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Measuring Well-being: Individual Based Approach*

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Abstract

Output based measures of economic development, such as GDP and GNI per capita, measure only one relatively narrow aspect of well-being: the value of goods and services produced or consumed over a given period. This has a number of well-known shortcomings. We propose an alternative measure based on objective individual-level determinants of well-being. We proceed in two steps. First, we identify factors that are associated with individual-level happiness. In this way, we obtain a happiness production function, relating individual happiness to a broad range of objectively measurable individual, regional and national determinants. Then, we use the resulting relation to construct an indicator of 'predicted happiness'. The resulting indicator is closely correlated with the actual happiness but can be decomposed into the contributions of the various determinants. Furthermore, although happiness is a highly subjective and abstract concept, our indicator is constructed entirely based on objective and measurable factors. We argue that a particularly fruitful area for using this indicator would be as a criterion for the allocation regional aid, including the EU Cohesion Policy.

Keywords: Happiness; Life satisfaction; Well-being.

JEL Codes: I31; D63; J18; O57.

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1 Introduction

Since the seminal study by Kuznets (1934), the gross domestic product (GDP) and gross national income (GNI) per person have been the preferred and most commonly used measures of economic development and national well-being. Such output-based indicators can be used to assess the economic performance of countries over time and to compare the relative progress of different countries. GDP/GNI per capita are also used to assess the eligibility of regions for regional aid, or to gauge the need of less-developed countries for international developmental assistance. For instance, the European Union uses GDP per capita to designate European regions as being less developed, transition or more developed. Each region's status within this classification has important bearing on its eligibility to receive funding the European structural and investment funds (ESIF). Similarly, the World Bank uses GNI per capita to classify countries into four groups: low income, lower middle-income, upper middle-income and high income countries, and reflects this classification in its aid allocations.

However, GDP and GNI were never intended as a sole measure of welfare and its wide-spread popularity has received much criticism (Costanza et al., 2009). Kuznets (1934) himself cautioned against over-reliance on income-based measures by pointing out that "the welfare of a nation can scarcely be inferred from a measurement of national income." By measuring the market-value of economic activities, GDP ignores natural, social, and human capital and fails to measure key aspects of quality of life (Costanza et al., 2009; Van den Bergh, 2007). In particular, GDP only imperfectly accounts for the size of the informal economy, does not include the value of household production, does not reflect the improvements in quality of products (unless these are reflected in rising prices), and includes inefficient output (e.g. prisons and security guards) and output associated with sizable negative externalities (Gundacker, 2016).

A number of alternative indices have been proposed to complement or replace GDP per capita in its role as a gauge of well-being. Yang (2014) mentions basic characteristics of 101 composite measures of human progress and well-being. Among the best known measures are the Human Development Index (HDI), Happy Planet Index (HPI), Genuine Progress Indicator (GPI), Weighted Index of Social Progress (WISP), Measure of Domestic Progress (MDP), and Index of Economic Well-being (IEW). Boarini et al. (2006) distinguish between monetary, non-monetary, and pseudo-monetary indices of well-being. They highlight the possibility to measure well-being using subjective measures of happiness and life satisfaction. Such subjective measures are based on surveys that ask people about their satisfaction with life and their happiness. These surveys also contain wide range of information about respondents, including many socio-demographic and socio-economic factors, which allows an analysis of determinants of well-being. According to Frey et al. (2009), subjective well-being is an adequate and valid approximation for individually experienced welfare and reported data about well-being can be used to assess individuals' preferences for public goods or externalities. Frey and Stutzer (2002) propose also the use of happiness studies in economic policy decision making. Fleurbaey (2008) and Van den Bergh (2007) consider measurement of individual well-being to be a promising alternative to GDP.

Most of the recent studies that use subjective well-being data focus on individual characteristics that affect happiness: Veenhoven (2016) surveys the results of about 2000 studies and lists hundreds of factors that correlate with happiness. Many studies similarly consider factors at the regional and/or national level. Happiness was found to be affected by inflation and unemployment (Di Tella et al., 2001; Alesina et al., 2004; Wolfers, 2003; Clark and Oswald, 1994), air pollution (Welsch, 2002; Luechinger, 2009; Cuñado and de Gracia, 2013), income equality (Alesina et al., 2004; Graham and Felton, 2006; Fahey and Smyth, 2004; Haller and Hadler, 2006; Verme, 2011), democracy (Frey and Stutzer, 2000), corruption (Tavits, 2008), life expectancy (Heukamp and Arino, 2011; Ovaska and Takashima, 2006), government expenditures (Ott, 2010), terrorism (Frey et al., 2009), to name just some of the most prominent results.

Despite the fact that GDP is used as a measure of welfare, its role as a determinant of happiness is not clear. The discussion about the effect of GDP or GNP per capita on happiness started with Easterlin (1974), who points out that increases in GNP in the United States between 1946-

1970 were not systematically accompanied by greater happiness. This result came to be known as the Easterlin paradox. However, Hagerty and Veenhoven (2003) come to a different conclusion. According to them, increases in GDP per capita do lead to increases in happiness. Stevenson and Wolfers (2008), likewise, find a positive relationship between GDP per capita and well-being across countries and also within European Union and Japan, but they cannot find this relationship for the USA.

All of these findings support the efforts to develop a more comprehensive indicator for measuring well-being at the regional and national level that would go further than output-based indicators such as GDP per capita. In this paper, we propose an alternative measure based on objective individual-level determinants of well-being. We proceed in two stages. First, we identify objective factors that are associated with individual-level happiness. In this, we combine individual, regional and national factors, which together form a 'production function of happiness'. Then, we use these results to construct a measure of 'average predicted happiness'. This measure has the advantage that we can directly identify which factors contribute positively or negatively to individual or regional happiness. Similarly, the estimated functional form can be used to evaluate the likely outcomes of policy interventions for the purposes of impact analysis. Last but not least, since our production function of happiness contains only objectively measurable variables, it is relatively straightforward to use it to construct the predicted-happiness indicator for any level of regional aggregation for which the required data are available. In this way, we can compute average predicted happiness also for regions, for which happiness estimates are not available, either because these regions are smaller than those identified in the aforementioned surveys, or because no such surveys were carried out for them.

In the next section, we outline the data used in our analysis and our methodology for estimating the production function of happiness. In Section 3, we present the results of our estimation of determinants of happiness. Given that we work with survey data, we consider both individual-level determinants, and aggregate (regional or national) determinants. In Section 4, we use the results of our analysis to compute average predicted happiness for all European NUTS2 regions, and compare them with the actually observed happiness values. In Section 5, we extend the analysis to a lower level and estimate average predicted happiness for 79 Slovak disctricts. Finally, Section 6 summarizes our conclusions.

2 Data and methodology

The objective of this paper is to analyze, and construct a new measure of, well-being at the level of European regions. The primary data source for our analysis is the European Social Survey (ESS) database. The ESS has been conducted across Europe every two years since 2002. Data from more than 280,000 respondents surveyed during the seven rounds conducted during th3 period 2002-14 have been used in our analysis. The surveys cover a broad range of areas, including the respondents' socio-economic characteristics, as well as various opinions and attitudes. To gauge their well-being, we use the following question: "Taking all things together, how happy would you say you are?". The scale of answers is from 0 (extremely unhappy) to 10 (extremely happy). We use the answers to this question as a measure of subjective happiness of respondents.

We relate happiness to a number of individual and aggreaate variables. In the first instance, we consider individual variables that could influence happiness. The ESS contains a host of information about the respondents. Based on the results of earlier studies (Di Tella et al., 2001; Alesina et al., 2004; Haller and Hadler, 2006; Caporale et al., 2009; Pittau et al., 2010; Rodríguez-Pose and Maslauskaite, 2011; Cuñado and de Gracia, 2013; de Vroome and Hooghe, 2015), the following variables were chosen:

- Gender,
- Age,

- Partner (Lives with husband/wife/partner at household grid or not),
- People in household (Number of people living regularly as member of household),
- Education (Years of full-time education completed),
- Main activity (Main activity in the last 7 days: employed, student, unemployed but looking for work, unemployed and not looking for work, sick or disabled, retired, in military or community service, housework, and other),
- Ratio of household income to national income average (Household's total net income divided by the average net income of household in the country),
- Minority (Belong to a minority ethnic group in country),
- Pray (Pray at least every day or not),
- Health (Self reported health),
- Discrimination (Would you describe yourself as a member of a discriminated group?),
- Safety (How safe would you feel walking alone in this area after dark?),
- Trust and satisfaction.

Respondents with a missing answer to any of these question or with "Don´t know" answers were removed from our data set. Note that the last four variables are subjective in nature: these were used in the initial stages of our analysis and the results featuring them are reported for the sake of comparison but they are not used in the final model used to construct predicted happiness.

One of the most important variables in the study of happiness is household income. This variable was changed after the third round of ESS: while originally, it featured 12 (nationally-defined) categories, from the 3rd wave it has been replaced by income deciles. The newer variable is clearly and unambiguously defined, unlike the original income thresholds. The categorization of respondents into deciles of income is not available for the first three rounds of ESS so our analysis only relies on data from 2008 to 2014. These four rounds together cover approximately 180 000 respondents.

The household income to national income ratio was computed as the average of income category (decile) divided by average net income of household in the country.

For trust and satisfaction, we use the first component resulting from principal component analysis of 9 questions about trust and satisfaction (trust in: parliament, legal system, police, politicians; and satisfaction with: economy, government, democracy, education, health services).

An important issue in the happiness literature is endogeneity. Many personal variables are potentially endogenous in happiness (Di Tella et al., 2003). Happiness has an impact on marital status (Stutzer and Frey, 2006), probability of being unemployed (Marks and Fleming, 1999), and many other outcomes such as income (Lyubomirsky et al., 2005). We see the problem of endogeneity as more serious in the case of subjective variables. Happiness makes people healthier (Sabatini, 2014; Rodríguez-Pose and Maslauskaite, 2011) and more optimistic. Therefore we dropped 4 individual subjective variables (health, discrimination, safety, trust and satisfaction) from our initial model and focused mainly on objective determinants of happiness.

In the next step, regional variables were added to the model. One of the problems we face is multicollinearity between some of these variables. For example, a cross-regional correlation between life expectancy and GDP per capita is around 0.6 and between life expectancy and infant mortality it is approximately -0.7. This problem is raised also by Boarini et al. (2006), who find strong cross-country correlations between GDP per capita and several social indicators. Therefore, we selected indicators that are not too closely correlated with each other but have significant impact on happiness so as to be responsible for the differences in the average levels of happiness in different regions. We identified the following regional variables as having a significant impact on happiness:

- Average disposable income of household in the region divided by the average net income of household in the country,
- Redistribution of income: Current taxes on income and wealth paid by households divided by net disposable income of households,
- Life expectancy at birth,
- Percentage share of households with access to the internet at home (in %),
- NEET rate - share of young people not in employment, education or training (in %).

Two other regional variables were included in some models but not in the final model:

- GDP per capita (in thousands of €),
- Unemployment rate (in %).

Regional data were obtained from the regional database of Eurostat.

The last independent variable in our model is the sum of the Worldwide Governance Indicators (WGI) produced by Kaufmann and Kraay (2016). The WGI are aggregate indicators of six broad dimensions of governance: voice and accountability, political stability and absence of violence/terrorism, government effectiveness, regulatory quality, rule of law, and control of corruption. These indicators are calculated at the national level. The sum of WGI is the only national-level variable in our model.

The final model has been estimated by OLS and can be written as follows:

$$Happiness_{i,r,c,t} = \alpha_0 + \sum \beta \, X_{i,r,c,t} + \sum \gamma \, Z_{r,c,t} + \delta \, W_{c,t} + \mu_{i,r,c,t} \tag{1}$$

where we explain the subjective happiness of individual i who lives in region r in country c at time t. X, Z and W are vectors of individual, regional and national factors mentioned above. β, γ, and δ are vectors of estimated coefficients.

The β coefficients of individual factors are the same for all individuals and across all regions: we assume that the these factors affect individual happiness in the same way in all regions. Differences in the levels of happiness between respondents and in different regions are thus attributed to the individual, regional and national factors, not to differences in parameters of the happiness function.

3 Results

As a first step, Table 1 presents the results of regressions featuring only individual variables: the nine objective variables in the first column and combining objective and subjective variables in the second column. Individual factors such as gender, age and marital status are important determinants of happiness: females are happier than males, happiness falls with age initially until it reaches a low point when people are in their forties and fifties and then it starts growing again, and those living with partner experience a sizable happiness premium. These results are very similar to the findings in the earlier literature (Winkelmann and Winkelmann, 1995; Di Tella et al., 2001, 2003; Alesina et al., 2004; Haller and Hadler, 2006; Frey et al., 2009; Pittau et al., 2010; Rodríguez-Pose and Maslauskaite, 2011; Cuñado and de Gracia, 2013; de Vroome and Hooghe, 2015). Employment status matters too: those who are employed are happier than those who are either unemployed, ill or retired while being a student is associated with an increase in happiness. Education and earnings (relative to the national average) boost happiness – both effects follow an inverted U-shaped pattern, peaking at 33 years for education and a four-fold multiple of national

Table 1: Models with objective individual variables (on left) and with objective and also subjective individual variables (on right)

Objective ind factors (1)			**Objective + subjective ind factors (2)**		
	Estimate	Std. Error		Estimate	Std. Error
(Intercept)	6.798***	(0.063)	(Intercept)	8.032***	(0.062)
gender female	0.068***	(0.011)	gender female	0.200***	(0.011)
age 20-29	−0.312***	(0.038)	age 20-29	−0.140***	(0.036)
age 30-39	−0.655***	(0.042)	age 30-39	−0.400***	(0.039)
age 40-49	−0.868***	(0.042)	age 40-49	−0.543***	(0.039)
age 50-59	−0.954***	(0.042)	age 50-59	−0.497***	(0.040)
age 60-69	−0.682***	(0.045)	age 60-69	−0.334***	(0.043)
age 70-79	−0.595***	(0.048)	age 70-79	−0.184***	(0.046)
age 80 +	−0.375***	(0.052)	age 80 +	−0.024	(0.051)
student	0.449***	(0.031)	student	0.206***	(0.029)
unempl looking	−0.570***	(0.027)	unempl looking	−0.460***	(0.026)
unempl not looking	−0.501***	(0.043)	unempl not looking	−0.353***	(0.042)
sick, disabled	−0.639***	(0.035)	sick, disabled	0.097***	(0.035)
retired	−0.198***	(0.023)	retired	0.030	(0.021)
mil/com service	−0.206	(0.215)	mil/com service	−0.335	(0.210)
housework	−0.032	(0.023)	housework	−0.003	(0.022)
other	0.079	(0.057)	other	0.154***	(0.054)
household 2	−0.188***	(0.021)	household 2	−0.017	(0.020)
household 3	−0.370***	(0.023)	household 3	−0.094***	(0.022)
household 4	−0.284***	(0.025)	household 4	−0.025	(0.023)
household 5+	−0.267***	(0.028)	household 5+	−0.012	(0.027)
minority	−0.471***	(0.025)	minority	−0.281***	(0.025)
pray no	−0.244***	(0.015)	pray no	−0.231***	(0.014)
partner no	−0.682***	(0.017)	partner no	−0.573***	(0.016)
edu years	0.066***	(0.005)	edu years	0.015***	(0.005)
edu yearsˆ2	−0.001***	(0.0002)	edu yearsˆ2	−0.0003*	(0.0002)
housh to cntry inc	1.009***	(0.021)	housh to cntry inc	0.505***	(0.020)
housh to cntry incˆ2	−0.127***	(0.004)	housh to cntry incˆ2	−0.069***	(0.004)
			health good	−0.387***	(0.014)
			health fair	−0.843***	(0.016)
			health bad	−1.539***	(0.026)
			health very bad	−2.359***	(0.051)
			safety safe	−0.256***	(0.013)
			safety unsafe	−0.461***	(0.017)
			safety very unsafe	−0.553***	(0.028)
			discrim yes	−0.205***	(0.021)
			trust and satisf	0.235***	(0.003)
Observations		116,431	Observations		103,636
R^2		0.135	R^2		0.269
Adjusted R^2		0.135	Adjusted R^2		0.268
Residual Std. Error		1.868	Residual Std. Error		1.661
F Statistic		675.145	F Statistic		1,057.299

*Note: *p<0.1; **p<0.05; ***p<0.01. Reference: male, age < 20, employed, household with one member, no minority group member, pray everyday, living with partner, health very good, feel very safety, no discriminated group member.*

income, respectively. [1] Being a member of an ethnic minority depresses happiness. Finally, religious individuals are happier than those who do not pray regularly, in line with previous findings (Ellison, 1991; Chang, 2015).

Subjective individual factors are also important, in rather predictable manner: good health and greater feeling of security are associated with greater happiness, trusting individuals are happier and those who feel being discriminated against are less happy. Adding subjective factors alters the coefficients of objective determinants, in a predictable manner: the effects of one's main activity, education and income fall, as educated, employed and well-off individuals are more likely to be in good health.

In table 2, we keep the nine objective individual variables and add to them five regional variables and WGI as the only national variable (Model 3). Again, we find a quadratic relationship between happiness and household income to country income ratio: maximum happiness is attained at household income 3.6 times higher than average income in the country. In contrast, the regional to national income ratio is negative when we control for household income: a given household income 'buys' more happiness in a relatively poor region than in a rich region. This is in line with the argument that we compare ourselves with people around us (Frey and Stutzer, 2002; Stutzer, 2004). [2]

The effects of other regional variables are rather intuitive. Unemployment has negative influence on happiness. Life expectancy, availability of internet connections and income redistribution increase happiness (the last effect is inverted-U-shaped). Finally, sound institutions at the country level are associated with greater happiness.[3] We have also estimated 6 models with individual sub-indicators from WGI instead of their sum: all indicators have significantly positive impact on happiness, and good governance makes people most happy.

Table 2 also contains separate estimates by gender, which reveal some important differences. Housework has a negative effect for males, but for females it is not significantly different from the reference group of being employed. Similarly, being unemployed imposes a greater happiness toll on males, while being single is more costly for females. For females, living in bigger household has a small negative impact on happiness, for males this effect is positive.

Table 3 considers different combinations of regional factors with the objective and subjective individual determinants, and with or without regional fixed effects.[4] The NEET rate has a negative sign in all the models, and seems a stronger determinant of happiness than unemployment rate. GDP per capita is insignificant in Model 10 with objective individual variables and fixed effects. It has a negative impact on happiness in models 7, 9, and 11. Internet access and life expectancy are significant in all models.

Table 4 reproduces Model 3 and reports similar estimates for satisfaction with life and satisfaction with the economy. Most coefficients are qualitatively similar across all three models, suggesting that our happiness model captures a rather broad notion of happiness. Therefore, we believe we can use general happiness to capture overall satisfaction with all aspects of life.

[1] The quadratic effect of income deviates from the literature, as most studies assume a linear relationship between income and happiness. Rodríguez-Pose and Maslauskaite (2011) find that the quadratic term for income is not significant. However, Caporale et al. (2009) find the coefficient for ninth income category to be greater than for the two next income categories, which approximately corresponds to our results.

[2] Clark and Oswald (1996) reports that job satisfaction is inversely related to income level of reference group.

[3] Positive impact of life expectancy on happiness can be found in Heukamp and Arino (2011). In the study by Ovaska and Takashima (2006) life expectancy has significant positive impact on satisfaction with life, but is insignificant for happiness. Positive impact of WGI indicators on happiness can be found in Helliwell and Huang (2006) and Helliwell (2006). Positive effect of redistribution on happiness was found for size of the state (Flavin et al., 2011), and for government expenditures and government transfers (Ott, 2010). The relation between government spending and happiness is not significant in Ram (2009).

[4] The fixed effects for models 10 and 11 are reported in Table 5.

Table 2: Models with objective individual variables, regional variables and WGI for both genders, females, and males

	Both genders (3)		**Females (4)**		**Males (5)**	
	Estimate	Std. err	Estimate	Std. err	Estimate	Std. err
(Intercept)	1.980***	(0.201)	2.864***	(0.279)	1.213***	(0.290)
gender female	0.087***	(0.011)				
age 20-29	−0.349***	(0.038)	−0.333***	(0.055)	−0.355***	(0.053)
age 30-39	−0.686***	(0.042)	−0.616***	(0.059)	−0.752***	(0.059)
age 40-49	−0.923***	(0.042)	−0.847***	(0.059)	−0.994***	(0.059)
age 50-59	−0.955***	(0.042)	−0.871***	(0.060)	−1.044***	(0.060)
age 60-69	−0.731***	(0.045)	−0.665***	(0.064)	−0.803***	(0.064)
age 70-79	−0.669***	(0.048)	−0.621***	(0.068)	−0.724***	(0.069)
age 80 +	−0.522***	(0.053)	−0.426***	(0.073)	−0.647***	(0.077)
student	0.289***	(0.031)	0.361***	(0.044)	0.221***	(0.044)
unempl looking	−0.636***	(0.027)	−0.509***	(0.040)	−0.751***	(0.037)
unempl not looking	−0.577***	(0.043)	−0.481***	(0.062)	−0.657***	(0.060)
sick, disabled	−0.791***	(0.035)	−0.829***	(0.050)	−0.757***	(0.049)
retired	−0.144***	(0.023)	−0.149***	(0.031)	−0.152***	(0.033)
mil/com service	−0.286	(0.219)	−0.161	(0.462)	−0.356	(0.244)
housework	−0.084***	(0.023)	−0.004	(0.026)	−0.267***	(0.065)
other	−0.015	(0.057)	0.019	(0.078)	−0.040	(0.084)
household 2	−0.009	(0.021)	−0.063**	(0.028)	0.042	(0.033)
household 3	−0.033	(0.023)	−0.130***	(0.032)	0.053	(0.035)
household 4	0.053**	(0.025)	−0.032	(0.035)	0.120***	(0.037)
household 5+	0.071**	(0.029)	−0.044	(0.040)	0.169***	(0.042)
minority	−0.339***	(0.024)	−0.367***	(0.035)	−0.318***	(0.034)
pray no	−0.261***	(0.015)	−0.241***	(0.019)	−0.313***	(0.024)
partner no	−0.617***	(0.017)	−0.591***	(0.023)	−0.642***	(0.028)
edu years	0.064***	(0.005)	0.083***	(0.007)	0.034***	(0.008)
edu yearsˆ2	−0.001***	(0.0002)	−0.002***	(0.0002)	−0.001***	(0.0003)
housh to cntry inc	0.687***	(0.022)	0.749***	(0.031)	0.634***	(0.031)
housh to cntry incˆ2	−0.095***	(0.004)	−0.108***	(0.006)	−0.084***	(0.006)
WGI	0.073***	(0.005)	0.085***	(0.007)	0.061***	(0.007)
redist of income	1.542***	(0.225)	1.224***	(0.316)	1.788***	(0.319)
redist of incomeˆ2	−0.870***	(0.284)	−0.573	(0.401)	−1.078***	(0.400)
reg to cntry inc	−0.626***	(0.056)	−0.556***	(0.077)	−0.711***	(0.081)
NEET rate	−0.018***	(0.001)	−0.022***	(0.002)	−0.013***	(0.002)
life expectancy	0.061***	(0.003)	0.047***	(0.004)	0.078***	(0.004)
internet	0.004***	(0.001)	0.005***	(0.001)	0.003***	(0.001)
Observations	108,966		58,084		50,882	
R^2	0.196		0.195		0.200	
Adjusted R^2	0.196		0.195		0.200	
Residual Std. Error	1.811		1.847		1.766	
F Statistic	781.114		427.172		386.255	

*Note: *p<0.1; **p<0.05; ***p<0.01. Reference: male, age < 20, employed, household with one member, no minority group member, pray everyday, living with partner.*

Table 3: Additional models with different combinations of regional variables, individual factors and fixed effects

	Model 6	**Model 7**	**Model 8**	**Model 9**	**Model 10**	**Model 11**
individual factors	objective	objective	objective	obj + subj	objective	obj + subj
fixed effects	no	no	no	no	yes	yes
WGI	0.073***	0.117***	0.107***	0.026***	0.076***	0.018
	(0.005)	(0.005)	(0.005)	(0.005)	(0.017)	(0.017)
redist of income	1.542***		0.802***	1.384***	0.100	1.441***
	(0.225)		(0.217)	(0.228)	(0.459)	(0.442)
redist of incomeeˆ2	−0.870***		0.051	−1.255***	−0.842	−1.712***
	(0.284)		(0.274)	(0.281)	(0.543)	(0.514)
reg to cntry inc	−0.626***	−0.385***	−0.227***	−0.190***	−0.369***	−0.185**
	(0.056)	(0.061)	(0.054)	(0.061)	(0.074)	(0.073)
NEET rate	−0.018***	−0.015***		−0.010***	−0.019***	−0.014***
	(0.001)	(0.001)		(0.001)	(0.002)	(0.002)
life expectancy	0.061***	0.062***	0.054***	0.053***	−0.016*	−0.037***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.008)	(0.008)
internet	0.004***	0.004***	0.004***	0.004***	0.006***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
GDP pc		−0.003***		−0.010***	0.001	−0.003***
		(0.001)		(0.001)	(0.001)	(0.001)
unemployment			0.007***			
			(0.001)			
R^2	0.196	0.194	0.195	0.283	0.212	0.298
Adjusted R^2	0.196	0.194	0.195	0.282	0.211	0.297
Observations	108,966	108,966	109,165	96,890	108,966	96,890

*Note: *p<0.1; **p<0.05; ***p<0.01*

Table 4: Model 3 with objective individual variables, regional variables and WGI

	Happiness (3)		**Sat w life (12)**		**Sat w economy (13)**	
	Estimate	Std. err	Estimate	Std. err	Estimate	Std. err
(Intercept)	1.980***	(0.201)	1.717***	(0.225)	10.217***	(0.237)
gender female	0.087***	(0.011)	0.053***	(0.013)	−0.157***	(0.014)
age 20-29	−0.349***	(0.038)	−0.489***	(0.043)	−0.258***	(0.046)
age 30-39	−0.686***	(0.042)	−0.884***	(0.047)	−0.440***	(0.050)
age 40-49	−0.923***	(0.042)	−1.121***	(0.047)	−0.478***	(0.050)
age 50-59	−0.955***	(0.042)	−1.152***	(0.047)	−0.512***	(0.050)
age 60-69	−0.731***	(0.045)	−0.799***	(0.051)	−0.326***	(0.053)
age 70-79	−0.669***	(0.048)	−0.656***	(0.054)	−0.106*	(0.057)
age 80 +	−0.522***	(0.053)	−0.485***	(0.059)	0.101	(0.063)
student	0.289***	(0.031)	0.310***	(0.035)	0.341***	(0.037)
unempl looking	−0.636***	(0.027)	−0.984***	(0.030)	−0.647***	(0.032)
unempl not looking	−0.577***	(0.043)	−0.774***	(0.048)	−0.434***	(0.051)
sick, disabled	−0.791***	(0.035)	−1.017***	(0.040)	−0.600***	(0.042)
retired	−0.144***	(0.023)	−0.116***	(0.025)	−0.098***	(0.027)
mil/com service	−0.286	(0.219)	−0.138	(0.247)	−0.059	(0.259)
housework	−0.084***	(0.023)	−0.083***	(0.026)	−0.128***	(0.027)
other	−0.015	(0.057)	−0.093	(0.064)	−0.212***	(0.068)
household 2	−0.009	(0.021)	−0.162***	(0.023)	−0.165***	(0.025)
household 3	−0.033	(0.023)	−0.204***	(0.026)	−0.218***	(0.027)
household 4	0.053**	(0.025)	−0.153***	(0.028)	−0.175***	(0.030)
household 5+	0.071**	(0.029)	−0.172***	(0.032)	−0.137***	(0.034)
minority	−0.339***	(0.024)	−0.469***	(0.027)	0.077***	(0.029)
pray no	−0.261***	(0.015)	−0.311***	(0.016)	−0.037**	(0.017)
partner no	−0.617***	(0.017)	−0.504***	(0.019)	−0.189***	(0.020)
edu years	0.064***	(0.005)	0.075***	(0.006)	0.032***	(0.006)
edu yearsˆ2	−0.001***	(0.0002)	−0.002***	(0.0002)	−0.001***	(0.0002)
housh to cntry inc	0.687***	(0.022)	0.952***	(0.024)	0.589***	(0.026)
housh to cntry incˆ2	−0.095***	(0.004)	−0.128***	(0.005)	−0.078***	(0.005)
WGI	0.073***	(0.005)	0.104***	(0.006)	0.186***	(0.006)
redist of income	1.542***	(0.225)	0.767***	(0.252)	−0.611**	(0.266)
redist of incomeˆ2	−0.870***	(0.284)	0.659**	(0.318)	1.199***	(0.335)
reg to cntry inc	−0.626***	(0.056)	−0.742***	(0.063)	−1.769***	(0.066)
NEET rate	−0.018***	(0.001)	−0.029***	(0.002)	−0.097***	(0.002)
life expectancy	0.061***	(0.003)	0.073***	(0.003)	−0.068***	(0.003)
internet	0.004***	(0.001)	0.004***	(0.001)	0.023***	(0.001)
Observations	108,966		109,140		107,989	
R^2	0.196		0.224		0.240	
Adjusted R^2	0.196		0.223		0.240	
Residual Std. Error	1.811		2.032		2.131	
F Statistic	781.114		924.294		1,005.001	

*Note: *p<0.1; **p<0.05; ***p<0.01. Reference: male, age < 20, employed, household with one member, no minority group member, pray everyday, living with partner.*

Table 5: Fixed effects

	FE Model 5		FE Model 6	
	Estimate	Std. err	Estimate	Std. err
BE	0.443***	(0.050)	0.265***	(0.048)
BG	−0.848***	(0.163)	−0.681***	(0.159)
CY	0.229**	(0.089)	0.252***	(0.088)
CZ	−0.368***	(0.093)	−0.244***	(0.090)
DE	−0.030	(0.041)	0.190***	(0.040)
DK	0.687***	(0.144)	0.172	(0.137)
EE	−0.212**	(0.084)	−0.135*	(0.082)
ES	0.806***	(0.093)	0.910***	(0.090)
FI	0.395***	(0.055)	0.205***	(0.053)
FR	−0.004	(0.059)	0.190***	(0.057)
GB	0.262***	(0.041)	0.264***	(0.040)
GR	−0.221	(0.135)	−0.166	(0.131)
HU	−0.675***	(0.111)	−0.593***	(0.109)
IE	−0.073	(0.045)	−0.070	(0.043)
IT	0.638***	(0.147)	0.626***	(0.141)
LT	−0.464***	(0.115)	−0.301***	(0.112)
LV	−0.301**	(0.135)	−0.029	(0.132)
NL	0.083*	(0.044)	0.114***	(0.042)
PL	0.159	(0.103)	0.278***	(0.100)
PT	−0.026	(0.085)	0.191**	(0.082)
RO	−0.272	(0.174)	−0.352**	(0.171)
SE	0.149**	(0.059)	−0.085	(0.057)
SI	−0.071	(0.104)	0.290***	(0.102)
SK	−0.051	(0.116)	0.014	(0.113)

*Note: *p<0.1; **p<0.05; ***p<0.01*

4 Predicted Average Happiness for European NUTS2 Regions

We use Model 3 (reported in Table 2 and also in Table 4), featuring objective individual variables and objective regional/national variables, but omitting any subjective factors, to compute the predicted average happiness in European regions at the NUTS2 level. We present the results graphically. First, in Figure 1, we show the the average regional values of happiness from the ESS surveys (all waves combined). The Nordic countries are among the happiest in Europe, followed by Western European countries, and then Southern and East European countries. A few countries stand out somewhat: France for being less happy than similar Western European countries, and Spain and Poland for appearing happier than similar Southern and Eastern European countries. Bulgaria, Romania, Greece, Hungary and Portugal seem to be the bleakest countries in Europe.

Figure 2 shows the estimated average happiness based on values of individual factors from 2014 (the last available round of ESS) and regional data from the same year. The regional distributions of happiness and predicted happiness are very similar. Interestingly, the odd cases identified above largely disappear: France has similar predicted happiness as Germany and the UK, Portugal does not differ much from Spain, and Poland now appears similar to the Czech Republic and Slovakia. These differences between reported and predicted happiness could reflect factors not captured by our analysis, or perhaps could be attributed to cultural and linguistic differences (the meaning of reporting being 'very happy', for example, may be slightly different in different languages).

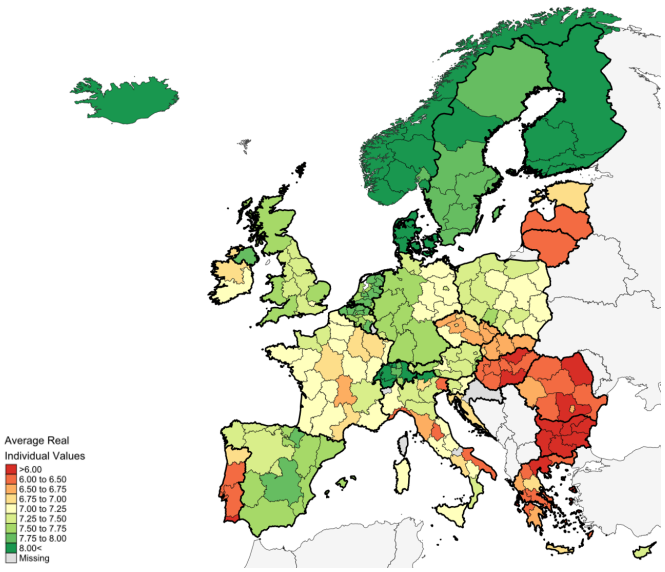

Figure 1: Average reported happiness for European regions (survey averages)

Finally, Figure 3 updates the regional data to the latest year available.

Our new indicator of predicted happiness has a number of distinct advantages over GDP per capita, and also relative to using actual (survey-based) happiness. It reflects actual well-being, and incorporates the contributions of objective and measurable factors. Because of this, it is possible to construct this indicator for any level of aggregation – countries, regions, individual postcodes or socio-economic groups – for which the required data are available. For the same reason, this indicator can be used in a straightforward manner for the purposes of impact assessment (e.g. what will be the effect of rising unemployment or increased educational attainments). Unlike GDP per capita, it is measured at the place of residence, not where production takes place: output statistics tend to overestimate the well-being of major urban areas because they include the economic contributions of commuters. Unlike actual average happiness, the predicted value removes country-specific deviations, which can result, for example, from cultural/linguistic biases.

Finally, predicted (and actual) happiness varies much less across regions than GDP per capita. In particular, the coefficient of variation is 0.53 in the case of GDP per capita and only 0.09 for predicted happiness (and 0.1 for actual happiness). Moreover, the richest European regions are not necessarily also the happiest: the region with the highest output per person is Inner London, whereas the region with highest predicted happiness is Southern Denmark; the poorest and least happy region is in both instances Yuzhen tsentralen in Bulgaria.

5 Application: Predicted Happiness in Regions and Discricts of Slovakia

As argued above, one of the advantages of our approach is that we can use the estimated functional relation to predict happiness also for regions for which happiness data are not collected (and even for regions for which GDP per capita data are not available). This offers an additional perspective at assessing well-being in such regions. Table 6 reports predicted average happiness at level of NUTS2 regions (names in bold), NUTS3 (in italics) and all 79 districts. The results are presented in graphical form in Figure 4.

To compute average predicted happiness for Slovak districts, we combined information from a number of sources. The demographic statistics (age, gender and education) are based on the latest

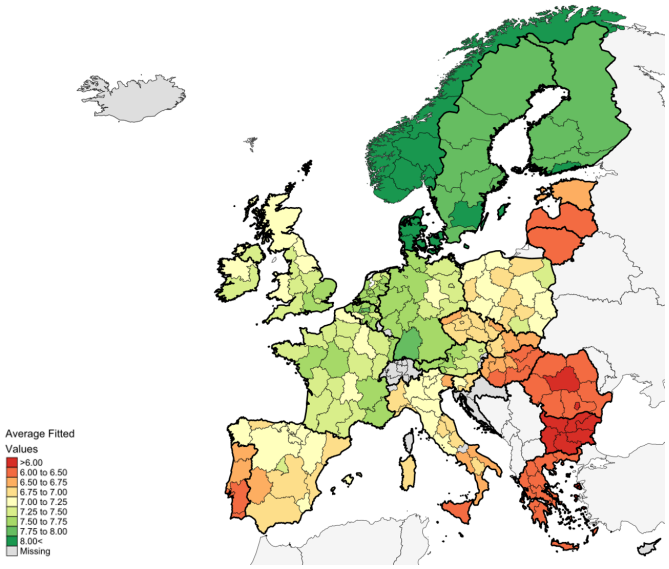

Figure 2: Average predicted happiness for European regions (2014)

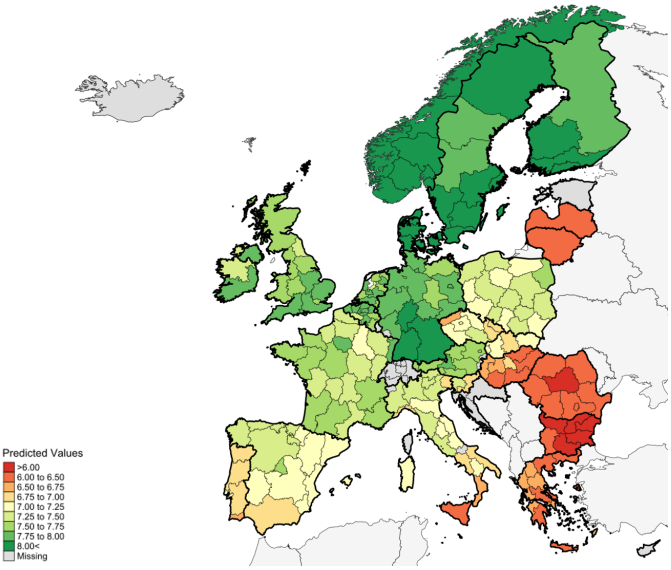

Figure 3: Predicted values of average happiness for European regions (latest available data)

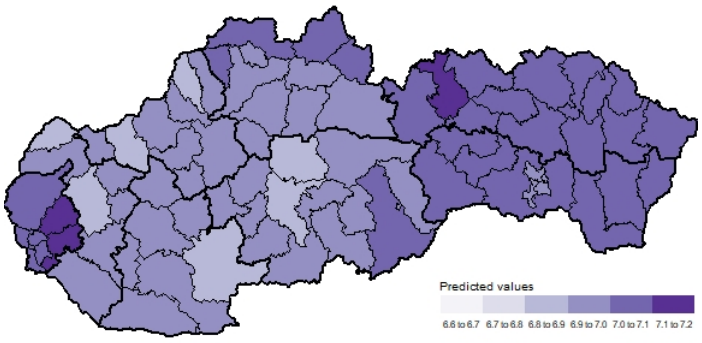

Figure 4: Average predicted happiness for Slovak districts

information published by the Statistical Office of the Slovak Republic for 2016. The main activity during the last 7 days and household size are based on information reported in the 2011 census.

There are two main ethnic minority groups in Slovakia: Hungarians and the Roma. The former live mainly alongside the Southern border, often in municipalities in which they form a local majority. Two districts, Dunajská Streda and Komárno, have an overall majority of ethnic Hungarians. Given their local concentration, we feel that it would be wrong to consider the Hungarians a minority in Slovakia. Therefore, we only consider the Roma as a minority. We use their share in the district population as of 2013 according to the Atlas of Roma Communities compiled by the Slovak Ministry of the Interior.[5]

The information on religiosity (frequency of praying) and living with a partner is based on the ESS. As the ESS only distinguishes NUTS2 regions, we only have information at this level: the same value is used for all districts with each NUTS2 region.

The average household income to national income ratio is effectively the same as the regional to national income ratio and is computed using average wages at district and national level in 2016 according to the Statistical Office of the Slovak Republic. The NEET rate for 2016 was likewise obtained from the Statistical Office of the Slovak Republic.

Access to the internet was based on Eurostat figures available for NUTS3 regions. Income redistribution and life expectancy were also obtained from Eurostat but only at the NUTS2 level. WGI are only observed at the level of countries. Information on all of these indicators was available for 2016.

The average predicted happiness figures allow an interesting observation. Economically, Slovakia displays a developmental gradient from West to East: Western Slovakia, and especially the region surrounding Bratislava, the capital, is most developed, while Eastern Slovakia is poorest. However, predicted happiness displays a different pattern. The Bratislava region has the highest predicted happiness, closely followed by Eastern Slovakia. Western Slovakia and Central Slovakia are in between. This pattern probably reflects, on the one hand, high level of economic development in Bratislava region, and on the other hand higher religiosity and larger household sizes in Eastern Slovakia. This observation suggests that there are factors that can compensate the residents of less developed regions in terms of their well-being.

[5] See `https://www.minv.sk/?atlas_2013`.

Table 6: Average Predicted Happiness: Districts of Slovakia

District	APH	District	APH	District	APH
Bratislavský kraj	7.06	**Stredné Slovensko**	6.96	**Východné Slovensko**	7.04
Bratislava I	7.04	*Žilinský kraj*	6.99	*Prešovský kraj*	7.04
Bratislava II	7.01	Bytča	7.03	Bardejov	7.07
Bratislava III	7.07	Čadca	7.02	Humenné	7.02
Bratislava IV	7.04	Dolný Kubín	7.00	Kežmarok	7.12
Bratislava V	7.07	Kysucké Nové Mesto	6.94	Levoča	7.05
Malacky	7.09	Liptovský Mikuláš	6.99	Medzilaborce	7.01
Pezinok	7.16	Martin	6.96	Poprad	7.00
Senec	7.16	Námestovo	7.08	Prešov	7.02
Západné Slovensko	6.91	Ružomberok	6.97	Sabinov	7.09
Trnavský kraj	6.92	Turčianske Teplice	6.99	Snina	7.02
Dunajská Streda	6.94	Tvrdošín	7.03	Stará Ľubovňa	7.06
Galanta	6.94	Žilina	6.97	Stropkov	7.02
Hlohovec	6.93	*Banskobystrický kraj*	6.93	Svidník	7.00
Piešťany	6.93	Banská Bystrica	6.88	Vranov nad Topľou	7.08
Senica	6.93	Banská Štiavnica	6.95	*Košický kraj*	7.03
Skalica	6.90	Brezno	6.93	Gelnica	7.09
Trnava	6.88	Detva	6.91	Košice I	6.98
Trenčiansky kraj	6.90	Krupina	6.95	Košice II	6.97
Bánovce nad Bebravou	6.93	Lučenec	6.97	Košice III	7.04
Ilava	6.90	Poltár	6.95	Košice IV	6.99
Myjava	6.91	Revúca	6.98	Košice - okolie	7.07
Nové Mesto nad Váhom	6.89	Rimavská Sobota	7.01	Michalovce	7.05
Partizánske	6.92	Veľký Krtíš	6.93	Rožňava	7.04
Považská Bystrica	6.91	Zvolen	6.89	Sobrance	7.03
Prievidza	6.90	Žarnovica	6.91	Spišská Nová Ves	7.08
Púchov	6.89	Žiar nad Hronom	6.90	Trebišov	7.07
Trenčín	6.90				
Nitriansky kraj	6.92				
Komárno	6.93				
Levice	6.90				
Nitra	6.92				
Nové Zámky	6.93				
Šaľa	6.91				
Topoľčany	6.94				
Zlaté Moravce	6.93				

6 Conclusions

This paper is devoted to the happiness of Europeans. The concept of happiness is closely related to well-being and utility and it has been becoming more and more popular not only in academic studies, but also among policy makers. We use answers of more than 100,000 respondents to the question: "Taking all things together, how happy would you say you are?" to analyze the determinants of individual happiness. Happiness itself is a subjective quality: it reflects one's feelings, mood and sentiments. When it comes to identifying its determinants, we therefore focus on objective factors, both at the individual and aggregate levels. By focusing on objective variables, we try to minimize the endogeneity problem. For instance, self-reported health is a strong predictor of one's perception of happiness. However, both are subjective outcomes and the direction of causality between them is unclear: healthy individuals are more likely to be happy, but happy individuals can also subjectively feel more healthy. Therefore, we only consider factors that are objectively

measurable as potential determinants of happiness. The result of our analysis is what we call *the production function of happiness*: a relation that explains how individual-level happiness is formed.

We identify nine objective individual variables, five regional variables, and a national variable as factors that shape happiness in our analysis. We can also use the resulting production function of happiness to predict happiness either within sample, or out of our original sample. In this way, we construct a new indicator of 'average predicted happiness' at the regional level. The index of average predicted happiness constitutes a novel broad indicator of well-being that is not based only on a relatively narrow criterion of measuring the market value of goods and services. Our indicator, furthermore, not only assesses well-being, it also and explains how it is attained.

Our approach allows us to predict happiness for different categories of people and estimate the impacts of changes in individual factors and regional indicators. We carry out this exercise for the EU NUTS 2 regions and also for the districts of Slovakia (LAU 1, the level that is just below NUTS 3 regions). When computing the index of average predicted happiness at the NUTS 2 level, we use the latest available data to predict the level of average happiness should prevail before new happiness data have been collected. One notable observation stands out: there is considerably less variation within and across countries in actual or predicted happiness than with respect to GDP per capita. Hence, the GDP overestimates well-being in rich (and mainly urban) regions and underestimates it in poorer regions.

The LAU 1 exercise, which we carry out only for Slovak districts, demonstrates that (predicted) happiness can be used to inform policy making also at a relatively low levels of regional aggregation. The prediction exercise could be similarly extended to regions at even lower levels, such as municipalities or even individual neighborhoods, at which information on actual happiness is not available or where collecting such information would not be practical, as long as the required objective individual and regional level socio-economic data are available.

The index of average predicted happiness could constitute an additional input into policy making in areas such as impact assessment of specific economic and social policies, or as a determinant of regional aid. We see the latter as especially suitable use of this indicator. Regional aid constitutes redistribution of national resources (or supra-national funds as in the case of the European Cohesion Policy) to aid lagging-behind regions in their development and to increase their well-being. GDP per capita can, however, be a poor measure of economic development and well-being: it is measured at the point of production, so that the well-being of rural regions is often under-estimated because of residents who commute to urban areas for work. Happiness, in contrast, is measured at the point of residence; likewise, predicted happiness is estimated based on information on residents. It is therefore free of this source of mis-measurement. Moreover, residents of less-developed rural areas may be partially compensated in terms of well-being for the lower level of economic development: by virtue of revealed preference, at least some of them prefer closer access to nature, rural calm, better environment and more space over high wages, long working hours, congestion, and urban amenities. Regional aid should take such compensating differentials into account. This holds equally for national regional aid programs, as for EU wide redistribution of regional aid.

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