fear, nervousness or other unpleasant emotions. It is measured by PANAS questionnaire in the same way as the positive affect. People with the high level of negative affect are more likely to have depression and other psychological disabilities and illnesses.

1.2. Other Well-Being Measures

There are also other well-being measures whose approach can differ a little bit from that of subjective well-being containing life satisfaction, positive affect and negative affect. They combine subjective well-being with other measure, often with those which are oriented towards the nature of sustainable growth.

1.2.1. Happy Planet Index

Happy Planet Index combines subjective well-being measures with other useful measures. It measures sustainable well-being for all in cross-national level. For its calculation, data from Gallup World Cup on well-being, data from United Nations on life expectancy and inequalities of outcome and data from Global Footprint Network on people's impact on environment are used. It highlights the importance of taking into account the protection of

environment, not only the fast economic growth which has harmful effect on our environment and nature.

1.2.2. Gross National Happiness

The notion Gross National Happiness was used in Bhutan for the first time. It measures the collective happiness and well-being across the population. It is also focused on the equilibrium with the nature and sustainable and equitable economic growth. It has nine components such as psychological wellbeing, health, education, time use, cultural diversity and resilience, good governance, community vitality, ecological diversity and resilience and living standards. All these domains are considered to be equal. For most domains, there are four underlying variables. All of the 33 variables are tested with questions during the 1.5 hour personal interview.

1.2.3. Better Life Index

Organization for Economic Co-operation and Development utilized the term Better Life Index for the first time in 2011 when it was trying to summarize international measures of well-being together. Its components are housing, income, jobs, community, education, environment, civic engagement, health, safety and work-life balance.

2. Literature Review

The happiness economics studies happiness with the theoretical and also with the quantitative approach. It focuses on different measures of happiness. It is often discussed with other fields such as psychology, health and sociology. The importance of this area has increased in the late 20-th century. Researches try to find the determinants which contribute to our happiness and the ways to maximize it. One of the most important indicators is Gross domestic product or Gross national product. Then they analyze individual income, personal characteristics, socially developed characteristics, measures focused on how we spend our time, attitudes towards life and wider economic, social and political environment. These determinants will be divided to two groups – macroeconomic and microeconomic determinants.

2.1. Macroeconomic Determinants

2.1.1. Standard Macroeconomic Determinants

2.1.1.1. Gross Domestic Product

The relation between Gross Domestic Product and life satisfaction has been widely discussed. One of the first who has been investigating in this question was the professor of Economics at the University of Southern Carolina Richard Easterlin. He found out positive relation between GDP and happiness. In 1974, he argued that people who are paid higher salaries tend to report higher life satisfaction with their lives but higher GDP, income at the national level does not correlate with greater level of happiness (Easterlin 1974). This phenomenon is called the Easterlin paradox. Later, many scientists were interested either in confirmation or negation of the Easterlin paradox with their studies and analysis of diverse datasets.

Also Veenhoven, Inglehard, Frey and Stutzer were studying if happiness and economic growth are related with cross-sectional data on these two variables (Veenhoven 1991, Inglehart 2002, Frey, Stutzer 2002). Angus Deaton analyzed 2006 Gallup World Poll data for 123 countries and stated: “Each doubling of GDP is associated with a constant increase of life satisfaction.” In his analysis, he used the rate of growth of GDP which is the percentage change in GDP per capita. But he used logarithmic transformation of proportionate GDP rather than its absolute change (Deaton 2008).

In 2008, Stevenson and Wolfers from University of Pensylvania studied the Easterlin paradox with time-series data and claimed that an increase in absolute income causes increase in happiness for individuals and it also influences happiness at the national level. They used logarithmic transformation of absolute income and happiness and concluded that not only the relative income but also the absolute income has an impact on happiness. (Stevenson, Wolfers 2008).

Easterlin and Angelescu concluded that the life satisfaction increases with the absolute change of GDP per capita but in decreasing rate. Moreover, they have showed that magnitude of this effect is lower in richer countries (Easterlin, Angelescu 2009).

Later Easterlin studied time-series data and failed to find evidence that higher economic growth rate improves life satisfaction. He claimed that the double multiplication of economic growth does not cause double multiplication in life satisfaction (Easterlin 2013).

So there are two main approaches and results. That of Easterlin shows that although GDP per capita in United States doubled from 1974 to 2004, average level of happiness showed no significant upward trend. European data confirmed these results as well. On the other hand, there are studies on cross-sectional data showing that life satisfaction is strictly monotonically increasing with an increase in income (Inglehart 2008; Deaton 2008; Stevenson, Wolfers 2008). To reconciliate findings of Easterlin and the further cross-sectional analyses, some scientists have suggested that this positive relation between happiness and income disappears beyond some levels of income (Layard 2006). Finally, Deaton, Stevenson and Wolfers claimed that there is a positive relation between GDP and life satisfaction in developed countries (Deaton 2008; Stevenson, Wolfers 2008). From the opposite perspective, this topic was also examined by Easterlin et al. who failed to find long-run effect even for developing countries (Easterlin, McVey, Switek, Sawangfa, Zweig 2010)

2.1.1.2. Unemployment

Almost all of the studies showed the negative correlation between unemployment and life satisfaction. Many studies have tried to quantify the effect of unemployment on the life satisfaction. For example, the difference in average life satisfaction between unemployed and employed workers aged 20 – 60 years is equal to 1.3 points on a 0-10 scale according to analysis of the German Socio-Economic Panel for 1984–2011. Models using life satisfaction as a continuous dependent variable show that unemployed people have in average 5 – 15 % lower happiness score (DiTella, MacCulloch, Oswald 2001), (Frey, Stutzer 2002), Lelkes analyzed

European data and found out that unemployment lowers happiness on average by 15% (Lelkes 2006). The effect was even more significant in Switzerland (Frey, Stutzer 2002). Winkelmann studied data from Germany from 1984 – 1989 and claimed that the effect of unemployment on happiness is drastic (Winkelmann, Winkelmann 1998).

The level of nonpecuniary individual costs depends on a variety of factors: the reasons for becoming unemployed, the duration of unemployment, the overall unemployment rate and age. One of the first scientists who were interested in this question was Junankar. He concluded that social cost exceeds the economic cost of unemployment (Junankar 1987). Also, the unemployed suffers less when his partner or many other people living around are also unemployed (Clark, Georgellis, Sanfey 2001).

2.1.1.3. Democracy Quality

It is quite natural that the degree of democracy affects life satisfaction of inhabitants. In a democratic society, people have possibility to express their opinions and participate in decision-making process and thus they can influence direction of development of their country. Participation in various referenda and high incentives increases life satisfaction (Frey, Stutzer 2000). However, there were doubts about robustness of their findings. The other scientists later pointed out to the fact that their results were significant only at 10 % level (Dorn, Fischer, Kirchgässner, Sousa-Poza 2007). Lane showed that the labor unions which are a form of the participating and controlling authorities in political and social systems affect quality and quantity of connection between people and thus they contribute to improvement of life satisfaction (Lane 2001).

Societies in which democracy is present on a long term basis such as Great Britain, Denmark, Sweden or Canada are characterized by quite high index of happiness. Contrarily, countries in which is or in which have been the authoritarian system have lower index of happiness. The effect of passing from authoritarian to democratic systems is long-term effect and thus it is not possible to observe improvement of happiness immediately. For example, collapse of Soviet Union supports this idea. In 1991, although there were movements towards democracy, people did not become happier. But few years later, people reported higher level of happiness associated with higher possibility to make free choices. However, the break-down of the social democracy is almost always linked with the fall in life satisfaction. Inglehart and Welzel examined the connection between democracy and economic development and thus happiness. (Inglehart, Welzel 2005).

To sum up, despite the existence of high correlation between the degree of democracy and happiness, rising level of democracy does not necessarily cause improvement of life satisfaction in short term. They can even fluctuate in opposite direction.

2.1.1.4. Inflation

Many studies have confirmed the negative relation between happiness and inflation (Bjørnskov 2003), (Alesina, Di Tella, MacCulloch 2004), (DiTella, MacCulloch, Oswald 2001). As high inflation damages price stability and also stability of the whole financial system people may feel less happy.

The Okun's laws shows trade-off between inflation and unemployment. Misery index provides a measure how much the inflation must decrease if there is an increase in unemployment in order to keep life satisfaction of people equal. Many scientists have studied impact of inflation and unemployment and thus the misery index on happiness but the results and ratio showing their preferences about trade-off between unemployment and inflation differ. The researchers studied OECD data from 1975 to 1992 and concluded that left-wing individuals care more about unemployment relative to inflation with comparison to right-wings (Di Tella, MacCulloch 2005). Moreover, the volatile inflation has a strong negative impact on happiness (Wolfers 2003). However, it is not simple to isolate the effect of inflation on life satisfaction and there is a possibility that inflation correlate with other macroeconomic independent variables so the effect of inflation on happiness is not clear so far.

Inflation can be measured by Harmonized Index of Consumer Prices (HICP). It measures the changes over time in the prices of consumer goods acquired by households. It is also one of the Maastricht criteria necessary for a country to join the Eurozone.

2.1.1.5. Inequality

It may seem that income inequality is negatively correlated with happiness. However, the results of various studies differ. Using evidence from World Value Survey, a negative impact of inequality to life satisfaction has been found (Fahey, Smyth 2004). On the other hand, Haller and Hadler found a positive correlation between these two variables (Haller, Hadler 2006). Bjørnskov tried to reconcile these two opposite theories by the argument that the use of international data with some particular countries can lead to spurious results (Bjørnskov 2003). However, scientists found out that Latin America is relatively happy even with unequal incomes. And former Communist countries, in which there is relative income equality, are

unhappy. Studies from Europe have similar results. Schwarze and Härpfer with use of GSOEP data found out negative correlation between these two variables and the fact that this effect is more significant for left-wing individuals (Schwarze 2003).

A study from America concluded that people were happier when there was a lower level of national income inequality. This negative relation was explained by perceived fairness and general trust in authorities. This effect was stronger for lower-income individuals. Also, it was explained that they were less happy because of the unfairness and lack of trust, not because of low household income (Oishi, Kesebir, Diener 2011).

When putting together all these facts, there is a negative relation between income inequality and happiness. But it is unclear which of the following matter more: a country's income inequality or average income inequality. Finally, results vary a lot across regions (Alois 2014).

Gini coefficient is one of the measures of inequality of household. It is derived from Lorenz curve which plots the proportion of the total income of the population that is cumulatively earned by the bottom of the population. 0 means perfect equality in a society and 1 perfect inequality. For OECD countries, in the late 20th century, considering the effect of taxes and transfer payments, the income Gini coefficient was ranged between 0.24 and 0.49.

2.1.1.6. Confidence in National Government

Trust in national government and authorities seems to be one of the fundamental elements of well-functioning society. Their contribution to sustainable growth of well-being is important. Also, according to Gross National Happiness index first developed in Bhutan, trust in national government is the key-element necessary for citizens' happiness. Good governance is not only important for high level of life satisfaction but also for lower inequality among citizens. The relation between good governance and inequality of happiness is not linear but it is bell shaped. Inequality of happiness among people tends to be the highest when there is a medium quality of government. Considering both extremes of quality and confidence in government, the inequalities among society are smaller or inconsiderable (Ott 2010).

People give less importance to the confidence of their authorities when evaluating the sources of happiness. It contributes to the whole life satisfaction less than other determinants. However, when comparing the index of life satisfaction in different countries, it is evident that countries with well-functioning, stable and credible government attaint higher level of

happiness. Thus, institutional factors, political freedom and confidence in national authorities have an impact on happiness (Helliwell, Barrington-Leigh 2010).During the years 1970 – 2005, there was an important decline in trust in national government in the United States but also in the member states of the European Union. However, the happiness level remained almost the same with slow decreasing trend in the United Stated and mixed trends which cannot be generalized in the European Union (Veenhoven 1991). Baltatescu claimed that the individual level of life satisfaction is not highly correlated with the trust in national government. Their correlation was only 0.15. On the contrary, at the aggregate level, a significant positive correlation between these two variables was observed. Furthermore, correlation at cross-national level tends to increase with time (Baltatescu 2005).

2.1.1.7. Immigration Inflow

There have been many studies which concluded that life satisfaction of migrants increase with migration to peace countries of their choice however their life satisfaction was still lower in comparison with residents. But the relation between number of migrants and happiness of residents has not been studied sufficiently. One study focused on the relation between immigration inflow and subjective well-being of native-born population during the years 2002 – 2010. It concluded that only large immigration inflow affects the native population significantly. Effect of this inflow is influenced by extent to which migrants try to assimilate with new culture and rules but also by their education, skills and willingness to work (Betz, Simpson 2013). Generally, immigration has small impact on resident's happiness. It brings overall advantages to a country, such as increasing factors of production, relative low prices of goods produced by migrants, increasing labor market efficiency and higher economic growth. On the other hand, social expenditures increase, unemployment can rise, wages at equilibrium can fall and level of crime usually increases. Also, another research showed the impact of immigration inflow on German natives. It demonstrated a positive significant relation between the amount of assimilated migrants and happiness of natives. On the contrary, no effect was found between not very assimilated migrants and life satisfaction of natives (Akay, Constant, Guilietti 2012). Of course, we should take into account that this study was conducted before one of the biggest migration crises which started in 2015 and affected Germany enormously. Also, there was another study covering this topic. It examined evolution of relation between migrants from Mexico to United States and natives Americans in twentieth century. Low-skilled workers with low education had a negative effect on well-being on this type of American workers. But there was a positive effect caused by these migrants on happiness of highly-skilled

people (Borjas, Katz 2005). To sum up, there is an ambiguous effect of immigration on native-born citizens and it is influenced by a large variety of circumstances.

2.1.2. Unusual Macroeconomics Determinants

2.1.2.1. Percentage of Women in Parliament

To achieve full gender equality, nations decided that the number of women in representative institutions should be comparable to that of men. Depending on the individual situation in different countries, the parity may be imposed in parliament. The percentage of women in parliament can be a good measure of gender equality in a particular country and it can have an impact on overall happiness. The research *Women in Political Positions and Countries'Level of Happiness* showed that countries with higher women representation in leader posts in politics have higher level of happiness (Kabene, Baadel, Jiwani, Lobo 2017). Furthermore, the study conducted by Helliwel discovered that the higher the Gender Inequality Index, the lower the happiness within a country (Helliwell, Huang, Wang 2014).

In the 1970's in America, women were generally happier than men. Then, overall women's happiness tended to decline during 1970 – 1990. Stevenson and Wolfers analyzed the situation in years 1970 – 2005 and discovered the "paradox of declining female happiness" despite the fact that during this period, there were many positive changes in women's rights and financial control.

However, all developed countries continue to neglect former inequality between genders. Results of studies done by Kabene et al. showed that countries where women have a large representation in parliament and other political authorities have lower amount of corruption and gender equality has an positive impact on overall happiness.

2.2. Microeconomic Determinants

2.2.1. Standard Microeconomic Determinants

2.2.1.1. Income

In our society, the sentence "Money cannot buy happiness" is pronounced very often. But is it really true? Economic researches could not agree with this statement. Statistically, household income is highly correlated to both emotional well-being and evaluation of our lives. Various studies pointed out to the fact that money buys happiness but not all the people agree with this statement (Aknin, Norton, Dunn 2009; Frey, Stutzer 2000). Money allows people to

purchase what they desire so then, theoretically, they should become happier. On the contrary, many things that we value the most in our lives cannot be bought. Money allows people to live longer, healthier, to have more active life with many adventures, travelling and experiences according to their wishes. They can spend their leisure time as they want and spend money on their sources of happiness (Anand, Hunter, Smith 2005).

Other studies concluded that the relative income compared to our relatives matters as well (Dorn, Fischer, Kirchgässner, Sousa-Poza 2007; Ferrer-i-Carbonell 2005). It means that happiness increases if a salary of a particular person increases. However, if a salary of an individual's relative rises as well, his or her relative income does not change and the individual does not become happier.

Majority of researches agree that there is a positive relation between happiness and income but this effect has diminishing marginal utility. Improvement of life satisfaction caused by an additional unit of income falls as income rises.

Deaton won Nobel Prize in 2015 for Economics with the help of psychologist Kahneman. He showed that income and happiness are positively correlated but only up to the salary of 75, 000$ per year based on Gallup and Healthways. Interpretation is quite logical. People earning low salary worry about existential problems such as not enough food or not enough money to cover their rent. These problems will disappear with higher salary, they will have less stress and so there will be a higher level of life satisfaction. This study evaluated subjective emotional well-being in previous days, not overall happiness so results can be a little bit different when evaluating whole happiness.

Kahneman and Tversky won Nobel Prize for Economics in 2002 for their Prospect Theory which says that a particular amount of money does not necessarily determine happiness but significant changes in an amount of money a person usually owns or gets determine the happiness.

Dun added that investing money in helping others creates more happiness than spending it on his or her own interests and this type of life satisfaction is long-term life satisfaction (Dunn, Aknin, Norton 2008)

Finally, money can buy happiness if it is spent correctly. It means that it is spent on improvement of our personality, our skills and desires. It should be used to help others,

purchasing things that would bring a long-term satisfaction and to buy rather experiences than material things.

2.2.1.2. Social Support

On average, people who feel that their family and friends are supportive have a greater level of life satisfaction in comparison with those who are doubtful about their social network and feel lonely. As human beings are social creatures, interaction between people and willingness to help the others when being in a difficult situation is important to live happily. Chan worked on the data from Beijing and Hong-Kong and found that the personal network size and especially its quality and perceived social support determine happiness more than education, for example (Chan, Lee 2006)

It has been proven that the structure of the support network of women differs from that of men. Women in general need closer social networking to increase their life satisfaction. On the contrary, the network structure of men is obviously limited and they have generally one close person who supports them mostly. Leavy showed that women report more sources of their social support (Leavy 1983). WanYoung studied the relation between the quality of social support and the life satisfaction for people with long-term mental illness (WanYoung 2006). Results confirmed that also for people in difficult mental situation, a supportive family and a good staff are crucial for improvement of their happiness. Aquino examined data of people aged between 65 and 97 years in order to investigate the role of social help in their health and thus in their life satisfaction. He found out that greater social support perceived was directly related to higher level of happiness (Aquino 1996).

To sum up, life would not be very happy without people which we can count on and who are able to provide us with sufficient social support and help.

2.2.1.3. Degree of Corruption

The presence of corruption in national authorities and in the whole politic and financial system is the key indicator of government quality and thus it has a direct impact on personal well-being. It decreases confidence in national authorities and lowers life satisfaction of citizens. People with higher level of happiness were those living in countries with well-performing government and low degree of corruption. Also, happiness of people is higher when party of their choice is in power. Welsch examined that corruption has a negative influence on GDP per capita, the important determinant of life satisfaction. Furthermore, corruption has not

only indirect effect on happiness through GDP per capita but also through nonmaterial factors (Welsch 2011). And Veenhoven concluded that corruption lowers happiness everywhere, on national level and also on individual level (Veenhoven 2010).

2.2.1.4. Degree of Freedom

Many people argue that possibility of free choice is important for personal development and happiness. Listening to our inner voice and trusting our choices lead to a life of happiness. The Athenian historian Thucydides said that the secret of the happiness is freedom. Veenhoven published his studies based on data of 46 countries. He showed that freedom can have various forms. Negative freedom means that the freedom form constraints. And positive freedom means the liberty to do something. Both of them are conceived to be a chance to do something without significant restrictions. The first analysis concluded that freedom and happiness are positively correlated. But later, taking into account different forms of freedom and different circumstances, he claimed that this effect is ambiguous and large amount of liberty can have harmful consequences. Freedom has a positive effect on happiness in rich nations. On the contrary, the opportunity for free trade is positively correlated with happiness in poor nations (Veenhoven 1991). Inglehart and the others examined that in recent decades, there has been a process of democratization especially in the Eastern Europe. In 1989, these countries quit the former Soviet Block and joined the European Union, the union based on freedom of movement, capital, people and goods. That means people received a possibility to choose and purchase what they desire, travel and work abroad and the degree of liberty has risen enormously. Also, the growth in life satisfaction was observed. In 1990 only 9% of inhabitants aged between 15 and 24 years answered “very happy”. In 2000 this number doubled. Moreover, the same effect was observed in the case of older inhabitants. Inglehart and the others showed that since 1981, there was a fast economic growth and democratization accompanied by increasing of social tolerance and improvement in life satisfaction. Thus human liberty, possibility to make choices, possibility to behave without unreasoning restrictions and possibility to express our ideas or to desire is inextricably connected with overall happiness (Inglehart, Foa, Peterson, Welzel 2008).

2.2.1.5. Health

Everyone agrees that healthy life and happy life go hand in hand. It seems that health increases our life satisfaction and improves the length of our lives but on the other hand, happiness, inner equilibrium and no stress have a positive impact on our health. Studies confirmed the existence of strong dependence between health and subjective well-being. Many

of them showed that mental health contributes more to happiness in comparison with physical health. However, some variations can be caused by the fact that mental health is indispensable for high level of happiness. Shields and Price showed that some specific health problems such as heart attacks and strokes have a significant negative effect on happiness (Shields, Price 2005).

People with serious health disabilities can adapt to their problems. The results of a study showed that as a length of illness increases, there is a reduction of negative impact of this illness on the life satisfaction. Even after one year with some specific health disability, people are more adapted and they do not allow their illness to reduce their life satisfaction in a large extent (Bavetta, Navarra, Maimone 2014). Also Gerdtham and Johannesson confirmed a strong positive relation between health and happiness based on Swedish data (Gerdtham, Johannesson 2001).

Other interesting results concluded by Palmore and Luikart say that the subjective evaluation of health status has a stronger influence on happiness than the one, medically observed by a physician (Palmore, Luikart 1972). These findings are similar to those in life satisfaction study among older people (Maddox 1962). He also claimed that more important determinant of happiness is the person's own perception of his health rather than the physician's view. All of these studies confirmed the importance of subjective evaluation and positive mind.

An interesting study was conducted by Parkerson who studied the relation between health status and life satisfaction among first year Duke University medical students. He observed the decline of both of these variables during the year. Students with less symptoms of depression, anxiety, better physical, mental and social health were very satisfied (Parkerson, Broadhead, Tse 1990).

The study *Common chronic health problems and life satisfaction among Macau elderly people* compared life satisfaction among Macau elderly people. It dealt with the healthy individuals and with those chronically mentally ill. People with the lowest life satisfaction were those with serious mentally related chronic illness (Hu, Lei, Chao, Hall, Chung 2016).

Moreover, not only actual health status determines happiness but also the extent to which the country cares about their citizen's health. This can be captured by health care expenditures. Relation between these expenditures and life satisfaction seems to be positive. It has been proven that losing health care does not cause only lower physical health but also it

damages life satisfaction. People who do not have health care coverage scored 16 % lower in life satisfaction in research done in California (Clarke, Harris, Zweifler, Lasher, Mortimer, Hughes 2016). Authors of this study think that people underestimate effect of health care on happiness. Even this effect is lower than that of social support or poverty, it is still relevant. Blanchflower examined the relation between health care coverage and life satisfaction. He concluded that inability to see a physician when it is needed has a significant negative impact on happiness even for people with high income but the lack of insurance was not significant in this study (Blanchflower 2009).

2.2.1.6. Degree of Generosity

It has been already mentioned that spending money on the others increases happiness more than spending it on needs of an individual. Thus generous behavior is strongly connected to higher levels of happiness. The recent study *A neural link between generosity and happiness* confirms this idea. It revealed a neurobiological reason why people are happy after being generous. Researchers compared individuals divided into two groups. The first has spent money on themselves and the second on other people. They concluded that participants who made more generous choices and decided to donate money or purchase something which would help the others, reported a higher level of life satisfaction. They came to a conclusion that generous behavior is driven by positive emotions with cause increase in life satisfaction (Park, Kahnt, Dogan, Strang, Fehr, Tobler 2017).

2.2.1.7. Education

There have been different studies investigating the relation between the level of educational attainment and life satisfaction. However, the results differ. Blanchflower and Oswald found a positive relation between each additional level of education and happiness (Blanchflower, Oswald 2000). Stutzer disagrees with their results and showes that people who report the highest level of life satisfaction are those who have attained medium level of education (Frey, Stutzer 2002). Fahey and Smyth and also Ferrer-I-Carbonell stated that education has a large impact on happiness especially in low income countries. As education is positively correlated with income and health, if these two variables are excluded from the econometric model, there can be a possibility of existence of positive bias in the effect of education on happiness (Fahey, Smyth 2004; Ferrer-i-Carbonell 2005).

But not every scientist agrees with the positive correlation between these two variables. Brown stated that low educational level is related to mental illness and she wanted to prove that

with increasing education, this mental well-being, defined as capability to feel happy and content with life more than others, will increase. On the contrary, she concluded that there is no link between higher education and improvement of life satisfaction (Brown 2015). The other arguments of scientists who disagree with positive correlation between these two variables are that education tends to raise the aspiration level. People with higher education are more stressed when they have troubles in finding the employment (Clark, Oswald 1996). Higher education also raises job expectations and difficulties to find an appropriate job. Over-education lowers happiness also because it causes frustration. It is characterized by inefficiency and waste of resources needed to attain this level of education. Moreover, the differences in salary rates increase very fast with increasing income, so there can be larger difference among people with high education and high income. And returns on education are higher if the access to education is rather restricted.

Proponents of the positive correlation between happiness and education claim that positive effect of higher education is incomparably more important than effects causing negative correlation. Spanish researches studied the impact of education on happiness in Spain. They found two forms of effects. The first affects happiness through income and labor status. People with higher education earn more in average and can find job more easily. The second, after controlling the income, labor and other variables, shows that education increases self-esteem, autonomy and self-confidence. It contributes to greater social network as well which is important in professional career and also is one of the determinants of happiness (Cuñado, Gracia 2012).

2.2.1.8. Pollution of Environment

Different form of pollution can have a strong negative effect on overall happiness. Naturally, people care about place where they live and their environment is an important part of their lives. Recent study stated that pollution from traffic can have a comparable bad effect on our lives as divorce or another difficult social situation. Presence of nitrogen dioxide is strongly correlated to happiness and it has identical harmful effects on well-being as the half effect of being unemployed (Johnston 2017). Zhang and the others studied the impact of air quality on subjective well-being in China. They founded that local air quality and weather conditions are negatively correlated to short-term happiness or to current mood. However, the whole life satisfaction was not influenced by the current air quality (Zhang, Zhang, Chen 2017). Luechinger analyzed the data from Germany and concluded that sulfur dioxide and nitrogen

dioxide harm subjective well-being because they have negative impact on health and also they create negative emotions (Luechinger 2009). Another research was conducted on cross-national data in order to calculate how people make decisions about trade-off between prosperity and pollution of environment (Welsch 2002). Happiness was examined as function of air pollution and current weather. People who were in cities with worse air pollution reported lower levels of their happiness (Levinson 2012).

2.2.1.9. Children

The effect of fertility on happiness is not at all straightforward. Having a child increases joy and contentment, strengthens relations in family, creates new roles for parents but it also requires much time, sacrifice of parents, it is expensive and it can have harmful effect on the relationship between parents. Having a child changes almost everything in comparison with previous life of parents. It is not possible to say if this effect is positive or negative; it depends on the parents' attitude. It has been found that men and women perceive parenthood in different ways. As women are more occupied with child, they are more stressed and have less time for themselves in comparison with men. Women thus experience negative shock to subjective well-being (Cowan, Heming, Garrett, Coysh, Curtis-boles, Boles 1985). On the other hand, they are able to feel higher emotional connection to child.

Moreover, relation between fertility and happiness depends on the age of parents. Young parents usually report higher level of distress in first moments of parenthood (Cleary, Mechanic 1983). On the other hand, there were not found any relations between fertility and happiness while analyzing data of older people (Connidis, McMullin 1993). Furthermore, high variation between cultures was found. In United Stated and Canada, a negative or very low positive relation was reported (Connidis, McMullin 1993). In European countries, there were no significant relations between fertility and happiness (Bergman, Daukantaite 2006). Finally, results suggest that a child is a long-term investment influencing the happiness of parents in both directions. However, there is a high importance of various circumstances which affect the ways in which fertility influence happiness of parents.

Both positive and negative effects are more present among people having children. People who want to live with children have lower life satisfaction if they are unable to be parents. And those who do not want to be parents are less happy if by mischance they become parents. A significant negative correlation between total fertility rate and the difference between people who do and who do not want to have children which is not consistent with hypothesis

that fertility is higher in places where people get the largest increases in life satisfaction from having children. Scientists agree that the effect of having children on life satisfaction is not well defined and people choose to become parents according to their preferences and in order to maximize their life satisfaction. In some poor countries, people have children even if they will lower their happiness (Deaton, Stone 2014).

2.2.2. Unusual Microeconomic Determinants

2.2.2.1. Number of Language Spoken

Knowledge of foreign languages has a shaping effect on thinking. And also wisdom, creativity and clarity of mind seem to have a positive effect on happiness (Pereltsvaig 2011). People who study foreign languages are usually future-oriented, they care about their professional carrier and they try to increase chances to being employed. Obviously, the higher average number of languages spoken is related to developed countries with quite high growth where intelligence and knowledge matters a lot. Moreover, knowledge of other languages makes the boundaries between the people disappear. People are able to communicate with foreigners, they are less afraid of travelling and they can understand others cultures better. All this can create positive emotions what increases happiness. There have not been many studies investigating this relation so far.

2.2.2.2. Degree of Tourism

Tourism contributes to our happiness in various ways. First, people who travel and who are interested in tourism can have higher level of life satisfaction. Tourism and travelling is a good component of leisure time, it strengthens relations with others, creates memories, it has a positive impact on both, mental and physical health (Kirillova, Wang, Lehto 2018).

A positive correlation between happiness and social tourism has been showed. Social tourists are those who have received money to make a holiday and who cannot afford to travel without this financial help. These tourists reported an increase in their happiness and thus social tourism contributes to quality of life (McCabe, Johnson 2013). On the other hand, tourism and happiness are related but it is just short-term effect. Long-term effect of tourism does not exist and happiness is not related to frequency and duration of holidays (Westerhof, Keyes 2010).

The second shows how tourism contributes to subjective well-being of residents. Tourist arrivals may reduce life satisfaction of residents especially in countries with excessive and fast-growing tourism but also in rural areas where inhabitants are not used to receive masses of

tourists. Tourists affect economic, social, cultural and environmental conditions of given local area in positive but also in negative way (Kim, Uysal, Sirgy 2013). Excessive tourism has harmful effects on pollution, relations and cultural differences between tourists and residents; it increases cost of living and crime level. On the other hand, for many countries tourism is the biggest source of income and they would not be able to survive without tourism. There is also a positive correlation between perceived amount of tourist's arrivals and happiness. People sharing opinion that tourism has many advantages for their lives reported higher level of life satisfaction (Woo, Kim, Uysal 2015). However, life satisfaction decreases with tourist's arrivals at fast-increasing rates. The estimate of this effect is a half effect of losing a partner. And finally, countries where tourism does not take place so much do not experience changes in life satisfaction (Nawijn, Mitas 2012).

2.2.2.3. Degree of Poverty and Social Exclusion

Naturally, it is clear that relation between poverty, social exclusion and happiness is strongly negative. Individual deprivation and social exclusion contributes to sadness and thus to lower reported level of happiness. Poverty reduces well-being in various ways. It is a source of inequalities among people. Poor people are more likely to feel this inequality and quality of their lives seems to be lower in comparison with that of rich people. As we discussed earlier, low income has a negative impact on life satisfaction. And it is a source of stress caused by inability to pay debts, rents and cover all other necessary expenditures. The study of Amato confirms these statements and adds that well-being of very poor individuals is higher in rural areas than in urban areas. It means that also a relative poverty matters. Poor people comparing themselves with richer people in urban areas perceive their situation more difficult and unequal and report lower life satisfaction level (Amato, Zuo 1992). The research from Turkey claims that there were high rates of unemployment and poverty and not very high level of happiness. This can be the cause of social exclusion. Poor and not very happy Turks were more likely to feel excluded from society (Bayram, Aytac, Aytac, Sam, Bilgel 2012). On the other hand, the study based on a sample of children aged between 10 and 15 years showed that their life satisfaction was not related to income of parents and happiness did not fall with poverty. They tended to be less influenced by material deprivation (Knies 2012). Finally, socially excluded people and people under poverty line have negative emotions and lower level of life satisfaction more often.

3. Data

To be able to make an appropriate and reasonable conclusion, it is important to conduct our analysis on carefully prepared and organized data. Two subcategories of dataset will appear. Firstly, we will use less detailed data for almost the whole world and then detailed European data that will help us to understand which unusual determinants of happiness exist. Both of these datasets consist of panel data. Panel data are multi-dimensional data containing observation over multiple time periods and multiple countries. The number of time periods is incomparably lower than that of countries. With the use of panel data, analysis becomes much more complex and authentic.

3.1. Description of Dataset

In both analyses, data collected mainly by Gallup World Poll in more than 150 countries representing more than 98 % of world's population for years 2008 – 2015 with high availability of observations will be used. In the second part of this analysis, these data will be filtered in order to have just European countries and they will be combined by additional data collected by Eurostat in OECD countries for years 2010 – 2015.

We do not have individual microeconomic data, but our data are aggregated measures. So we will not use classical microeconomics and macroeconomics explanatory variables used in majority of similar studies like age, marital status or sex. We are interested in some unusual explanatory variables which can influence average subjective well-being of given countries.

Gallup World Poll research initiatives usually use The Cantril Self-Anchoring Striving Scale developed by pioneering social researcher Dr. Hadley Cantril (Cantril 1966). It consists of this question: "Please imagine a ladder with steps numbered from zero at the bottom to 10 at the top. The top of the ladder represents the best possible life for you and the bottom of the ladder represents the worst possible life for you. On which step of the ladder would you say you personally feel you stand at this time? On which step do you think you will stand about five years from now?" It contains present ladder but also the future ladder. The fact that Cantril ladder is used in variety of researches almost everywhere confirm the idea that it is empirically and conceptually appropriate. Cantril ladder is often used to categorize different properties. By grouping the responses, we can have another idea about the data. Regarding this subjective well-being dataset, we have three categories of quality of life. The first is thriving. Well-being of these individual is strong, consistent and progressing. These respondents have positive views of their present life situation. Their Cantril ladder is above seven. They report significantly

fewer health problems, fewer sick days, less worry, stress, sadness, anger, and more happiness, enjoyment and other positive emotions. The second category is struggling. Well-being of these individual is moderate. These respondents have moderate views of their present life situation. They are either struggling now or they expect to struggle in the future. They report daily stress and worry about money more than the thriving respondents, and more than double the amount of sick days. They are more likely to smoke, and are less likely to eat healthy. Their Cantril ladder is between four and seven. The last category is suffering .Well-being of these individuals is poor. These respondents have low ratings of their current life situation and also negative views of the next years. They are more likely to report the lack of the basic food, more likely to have physical pain, a lot of stress, worry, sadness and anger. They have less access to health insurance and care and they are worry about their health.

3.1.1. Dependent Variables

3.1.1.1. Life Ladder

The dependent variable used in the majority of econometric model will be happiness score of life satisfaction. It was done by Gallup World Poll the 23-th December 2016 and covers the years 2005 – 2016. However, some observations are not available. It is the average national answer to question "Please imagine a ladder, with steps numbered from 0 at the bottom to 10 at the top. The top of the ladder represents the best possible life for you and the bottom of the ladder represents the worst possible life for you. On which step of the ladder would you say you personally feel you stand at this time?" This measure is called *ladder, life ladder* or *life satisfaction.*

3.1.1.2. Positive Affect

Positive affect is defined as the average of three positive affect measures in Gallup World Poll. Those sentiments are happiness, laugh and enjoyment in the Gallup World Poll. These measures are the answers to three questions: "Did you experience the following feelings yesterday? How about Happiness?", "Did you smile or laugh a lot yesterday?", and "Did you experience the following feelings during yesterday? How about enjoyment?" The responses are in the range between 0 and 1, with 0 meaning that these emotions were not present at all.

3.1.1.3. Negative Affect

Negative affect is defined as the average of three negative affect measures in Gallup World Poll. They are worry, sadness and anger. Questions were "Did you experience the

following feelings during yesterday? How about Worry?", "Did you experience the following feelings during yesterday? How about Sadness?", and "Did you experience the following feelings during yesterday? How about Anger?" The range of the answer is between 0 and 1 and 0 means that individual does not experience these feelings.

3.1.2. Independent Variables

We will use two categories of independent variables. The first are macro-based and the second are micro-based variables.

3.1.2.1. Independent variable in data for whole world

Variable *log GDP per capita* is the statistics of GDP per capita in purchasing power parity at constant 2011 international dollar prices are from the August 10th, 2016. They were released by the World Development Indicators. Variable *social support* expresses the situation of having someone to count on, it is the national average of the binary responses to the Gallup World Poll question: "If you were in trouble, do you have relatives or friends you can count on to help you whenever you need them, or not?" The time series of *healthy life expectancy at birth* are based on data from the World Health Organization, the World Development Indicators and statistics published in journal articles. Healthy life expectancy at birth is the average of all responses to question about person's perception of healthy years. *Freedom to make life choices* is the national average of responses to the Gallup World Poll question "Are you satisfied or dissatisfied with your freedom to choose what you do with your life?" The range of the answers is between 0 and 1, where 1 means the full freedom. *Generosity* is the residual of regressing national average of response to the Gallup World Poll question "Have you donated money to a charity in the past month?" on GDP per capita. Here the values can be positive but also negative.

Variable *perception of corruption* is the measure is the national average of the survey responses to two questions in the Gallup World Poll: "Is corruption widespread throughout the government or not" and "Is corruption widespread within businesses or not?" The overall perception is just the average of the two responses which are either 0 or 1. In case the perception of government corruption is missing, the perception of business corruption is used as the overall perception. The corruption perception at the national level is just the average response of the overall perception at the individual level. The range of these values are between 0 and 1, where 0 means absence of corruption. *Confidence in national government* is the average of the survey responses from the Gallup World Poll. The question is "Do you have confidence in each of the following, or not? How about the national government? "The range of these values is between

0 and 1, where 0 means no confidence in national government. *Democratic quality* measures of governance are based on Worldwide Governance Indicators project. The original data had two dimensions: Voice and Accountability, Political Stability and Absence of Violence. The indicators are on a scale with the mean of zero and a standard deviation of one. Number of dimension is reduced to two, using the simple average of these two measures. *Delivery quality* measures of governance are based on Worldwide Governance Indicators project. The original data had four dimensions: Government Effectiveness, Regulatory Quality, Rule of Law and Control of Corruption. The indicators are on a scale roughly with the mean of zero and a standard deviation of one. Number of dimension is reduced to two using the simple average of these four measures. *GINI coefficient* is the average of GINI coefficients measured by Gallup World Poll. Range of this coefficient is between 0 and 1, where 1 means the perfect inequality of household income.

3.1.2.2. Additional Independent Variables in European Data

Number of languages spoken is the average of self-reported number of foreign languages spoken. These data were collected by Eurostat in a sample of people with finished upper secondary education. *Fertility* measures amount of newborns in a particular country. These data were also collected and organized by Eurostat. The variable *health care expenditures* indicates the amount of money that a country investigates in health care. All providers of health care such as hospitals, mental health hospitals and other specialized hospitals are included. The numbers are in million Euro and Eurostat collected these data. The variable *education* expresses how many people aged from 15 to 64 years have finished tertiary education (ISCED level 5-8). It is expressed in percentage of the whole population and collected by Eurostat. The variable *pollution* expresses the quantity of carbon dioxide emission in the air from all sectors, such as agriculture, mining, manufacturing, transportation. It is expressed in tones of carbon dioxide which is the most important air pollutant. This data survey was conducted by Eurostat. *Inflation* is the variable measured by Harmonized index of consumer prices in which the benchmark is the price in the year 2015. These data are measured annually and inflation is calculated as annual average rate of change by Eurostat.

The variable *mortality* measures the annual amount of departed in the countries. The variable *net fertility* measures the difference between fertility and mortality in particular year and country. Usually, it is positive. The variable *tourism* indicates the number of nights spent by non-resident in a particular country. These data were collected by Eurostat. The variable

poverty measures how many people are affected by poverty and social exclusion in cities in a particular country. These numbers are expressed in percentage and collected by Eurostat. The variable *female share in parliament* shows the percentage of females in national parliament. Eurostat conducted this survey. The variable *social expenditures* measures all social expenditures in a country. Numbers are in millions Euro and they were collected by Eurostat. The variable *population* express total population measured on January 1st of particular year by Eurostat.

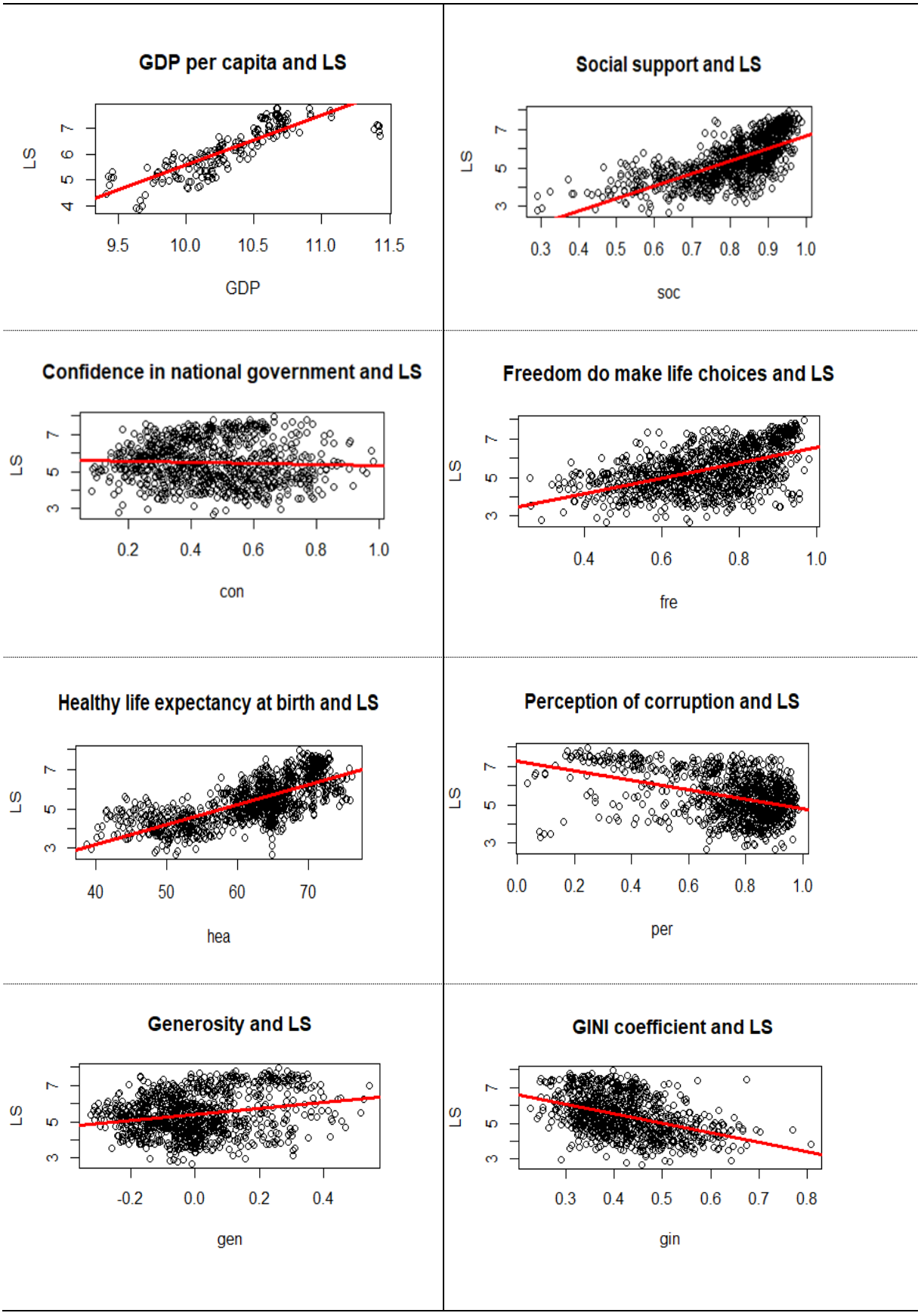
The variable *immigration per capita* measures immigration inflow per 1,000 inhabitants in a country, i.e. how many migrants live in a sample of 1,000 of residents. The variable *tourism per capita* indicates the inflow of foreign tourists in a country per inhabitant. The variable *health care expenditures per capita* expresses the amount of finances dedicated to health care for an inhabitant. It is expressed in 1,000 Euro. The variable *social care expenditures per capita* expresses the amount of money dedicated to social care for one inhabitant. It is also expressed in 1,000 Euro. *Sea* is a dummy variable which represents the fact of country having access to sea (1) or not (0). *Post-communist* is a dummy variable which represents the fact of country being a part of the Soviet Union before the year 1969 (1) or not (0). *OECD* is a dummy variable which represents the fact of country being a part of Organization for Economic Co-operation and Development (1) or not (0).

3.2. Exploring the Dataset

In order to make proper and correct analysis, we have to know how our data look like, which values they take and understand the logic behind correlation of our variables. We can see here descriptive statistics of each variable. Secondly, we can observe the relation between each of our independent variables and dependent variable life satisfaction. *Table 1* and *Graph 1* summarize data from almost the whole word.

acronyme	Name	min	1st quartile	median	mean	3rd quartile	max
LS	Life ladder	2.688	4.606	5.317	5.432	6.290	7.971
GDP	Log GDP per capita	6.355	8.336	9.358	9.201	10.143	11.806
Soc	Social support	0.2909	0.7476	0.8299	0.8077	0.902	0.9873
Hea	Healthy life at birth expectancy	37.7	57.09	63.92	62.13	67.96	76.04
Fre	Freedom to make life choices	0.2575	0.6201	0.7375	0.7193	0.8346	0.9799
Gen	Generosity	0.32517	0.11492	0.02341	0.00196	0.08691	0.54137
Per	Perception of corruption	0.0352	0.6942	0.8101	0.7541	0.8846	0.9833
Con	Confidence in national government	0.0843	0.3277	0.4543	0.4642	0.5404	0.9795
Del	Delivery quality	-2.1675	-0.72164	-0.22103	-0.0096	0.67197	2.14057
Gin	GINI coefficient	0.2261	0.3561	0.4067	0.4202	0.4748	0.8072
dem	Democracy quality	-2.07	-0.0863	-0.2671	-0.1601	0.58	1.53
Pa	Positive affect	0.3625	0.6182	0.7184	0.7084	0.8030	0.9436
Na	Negative affect	0.0843	0.19774	0.24874	0.25811	0.30600	0.70454

Table 1 - Summary of Variables – Dataset from the Whole World


GDP per capita and LS
LS
GDP
Social support and LS
LS
soc
Confidence in national government and LS
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Freedom do make life choices and LS
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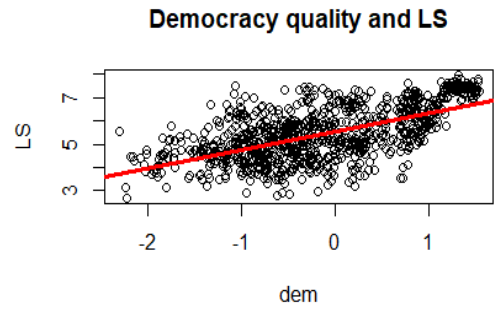


Graph 1 - Relations between Variables - Dataset from the Whole World

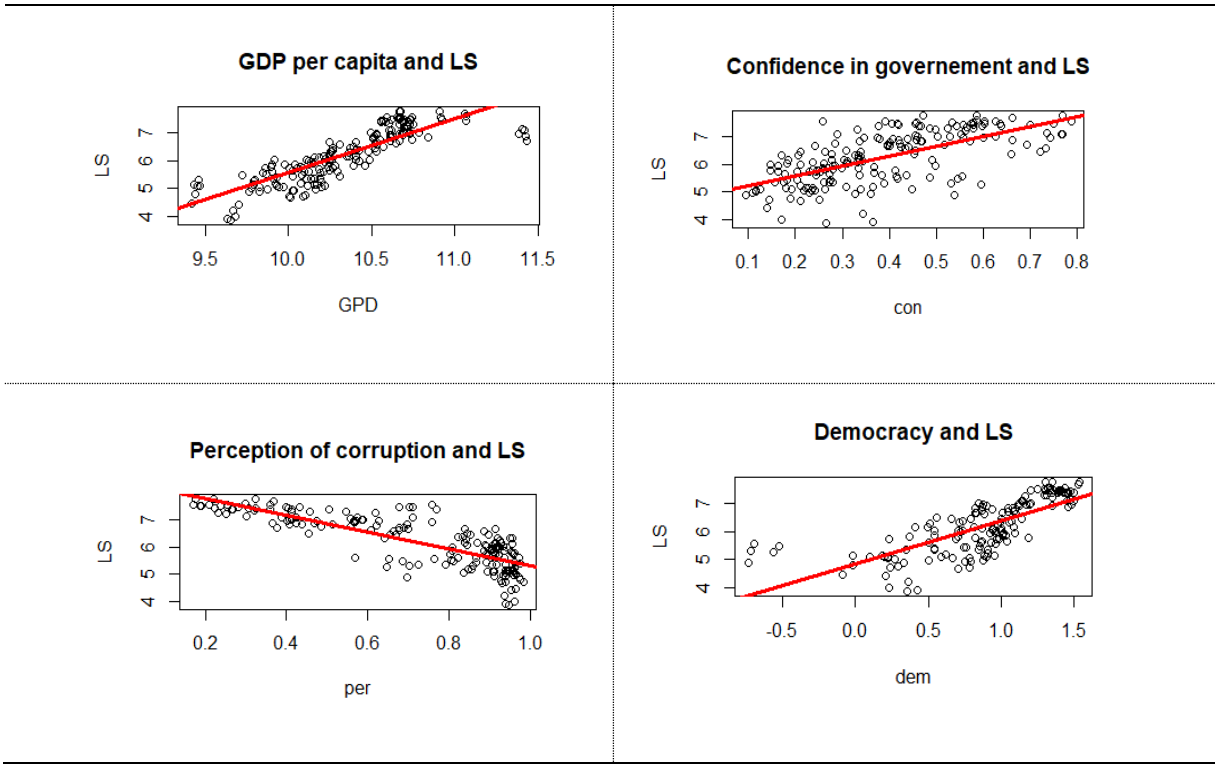
Secondly, in *Table 2* and *Graph 2*, we will observe information about detailed European dataset. We describe statistics of each independent variable and then its relation with dependent variable life satisfaction.

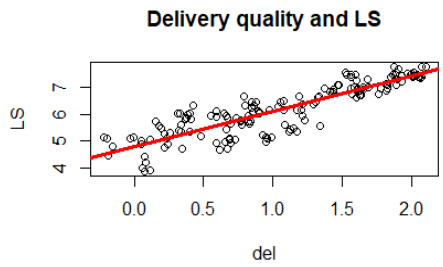
Acronym	Name of variable	Min	1st quartile	Median	Mean	3rd quartile	Max
LS	Life ladder	3.875	5.487	6.162	6.220	7.007	7.788
GDP	Log GDP per capita	9.417	10.077	10.303	10.340	10.655	11.430
soc	Social support	0.6457	0.8639	0.9139	0.8921	0.9376	0.9790
hea	Healthy life at birth expectancy	64.32	66.67	70.54	69.40	71.30	73.42
fre	Freedom to make life choices	0.3692	0.6311	0.8020	0.7632	0.9044	0.9618
gen	Generosity	-0.3251	-0.1455	-0.0413	-0.0060	0.1112	0.4008
per	Perception of corruption	0.1700	0.5120	0.8217	0.7124	0.9211	0.9833
con	Confidence in national governement	0.09385	0.25714	0.36487	0.38614	0.49930	0.78773
dem	Democracy quality	-0.7318	0.6699	0.9309	0.8658	1.1796	1.24

Acronym	Name of variable	Min	1st quartile	Median	Mean	3rd quartile	Max
del	Delivery quality	-0.2215	0.5946	1.0431	1.0644	1.40	2.1009
gin	GINI coefficient	0.2480	0.3261	0.3530	0.3572	0.3828	0.5561
Pa	Positive affect	0.4602	0.6421	0.7323	0.7171	0.7978	0.8997
Na	Negative affect	0.1452	0.2050	0.2453	0.2612	0.3025	0.4822
lan	Average number of language spoken	0.800	1.200	1.500	1.482	1.700	2.400
fer	Fertility	3898	41771	82367	214373	193103	1337504
heaexp	Health care expenditures (in millions euro)	961.6	3554.0	19224.6	56130.1	61631.1	338207
educ	Attainment of tertiary education, level 5 – 8 (in percentage)	10.50	18.10	26.60	25.11	31.55	39.60
pol	Pollution of dioxide carbone (in tones)	300952	19426054	48409473	11216827	1628603	703345995
im	Immigration inflow	2639	16643	56264	140372	150821	1864889
inf	Inflation (annual average rate of change)	-1.600	0.400	1.700	1.995	3.000	11.200
mor	Mortality	1955	41037	102400	178416	251439	925200
tou	Tourism (nights spent by non-residents)	1766627	5558339	12510794	40214906	6063551	269418103
pov	People of risk poverty or social exlusion (in cities, in percentage)	12.50	18.77	23.45	23.14	26.65	40.60
fem	Female share in parliament (percentage)	8.80	19.85	27.15	27.64	36.67	45.00

Acronym	Name of variable	Min	1st quartile	Median	Mean	3rd quartile	Max
socexp	Social expenditures (million euro)	1273	9056	46200	133932	116320	885437
pop	Population (January 1st)	319575	4289857	8451860	19214249	1994731	81802557
imperca	Immigration per capita (migrant per 1,000 inhabitants)	0.8955	4.60	7.3384	9.73	11.6	42.2820
touperca	Tourism per capita	0.1638	1.1855	1.33	3.21	4.1677	19.8956
Heaperca	Health care expenditures per capita (in 1,000 euro)	0.3799	1.1061	2.97	2.76	3.74	7.53

Table 1 - Summary of the Variables - European Dataset




Delivery quality and LS
LS
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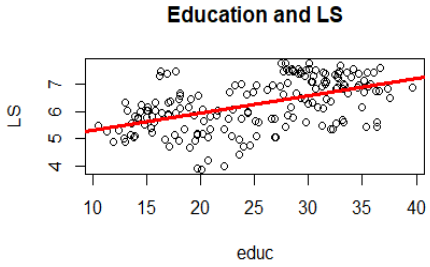
del


Education and LS
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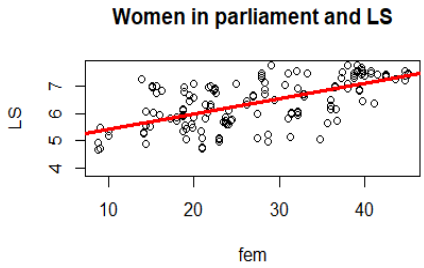
educ


Women in parliament and LS
LS
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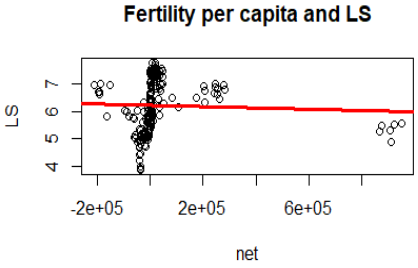
10 20 30 40
fem


Fertility per capita and LS
LS
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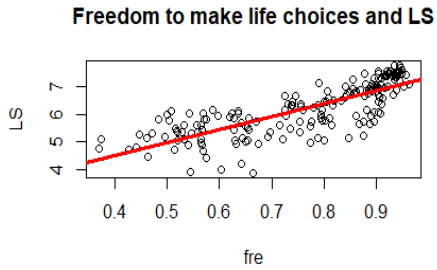
-2e+05 2e+05 6e+05
net


Freedom to make life choices and LS
LS
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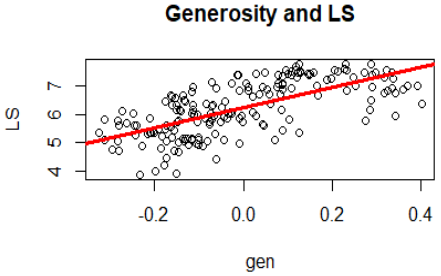
0.4 0.5 0.6 0.7 0.8 0.9
fre


Generosity and LS
LS
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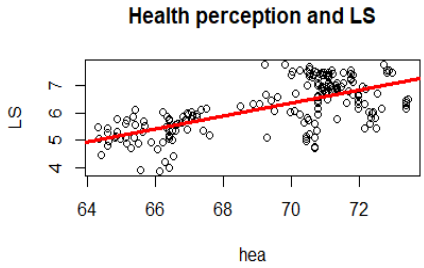
-0.2 0.0 0.2 0.4
gen


Health perception and LS
LS
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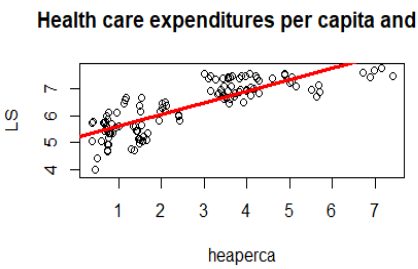
64 66 68 70 72
hea


Health care expenditures per capita and LS
LS
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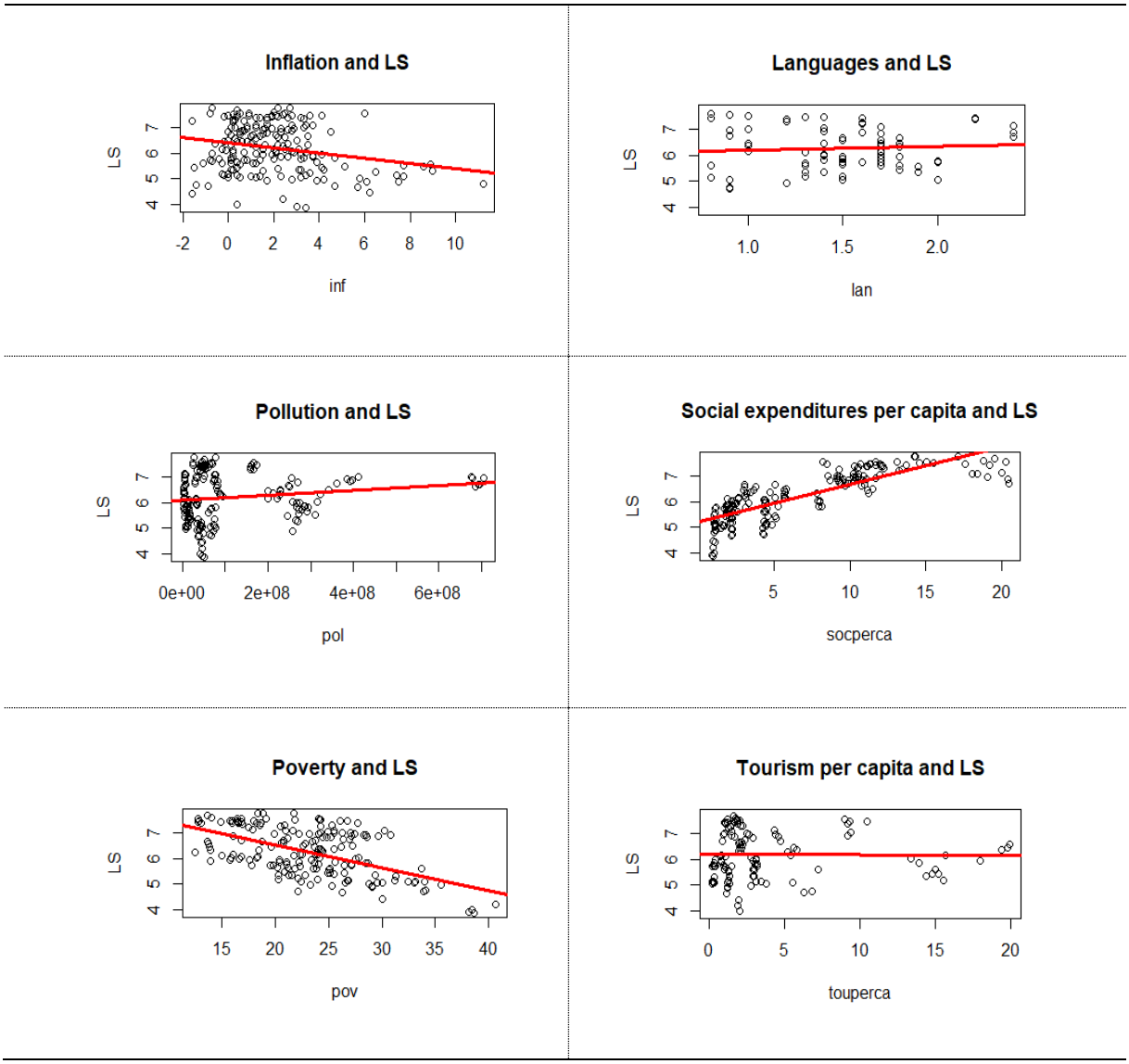
1 2 3 4 5 6 7
heaperca



Graph 2 - Relations between Variables - European Dataset

4. Methodology

To conduct correct analysis of our data and to make an appropriate conclusion, we have to understand the characteristics of life satisfaction data. As they are self-reported, the reality can be slightly different. Then, it is important to understand the structure of panel data and appropriate econometric methods and models. The most common type of model is the fixed effect model and the panel data model. Also, we will compare it with simple pooled ordinal least square model (OLS). And for dependent variable positive affect and negative affect taking values in unit interval, beta regression model will be also used.

4.1. Panel Data

Panel data or sometimes called longitudinal data are multi-dimensional data. These data are obtained for multiple time period and multiple entities, in our case countries. Panel data models provide information on individual behavior, both across countries and over time. The data have both cross-sectional and time-series dimensions. Panel data can be balanced when all considered countries are observed in all time periods or unbalanced when observations for some countries are missing in some time periods. There are some advantages that panel data analysis offers. They are useful to increase the sample size and thus we can obtain more precise estimators. Also, they can be used in order to investigate in the effect of time.

The standard panel model with i=1,…,N and t= 1,….,T is

$$y_{it} = \alpha + \beta\, \boldsymbol{x}_{it} + \varepsilon_{it} + a_i \qquad \varepsilon_{it} \sim N(0, \sigma^2)$$

$\boldsymbol{x}_{it}$ is a K-dimensional vector of explanatory variables,

y_{it} is the independent variable,

α is the intercept independent of *i* and *t*

β, a (K × 1) vector of the slopes independent of *i* and *t*

a_i is time-invariant, individual specific, unobserved effect on the level of y_{it}

ε_{it} is the error term which varies over *i* and *t*.

The error term is distributed normally and independently with the zero mean and constant variance σ^2. It is called idiosyncratic error. a_i is also called unobserved heterogeneity or individual heterogeneity. It is a time-invariant characteristic of a country which does not

change over time. Due to its presence in whole error term in every time period, the errors are serially correlated.

4.2. Econometric Issues with Life Satisfaction

4.2.1. Reliability and Validity

Reliability refers to the repeatability of the same findings. The situation of high reliability is characterized by a possibility to find the same results on the study for the second time. And validity refers to the credibility or the believability of the research.

Considering an observed variable, *y*, which is a noisy measure of the variable of interest, *y**. We can write where y_i is the observed value for individual *i*. We want to observe variable *y** but we get variable *y*. E_i is the disturbance term which is uncorrelated with $y*_i$ and homoscedastic. If we can measure y_i at two points in time, the measurement errors are independent and if we have a constant variance over time, then the correlation between the two measures provides an estimate of the ratio of the variance in the signal to the total variance in y. We thus define the reliability ratio, r, as $r = Corr(y_i^1, y_i^2)$, where the superscripts refer to the periods 1 and 2. Under the assumptions stated, $plim\ r = \frac{\mathrm{Var}(y*)}{Var(y*)+Var(e)}$

Krueger and Schkade studied how persistent the responses about subjective well-being were. Both components of subjective well-being, life satisfaction and its affective part were serially correlated (0.60) with responses two weeks apart. This reliability is higher for education, income or other microeconomic variables (Krueger, Schkade 2008). Higher life satisfaction was correlated with the household income in 2011 more than twenty years ago. Also other variables such as confidence in government and relationships were more correlated with life satisfaction (Dabalen, Paul 2011).

Problems with reliability and validity can rise because of different reasons. Ordinality and subjectivity can be a possible disadvantage of happiness data. As a result, there can be difficulties in comparing individuals between them. For example, although an individual has 5 in life satisfaction, it does not necessarily mean that he or she is less happy than that with score 6. Furthermore, difference between 2 and 3 can be different from that between 9 and 10. On the contrary, Frey and Stutzer argued that relative level of happiness is important. So happiness in self-reported subjective data is an appropriate measure. These data can be treated as ordinal

data and there is no need to have cardinal data (Stutzer, Frey 2006). As not everybody answers to the question truly, there can be non-sampling bias created either consciously or not. Because of this bias which is an important factor in analyzing of subjective well-being data, data can suffer from the lack of validity (Bertrand, Mullainathan 2001). Chen and Spector showed that self-reported measures are a compilation of circumstances, aspiration and individual happiness perception. All these factors affect answer which may cause lower reliability (Chen, Spector 1999). Other researchers concluded that the ordinal data can negatively affect interpersonal comparison. However, if we compare groups it is not so likely to find systematic differential reporting biases (DiTella, MacCulloch, Oswald 2006).

Fortunately, with the use of standard methods for psychometric quality assessment, estimating happiness function provides a reliable and valid measures for measuring people's preferences and happiness (Van Hoorn 2016). Despite the fact that there are always some problems with reliability and validity, we can use happiness data to our analysis.

Finally, as we will use the aggregated data for the whole country and not for each individual living in this country, stability will be more significant and we can rely on these data (Clark, Avery 1976). Furthermore, the use of fixed effect model which will be explained later, will eliminate problems causing reliability and validity.

4.2.2. Unbalanced Panels

In a balanced panel, the number of time periods T is the same for all individuals *i*. However, usually in reality we are dealing with an unbalanced panel. In numerous cases, we found that we have missing observations. Either, these data were not available or individual did not want to answer. We should know the reason why is the observation missing. Provided the reason we have missing data for some *i* is not correlated with disturbance u_{it}, unbalanced panel causes no problem. But if we have for example missing data of some countries because they disappear, we have a nonrandom sample. Fortunately, in our case, observation is missing because not every survey was done in all countries in our data sample. Thus, unbalanced panels do not cause bias.

4.2.3. Endogeneity

As we study panel data, we should be careful about endogeneity issues. Appleton and Song claimed that there were significant differences in studies witch used cross-sectional

happiness data and those which used panel data. In the second, there was often unobservable heterogeneity across countries or years which could cause problems (Song, Appleton 2008)

In social sciences researches, we are often suspicious whether some explanatory variables are correlated with error term. It can arise if we omit some variable, due to the measurement error or simultaneous causality. The Hausmann test, sometimes called as test for model misspecification, detects endogeneity in regression and it helps us to decide between fixed effect model and random effect model.

As results may suffer from endogeneity due to the reverse causality, we will be careful in interpreting results. As we have already seen, for example, health affects happiness but also happiness affects health. So the positive correlation between two variables does not necessarily mean that explanatory variables influence happiness in that magnitude. To avoid significant error in our interpretation, we will use previous studies as an example.

4.2.4. Bias

Bias in answers about life satisfaction can result from unobserved personal traits and measurement errors. Respondents usually have less likely to be dishonest about their happiness in comparison with their income; they still may underestimate and overestimate their real and overall happiness (Graham 2012). Answers about happiness can be biased by strong cultural norms, if it is in national pride to be positive. An interesting example is that North Korea is the second happiest country in the world following China which is first. Not surprisingly, this survey was done by North Korea in 2015. The United States finished at the end of this survey (Brenhouse 2011). Using panel data allows to filter out the unobserved determinants constant over time, this removes bias and improves estimated coefficients from cross-sectional (Graham 2012). Paul and Ranzani concluded that questions of happiness should be asked as the first to minimize the bias (Ranzani, Paul 2008).

Despite all these possible problems, happiness data seem consistent and appropriate for further analysis.

4.3. Fixed Effect Models

Fixed effect model is one of the models used in panel data analysis. Due to the differences between panel data and cross-section data such as heterogeneity across time and

entities, simple ordinary least square model (OLS) will be biased. Fixed effects model is a statistical model representing the observed quantities in terms of explanatory variables that are treated as if the quantities were non-random. Time-invariant error a_i can be correlated with explanatory variables. Using the fitted value, we can write $\hat{a}_i = \hat{y}_i - \beta \hat{x}_i$ as the leftover variation in the dependent variable that cannot be explained by explanatory variables.

These models try to remove unobserved heterogeneity which is constant over time. So, it can be removed from the data through differencing, for example by using so called first difference model. It will remove all time-invariant components of the model. The first-difference estimator is obtained by running OLS estimation on following model which was obtained by subtracting equation in time 1 from that in time 1 and

$\Delta y_i = \beta \Delta x_i + \varepsilon_i$ where

$\Delta y_i = y_{it} - y_{i\,t-1}$ and $\Delta x_i = x_{it} - x_{i\,t-1}$

As a_i is constant across time, it was differentiated away. Under the assumption

$E[\varepsilon_{it} - \varepsilon_{i\,t-1} | x_{it} - x_{i\,t-1}]=0$, the first-difference estimator is unbiased and consistent.

An alternative to the first-difference method, which works better under certain

assumptions, it is called the fixed effects transformation. For each i, we will average this equation over time: $\overline{y_i} = \beta \overline{x_i} + a_i + \overline{\varepsilon_i}$ where $\overline{y_i} = \frac{\sum_{t=1}^{T} y_{it}}{T}$ similarly for $\overline{x_i}$ and for $\overline{\varepsilon_i}$.

Subtracting the averages from original equation, we will get time-demeaned data:

$\ddot{y}_{it} = \beta \ddot{x}_{it} + \ddot{\varepsilon}_{it}$ where $\ddot{y}_{it} = y_{it} - \overline{y_i}$ and similarly for $\ddot{x}_{it}$ and for $\ddot{\varepsilon}_{it}$. This fixed effects transformation is also called the within transformation. Unobserved effects a_i disappeared, so omitted variable bias is no longer a problem and we can use pooled OLS to this equation. Pooled OLS estimator using time-demeaned variables is called the fixed effects estimator, or the within estimator. It is important to note that the intercept is removed by fixed effect transformation (Baltagi 2008).

We also know a between estimator, which is obtained using the OLS estimation of $\overline{y_i} = \alpha + \beta \overline{x_i} + a_i + \overline{\varepsilon_i}$. We use time averages and then we can run a cross-sectional regression and OLS estimation. However, between estimator is biased when a_i is correlated with x_i.

It is not always easy to decide which fixed effect model should be used. Both time-demeaned and first-difference are the same for T=2. If ε_{it} are uncorrelated, fixed effect

transformation is more efficient than first-difference because first-difference will generate correlation between $\Delta\varepsilon_{it}$.

On the other hand, if ε_{it} are correlated, for example, they follow random walk then $\Delta\varepsilon_{it}$ will be uncorrelated and first-difference method will be more appropriate. In most data, $\Delta\varepsilon_{it}$ are slightly correlated but it is rare that they follow random walk. The best idea is always to compute both estimators and to compare them.

4.4. Random Effect Models

The random effect model also called the variance component model is an alternative to the fixed effect model. It means that we do not assume fixed effects and random effect model allows the individual effect. The most important assumption is that individual specific effects are uncorrelated with the explanatory variables. If this assumption is satisfied, the random effect model is more efficient than the fixed effect. Otherwise, the random effect is not more consistent and it is better to use the fixed effect which is less efficient but consistent.

So if in our regression

$$y_{it} = \alpha + \beta_1 x_{it1} + \cdots + \beta_k x_{itk} + a_i + \varepsilon_{it}$$

the assumption $Cor(x_{itj}, a_i) = 0$ is satisfied t=1,…,T and j=1,…,k we can use the random effect model.

However, we know that if $a_i$is uncorrelated with independent variables, single cross-section OLS is consistent so we do not need the panel data. Also the pooled OLS for more periods of time is consistent. But this way, we throw away useful information that the observation within cross-section units in our case countries share common unobserved characteristics which can be useful. Hence, random errors are serially correlated and the pooled OLS will be not efficient.

If we consider following regression equation

$$y_{iy} = \beta_1 x_{it1} + \cdots + \beta_k x_{itk} + \vartheta_{it}$$

where $\vartheta_{it} = a_i + \varepsilon_{it}$ is composite error term,

we have a problem of serially correlated composite error as a_i is present in all periods of time.

Furthermore, $Corr(\vartheta_{it}, \vartheta_{is}) = \frac{\sigma_a^2}{\sigma_a^2 + \sigma_\varepsilon^2}$ for all $t \neq s$ where $\sigma_a^2 = Var(a_i)$ and $\sigma_\varepsilon^2 = Var(\varepsilon_{it})$.

Because of this positive serial correlation, pooled OLS is no efficient.

To solve this problem, it is useful to use Generalized least square (GLS) transformation eliminating serial correlation in errors. It consists of subtracting a fraction of time average which depends on σ_ε^2, σ_a^2 and number of time periods T.

$$y_{it} - \lambda\overline{y_i} = \alpha(1-\lambda) + \beta_1(x_{it1} - \lambda\overline{x_{i1}}) + \ldots + \beta_k(x_{itk} - \lambda\overline{x_{ik}}) + (\vartheta_{it} - \lambda\overline{\vartheta_i})$$

where $\lambda = \sqrt{\frac{\sigma_\varepsilon^2}{\sigma_\varepsilon^2 + T\sigma_a^2}}$ and $\overline{y_i}$ is the time average.

This transformation uses quasi-demeaned data. Now, errors are not serially correlated.

GLS estimation is the pooled OLS of this transformation.

The most important advantage for fixed effect is that with random effect we can use constant explanatory variables in our regression.

As λ is never known, it has to be estimated by pooled OLS as

$\hat{\lambda} = 1 - \sqrt{\frac{\widehat{\sigma_\varepsilon^2}}{\widehat{\sigma_\varepsilon^2} + T\widehat{\sigma_a^2}}}$ where $\widehat{\sigma_\varepsilon^2}$ and $\widehat{\sigma_a^2}$ are consistent estimators of variances estimated by pooled OLS. By replacing λ by $\hat{\lambda}$, random effect model is estimated by feasible generalized least square (FGLS).

It is not so simple to decide whether to use fixed effect or random effect models. We decide whether to use the first or the second based on the error term a_i. If unobserved effect is something we want to estimate, we should rather use the fixed effect. In panel data for a European country, unobserved effect is something we want to estimate. If unobserved effect is supposed to be random, it is better to use random effect models. But in this case, we have to be sure that it is not correlated with explanatory variables.

If unobserved effect a_i is correlated with explanatory variables, fixed effect estimator is consistent, while random effect estimator is inconsistent. Otherwise, random effect estimator is more efficient than fixed effect estimator. Thanks to this property, we can statistically test whether it is better to use the fixed effect or the random effect with so called Haussman test. Our null hypothesis will be that error term a_i and explanatory variables are uncorrelated. Under

the null, both estimators are consistent, but random effect estimator is asymptotically more efficient. Under the alternative, fixed effect estimator is still consistent but random effect estimator is not.

We can also test statistically whether it is better to use random effect model of the pooled OLS with Breusch-Pagan Lagrange Multiplier for random effects. Null hypothesis is that variances across entities are zero. That means that there is no significant difference among units and thus we can use simple pooled OLS estimation.

4.5. Pooled OLS Model

The pooled OLS estimator is obtained by stacking the data over different countries and period of time into one long regression with nT observations and estimating it by OLS:

$$y_{it} = \alpha + \beta x_{it} + \varepsilon_{it}$$

where i=1,…,n and t=1,…,T.

If $Cor(\varepsilon_{it}, x_{it}) = 0$ then either n→ ∞ or T→ ∞ is sufficient for consistency. The pooled OLS is a simple cross-section where we do not take the unobserved heterogeneity into account. But if there is an unobserved heterogeneity, the pooled OLS estimators are not consistent whereas fixed effect estimators are. If $Cor(a_i, x_{it}) = 0$ pooled OLS estimators are consistent but inefficient due to the serial correlation. So the pooled OLS is the most suitable when each observation is not depending on the others. It is useful when within-panel correlation of observation is very low thus negligible.

The pooled OLS estimators are consistent if the pooled model is appropriate and explanatory variables are uncorrelated with errors. The usual OLS variance matrix based on errors is not appropriate as the errors for given country are certainly positively correlated over time. Furthermore, nT correlated observations gives us less information as NT uncorrelated observations.

Finally, as the pooled OLS model ignores the panel data structure, we can use to get initial information about our data but then we will prefer fixed effect or random effect model which can deal with specific issues of panel data.

We can statistically test whether it is better to use the fixed effect or the pooled OLS model with F test for significance of individual effect. If individual effect is significant, it is

always better to use the fixed effect model which takes this specific characteristic of panel data into account.

4.6. Other Tests

There are many of other tests that can help to decide which model is better or which adjustment we should use in order to conduct correct analysis with appropriate models.

Even problems with serial correlation usually appear in macro panels with long time series, we can be interested in how it is in our panel within few years. We can use Breusch-Godfrey test for serial correlation in panel models. The null is that there is not a serial correlation in idiosyncratic error. If significant serial correlation is detected, we must conduct some changes.

Despite the fact that stochastic trend appears usually in time-series data, we can use the Dickey-Fuller test to check for stochastic trends. The null hypothesis is that the series has a unit root. If a unit root is present, we should take the first difference of the variable in order to have stationary data.

The very important issue is heteroscedasticity. That means that variances depend on the level of explanatory variables. In the presence of heteroscedasticity, our estimator will be not efficient. Breaking assumption of homoscedasticity means that the Gauss–Markov theorem does not apply, meaning that the OLS estimators are not the best linear unbiased estimators (BLUE) and their variance is not the lowest of all other unbiased estimators. There are several tests for detecting heteroscedasticity. One of these tests is Breusch-Pagan test where the null hypothesis is that our data are homoscedastic. If heteroscedasticity is detected, standard variances are no more valid and we have to use robust covariance matrix. With these standard errors, our estimators will be heteroscedasticity consistent.

4.7. Heteroscedasticity Robust Errors

If heteroscedasticity is detected in our data, normal standard errors are not valid as they ignore heteroscedasticity. If disturbance has not same variance across all observations, errors are heteroskedastic and this characteristic is reflected to the fitted value of errors.

In panel data, errors may be serially correlated and not independently distributed and robust standard errors offer protection against such phenomena (Stock, Watson 2008).

Allowing the heteroscedasticity and serial correlation of unknown form, the asymptotic variance Avar($\widetilde{\beta_k}$) can be consistently estimated with the so-called cluster-robust covariance estimator treating each individual as a cluster. Then the usual tests for large samples can be performed. As the idiosyncratic errors are often serially correlated, it has been shown that the usual standard errors of the fixed effects estimator are understated in the presence of serial correlation. It is always better to use cluster-robust standard errors for the fixed effects estimator (Bertrand, Duflo, Mullainathan 2002).

4.8. Beta Regression

As we have already mentioned, in the majority of models, we will use life ladder as dependent variable which represents continuous variables taking values between 0 and 10. But it is also important to know how our independent variables influence positive affect and negative affect, affective component of subjective well-being. Both variables positive and negative affect are variables taking values in the range between 0 and 1 according to current mood of particular individual.

With the use of the simple OLS, we may find some fitted values which are above 1 or below 0 and also other important problem. The data are heteroscedastic and they display more variation around the mean and less variation as we approach the lower and upper limits of the standard unit interval. Fortunately, there are models appropriate for analysis of dependent variables with such characteristics. This method is called Beta regression.

The class of beta regression models is frequently used when analyzing models with variables that assume values in the standard unit interval (0, 1). It is based on the assumption that the dependent variable is beta-distributed and that its mean is related to a set of independent variables through a linear predictor with unknown coefficients and a link function. A link function is a function of the mean of the response variable y that we use as the response instead of y itself. It is a standard maximum likelihood (ML) task for which there is no closed-form solution but numerical optimization is required. Also, the beta regression model shares some properties for example linear predictor, link function, dispersion parameter with generalized linear models.

Beta distribution is continuous probability distribution defined on unit interval [0,1]. It is characterized by two positive shape parameters, commonly denoted by α and β controlling the shape of distribution. The probability density function (pdf) of the beta distribution, for 0

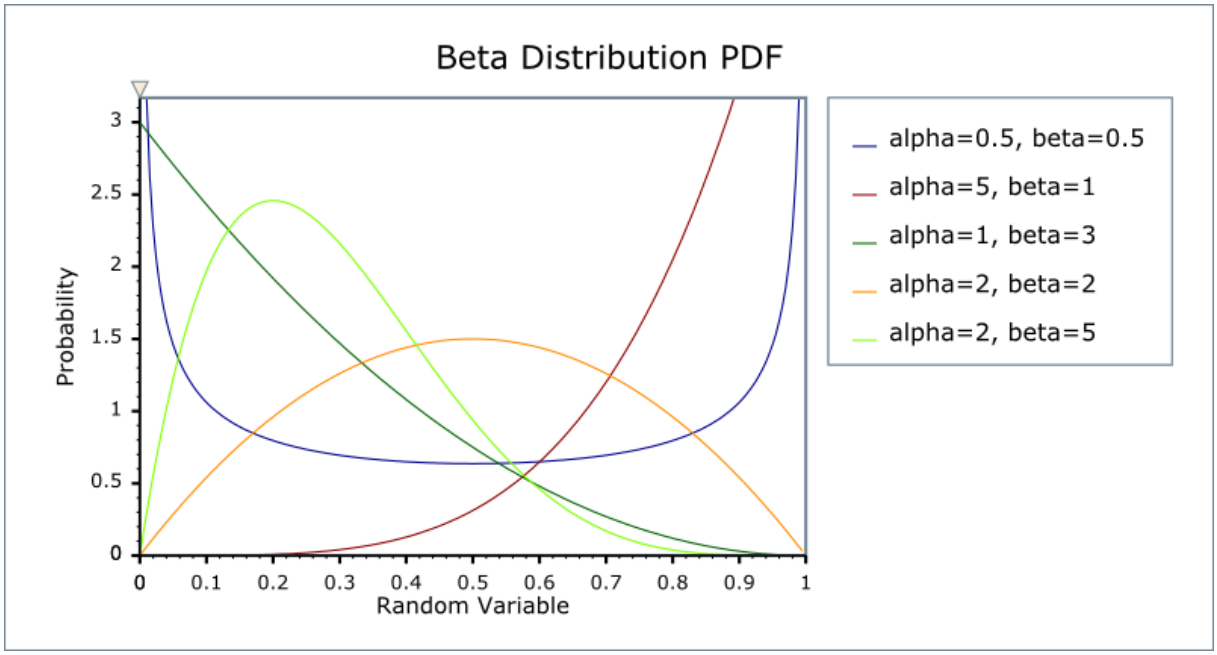
$\leq y \leq 1$, and shape parameters $\alpha, \beta > 0$, is a power function of the variable y and it looks like this:

$$f(y) = \frac{1}{B(\alpha,\beta)} y^{\alpha-1}(1-y)^{\beta-1}$$

where

$$B(\alpha,\beta) = \int_0^1 y^{\alpha-1}(1-y)^{\beta-1}\, dy$$

Usually, we define the general form of the beta distribution by the location parameter α and the scale parameter $\beta - \alpha$.



Graph 2 - Beta Distribution

Source of graph 3:

https://valelab4.ucsf.edu/svn/3rdpartypublic/boost/libs/math/doc/sf_and_dist/html/math_toolkit/dist/dist_ref/dists/beta_dist.html

Graph 3 shows probability distribution function of beta distribution for different parameters.

The model also includes a precision parameter which may be constant or depend on explanatory variables. This approach incorporates other possible complications such as

heteroscedasticity which is commonly observed in data taking values in the standard unit interval.

When we are working with such dataset, firstly we have to transform our data, so that the transformed values - $\tilde{y}$ assumes values in the real line and then apply a standard linear regression analysis. A commonly used transformation is the logit $\tilde{y} = \log(\frac{y}{1-y}y)$. Unfortunately, this transformation has some disadvantages which can cause problems in our analysis. First, the regression parameters are interpretable in terms of the mean of $\tilde{y}$, and not in terms of the mean of y. Then, regressions involving data from the unit interval are typically heteroskedastic. And finally, the distributions of variables taking values in unit interval are usually asymmetric, and thus Gaussian-based approximations for estimation and hypothesis testing can be sometimes inaccurate if we do not have sufficiently large sample and we cannot rely on asymptotic properties.

Later, other researchers proposed a regression model for continuous variables taking values unit interval. Since this model is based on the assumption that the response is beta-distributed, they called their model the beta regression model. In their model, the regression parameters are interpretable in terms of the mean of dependent variable (Ferrari, Cribari-Neto 2004).

Beta regression can be also used with panel data but we must be aware that it does not take the heterogeneity across countries into account what is significant in our case. Wagner analyzed a large panel data set of firms to explain the export-sales ratio as a function of firm size (Wagner 2003). Wagner explicitly includes specific intercepts in his model, a strategy suggested by Hardin and Hilbe used for the observation of the entire population. General solution of that problem can be including the dummy variables for each country. It allows the unobserved heterogeneity to enter in a flexible way (Hardin, Hilbe, Hilbe 2007).

5. Analysis

Our next objective is to analyze the impact of all our variables on dependent variable and compare it to previous research. We want to find out which variables and in which extent can influence subjective well-being and its components. In order to do so, we run various econometric models and then we are interested in their results.

5.1. Analysis of Data of Whole World

As we have conducted two different analyses, we will comment our results and interpret them in two steps. Now, we run model using data from all the countries.

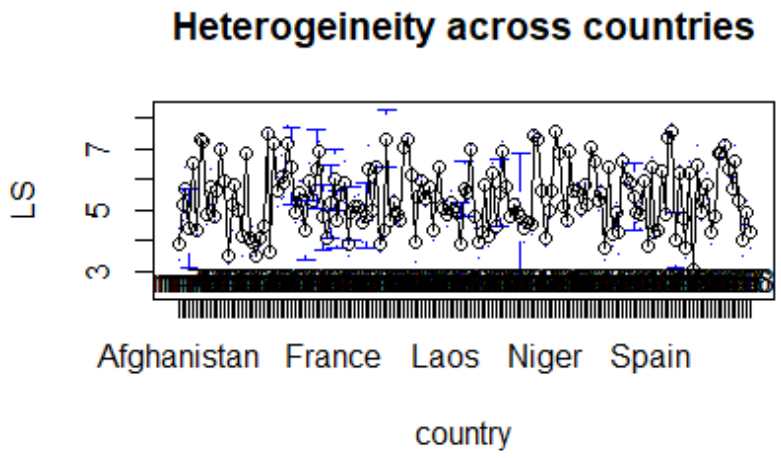
5.1.1. Analysis of Life Satisfaction

Firstly, we choose life ladder as dependent variable and we estimate following equation:

$$LS_{it} = \alpha + GDP_{it} + soc_{it} + hea_{it} + dem_{it} + del_{it} + gen_{it} + fre_{it} + gin_{it} + con_{it} + \varepsilon_{it}$$

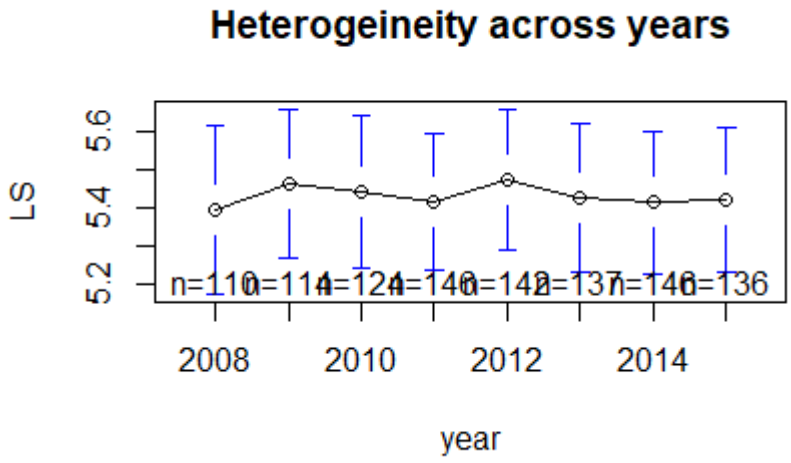
where the error term is composed by time-variant and time-invariant component. We expect that at least some of these explanatory variables will be significant at appropriate confidence level due to the intuition but also to the previous studies.

We have three possibilities of models: fixed effect, random effect or pooled OLS model. In order to investigate more in the choice of model, it is useful to plot heterogeneity across the countries and across the years.



Graph 3 - Heterogeneity across the Countries – Analysis of Life Satisfaction in the Whole World

Graph 3 draws a 95% confidence interval around means of life satisfaction in function of different countries. In horizontal axes, there are all the countries in alphabetical order and in vertical axe, there is the life satisfaction. As we can see the fluctuation here, significant heterogeneity across countries can be a problem and the pooled OLS will be biased.



Graph 4 - Heterogeneity across Years – Analysis of life Satisfaction in the Whole World

Graph 4 displays 95% confidence interval around means of life satisfaction in the function of years. There is no heterogeneity across the years.

First of all, we run a fixed effect model and then we remove variables with the highest p-value in order to increase significance of other variables. We run various tests to investigate this model better. Thanks to the augmented Dickey-Fuller test, we found out that there is not any unit root process and we can easily work with these data. We investigate in serial correlation with use of Breusch-Godfrey test and we concluded that there is not a significant form of serial correlation. Breusch-Pagan test detected heteroscedasticity. Under heteroscedasticity, our estimators will be unbiased and consistent but less efficient. We have to use robust standard errors which take into account heteroscedasticity of errors. Results of this analysis are in the *Table 2*. Results are with robust errors. In the first column, there are results of previous model and in the second, variables democracy quality and delivery quality have been removed due to their high p-values. In the third column, there are results of random effect model and in the last results of the pooled OLS.

Results with robust errors				
Dependent variable: Life satisfaction				
	FErobust	FErobust	RErobust	POOLrobust
	(1)	(2)	(3)	(4)
GDP	1.251***	**1.383*** **	0.521***	0.293***
	(0.298)	**(0.297)**	(0.067)	(0.066)
Soc	1.598***	**1.651*** **	1.920***	1.958***
	(0.388)	**(0.395)**	(0.310)	(0.500)
Hea	-0.115***	**-0.120*** **	0.001	0.028***
	(0.025)	**(0.024)**	(0.009)	(0.008)
Fre	0.722**	**0.710** **	0.923***	1.968***
	(0.302)	**(0.304)**	(0.265)	(0.373)
Gen	0.401	**0.446***	0.733***	0.978***
	(0.244)	**(0.239)**	(0.211)	(0.322)
Con	0.295	**0.351***	0.195	-0.434
	(0.211)	**(0.203)**	(0.199)	(0.294)
Dem	0.0004			
	(0.137)			
Del	0.281			
	(0.283)			
Gin	-0.444	**-0.499**	-0.746*	-1.121**
	(0.502)	**(0.500)**	(0.451)	(0.562)
Constant			-1.390***	-1.305**
			(0.523)	(0.532)
Observations	747	747	747	747
R^2	0.182	0.179	0.511	0.736
Adjusted R^2	-0.019	-0.019	0.507	0.734
F Statistic	14.823*** (df = 9; 599)	18.764*** (df = 7; 601)	110.403*** (df = 7; 739)	294.693*** (df = 7; 739)
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 2 - Results – Analysis of Life Satisfaction in the Whole World

We see that in the second model, three explanations are statistically significant at 99 % confidence level, one at 95 % and two at 90 %. GINI coefficient measuring inequality is statistically significant at 85 % which is not appropriate confidence level. 1 % increase in GDP per capita will cause an increase of life satisfaction on average by 0.013 of the unit. If social support rises by 1 unit, life satisfaction will rise by 1.651 which is significant change. What is really surprising is that one year more in healthy life expectation will lower the average life satisfaction by 0.12 of the unit. The coefficient is also negative in the first model. We can thus conclude that people, who expect less healthy years, could be happier as they do not have so high and optimistic expectations. The rise by 1 unit in freedom to make life choices will increase life satisfaction by 0.71 of the unit and unit rise in generous behavior will increase life satisfaction by 0.446. If the confidence in national parliament rises by 1, life satisfaction should on average rise by 0.351 of the unit. Correlation between GINI coefficient and life satisfaction is negative as we expected but this effect is not significant. According to this model, determinants influencing life satisfaction are mostly social support and freedom to make life choices which is quite logical. It is crucial to understand what it means that 1unit increases in explanatory variable. As our explanatory variables are not all measured in the same way, one unit increase in social support is not equal to one unit increase in healthy year expectancy at birth. For example for the variable social support, 1 unit increase never happens because this variable range is between 0 and 1. The same is valid for variable freedom or confidence in national government. On the contrary, the unit increase in healthy year expectancy at birth means the change on 1 year. Thus, the unit increase in variable social support, freedom to make choices or confidence in national government is relatively bigger change in comparison with the unit increase in healthy year expectancy.

However, R squared of this model is quite low but p-value of overall significance of this model is very low so we can conclude that we have chosen our explanatory variables correctly.

R squared in random effect model is higher than in fixed effect model. However, in order to decide which model is better, we have to use Hausmann test. As the p-value of this test is almost zero, we can conclude that the random effect the model is not consistent and we have to use the fixed effect model. So far, our preferred model is fixed effect model with robust standard errors and some removed variables which we described and interpreted earlier.

The third possibility to estimate our econometric equation is the simple pooled OLS estimation. The main disadvantage is that it does not take the fact that we are working with

panel data into account. As unobserved heterogeneity across the countries is very significant, we believe that the pooled OLS is not very appropriate. However, we have decided to try to run this regression and then to compare it with the fixed and the random effect models.

As we have already mentioned, pooled OLS is not a good choice. However, we run some test to confirm our idea. First of all, we run Breusch-Pagan Lagrange Multiplier for random effects. Null hypothesis is that there is no panel effect. As p-value is very small, the random effect is better as the pooled OLS. There is an evidence of significant differences among countries so the pooled OLS is not a good idea. F test for individual effect between the fixed effect and the pooled OLS confirmed this idea in favor in the fixed effect model.

Finally, if we compare the pooled OLS and the random effect model, the random is the better one. If we compare the pooled OLS and fixed effect model, the fixed one is better. And results of Hausmann test were in favor of the fixed effect model. Thus our preferred model is the fixed effect model with robust standard errors with results in the second column.

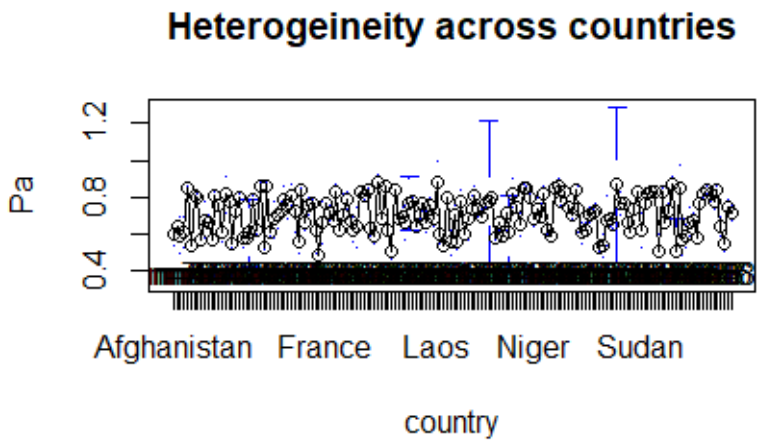
5.1.2. Analysis of Positive Affect

The other dependent variable of our interest is the positive affect and we will estimate following econometric equation:

$$Pa_{it} = \alpha + GDP_{it} + soc_{it} + hea_{it} + dem_{it} + del_{it} + gen_{it} + fre_{it} + gin_{it} + \varepsilon_{it}$$

As the positive affect expresses current mood, current emotions and current feelings, we suppose that it will be less influenced by our independent variables. We think that GDP or GINI coefficient will not influence so much how we feel and how much we report positive emotions in a particular time. However, explanatory variable social support may have a large positive impact on our positive affect. As positive affect is measured in a unit interval, the simple OLS may predict some values outside of this interval. However, we have tried to estimate it by the OLS and calculated how many predicted values fall outside of this interval. As we found out that 100% of our predicted values are in the unit interval, we can use the OLS model and we have no reason to be worried. Another possibility is to estimate this model with beta regression model. With this model, all predicted values stay in the unit interval and it is adapted to treat such type of data.

Another possible problem that we may meet is that these models do not take unobserved heterogeneity across country into account what is quite significant. As we see in the following graph:



Graph 5 - Heterogeneity across the Countries – Analysis of Positive Affect in the Whole World

However, we have a possibility to insert all dummy variables for the countries in our models manually and this will work like the fixed effect. We have done it for both types of regression, the simple OLS estimation and the beta regression. *Table 3* reports the results: In the first column, we have the OLS estimation without the country fixed effect. In the second, we have added country dummies to take into account unobserved heterogeneity across different countries. In the third, we used the beta regression model taking into account the fact that we have fractional data. And in the last column, we added country dummy variables to beta regression.

In the OLS regression, we have the significant effect of unobserved country heterogeneity. If we are not conditioning on countries, we have in some coefficients opposite results which proves that model with country dummies is more appropriate. OLS without dummies suffers from heterogeneity. We tested appropriateness of fixed effect with Hausmann test. Furthermore the results of beta regression with and without country dummies have also some coefficients different but the others are quite similar which implies that we do not have a serious problem of inconsistency. The beta regression gives us the same qualitative results as the OLS and we feel that the specification does not suffer from functional form misspecification. The specification including fixed effect is in both cases preferred. Finally, thanks to these results and those of Hausmann test, we think that the OLS estimation with the country dummies included is the most appropriate model to estimate this econometric equation.

Results with country dummies				
Dependent variable: Positive affect				
	OLS		*beta*	
	Ols	OlsFixed	Beta	BetaFixed
	(1)	(2)	(3)	(4)
GDP	0.008	**-0.044*****	0.054*	-0.179***
	(0.006)	**(0.012)**	(0.028)	(0.052)
soc	0.237***	**0.154*****	1.114***	0.737***
	(0.035)	**(0.039)**	(0.162)	(0.172)
hea	0.002***	**0.010*****	0.012***	0.046***
	(0.001)	**(0.001)**	(0.003)	(0.006)
fre	0.339***	**0.144*****	1.597***	0.711***
	(0.031)	**(0.031)**	(0.149)	(0.138)
gen	0.178***	**0.130*****	0.975***	0.661***
	(0.020)	**(0.027)**	(0.102)	(0.119)
con	-0.001	**-0.008**	0.007	-0.058
	(0.020)	**(0.021)**	(0.098)	(0.096)
dem	0.011	**0.030****	0.058	0.145***
	(0.008)	**(0.012)**	(0.037)	(0.055)
del	-0.035***	**-0.030****	-0.184***	-0.156**
	(0.008)	**(0.015)**	(0.040)	(0.067)
gin	0.159***	**0.055**	0.805***	0.272
	(0.042)	**(0.040)**	(0.207)	(0.180)
Constant	-0.004	**0.241****	-2.675***	-1.430***
	(0.058)	**(0.118)**	(0.284)	(0.523)
Country fixed effects?	No	Yes	No	Yes

Results with country dummies				
Dependent variable: Positive affect				
	OLS		*beta*	
	Ols	OlsFixed	Beta	BetaFixed
	(1)	(2)	(3)	(4)
Observations	745	745	745	745
R^2	0.522	0.871	0.524	0.867
Adjusted R^2	0.517	0.839		
Log Likelihood			877.782	1,360.895
Residual Std. Error	0.078 (df = 735)	0.045 (df = 597)		
F Statistic	89.352^{***} (df = 9; 735)	27.394^{***} (df = 147; 597)		
Note:	*p<0.1; **p<0.05; ***p<0.01			

Table 3 - Results – Analysis of Positive Affect in the Whole World

Now, we are going to interpret the OLS model with the country fixed effects. A negative coefficient between variable GDP per capita suggest that the correlation between people's current positive affect and growth of GDP per capita can be negative. If there is a rise of 1% in GDP per capita, the average positive affect reported by an individual falls by 0.044 which is a quite significant change. The rise of 1 unit in social support causes the rise in positive affect by 0.154 of the unit. This variable is also significant at 99% confidence level. It is quite logical that this variable has a great influence on our positive emotions. However, this effect is higher when we do not take into account unobserved country heterogeneity. If the perception of healthy years increases by one year, the positive affect increases by 0.01. A free person that can make free life choices has a higher positive affect by 0.144 on average. Generous people reported higher positive affect by 0.13 on average. This effect is significant at 99% confidence level. Variables confidence in national government and inequality among people expressed GINI coefficient were not statistically significant. Democracy and delivery quality were significant at the 95% confidence level. If democracy quality increases by 1 unit, positive affect rises by 0.03. An increase by 1 unit in delivery quality lowers its positive affect by 0.03. This

is quite surprising finding. R squared is very high, 0.871. That means that our explanatory variables explain 0.871% of variation in positive affect and we have chosen well set of explanatory variables. Adjusted R squared what penalizes for adding to many independent variables is 0.839. This is also very high. However, we should take into account that this can be caused by the fact that we added all country dummies. So we should not think that the second and the fourth models are better than the first and the third because of R squared which are remarkably higher.

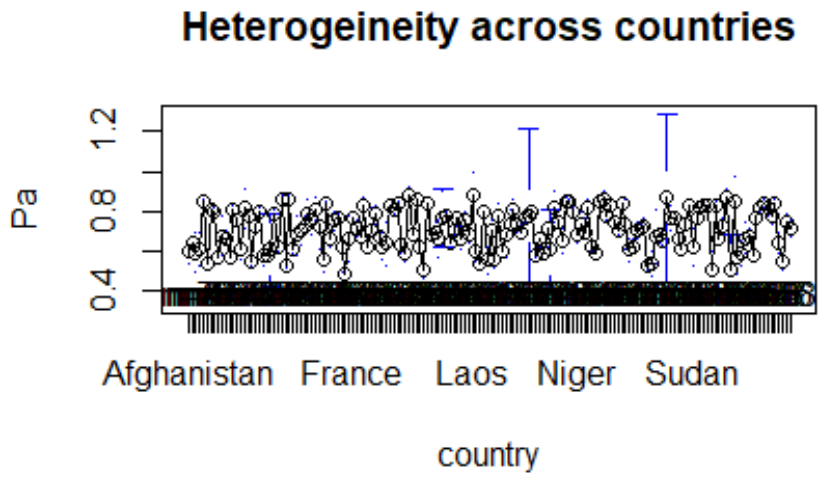
Furthermore, beta regression model can be understood as robustness check test incorporated directly into the analysis. As we used two different types of models and both have some qualitative results, we can conclude that our analysis was conducted properly. Our coefficients are plausible and robust which can be interpreted as the evidence of structural validity.

5.1.3. Analysis of Negative Affect

Now, we are going to analyze the determinants of the negative affect and we are going to estimate the following equation

$$Na_{it} = \alpha + GDP_{it} + soc_{it} + hea_{it} + dem_{it} + del_{it} + gen_{it} + fre_{it} + gin_{it} + \varepsilon_{it}.$$

We expect that these variables will not explain the variation in negative affect in comparison with the positive affect or even life satisfaction. Here we have the same problems as we had with the analyzing of the positive affect. These data are fractional and the OLS estimation predicts value outside of unit interval. For that, we will also estimate the equation by beta regression. However, if we calculate predicted values, we find out that all are in the unit interval. Both of these methods can suffer from unobserved heterogeneity problem so we will add the country dummy variables into equation. As we see from *Graph 6*, it is important because unobserved heterogeneity is significant. It is conditional plot showing a 95% confidence interval around means and they have quite large fluctuations.



Graph 6 - Heterogeneity across Countries – Analysis of the Negative Affect in the Whole World

Results with country dummies				
Dependent variable: Negative affect				
	OLS		*beta*	
	Ols	OlsFixed	Beta	BetaFixed
	(1)	(2)	(3)	(4)
GDP	0.016***	**0.047*** **	0.082***	0.246***
	(0.005)	**(0.010)**	(0.025)	(0.047)
Soc	-0.215***	**-0.170*** **	-1.125***	-0.905***
	(0.029)	**(0.032)**	(0.145)	(0.152)
Hea	0.003***	**0.003*** **	0.014***	0.019***
	(0.001)	**(0.001)**	(0.003)	(0.005)
Fre	-0.074***	**-0.032**	-0.357***	-0.167
	(0.026)	**(0.025)**	(0.131)	(0.120)
Gen	-0.021	**0.022**	-0.113	0.105
	(0.017)	**(0.021)**	(0.087)	(0.104)
Con	-0.089***	**-0.016**	-0.478***	-0.103

Results with country dummies				
Dependent variable: Negative affect				
	OLS		*beta*	
	Ols	OlsFixed	Beta	BetaFixed
	(1)	(2)	(3)	(4)
	(0.016)	**(0.017)**	(0.085)	(0.082)
Dem	-0.010	**-0.003**	-0.041	-0.018
	(0.006)	**(0.010)**	(0.032)	(0.049)
Del	-0.011	**-0.058*****	-0.062*	-0.311***
	(0.007)	**(0.012)**	(0.035)	(0.058)
Gin	0.167***	**0.124*****	0.868***	0.652***
	(0.035)	**(0.032)**	(0.178)	(0.153)
Constant	0.146***	**-0.259*****	-1.664***	-3.863***
	(0.048)	**(0.095)**	(0.248)	(0.466)
Country fixed effects?	No	Yes	No	Yes
Observations	747	747	747	747
R^2	0.254	0.807	0.251	0.796
Adjusted R^2	0.244	0.759		
Log Likelihood			1,020.690	1,514.265
Residual Std. Error	0.064 (df=737)	0.036 (df=599)		
F Statistic	27.822*** (df = 9; 737)	16.993*** (df = 147; 599)		
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 4 - Results – Analysis of Negative Affect in the Whole World

When we are observing the results reported in *Table 4*, we state that they are quite similar if we include the country dummies and without the country dummies which suggest us that unobserved country heterogeneity is not so significant as it was in the positive affect. All the signs of coefficient in models with and also without country fixed effect are the same. We think that all the models can be appropriate but it is still preferred to include these dummies. As in both models in beta regression, estimates are quite similar, we do not have problem with inconsistency of estimators. Finally, we find out that also here the OLS model with fixed effect is the most appropriate. Five variables are statistically significant at 99% confidence level but their estimators are not that high. If there is a 1% growth in GDP per capita, people in average reported higher negative affect by 0.047 of the unit. The most important variable in determining negative affect is social support. If social support increases by 1 unit, negative affect tends to decrease on average by 0.170 of the unit. An increase by one year in the healthy life expectancy increases its negative affect by 0.003. If delivery quality rises by 1 unit, negative affect falls by 0.058 of the unit. Surprisingly, the effect of inequality in society measured by GINI coefficient is important. Its estimate is equal to 0.124 which means that one unit increase in GINI coefficient will cause on average 0.124 unit increase in negative affect. It is also statistically significant at 99% confidence level. Estimates of freedom, confidence in government and democracy quality are also negative, they lower negative affect but they are not statistically significant at any appropriate level. When comparing R squared to these four models, we see that models with country dummy variables have importantly higher R squared. Similarly as in positive affect, this does not mean that they explain better variation in dependent variables, it is caused by adding all country dummies. As R squared from model without country dummies is 0.254, these explanatory variables do not explain very well variation in negative affect. Finally, it is difficult to find variables determining the negative affect. As it represents particular negative emotions, it is caused by other circumstances in people's life, their successes and failures more than by these measurable variables.

As we have already mentioned in the analysis of positive affect, beta regression model can be understood as robustness check test incorporated directly into analysis. Using two different approaches and functional forms, we have obtained the same qualitative results. Our coefficients are plausible and robust which can be interpreted as evidence of structural validity.

5.2. Analysis of European data

Now, we are going to analyze the European countries. For these countries, we will use our expanded dataset with many of independent variables in order to find out which additional determinants may influence life satisfaction. So far, in economic theory, we do not have a sufficient knowledge about relationship between life satisfaction and some our explanatory variables such us number of language spoken, social expenditures, health care expenditures, tourism per capita, immigration inflow, female representation in parliament or dummy variable which indicates if a country has a sea or not.

5.2.1. Analysis of Life Satisfaction

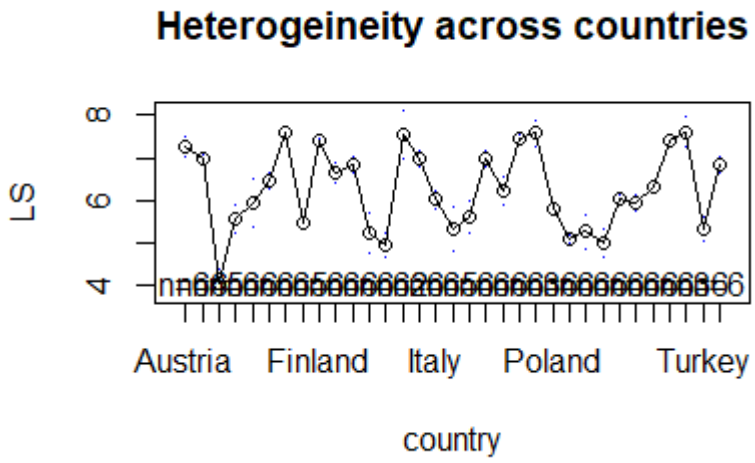
Firstly, we estimate following econometric equation where life ladder is dependent variable.

$$LS_{it} = \alpha + GDP_{it} + soc_{it} + hea_{it} + dem_{it} + del_{it} + gen_{it} + fre_{it} + gin_{it} + con_{it} + fem_{it} + lan_{it} + netfer_{it} + educ_{it} + pol_{it} + inf_{it} + pov_{it} + imperca_{it} + touperca_{it} + heaperca_{it} + soceperca_{it} + OECD_{it} + sea_{it} + postcom_{it} + \varepsilon_{it}$$

where the error term is composed by time-variant and time-invariant component and variable *netfer* is fertility minus mortality.

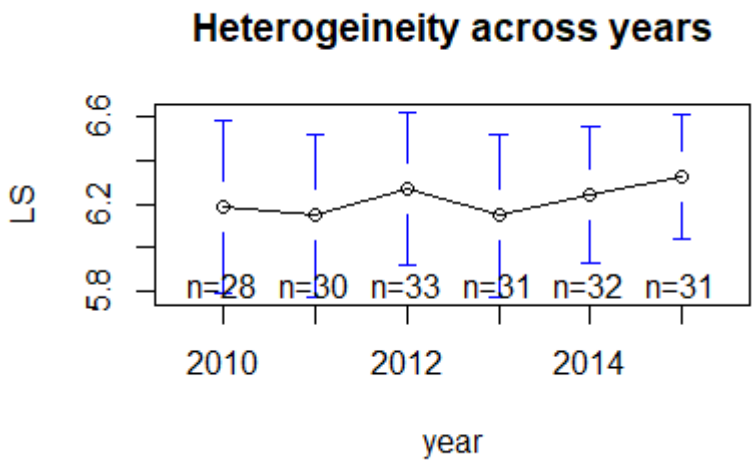
Thanks to Hausmann test, we found out that the random effect model is inconsistent and thus our preferred model is fixed effect model as it was in the analysis of whole world's data. However, its biggest disadvantage is that we cannot estimate the effect of the time-invariant variables, in our case dummy variables

It is important to know how our data look like and if heterogeneity across countries and years is significant. For this purpose, we plot following graphs.



Graph 7 - Heterogeneity across Countries – Analysis of Life Satisfaction in Europe

Despite the fact that one can think that heterogeneity and unobserved characteristics across European countries will be less significant as they were in the whole world, there is still a significant form of unobserved heterogeneity which needs to be taken into consideration. This supports our idea to use fixed effect model.



Graph 8 - Henerogeneity across Years – Analysis of Life Satisfaction in Europe

Heterogeneity across the years is also present here in a negligible amount. Thus, we can ignore it without any impact on our further analysis.

Then our next objective is to find out more about our data. For this, we run various tests.

First of all, augmented Dickey-Fuller test found out that there is not a unit root process in our dependent variable and thus we can easily work with these data. We run Breusch-Godfrey test and we found out that our model does not suffer from serial autocorrelation of errors. Breusch-Pagan test detected heteroscedasticity. Under heteroscedasticity, our estimators will be unbiased and consistent but less efficient so we report results always with robust standard errors taking heteroscedasticity of errors into account.

We expect that at least some of these explanatory variables will be significant at appropriate confidence level due to the intuition but also to the previous studies. However, as we included many explanatory variables, we suppose that some of them will not be significant at any appropriate level. Our strategy is to eliminate variables with very high p-value from the equation or variables which are missing the observations often. Their effect on life satisfaction is not significant at any appropriate level. By this procedure, we found out that the following econometric is appropriate to estimate:

$$LS_{it} = \alpha + GDP_{it} + soc_{it} + hea_{it} + gin_{it} + fem_{it} + educ_{it} + inf_{it} + heaperca_{it} + netfer_{it} + \varepsilon_{it}$$

Then we estimated this econometric equation by pooled the OLS, random effect model and fixed effect model. The results are reported in the *Table 5*. We have to notice that we have smaller number of observations because many of them were deleted due to the missingness.

OECD Results with robust standard errors			
Dependent variable: Life satisfaction			
	POOL	RANDOM	FIXED
GDP	0.821*	1.835***	**3.199*** **
	(0.435)	(0.647)	**(1.004)**
soc	7.237***	3.159***	**1.787** **
	(1.521)	(0.985)	**(0.760)**
hea	-0.016	0.042	**0.244*** **
	(0.041)	(0.048)	**(0.073)**
fem	0.028	0.015***	**0.005***
	(0.007)	(0.006)	**(0.006)**
gin	-2.184***	-0.536	**0.140**
	(1.866)	(0.932)	**(0.805)**
netfer	0.00000	0.00000***	**-0.00000**
	(0.00000)	(0.00000)	**(0.00000)**
educ	-0.007	-0.022**	**-0.056*** **
	(0.010)	(0.009)	**(0.009)**
inf	-0.016**	-0.008	**-0.012**
heaperca	0.132***	0.014	**0.067**
Constant	-7.900*	-18.250***	
	(4.324)	(7.040)	
Observations	87	87	87
R^2	0.874	0.872	0.683
Adjusted R^2	0.859	0.857	0.477
F Statistic	59.154*** (df = 9; 77)	57.020*** (df = 9; 77)	12.476*** (df = 9; 52)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 5 - Results – Analysis of Life Satisfaction in Europe

Now, we can interpret the estimators. If GDP per capita increases by 1%, life satisfaction is supposed to increase by 0.03199 of the unit which is an important change. GDP per capita seems to be really reliable determinant of life satisfaction of a particular country. This variable is statistically significant at 99%. The variable social support is significant at 95 % confidence level. If social support increases by 1 unit, life satisfaction will rise by 1.787 of the unit on average. Variable healthy life expectancy is statistically significant at 99% confidence level. If the healthy life expectancy increases by 1 year, life satisfaction is supposed to increase by 0.244 of the unit. Another variable that appears in our models for the first time is female representation is a national parliament. This variable is statistically significant at 90% confidence level that can be such an interesting finding. If female representation increases by 1%, life satisfaction will rise by 0.005 on average. We can conclude that the equality and the parity between women and men are important determinants of life satisfaction in European society. A new variable introduced in this model net fertility is not significant at any appropriate confidence level. We also studied the impact of education on life satisfaction. If attainment of university education increases by 1%, life satisfaction will decrease by 0.056 on average. This variable is statistically significant at even 99% confidence level. The possible explanation is that people with university degree have higher expectation about their salary or job. Furthermore, it is more difficult to make them happy with simple things. We found out also that inflation and life satisfaction are negatively correlated which confirmed previous studies. However, inflation was not statistically significant at any appropriate level. Variable health care expenditures per capita are positively correlated with life satisfaction but it is not statistically significant at any appropriate confidence level.

Similarly to the analysis of data of the whole world, the most important determinants of life satisfaction are GDP per capita, social support and healthy life expectancy. However, we found out some new variables that influence life satisfaction in European countries.

We also notice that R squared from fixed effect model is 0.683. It means that these explanatory variables explain 68.3% of variation in life satisfaction.

One of the main findings of this part of analysis are that female representation in national parliament influence life satisfaction in a large extent and these nations should try to achieve parity in order to keep their inhabitants happy. The very important result from study of the European data is that attainment of university education and life satisfaction are correlated negatively. That means that the university education is not always the key to happy life. It can

improve many things such as professional carrier or another personal goals but it can also have diminishing effect on overall happiness.

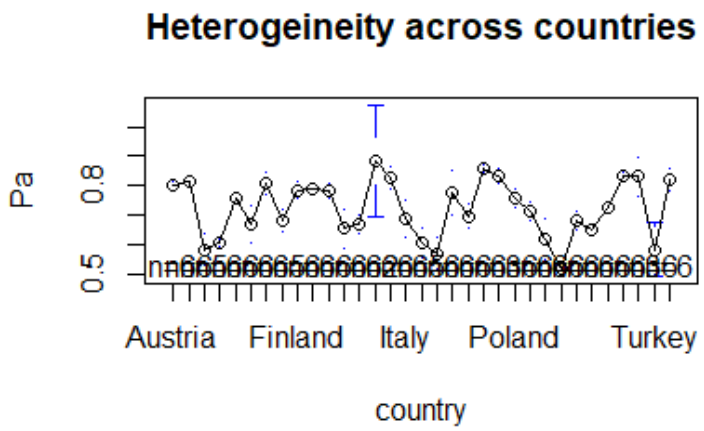
5.2.2. Analysis of Positive Affect

The second dependent variable of our interest is the positive affect and we will estimate following econometric equation:

$$Pa_{it} = \alpha + dem_{it} + gen_{it} + fre_{it} + gin_{it} + postcom_{it} + netfer_{it} + socperca_{it} + inf_{it} + im_{it} + Oecd_{it} + \varepsilon_{it}$$

As positive affect is part of the subjective well-being which depends on current mood, it will not be probably well explained by our explanatory variable.

We estimated this equation by three methods. Firstly, we use the simple OLS estimation and then we take into consideration that we have the panel data and unobserved country heterogeneity is quite important so we used country dummies to capture this effect. In addition, *Graph 9* confirmed that heterogeneity across countries is significant.



Graph 9 - Heterogeneity across Countries – Analysis of Positive Affect in Europe

Finally, the beta regression is used. As all the predicted values are in the unit interval, the beta regression is not necessary. There are some variables having the opposite sign when country dummies are used. Furthermore, we used Hausmann test to decide between the model with country dummies which is similar to the fixed effect model and the random effect model

and the result was in favor of fixed effect model. Thus the most appropriate model is the OLS with country dummies. The results of all those three models are in the following table.

Results with country dummies			
Dependent variable: Positive affect			
	OLS		*beta*
	Ols	OlsFixed	Beta
	(1)	(2)	(3)
Fre	0.072	**0.006**	0.273
	(0.054)	**(0.081)**	(0.260)
Gen	0.088***	**0.025**	0.541***
	(0.034)	**(0.064)**	(0.173)
Dem	0.098***	**0.061**	0.470***
	(0.027)	**(0.066)**	(0.129)
Gin	0.118	**-0.016**	0.608
	(0.101)	**(0.141)**	(0.513)
Postcom	-0.062***	**-0.337*****	-0.276***
	(0.013)	**(0.077)**	(0.065)
Netfer	0.000001**	**0.000001**	0.000001**
	(0.000001)	**(0.000001)**	(0.000001)
Soceperca	-0.0003	**-0.022****	0.005
	(0.002)	**(0.009)**	(0.009)
Inf	-0.004	**-0.004***	-0.016
	(0.003)	**(0.003)**	(0.013)
im	0.000001	**-0.000001**	0.000001
	(0.000001)	**(0.000001)**	(0.000001)
Oecd	0.038***	**-0.065***	0.164***
	(0.012)	**(0.035)**	(0.058)

Constant	0.532^{***}	**1.114^{***}**	0.081
	(0.046)	**(0.160)**	(0.226)
Country fixed effects?	No	Yes	No
Observations	142	140	142
R^2	0.774	0.900	0.764
Adjusted R^2	0.757	0.859	
Log Likelihood			242.783
Residual Std. Error	0.046 (df = 131)	0.035 (df = 99)	
F Statistic	44.991^{***} (df = 10; 131)	22.170^{***} (df = 40; 99)	
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 6 - Results – Analysis of Positive Affect in Europe

Now, we interpret the result of our preferred model. As we supposed, there are not many significant variables. An important finding is that we do not include variable GDP per capita in those models because we found out that it does not influence positive affect in the European countries. However, it was an important determinant of life satisfaction and also of positive and negative affect for whole world data. A dummy variable postcom is statistically significant at 99% confidence level. If a given country is a postcommunist country, its average positive affect is supposed to be 0.337 lower in comparison with non-postcommunist countries. Also the inflation lowers positive affect and it is statistically significant at 95% confidence level. If inflation increases by 1%, positive affect is supposed to decreases on average by 0.004 of the unit. Dummy variable indicating if the country is OECD country is significant at 90% confidence level. OECD countries are supposed to have the positive affect lower by 0.065 of the unit.

R squared from this model is 0.9 which is really high so it confirms our idea that we have chosen our model appropriately. We have chosen this model but we can use the beta regression model as the robustness check. They have same qualitative results and it confirms that our model does not suffer from functional misspecification.

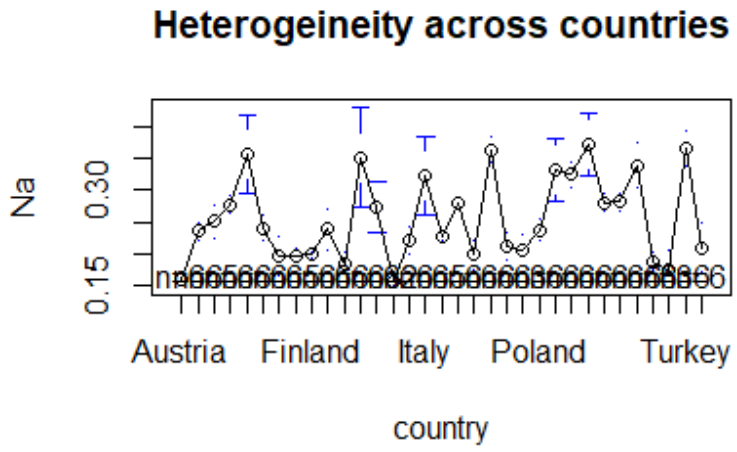
To sum up, this part of the analysis showed that postcommunist countries have lower positive affect on average. The other important finding is that GDP per capita does not contribute to positive affect in the European countries as it did in whole world analysis. And we found out that positive affect cannot be explained by the set of our explanatory variable in comparison with life satisfaction that clearly. These results are quite natural and do not surprise us.

5.2.3. Analysis of Negative Affect

The third dependent variable of our interest is the negative affect and we will estimate the following econometric equation:

$$Na_{it} = \alpha + soc_{it} + hea_{it} + con_{it} + dem_{it} + del_{it} + gen_{it} + fre_{it} + gin_{it} + postcom_{it} + netfer_{it} + fem_{it} + socperca_{it} + inf_{it} + im_{it} + Oecd_{it} + \varepsilon_{it}$$

We will use the same three methods as in the previous parts. The OLS estimation, the OLS estimation with country dummies and the beta regression. As we can see in the *Graph 10*, heterogeneity across countries is quite significant so it is better to use the country fixed effect.



Graph 10 - Heterogeneity across Countries – Analysis of Negative Affect in Europe

As all predicted values of this equation are in the unit interval, beta regression is not necessary and the best idea is to estimate this equation by the OLS estimation with the country dummies. Other arguments in favor of this model are that with country dummies, coefficients have in some cases the opposite sign and also Hausmann test confirms our hypothesis.

Results with country dummies			
Dependent variable: Negative affect			
	OLS		*beta*
	Ols	OlsFixed	Beta
	(1)	(2)	(3)
soc	-0.153	**-0.306***	-0.634
	(0.138)	**(0.161)**	(0.612)
hea	0.008*	**-0.054***	0.045**
	(0.004)	**(0.030)**	(0.020)
fre	0.081	**0.071**	0.488
	(0.079)	**(0.107)**	(0.367)
con	0.088	**-0.028**	0.453*
	(0.056)	**(0.061)**	(0.262)
dem	-0.085**	**0.040**	-0.464***
	(0.039)	**(0.102)**	(0.178)
del	-0.120***	**0.097**	-0.608***
	(0.024)	**(0.074)**	(0.109)
gin	0.203	**-0.020**	0.987
	(0.142)	**(0.163)**	(0.661)
fem	0.001	**-0.002**	0.003
	(0.001)	**(0.002)**	(0.003)
netfer	-0.00000	**-0.00000**	-0.00000
	(0.00000)	**(0.00000)**	(0.00000)
touperca	-0.007***	**0.008**	-0.045***
	(0.002)	**(0.015)**	(0.011)
soceperca	-0.002	**-0.007**	-0.010
	(0.002)	**(0.018)**	(0.010)

Results with country dummies			
Dependent variable: Negative affect			
	OLS		*beta*
	Ols	OlsFixed	Beta
	(1)	(2)	(3)
Im	-0.00000***	**0.00000**	-0.00000***
	(0.00000)	**(0.00000)**	(0.00000)
Oecd	-0.071***	**-0.239**	-0.382***
	(0.024)	**(0.551)**	(0.109)
Postcom	-0.066**	**0.187**	-0.315**
	(0.027)	**(0.168)**	(0.123)
Constant	0.044	**4.335****	-2.685**
	(0.289)	**(2.048)**	(1.336)
Country fixed effects?	No	Yes	No
Observations	71	71	71
R^2	0.838	0.956	0.836
Adjusted R^2	0.798	0.906	
Log Likelihood			156.028
Residual Std. Error	0.032 (df = 56)	0.022 (df = 33)	
F Statistic	20.734*** (df = 14; 56)	19.193*** (df = 37; 33)	
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 7 - Results – Analysis of Negative Affect in Europe

Similarly to analysis of the positive affect, here as well, are just some variables statistically significant. Variable social support lowers the negative affect. If social support increases by 1 unit, negative affect will decrease by 0.306 of the unit on average. If healthy life expectation increases by 1 year, the negative affect is supposed to decrease on average by 0.054.

The other variables are not statistically significant at any appropriate confidence level so they do not contribute to the negative affect in large extent.

Thanks to the European dataset, we discovered some interesting relations between dependent and independent variables. Majority of them confirm previous studies. The main determinants of life satisfaction are GDP per capita, social characteristics and political characteristics of a country. In addition, our research discovered negative correlation between education and life satisfaction and positive correlation between female representation in national parliament and life satisfaction. Variables tourism per capita, social expenditures, immigration inflow, net fertility or health care expenditures were not significant at any appropriate level. Maybe if we had better and more available data, we would discover more in these relations.

Conclusion

The main goal of this paper was to find out new relations between different components of subjective well-being such as life satisfaction, positive affect and negative affect thanks to two different datasets, one of them containing information about almost all the countries of the world and the second detailed data from European countries.

We have discovered that with our explanatory variables, we are able to express the variation in the cognitive part of subjective well-being more appropriately, life satisfaction as in emotional parts, positive affect and negative affect. Whereas life satisfaction was easily expressed by the specific characteristics of the countries, the positive affect and the negative affect are not influenced in such extent by economic, political and social parameters of the countries. They depend mostly on given situation and inexplicable determinants. Then, we found out that the major determinants of life satisfaction are GDP per capita, social support, health, democracy quality and freedom to make life choices. However, in European countries, female representation in national parliament influences the life satisfaction in a positive manner. As increasing female representation in national parliament is one of the measures of equality in country, we found out that the equality between men and women and the parity is important feature of developed society.

One of the most interesting findings is that the correlation between university attainment and life satisfaction is negative in European countries. This result confirmed the view that education mainly raises aspirations and therefore leads to lower levels of happiness.

As expected, inflation, inequalities in society and post-communism were negatively correlated to the level of life satisfaction and also to the negative affect and the positive affect. This paper has discovered positive link between health care and social care expenditures and happiness but their effects were not statistically significant at any appropriate confidence level.

Even though the analysis established some new results, it suffered from some variables being absent in many countries. We would be able to conduct a better analysis and maybe discover some new relations between happiness and other variables included in our datasets if there would not be any problem with the lack of data and if we would be able to gather more precise data.

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