# Does Higher GDP Per Capita Cause Higher Life Happiness?

By

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## Abstract

The public discussion about the economic policies usually focuses on increases in GDP. But does higher income cause higher life happiness? I focus in my thesis on this subject. If it does not, the main focus of economic policies on GDP growth makes little sense.

The association between happiness and income is usually divided into three subgroups. In this thesis I focus on over-time comparison and between-country comparison as in within-country comparison the consensus already exists that higher income is associated with higher happiness. Yet in the two former analyses no consensus exists and therefore I try to make here my contribution.

I find that in over-time comparison income plays role (even though not that strong) in EU (panel data approach) but does not play role in US (time-series data approach). It seems that there are more important factors determining life satisfaction, namely unemployment and quality of institutions.

In between-country comparison concerning the whole world (cross-sectional data approach) income plays more important role than in the regression just from EU countries. Therefore it looks that income plays more important role in the world than just in EU. However, much more important role play unemployment and institutional quality and especially the presence of communism (in the past or present), for which the impact is the most extreme.

If I sum up the main findings of my thesis the increase in income still plays quite important role both in between-country comparison and over-time comparison with the exception of United States where higher income did not make Americans happier. Yet I find more important factors affecting happiness. Those are namely unemployment, institutional quality and (past or present) presence of communism. All of them are both statistically and economically very significant and play much more important role in determining happiness than income. Therefore the focus of economic policies should be more on unemployment and institutional quality rather than income by itself.

*Key words*: happiness, GDP per capita, unemployment, institutional quality.

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## **Chapter 1: Introduction**

Happiness can be considered to be an ultimate goal of our being here. There can be philosophical disputes if this is the real meaning of the life but at least we can say that if it is not, still it will be very close to it. The public discussion about the economic policies usually focuses on increases in GDP (which is the income) and if we talk about recessions it means the economic growth is negative. If politicians talk about getting out of the recession they mean GDP growth rates must return to the positive figures, as this is by definition the end of the recession.<sup>1</sup> The focus is always on income. But does higher income cause higher life happiness? If it does not, the main focus of economic policies on GDP growth makes little sense. Therefore I consider this question to be the most important economic policy question out of all and focus my thesis on this subject.

This question is one of the main questions of a quite young field called happiness economics, dated back to 1974 to publishing a paper by Richard Easterlin called "Does Economic Growth Improve the Human a Lot? Some Empirical Evidence" which is now considered to be the beginning of happiness economics as a separate branch of economics.

Easterlin asked, does higher income cause higher happiness? The answer was, it depends. The finding of the paper was that within a country higher income makes people happier. However, comparing different countries, higher income was not associated with higher happiness, at least for countries with income that meets the basic needs. Moreover, as GDP per capita was rising over time people in USA did not seem to become happier, actually the happiness was approximately the same. These findings became to be known as Easterlin paradox and have been one of the biggest challenges of happiness economics.

<sup>&</sup>lt;sup>1</sup> In USA the decision if there was a recession is made by NBER Business Cycle Dating Committee. There is no fixed rule but a rule of thumb can be considered 2 consecutive quarters of decling real GDP.

This is exactly the focus of my thesis. Since the inception of happiness economics in 1974 there has been quite a lot of research on these topics which is summarized in the literature review. For research purposes happiness is usually measured by an index constructed by directly asking people about subjective evaluation of their life satisfaction. The question is usually something like "On the whole are you very satisfied, fairly satisfied, not very satisfied or not at all satisfied with the life you lead?" and to each category we can assign a numerical value, e.g. 4 for very satisfied, 3 for fairly satisfied etc. This is the usual way of constructing a happiness index. In happiness economics research the terms happiness, life satisfaction and subjective well-being (SWB) are used interchangeably. I follow the same convention. I will deal more with measuring the happiness in the literature review. In this thesis I use the terms income and GDP per capita also interchangeably. The association between happiness and income can be divided into three subgroups:

- within-country comparison here the question is if within a particular country higher income causes higher happiness, i.e. it is a micro approach comparing individuals in the country. As a measure of income is usually used salary of a person, or some kind of personalized family income
- between-country comparison the question here is if higher income countries are happier than lower income countries, i.e. it is a macro approach comparing countries among themselves. As a measure of income is usually used GDP per capita in purchasing power parity
- over-time comparison the question here is if the economic growth experienced over years is associated with increasing happiness, i.e. it is a time-series macro approach of a particular country. As a measure of income GDP per capita is used as well

As for the within-country comparison, there is consensus among happiness economists that on average higher income of a person is associated with higher happiness, e.g. Easterlin (1974,

2005), Blanchflower and Oswald (2000), Frey and Stutzer (2000), Graham et al. (2001), Stevenson and Wolfers (2008). Easterlin (2005) provides a nice summary: "As far as I am aware, in every representative national survey ever done a significant bivariate relationship between happiness and income has been found." This fact is usually explained by relative income importance where people in a country compare with their peers. The phrase "keeping up with Joneses" is often used.

However, there is no consensus for between-country comparison and over-time comparison. The evidence here is mixed. As for the between-country comparison Diener et al. (1995), Inglehart (1990), Stevenson and Wolfers (2008, 2013) suggest that higher GDP per capita is associated with higher happiness. On the contrary Easterlin (1974, 1995) Helliwell (2001) suggest that there is no or very insignificant association of GDP per capita and happiness. The same is true for over-time comparison. Alesina et al. (2001), Easterlin (2001), Diener and Oishi (2000) found no link between higher GDP over time associated with higher happiness. Actually, Blanchflower and Oswald (2000) found negative link between happiness and income in US after controlling for individual characteristics. Yet Stevenson and Wolfers (2008) are trying to refute at least partly the argument of no association between income and happiness over time.

In this thesis I will contribute to the discussion by dealing with the two latter questions where no consensus exists. I construct the models in my thesis based on the latest psychology research about happiness which tries to guide us what are its determinants (as well as consequences). This thesis uses the best currently availably happiness data sets which are described later.

## **Chapter 2: Literature review**

Does higher income cause higher life happiness? This question is one of the main questions of a quite young field called happiness economics. Happiness has been historically the focus of philosophers, and much later with the emergence of positive psychology of psychologists. Yet economists were not completely out of focus on this question. Aristotle is considered to be one of the first economists and we can find a lot of work on happiness mainly in his work Nicomachean Ethics.<sup>2</sup>

Adam Smith himself provides his own views in both of his magnum opuses "The Wealth of Nations" and his more philosophical book "The Theory of Moral Sentiments" which was published in 1759. Smith was even aware of the "hedonic treadmill" concept used in happiness economics, which states that the person will remain at the approximately same level of happiness no matter what happens, as there is a tendency of humans to get used to the current conditions.<sup>3</sup>

As Rasmussen (2011) notes "Smith repeatedly and insistently claims in The Theory of Moral Sentiments (and, to a lesser degree, in The Wealth of Nations) that neither the pursuit nor the possession of material goods does much to make people any happier, and in fact he argues

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<sup>&</sup>lt;sup>2</sup> In his work Nicomachean Ethics (Aristotle. "Nicomachean Ethics." Translated by W. D. Ross) he contemplates about happiness as being the single end of all actions in life. He begins his essay with words: "Every art and every inquiry, and similarly every action and pursuit, is thought to aim at some good; and for this reason the good has rightly been declared to be that at which all things aim."

Later, in part 7 he gives himself an answer what is the final good we all aim for: "Now such a thing happiness, above all else, is held to be; for this we choose always for self and never for the sake of something else, but honour, pleasure, reason, and every virtue we choose indeed for themselves (for if nothing resulted from them we should still choose each of them), but we choose them also for the sake of happiness, judging that by means of them we shall be happy. Happiness, on the other hand, no one chooses for the sake of these, nor, in general, for anything other than itself."

<sup>&</sup>lt;sup>3</sup> Happiness consists in tranquillity and enjoyment. (...) But in every permanent situation, where there is no expectation of change, the mind of every man, in a longer or shorter time, returns to its natural and usual state of tranquillity. In prosperity, after a certain time, it falls back to that state; in adversity, after a certain time, it rises up to it (Smith, Adam. 1790. "The Theory of Moral Sentiments. p. 36)

that they might jeopardize people's happiness." Even though Smith tried to show us where the wealth of nations comes from, he did not consider it that important for happiness in life.

In the same year as publishing of Smith's Wealth of Nations the United States Declaration of Independence was adopted which established pursuit of happiness as a right for every American.<sup>4</sup> Also a lot of neoclassical economists dealt with this topic and later also John Maynard Keynes.

However, all of these approaches were rather philosophical than empirical. Then in 1974 Richard Easterlin published a paper named "Does Economic Growth Improve the Human a Lot? Some Empirical Evidence" which is now considered to be the beginning of happiness economics as a separate branch of economics. The field was evolving first slowly, however, it gained momentum with a symposium hosted by Economic Journal in 1997 and is becoming more important now with the rising field of behavioral economics.

Easterlin asked, does higher income (GDP) cause higher happiness? The answer was, it depends. The finding of the paper was that within a country higher income makes people happier. However, comparing different countries, higher income was not associated with higher happiness, at least for countries with income that meets the basic needs. This became to be known as Easterlin paradox and has been one of the biggest challenges of happiness economics.

Different papers refer to Easterlin paradox in different ways. Some consider Easterlin paradox to be no association of happiness and income between countries, others no association of happiness and income over time and still others as both at the same time. In this thesis I will use the last approach mentioned.

<sup>&</sup>lt;sup>4</sup> The text of the second section of the Declaration reads: "We hold these truths to be self-evident, that all men are created equal, that they are endowed by their creator with certain unalienable Rights, that among these are Life, Liberty, and the pursuit of Happiness."

However, Easterlin in his paper from 1974 shows only correlations without any direct causal link. The paper uses 30 different data sets for 19 different countries. Easterlin found out that across these countries the same things were important for people, namely money, family and health.

Easterlin paradox has become the main question of happiness economics and is also the main topic of this thesis. First, I look at the association of happiness and income within countries. As for the within-country comparison, there is consensus among happiness economists that on average higher income of a person is associated with higher happiness, e.g. Easterlin (1974, 2005), Blanchflower and Oswald (2000), Frey and Stutzer (2000), Graham et al. (2001), Stevenson and Wolfers (2008). This fact is usually explained by relative income importance where people in a country compare with their peers. Importance of relative income was first proposed and empirically tested by Duesenberry (1949). The phrase "keeping up with Joneses" is often used.

Second, I look at the association of happiness and income between countries. As for the between-country comparison Diener et al. (1995), Inglehart (1990), Stevenson and Wolfers (2008, 2013) suggest that higher GDP per capita is associated with higher happiness. On the contrary Easterlin (1974, 1995) Helliwell (2001) suggest that there is no or very insignificant association of GDP per capita and happiness.

Third, I look at the association of happiness and income over time. Alesina et al (2001), Easterlin (2001, 2013), Diener and Oishi (2000) found no link between higher GDP over time associated with higher happiness. Actually, Blanchflower and Oswald (2000) found negative link between happiness and income in US after controlling for individual characteristics. Yet Stevenson and Wolfers (2008) are trying to refute at least partly the argument of no association between income and happiness over time. They found that increase in GDP per capita in Europe is associated with rising happiness. Example of Japan is often mentioned as a significant outlier. The GDP per capita has risen since World War II six fold but the average happiness has remained roughly constant. After making translation of the happiness questions from Japanese to English they found there were several changes in methodology. When they made comparison in periods with same methodology, in each period besides the last one (since 1992) they found a positive relationship between income and happiness. However, as for the US time series, even Stevenson and Wolfers agree that there is Easterlin paradox. Yet they consider it an interesting exception warranting further scrutiny.

There have emerged several possible explanations of Easterlin paradox. The most interesting is called adaptation level theory or hedonic treadmill (the term hedonic treadmill was first coined in a paper by Brickman and Campbell (1971) and provides a very plausible explanation for Easterlin paradox). There is a lot of research on this topic in psychology, e.g. Helson (1964), Brickman et al. (1971) and more recently Loewenstein et al. (1999). It means that whatever happens to the human being he tends to come back to some baseline level of happiness, substantial life changes impact happiness only temporarily. Adaption can have its roots in evolution where species were always forced to adapt to current conditions. Frey and Stutzer (2002) found that adaptation offsets about two-thirds of gain in happiness from income. Also Clark et al. (2003) found that happiness of women is higher one year before and one year after marriage, but then returns back to the previous level. However, the adaptation is not always complete. Lucas et al. (2004) found that unemployment and chronic pain can have forever-lasting impact on happiness.

Another explanation is called aspiration level theory, see Irwin (1944). If the income of a person increases, the expectations rise in tandem and there is no permanent gain in happiness. Happiness is then determined by the gap between aspiration and achievement, see Inglehart et al. (1990) (e.g. promotion raises happiness but also aspirations). It is usually true that the more one has the more one wants.

Easterlin reassured his statement in his paper from 1995 called "Will Raising the Income of All Raise the Happiness of All?" where he gave a resounding answer: No. However, his research was later challenged by other scholars, e.g. Veenhoven et al. (2003). The answer was the same from already mentioned Stevenson and Wolfers (2008). They concluded that Easterlin paradox does not exist and countries are indeed becoming happier as the income rises although the rise in happiness tends to be smaller the higher is the income. In 2010 Easterlin published a paper called "The Happiness-Income Paradox revisited" where he confirmed his previous findings and to previous researchers responded that "recent critiques of the paradox, claiming the time series relationship between happiness and income is positive, are the result either of a statistical artifact or a confusion of the short-term relationship with the long-term one." The debate is still going on.

However, the happiness economics does not deal only with the income-happiness relationships. There are a lot of determinants of happiness. This is probably more a question for psychologists, sociologists or philosophers, yet it is a lot interconnected with economics and all disciplines complement each other.

As for macroeconomics, both inflation and unemployment tend to make people less happy. Long ago there has been constructed the misery index which simply sums the unemployment rate and the rate of inflation. The higher the sum, the worse the state of an economy. Yet Oswald (2001) found that one percentage point of increase in unemployment decreases the happiness by the same amount as 1.7 percentage point increase in inflation. Thus people are much more sensitive to similar increase in unemployment compared to inflation and the misery index should be weighted more towards unemployment rate.

In European countries there was conducted a survey called Eurobarometer Survey Series between 1975 and 1991. It was tracking the self-reported happiness of European people and besides this asked about their current individual characteristics. The self-reported happiness was correlated with these individual characteristics in order to find out what kind of people tend to be happy. Holding other things equal, on average happier are people who are married, on high income, women, whites, well-educated, self-employed, young or old (as opposed to middle aged)<sup>5</sup>, looking after home. Oswald et al (2003) later found similar relationships. Stevenson and Wolfers (2009) found that even though women were on average happier than men in the sample period used, since 1970s their happiness is decreasing and this phenomenon is found across demographic groups and industrialized countries. Now it looks that it is even lower than men's happiness. The same study found that lower life satisfaction is connected with people who are unemployed, divorced or live with a teenager. Of course these were only correlations and the causality can be reverse: happier people tend to marry more than the unhappy ones.

The effect of income on happiness is not straightforward. If happiness economists can be sure about something it is that unemployment has large negative effect on well-being. This is true across countries and different time periods, see Frey and Stutzer (2004), MacKerron (2012), Blanchflower et al. (2000), Korpi (1997), Goldsmith (1996). Di Tella et al (2003) found especially significant negative effects of unemployment on happiness even after controlling for a lot of macro variables and personal characteristics. Clark and Oswald (1994) found that unemployment decreases happiness by more than any other variable, involving very negative personal events such as divorce or separation. They also found that unemployment affects more happiness of more educated than less educated. Ruhm (2000) found that 1 percentage point of increase in the unemployment rate is associated with increase in suicides by 1.3 %. Darity et al. (2003) mention that unemployment besides its main effect of causing people to lose jobs and thus making them less happy can lower happiness also in employed people as

<sup>&</sup>lt;sup>5</sup> Happiness is actually a U-shaped function of age, minimized around 30s

the fear of dismissing oneself increases. However, there can be also positive effects of unemployment. During higher unemployment rates, the unemployed can feel less as being outliers. This was empirically proven by Kelvin (1985) and later Clark et al. (2001).

Lower unemployment definitely means higher happiness even after controlling for a lot of factors. However, important is also reverse causality. Diener et al. (2008) mention that happier people are more productive and they are less likely to be unemployed.

The role of institutions is proposed by Frey and Stutzer (2002) as a possible determinant of happiness, however not much of research has been done in this area.

Important question which often arises is that what role is played by the genes in how happy people are. Actually, the nature vs. nurture question is one of the main questions of psychology, as many psychology textbooks explain, see e.g. Weiten (2007). What proportion of life is affected by inborn genes and what proportion plays the environment (upbringing, peers, society, etc.)? Diener et al. (2008) state that some people are just born with "happy genes". They however emphasize that it does not mean that people cannot change their happiness level and say that there is no happiness set point. Fowler et al. (2012) found 33 % of life satisfaction is explained by genetic factors. In micro panel data this can be controlled for by unit specific fixed effects, as genes are by definition time-invariant.

A big objection to happiness economics is that subjective wellbeing data are not reliable. The complaints are vast: people do not tell the truth, there are cultural differences, "mine feeling happy" means different than "yours feeling happy", the answer about happiness reports just the current state and many others. Therefore a lot of importance has been attached on how to measure happiness. Actually, the subjectivity of data is a good property as feeling good is a feeling hard to measure and more importantly it is a subjective feeling. The fact that subjective reporting of happiness is a valid measure was also shown by assessment of person by her friends or relatives. The responses of a person and her peers correlated substantially.

Kahneman and Krueger (2006) provide a table of correlates of high life satisfaction and happiness:

Table 1: Correlates of high life satisfaction and happiness

Smiling frequency
Smiling with the eyes (unfakeable "Duchenne" smile)
Ratings of one's happiness made by friends
Frequent verbal expressions of positive emotions
Sociability and extraversion
Sleep quality
Happiness of close relatives
Self-reported health
High income, and high income rank in a reference group
Active involvement in religion
Recent positive changes of circumstances (increased income, marriage)

Source: Kahneman and Krueger (2006)

Thus if somebody answers as being happy in a survey, the answer correlates with a lot of more objective factors. Moreover the same authors provided an alternative measure for happiness, a U-index (U for unpleasant, undesirable). U-index measures the proportion of time an individual spends in an unpleasant state. The main advantage of U-index is that it is ordinal, i.e. it circumvents the problem "my rating of 4 is not the same as yours rating of 4". The disadvantage is that it can be obtained only from Experience Sampling Method or Day Reconstruction Method mentioned below.

There are several biological ways trying to measure happiness as mentioned in Diener et al. (2008). Neuroscientists use brain images in order to measure celebral activity of happy people. Scientists found an area in prefrontal cortex that is associated with happiness. Another

biological approach is to measure hormones in the brain, or more easily in blood. Hormones serotonin, noradrenaline and dopamine are believed to be related to happiness. Diener et al. (2008) mentions: "In fact, self-reports of happiness correlate with the biological measures, suggesting that asking folks about their happiness is a valid route to measuring this experience."

Moreover, more methods of how to assess happiness have been proposed as time went on. Experience sampling method (ESM) uses a hand computer which is carried by a person the whole day and when the random alarm beeps the person is supposed to notice his state of happiness as well as other current-state information. By this method scientists can measure happiness in many different social situations. Day reconstruction method (DRM) asks people to recall the feelings from recent past in different situations and scientists then evaluate them. Different indicators can be combined in order to get better results.

ESM is considered to be the best method for gathering happiness data. However, the obvious problem is high cost. Kahneman and Krueger (2006) mention that DRM provides an efficient approximation to ESM. The advantage is lower cost of obtaining DRM data.

One suggestion was done by Veenhoven (1996). He proposed to measure "happy life years" which is just the usual happiness index multiplied by life expectancy. Its logic is that it is different to be happy for 40 years and to be happy for 80 years. As with higher GDP there is better health care, finally higher income will cause higher happiness measured by happy life years which can be an argument for government that increasing GDP really matters.

## Chapter 3: Econometric models

This part presents the outcome of my analysis. I built several models based on the latest psychology research about what are the determinants of happiness. The sources for building the models were many papers but especially useful was the book written by the biggest authority in the happiness research Ed Diener and his son Robert Biswas-Diener "Happiness: Unlocking the Mysteries of Psychological Wealth (2008)". It reads that "the findings in this book represent the best understanding of happiness that currently exists". I use the best data sets on happiness currently available in the world, namely Eurobarometer survey, General Social Survey and Gallup World Poll. In this chapter I provide a brief description of the data sets (including independent variables), detailed description of the data can be found in Appendix 1.

As mentioned in the introduction, I divide the analysis into two sections, over-time comparison and between-country comparison. In none of these areas consensus exists so I will try to contribute with my own findings.

In the over-time comparison I use the panel data analysis with Eurobarometer Survey data and time-series analysis with General Social Survey data. In the between-country comparison I use cross-sectional analysis with Gallup World Poll data. In each section there is a justification for my model as well as mentioning the limitations and a brief description of the data used. Then the outcome and my interpretation are presented.

### 3.1 Over-time comparison

As mentioned in the introduction there is no consensus in over-time comparison. Most of the countries experience in the long run economic growth so their income increases. But does also happiness increase hand in hand with income? As mentioned in the literature review most of

the studies found no link over time. However the problem is that not enough and not long enough time series are available. Therefore the analysis usually focuses on three countries (or regions) with at least some data at hand. These three regions are Japan, European Union and USA.

As for Japan, Stevenson and Wolfers (2008) found several changes in methodology in Japanese happiness data so I consider this data as unreliable.

Hence I was left with EU data and US data. For European Union the Eurobarometer survey data are used. It covers the period since 1973. As for the USA they have the most reliable data so this can make my analysis convincing. Most of the over-time comparison studies done focus on USA. Many studies found no link between higher GDP per capita over time associated with higher happiness in USA, moreover one study found negative link between happiness and income in US after controlling for individual characteristics. Even Stevenson and Wolfers agree that there is Easterlin paradox in United States yet they consider it an interesting exception.

## **3.1.1** Eurobarometer regression (panel data approach)

## 3.1.1.1 Data and justification

Since 1973 Eurostat makes a poll in European Union countries called Eurobarometer survey. In a lot of years more countries than just member states were interviewed. I deleted the answers of non-member countries in order to be able to interpret the data as happiness study in European Union, not to create confusion. The deleted countries are mentioned in Appendix 1. Eurobarometer is a panel data set ranging from 1973 to 2012, with skipping the years 1974 and 2002. A lot of questions are asked, however my interest was only in life satisfaction question. The question was this: "On the whole are you very satisfied, fairly satisfied, not very satisfied or not at all satisfied with the life you lead?" Therefore there were four possible

answers to choose from. I assigned each category a number: 4 = very satisfied, 3 = fairly satisfied, 2 = not very satisfied, 1 = not at all satisfied. For each country in each year I calculated average happiness by making a weighted average, where weights were the proportions assigned to each answer. These values are used as observations of the dependent variable.

I also deleted the observations for countries which in given year had the difference between GDP and GNP more than 10 %. The justification for this as well as the observations which were cancelled are mentioned in Appendix 1.

Subjective well-being data are available, the question is now: what determines happiness? Most obviously there are thousands of determinants of happiness which usually differ across individuals. However studies always deal with averages, what on average causes happiness. This thesis is moreover focused on macro averaging which is even more aggregation than averaging on micro level. Diener et al. (2008) mention as causes of life satisfaction for most of the people relationships, health, work, income and leisure.

Relationships and leisure are hard to measure. Moreover for leisure there is no consensus even for defining it so it is very hard to try to figure out quantitatively if it is a determinant of happiness. Some people have a lot of activities and enjoy their leisure. Some people watch a lot of TV in their leisure and it is found that excessive watching of TV decreases happiness (possibly because people have nothing better to do). Other people may have "leisure" because they are unemployed. Unemployment is one of the most happiness-decreasing situations, so the "leisure" for unemployed people may be very different than those for employed. On the macro level I will not include leisure in the regression because of the problems mentioned. Relationships are also hard to measure life situations as it is a very complex thing. For all regressions it is omitted for almost impossibility of measuring it. Health, work and income are easier to measure. For measuring the quality of health there are a lot of indicators. Theoretically the best indicator is Quality-Adjusted Life Years (QALY). It measures how long a person lives on average adjusted for health conditions. For example 2 years in full health would mean 2 QALYs. One year in full health and one year in 50 % health would mean 1.5 QALY. This indicator is the best in theory however there are a lot of practical problems with measuring it and it is not available. The second best option is Healthy Life Years (HLY). Those are years spent in full health. This indicator is published by Eurostat since 1996 and is available only for EU countries. Therefore the amount of data for my analysis is insufficient. Hence I decided for the simplest indicator measuring health, which is available for all countries in all time periods. It is the life expectancy at birth and it has been used as a proxy for measuring health state for decades.

Influence of work on happiness can be measured in various ways. From a macro policy perspective the most interesting is to look at the influence of unemployment on happiness. If happiness economists can be sure about something it is that unemployment has large negative effect on well-being. Therefore I include this indicator in my model.

Income is the most important independent variable for this thesis, as I try to assess whether income affects happiness or not, and if yes to what extent. As this thesis is policy oriented, I focus here on the indicator which gains the most interest among economists – GDP per capita. GDP per capita tells us the average income (of labor, capital and land) in one year. I use GDP per capita in constant prices (i.e. focusing on real values) and in purchasing power parity (PPP). PPP adjustment allows controlling for different price levels in countries. More developed countries usually have higher price level often explained by Balassa-Samuelson effect. For my analysis, the purchasing power is important, i.e. how much a person can really buy. For comparability among data sets used in this thesis I always use GDP per capita in constant 2005 dollars. GDP has a lot of advantages and drawbacks which are discussed in

every economics textbook. However, the main focus of economic policies is to increase GDP (income) and hence I focus in this thesis directly on this indicator.

Moreover I included some new independent variables which can be important for happiness and are sometimes mentioned in happiness economics literature. Inflation is a lot of times mentioned as having impact on happiness. This was pointed out in literature review. As a measure of inflation I use here the change in consumer price index (CPI).

Gradually also institutional quality starts to be important for happiness economists. They found some links with happiness. Different papers have different approaches how to measure institutional quality. I used a very aggregated approach. Institutional quality data used in this thesis come from the paper Institutional Quality Dataset (2013) by Aljaz Kuncic. He aggregates more than 30 currently available indicators measuring the quality of institutions and out of them creates three indicators: legal environment, political environment and economic environment. The data set is available for almost each country in the world for period 1990 – 2010. Details of the construction of the data set can be found in the paper mentioned above. I created my own indicator of institutional quality by making simple average of these three indicators. My composite indicator can achieve values from zero (worst institutional environment) to 1 (best institutional environment).

#### 3.1.1.2 Econometric estimation

Eurobarometer data set in this thesis is a panel, because it follows the same unit (country) over time. My model for Eurobarometer regression has the form:

### HAPPEURO = f(RGDPPC, INFL, INSTITUT, LIFEEXP, UNEMPL)

where happiness in European Union (HAPPEURO) is a function of real GDP per capita in PPP (RGDPPC), inflation rate (INFL), institutional quality (INSTITUT), life expectancy (LIFEEXP) and unemployment rate (UNEMPL).

The sample size is 519 country/years. First I did a test for the presence of heterogeneity. Both Chow test and LM test strongly rejected the hypothesis of no heterogeneity with both p-values of 0. Results of both tests can be found in Appendix 2. Therefore I found that significant heterogeneity among units is present and pooling the data would be incorrect. Hence, fixed effects estimator (FE) or random effects estimator (RE) can be considered. I used Hausman test in order to decide for one of them. Hausman test strongly rejected the zero hypothesis of no correlation between time-invariant part of the error and independent variables with p-value of 0. The result can be found in Appendix 2. Therefore in this case RE is an inconsistent estimator and I will use FE.

Thus, the most suitable estimation procedure for my model is ordinary least squares (OLS) with country fixed effects. My econometric model looks as follows:

$$\begin{split} HAPPEURO_{it} &= \beta_0 + \beta_1 RGDPPC_{it} + \beta_2 INFL_{it} + \beta_3 INSTITUT_{it} + \beta_4 LIFEEXP_{it} + \beta_5 UNEMPL_{it} \\ &+ u_i + e_{it} \end{split}$$

where each variable differs across country (i) and across time (t).  $u_i$  is the time-invariant part of the error and  $e_{it}$  is part of the error which changes over time. FE procedure is very helpful here because by FE transformation I get rid of the time-invariant part of the error and therefore decrease the bias of the estimator. In this case time-invariant part of the error term can include for example country specific culture. Using country fixed effects turns my regression into over-time analysis as FE estimator takes into account only variation over time but disregards variation between countries as will be explained later.

Here I present the results of the estimation by OLS with country FE.

 Table 2: Eurobarometer regression estimation

Dependent variable: HAPPEURO			
Independent variable	OLS with country FE	OLS with country FE	
RGDPPC	7.25x10 <sup>-6</sup> *		
	$(4.01 \times 10^{-6})$		
LOG(RGDPPC)		0.146594	
		(0.103811)	
INFL	0.000843	0.001243	
	(0.002584)	(0.002529)	
INSTIT	0.390064**	0.404478**	
	(0.195568)	(0.196976)	
LIFEEXP	-0.015819*	-0.012618	
	(0.008936)	(0.008202)	
UNEMPL	-0.010833***	-0.010924***	
	(0.002501)	(0.002795)	
Constant	3.763999***	2.208044***	
	(0,643452)	(0.652338)	
Pseudo-R squared	0.94	0.94	

Note: \*\*\*p<0.01, \*\*p<0.05, \*p<0.10 Robust standard errors in parentheses

Two regression results are presented – one uses real GDP per capita in PPP as a measure of income and the other uses its natural logarithm. By using LOG(RGDPPC) I wanted to allow for diminishing "utility" of money, i.e. each additional dollar will bring lower happiness. I found that the happiness – income relationship is stronger in linear form (p-value = 0.072) than in logarithmic form (p-value = 0.152). From these results it looks that there is rather linear relationship and at least in the sample of EU countries it does not seem that there is diminishing utility of money. Hence I will focus on the linear relationship (first estimation). All other variables are in linear form as there is no economic justification to put them in any other form.

From the statistical significance of coefficients it can be seen that institutional quality and especially unemployment have higher influence on happiness than income (GDP per capita). However, the influence of income on happiness is still significant at 10 % level. An increase

in GDP per capita in PPP of 1000 USD will on average increase the happiness by 0.00725 points on the scale. I just remind that the happiness scale in Eurobarometer data is from 1 to 4. Hence economically this looks like a very negligible impact on happiness.

Looking at unemployment there can be seen an extremely statistically significant impact on happiness. Actually, as will be pointed out this will be true across all the data sets and is absolutely in line with current research (see literature review). A decrease of unemployment rate by one percentage point will on average increase happiness by 0.011 points on the happiness scale.

Let's give it a perspective via Okun's law. Estimation is that a 2 % increase in GDP is associated with 1 percentage point decrease in unemployment rate. As the population growth rate in EU has been during the past decades close to zero, an approximation can be made and in Okun's law instead of GDP using GDP per capita. In the sample, the average GDP per capita in PPP is approximately 25 000 USD. Therefore a 4 % increase in GDP per capita means an increase by 1 000 dollars. Now if I come back to Okun's law and apply it to the data a 1 000 USD increase in GDP per capita (a 4 % increase) is associated with a decrease in unemployment rate of 2 percentage points. I can compare the economic effect of an increase in GDP per capita will on average increase the happiness by 0.00725 points. A 2 percentage points decrease in unemployment rate will on average increase the happiness by 0.022 points. Therefore the economic effect of decreasing unemployment rate is on average more than 3 times higher than an equivalent increase in income. This is an important finding as both statistically and economically unemployment affects happiness to a much higher degree than income. I will mention this in policy conclusions.

We see that inflation has no significant effect on happiness. Studies mentioned in literature review which found impact of inflation on happiness in the same data set did not control for other variables. After I controlled for other variables the impact of inflation on happiness is strongly insignificant (p-value = 0.74). This analysis was done in European countries which did not encounter high inflation rates. High inflation and for sure hyperinflation have effect on happiness but low inflation rates seem to be unimportant for happiness of people.

Yet what seems to be a very important aspect for happiness is the institutional quality. The estimate is significant on o 5 % level (p-value = 0.047). As mentioned earlier, the institutional quality indicator can achieve values from zero (worst institutional environment) to 1 (best institutional environment). According to my estimates, if we increase the institutional quality by 0.1 on the scale, happiness will on average increase by 0.039 points. Compared to my previous estimates (e.g. the most important that a decrease of unemployment rate by one percentage point will on average increase happiness by 0.011 points on the happiness scale) institutional quality looks very important for happiness. However, a jump by 0.1 points in the institutional quality is quite big and institutional quality is already quite high in old EU member countries. To put it into perspective, in the data set, the average institutional quality is 0.76, standard deviation 0.08, minimum is 0.55 and maximum is 0.95.

The only striking estimate in the equation is that of impact of life expectancy on happiness. The sign is unexpected as an increase in life expectancy causes a decrease in happiness and the result is statistically significant at 10 % level (p-value = 0.078). An increase of one year in life expectancy causes on average a decrease in happiness by 0.016 units, which is quite significant value. When I tried to make a simple regression of happiness just on life expectancy there was a clear positive and statistically significant link. However, after controlling for other factors in the happiness equation the link completely changed its direction. The fact of negative association is hard to explain. One of the reasons can be that with higher life expectancy there can be more older people and if their happiness is lower than average this will cause an overall decrease in happiness. Yet this is not true according to the

research (according to some research old people are as happy as their younger counterparts, according to other research there is a U shape of age-happiness relation, with youngest and oldest people being the happiest). The most plausible explanation for this is that I use different control variables compared to other studies which found that older people are happy. However, I decided to keep life expectancy in the equation despite this problem as in my opinion its omission can introduce bias to the estimator. Health is proven to be an important aspect for happiness and life expectancy can hardly be challenged as a bad indicator of health condition of population even though it is not perfect as mentioned earlier.

One of the biggest problems with all happiness equations is endogeneity. We still do not know all of the determinants of happiness and omitting important variables correlated with regressors can introduce a substantial bias into equation. Considering only reverse causality, there is evidence that happiness affects productivity of workers (and hence probably unemployment rate) and their health (Diener et al., 2008). These issues can be dealt with instrumental variables which I will mention together with one limitation of FE procedure in the following paragraph.

Here I make one point regarding the estimation procedure. I used FE estimator which is a within estimator, i.e. it takes into account only variation within a unit (in our case within a country) and disregards the variation between the units (between countries). This means a lot of loss in efficiency. RE estimator is a generalized least squares (GLS) procedure where the higher precision comes mainly from the fact that it is a weighted average of within estimator and between estimator. In my case, it would take into account both how happiness changes over time as independent variables change over time and how happiness changes for different countries at one point in time as the independent variables change. RE estimation could provide me with much better information by considering also between-country comparison. However, as was already mentioned, I found that RE estimator would be inconsistent because

of correlation between the time-invariant part of the error and independent variables. I tried to overcome this endogeneity issue by using Two-Stage Least Squares (TSLS) estimation procedure with instrumental variables (IV). I spent a vast amount of time looking for suitable instruments. Yet I found several problems which can be interesting to mention here in order to provide my experience for further researchers.

First, it can be difficult to find a variable which does not influence happiness as happiness is determined by thousands of factors. It can be easier on macro level, where the aggregation is quite high and a lot of factors just average out. Happiness of each person is affected by a lot of different factors but on a very aggregated macro level analysis can be limited to much less variables. Hence in future research it would be easier to find an IV for endogenous regressors on macro level than on a less aggregated micro level. Using IVs on micro level can be very disputable. Yet TSLS can only be used in large samples (as it is a biased estimator) which can be problematic on macro level.

Second, even after indicating potential IVs for endogenous regressors it is very difficult to find strongly correlated IVs with endogenous regressors (rule of thumb is that F statistic > 10). When I found a strong correlation its strength disappeared after accounting for the influence of other exogenous variables. Even after finding suitable IVs they should be jointly significant, which is a very difficult task. IV estimation is by definition less efficient than OLS estimation so avoiding weak correlation is important for good estimation results.

Third, I tested in overidentified equation for validity of surplus instruments, which was often rejected. Finding suitable IVs for happiness equation is probably the most challenging task for future researchers because happiness equations usually have endogeneity problem, as happiness is so everything encompassing phenomenon. This is what I wanted to mention as a suggestion for future research. Causality in social sciences usually goes both directions and

happiness is determined by a huge amount of factors so forgetting to take into account those facts can introduce substantial bias in the happiness equations.

## **3.1.2** General Social Survey regression (time-series data approach)

## 3.1.2.1 Data and justification

The data come from a survey by National Opinion Research Center called General Social Survey (GSS). GSS was conducted in USA every year from 1972 to 1994 (except in 1979, 1981, and 1992). Since 1994, it has been conducted every second year. This data are often used in happiness economics research.

The question asked in the survey is "Taken all together, how would you say things are these days – would you say that you are very happy, pretty happy or not too happy?" I coded the answers in the following way:

3 = very happy

2 = pretty happy

1 = not too happy

More on the data can be found in Appendix 1.

This time series has been a lot of time used to show that there is no increase in happiness over time despite high economic growth. If I plot yearly happiness data from GSS together with GDP per capita for period 1972 - 2010, it looks like this:



Table 3: Average life happiness vs. GDP per capita over time (both in USA)

Source: GDP per capita data is obtained from the World Bank, Average happiness is obtained from the General Social Survey

Despite more than two times increase in income happiness stayed during 40 years approximately at the same level. Yet no presence of association does not mean that there is no causal link. It can be that income really increased happiness over time but other factors contributed to its decline so on average we see no increasing trend in happiness. Therefore I need to control for these omitted variables in the regression.

As independent variables I include real GDP per capita, inflation rate, life expectancy and unemployment rate. I used institutional quality in previous data set, however, there is no long enough time series which can serve as a proxy for this purpose. So I had to skip it. Institutional quality did not change a lot at least during nineties in USA according to the indicators so this should not create a big problem. The reasoning for including control variables is the same as in the previous model.

GDP per capita was again for the reason of direct comparison with the other data sets used in constant 2005 dollars. As there is no cross-country comparison, PPP adjustment is not necessary.

## 3.1.2.2 Econometric estimation

The model for General Social Survey regression has the following form:

HAPPYUSA = f(GDPPC, INFL, LIFEEXP, UNEMPL)

where happiness in USA (HAPPYUSA) is a function of GDP per capita (GDPPC), inflation rate (INFL), life expectancy (LIFEEXP) and unemployment rate (UNEMPL).

The sample size is 29 observations, data are yearly. First of all, time series analysis has to be made with stationary data in order to avoid spurious correlation. I did an augmented Dickey-Fuller test (ADF test) in order to find out if the series are stationary and if not to check the order of integration. Here are presented the results.

Order of Integration of	variables (determined b	y augmented Dickey-
Fuller test)		
Variable	Order of Integration	Type of ADF test
HAPPYUSA	I(0)	Intercept
GDPPC	I(1)	Trend and intercept
LOG(GDPPC)	I(0)	Trend and intercept
INFL	I(0)	Trend and intercept
LIFEEXP	I(1)	Trend and intercept
UNEMPL	I(1)	Intercept

Table 4: Order of integration of variables

Note: I(0) means integrated of order zero, I(1) means integrated of order 1

I include in the Type of ADF test column whether I used equation only with intercept or both intercept and trend in the equation. The cointegration of variables was not found, as the residuals were not stationary. There is no problem with HAPPYUSA, as it is I(0). We detrended GDPPC, LOG(GDPPC), INFL and LIFEEXP in order to make them stationary. We will refer to the de-trended values as GDPPC\_DETR, LOG(GDPPC)\_DETR, INFL\_DETR, and LIFEEXP\_DETR respectively. UNEMPL was put in the first-difference form where it is stationary. It is named UNEMPL\_DIF.

The equation without any lagged dependent variable showed first-order and second-order autocorrelation. Hence I included two lags of HAPPYUSA, namely HAPPYUSA\_1 and HAPPYUSA\_2, which are first-order lag and second-order lag respectively. By including these lags in the equations I got rid of autocorrelation completely.

I experimented with several lag structures after I came to the conclusion that the simple model without any lags of independent variables seems to be the best. Including lags of independent variables never produced an effect of making them significant even at 10 % level, actually the significance was always very far from it. Finally I decided to estimate two equations which are similar, the only difference is that the first equation uses real GDP in linear form (detrended values) and the second equation uses real GDP in logarithmic form (detrended values). As the coefficients are difficult to interpret because of their detrended and first-differenced nature, I provide just the p-values to show which variables were significant in influencing the happiness over time and if income played an important role after controlling for other variables. Here is the outcome.

Dependent variable: HA	APPYUSA	
Independent variable	OLS (p-values)	OLS (p-values)
HAPPYUSA_1	0.07	0.10
HAPPYUSA_2	0.26	0.26
GDPPC_DETR	0.66	
LOG(GDPPC)_DETR		0.59
INFL_DETR	0.49	0.39
LIFEEXP_DETR	0.95	0.99
UNEMPL_DIF	0.01	0.04
Constant	0.24	0.20
R squared	0.50	0.51

Table 5: General Social Survey regression estimation

Note: Numbers in the table are p-values

Both equations have very similar R squared. According to both residual correlogram and serial correlation LM test no autocorrelation is present in neither of equations. The most important finding is that both coefficients on real GDP in logarithmic form and its linear counterpart are highly insignificant. This is in line with most of the previous research. Over time the growth in GDP per capita is not that important for United States. Both adaptation level theory (people get used to most of the conditions) and aspiration level theory (with rising income also aspirations rise) are in my opinion very plausible explanations of this phenomenon. They were described in more detail in literature review. Yet we need to be aware that this concerns the US data, where the basic needs are already met. If happiness data for countries poor in the past were readily available, most probably we would see an increase in happiness accompanying an increase in income. It seems that over time there exists some set point, over which increase in income would not cause an increase in happines.

All of the coefficients are insignificant besides two: UNEMPL\_DIF and HAPPYUSA\_1. Both lags of dependent variables were necessary to dispose of autocorrelation even though the coefficient on the second lag is not significant. The only interesting variable that is significant is unemployment. The analysis has shown that unemployment plays role even over time in US. In this regression unemployment rate is much more important than GDP per capita. For Americans joblessness seems to decrease happiness as compared to no significant impact of income. I got the same conclusion as in previous regression – unemployment is one of the most important determinants of happiness.

If I sum up the findings from over-time comparison income plays role (even though not that strong) in EU but does not play role in US. These findings are in line with those of Stevenson and Wolfers (2008) who came to the same conclusion. I found that there are more important factors determining life satisfaction, namely unemployment and quality of institutions.

## 3.2 Between-country comparison

There is also no consensus in between-country comparison if higher income causes higher happiness. Some papers find the association between income and happiness yet in others the associations is at most mild. The differences are caused by using different techniques or different data sets. Here I built model based on one of the best data set currently available.

## **3.2.1** Gallup World Poll regression (cross-sectional data approach)

## 3.2.1.1 Data and justification

For the cross-sectional analysis I use the data from Gallup World Poll from 2012. I consider the Gallup data sets in general to be the best in the world and they cover 98% of the world's residents through nationally representative samples. This is an advantage over the Eurobarometer data as Gallup data cover the whole world and I can estimate the impact of income on happiness on the global level.

The happiness question was: "Imagine a ladder with steps numbered from 0 at the bottom to 10 at the top. Suppose the top of the ladder represents the best possible life for you and the bottom represents the worst possible life for you. On which step of the ladder would you say you personally feel you stand at this time, assuming that the higher the step the better you feel about your life, and the lower the step the worse you feel about it? Which step comes closest to the way you feel?" That means an 11 point scale is used with 10 meaning the highest life satisfaction and 0 the lowest life satisfaction. Again, countries with higher than 10 % difference between GDP and GNP were discarded. More about both dependent and independent variables used in this regression can be found in Appendix 1.

The reasoning for choosing independent variables is the same as in previous data sets. Moreover I also tried to find out if the presence of communism (in the past or present) affects life happiness. Therefore I included a dummy variable for communism. Communism dummy variable is 1 for all countries with at least 10 years history of communism or currently communist countries. It is 0 otherwise. It was not possible to use it in panel data analysis as FE cancels out all time-invariant variables.

Again I used GDP per capita in constant prices (real GDP) even though it was not necessary because of cross-sectional form of data set, i.e. no year-to-year changes. However, I wanted to make GDP per capita comparable to previous data sets so I used again GDP per capita in 2005 dollar prices. PPP adjustment was also used because of cross-country comparison.

All other variables are measured in the same way as in Eurobarometer regression besides one. It is the measurement of institutional quality. As the institutional quality data set used in Eurobarometer survey is available only until 2010, I needed to choose an indicator accessible also for 2012. In my opinion one of the best other indicators used to measure institutional quality is the Transparency International's Corruption Perception Index. It is available for 2012 and is also a composite indicator of different indicators. It can reach values from 0 (worst perceived corruption) to 100 (best corruption achievement).

#### 3.2.1.2 Econometric estimation

My model for Gallup World Poll regression has the following form:

LIFESAT = f(GDPPC, COMMUN, INFL, INSTITUT, LIFEEXP, UNEMPL)

where life satisfaction (LIFESAT) is a function of GDP per capita in PPP (GDPPC), communism dummy (COMMUN), inflation rate (INFL), institutional quality (INSTITUT), life expectancy (LIFEEXP) and unemployment rate (UNEMPL).

The sample size is 145 observations, i.e. 145 countries are tracked. First, I did the RESET test for model specification. Both with just squared fitted values and squared and cubed fitted

values the tests did not find any misspecification. Results of both tests can be found in Appendix 2.

I estimated the equation by OLS, again using GDP per capita once in linear form and once in logarithmic form. Here are presented the results:

Table 6: Gallup World Poll regression estimation

Dependent variable: LIFESAT				
Independent variable	OLS	OLS		
GDPPC	$2.00 \times 10^{-5} $			
	$(8.35 \times 10^{-6})$			
LOG(GDPPC)		0.247244**		
		(0.098239)		
COMMUN	-0.354011**	-0.415585**		
	(0.160457)	(0.162030)		
INFL	0.003229	0.003804		
	(0.010715)	(0.010692)		
INSTIT	0.016368***	0.017813***		
	(0.005919)	(0.005532)		
LIFEEXP	0.008267	0.008411		
	(0.018484)	(0.018406)		
UNEMPL	-0.045233***	-0.047199***		
	(0.013049)	(0.012885)		
Constant	4.605046***	2.574712*		
	(1.291166)	(1.140044)		
R squared	0.58	0.59		

Note: \*\*\*p<0.01, \*\*p<0.05, \*p<0.10 Standard errors in parentheses

Breusch-Pagan test did not reveal any heteroskedasticity so I did not make any adjustment to standard errors. The results in both equations are quite similar yet the second equation is slightly more significant based on R squared and p-values of coefficients. For the interpretation purposes I will focus on the first estimation (even though both are quite similar) as easier comparison can be made with Eurobarometer data set as I was focusing on GDP per capita in linear form. If the most interesting coefficients are compared, those on GDP per capita in linear form and GDP per capita in logarithmic form, we see that they are statistically quite significant; p-values are equal to 0.019 vs 0.014, respectively. Here it seems it makes some sense to allow for diminishing utility of money, but the difference is slight. Compared to Eurobarometer regression this regression takes into account almost all countries in the world as opposed to just European Union where smaller cultural differences are present. As we see from the results, a 1 % increase in income increases the happiness on average by approximately 0.0025 points on the scale. It is important to keep in mind that the scale is 11 point, from 0 to 10, while in Eurobarometer regression was just 4 point. So a 1 point jump in Eurobarometer happiness data set is much higher than a 1 point jump in Gallup World Poll happiness data set. If we come back and interpret the coefficient on GDP per capita in the first equation then an increase of 1 000 USD in GDP per capita will on average increase happiness by 0.02 points. The scale in Gallup World Poll happiness data set is wider by factor of 2.75 than the scale in Eurobarometer. A 1 000 USD increase in GDP per capita in Eurobarometer regression increased the happiness on average by 0.00725 (always the constant 2005 dollars are used). If we take into account the scaling then for reasons of comparing to Gallup scale we can find the comparable increase in happiness by multiplying 0.00725 by factor of 2.75. The result will be that an increase in happiness will be 0.02 which is the same value as in Gallup World Poll regression. Thus we can say that a 1 000 USD increase in GDP per capita increases the happiness on average by the same amount in EU as in the whole world. However, the coefficient in Gallup World Poll regression is much more statistically significant. It needs to be understood that these are different data sets with different methodologies but the similarity of impact in EU and the whole world is still striking. Yet if we take into account also the statistical significance, income seems to play more important

role in the whole world than just in EU countries. This can be justified as in the Gallup World Poll also the less developed countries are included and income can play higher role there.

As for the unemployment the results are very similar to Eurobarometer regression. The impact of unemployment on happiness is extremely statistically significant (p-value=0.00). A one percentage point decrease in unemployment rate increases happiness by 0.045 points on the happiness scale.

Again, we can give a look at the GDP-unemployment relationship via Okun's law. However, we would need its estimate for the whole world and we cannot make the approximation that the population growth is zero, as it is higher than 1 %. Therefore I will make conclusions based on just some economic intuition. First, I will present some descriptive statistics for the GDP per capita in the sample used. The average is 12 000 USD, standard deviation 12 150 USD, minimum 350 USD and maximum 53 250 USD. We can see a high variation as the whole world is covered. Now we will look at the impact of GDP per capita on happiness both from absolute perspective and from relative perspective.

From absolute perspective, as was mentioned, an increase of 1 000 USD in GDP per capita will on average increase happiness by 0.02 points. Such an increase in GDP per capita can be considered extremely high in less developed countries and still high in more developed countries. A decrease in unemployment by one percentage point seems to be more achievable. Despite easier achievement, a one percentage point decrease in unemployment rate increases happiness by 0.045 points, which is more than 2 times higher effect than the effect of increase of GDP per capita by 1 000 USD. Moreover, in less developed countries the tradeoff is almost impossible; it would be much easier to accomplish a 1 p.p. decrease in unemployment rate than an increase in GDP per capita by 1 000 USD. Still the decrease in unemployment will bring much higher happiness than the increase in income. If both statistical significance and

economic significance are taken into account, unemployment is much more important for happiness than income in the whole world. This should be kept in mind when I will be making policy conclusions.

From a relative perspective, a 1 % increase in income increases the happiness on average by approximately 0.0025 points on the scale. More realistic can look a 2 % increase in GDP per capita, i.e. the impact on happiness would be an increase by 0.005 points. The impact of a 1 p.p. decrease in unemployment is much higher (0.047 – see the second equation using LOG(GDPPC)). Again, the impact of unemployment on happiness is both statistically and economically much higher than the impact of GDP per capita.

The effect of inflation, same as in Eurobarometer regression, is statistically insignificant (p-value = 0.76). In my sample only 14 countries exceeded the inflation rate of 10 %, with the highest inflation rate of 59 % (Belarus), which was quite an outlier. Therefore it seems that low to even moderate inflation does not influence happiness at all.

Interesting is the impact of quality of institutions on happiness. The statistical significance in the Gallup World Poll regression (p-value = 0.007) is even higher than in Eurobarometer regression even though a different indicator for measuring it was used. As mentioned earlier, the indicator can reach values from 0 (worst perceived corruption) to 100 (best corruption achievement). From the regression, an increase by 10 points on the scale for institutional quality will on average raise happiness by 0.16 points. This is a huge effect; however, a 10 point jump in corruption perception index is a big jump. But it seems worth doing it. Both from Eurobarometer regression and Gallup World Poll regression we see that the impact of institutional quality on happiness is very significant. I will mention this conclusion in policy recommendations.

The impact of life expectancy on happiness was very confusing in the Eurobarometer regression, some confusion still remains here. The impact is no longer negative, however, is statistically very insignificant (p-value = 0.66). It is hard to explain that life expectancy does not play role in happiness, even though I did cross-sectional (cross-country) analysis, whereas in Eurobarometer I used FE which was rather a time-series analysis. Yet I keep this variable in the equation in order to avoid bias.

In this regression I introduced a new variable, a communism dummy variable. The coefficient for it is highly statistically significant (p-value = 0.03). As for the interpretation, even after controlling for the factors in our regression, countries with history of communism or current communist countries are on average less happy than their non-communist counterparts by 0.35 points. This is an extremely huge impact and probably the most important lesson should be taken from it. I will mention it in the policy conclusions.

If I sum it up, variables which played a role in determination of happiness were unemployment, communism, institutional quality and income. The extent of the impact of each variable was discussed. The factors which do not seem to play an important role in happiness were inflation rate and life expectancy. R squared equal to 0.58 is quite high for a cross-sectional data set, so the estimation seems quite good. Yet as could have been expected with trying to explain determinants of happiness, still a lot is unknown, especially genetic factors which are impossible to measure can play a big role (as mentioned in literature review). Endogeneity issues are still a problem as mentioned earlier.

## Chapter 4: Conclusions and policy recommendations

Three regression models were presented: Eurobarometer regression, General Social Survey regression and Gallup World Poll regression. Here I will sum up the main findings of my analysis and propose some direct implications for policy measurements.

The main conclusions from Eurobarometer survey were that income is still important for happiness, yet both economic and statistical significance is not that high. More statistically and economically important were institutional quality and unemployment.

General Social Survey regression showed us that at least in US higher income did not make Americans happier over the past four decades. Adaptation level theory and aspiration level theory explain this fact very well. Yet I found one variable which has always seemed to be important and that is the unemployment rate.

In the Gallup World Poll regression income played more important role than in the regression just from EU countries. Therefore it looks that income plays more important role in the world than just in EU. The possible explanation was proposed. However, much more important role played unemployment and institutional quality and especially a new variable included, the presence of communism (in the past or present), for which the impact was the most extreme.

If I sum up the main findings, the increase in income still plays quite important role both in between-country comparison and over-time comparison with the exception of United States where higher income did not make Americans happier. However, I found more important factors affecting happiness. Those are namely unemployment, institutional quality and (past or present) presence of communism. All of them were both statistically and economically very significant and played much more important role in determining happiness than income. This leads me to several policy implications. Focus on increasing GDP per capita should still play role in economic policy, especially in less developed countries. Increasing income in them will afford them better health care, basic education and other important factors necessarily for further development. However, in developed countries the focus on increase in GDP should not play that important role as today. It seems that income played different role in Europe than in USA over the past decades. Higher income of Europeans was associated with increase in happiness. Yet increasing income in USA over the past four decades did not make Americans happier. This is in line with a lot of previous research.

What is important to highlight is that in my regressions I found variables which play more important role in determining happiness than income. Those were unemployment, institutional quality and communism. Unemployment seems to play one of the most important roles in determining happiness, which I found across all of the three data sets. Unemployment does not create only economic losses but also huge psychic losses described in a lot of literature. Here we will deal with possible solutions.

Unemployment can be divided into three parts: frictional, structural and cyclical. Frictional unemployment is not a problem as it is short term and necessary for the development of economy. For cyclical unemployment I somehow controlled by including GDP per capita which accounts for the ups and downs of the economy. Cyclical unemployment should be reverted after recession disappears (however we should not forget the hysteresis theory). Most of the policies focus on decreasing structural unemployment, which is mostly a mismatch between supply and demand for the labor.

Usually three facts explain the structural unemployment: efficiency wages, minimum wage and labor unions. Efficiency wages are in full control of the employer and she can decide about paying more to employees. Efficiency wages can even improve the productivity (hence the name "efficiency").

Minimum wage laws in theory create a floor for setting wages. There is no empirical consensus, some papers point to strong effects, some to milder effects on unemployment. Minimum wage laws affect mostly the least skilled and young workers. As their productivity is low, employer will not pay them more than is their productivity. This makes them unemployed rather than working for low income. In the meantime they lose even those skills which they had and this makes them even less competitive. In developed countries abandonment of minimum wage laws seems to be too strong and unaffordable. Therefore at least the ratio of minimum wage to average wage should be taken into account and tried to be minimized.

Important for unemployment is the presence of unions. Most studies find that workers which are part of a labor union (insiders) have on average 10 to 20 % higher wage than similar people who are not members of unions (outsiders). This creates unfairness as for the same work people do not get the same wage. Most importantly the wage bargained between the employer and union is above labor market equilibrium. This creates an excess supply of labor – the unemployment. In other words, insiders are happier that they get higher wage but it is at the expense of outsiders who get lower wage or even worse, are unemployed.

There are a lot of opinions about the role of unions. Here I will present mine. In my opinion unions should not bargain about the price of labor (wage) but only about the working conditions. The only exception here can be monopsony (a single employer in the city/village) which means competition among employers is not present and their bargaining power is huge. Besides this unions should not bargain about wages as this indirectly increases unemployment. Unions care mainly about their members (in the better case) and do not take into account the whole picture about economy. With wages bargained above equilibrium higher unemployment will be present in the economy. Yet the unions still should play a very important role. They should communicate the problems, requests and suggestions of employees to employer as the bargaining power of a single employee is very small compared to a huge employer.

Important for unemployment is also the setting of social welfare. Too generous welfare systems create incentives to work less. This affects mainly the least skilled as they are motivated to stay on a welfare rather than to take a low paid job. Welfare is still very important in developed countries and the discussion should always be about its extent.

The next important happiness determinant which I found was the quality of institutions. According to my estimates it plays much more important role than GDP per capita. Therefore its improvement can add a lot to happiness of people. There are a lot of recipes for enhancement of the institutional environment as it encompasses a lot of aspects. One of the most prominent is corruption. Very good step forward is an obligation to make all of the government documents which are possible public. Subsequently the voters get more information and are able to make more sophisticated decisions. However, I find the change of the mentality of people to be the single most important factor for changing institutional quality. Yet this step takes decades. Politicians can improve this by speaking about the fight against corruption publicly in order to make citizens care more about this topic. Better institutions improve the standard of living yet what was the important finding of this thesis is that their quality is not only about more money but also about more happiness.

Yet the most important for happiness seems to be the presence of communism. People from countries with experience of communism are less happy than their non-communist counterparts even after controlling for other variables as income or unemployment. The impact on happiness was by far the highest out of all variables. This should lead us to the most important policy conclusion here. It is that the whole world should try not to make communism ever happen again.

Communism totally distorts the whole economic environment. However, the most important from my point of view is the moral distortion in people's minds (the author of this thesis comes from a post-communist country). People have pessimistic thinking and complain about lot of things which worsens their state of happiness. There is also a lot of envy as people during communism were "equal" in income regardless of their contribution. This fact comes completely against fairness where everybody should get what he deserves. The equality should be in opportunities (as everybody has a different starting point in life) and not in outcomes (which income is part of). Communism is a vast topic reaching far behind the scope of this thesis. Yet if I can contribute at least with something it is the finding that even after controlling for other variables people in countries with communist history or currently communist countries are on average much less happy than their capitalist counterparts.

Here it is important to mention that this topic needs much further research. I used the best data sets currently available; however, measurement problems, problems of endogeneity and still little knowledge about the determinants of happiness are present. Each policy measurement should be carefully contemplated with taking into account all of the cost and benefits. This thesis tried to provide some hints for policy makers while taking into account the impact not only on GDP but also on happiness.

## Appendices

## Appendix 1

In this appendix I provide a detailed description of the data sets used. As mentioned earlier, I used 3 happiness data sets: Eurobarometer survey, General Social Survey and Gallup World Poll. I divide this appendix into three parts, in which I will describe each happiness data set respectively. Moreover I will divide the description of the data to description of the dependent variable data (happiness data) and independent variables data.

1A Eurobarometer survey regression

## 1A1 Dependent variable

The dependent variable (happiness) was taken from the Eurobarometer survey. The data is available on this link: http://ec.europa.eu/public\_opinion/cf/index\_en.cfm

Since 1973 Eurostat makes a poll in European Union Countries called Eurobarometer survey. It is a representative survey of each member state in particular year. In a lot of years more countries than just member states were interviewed. I deleted these answers in order to be able interpret the data as happiness study in European Union, not to create confusion. The countries not included in my analysis were namely Macedonia, Iceland, Montenegro, Serbia, and Turkey. Eurobarometer is a panel data set ranging from 1973 to 2012, with skipping the years 1974 and 2002. The poll is usually taken twice a year (sometimes even three times). I always used the earliest answer in current year. Only the current member states were interviewed. A lot of questions have been asked, however I was interested only in life satisfaction question. The question was this: "On the whole are you very satisfied, fairly satisfied, not very satisfied or not at all satisfied with the life you lead?" Therefore there were four possible answers to choose from. The data set provides proportion in percentages of the

responses to each of four categories. I assigned each category a number: 4 = very satisfied, 3 = fairly satisfied, 2 = not very satisfied, 1 = not at all satisfied. The answers "don't know" were disregarded. Then I calculated an average happiness of each country in each year by making a weighted average of happiness, where weights were the proportions assigned to each answer.

I also deleted the observations for countries which in a given year had the difference between GDP and GNP more than 10 %. To get this information, World Penn Tables version 7.1 was used. GDP is the total income for goods and services produced domestically regardless of the residency of the actors in economy. GNP is the income obtained by residents of a country. These two figures do not usually diverge too far from each other but in cases in which they do I think it can create bias in the results. Good example is Luxembourg in which GDP is usually higher than GNP. A lot of firms have the headquarters in Luxembourg for tax reason but the retained profits are usually repatriated to residents of other countries. Moreover, a lot of workers commute to Luxembourg for job but then come back to the home country and spend the income there. Therefore a lot of income is created in Luxembourg but a big part of it flies behind the borders. I think this can create confusion as it is not clear, in which country the income causes happiness. A lot of income can be created in countries with high GDP to GNP ratio but then a lot is consumed out of the country. In order not to create confusion and still be able to focus on nowadays widely used GDP per capita, I deleted observations for countries in which the difference between GDP and GNP was more than 10 %. The 10 % threshold was determined arbitrarily. The deleted observations are as follows: Ireland since 1998, Luxembourg: 1973 – 1981, 1994, 1999 – 2012. I also deleted observations where happiness data were missing.

1A2 Independent variables:

Independent variables in Eurobarometer regression were these: real GDP per capita in PPP, inflation rate, institutional quality, life expectancy, unemployment rate. All data except institutional quality were taken from the World Bank. Detailed description can be found on its web page; here I provide information important for my analysis. GDP per capita in constant 2005 dollars in PPP was used. Constant price level (real GDP) allows us to take into account real changes instead of nominal changes over years. PPP allows us to control for different price levels in countries. More developed countries usually have higher price level which is often explained by Balassa-Samuelson effect. For my analysis the purchasing power is important, i.e. how much a person can really buy. Exchange rates do not take all of the price level differences into account (law of one price does not hold) and 1 dollar can buy more in China than in USA. After making the PPP adjustment we obtain the real purchasing power of people of a given country and cross country comparison can be made (1 international dollar used here as anchor currency can buy the same basket of goods and services in USA as in China).

Inflation rate, life expectancy, unemployment rate are straightforward measures with all of its impreciseness. As a measure of inflation change in CPI was used. As for the unemployment rate the comparison can be sometimes difficult as the World Bank only collects data from national statistical (or other responsible) offices and not all of the countries measure unemployment rate according to ILO standards. Also a lot of changes in methodologies are made over time (mainly to improve the quality of the indicator in given country). Most importantly, unemployment rate is one of the hardest to interpret indicator. For example it is hard to track the movements between unemployed and out of the labor force people. Life expectancy is life expectancy at birth.

Institutional quality data come from the paper Institutional Quality Dataset (2013) by Aljaz Kuncic. He aggregates more than 30 currently available indicators measuring the quality of

institutions and creates three indicators out of them: legal environment, political environment and economic environment. The data set is available for almost each country in the world for period 1990 – 2010. Detailed description of construction of the data set can be found in the paper mentioned above. I created my own indicator of institutional quality by making simple average of these three indicators. My composite indicator can achieve values from zero (worst institutional environment) to 1 (best institutional environment).

## 1B General Social Survey regression

#### 1B1 Dependent variable

General Social Survey was conducted in USA every year from 1972 to 1994 (except in 1979, 1981, and 1992). Since 1994, it has been conducted every other year. Therefore this data set has a time-series form. The survey is conducted by National Opinion Research Center. For my analysis I used question number 164 (in the code book) namely "Taken all together, how would you say things are these days – would you say that you are very happy, pretty happy or not too happy?" The possible answers include: "very happy, pretty happy, not too happy". I changed the numbering following convention in this theses that higher value means higher happiness so I coded it this way:

3 =very happy

2 = pretty happy

1 = not too happy

There was a little change in the question order but adjustment has been made as explained in the Methodological Report No. 56 (discussed mainly on page 14 of the Report) found on the web page of National Opinion Research Center. Observations with no answer were disregarded. For each year I made an average of all observations so I got the average happiness for each year when the survey was conducted.

### 1B2 Independent variables

As independent variables were used real GDP per capita, inflation rate, institutional quality, life expectancy, unemployment rate, education. Data for real GDP per capita, inflation rate, life expectancy and education were taken from the World Bank. Unemployment rate was obtained from Bureau of Labor Statistics from Current Population Survey (it is a survey of households as opposed to Establishment Survey which is a survey of companies). As for the institutional quality again the data from paper by Kuncic (2013) were used. The limitation here was of course that these data are available only from 1990. Yet I have not found any suitable proxy because most of the institutional quality measuring indices were not constructed that far in the past and for a lot of others the methodology has been changing over years (even for Corruption Perception Index).

GDP per capita was again for reason of direct comparison with my other data sets used in constant 2005 dollars. As there is no cross-country comparison, PPP adjustment is not necessary.

For all data sets I struggled with finding a suitable proxy for education. There were several options but for today it seems that there is no suitable indicator measuring the quality of education of people on the national level. For some, short time period of tracking is a problem. Others do not cover the whole world. A very promising measure PISA testing done by OECD has both of these problems – it is done only shortly and only every 3 years, moreover only for OECD countries and some associated countries. However the idea itself is very good.

The first proxy for measuring education which usually comes to mind is literacy rate. The obvious problem is almost no variation for higher income countries (the literacy rate is usually around 99 % in more developed countries). Therefore this measure has no use in any of my data sets.

The most suitable proxy which I found was Gross Tertiary School Enrollment Rate found on the World Bank webpage. There is quite good availability of this indicator there. However, it measures only participation, not even outcome (graduation rate). Adjustment can be made by using the data set by Barro and Lee (2013) and calculating graduation rates. Yet this would be only approximation because the data set provides information for only every five years. Even after making this adjustment it would be still only an output indicator not measuring the quality. Therefore after searching for other suitable indicators I decided to use Gross Tertiary School Enrollment Rate just as approximation to educational attainment.

## 1C Gallup World Poll regression

## 1C1 Dependent variables

Gallup World Poll data is a cross-sectional data set in year 2012. I consider the Gallup data sets in general to be the best in the world. They even write on their website: "Gallup conducts surveys in 160 countries and is committed to doing so for the entire century. The Gallup World Poll provides a scientific window into the thoughts and behaviors of 98% of the world's residents through nationally representative samples. It is the only global study of its kind in existence." On the Gallup Institute webpage there is a long description of the process how the data are obtained. The problem is that most of the data are not freely accessible and are extremely expensive. So my happiness data were constrained just to those freely available on their webpage. I used the data from Gallup World Poll which covers almost the whole

world. The data were collected from an application WorldView, which is a map showing the average happiness of each country in year 2012 (no more years are freely available).

The happiness question was: "Imagine a ladder with steps numbered from 0 at the bottom to 10 at the top. Suppose the top of the ladder represents the best possible life for you and the bottom represents the worst possible life for you. On which step of the ladder would you say you personally feel you stand at this time, assuming that the higher the step the better you feel about your life, and the lower the step the worse you feel about it? Which step comes closest to the way you feel?" So an 11 point scale is used with 10 meaning the highest life satisfaction and 0 the lowest life satisfaction. As the values available are already country averages they are a continuous variable rather than a discrete variable.

Again, countries with higher than 10 % difference between GDP and GNP were discarded. As the latest available data in World Penn Tables are from 2010, I used the approximation that the GDP / GNP ratio is the same in these two years (2010 and 2012). Deleted countries were Afganistan, Belize, Congo, Gabon, Iceland, Ireland, Lesotho, Liberia, Luxembourg, Puerto Rico and Zambia.

## 1C2 Independent variables

The independent variables used in Gallup regression are: real GDP per capita in PPP, inflation rate, unemployment rate, institutional quality, life expectancy and communism dummy. Again I used GDP per capita in constant prices (real GDP) even though it was not necessary because of cross-sectional form of data set, i.e. no year-to-year changes. However, I wanted to make GDP per capita comparable to previous data sets so I used again GDP per capita in 2005 dollar prices. PPP adjustment was also used because of cross-country comparison. This data as well as inflation rate were obtained from World Bank. As a measure of inflation again

change in CPI was used. Unemployment rate data were mostly unavailable for 2012 and the second best option was to use IMF estimates from IMF web page.

As a measure of institutional quality no longer the "Institutional Quality Dataset" paper was used, as it provides only data between 1990 and 2010. In my opinion one of the best other indicator used to measure institutional quality is the Transparency International's Corruption Perception Index. It is available for 2012 and also is a composite indicator of different other indicators. Description of the Corruption Perception Index can be found on Transparency International web page. It can reach values from 0 (worst perceived corruption) to 100 (best corruption achievement).

Communism dummy variable is 1 for all countries with at least 10 years history of communism or currently communist countries. It is 0 otherwise.

## Appendix 2

2A Eurobarometer regression

Test for the presence of heterogeneity

Chow F-test:

 $H_0: \beta_{11} = \beta_{12} = ... = \beta_{1N}$ 

 $H_1$ : non  $H_0$ 

LM test:

 $H_0: \sigma_u^2 = 0$ 

 $H_1: \sigma_u^2 > 0$ 

Redundant Fixed Effects Tests Equation: Untitled Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	42.518384	(26,272)	0.0000
Cross-section Chi-square	493.151080	26	0.0000

Cross-section fixed effects test equation: Dependent Variable: HAPPEURO Method: Panel Least Squares Date: 09/05/13 Time: 16:06 Sample (adjusted): 1990 2010 Periods included: 19 Cross-sections included: 27 Total panel (unbalanced) observations: 304 White diagonal standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RGDPPC INFL INSTITUT LIFEEXP UNEMPL C	1.12E-05 -0.000615 2.166501 0.018525 0.000108 -0.429489	2.77E-06 0.003815 0.190904 0.005407 0.002765 0.414915	4.039157 -0.161321 11.34866 3.425823 0.039191 -1.035126	0.0001 0.8719 0.0000 0.0007 0.9688 0.3014
R-squared Adjusted R-squared S.E. of regression Sum squared resid Log likelihood F-statistic Prob(F-statistic)	0.712022 0.707190 0.173803 9.001799 103.6224 147.3600 0.000000	Mean depende S.D. dependen Akaike info critt Schwarz criteri Hannan-Quinn Durbin-Watson	nt var t var erion on criter. stat	2.926151 0.321191 -0.642252 -0.568890 -0.612906 0.312094

#### Hausman test:

#### Correlated Random Effects - Hausman Test Equation: Untitled Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	68.753811	5	0.0000

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
RGDPPC	0.000007	0.000012	0.000000	0.0312
INFL	0.000843	0.001763	0.000000	0.0034
INSTITUT	0.390064	0.782572	0.003585	0.0000
LIFEEXP	-0.015819	-0.015465	0.000018	0.9338
UNEMPL	-0.010833	-0.007685	0.000001	0.0004

Cross-section random effects test equation: Dependent Variable: HAPPEURO Method: Panel Least Squares Date: 09/05/13 Time: 16:13 Sample (adjusted): 1990 2010 Periods included: 19 Cross-sections included: 27 Total panel (unbalanced) observations: 304

Variable	Coefficient	Std. Error	t-Statistic	Prob.
С	3.763999	0.574546	6.551257	0.0000
RGDPPC	7.25E-06	4.01E-06	1.808659	0.0716
INFL	0.000843	0.002322	0.362884	0.7170
INSTITUT	0.390064	0.176713	2.207335	0.0281
LIFEEXP	-0.015819	0.007990	-1.979941	0.0487
UNEMPL	-0.010833	0.002579	-4.200839	0.0000
	Effects Spe	ecification		
Cross-section fixed (dum	my variables)			
R-squared	0.943135	Mean depende	nt var	2.926151
Adjusted R-squared	0.936654	S.D. dependen	t var	0.321191
S.E. of regression	0.080839	Akaike info crite	erion	-2.093407
Sum squared resid	1.777516	Schwarz criteri	on	-1.702141
Log likelihood	350.1979	Hannan-Quinn	criter.	-1.936892
F-statistic	145.5248	Durbin-Watson	stat	1.143614
Prob(F-statistic)	0.000000			

## 2B Gallup World Poll regression:

**RESET** test

## RESET test with squared fitted values

#### Ramsey RESET Test Equation: UNTITLED Specification: LIFESAT GDPPC COMMUN INFL INSTIT LIFEEXP UNEM C Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.587075	72	0.5590
F-statistic	0.344657	(1, 72)	0.5590
Likelihood ratio	0.382038	1	0.5365
F-test summary:			
			Mean
	Sum of Sq.	df	Squares
Test SSR	0.145674	1	0.145674
Restricted SSR	30.57748	73	0.418870
Unrestricted SSR	30.43181	72	0.422664
Unrestricted SSR	30.43181	72	0.422664
LR test summary:			
	Value	df	_
Restricted LogL	-75.04457	73	_
Unrestricted LogL	-74.85355	72	

### RESET test with squared and cubed fitted values

Ramsey RESET Test Equation: UNTITLED Specification: LIFESAT GDPPC COMMUN INFL INSTIT LIFEEXP UNEM C Omitted Variables: Powers of fitted values from 2 to 3

F-statistic	Value 1.224800	df (2, 71)	Probability 0.2999	
Likelihood ratio	2.713566	2	0.2575	
F-test summary:				
			Mean	
	Sum of Sq.	df	Squares	
Test SSR	1.019782	2	0.509891	
Restricted SSR	30.57748	73	0.418870	
Unrestricted SSR	29.55770	71	0.416306	
Unrestricted SSR	29.55770	71	0.416306	
LR test summary:				
	Value	df		
Restricted LogL	-75.04457	73	_	
Unrestricted LogL	-73.68779	71		

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