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The usefulness of a Happy Income Index

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The Usefulness of a Happy Income Index[1]

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(revised version of "Living in a material world: Happy Income and Happy Life Years")

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by

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Abstract

In this paper, Happy Income is introduced as an indicator of physical and socio-psychic well-being. It is constructed on the assumption that socio-economic well-being is based on objective circumstances, such as personal income as well as on a subjective evaluation of life. In combining these factors, Happy Income is a cardinal measure of overall well-being in a given country. Therefore, Happy Income is not subject to the limitations of purely ordinally scaled indicators, i.e. it is not restricted by an upper bound, which may be one explanation of the Easterlin paradox. The Happy Income concept is employed to measure social well-being in various different European countries. The results are compared to these countries' score on Ruut Veenhoven's Happy Life Years. It is argued that Happy Income is a valuable complement to other indicators of well-being at an aggregated level.

JEL-classification: I 10, I 31

Keywords: Happiness research, Happy Income, Happy Life Years, Subjective Well-being

Introduction

The relationship between happiness and income is one of the key issues in happiness economics (Easterlin, 2002; Bruni and Porta, 2007; Frey *et al.*, 2008; Mentzakis and Moro, 2009). Starting with Easterlin's (1974) seminal paper, a large body of writing is devoted to this topic, including Diener and Oishi (2000), Easterlin (1995, 2001), Hagerty and Veenhoven (2003), as well as Stutzer (2004). In these studies, as in more recently published work by Caporale *et al.* (2009) and Becchetti and Rosetti (2009), not only the determining factors of individual happiness are considered, but also the degree of life satisfaction or happiness at the macro level of nations.

One of the reasons to seek out useful and reliable indicators of a nation's well-being is that such indicators could provide a guideline for policy-making, such as development policy (Goulet, 1992). Indeed, it seems that the search for indicators of 'the wealth of nations' (i.e., an economy's material output), commenced as early as the sixteenth century and has never ceased. The question of how to measure *social* well-being – in contrast to material well-being alone - has been answered since the 1970s with the social indicators movement, which focused on heteronomous indicators, using a top-down approach. The indicators proposed were developed mainly by researchers in the social sciences, without active participation of the population as a whole. In the 1990s, research on happiness revolutionized the approach to finding out what social well-being means and how it can be measured, by asking people themselves how they are feeling.[3] Consequently, the resulting indicators may be considered as autonomous, being constructed in a bottom-up approach (Prinz, 2009).

The traditional attempt to concentrate solely on material output in order to determine the well-being of a society seems too narrow to grasp what makes living in a certain country worthwhile. On the other hand, the exclusive usage of subjective attitudes, as indicators of well-being at the macro-level, neglects the fact that human beings do indeed have material needs. Therefore, both material endowments and the psycho-social conditions of living (i.e., subjective satisfaction with life or happiness) determine the level of socio-economic well-being in a society.

[3] For an overview see e.g. Kahneman/Diener/Schwarz (1999).

Ruut Veenhoven's index of Happy Life Years (HLY) is an initial attempt at combining material and non-material well-being. This index can be described as the transformation of ordinally scaled utility into a cardinally measurable form, by combining the life expectancy in a country and multiplying it with the average self-reported life satisfaction (Veenhoven, 1996). This index, however, does not take into account the wealth of a country and, therefore cannot capture the effect of income growth.

The present paper is intended as a contribution to the debate on the measurement of well-being at a societal macro-level. We provide a theoretical justification for a new aggregate measure of well-being, which we call the Happy Income (HI) index. Furthermore, applying the HI index to data from the European Quality of life Survey (EQLS), we contribute to the empirical comparison of well-being among European nations. Since the HI index is related to the Veenhoven's Happy Life Years (HLY) index, we also contribute to the debate on this indicator.

The paper is organized as follows. In the second section, ordinal scales are discussed as one possible cause of the Easterlin paradox. In the third section, Happy Income (HI) is introduced, justified and defined. In addition, empirical results for several European countries are presented. The fourth section contains a methodological and empirical comparison of Happy Income and Happy Life Years. The final section concludes.

2 Index scales and the Easterlin paradox

The least one can say is that the Easterlin paradox (Easterlin, 1974, 1995, 2005) – which states that economic growth does not necessarily improve the human lot, as measured by the average level of subjective well-being or 'happiness' in a society – tremendously stimulated both empirical and theoretical research into the measurement of a society's well-being. The paradox has been criticized for the econometric methods applied (e.g., Boes and Winkelmann, 2006), rejected empirically on the basis of recent data (e.g., Stevenson and Wolfers, 2008; D'Ambrosio and Frick, 2007; Hagerty and Veenhoven, 2003) and explained by a large number of authors. In particular, it is emphasized that relative income – in addition to absolute income – may play a crucial role for well-being (e.g., Caporale *et al.*, 2009; Mentzakis and Moro, 2009; Clark *et al.*, 2008; Ferrer-i-Carbonell, 2005).

However, we do not intend to discuss these results in detail here. Rather, we argue that the Easterlin paradox could be a consequence of measuring life satisfaction through a Likert scale, i.e., an ordinal scale with an upper bound, so that it cannot grow over time once the maximum value is attained. Moreover, in contrast to much of the existing literature on happiness, it is assumed here that the survey question on general life satisfaction is not an equivalent index to that of economic 'utility'.[4] In this paper, we interpret the results of the life satisfaction question as a measure of a person's well-being according to the following utility function:[5]

$$U_i(\psi_{i,t} | y_t) \rightarrow INT(1,...,10). \quad (1)$$

The mapping in (1)[6] states that utility (measured as the level of life satisfaction) is reflected in the Likert scale of integer numbers INT(1,…, 10), as the level of psycho-social well-being a person i experiences at time t, $\psi_{i,t}$, *under the condition* that the average material life conditions (i.e., income) are given by y_t. This contrasts with the standard interpretation of utility measurements via the life satisfaction question, by using a ten-point Likert scale which can be stated as follows:

$$U_{i,t} = \psi_{i,t} \rightarrow INT(1,...,10). \quad (2)$$

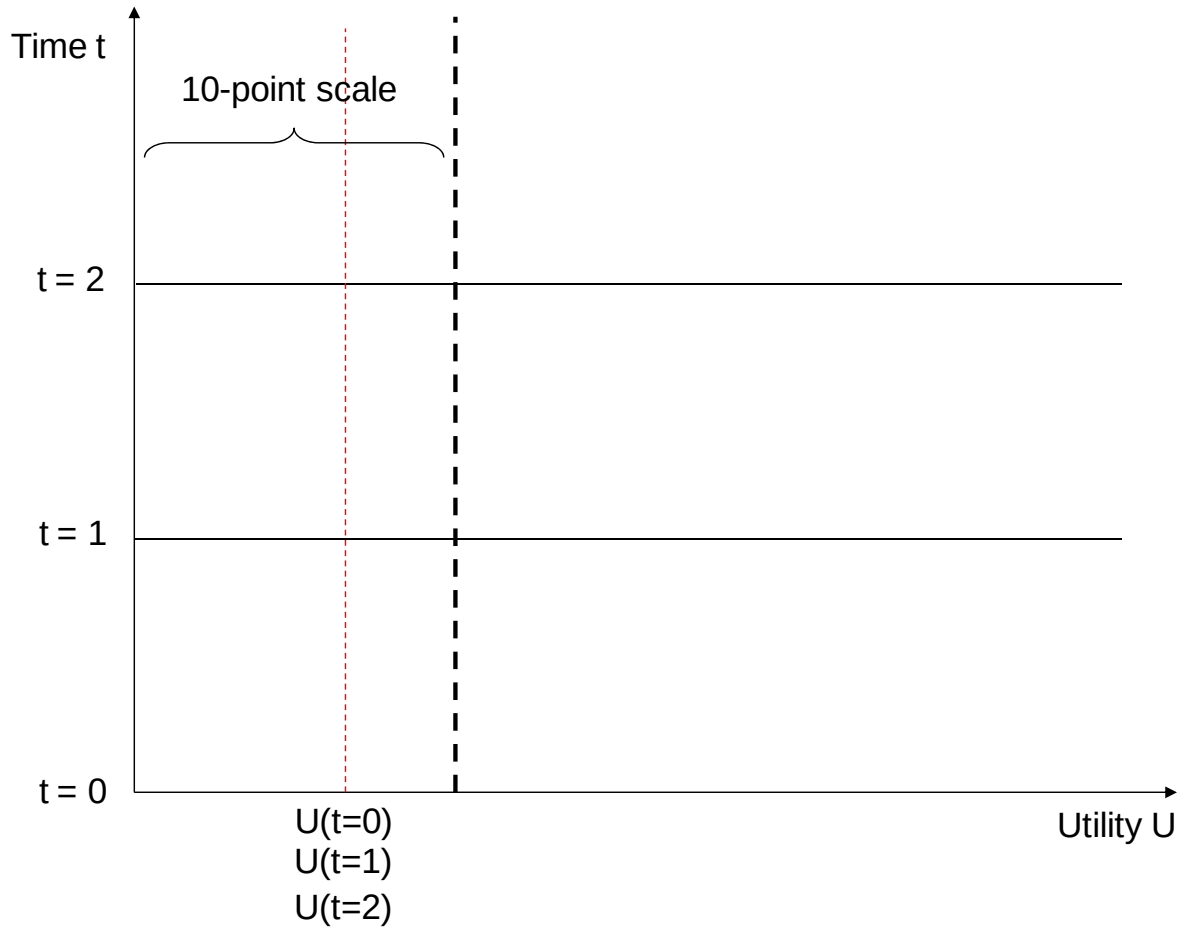
In (2), life satisfaction is *equivalent* to utility and is measured by a ten-point integer number scale.

In Figure 1, utility measured on an ordinal scale is depicted for three different points in time, t = 0, 1, 2. We assume that utility can indeed be measured on a *cardinal* scale. In contrast, the actual measurement is conducted with an *ordinally* scaled item. We introduce the average

[4] See Becker and Rayo (2008), who also question the assumption that 'happiness', as measured by the answers to the question on the level of life satisfaction, is identical to 'utility' as defined in economic theory. For a similar position, see Kimball and Willis (2006).
[5] See Kristofferson (2010) for a comprehensive survey on the interpretations of data on subjective well-being, with particular respect to issues like cardinality, neutrality and additivity.
[6] In order to avoid confusion, the index i for individuals is omitted from the formulas for the remainder of the paper.

disposable income as a cardinal factor to reflect the economic situation of a particular society at a given time.

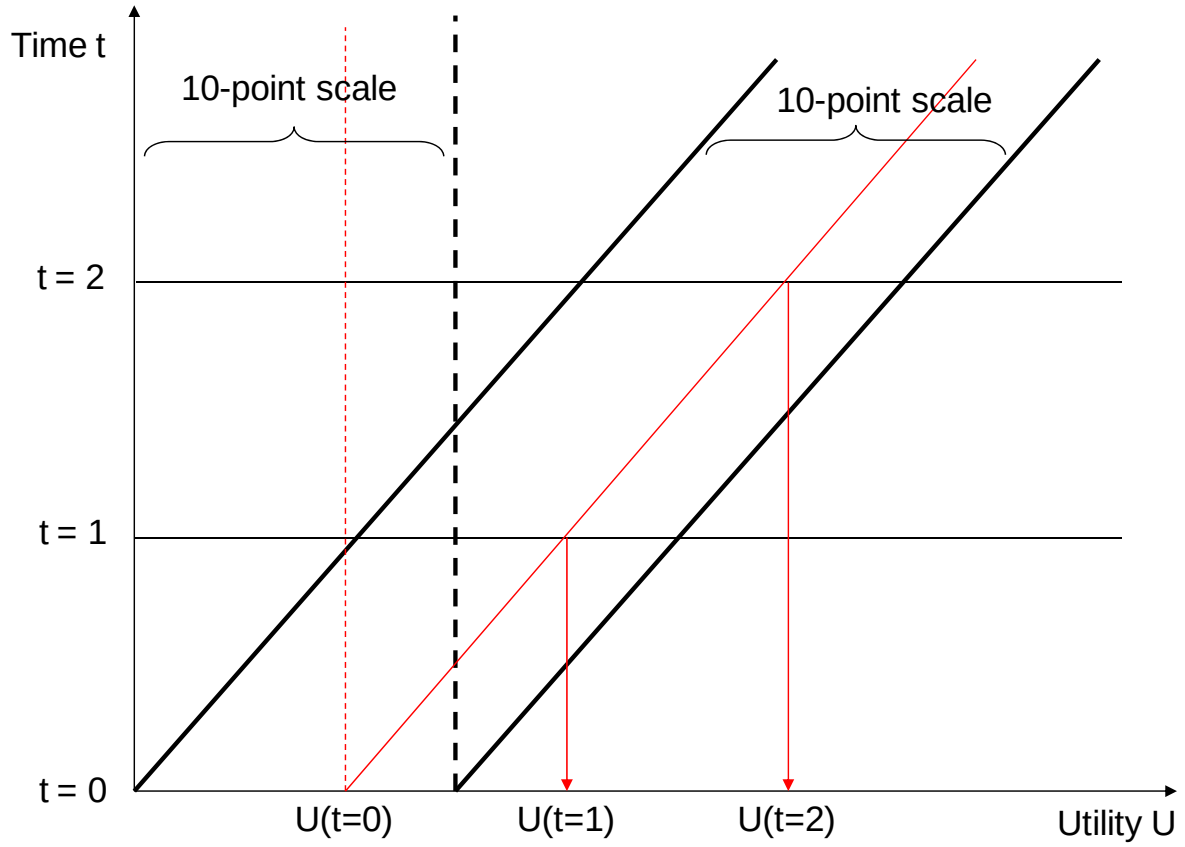
Figure 1: Measuring well-being on an ordinal scale. Constant average income



Source: Own depiction.

Firstly, consider a situation in which the average income remains unchanged over time. A personal evaluation of one's satisfaction with life on a ten-point scale is depicted by the corridor between the ordinate and the vertical dashed bold line. This scale represents the ordinal utility level. Let us assume an individual is quite satisfied with his life and scores a "seven", as depicted by the vertical dashed thin line. This corresponds to a utility of $U(t = 0)$ in terms of the absolute (or cardinal) utility level. Over time, the individual remains equally content with his life (at $t = 1$ and $t = 2$, happiness is also "seven") and, as can be seen on the abscissa, the utility remains constant ($U(t = 0) = U(t = 1) = U(t = 2)$).

Figure 2: Measuring well-being on an ordinal scale. Increasing average income



Source: Own depiction.

Now consider a development where the average income increases as depicted in Figure 2. Here, the evaluation of life satisfaction is indicated by the corridor between the two tilted bold lines. Again, the individual is quite satisfied and remains so over time (a "seven" on a one-to-ten happiness scale). Due to the rising income, this happiness corresponds to the utility U(t = 0) in t = 0, but changes in the second and third periods. As can be seen by the downward arrows, the cardinal utility level increases over time, while the reported life satisfaction remains constant.

For instance, the constant ordinal utility levels for t = 0 to t = 2 are compatible with a constant income over time, as well as with an increasing income level (the tilted case). However, as shown by the downward arrows in Figure 2 for U(t = 1) and U(t = 2), the absolute levels of utility may increase with increasing income, without being detected by the metric defined by (2). With a measure as defined by (2), it cannot be stated with certainty whether a constant

level of *ordinal* utility entails the same level of *cardinal* utility. The reason is the lack of an absolute comparative measure.

Consequently, it comes as no surprise that economic growth does not evidently improve the human lot, as claimed by the Easterlin paradox. However, the paradox seems to more of an artefact of the measurement method than a correct description of the effects of economic growth on subjective well-being. In order to overcome the ordinal nature of utility measurement, we develop the Happy Income index below.

3 Happy Income Index

3.1 Theoretical justification and definition

The concept of "Happy Income", as developed here, captures both material and psycho-social well-being. Moreover, its dimension is a monetary unit (e.g. Euro), so that Happy Income is a measure of *satisfaction-weighted income*.

In order to develop a theoretical justification, we start with a utility function of the Lindenberg-type (1986) and assume that individual utility depends on material as well as psycho-social well-being. Moreover, assume that material well-being is defined by the availability of income (φ), and psycho-social well-being by the disposability of those goods and services that cannot be bought by money (e.g., friends, love etc.) (ψ). The individual utility function can generally be written as follows:

$$\begin{aligned} &U : R^+ \times R^+ \rightarrow R^+ \\ &(\varphi, \psi) \rightarrow U(\varphi, \psi). \end{aligned} \tag{3}$$

Note that in (3), the utility function already contains two arguments which are represented through the mapping of U onto a single utility level. Furthermore, the utility levels given by (3) have no upper ceiling; in contrast to (2), U is mapped in (3) onto the real numbers greater than zero. However, the functional form of the mapping in (3) is not yet defined.

For utility functions with more than one attribute, there are two crucial ways of specifying (3) in order to render them relatively easy to calculate, namely as an additive-separable utility function as in (4) and as a quasi-additive (multiplicative) utility function as in (5):

$$U(\varphi,\psi) = \alpha \cdot U(\varphi) + \beta \cdot U(\psi), \tag{4}$$

$$U(\varphi,\psi) = \alpha \cdot U(\varphi) + \beta \cdot U(\psi) + (1 - \alpha - \beta) \cdot U(\varphi) \cdot U(\psi). \tag{5}$$

Note that additive-separable utility functions are called *value independent* (Pliskin *et al.*, 1980), because the respective levels of material well-being φ and psycho-social well-being ψ do not interact with each other with respect to the total level of utility. By contrast, the utility function defined by (5) exhibits the weaker *mutually utility independence* (Keeney and Raiffa, 1993; Keeney, 1971, 1974). That is, if one factor is fixed and the other changed, the decision maker has an identical ordering of preferences, irrespective of the value at which the first factor is fixed.

We suggest that material and psycho-social well-being are mutually utility-independent. Mathematically, this implies that the cross-derivatives of the utility function $U(\varphi,\psi)$ do not exist. Nevertheless, the levels of material as well as psycho-social well-being do mutually influence each other, i.e. they are mutually utility-independent, but not value-independent. The higher the one level, the higher (*c.p.)* the total level of utility, and *vice versa*. In the following analysis, (5) is considered the most appropriate form of utility measurement.

Moreover, we argue that material and psycho-social well-being are *mutually necessary* for well-being. Therefore, in (5), α and β are set equal to zero so that the utility function reads:

$$U(\varphi,\psi) = U(\varphi) \cdot U(\psi). \tag{6}$$

Note that the utility function in (6) implies value dependence for total utility, as well as for the marginal utilities of material and psycho-social well-being, respectively:

$$\frac{\partial U}{\partial \varphi} = U_{\varphi} \cdot U(\psi)$$
$$\frac{\partial U}{\partial \psi} = U_{\psi} \cdot U(\varphi) \qquad (7a)$$

and, according to Young's theorem,

$$\frac{\partial^2 U}{\partial \varphi \partial \psi} = \frac{\partial^2 U}{\partial \psi \partial \varphi} = U_{\varphi} \cdot U_{\psi}. \qquad (7b)$$

Having decided on the general functional form of the multiattributed utility function in (6), the remaining task is to specify the utility functions for material well-being, *U(φ)*, and psycho-social well-being, *U(ψ)*. In economics, (6) is often specified as:

$$U(\varphi,\psi) = (\varphi - \varphi_0)^{\gamma} (\psi - \psi_0)^{1-\gamma} \qquad (8)$$

with $0 < \gamma < 1$. This is a Stone-Geary utility function with φ_0 and ψ_0 as the required minimum levels of the respective goods. Note that the transformation of these goods into welfare levels entails a concave function. This transformation implies that all goods taken into account exhibit decreasing marginal welfare. The assumption of decreasing marginal welfare with respect to all components of welfare is quite common in international comparisons of well-being, see, for instance, Becker *et al.* (2005), Fleurbaey and Gaulier (2007) and for an overview, Decancq *et al.* (2009).

Material well-being, φ, seems to be measured best by income and, because human beings live together in households, disposable household income is a good indicator. However, since the size and composition of households differ, it is necessary to make the incomes comparable among households. The economic tool for doing so is the equivalence scale, which indicates how much more income households with several members need to gain a standard of living comparable to a single-person household earning a certain income. Dividing the household income by its equivalence scale number yields the equivalent household income.

The question is whether these incomes should be transformed as indicated by (8), in order to obtain a utility index of material well-being. Note, however, that the transformation of the

household income to equivalent household incomes in virtually all equivalence scales involves a concave mapping of the raw income onto the equivalent income.[7] This is justified, as the income required to sustain the standard of living of a single-person household decreases with household size, due, for example, to economies of scale. Therefore, it might be argued that the transformation of incomes into equivalent incomes creates a utility measure of material well-being. Of course, one could also justify an additional transformation of the income as indicated by (8). However, it is suggested here that the equivalent household incomes are a valid and reliable utility measure of material well-being:

$$U(\varphi_t^j) = EY_t^j . \tag{9}$$

The material well-being of an individual i in country j at time t is measured by the household's equivalent income. For sake of simplicity, in (9), the minimum required material well-being in (8) (φ_0) is not explicitly taken into consideration. Therefore, when comparing countries, one should select only those which are not constrained by φ_0, i.e. countries in which the vast majority of citizens are not considered poor.

Psycho-social well-being is measured next, in order to compare the well-being of nations. A generally accepted method is to ask people directly about their levels of life satisfaction. From the perspective of happiness research, these answers are a reliable and valid measure of so-called eudaimonic happiness (Ryan and Deci, 2001). From a theoretical point of view, the measurement may be interpreted as the mapping *H* of a vector of objective psycho-social life circumstances $l_1, l_2, l_3, \ldots, l_n$ of the household onto an integer number Int (1,…,10) that represents the level of positive subjective feelings:

$$\begin{aligned} &H : R^+ \times R^+ \times \ldots \times R^+ \rightarrow INT(1,\ldots,10) \\ &(l_1, l_2, l_3, \ldots, l_n) \rightarrow H(l_1, l_2, l_3, \ldots, l_n). \end{aligned} \tag{10}$$

In this context, the life circumstances (expressed in positive real numbers) are mapped onto an integer from one to ten. Consequently, $H(l_1, l_2, l_3, \ldots, l_n)$ may be interpreted as a measure of psycho-social well-being. Although Oswald (2008) argued that the curvature of the reporting

[7] For example, in the scales used in publications of the OECD: the OECD equivalence scale, the OCED-modified scale and the square root scale, see OECD (n.y.).

function *H(...)* is not clearly defined, it is assumed here that the reported level of life satisfaction by an individual, H(…), is the best available measure of psycho-social well-being, that is:

$$H(l_1, l_2, l_3, ..., l_n) = U(\psi). \tag{11}$$

Note that (11) seems to suggest that psycho-social well-being is measured on an unrestricted ordinal scale of real numbers. This is not in fact the case, as can be seen by the definition of the H(…) function in (10). Hence, U(ψ) in (11) is still measured ordinally on a Likert scale. Nevertheless, the survey data on life satisfaction are interpreted as the level of psycho-social household well-being. As with the measure of material well-being, the minimum required level of psycho-social well-being is not considered explicitly here.

The level of well-being in a society as a whole may be measured by:

$$U_t^j(\varphi, \psi) = U_t^j(\varphi) \cdot U_t^j(\psi) = HI_t^j = \frac{1}{N} \sum_{i=1}^{N} (EY_{i,t}^j \cdot H_{i,t}^j) \tag{12}$$

with $EY_{i,t}^j$ as the equivalent income of household i, i = 1, …, N, at time t in country j and $H_{i,t}^j$ as the level of life satisfaction of that household.

According to (12), the HI index is defined as the average level of the product of equivalent household income and individual life satisfaction. The latter is measured via a Likert scale and is therefore a unit-free measure. The equivalent income is the income of a household adjusted through an equivalence scale, so as to make households of different sizes and compositions comparable. Since the equivalent household income is measured in a monetary unit (e.g., Euro, US-Dollar), the HI index is denominated in monetary units. In order to render HI indices of different countries comparable, purchasing power parities (PPP) of the national currencies may be used to represent of equivalent incomes.

Relying on non-monetary indicators has the disadvantage that outcomes are not compatible with cost measurements which are ordinarily denoted in monetary terms. Since the measurement unit of HI is money, it can easily be used in cost-benefit analysis, e.g., for measuring and comparing the outcomes of public policy instruments.

From a practical perspective, there are two potential objections to the approach described by (12). Firstly, the answers to the question about life satisfaction may contain an evaluation of the household income. Hence, (12) could lead to double counting the effect of income on well-being. Of course, it seems difficult to argue that the answers to questions about life satisfaction are not influenced by household income. However, the answers do not seem to depend predominantly on income. Furthermore, life satisfaction is measured by an ordinal scale which cannot change, that is, it is restricted to integer values between 1 and 10. This is not compatible with the measurement of utility effects of growing incomes which require a utility measure without bounds. The HI index of (12) is thus a possible measurement.

A second objection may be based on Veenhoven's (2000) distinction of 'four qualities of life'. It could be argued that HI inappropriately mixes two different things, namely *chances* in form of income, with *outcomes* in the form of happiness. First of all, both income and life satisfaction are outcomes, but from different processes. Income is the outcome of the material part of the 'game of life' which can be valuated separately from other aspects of life as formalized by equation (6). With this view, 'happiness' or more precisely, satisfaction with life, on the other hand, is the outcome of the psycho-social aspect of the 'game of life'. Hence, both variables represent outcomes of different aspects of life.[8]

In short, there seem to be good reasons for measuring national well-being in monetary units, by summing the product of individual life satisfaction and equivalent income.

3.2 Empirical results

In this section, the concept of the HI is applied to different European countries. The selected member states of the European Union can be regarded as relatively wealthy, so that the omission of a minimum requirement for financial endowments seems justified.

[8] Veenhoven's HLY may also be interpreted as mixing chances (life years) with outcomes (happiness). It could be argued that life years are a necessary (but not sufficient) input in the 'production' of well-being, of which happiness (as the 'appreciation of life') is the ultimate outcome. In a similar manner, income is also a necessary (but not sufficient) input in the 'production' of happiness (outcome). Hence, from this perspective, there is no categorical difference between HLY and HI.

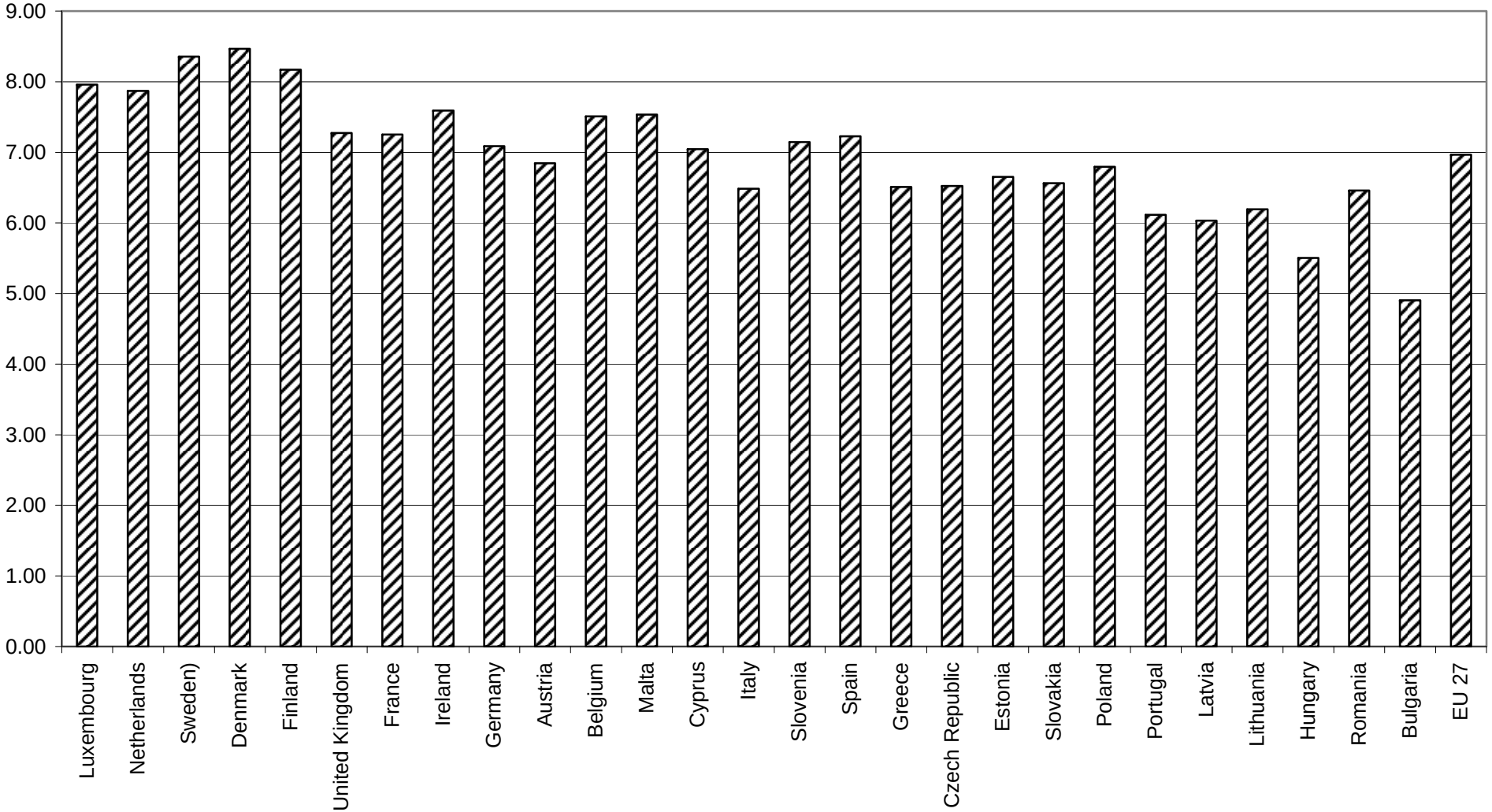
The data on happiness and income from the 2007 European Quality of Life Survey (EQLS) are used in the following analysis. The EQLS is a micro-survey based on face-to-face interviews in 31 European countries and is conducted by the European Foundation for the Improvement of Living and Working Conditions (Eurofound).[9] The regular sample size in each country comprises 1,000 individuals. In France, Italy, Poland and the United Kingdom 1,500 individuals are interviewed and in Turkey and Germany, about 2,000 interviews are conducted (Eurofound 2009). The survey includes two items related to general subjective well-being: one question about life satisfaction and one about happiness. As both questions are ordinally scaled and constructed as 10-point Likert scales, where 1 is the lowest possible level ("very unhappy"/"very dissatisfied") and 10 the highest possible ("very happy"/"very satisfied"), both are appropriate for the calculation of HI measures. The general-life-satisfaction question was chosen to enable comparability with the concept of Happy Life Years, because it is more similar in phrasing to Veenhoven's example of happiness questions (e. g., Veenhoven, 2004).

Figure 3 shows the average life satisfaction (or happiness) for the EU 27 countries.[10]

[9] In addition to the 27 member states of the European Union, the survey was carried out in three candidate states (Croatia, the Former Yugoslav Republic of Macedonia and Turkey) and in Norway. For the present analysis, only the data for the twenty-seven member states are used.

[10] The descriptive statistics for the data are given in Table A1 in the appendix.

Figure 3: Average happiness (general life satisfaction) in 2007

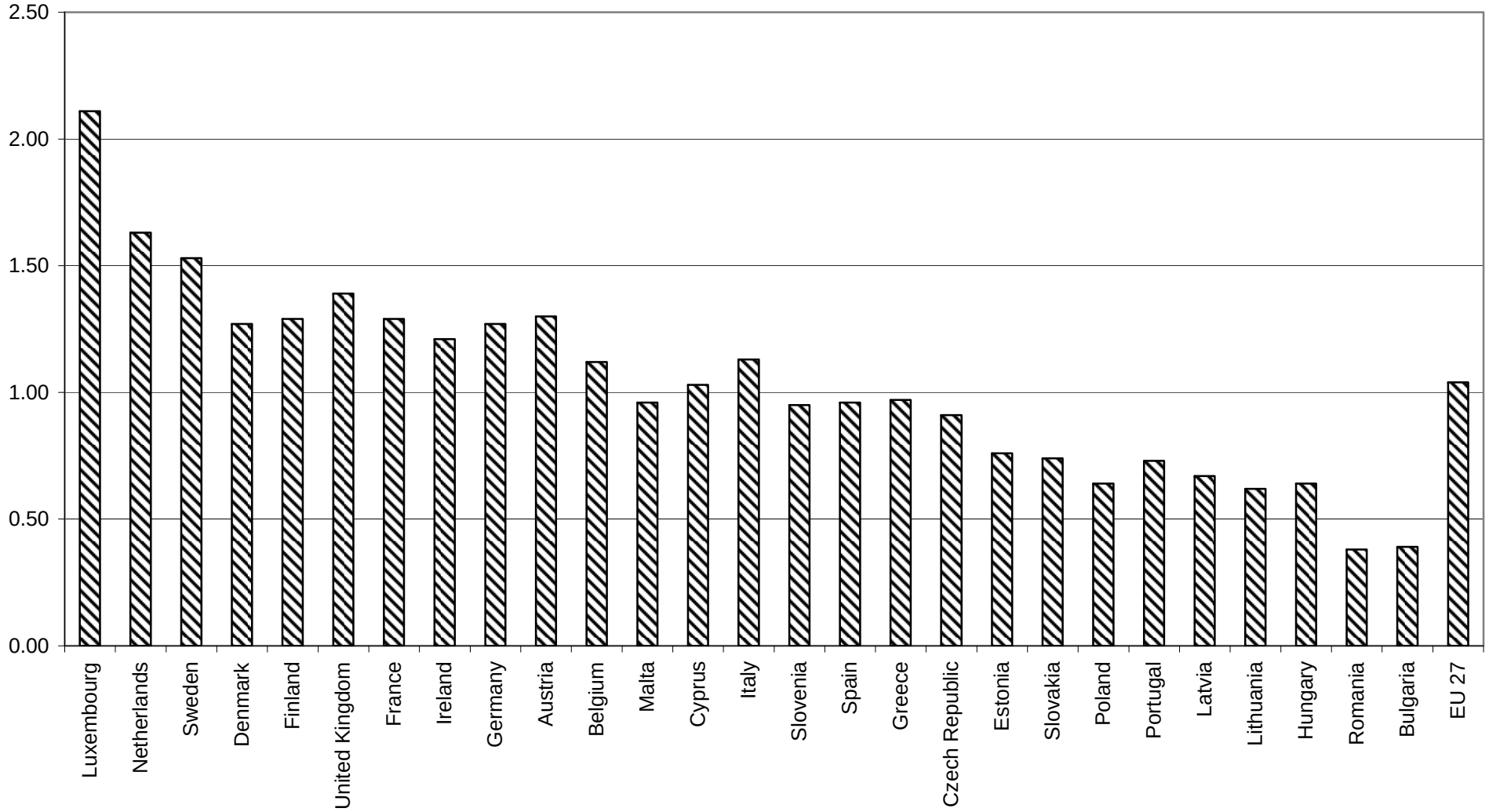


Source of data: EQLS 2007.

The income question in the EQLS first requests the exact net income (or an estimation) and if this question cannot be answered, a second question asks the respondent to give the range of household income (nineteen ranges are provided).[11] The values of the income variable are calculated by combining the answers to this twofold question.[12] To allow for differences in the purchasing power of income in the different countries, the income in monetary units is not used, but rather the purchasing power parity (PPP). To allow for the different household sizes and structures, equivalent incomes are used.[13] When only the income ranges are given, they are replaced by the arithmetic means of the ranges. For the highest (open-ended) range, its lower bound plus half the range of the second-highest income bracket is used. This amount of 4724.50 Euro is the highest possible value attained with a single person answering this question (households with more members have a lower equivalent income, due to the equivalence operation). Monthly equivalent income is cut at this value, so as to correct for outliers, as values above and beyond can only be the result of the 'precise' income question. Especially in these income regions, the precision of and willingness to give correct answers is questionable. Finally, the values for monthly income are divided by 1,000 for convenience. The income component of the HI is presented in Figure 4 (and Table A2 in the appendix).

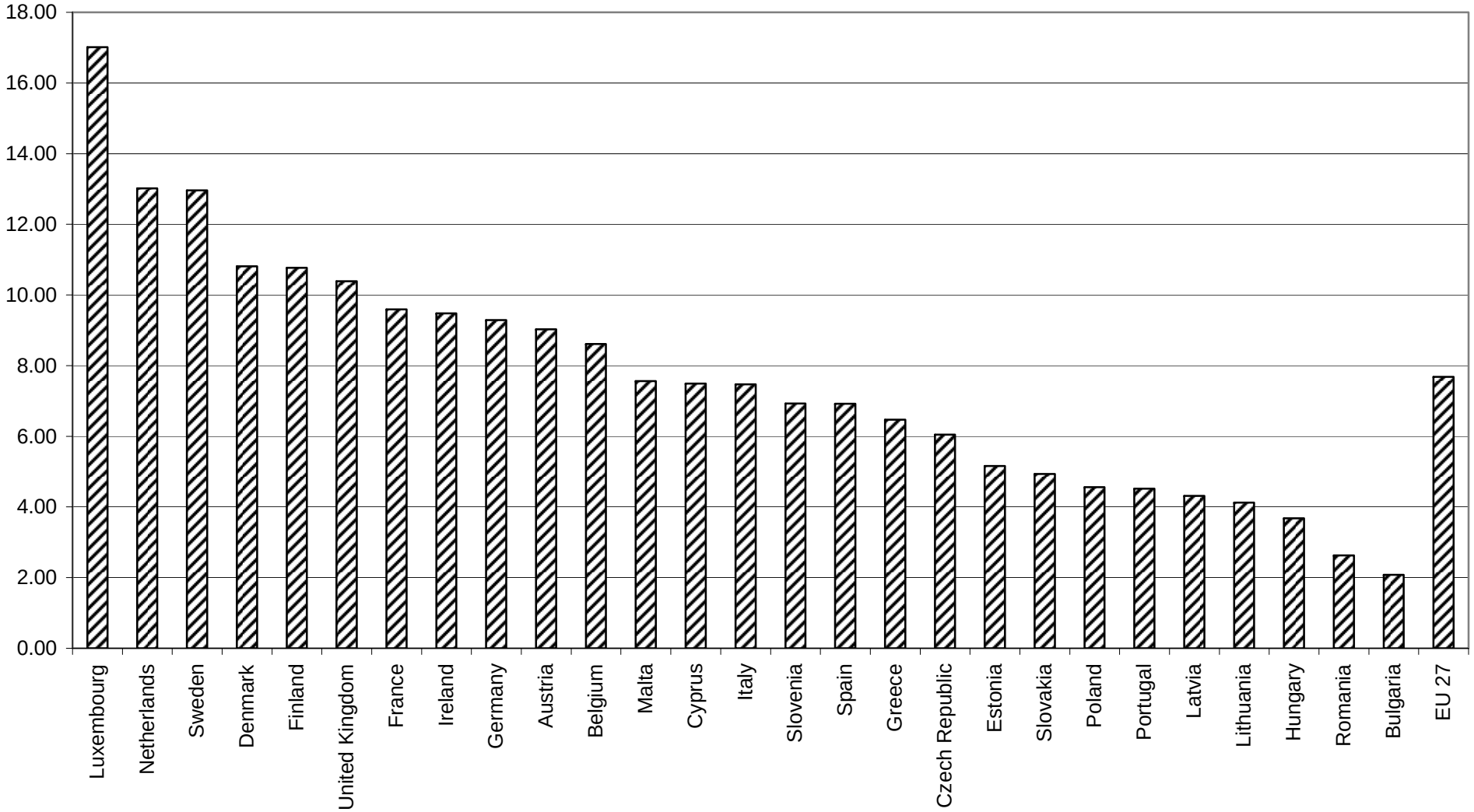
[11] In this question, the income ranges are presented as weekly, monthly or annual.
[12] Eurofound (n. y.).
[13] In the EQLS survey, the modified OECD equivalence scale is used. This scale weights the first adult in a household as 1.0, any additional person 14 years and older as 0.5 and any child 0.3, see Eurofound (2009) and OECD (n.y.).

Figure 4: Average equivalent household income in € 1,000 PPS 2007



Source of data: EQLS 2007.

Figure 5: Happy Income 2007



Source of data: EQLS 2007.

The average values of the Happy Income indicator for 2007 are shown in Figure 5. Table 1 shows the unweighted arithmetic mean and median, as well as the standard deviation of the Happy Income index for the European countries in 2007 and the number of observations on which the index is calculated. For example, the happiness-weighted income is 17.01 in Luxembourg, 10.39 in the United Kingdom, 9.59 in France and for Bulgaria, 2.08. The relative frequencies of the values for HI are shown in Figures A1a – c in the appendix. As expected for a measure containing income, all distributions are left-skewed, but there are some extreme cases where the lowest category is the mode (e.g. Bulgaria and Latvia).

Table 1: Happy Income 2007

Country	Mean	Median	Std. Dev.	Obs.
Austria	9.03	8.54	4.93	572
Belgium	8.61	7.77	5.69	735
Bulgaria	2.08	1.42	2.46	729
Cyprus	7.49	6.23	5.50	767
Czech Republic	6.05	5.16	4.84	786
Germany	9.29	7.58	6.57	1437
Denmark	10.81	10.09	6.37	810
Estonia	5.16	3.91	4.69	841
Greece	6.47	5.45	4.79	726
Spain	6.92	5.90	5.20	506
Finland	10.77	9.87	6.17	802
France	9.59	8.56	5.98	1170
Hungary	3.68	2.87	3.68	742
Ireland	9.48	7.58	7.60	474
Italy	7.47	6.62	5.49	498
Lithuania	4.12	2.97	4.25	871
Luxembourg	17.01	15.96	8.54	566
Latvia	4.31	2.94	4.77	716
Malta	7.56	6.40	4.99	611
Netherlands	13.02	11.57	7.24	805
Poland	4.56	3.38	4.35	1063
Portugal	4.52	3.07	4.74	419
Romania	2.63	1.95	2.83	736
Sweden	12.96	12.05	6.29	942
Slovenia	6.93	5.74	5.12	712
Slovakia	4.93	4.19	4.11	769
United Kingdom	10.39	8.12	8.26	817
EU 27	7.68	5.99	6.52	20622

Source of data: EQLS 2007.

4 Comparison of Happy Income and Happy Life Years

4.1 Theoretical concept of Happy Life Years (HLY)

One of the first indicators to transform two-dimensional ordinal utility to a one-dimensional indicator was the Happy Life Years index. The concept of "Happy Life Years" (HLY) (Veenhoven, 2005b, 2002) was developed by Ruut Veenhoven (1996, 2005a)[14] and was the result of his search for an indicator of the well-being of nations (Veenhoven, 1996, 2002, 2004, 2005a, 2005b).

Employing the formalization applied here, the indicator of Happy Life Years can be expressed as

$$\begin{aligned} &U : R^+ \times R^+ \to R^+ \\ &(L, \psi) \to U(L, \psi) \end{aligned} \tag{13}$$

where L denotes the lifetime as the input and ψ the psycho-social well-being. In a similar manner to Happy Income, the one-dimensional utility levels given by (13) have no upper ceiling a priori. The functional form is specified by Veenhoven as a multiplicative construct, i.e. life time and happiness are *mutually utility independent* and *mutually necessary* for well-being:

$$U(L, \psi) = U(L) \cdot U(\psi) \tag{14}$$

where the lifetime utility is the expected lifetime

$$U(L_{i,t}^j) = EL_{i,t}^j = \frac{1}{N} \sum L_i \tag{15}$$

and psycho-social well-being is again the individually reported life satisfaction:

$$U(\psi) = H(l_1, l_2, l_3, ..., l_n). \tag{16}$$

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[14] Alternative expressions are "Happiness adjusted life-years" (HALY) (Veenhoven, 2002), or "Happy Life-Expectancy" (HLE) (Veenhoven, 1996).

For psycho-social well-being, the same holds as in the case of Happy Income. The measurement may be interpreted as the mapping *H* of a vector of objective psycho-social life circumstances l_1, l_2, l_3, ..., l_j, l_n of an individual (where l_j might be interpreted as the equivalent income) onto an integer number, *Int* = 1, … , 10:

$$H : R^+ \times R^+ \times ... \times R^+ \rightarrow INT(1,...,10)$$
$$(l_1, l_2, l_3, ..., l_j, l_n) \rightarrow H(l_1, l_2, l_3, ...l_j, l_n). \qquad (17)$$

As before, $H(l_1, l_2, l_3, ..., l_n)$ may be interpreted as a measure of psycho-social well-being. It is assumed that the level of life satisfaction reported by an individual, H(…), is the best available measure of psycho-social well-being.

The Happy Life Years of a society j at time t can therefore be measured as:

$$U_t^j(L,\psi) = U_t^j(L) \cdot U_t^j(\psi) = HLY_t^j = \frac{1}{N}\sum_{i=1}^{N}(EL_{i,t}^j \cdot H_{i,t}^j). \qquad (18)$$

The theoretical foundation of the HLY index is quite similar to the HI index in (12). The main difference is that the HLY index uses life expectancy as a non-monetary utility component which is cardinally measurable, in addition to self-reported life satisfaction, in order to specify utility, whereas the HI index employs household equivalent incomes instead. Nevertheless, the interpretation of the indices is different. The HI index can be useful for determining the short-term economic and psycho-social conditions of life, whereas the HLY index provides a measure of the comparison of the life-satisfaction-weighted average life span.

4.2 Empirical comparison

The HLY and the HI of the twenty seven member states of the EU are compared. Both indicators are calculated using data from the European Quality of Life Survey (EQLS); data on life expectancy is taken from the World Health Organization (WHO). The idea behind

HLY is to combine quality of life (self-reported happiness measured on a Likert-scale) [15] with life expectancy at birth (measured in years), i.e. the time a person may be expected to enjoy life happiness. These dimensions are multiplied by one another (Veenhoven, 2004, 2005b), implying an equal weight for both the quality and quantity of life.[16] "Suppose that life expectancy in a country is 60 years, and that the average score on a 0 to 10-step happiness scale is 5. Converted to a 0 - 1 scale, the happiness score is then 0.5. The product of 60 and 0.5 is 30. So the number of happy life-years is 30 in that country. If life-expectancy is also 60 years but average happiness 8, the number of happy life-years is 48 (60 x 0.8)." (Veenhoven, 2005b; similarly Veenhoven, 1996).

The WHO collects data on health in its member countries. For the calculation of Happy Life Years, the life expectancy at birth for the year 2007 is used. These are the estimated average life years of a child born in the respective country in 2007.[17] Thus, we do not calculate the Happy Life Years with the original data for life expectancy of the respondents, but instead, with the counterfactual value of life expectancy for individuals born in 2007.

Because the HLY are calculated as the product of the degree of happiness and the life span over which this happiness is experienced, the isolated components are average happiness scores (qualitative life component) and the average life expectancies (quantitative life component). Figure 6 presents the average life expectancy at birth (for both sexes jointly) in 2007. In Figure A2 in the appendix, the countries' HLY are depicted graphically.[18] For example, the Happy Life Years in 2007 are 60.36 in Luxembourg (LU), 57.86 in the United Kingdom (UK), 57.23 in France (FR) and 35.92 in Bulgaria (BG).

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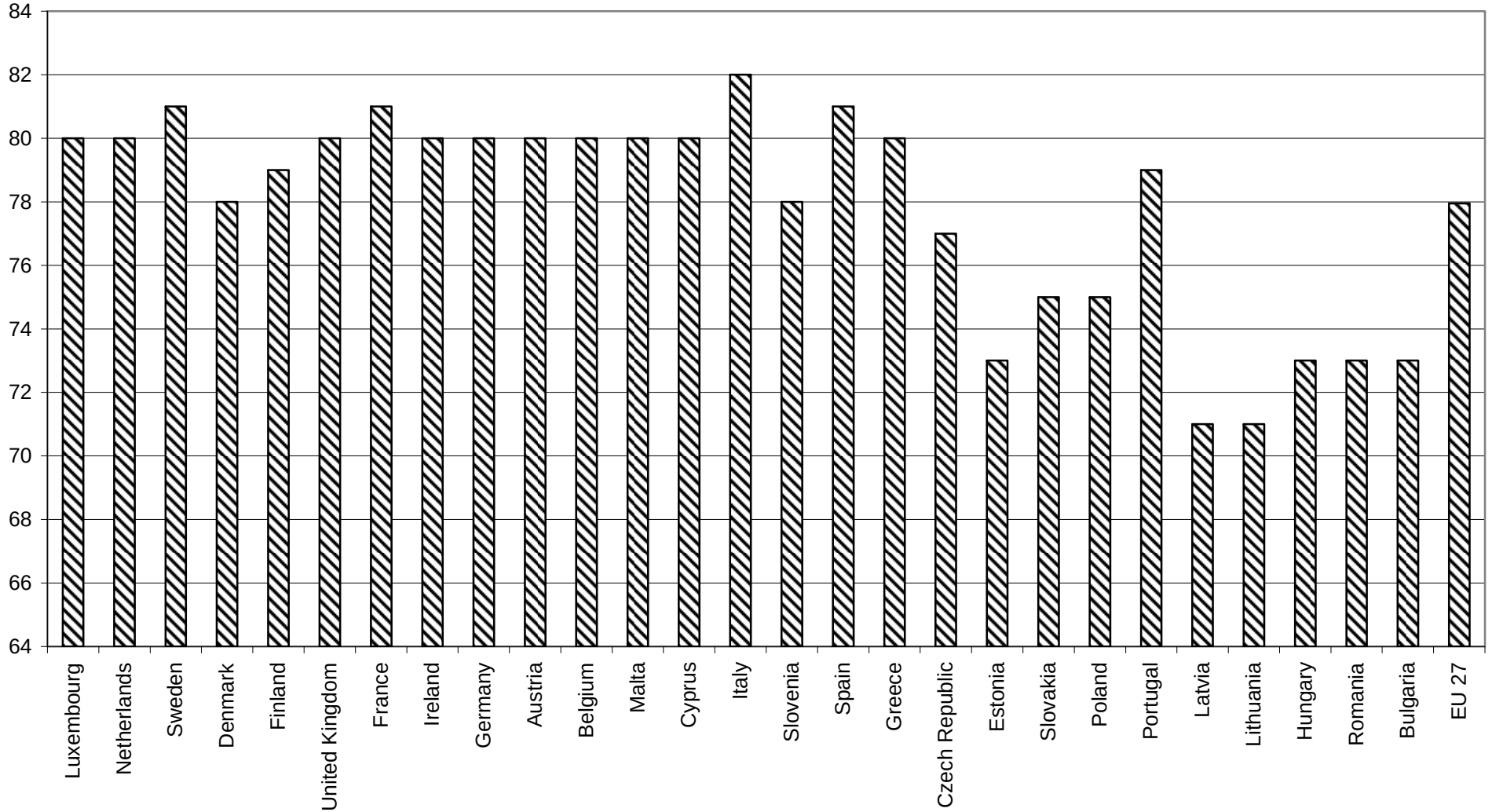
[15] "Happiness is a person's overall evaluation of his/her life as-a-whole." Veenhoven (1996) Therefore, happiness is understood as the evaluation of enduring satisfaction with life-as-a-whole (Veenhoven, 2004). – For a comprehensive discussion of happiness concepts, see McMahon (2006).

[16] While at the individual level, the happiness score has to be added on a year-by-year basis over the entire life-time (Veenhoven, 2002), at the macro level, indicators averaged over the whole population for single years can be employed.

[17] As these values differ for women and men, the mean WHO value for both genders was used in the calculations.

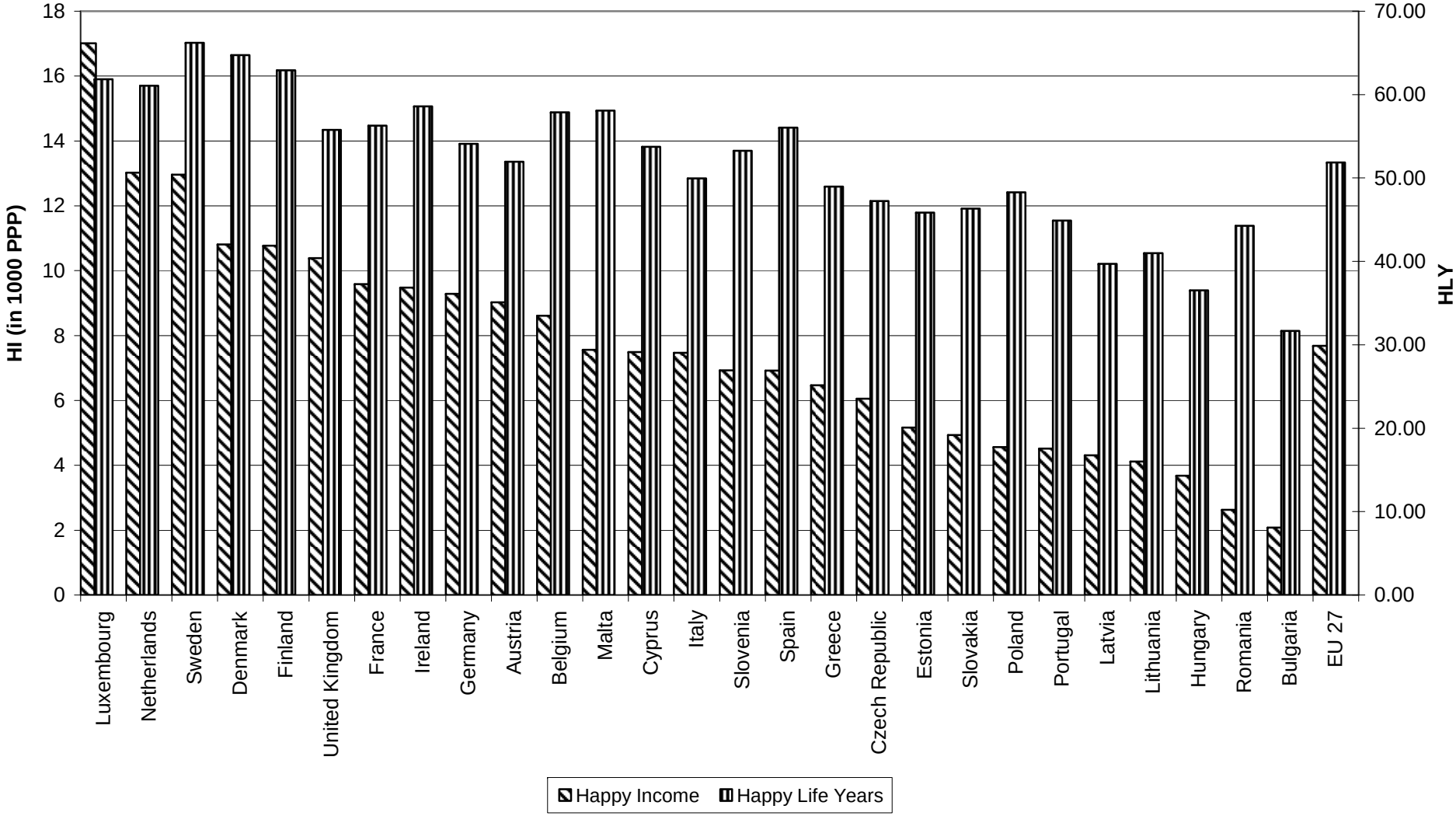
[18] An alternative procedure would have been to use the data from Veenhoven's World Data base on happiness, (see Veenhoven, 2009). Instead, the HLY were calculated with data from the EQLS and the WHO, so as to ensure comparability between the values for the HLY and the HI measure.

Figure 6: Life Expectancy at Birth 2007 (both sexes)



Source of data: WHO (2009).

Figure 7: Comparison of Happy Income and Happy Life Years 2007



Source of data: EQLS 2007, WHO (2009), own calculations.

Figure 7 depicts, in one diagram, the values for Happy Income and Happy Life Years for the countries. As the countries are sorted according to their Happy Income index, the differences between the columns for the countries (with exception of the EU 27 average) indicate that there are differences in the rankings, according to the HLY and the HI index.

Table 2 shows the values for both indicators for each country in 2007. The rank refers to the position of the country within the EU 27 countries according to the arithmetic mean signifying that the highest value is determined as rank one (and so on). The top three countries in the Happy Income ranking are Luxembourg (1^{st}), the Netherlands (2^{nd}) and Sweden (3^{rd}), in contrast to Sweden (1^{st}), Denmark (2^{nd}) and Finland (3^{rd}) according to the Happy Life Years ranking.

The last column in Table 2 shows the absolute value of the differences in ranking according to the Happy Income and Happy Life Years indexes. The largest ranking difference occurs for Spain, which is ranked ninth according to Happy Life Years, but only sixteenth with respect to Happy Income. The last ranking according to Happy Incomes are Bulgaria (27^{th}), Romania (26^{th}) and Hungary (25^{th}), in contrast to Bulgaria (27^{th}), Hungary (26^{th}) and Latvia (25^{th}), according to Happy Life Years.

In order to further analyze the relation between the Happy Income and Happy Life Years index, the correlations between the arithmetic mean of the aggregated measures per country are calculated. The Pearson correlation coefficient is 0.87 ($p < 0.001$), while the Spearman rank correlation coefficient for the correlation of the two indicators is 0.94 ($p < 0.001$). Obviously, the rankings at the aggregate level are quite similar. In contrast, the correlations between Happy Life Years and Happy Income are still significant, but much weaker at the individual level. For individual observations, the Pearson correlation coefficient is 0.56 ($p < 0.001$) and the Spearman rank order coefficient 0.67 ($p < 0.001$). Thus, the relationship is more pronounced at the individual level than at the aggregate level. This may be due to a concentration effect (Welzel, 2003). Avoiding an ecological fallacy (Robinson, 1950), one could say that there is a strong, but by no means perfect positive correlation between the two indicators.

Table 2: Happy Life Years and Happy Income

	Happy Life Years		Happy Income		Rank-Diff.
Country	**Rank**	**Mean**	**Rank**	**Mean**	
Austria	14	51.95	10	9.03	4
Belgium	8	55.69	11	8.61	-3
Bulgaria	27	29.92	27	2.08	0
Cyprus	12	52.40	13	7.49	-1
Czech Republic	19	45.41	18	6.05	1
Germany	13	52.07	9	9.29	4
Denmark	2	63.07	4	10.81	-2
Estonia	23	42.08	19	5.16	4
Greece	17	47.12	17	6.47	0
Spain	9	53.98	16	6.92	-7
Finland	3	60.54	5	10.77	-2
France	11	53.49	7	9.59	4
Hungary	26	34.54	25	3.68	1
Ireland	6	56.38	8	9.48	-2
Italy	16	48.14	14	7.47	2
Lithuania	24	37.52	24	4.12	0
Luxembourg	5	59.53	1	17.01	4
Latvia	25	36.92	23	4.31	2
Malta	7	56.34	12	7.56	-5
Netherlands	4	59.55	2	13.02	2
Poland	18	45.70	21	4.56	-3
Portugal	21	43.20	22	4.52	-1
Romania	22	42.46	26	2.63	-4
Sweden	1	64.56	3	12.96	-2
Slovenia	15	51.21	15	6.93	0
Slovakia	20	43.88	20	4.93	0
United Kingdom	10	53.67	6	10.39	4
EU27		49.78		7.68	

Source of data: EQLS 2007, WHO (2009), own calculations. Rank differences are positive where the ranking according to Happy Income is higher (better) than the ranking according to Happy Life Years.

The two indicators measure different aspects of human well-being and the rankings derived from the indicators are different. Due to the inclusion of relatively stable life expectancy, HLY is more of a long-term indicator. HLY may therefore, not be the comprehensive indicator required for the comparison of the well-being of nations on a year-by-year basis. The Happy Income index seems to be better suited for this purpose.

5 Concluding remarks

In this paper, it is argued that the simple concept of Happy Income may be considered as a useful measure for comparing the well-being of nations in monetary terms. Instead of using more complicated transformations of income and other variables, an ordinal happiness scale is multiplied by a country's mean equalised household net income. Firstly, this procedure allows for the comparison of well-being in a country over time, as the measure of self-reported happiness limited by an upper and lower bound is combined with an unlimited cardinal measure of income. Therefore, increases in well-being that are in principle unrestricted, can be captured by the indicator. Secondly, since the happiness scale is interpreted as a transformation of objective life circumstances into subjective feelings, the multiplication by mean income monetizes happiness at the level of the country's wealth. This allows for inter-country comparisons of well-being levels.

The new HI indicator is compared with Veenhoven's HLY indicator. Despite considerable correlations of HI and HLY in European countries, both indicators seem to be valuable measures of a country's average well-being. An advantage of the HI may be that the reaction of income to an improvement in material life is faster than the adaptive processes in life expectancy. Another advantage could be that income can be derived from recent data, while the data on life expectancy refers to persons born not in the year in question, but in the past. Happy Income could therefore be a valuable indicator which complements the measurement of quality of life in nations, beyond other alternative indicators like Happy Life Years.

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Appendix

Table A1: General satisfaction with life

Country	Mean	Median	Std. Dev.	Obs.
Austria	6.84	7.00	2.16	1043
Belgium	7.51	8.00	1.74	1009
Bulgaria	4.90	5.00	2.01	1001
Cyprus	7.05	8.00	2.22	1002
Czech Republic	6.52	7.00	2.12	1225
Germany	7.09	8.00	2.29	2007
Denmark	8.47	9.00	1.71	1003
Estonia	6.65	7.00	1.95	1021
Greece	6.51	7.00	2.07	1000
Spain	7.23	7.00	1.76	1015
Finland	8.17	8.00	1.36	1002
France	7.25	8.00	1.72	1533
Hungary	5.51	5.00	2.25	998
Ireland	7.59	8.00	1.89	998
Italy	6.48	7.00	1.82	1515
Lithuania	6.20	6.00	2.12	1003
Luxembourg	7.96	8.00	1.82	1003
Latvia	6.03	6.00	2.15	1000
Malta	7.54	8.00	1.97	992
Netherlands	7.87	8.00	1.24	1011
Poland	6.79	7.00	2.08	1492
Portugal	6.12	6.00	2.00	998
Romania	6.46	7.00	2.06	943
Sweden	8.35	9.00	1.63	1017
Slovenia	7.15	7.00	1.95	1034
Slovakia	6.56	7.00	2.04	1127
United Kingdom	7.27	8.00	2.04	1502
EU 27	**6.97**	**7.00**	**2.11**	**30494**

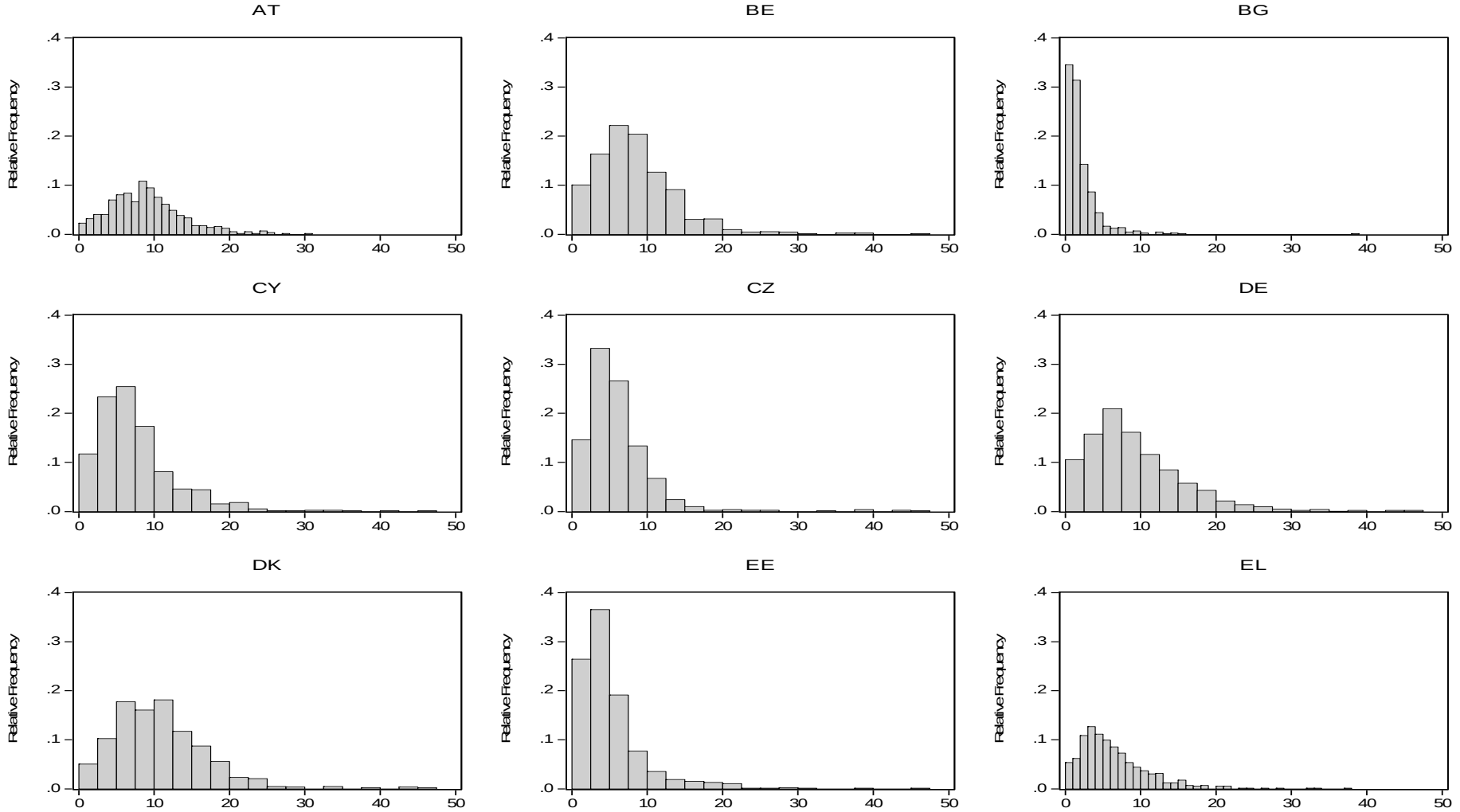
Source of data: EQLS 2007.

Table A2: Equivalent household income in 1,000 € PPP 2007

Country	Mean	Median	Std. Dev.	Obs.
Austria	1.30	1.20	0.54	572
Belgium	1.12	1.01	0.63	735
Bulgaria	0.39	0.30	0.33	746
Cyprus	1.03	0.89	0.61	768
Czech Republic	0.91	0.77	0.57	787
Germany	1.27	1.14	0.69	1437
Denmark	1.27	1.16	0.69	811
Estonia	0.76	0.56	0.62	841
Greece	0.97	0.85	0.59	726
Spain	0.96	0.88	0.64	506
Finland	1.29	1.18	0.68	802
France	1.29	1.17	0.70	1173
Hungary	0.64	0.54	0.49	742
Ireland	1.21	0.97	0.85	475
Italy	1.13	0.96	0.77	498
Lithuania	0.62	0.48	0.53	872
Luxembourg	2.11	1.95	0.91	567
Latvia	0.67	0.47	0.60	717
Malta	0.96	0.83	0.57	612
Netherlands	1.63	1.49	0.81	805
Poland	0.64	0.51	0.54	1065
Portugal	0.73	0.54	0.64	419
Romania	0.38	0.29	0.39	776
Sweden	1.53	1.41	0.65	942
Slovenia	0.95	0.84	0.58	713
Slovakia	0.74	0.64	0.54	770
United Kingdom	1.39	1.14	0.97	819
EU 27	1.04	0.86	0.75	20696

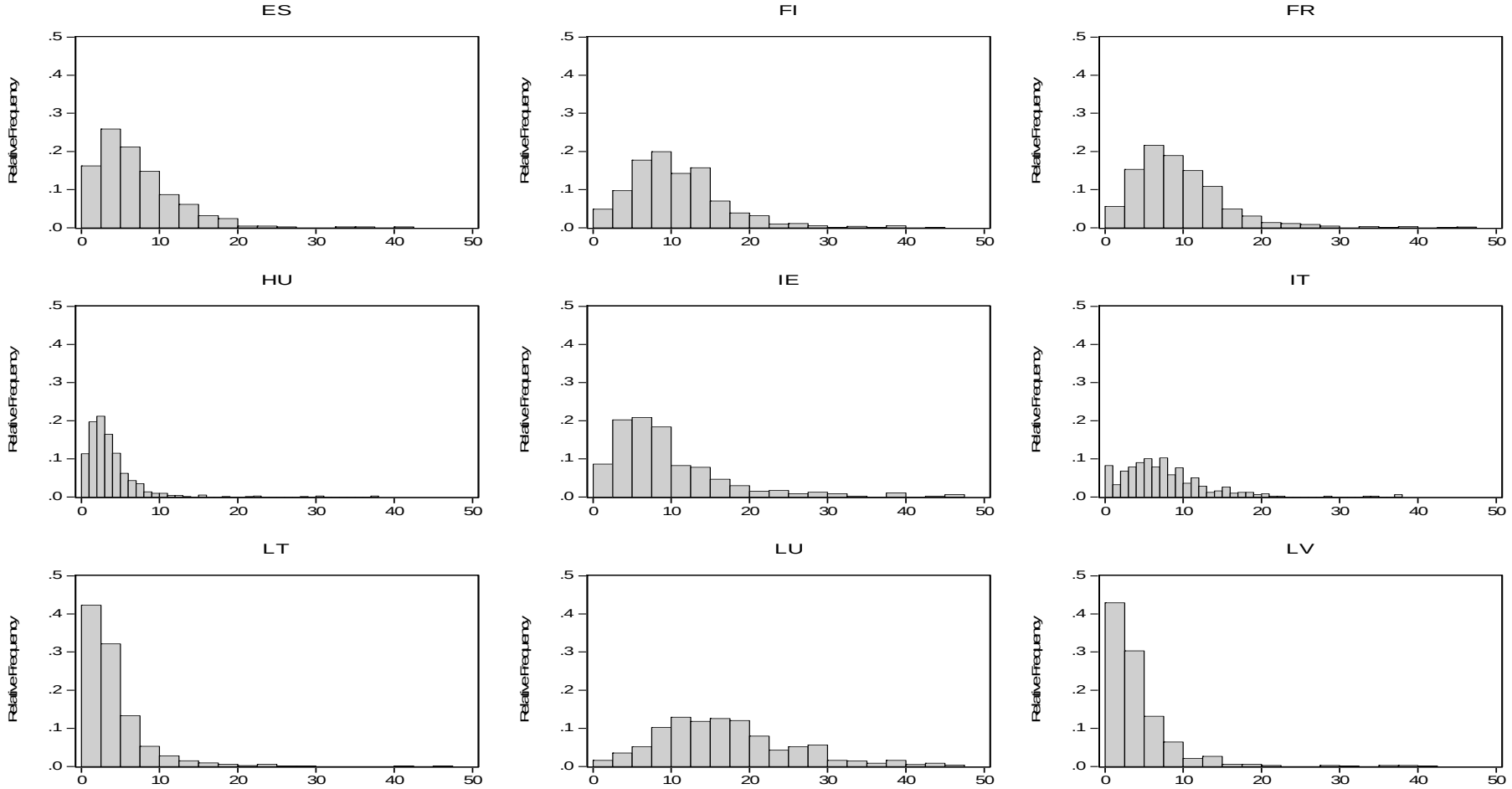
Source of data: EQLS 2007.

Figure A1a: Happy Income distribution in EU countries (part one)



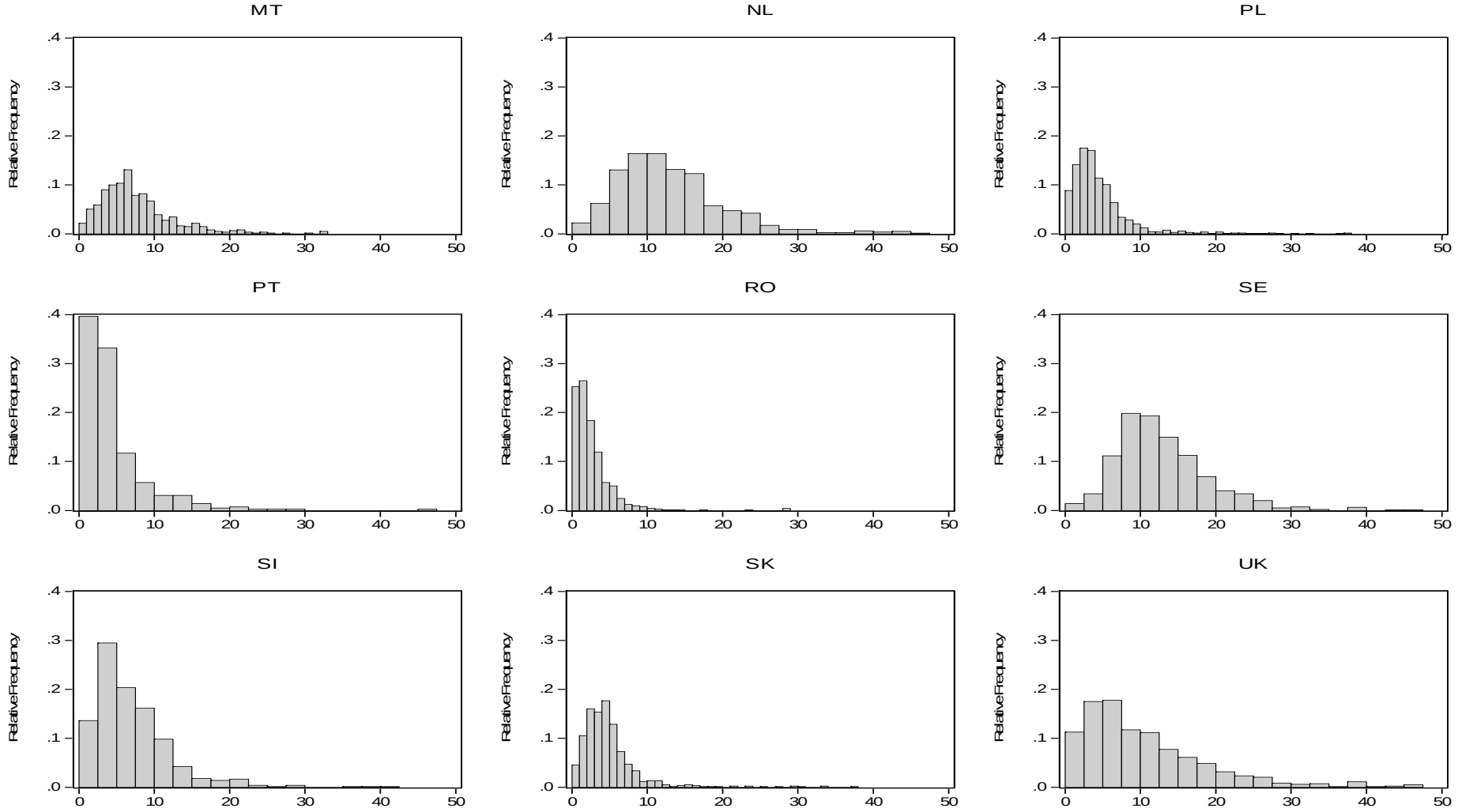
Source of data: EQLS 2007.

Figure A1b: Happy Income distribution in EU countries (part two)



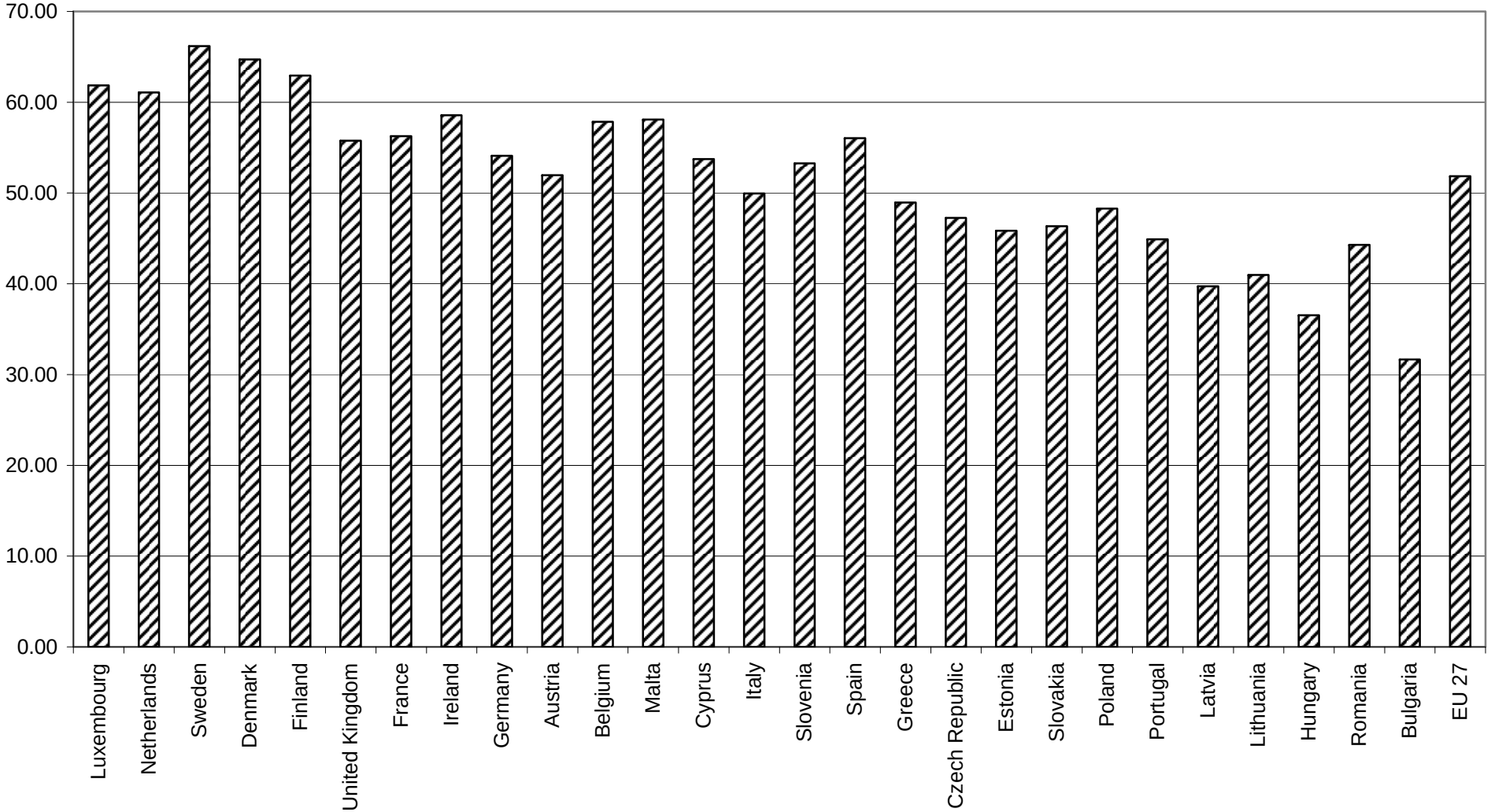
Source of data: EQLS 2007.

Figure A1c: Happy Income distribution in EU countries (part three)



Source of data: EQLS 2007.

Figure A2: Happy Life Years 2007



Source of data: EQLS 2007, WHO (2009), own calculations.