J Happiness Stud (2016) 17:413–430
DOI 10.1007/s10902-014-9601-9

RESEARCH PAPER

An Empirical Investigation into the Determinants and Persistence of Happiness and Life Evaluation

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Published online: 13 December 2014

Abstract The purpose of this study is to compare the correlates of two types of well-being: happiness and life evaluation. Analysis is based on data from the social diagnosis survey conducted in Poland between 2003 and 2011. The measure of happiness is defined in terms of how one assesses one's life in recent times. Life evaluation refers to the perception of satisfaction with one's life as a whole. Particular attention is devoted to the relationship between current and past well-being. We have found that higher levels of past well-being are associated with higher levels of current well-being. Additionally, in order to examine differences between happiness and life evaluation, a distinction is made between temporary and permanent changes in determinants of well-being. Temporary changes in one's health, employment status, and income are more closely related to changes in one's happiness than life evaluation. The reverse is observed for permanent changes. In the case of a permanent change in religiosity and a temporary change in number of friends, a significant correlation with well-being is independent of its type.

Keywords Hedonic adaptation · Subjective well-being · Determinants of happiness

JEL Classification D0 · I31

1 Introduction

A surge of interest in subjective well-being has been responsible for a growing number of empirical studies on the subject. Some of the most important issues addressed by researchers concern the determinants of well-being and the process of adaptation to changes in life circumstances. Research into statistical correlations between well-being and the objective characteristics of an individual has a long history. However, there are substantial difficulties with defining subjective well-being. Questions about well-being may take different forms due

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to, amongst others, the ambiguity of the concept of well-being. Should well-being be measured from the perspective of one's whole life, a selected time period, or the current status? Does subjective well-being equal happiness or is it a form of satisfaction with one's life? Or perhaps it corresponds to the emotional state of respondents? It is clear that it is impossible to construct one all-encompassing measure of well-being. This observation has resulted in research into similarities and differences between the various concepts of well-being see for example Kahneman and Deaton (2010). Our study was conducted in this tradition as we set out to compare the determinants of happiness and life evaluation.

One of the special features of the present study is that it applies a binary scale to happiness and life evaluation. To meaningfully compare both types of well-being, all scales were projected onto a binary scale that corresponds to yes/no answers. As a result, we contrast the happy with the unhappy and the satisfied with their life with the unsatisfied. Within this framework, well-being is represented as a positive or negative state. In this respect, it differs from most studies that use ordinal scales of well-being. While this approach might lead to losing some information, it enables a comparison between happiness and life evaluation.

Among the determinants, special attention is paid to the relationship between past and current well-being. The incorporation of past well-being into the study makes it possible to analyze the process of hedonic adaptation. Hedonic adaptation occurs in a situation in which a change in the determinants has only a temporary effect on one's overall well-being. According to the hypothesis of hedonic adaptation, every person has his or her set point, which is a fixed level of psychological well-being specific for that individual. Positive and negative events cannot affect the set point, but cause a deviation from it. As a result, well-being fluctuates around that fixed level. This is often described as the hedonic treadmill. People strive for a better life and happiness, but it cannot be sustained because once they have attained what they want they will adapt to the new situation and return to the starting point. This mechanism works not only for positive, but also negative, experiences. After the initial impact of a negative event, well-being increases over time. According to the hypothesis of hedonic adaptation, one should observe a negative relationship between past and current well-being after controlling for the set point.

The present study aims at reconciling two strands of literature, one on the correlates of different types of well-being and the second one on hedonic adaptation. The determinants of happiness and life evaluation are compared within a statistical framework. Past levels of happiness and life evaluation are treated as another determinant. This makes it possible to study the dynamics of hedonic adaptation for two different types of well-being, rather than only a static relationship between socioeconomic variables and well-being.

1.1 Happiness and Life Evaluation

A precise distinction between the different types of well-being should be made as it is crucial for avoiding confusion. While in most research the terms well-being, happiness, and life evaluation are used interchangeably, in the present paper they are given strict definitions. "Well-being" is used as the broadest concept encompassing happiness and life evaluation. "Happiness" corresponds to subjective evaluation of an emotional state in terms of how happy a person has been recently. The measure of "life evaluation" is based on what the individual thinks of his or her life. This measure reflects the perception of how good or bad one's life is.[1]

[1] More precise definitions are provided in Sect. 2 devoted to data description.

There is a consensus among researchers that different types of well-being may have different determinants. For example, the study conducted by Kahneman and Deaton (2010) compares the correlates of life satisfaction and daily satisfaction. The authors conclude that life and daily satisfaction have different determinants. Moreover, extensive studies by psychologists have characterized and stressed the importance of different forms of well-being.[2] Seligman (2011) distinguishes between three types of well-being: pleasure, engagement, and meaning. Pleasure is associated with a hedonistic approach to life, when one seeks pleasant experiences and avoids pain. This concept is rooted in the utilitarian tradition of maximizing positive emotions, while minimizing negative ones. Engagement occurs when a person is absorbed by experiencing something, such as a piece of art, sports activity, or work. Meaning is associated with having a purpose in life. The *onion* theory of psychological well-being proposed by Czapinski (1991) describes three layers of well-being: the will to live (the most basic and the least dependent on external circumstances), general subjective well-being (evaluation of life), domain satisfaction (for example, satisfaction with finances or family life). Czapinski (1991) not only described the layers of well-being, but also showed that the inner levels are less dependent on changes in circumstances. Kahneman (1999) proposes two types of well-being: experienced and remembered. The first one is associated with the present experiences while the second is related to how one's life was in the past. Other authors have identified even more categories; for example, Dolan et al. (2006) distinguish five different types of well-being; these are objective list, preference satisfaction, flourishing (self-realization), hedonic, and evaluative (assessment of individual life). It is clear that psychologists have recognized that well-being must not be treated as a one-dimensional phenomenon. This point was explicitly made by Wong (2011), who stressed the importance of the distinction between a good meaningful life and a hedonistic attitude in psychological well-being research.

The concepts of well-being in the literature correspond to the distinction between different types of well-being in this study. The empirical nature of the research makes it impossible to project the dependent variables on the more theoretical typologies. However, there do exist some strong similarities between the above-mentioned accounts of well-being and the variables used in the presented empirical model. Most typologies distinguish between some form of life evaluation and happiness. Life evaluation is a retrospective measure of well-being which involves thinking of one's life as a whole in terms of past experiences. It could be expected that when individuals are faced with evaluation of their lives, they are more concentrated on meaning and values. In contrast, happiness is more rooted in the present, as it defines how one is feeling. One might hypothesize that happiness is more about comparing good and bad experiences.

The presence of happiness and life evaluation in almost all classifications is not accidental, since most definitions of well-being can be placed in one of the two traditions: hedonic and eudaimonic. Eudaimonia is a term coined by Aristotle to describe the good life as a life in accordance with virtues and higher values. The fulfilled life is perceived as striving to achieve meaningful goals for the greater good. In the eudaimonic tradition, well-being results from the meaning of life. It is more about how one assesses one's actions through the lens of virtues and values than about how one feels. Hedonists do not attach importance to those values and goals as they emphasize pleasure, feelings, and experiences. In the eudaimonic tradition, there is one general path to well-being (the purpose of life), but according to hedonists there are many possible ways of achieving happiness one

[2] The above-mentioned studies use various terms for subjective well-being, but for the sake of consistency with the typology introduced in the previous paragraph, the term "well-being" is used throughout this paper.

should do only what makes one happy. Both traditions are not completely contradictory, as a meaningful life may also be a happy one. A problem arises when accomplishing one's life goals require sacrifices. They can result in a disagreeable experience, but may lead to a more fulfilled life.

The hypothesis about what individuals think when evaluating their well-being is speculative and cannot be tested within the proposed framework. Nevertheless, what can be determined from statistical analysis is how significant socioeconomic determinants are for self-reported well-being. It could be expected that temporary changes in those determinants should have a stronger effect on happiness than life evaluation. Indeed, temporary changes in income, employment status, and health are more strongly correlated with happiness than with life evaluation. The reverse is observed for permanent changes. These results are in line with the predictions concerning the effects of temporary and permanent changes on well-being. However, two exceptions are religiosity and number of friends. The same association between temporary changes in number of friends and well-being was observed for both measures, while no statistically significant correlation was found for permanent changes in those determinants. In addition, only permanent changes in religiosity are statistically significant. The quantitative effects and significance of religiosity were similar for both types of well-being.

1.2 Hedonic Adaptation

The question of hedonic adaptation in empirical studies that exploit longitudinal data from national surveys is approached in two distinct ways. One strand of the literature focuses on the reaction of individuals to life events and analyzes the persistence of changes in self-reported well-being. There is a long tradition of this type of research, covering a wide range of circumstances that people partially or fully adapt to.[3]

The second approach, which has emerged only recently, studies well-being as an autoregressive process (Lee and Oguzoglu 2007; Pudney 2008; Bottan and Perez Truglia 2011; Piper 2012. In this approach, the time dimension of well-being is not restricted to the relation between past events and current well-being, but the relationship between past and current well-being is taken into account. The rationale behind the inclusion of lagged well-being in the set of explanatory variables refers to the concept of general adaptation. Contrary to specific adaptation, which can be described as a process of getting used to a specific life event, general adaptation draws on the idea that past levels of well-being affect its current levels. According to this hypothesis, higher- or lower-than-normal levels of well-being should result in reversion to the individual's set point.

Other reasons for having a lagged dependent variable in the model are linked to a purely technical point of view. This method can be used to obtain correct standard errors of estimators in the case of serial correlation. Moreover, as indicated by Piper (2012), a dynamic model may be a solution preventing misspecification in static regression. Nevertheless, putting aside theoretical aspects, we address the question: are people that were happy in the past happy today? To provide a meaningful answer, one has to control for various socioeconomic variables and individual effects. The results from a dynamic random effects probit model indicate that well-being is positively correlated with its past values (which is consistent with the previously mentioned studies). Hence, higher well-being in the past means higher well-being in the present. These results do not seem to

[3] See, e.g., Headey and Wearing (1989), Clark et al. (2004, 2008), Clark (2006), Gardner and Oswald (2006), Zimmermann and Easterlin (2006), Binder and Coad (2010), Di Tella et al. (2010).

support the general habituation hypothesis, but they may be driven by unobservable factors.

The remaining part of the paper develops the concepts of general habituation and determinants of well-being from an empirical perspective. In Sect. 2, we describe the source data and provide information about the process of selecting variables. Section 3 gives a detailed account of the statistical method. Section 4 presents the results obtained from the model. Section 5 contains our conclusions.

2 Data Description

The data used in the study come from the social diagnosis survey by the Council for Social Monitoring, which is conducted every two years in Poland. It is a comprehensive household survey that provides information about numerous issues ranging from financial conditions, health, and political opinions to subjective well-being. With the exception of the years 2000–2003, when the time difference between the first and the second survey was three years, it has been conducted biannually. Because of the initial irregular time period, which might distort the state-dependence of well-being, the sample was restricted to surveys from 2003 to 2011. Based on these data, a three-wave balanced panel was constructed. The choice of three waves was based on a trade-off between the time covered by the panel and the number of individuals. An increase in the number of waves drastically reduces the sample size. For four waves, the sample would be reduced to 807 individuals and, as a result, almost all coefficients in the model would be non-significant. On the other hand, with a lower number of waves it is impossible to take into account unobserved heterogeneity.

The panel consists of 3,706 individuals for whom data for three consecutive waves were available. If an individual took part in more than three surveys in a row, only the first three were included in the panel. The choice of which three consecutive waves are to be included in the sample has no impact on the results. Table 1 shows summary statistics by sex and age. The observations are spread evenly between the sex–age cells. The number of individuals in a single sex–age cell ranges from 175 to 470, with an average of 300 individuals. In the first survey, about 67 % of individuals declared that they were happy, while the proportion of positive life evaluations amounted to 71 %. Moreover, about 39 % of individuals changed their life evaluation at least once over six years. The corresponding figure for happiness was 34 %.

Table 1 Summary statistics of the sample

Age	Males	Females
<25	201 [79 %, 82 %]	175 [75 %, 77 %]
25–35	180 [72 %, 72 %]	236 [77 %, 78 %]
36–45	352 [66 %, 73 %]	381 [70 %, 73 %]
46–55	388 [67 %, 71 %]	470 [64 %, 72 %]
56–65	284 [68 %, 73 %]	371 [64 %, 64 %]
>65	254 [69 %, 70 %]	414 [58 %, 60 %]

The first figure is the number of individuals, the second figure is the percentage of happy individuals in the first period, and the third figure is the percentage of individuals satisfied with their life in the first period

A practical obstacle in comparing the various types of well-being is the fact that different measures are recorded on different scales. To solve this problem, happiness and life evaluation are projected on a binary scale. The value one corresponds to positive feelings or evaluation while zero to negative feelings or evaluation. In other words, all answers concerning subjective well-being were reduced to a yes–no framework. This step is justified because all measures have a clear point that marks the line between positive and negative feelings or evaluation. However, it is not always possible, as in the case of the scale proposed by Cantril (1966), which is extensively used in cross-country comparisons, see for example Easterlin (1974), Stevenson and Wolfers (2013). While Cantril's ladder enables the assessment of well-being in numerical values from zero to ten, it has no threshold indicating the transition from positive to negative evaluation.

Happiness and life evaluation are measured on ordinal scales. Possible answers to the question about life evaluation are: great, good, rather good, mixed, rather bad, unhappy, and terrible.[4] There are four levels of happiness: very happy, rather happy, not very happy and unhappy. Despite the differences, these questions share one important characteristic, that is, an evident distinction between positive (happy/satisfied) and negative (unhappy/not satisfied) assessment. Hence, a binary variable was constructed based on this feature in such a way that the number one designates positive evaluation and zero designates negative evaluation. Neutral answers, such as *mixed* in the question about life evaluation, are coded as zero.[5]

The variables considered to be determinants of well-being can be divided into three categories: individual, household-related, and regional. Individual characteristics used in the regression include sex, age, personal income, marital status, employment status, mental and physical health, education, number of friends, and religious practices. In turn, variables such as house/apartment size and household income are the same for all members of a household. Moreover, the empirical model also includes a regional variable, which assigns to every observation the unemployment rate in the voivodeship in which the respondent lives.[6]

Among the variables used, only sex and house/apartment size are constant over time for every individual. To be precise, house/apartment size did exhibit some variation over time due to measurement error, as people tended to give approximate sizes. In the social diagnosis survey, households were chosen at random by address, so house/apartment size was in fact unchanged, but answers might vary between different waves. To avoid the impact of measurement error, an average value was calculated for every household. The variables changing over time were processed using standard coding practices. Employment status indicates if a given individual is employed, unemployed, or inactive. Marital status includes the categories of single, married or divorced. Education was coded at three levels: primary, secondary, and tertiary.

Due to the lack of objective variables describing health, we used two measures of health that are based on respondent self-assessment. One question concerns feeling unwell to an extent that it limits one's mobility. The second one concerns health problems that make the performance of daily activities difficult. Both questions have three answers that indicate

[4] The full question for life evaluation is *How do you perceive your entire life? Would you say it has been...* For happiness, the full question is *All things considered, how do you perceive your life over the past several days would you say you have been...*

[5] The case when this answer is coded as one is also discussed to assess sensitivity to coding practice.

[6] A voivodeship is the largest administrative unit in Poland corresponding to a province or state. There are sixteen voivodeships.

the frequency of experienced problems: never, sometimes, and often. Both variables are highly correlated, so we used only one. In the section presenting the basic results, the variable describing health problems (rather than feeling unwell) was used as a proxy for health. Besides physical health, we also used a proxy for mental health (the question about whether the individual visited a psychotherapist or psychiatrist in the past year).

Of particular interest in empirical studies of well-being is how income affects well-being. To obtain a more accurate picture of the relationship between income and well-being, we use three types of income: household income per member, individual income, and equivalent household income.[7] The preferred variable is the logarithm of relative household income per household member, and that for three reasons. First, many studies (Clark et al. 2008; FitzRoy et al. 2011) have emphasized the importance of social comparisons to well-being. We calculate the reference income as the median income in a sample in a given year. Second, household income per capita can also be perceived as an approximation of individual consumption. Headey et al. (2004) show that consumption has at least the same impact on well-being as income. Third, according to the standard economic theory, the higher the income, the smaller the effect of income increase on well-being. This is captured by the logarithmic transformation of income.

3 Empirical Model

In our model, well-being is treated as a discrete state that may be positive or negative. The same discrete scale is applied to happiness and life evaluation. The state y is determined by a composite index (latent variable) that aggregates the effect of socioeconomic variables. The latent variable y^* is a linear combination of socioeconomic determinants. To calculate the latent variable y^* for a given individual i for time t, we add all the values of the determinants multiplied by the corresponding coefficients according to the formula $y^*_{it} = x'_{it}\beta$. We are particularly interested in the values of the coefficients that indicate how a given variable affects the latent variable. A latent variable greater than or equal to zero implies a positive state.

$$y_{it} = \begin{cases} 1 & \text{if} \quad y^*_{it} \geq 0 \\ 0 & \text{if} \quad y^*_{it} < 0 \end{cases} \tag{1}$$

However, the variables included in the model do not explain all variation between individuals. It is possible to observe negative states for a positive value of the latent variable. To better reflect this aspect of reality, a disturbance term, which represents non-observed variables, was added. In this setting, it is common to analyze how a change in determinants affects the probability of a given state. Therefore, we applied a function that transformed the latent variable into probability. As in most studies, the cumulative distribution function of the standard normal distribution was used.

Our focus is on the coefficients of determinants. The effect of a change in a determinant on well-being takes place in three steps. First, it changes the value of the latent variable. Then, the latent variable affects the probability of a given state. Finally, the probability is translated into a state. If an individual has a high probability of being in a given state, then we can assign that state to him or her. In the study, we examine how various

[7] The method of calculating equivalence scales is described in (Czapinski 2011, p. 440).

socioeconomic determinants are related to the probability of being happy or having positive life evaluation.

Apart from standard socioeconomic determinants such as income, health, age or marital status, we also included well-being from the previous period. The coefficient associated with lagged well-being was used to assess general habituation. The coefficient can have three possible values: negative, positive, or zero. Zero indicates that there is no relationship between past and current well-being. In the model, well-being is determined by the current determinants. A permanent change in determinants has a permanent effect on well-being. There is no adaptation. A positive coefficient is associated with a carryover effect of well-being. An increase in the level of past well-being (change from a negative to a positive state) increases the probability of a current positive state. This magnifies the impact of changes in determinants. In the case of a positive coefficient, it is possible that a temporary change in the determinant has a permanent effect on the state. This may happen when the value of the latent variable is slightly below the zero. This is a classical case of state dependence: even when all other variables are equal, the past determines the current state. Finally, a negative coefficient indicates a situation of general habituation. An improvement in well-being leads to a lower probability of a positive state in the future.

It is worth noting that that due to the short panel, we did not include lagged determinants, so general habituation captures also the impact of specific habituation. As a result, the estimated coefficient of lagged well-being does not correspond to pure general habituation. Since many studies have documented adaptation to changes in various determinants, it is reasonable to assume that the coefficient is biased downward. As the estimate of the coefficient of past well-being is positive, the bias has no effect on qualitative interpretation. The results can be interpreted as the lower bound of the impact of past well-being.

The choice of the method is mostly dictated by the type of question that is investigated. As the study is centered on two measures of well-being in the form of binary variables, the model itself also has to be binary. At this point, there are two possibilities: the model may be linear or nonlinear. In this regard a standard econometric approach was followed and a random effect probit model was applied to the data. However, the inclusion of a lagged dependent variable in the model led to biased estimates due to the presence of both past values of well-being and unobserved heterogeneity.

The problem of biased estimates, when a lagged dependent variable is included, is called an initial value problem. Since in the initial period the lagged dependent variable is taken to be exogenous, but it is correlated with unobserved heterogeneity, the strict exogeneity assumption of the random effect model is invalidated. There are three estimation strategies that deal directly with this problem, proposed by Heckman (1981), Wooldridge (2005), and Orme (1996). The study by Akay (2009) shows that in small samples Heckman's estimator performs better than Wooldridge's method. On the other hand, Arulampalam and Stewart (2007) and Panos (2008) provide evidence from simulation studies that differences between the methods are minor. Taking into account the results of those studies and the fact our panel consists of only three periods, Heckman's method is preferable.

What distinguishes Heckman's method from the standard random effect probit is separate treatment of the initial period. Well-being in the initial period is taken as endogenous with respect to the dependent variables, but the lagged dependent variable is omitted. In most applications, the set of explanatory variables is the same for both initial and subsequent periods. The specification of the model can be expressed in the form of a latent variable that incorporates the difference between the initial period and the other periods:

$$\begin{cases} y_{it}^{*} = \rho y_{it-1} + x_{it}'\beta + \sigma\alpha_i + \epsilon_{it}, & t \geq 1 \\ y_{i0}^{*} = z_{i0}'\gamma + \sigma_0\alpha_i + \epsilon_{i0}, & t = 0 \end{cases} \tag{2}$$

where y is the dependent variable that represents well-being, the index i stands for the individual, and t for the time period; and y^* is the latent variable defined by Eq. (2). The other symbols are x for exogenous variables, α for the individual random effect that is normally distributed with standard deviation σ_0 for $t = 0$ and σ for $t > 0$. Disturbance is defined as ϵ and it is assumed that it has normal distribution with a standard deviation of one. Additionally, disturbance is independent from the individual effect.

Heckman's estimator is based on the idea of a joint distribution of $y_0, \ldots, y_T$ characterized by Eq. (2) and the assumption regarding disturbance. Given the above assumptions and the specification of the model, the likelihood function may be formulated as follows:

$$\prod_{i=1}^{N} \int_{\alpha} \left[\Phi[(z_{i0}'\gamma + \sigma_0\alpha)(2y_{i0} - 1)] \prod_{t=1}^{T} \Phi[(\rho y_{it-1} + x_{it}'\beta + \sigma\alpha)(2y_{it} - 1)] \right] dF(\alpha) \tag{3}$$

Random effects models require an exogeneity assumption, $E[\alpha_i | x_{it}] = 0$. This is a strict assumption and it is not always possible to guarantee that it holds. A method of relaxing this assumption has been proposed by Mundlak (1978). The most popular form of Mundlak's correction involves specifying a conditional random effect by adding the time averages of all time-varying variables. The idea behind this step is that individual effects are probably correlated with the time-invariant component of the independent variables. As a result, individual effects take the form of:

$$\alpha_i = \alpha_i^{*} + \bar{x}_i'\beta^{*} \tag{4}$$

Besides improving the statistical properties of the model, the introduction of time averages may also be a useful tool for distinguishing between the short-term and long-term effects of changes in variables. When both variables and time averages of those variables are included in the model equation, the coefficient of time-varying variables can be interpreted as deviation from steady-state. This can be expressed by rearranging the independent variables and the coefficients associated with them (asterisks are assigned to time averages):

$$x_i'\beta + \bar{x}_i'\beta^{*} = (x_i' - \bar{x}_i')\beta + \bar{x}_i'(\beta^{*} + \beta) \tag{5}$$

The asterisks are dropped in order to avoid unnecessarily complicated notation, and it is simply assumed that time averages belong to the set of independent variables. Having a complete specification (Eq. 2) of the model, under the assumption of normal distribution of α, heterogeneity can be integrated out using Guassian-Hermite quadrature (Arulampalam and Stewart 2007) or approximated by simulation. In this study, simulation is applied to evaluate the integral. To approximate the integral from Eq. (3), one can take R draws from a normal distribution, calculate the value of the integrand for each draw and take the mean of the obtained values. The formula for approximation of the likelihood function is:

$$\prod_{i=1}^{N} \left[\frac{1}{R} \sum_{r=1}^{R} \left[\Phi[(z_{i0}'\gamma + \sigma_0\alpha_r)(2y_{i0} - 1)] \prod_{t=1}^{T} \Phi[(\rho y_{it-1} + x_{it}'\beta + \sigma\alpha_r)(2y_{it} - 1)] \right] \right] \tag{6}$$

However, pseudo-random numbers might be computationally inefficient. As it was indicated by Train (2003), the application of the Halton sequence, which is a quasi-random number sequence, might provide satisfactory results of simulation with a relatively small number of draws. The advantage of the Halton sequence is better coverage due to the negative correlation of consecutive draws. As a result, the error of evaluation of a log-likelihood function is reduced. In the simulation, 500 Halton draws were used.

The model coefficients have no quantitative interpretation, while the model is nonlinear. However, to assess how a change in a variable affects the probability of being happy or feeling satisfaction with one's life, one might calculate average partial effects. They are obtained by averaging across individuals the impact of a change in a variable of interest on probability. The formula for discrete variables is:

$$\frac{1}{N}\sum_{i=1}^{N}\left[\Phi(\overline{x}'\beta+\rho+\overline{x}_i'\beta^*)-\Phi(\overline{x}'\beta+\overline{x}_i'\beta^*)\right] \tag{7}$$

A different formula is used for continuous variables:

$$\frac{1}{N}\sum_{i=1}^{N}\beta_k\Phi(\overline{x}'\beta+\rho\overline{y}+\overline{x}_i'\beta^*) \tag{8}$$

The next section presents results from the Heckman random effect probit model with Mundlak's correction estimated using a simulated maximum likelihood method. We applied average partial effects to assess the quantitative impact on the probability of a positive state.

4 Results

Before moving to a discussion of differences between life evaluation and happiness, it is worth analyzing similarities. One common feature of both of these well-being measures is their state-dependence. Past well-being is positively associated with its current levels. The statistically significant positive correlation between past and current well-being does not support the general habituation hypothesis.

The main results contained in Table 2 shows that the lagged dependent variable is significant in both models at a 0.05 significance level. The values of estimates are 0.25 for life evaluation and 0.22 for happiness (in both cases at a standard error of 0.10). The results are not only statistically significant, but also quantitatively substantial (Table 3). The value one of lagged life evaluation increases the probability of positive life evaluation on average by about 6.6 percentage points. Similarly, being happy in the previous period increases the probability of happiness by about 4.1 percentage points. Expressing the relationship of past and current values of well-being in terms of relative income shows that positive life evaluation in the previous period is equivalent to an increase in relative income from the median to 1.75 of the median. In the case of happiness, the value one for the lagged dependent variable is equivalent to the difference between the median relative income and 1.85 of the median. Other specifications with different proxies of income and health do not affect the statistical or quantitative significance of lagged well-being. However, Bottan and Perez Truglia (2011) argue that a positive correlation between past and current well-being might be due to time-inconsistency of the well-being scale. In our study, we use a binary scale that shows only negative and positive states of well-being. This approach should

Table 2 Main estimation results

Variables	Life evaluation	Happiness
Independent variables		
Lagged dependent variable	0.252 [0.100]*	0.221 [0.095]*
Intercept	1.357 [0.258]***	1.319 [0.218]***
Female	−0.053 [0.053]	−0.097 [0.051]
Age	0.002 [0.026]	0.095 [0.025]***
Relative household income (log)	0.160 [0.080]*	0.359 [0.079]***
House/apartment size	0.004 [0.001]***	0.004 [0.001]***
Married	0.008 [0.053]	0.014 [0.051]
Divorced	0.041 [0.102]	−0.045 [0.100]
Number of friends	0.010 [0.005]*	0.011 [0.004]*
Religious practice	−0.018 [0.012]	−0.004 [0.012]
Health problems (often)	−0.130 [0.109]	−0.490 [0.097]***
Health problems (sometimes)	0.002 [0.079]	−0.192 [0.074]**
Mental health	−0.249 [0.144]	−0.315 [0.140]*
Inactive	−0.057 [0.121]	−0.204 [0.118]
Unemployed	0.019 [0.135]	−0.501 [0.131]***
Regional unemployment	−0.006 [0.008]	0.003 [0.008]
Secondary education	0.041 [0.050]	0.024 [0.048]
Tertiary education	0.011 [0.069]	0.052 [0.067]
Time averages		
Age	−0.012 [0.026]	−0.105 [0.026]***
Relative household income (log)	0.437 [0.106]***	0.186 [0.099]
Married	−0.061 [0.105]	0.065 [0.097]
Divorced	−0.337 [0.202]	−0.026 [0.198]
Number of friends	0.008 [0.007]	0.009 [0.007]
Religious practice	0.066 [0.016]***	0.050 [0.015]***
Health problems (often)	−0.614 [0.196]**	−0.502 [0.150]***
Health problems (sometimes)	−0.337 [0.144]*	−0.157 [0.114]
Mental health	−0.298 [0.217]	−0.222 [0.204]
Inactive	−0.074 [0.142]	0.082 [0.136]
Unemployed	−0.569 [0.198]**	−0.289 [0.187]
Regional unemployment	−0.010 [0.010]	−0.029 [0.009]**
Sigma	0.953 [0.109]***	0.870 [0.101]***
Log-likelihood	−5446.09	−5667.47
Halton draws	500	500

The reference group for dummy variables is: male, single, without health problems, employed, with primary education. Statistical significance: *** 0.001, ** 0.01, * 0.05. Standard errors are given in brackets

mitigate the problem of time-consistency of reported well-being. Bottan and Perez Truglia (2011) also consider the effect of unobserved determinants. It possible that the statistical relationship between past and current well-being is due to the presence of unobserved factors that are positively autocorrelated.

Other similarities concern specific determinants of well-being. In both cases, the significant time-changing variables are income and number of friends. Moreover, the

quantitative impact of those variables (as measured by their average partial effects) on life evaluation and happiness is similar. As for the time averages, health problems and religion are associated with both types of well-being in a similar way in terms of statistical significance and magnitude of the relationship. Nevertheless, such strong similarities are an exception that rather the rule.

Despite the above-mentioned similarities, there are some major differences in terms of how the socioeconomic variables are correlated with happiness and life evaluation. The two main differences are as follows. First, more time-varying variables are statistically significant in the model explaining happiness. The variables that are significant in the case of happiness, but non-significant for life evaluation include employment status and health. This means that temporary changes in employment status or health are more related to changes in happiness than life evaluation. Moreover, income is less significant for life evaluation. Second, in the case of happiness the main determinants are deviations from time averages, while the opposite can be observed for life evaluation. Changes in time averages are correlated with changes in life evaluation.

A more detailed discussion of the results begins with a description of the relationship between well-being and income. The average relative income over six years has a significant statistical impact on life evaluation: the estimate is 0.44 with a standard error of 0.11. However, the coefficient of time-averaged income in the model of happiness is insignificant with a p-value above 0.05. The reverse pattern is observed for deviation from the average relative income. In the case of happiness, the parameter of deviation from the average equals 0.36 with a standard error of 0.08. This contrasts with the results obtained from the model of life evaluation: the value of the parameter is 0.16 with a standard error of 0.08.

Table 3 Average partial effects

Variables	Life evaluation	Happiness
Lagged dependent variable	0.066 [0.029]	0.041 [0.016]
Female	−0.013 [0.011]	−0.018 [0.008]
Age	0.001 [0.003]	0.018 [0.003]
Relative household income (log)	0.040 [0.020]	0.066 [0.016]
House/apartment size	0.001 [0.000]	0.001 [0.000]
Married	0.002 [0.010]	0.003 [0.007]
Divorced	0.010 [0.020]	−0.008 [0.015]
Number of friends	0.002 [0.001]	0.002 [0.001]
Religious practice	−0.005 [0.003]	−0.001 [0.002]
Health problems (often)	−0.033 [0.024]	−0.093 [0.021]
Health problems (sometimes)	0.001 [0.015]	−0.036 [0.013]
Mental health	−0.068 [0.035]	−0.060 [0.023]
Inactive	−0.014 [0.024]	−0.038 [0.189]
Unemployed	0.005 [0.026]	−0.095 [0.025]
Regional unemployment	−0.002 [0.002]	0.001 [0.001]
Secondary education	0.010 [0.010]	0.004 [0.007]
Tertiary education	0.003 [0.013]	0.010 [0.010]

The standard errors given in brackets were obtained by a simulation that exploits the variance covariance matrix and the assumption that disturbances are normally distributed with a standard deviation of one

The results can be interpreted in the following way: richer people exhibit a more positive evaluation of their lives, but temporary improvement has a relatively small effect on life evaluation. The ratio of the coefficients of time-averaged to time-varying variables is 2.74. In contrast, the regression explaining happiness shows a different pattern. In this model, a deviation from the average is correlated positively with change in self-reported assessment. The ratio of coefficients is much smaller than in the model of life evaluation, and it equals 0.52. These results are also supported by average partial effects. An increase in relative household income per member by one log unit is associated with a higher probability of being happy or having a positive life evaluation. The figure is larger for happiness than for life evaluation (0.07 vs. 0.04). The standard error is also smaller in the case of happiness (0.016 vs. 0.02 for life evaluation). The application of relative income without a logarithmic transformation but with additional squared values does not affect the main results. Nevertheless, in general logarithmic transformation yields a better fit than the quadratic form (Tables 4 and 5).

Happiness is more dependent on temporary changes in income also for equivalent household income. In the happiness model , the parameter for equivalent income change equals 0.36 with a 0.08 standard error. The corresponding figures for life evaluation are − 0.03 and 0.06, respectively. The statistical relationship between equivalent income and life evaluation is negative, but non-significant. The impact of personal income on well-being is negligible in both models (Tables 4 and 5).

Life evaluation and happiness differ in the strength of their association with temporary changes in health. In the case of happiness, the physical and mental health variables are significant and quantitatively important. Frequent health problems reduce the probability of being happy by 9 percentage points, while the corresponding figure for life evaluation is 3 percentage points. Mental problems decrease the probability of happiness by 6 percentage points. This suggests that health is a quantitatively significant determinant of happiness. Additionally, none of the time-varying health variables is significant in the model of life evaluation. Replacing the health problem variable with the disability variable in the model of happiness does not alter the results (Tables 4 and 5).

The employment status of an individual is a significant determinant of happiness. The value of the time-varying unemployment parameter is 0.50 with a standard error of 0.13. The average partial effect equals 0.10. This shows that unemployment increases the probability of being unhappy by 10 percentage points. However, the same cannot be said of life evaluation. Moreover, for time-averaged variables there does not seem to be any relationship between happiness and unemployment, but for life evaluation the estimate depends on how life evaluation was coded. Additionally, higher regional unemployment is associated with lower well-being, but it is significant only for happiness.

While the independent variable was constructed from an ordinal scale, it is possible that at least some results are driven by the coding method. To check this, we recoded the life evaluation variable by assigning 1 to the *mixed* answer. Table 6 shows that there is little difference between these models. The conclusions following from the modified life evaluation model are even clearer in comparison to the original specification, as the modified measure shows stronger state-dependence and slightly lower dependence on external factors. The only exception is the time average of the mental health variable. It is non-significant in the original model, but highly significant under modified coding. Also long-term health becomes less important as a determinant of life evaluation in the alternative model. Nevertheless, the main results are consistent with both coding practices.

Table 4 Estimation results: life evaluation

Variables	Model I	Model II	Model III	Model IV
Lagged dependent variable	0.258 [0.103]	0.225 [0.115]	0.377 [0.105]	0.287 [0.098]
Intercept	0.837 [0.288]	1.129 [0.281]	0.032 [0.194]	1.310 [0.215]
Female	−0.049 [0.053]	−0.017 [0.057]	−0.045 [0.049]	−0.050 [0.052]
Age	−0.009 [0.027]	−0.002 [0.026]	−0.004 [0.025]	−0.000 [0.025]
Relative household income				
Level	0.227 [0.106]			
Logarithm				0.153 [0.080]
Squared	−0.031 [0.016]			
Personal income				
Logarithm		0.013 [0.009]		
Equivalent income			−0.033 [0.059]	
House/apartment size	0.004 [0.001]	0.004 [0.001]	0.003 [0.001]	0.004 [0.001]
Marital status				
Married	0.011 [0.052]	−0.003 [0.053]	0.002 [0.051]	0.005 [0.052]
Divorced	0.043 [0.102]	0.030 [0.103]	0.036 [0.099]	0.042 [0.105]
Number of friends	0.010 [0.005]	0.009 [0.005]	0.010 [0.005]	0.010 [0.005]
Religious practice	−0.018 [0.012]	−0.019 [0.012]	−0.020 [0.012]	−0.019 [0.012]
Health				
Problems (often)	−0.135 [0.098]	−0.120 [0.094]		
Problems (sometimes)	−0.005 [0.075]	0.009 [0.073]		
Disability (often)			−0.084 [0.098]	−0.092 [0.100]
Disability (sometimes)			0.051 [0.069]	0.035 [0.071]
Mental	−0.253 [0.144]	−0.269 [0.145]	−0.238 [0.141]	−0.255 [0.141]
Employment status				
Inactive	−0.058 [0.118]	−0.075 [0.126]	−0.106 [0.116]	−0.066 [0.127]
Unemployed	0.009 [0.132]	0.008 [0.136]	−0.032 [0.128]	0.011 [0.156]
Regional Unemployment	−0.007 [0.008]	−0.008 [0.008]	−0.008 [0.008]	−0.007 [0.008]
Education				
Secondary	0.038 [0.049]	0.042 [0.050]	0.037 [0.048]	0.042 [0.049]
Tertiary	0.009 [0.068]	0.015 [0.070]	0.012 [0.066]	0.014 [0.068]
Sigma	0.942 [0.115]	1.014 [0.148]	0.803 [0.118]	0.917 [0.107]
Log-likelihood	−5431	−5539	−5414	−5445
Halton draws	500	500	500	500

5 Discussion and Conclusion

Our study combines two strands of the literature. One deals with habituation and analyzes how well-being fluctuates over time in response to life events. The second strand is concerned with differences between the determinants of happiness and life evaluation. With respect to the first point, we have found that both types of well-being exhibit state-dependence current well-being is positively related to past well-being. A positive assessment of well-being in the past is associated with a higher probability of a current positive assessment. A past positive life evaluation increases the probability of having positive life

Table 5 Estimation results: happiness

Variables	Model I	Model II	Model III	Model IV
Lagged dependent variable	0.220 [0.096]	0.338 [0.096]	0.276 [0.095]	0.233 [0.090]
Intercept	0.698 [0.213]	0.913 [0.204]	0.191 [0.186]	1.331 [0.228]
Female	−0.095 [0.051]	−0.054 [0.047]	−0.080 [0.048]	−0.085 [0.050]
Age	0.093 [0.025]	0.083 [0.025]	0.074 [0.025]	0.091 [0.025]
Relative household income:				
Level	0.382 [0.099]			
Logarithm				0.358 [0.079]
Squared	−0.038 [0.013]			
Personal income				
Logarithm		0.008 [0.007]		
Equivalent income			0.151 [0.063]	
House/apartment size	0.004 [0.001]	0.004 [0.001]	0.003 [0.001]	0.004 [0.001]
Marital status				
Married	0.016 [0.051]	0.003 [0.049]	0.004 [0.050]	0.008 [0.050]
Divorced	−0.049 [0.100]	−0.063 [0.096]	−0.051 [0.096]	−0.043 [0.099]
Number of friends	0.011 [0.004]	0.012 [0.004]	0.010 [0.004]	0.010 [0.004]
Religious practice	−0.004 [0.012]	−0.004 [0.011]	−0.005 [0.012]	−0.005 0.012
Health				
Problems (often)	−0.492 [0.096]	−0.480 [0.096]		
Problems (sometimes)	−0.197 [0.073]	−0.191 [0.072]		
Disability (often)			−0.492 [0.099]	−0.507 [0.099]
Disability (sometimes)			−0.209 [0.070]	−0.229 [0.071]
Mental	−0.323 [0.142]	−0.321 [0.138]	−0.309 [0.137]	−0.315 [0.138]
Employment status				
Inactive	−0.223 [0.116]	−0.259 [0.113]	−0.234 [0.115]	−0.190 [0.118]
Unemployed	−0.524 [0.128]	−0.559 [0.126]	−0.546 [0.128]	−0.503 [0.127]
Regional Unemployment	0.002 [0.008]	0.001 [0.007]	−0.001 [0.008]	0.002 [0.008]
Education				
Secondary	0.021 [0.048]	0.029 [0.046]	0.022 [0.047]	0.023 [0.048]
Tertiary	0.051 [0.067]	0.060 [0.065]	0.050 [0.066]	0.048 [0.067]
Sigma	0.870 [0.102]	0.783 [0.106]	0.780 [0.104]	0.842 [0.094]
Log-likelihood	−5667	−5747	−5615	−5644
Halton draws	500	500	500	500

evaluation on average by about 6 percentage points. In the case of happiness the corresponding figure is 4 percentage points. We have not found statistical evidence supporting the general habituation hypothesis, which claims that humans adapt to well-being levels that are above or below one's normal level (then, we would have obtained a negative correlation between past and current well-being).

Besides past well-being, we have looked at various socioeconomic determinants of happiness and life evaluation. There are some substantial differences and similarities between the determinants of the two types of well-being. The main difference is that life evaluation is less dependent on external factors. Deviations from time averages of income,

Table 6 Life evaluation: recoding

Variables	Life evaluation *mixed* = 0	Life evaluation *mixed* = 1
Independent variables		
Lagged dependent variable	0.252 [0.100]*	0.467 [0.177]**
Intercept	1.357 [0.258]***	2.122 [0.494]***
Female	−0.053 [0.053]	−0.184 [0.089]*
Age	0.002 [0.026]	0.020 [0.042]
Relative household income (log)	0.160 [0.080]*	0.025 [0.129]
House/apartment size	0.004 [0.001]***	0.007 [0.002]***
Married	0.008 [0.053]	0.058 [0.085]
Divorced	0.041 [0.102]	0.290 [0.179]
Number of friends	0.010 [0.005]*	0.022 [0.009]*
Religious practice	−0.018 [0.012]	−0.026 [0.021]
Health problems (often)	−0.130 [0.109]	−0.273 [0.159]
Health problems (sometimes)	0.002 [0.079]	−0.044 [0.124]
Mental health	−0.249 [0.144]	−0.053 [0.196]
Inactive	−0.057 [0.121]	0.049 [0.203]
Unemployed	0.019 [0.135]	−0.223 [0.208]
Regional unemployment	−0.006 [0.008]	−0.008 [0.014]
Secondary education	0.041 [0.050]	0.015 [0.081]
Tertiary education	0.011 [0.069]	0.057 [0.115]
Time averages		
Age	−0.012 [0.026]	−0.030 [0.043]
Relative household income (log)	0.437 [0.106]***	0.513 [0.174]**
Married	−0.061 [0.105]	−0.131 [0.167]
Divorced	−0.337 [0.202]	−0.237 [0.331]
Number of friends	0.008 [0.007]	0.016 [0.013]
Religious practice	0.066 [0.016]***	0.096 [0.029]**
Health problems (often)	−0.614 [0.196]**	−0.264 [0.244]
Health problems (sometimes)	−0.337 [0.144]*	−0.080 [0.195]
Mental health	−0.298 [0.217]	−1.185 [0.298]***
Inactive	−0.074 [0.142]	−0.114 [0.234]
Unemployed	−0.569 [0.198]**	−0.245 [0.299]
Regional unemployment	−0.010 [0.010]	−0.006 [0.016]
Sigma	0.953 [0.109]***	1.169 [0.200]***
Log-likelihood	−5446.09	−2348.66
Halton draws	500	500

employment status, or health have a stronger effect on happiness than on life evaluation. In contrast, temporary changes in those determinants play a more significant role in the model of happiness than in that of life evaluation. Similarities include the relationship between well-being and two determinants: number of friends and religiosity. Only a temporary change in number of friends is associated with increased well-being. The relationship between religiosity and well-being is almost the same for happiness and life evaluation.

There are two main limitations to our study associated with the data. First, they concern the length of the panel. Only three waves were used, since more waves would result in too small a number of individuals in the sample. Second, happiness and life evaluation were mapped as binary variables, leading to only positive or negative assessments. However, this unification of scales enabled us to reasonably compare happiness and life evaluation at the cost of losing some valuable information. There is no doubt that having a longer panel and comparable scales would significantly improve the precision of estimates.

Additionally, there is a conceptual problem. The distinction between specific and general habituation is clear from the statistical perspective, but both phenomena might be interrelated. As a result, statistical inference is somewhat limited in scope. Another inconsistency is associated with the interpretation of permanent and temporary changes in determinants. Analysis of permanent changes is based on interpersonal comparison (differences between individuals), while temporary changes are analyzed in terms of intrapersonal comparison (changes in time).

Some of the problems may be mitigated by improvement in the quality and quantity of data. This will probably happen over time. Nevertheless, there seems to be a need for research into the theoretical foundations of determinants and habituation. To be useful for empirical research, theories must be precise and easily quantifiable. Then, they will facilitate the interpretation of empirical results and enhance the understanding of mechanisms that determine well-being.

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