

# Multivariate multilevel model of well-being across Europe during the crisis

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## Abstract

The crisis in Europe in 2007 has detrimental effect on its citizens' well-being including on both happiness and health. Most studies of well-being use health or happiness as a single outcome. They either explain happiness in terms of health (and other factors) or conversely health in terms of happiness. Even more, a few studies include contextual effects at both NUTS 2 and NUTS 3 levels in explaining well-being. This study investigates the individual and (a relatively detailed at NUTS 3) contextual factors, in explaining covariation in happiness and health. We thus use multivariate multilevel model to explain two well-being aspects: happiness and health not separately, but simultaneously. We focus on countries across Europe during the crisis by using data from European Values Study 2008. Because of large number of missing data especially in income data and NUTS 3 level data, we use the recently developed multiple imputation using Bayesian estimation to deal with the problem. We find that determinants of both happiness and health are quite similar. Both at individual and NUTS 3 levels, happiness and health are strongly and positively correlated. Education, income and GDP growth are positively associated with happiness and health. Conversely, age, individual unemployment, unemployment rates in NUTS 3 level are negatively associated with happiness and health.

**Keywords:** Well-being, Happiness, Health, Multivariate multilevel model, Multilevel multiple imputation, Bayesian estimation

## 1 Introduction

The growing interest in the study of happiness and health can be seen in a number of studies across social sciences such as sociology and psychology (Diener and Biswas-Diener 2008; Argyle 1999; Kahneman et al. 1999), social epidemiology (Kawachi et al. 1999), economics (Frey and Stutzer, 2002; Bruni and Porta, 2005; Layard, 2005; Graham, 2009), politics and public policy (Lane, 2000). However, most studies use health or happiness as a single outcome. They either explain happiness in terms of health (and other factors) or conversely health in terms of happiness.

It is important to study happiness and health simultaneously for three reasons. First, both health and happiness are often subjectively elicited. They are neither neurologically measured (happiness) nor clinically measured (health). Arguably as subjective perception, health assessment may involve affect (happiness) and happiness assessment may involve health consideration. Second, some studies have argued that happiness and health can be treated as independent and dependent variables for each other (Blanchflower, 2004; Graham, 2008). Lastly, a simultaneous or multivariate study will generate important insights on two key variables of well-being especially in Europe during the crisis.

There are three studies (Subramanian et al. 2005; Oshio and Kobayashi, 2010; Kristen et al., 2007) which are an exception in the literature that examine the determinants of both happiness and health simultaneously. Another study using British Household Panel Survey examines happiness and subjective well-being but not health (Ballas and Tranmer, 2008). The European study conducted by Kristen et al. (2007) uses data from the European Social Survey 2002 and 2004 and thus has not covered the period during the crisis in Europe in 2007. Moreover, the vast majority of studies on well-being use individual and/or country level, do not cover regions level.

This paper aims to investigate demographic and socio-economic covariates in happiness and health at individual and their contextual levels across Europe. Since we analyse individual respondents nested in regions, two-level or multilevel model is appropriate. Two individual outcomes (happiness and health) are explained simultaneously so we ultimately use multivariate multilevel approach for the analysis. We also deal with the problem of missing data. Data are missing at the region and individuals level. Because the structure of the data is multilevel, we use multilevel multiple imputation method.

This paper is organised as follows: first, we identify the determinant of happiness and health based on previous studies. We then describe the data and method used in this study, including the construction of the covariates. In the penultimate section we present the results and lastly conclude with theoretical and methodological implications for future research.

## **2 Determinants of Happiness and Health**

Several studies (Subramanian et al. 2005; Oshio and Kobayashi, 2010) find that the determinants of happiness and health are relatively similar. However, some determinants have different effects on happiness and health when both are explained simultaneously.

Gender has been identified as an important predictor for happiness and health. However, the effect of gender tends to be different in direction. Oswald (1997) notes that women are more likely to be happy, but they are less likely to be healthy than men (Subramanian et al. 2002).

Age is an important covariate to predict health and happiness, but different directions can be found in previous studies. Association between age and happiness

is slightly positive (Argyle, 1999); older people are likely to be happier than younger ones. However, previous studies also found a U-shaped relationship between age and happiness (Clark, 2003; Blanchflower and Oswald, 2008). People tend to be happier when they are younger or older than when they are middle aged. This debate is still continuing in the literature. Similar pattern can be found in health in which age is associated with this outcome inconsistently. Negative association between age and self-reported health has been demonstrated by Song and Lin (2009) who use a sample from Taiwan. A weak positive association is shown by Subramanian et al. (2005) using Social Capital Benchmark Survey across the US.

Education may be one of the most important determinants of happiness and health. As a human capital indicator this covariate predicts well-being status. Some authors find that the association between education and happiness is positive (Diener et al. 1993; Stutzer and Frey, 2008; Diener and Oishi, 2000). However, Clark and Oswald (1997) demonstrate the negative relationship between education and happiness. This may be due to the increase of aspiration of people with higher level of education. Subramanian et al. (2005) show that education is strongly correlated with both happiness and health.

The impact of marital status on happiness is reported in some studies. Married people benefit socially and emotionally from their spouses. They can share with and support each other. This argument is supported by previous studies (Clark and Oswald, 2002; Graham, 2009) that demonstrate the positive effect of marriage on happiness, and the negative effect of widowhood and divorce on happiness. However, Diener and Biswas-Diener (2008) argue that the benefit of being married depends on the people's personality and their context of life.

Marriage can also influence health. Social support provided by a partner in a marriage may benefit individual's health. As can be seen from previous research, for instance Song and Lin (2009), social support has been identified as strong predictor of self-rated health. The study finds that marital status has strong positive effect on self-rated health. Another study by Subramanian et al. (2005) shows similar finding that married people are more likely to be healthier.

Unemployment has been recognised as an important predictor for unhappiness and ill health. Previous studies (Clark and Oswald, 1994; Oswald, 1997) point out that unemployment is strongly and negatively associated with happiness. Unemployment also has a negative effect on health. A study using Canadian National Population Health Survey demonstrates that unemployed people are associated with unhealthy conditions (Cott et al., 1999).

The effect of income has become a major debate in explaining of happiness. Easterlin (1974) shows that personal income has positive effect on happiness, but also shows that when GDP grows over time, happiness does not follow. This has been known as the Easterlin paradox. However, several studies examining this paradox have produced inconsistent and contradictory results. Venhoveen (1991) finds that people living in poor, war-torn and isolated country are likely to be unhappy, while Diener et al (1993) reported that income generates similar level of happiness in poorer and richer areas in the U.S. In relation to health, recent research conducted in the U.S. by Subramanian et al. (2005) found that income has a strongly positive impact on

health. They show that poor people are four times more likely to report unhealthy than rich people. Likewise, Oshio and Kobayashi (2010) using Japan nationwide survey conclude that people with higher income are more likely to be healthy than those with lower income. These mean that income inconsistently predicts happiness but consistently predicts health.

To summarise, there are a number consistent findings from previous research in terms of covariates of happiness and health. Education, marital status, income and equality have been consistent factors contributing to happiness and health. By contrast, other covariates such as gender and age have different tendency to predict happiness and health.

### 3 Data and Methods

We use data from the 2008 European Values Study which includes 47 countries, 120 NUTS 1 level, 327 NUTS 2 level, 1,059 NUTS 3 level and approximately 67,786 individual respondents across Europe. The purpose of this study is to provide understanding about the ideas, beliefs, preferences, attitudes, values and opinions of citizens from across Europe. This is a series of study that was conducted four times in 1981, 1990, 1999, and 2008 (European Values Study 2008).

This paper uses the questions regarding the outcomes measures for happiness and health. To assess happiness, we use this question: ‘Taking all things together, would you say you are: very happy, quite happy, not very happy and not at all happy’. To measure health, we use self-reported health question: ‘All in all, how would you describe your state of health these days? Would you say it is: very good, good, fair, poor and very poor’.

Following the above discussions, the covariates used in this research are gender, age, education attainment, marital status, employment status and household income. We use a dummy variable to measure gender (1 for female, 0 for male). Education attainment is measured by the highest level education attained by respondents, ranging from pre-primary education until second stage of tertiary education.

Marital status is captured using dummy variables for union, widowed, and divorced with never married as the reference group. Another measure of socio-economic covariate is employment status, differentiated as retired, housekeeper, student, unemployed, and disabled. They are used as dummy variables with employed/self employed is the reference group.

We use a relatively detailed region in Europe: NUTS (Nomenclature of Territorial Units for Statistics) level 3. This is the smallest region level used in Europe to describe the administrative units. Thereafter we will use regions to mention NUTS 3. We assume that by using the more detailed area, we can better capture the social process affecting happiness and health. We use contextual data for regions: GDP, GDP growth and unemployment rates. These contextual variables are obtained from Eurostat region data (Eurostat, 2010).

Multilevel multivariate model is appropriate for this study because we use multi-level setting, that is individuals nested in NUTS 3 area and we explain two outcomes simultaneously (Goldstein, 2003). This model corresponds to a schema where individual outcome such as happiness and health are explained by both individual and NUTS 3 level determinants. Although we follow the majority of studies on European comparative research in using multilevel model, unlike most of these we explain two outcomes simultaneously.

Because of large number of missing data especially on income, 10,740 of 67,786 respondents do not mention their income, we apply a recently developed method of multiple imputation (Goldstein, 2009). In addition, we have few missing at regions levels. Because the structure of data is multilevel, we use multilevel multiple imputation to impute missing data in both individual and NUTS 3 level. Ignoring multilevel structure may result in the poor imputation (Carpenter, 2010). This multilevel multiple imputation method consists of three-step process, first, imputing data with plausible values and thus creating a number of complete datasets. Second, analysing of each dataset using complete-data method i.e. multivariate multilevel model. Lastly, combining the results from the analysis, recognizing the uncertainty due to imputation.

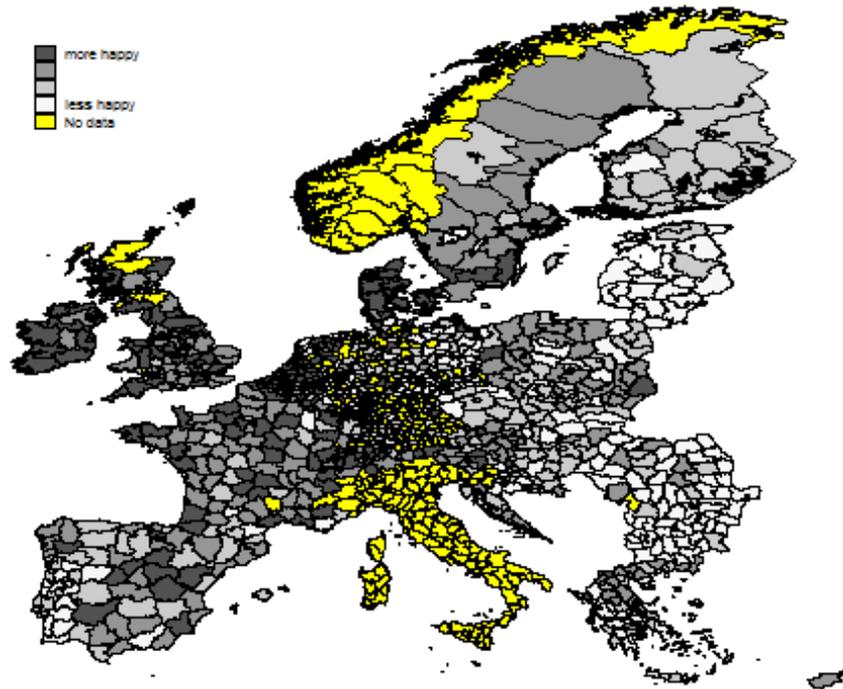
We use Mplus because this software provides Bayesian estimation using MCMC iterations. There are three steps to do multiple imputation using Bayesian estimator (Asparouhov and Muthen, 2010). First, we estimate the model using Bayes. Second we draw a set of parameter values from the posterior distribution. Finally, we generate imputed missing data for each set of parameter. In the first step, we use H0 or restricted model using two-level model.

To describe happiness and health visually, we use Europe map obtained from EuroBoundaryMaps 4.0. We combine the map database with the data from EVS. Some areas are not covered by the map databases. Others are not sampled by EVS. There are 1280 NUTS 3 that have been merged in our datasets.

## 4 Results

Map 1 shows the mean of happiness across regions in Europe. The figure demonstrates that happiness varies within each country. Sweden, for example, has different level of happiness across its regions. Happiness levels in southern areas tend to be higher than that in northern areas. It can also be seen in the UK where happiness levels vary from the north to the south. Districts Limburg-Weilburg in Germany and Shetlands Islands in the UK are among the happiest districts across Europe. While, district Amberg-Sulzbach and Ingolstad in Germany and District Autonoma de Madeira in Portugal are among the least happy districts across Europe. Some districts in Greece are among the happiest districts compared to surrounding district in other countries.

Map 1. Happiness in NUTS 3 level



Map 2 describes self-reported health in regions across Europe. Similar to happiness level, self-rated health also varies across countries. Different districts may have different self-rated health level. Spain, for example, has various level of self-rated health. Similarly, France also has different level of self-reported health, in NUTS 3 level. District Ostalbkreis and Ennepe-Ruhr-Kreis in Germany and West Lothian in the UK are among the most healthy districts across Europe. Meanwhile, district Serra da Estrela in Portugal, Erlangen in Germany and Somerset in the UK are among the least healthy districts across Europe.

Map 2. Health in NUTS 3 level

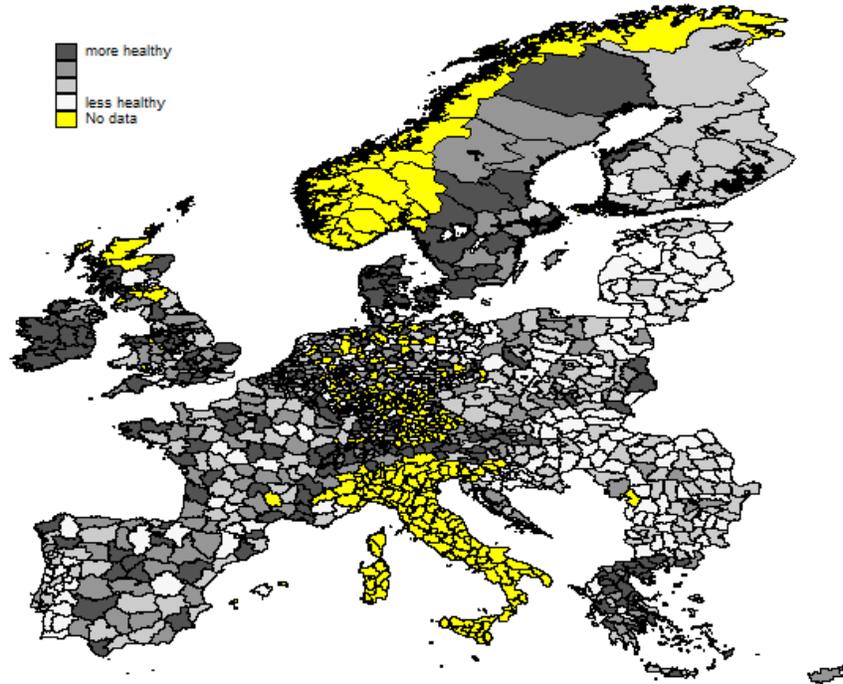


Table 1 presents multilevel multivariate regression model for regions across Europe to capture the determinants of happiness and health. It is apparent from the table that correlation between happiness and health is significant both at individual level is 0.19 and at regions level is 0.012. The following covariates have consistent positive effect on both happiness and health: education (0.011 and 0.02, respectively), income (0.16 and 0.19) and GDP NUTS (0.06 and 0.05). While other covariates (i.e. age, widow, separated, never married, housekeeper, unemployed and disabled) have various negative effects on happiness and health. Female, pensioner and student have different directions in predicting both happiness and health. The following will explain the result in detail.

Gender has different effects in explaining happiness and health. Female tend to be happier than male, but they do not tend to be healthier.

Age has negative effect on both happiness and health. This result is rather different from previous studies which show the association between age and happiness is forming U-shaped relationship. Nevertheless, the consistent results are produced by health related research that show negative association between age and health.

The important covariate that has strong influence on happiness and health is education. This covariate has strong positive associations with both outcomes. This result is similar to most previous studies on both happiness and health. However, this finding contradicts the finding of Oswald (1997) which shows negative association between education and happiness.

Marital status are important predictors for happiness and health. Being widowed is more likely to be associated with less happy and less healthy, compared to those in being married. The similar result can be seen among those who are separated and never married. These have significant negative effect on happiness but insignificant on health.

Table 1: Multilevel multivariate happiness and health across Europe

	Happy		Health	
	coeff.	<i>p</i>	coeff.	<i>p</i>
<i>Fixed Part :</i>				
Cons	2.817	(0.000)	3.365	(0.000)
<i>Individual</i>				
Female	0.032	(0.005)	-0.081	(0.002)
Age	-0.025	(0.000)	-0.029	(0.000)
Age2	0.000	(0.000)	0.000	(0.000)
Education	0.011	(0.061)	0.020	(0.000)
Union	0.168	(0.000)	-0.014	(0.705)
Widow	-0.138	(0.000)	-0.178	(0.000)
Separated	-0.077	(0.008)	-0.094	(0.038)
Professional	0.044	(0.001)	0.080	(0.001)
Intermediate	0.035	(0.175)	0.057	(0.076)
Pensioner	-0.013	(0.461)	-0.183	(0.000)
Housekeeper	0.032	(0.051)	-0.023	(0.466)
Student	0.042	(0.006)	0.015	(0.255)
Unemployed	-0.076	(0.025)	-0.068	(0.254)
Disabled	-0.157	(0.000)	-0.976	(0.000)
Log median household income	0.159	(0.000)	0.191	(0.000)
<i>NUTS 3</i>				
Log GDP	0.063	(0.102)	0.048	(0.144)
GDP Growth	0.030	(0.014)	0.052	(0.001)
Unemployment rate	-0.241	(0.007)	-0.172	(0.168)
<i>Random part individual level :</i>				
Residual variances	0.400	(0.000)	0.665	(0.000)
<i>Random part NUTS 3 level :</i>				
Residual variances	0.010	(0.222)	0.019	(0.043)
<i>correlation happiness and health :</i>				
individual level	0.190	0.000		
NUTS 3 level	0.012	0.052		

*Bold=significant at 5%*

Employment status can be classified into: housekeeper, student, unemployed, and pension. Housekeepers are less likely to be happy and healthy than employed or self employed. Students are more likely to be happier but unhealthier than employed or self employed group. Unemployed people seem to be unhappy and unhealthy compared to employed or self employed people. This result is similar to another category that is disabled people where they are less likely to be happy and healthy than employed people. Unemployment rate in NUTS level has significant negative effect on happiness but only has weak and negative association with health.

As might be expected income is a significant predictor for both happiness and health. In the contextual setting, GDP is weakly associated with both happiness and health. However, GDP growth is positively associated with both happiness and health.

## 5 Discussion

There are five key findings in this study, First, happiness and health are strongly and positively correlated at individual and regions levels. Happier people tend to be in healthier too, and vice versa. This vindicates our use multivariate response model.

Second, unlike the majority studies of happiness and health that use country level as level two. This study uses regions level as contextual level. We find that in each country, happiness and health vary at region levels. This result needs to be addressed because information about regions level will provide a better understanding to capture both happiness and health. The effect of regions level on individuals happiness and health is apparent. Third, the majority of covariates have similar pattern of effects on health and happiness. It can be argued that both happiness and health tend to be identical. Therefore, they move simultaneously because they are determined by similar factors. This finding also confirms the previous study by Oshio and Kobayashi (2010) that find the socio-economic factors contributing to both happiness and health are relatively similar in direction.

Fourth, education and income are strong positive predictors for both happiness and health. The preposition ‘money do buy happiness and health‘ has been examined in this study. This finding confirms previous studies that two predictors above are important for happiness and health. Although the GDP does not matter both for happiness and health, but GDP growth matters. Education is by far the more important determinant of happiness and health. This study finds that income is positively associated with happiness and health.

Lastly, being married is an important factor for predicting happiness and health, presumably because marriage provides good companionship among other things. As has been argued by Argyle (1999), social relations including marriage and friendships have been one of the most important features of happiness. This finding confirms previous studies about social support and its effect on happiness and health. Social support can be considered as the important variable involved in companionship.

The limitation of this study is the use of single item of happiness and self-reported

health measure. This research uses cross-sectional data and thus that cannot capture change over time both at individual and region levels. For future research, it is recommended to use panel data on individual and NUTS 3. This will add a deeper understanding and provide detailed explanation of happiness and health changes.

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