An empirical investigation into the determinants and persistence of different types of subjective well-being

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Abstract

A comparison of three measures of subjective well-being indicates two areas of difference. First, life evaluation is less dependent on external circumstances than evaluation of the past year. Temporary changes in health, labor market status and income have a smaller impact on life evaluation than on evaluation of the past year. Second, measures concerning the whole life exhibit a significant positive relation between current and past levels of well-being, but there is no such relation in case of evaluation of the past year. Moreover, external factors have a greater impact on the emotional dimension of life evaluation than on cognitive.

JEL-Classification: D0, I31

Keywords: hedonic adaptation, subjective well-being, determinants of happiness

1 Introduction

The question of hedonic adaption 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 the changes in self-reported well-being. There is a long tradition of this type of research covering wide range of circumstances that people partially or fully adapt to.[1]

However, only recently well-being itself has been analyzed as an autoregressive process (Lee and Oguzoglu, 2007; Pudney, 2008; Bottan and Perez Truglia, 2011; Piper, 2012). In this context the time dimension of happiness is not restricted to the relation between past events and current happiness, but the link 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 the specific adaptation that can be described as the process of getting used to a specific life event, the general adaptation appeals to the idea that past levels of happiness affect its current level. According to this hypothesis the past higher or lower than normal well-being levels should result in the reversion to the individual's set point.

Other reason to have lagged dependent variable in the model is purely from a technical point of view. It can be perceived as a method to obtain correct standard errors of estimators in case of the serial correlation. Moreover, a dynamic model as indicated by Piper (2012) may be a solution to the misspecification of the static regression. Nevertheless, leaving behind theoretical aspects, I try to answer the question: are people that were happy in the past happy today? Obviously, to answer this meaningfully one have to control for various socio-economic variables and individual effects. The results from dynamic random effects probit model indicate, in accordance with previously mentioned studies, that life evaluation depends positively on its past. Hence, higher well-being in the past means higher well-being in the present. This result clearly contradicts the general happiness adaption theory. This phenomenon is however associated only with life evaluation since in case of evaluation of the past year there is no such dynamic relation.

Beside testing general adaption hypothesis the objective of this article is to compare the correlates of different well-being measures. From this point the precise distinction between different concepts of well-being will be introduced as it is crucial for avoiding confusion. While in most research the words well-being, happiness and life evaluation are used interchangeably, I will assign strict meanings to those. The well-being will be

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

used as the broadest concept including happiness, life evaluation and evaluation of the past year. Happiness will correspond to subjective evaluation of the life in terms of how happy it was. This measure shows the emotional assessment of the whole life. On the other hand, the measure of life evalauation is cognitive and is based on the question how individual think of his or her life. This measure reflects the perception of how good or bad the life was. Evaluation of the past year describe the cognitive evaluation of a one year. This measure is also cognitive like life evaluation, but has considerable shorter time interval that is evaluated.

It is possible to group these three measures into categories that are characterized by two features. One is time that describes how long is the period that is evaluated. In our case it is whole life and one year. The second deals with the distinction of two dimension of evaluation: cognitive and emotional. Cognitive measures show how individuals think of their lifes or last year. On the other hand, emotional measures are more about how one feels and his or her emotional states. These two features of well-being measures will define the axis of comparison. First, life evaluation and evaluation of the past year are cognitive measures, so they will consist a pair to analyze the differences and similarities in regard to time covered. Second, a juxtaposition of life evaluation with happiness will show what role has the emotional and cognitive dimension in determining well-being.

Despite the importance of distinction of different types of well-being most empirical research in the field ignores the variety of measures (e.g. Ferrer-i Carbonell, 2005; Rehdanz and Maddison, 2005; Easterlin, 2003) or use it only as a robustness check. Among the exceptions is the study conducted by Kahneman and Deaton (2010) that compares the correlates of life satisfaction and daily satisfaction. They came to the conclusion that life and daily satisfaction have different determinants. Nevertheless, extensive studies by psychologists have characterized and stressed the importance of different forms of well-being.[2] Seligman (2011) distinguishes 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. The concept is rooted in the utilitarian tradition of maximizing positive emotion at the same time minimizing the negative. The engagement happens when a person is absorbed by experiencing something. This might be for example a piece of art, sports activity or work. On the other hand, meaning is associated with having a purpose of life. The *onion* theory of psychological well-being proposed by Czapinski (1991) describes three layers of well-being: willingness to life (the most basic and the least dependent of external circumstances), general subjective well-being (eval-

[2]The mentioned studies mostly use the word *happiness*, but for the sake of consistency with the introduced typology in the previous paragraph I use word *well-being*.

uation of the life), domain satisfaction (for example, satisfaction with financial or family life). Czapinski (1991) did not only describe the layers of the well-being, but also showed that the inner levels are less dependent of changes in circumstances. Kahneman (1999) distinguished two different types of well-being: experienced and remembered. The first is associated with present experiences and the second is about how the life was in the past. Others identify even more categories, for example Dolan et al. (2006) distinguish five different accounts of well-being, they are: objective lists, preference satisfaction, flourishing (self-realization), hedonic and evaluative (assessment of individual life). To sum up the paragraph, it is clear that psychologists has recognized that it is impossible to treat well-being as one-dimensional. This point is made explicitly by Wong (2011), who stresses the importance of distinction between good meaningful life and hedonistic attitude when studying psychological well-being.

The theoretical concepts are corresponding with the distinction between different types of well-being in this study. Obviously due to empirical nature of the research it is impossible to map the dependent variables used into one of the mention typology, but there are strong similarities between theoretical accounts of well-being and variables used. For example, it could be expected that individuals when faced with the evaluation of their lives are more concentrated on the meaning, values that they represent and thinks of his life as a whole in terms of past experience. On the other hand, when the question concerns shorter time period individuals probably would tend to assess the particular events that happened within the time interval and try to weight the pleasures against unpleasantness. A hypothesis might be put forward that the life evaluation is more about meaning and feeling the purpose of life, but when it comes to shorter time periods individuals prefer to think in a more hedonistic way that compares the bad events with good one.

The presented hypothesis can not be directly tested within the proposed framework. Nevertheless, what can be said from the econometric analysis is how significant for the self-reported well-being are external factors. The econometric results show that life evaluation in comparison to evaluation of the past year is less dependent on external circumstances.

The second feature that is used for the comparisons is the distinction between emotional and cognitive measures. The question is, how do external factors affect life evaluation (cognitive) and happiness (emotional). One might think that there should not be any significant differences in determinants. However it also possible that the influence of various circumstances has stronger impact on emotional states so happiness should be more dependent on time changing socio-economics variables. To test this hypothe-

sis I compare the estimates for happiness and life evaluation. This comparison shows that happiness is characterized by stronger relation to external circumstances than life evaluation and indicate that the emotional evaluation tent to be less stable.

The remainder of the article develops these mentioned concepts and provide description of an empirical method used to test the presented hypothesis. First, the description of the data source with the information about the process of variable selection is provided. The third section covers the econometric method in details. The fourth section presents the results obtained from the model. Conclusions constitute the last part that summarizes the study.

2 Data description

The data used in the study come from Social Diagnosis[3] that is conducted every two years in Poland. It is a comprehensive household survey that provides information about numerous topics ranging from material conditions, health, political opinions to subjective well-being.

With exception of 2000-2003 period when the time difference between the first and the second wave was three years, the survey is conducted every two years since 2003. Due to this irregular time gap, that might distort the state-dependence of well-being, the sample was restricted to the period from 2003 to 2011. Based on this data a three-wave balanced panel was constructed. The panel includes 3706 individuals for whom the data for three consecutive waves were available. In case that an individual took part in more than three surveys in a row only the first three were included in the panel.

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

[3]The survey is conducted by Council for Social Monitoring survey. The information about the survey is available on the website: *http://www.diagnoza.com/index-en.html*.

In Social Diagnosis are three questions that directly ask respondents about well-being and were in the unchanged form in the course of following waves. One is the standard question about life evaluation, the second is about happiness as it was defined in the previous section, the third is evaluation of the past year. First two are measured on ordinal scales. The possible answers for life evaluation question are: delighted, pleased, mostly satisfied, mixed, mostly dissatisfied, unhappy and terrible. In case of happiness there are four levels: very happy, rather happy, not very happy and unhappy. Despite the differences those questions share one important characteristic, the distinction between a positive (happy/satisfied) and negative (unhappy/not satisfied) assessment is evident. Hence, as it has been already mentioned the binary variable is constructed in a such way that one is assigned to positive assessment and zero to negative. Neutral answers, like *mixed* in the question about life evaluation, are coded as zeros.[4] The question concerning evaluation of the past year is already in the yes/no form and asks if the last year was good for a respondent.

The variables that are considered as a determinants of the well-being can be divided into three categories: individual, household and regional. The individual characteristics used in the regression include gender, age, personal income, martial status, labor market status, mental and physical health, education, number of friends and religion practices. On the other hand, variables like the size of a apartment and household income are the same for all members of the household. Moreover, the empirical model has also a regional variable that assigns every observation the unemployment rate one of the sixteen voivodoships (an administrative region in Poland) that he or she lives in.

Among variables used only gender and the size of an apartment are constant over time for every individual. To be precise the apartment size variable exhibited time variation due to measurement error, because people tended to answer giving an approximate size of the apartment. In the Social Diagnosis survey the households were chosen at random by address, so the apartment size was unchanged, only the answer might vary in different waves. To avoid the impact of measurement the time average was calculated for every household. The time varying variables follow standard coding practices. Labor status indicates, if the individual is employed, unemployed or inactive. Martial status can be: single, married or divorced. Educational levels were coded at three levels: primary, secondary and tertiary.

Due to lack of objective variables describing health I use two measures of health that are based on self-assessment of respondents. One question reflects the physical indisposition like problems with walking. The second one is about health problems that

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

make the performance of daily activities difficult. Both questions have three answers that indicate the frequency of experienced problems: never, sometimes and often. Both variables are highly correlated, so I use only one. In the section presenting results the variable describing health problem (not physical indisposition) is used as a proxy for health. The estimation with physical indisposition are included in the appendix. Additionally to physical health I also proxy mental health by the observation if the individual visited a psychotherapist or psychiatrist in the last year.

The special interest in empirical studies of well-being is devoted to the question how does the income affect well-being. To obtain a more accurate picture of the relation I use three different variables of income: household income per member, individual income, and equivalent household income. The preferred measure is logarithm of relative household income per household member. There are three reasons for this. First, many studies emphasized (Clark, Frijters and Shields, 2008; FitzRoy et al., 2011) the role of social comparison when assessing individual well-being. I calculated the reference income as a median income in a sample in a given year. Second, the household income per capita also can be perceived as an approximation of individual consumption. Headey et al. (2004) show that consumption has at least the same impact as income on well-being. Lastly, according the standard economic theory with higher income the same increases in income should have smaller effect on well-being. This effect is captured by logarithmic transformation of income. Despite the main results are presented with relative household income per member I show estimates for other variables in the appendix.

3 Econometric model

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

The problem of biased estimates when lagged dependent variable is included is called an initial value problem. Since in the initial period the lagged dependent variable is taken as exogenous, but it is correlated with unobserved heterogeneity, the strict exogeneity assumption of random effect model is invalidated. There are three estimation strategy that deals directly with this problem proposed by: Heckman (1981), Wooldridge (2005)

and Orme (1996). The study by Akay (2009) show that Heckman's estimator has better performance in small samples. On the other hand, Arulampalam and Stewart (2007) and Panos (2008) provide evidence from simulation studies that the differences between methods are minor. Taking this into account results of those studies and the fact the panel has only three periods I prefer the Heckman's method.

The most general form of the model can be presented as:

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

Where y is a dependent variable that represents well-being, the index i stand for individual and t for time period. The y^* is a latent variable defined by the equation 2. The other notation used involve x as exogenous variables, α that stands for a individual random effect that is normally distributed with standard deviation σ_0 for $t = 0$ and σ for $t > 0$. The error terms is defined as ϵ and it is assumed that it has normal distribution with standard deviation set to one. Additionally, the error term is independent of individual effect.

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

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

The Heckaman's estimator is based on the idea of joint distribution of $y_0, ..., y_T$ characterized by equation 2 and the assumption regarding the disturbance. By stated assumptions and the model specification the likelihood function migth be formulated as:

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

Random effects models demand the exogeneity assumption, $E[\alpha_i | x_{it}] = 0$. This is a strict assumption and it not always possible to guarantee that it holds. The method to relax this assumption was proposed by Mundlak (1978). The most popular form

of Mundlak's correction involves specifying conditional random effect by adding time averages of all time-varying variables. The idea behind this step is that that the individual effects are probably correlated with time-invariant component of the independent variables. So the individual effects take the form of:

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

Besides the improved statistical properties of the model the introduction of time averages also might be useful as a tool of distinguishing a short-term and long-term impact of changes in variables. While in the model equation both variables and time-averages of those variables are included the coefficient of time-varying variables can be interpreted as the deviation from the steady-state. This can be expressed by regrouping the independent variables and coefficients associated with them, asterisks were assigned to time-averages:

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

To avoid unnecessary complication of notation the asterisks will be droped and it will be simply assumed that the variables that are time averages belongs to the set of independent variables. Having the complete specification (equation 2) of the model under the assumption of the normal distribution of α the heterogeneity can integrated out using Guasian-Hermite quadrature (Arulampalam and Stewart, 2007) or approximated by simulation. In this study the simulation is applied to evaluate the integral. To approximate the integral from equation 3 it is possible to take R draws from normal distribution, calculate for each draw the value of integrand and take the mean of obtained values. The formula for approximation of likelihood function is presented below:

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

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

The models' coefficients have no quantitative interpretation due to the fact that error term was normalized to one. However, to assess how does a change in some variable affect the probability of being happy or feeling satisfaction with own life one might calculate average partial effects. They are obtained by averaging the impact of change in a variable of interest on probability across individuals. The formula for a discrete case is:

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

A separate formula is used for continuous variables:

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

In the next section I will present the results from the Heckman random effect probit model with the Mundlak correction estimated using a simulated maximum likelihood method. I will also look at average partial effects to assess the quantitative impact on probabilities.

4 Estimation results

This section is divided into two parts: (1) life evaluation and evaluation of the past year and (2) life evaluation and happiness. The first subsection deals with the cognitive measures and the difference along the time axis. It will be focused on the autoregressive nature of life evaluation in comparison to evaluation of the past year. I will also cover the differences in correlates of both measures. The second subsection will involve the comparison of determinants of life evaluation and happiness.

4.1 Life evaluation and evaluation of the past year

The comparison of the estimation results for two cognitive measures of well-being indicates two main areas of difference. First, life evaluation tends to be more persistent than evaluation of the past year. The results show that the lagged variable in case of life evaluation is characterized by higher statistical significance and greater average partial effects than evaluation of the past year. Second, more variables in the model of evaluation of the past year are significant and average effects are greater. Both things together lead to the conclusion that evaluation of the past year is more dependent on external factors than life evaluation.

Table 1. Estimation results.

variables	life evaluation	happiness	evaluation of the past year
independent variables:			
lagged dependent variable	0.252 [0.100] *	0.221 [0.095] *	0.133 [0.089]
intercept	1.357 [0.258] ***	1.319 [0.218] ***	1.195 [0.186] ***
female	-0.053 [0.053]	-0.097 [0.051]	-0.054 [0.044]
age	0.002 [0.026]	0.095 [0.025] ***	-0.013 [0.024]
relative household income (log)	0.160 [0.080] *	0.359 [0.079] ***	0.272 [0.074] ***
apartment size	0.004 [0.001] ***	0.004 [0.001] ***	0.003 [0.001] ***
married	0.008 [0.053]	0.014 [0.051]	0.025 [0.048]
divorced	0.041 [0.102]	-0.045 [0.100]	0.021 [0.096]
number of friends	0.010 [0.005] *	0.011 [0.004] *	0.012 [0.005] **
religious practice	-0.018 [0.012]	-0.004 [0.012]	-0.004 [0.011]
health problems (often)	-0.130 [0.109]	-0.490 [0.097] ***	-0.637 [0.092] ***
health problems (sometimes)	0.002 [0.079]	-0.192 [0.074] **	-0.246 [0.070] ***
mental health	-0.249 [0.144]	-0.315 [0.140] *	-0.325 [0.132] *
inactive	-0.057 [0.121]	-0.204 [0.118]	-0.337 [0.110] **
unemployed	0.019 [0.135]	-0.501 [0.131] ***	-0.515 [0.124] ***
regionional unemployment	-0.006 [0.008]	0.003 [0.008]	-0.024 [0.007] **
secondary education	0.041 [0.050]	0.024 [0.048]	0.045 [0.045]
tertiary education	0.011 [0.069]	0.052 [0.067]	0.134 [0.064] *
time averages:			
age	-0.012 [0.026]	-0.105 [0.026] ***	0.009 [0.024]
relative household income (log)	0.437 [0.106] ***	0.186 [0.099]	0.210 [0.090] *
married	-0.061 [0.105]	0.065 [0.097]	0.106 [0.089]
divorced	-0.337 [0.202]	-0.026 [0.198]	-0.006 [0.176]
number of friends	0.008 [0.007]	0.009 [0.007]	0.011 [0.006]
religious practice	0.066 [0.016] ***	0.050 [0.015] ***	0.037 [0.013] **
health problems (often)	-0.614 [0.196] **	-0.502 [0.150] ***	-0.377 [0.140] **
health problems (sometimes)	-0.337 [0.144] *	-0.157 [0.114]	-0.144 [0.106]
mental health	-0.298 [0.217]	-0.222 [0.204]	-0.235 [0.187]
inactive	-0.074 [0.142]	0.082 [0.136]	0.383 [0.125] **
unemployed	-0.569 [0.198] **	-0.289 [0.187]	0.079 [0.170]
regional unemployment	-0.010 [0.010]	-0.029 [0.009] **	-0.007 [0.008]
sigma	0.953 [0.109] ***	0.870 [0.101] ***	0.642 [0.092] ***
log-likelihood	-5446.09	-5667.47	-5491.08
Halton draws	500	500	500

Note: For dummy variables the reference group is: male, single, without health problems, employed, with primary education. Statistical significance: *** 0.001, ** 0.01, * 0.05.

Table 2. Average partial effects.

variables	life evaluation	happiness	evaluation of the past year
lagged dependent variable	0.066 [0.029]	0.041 [0.016]	0.036 [0.021]
female	-0.013 [0.011]	-0.018 [0.008]	-0.014 [0.010]
age	0.001 [0.003]	0.018 [0.003]	-0.003 [0.004]
relative household income (log)	0.040 [0.020]	0.066 [0.016]	0.071 [0.026]
apartment size	0.001 [0.000]	0.001 [0.000]	0.001 [0.000]
married	0.002 [0.010]	0.003 [0.007]	0.006 [0.010]
divorced	0.010 [0.020]	-0.008 [0.015]	0.006 [0.019]
number of friends	0.002 [0.001]	0.002 [0.001]	0.003 [0.001]
religious practice	-0.005 [0.003]	-0.001 [0.002]	-0.001 [0.002]
health problems (often)	-0.033 [0.024]	-0.093 [0.021]	-0.190 [0.052]
health problems (sometimes)	0.001 [0.015]	-0.036 [0.013]	-0.065 [0.025]
mental health	-0.068 [0.035]	-0.060 [0.023]	-0.095 [0.037]
inactive	-0.014 [0.024]	-0.038 [0.189]	-0.088 [0.035]
unemployed	0.005 [0.026]	-0.095 [0.025]	-0.157 [0.046]
regional unemployment	-0.002 [0.002]	0.001 [0.001]	-0.006 [0.003]
secondary education	0.010 [0.010]	0.004 [0.007]	0.012 [0.010]
tertiary education	0.003 [0.013]	0.010 [0.010]	0.034 [0.017]

Note: Standard errors in the brackets are obtained by a simulation that exploits the variance–covariance matrix and the assumption that disturbances are normally distributed with the standard deviation one.

The estimation results that are presented in table 1 show that the coefficient of lagged life evaluation is statistical significant. The effect of positive life evaluation in the previous period is equivalent to the increase in time average relative income per member from 1 to 1.75 or from 2 to 3.5. This is result is not only statistically significant, but also quantitatively large. The value one of lagged life evaluation increases the probability of positive life evaluation on average by about 6.6 percentage points. On the other hand, lagged evaluation of the past year is insignificant with p-value 0.134. The quantitative impact of lagged evaluation of the past year on the present probability is smaller than in case of life evaluation and amounts to 3.6 percentage points with the standard error 2.1 percentage points.

The differences between life evaluation and evaluationt of the past year are not only limited to state-dependence. Both measures are characterized by different correlates. The general pattern is that life evaluation is less dependent on external circumstances. Temporary changes in income, health and labor status has no effect on life evaluation. However, changes in these variables have a quantitatively and statistically significant impact on evaluation of the past year.

Time averages of logarithm of relative household income per member are significant

in both cases. However, higher values are in case of life evaluation. In case of time-varying income the situation is reversed, the p-value for life evaluation is 0.0457 and 0.0002 for evaluation of the past year. The importance of temporary and permanent changes in income can be summarize as the ratio of the coefficient of the time average to the coefficient of the time-varying income. The ratio for life evaluation is 2.74. and 0.77 for evaluation of the past year. This show that in case of life evaluation the changes in the time average of income are much more important. The one period increase by one in relative household income per member has the same effect as the increase by one third in the time average. For evaluation of the past year the relation is almost one to one. The pattern is also documented with average partial effects. This statistic for life evaluation is equal to 4 percentage points and for evaluation of the past year is higher and amounts to 7 percentage points.

Using equivalent household income instead of logarithm of relative household income per member shows a similar pattern, that is even more pronounced in this specification. Time-varying equivalent income in case of life evaluation has negative, but statistical insignificant coefficient. The value of the same coefficient in the model of evaluation of the past year is 0.21 with the standard deviation 0.07, which indicate high significance. However, for both measures personal income is insignificant. This shows that for well-being the household financial situation is more important than personal income. Moreover, since the personal income is nominal not relative the result might indicate the importance of social comparison.

In case of reported health the temporary changes does not affect life evaluation. Both dummy variables that describe the frequency of health problems are insignificant. On the other hand, time averages are highly significant. This shows that permanent health problems have a detrimental impact on life evaluation. A different pattern emerge in the model of evaluation of the past year. The time-varying health variables are highly significant. The impact of frequent health problems has comparable effect as the reduction of household income per member from 10 times the median to the median. The average health plays limited role in determining well-being during the past year and only frequent health problems have significant impact on evaluation of the past year. Replacing the health problems variable with the disability variable shows the same relation for both measures.

The labor status has little influence on life evaluation. One year change in labor status has negligable impact on the probality on having a positive assessment of the whole life. Some effect is only significant in case of average number of times being unemployment. Nevertheless, the unemployment lowers significantly the probability

of the positive assessment of the past year. The effect is large and is comparable to having frequent health problems. There is also a negative temporary impact of being inactive on evaluation of the past year, but interestingly there is also a positive effect of being longterm inactive. This might indicate that there is a difference between labor deactivation and being nonworking due to other reasons, like school and age pension.

Despite the importance of the differences when comparing life evaluation with evaluation of the past year, there are some similiarties between both measures. First, in both cases martial status is insignificant when determining the probability of a positive assessment. Second, the deviation from an average number of friends positively affects well-being, but the change in the time average of number of friends has no such effect. Third, religious people have better evalution, but temporary increase in attendance in religious practices is insignificant. Moreover, apartment size is in all cases important, but age and gender are not significant.

While the independent variable was constructed from ordinal scale there is possibilty that at least some resutls are driven by coding strategy. To check this point I recoded the life evalution varaible by setting 1 for the *mixed* answer. The table 3 shows that there is litle diffrence between both models. The conclucions that might be reached using the modified life evaluation are even sharper in comparison to the orginal speciffication, while the new measure shows stronger state-dependance and is slightly less dependant on external factors. The only large diffrence is with the time average of mental health variable. It is insignificant in the orginal model, but strongly significant with new coding. For the new variable also long-term health is less important when determining life evaluation. Neverthless, the main results are consistant with both coding practices.

4.2 Life evaluation and happiness

Before moving to the discussion of differences between life evaluation and happiness it is worth analyzing similarities. One common feature for both well-being measures is their state dependance. The past well-being has a positive effect on the current level. This statistically significant impact of the past shows that the hypothesis of general adaption can not be proved in case of well-being concerning whole life. Other similarities concern specific determinants of the well-being. In all cases the time varying variables that are significant are: apartment size, number of friends and mental health.

Despite mentioned similarities there are major differences how the socio-economic variables affect happiness and life satisfaction. In model describing happiness more variables are significant. Moreover, the emphasis for happiness is put more on the deviation

Table 3. 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]	
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	

from the trend. The variables that are significant in case of happiness, but insignificant for life satisfaction include those of income, labor status and health. This means that temporary changes in income, employment status or health have no significant effect on life satisfaction, but affect happiness.

In case of both types of well-being the average income during the six years has a highly significant impact on well-being. However, the coefficient of the time varying income in the model of life evaluation is only significant at the critical value 0.05. The results can be interpreted in a following way: richer people are assessing their lifes better, but a temporary boost has a relatively small effect on life evaluation. The ratio of the coefficient of time average to time-varying is 2.74. A different pattern comes from the regression explaining happiness. In this model the deviation from the time average has a positive significant effect on the self-reported assessment. The ratio of coefficients is much smaller than in the model of life evaluation and is equal to 0.52. This results are also supported by looking at average partial effects. An increase in logarithm of relative household income per member by one is associated with a higher probability of being happy or having a positive assessment of life. The figure is larger for happiness and is equal to 0.066 in comparison to 0.040 in case of live evaluation. The standard error is also smaller in case of happiness, 0.020 and respectively 0.016 for life evaluation.

Using equivalent income instead of relative household income does not change results. However, personal income seems to be unrelated with life evaluation and happiness. The test for non-linearity by including squared relative household income per member shows that squared term is significant only in the model of happiness. Nevertheless, in general the logarithmic transformation yields better fit that quadratic one.

The major difference between life evaluation and happiness in the context of health is due to different strength of the impact of temporary changes in a health variable. In case of happiness all three (physical and mental) health variables are significant and the effect is quantitatively important. Having often health problem is associated with reduced probability of being happy by 0.093. The same figure for life evaluation is 0.033. Additionally, none of the time varying health variables are significant in the model of life evaluation. Replacing the health problems variable with a variable describing disability does not alter main conclusions.

As it was in the juxtaposition of life evaluation and evaluation of the past year the coding practice does not influence the results.

5 Conclusions

In this study I compared determinants and state-dependance of three different types of well-being: life evaluation (how good was life), happiness (how happy was life) and evaluation of the past year (how good was the past year). The life evaluation and evaluation of the past year represent cognitive measures. On the other hand, happiness is associated with an emotional assessment of the whole life. The comparisons are conducted along two axis: period evaluated (year or life) and cognitive/emotional dimension. To assess the impact of the length of evaluated period I juxtaposed life evaluation and evaluation of the past year. Moreover, I analyzed the differences in cognitive and emotional dimensions comparing life evaluation with happiness.

The juxtaposition of life evaluation and evaluation of the past year indicate two main differences. First, life evaluation is less dependent on the external circumstances. Changes in relative household income, labor status or health are insignificant or their significance is marginal in comparison to evaluation of the past year. On the other hand, an assessment of the past year is mostly influenced by the current event. The external circumstances play the major role in determining positive evaluation of the past year. Second, life evaluation is autoregresive. The positive evaluation of the whole life in the previous period has a significant positive impact on the current well-being. Evaluation of the past year lacks the dynamic relation of this sort.

Life evaluation and happiness refer to two ways of assessing life. Both types of well-being are autoregresive. However, despite this similarity there are substantial differences in determinants of both measures. While temporary changes in income, health and labor status have no effect on life evaluation, they affect happiness. As a result the socio-economic factors are more important as the determinant of happiness than life evaluation.

Appendix

The appendix provides the estimation results of different specifications of the model. I test for different types of income and health variables. The time-averages were excluded due to limited space, but the figures are available at request.

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]	
apatament size	0.004 [0.001]	0.004 [0.001]	0.003 [0.001]	0.004 [0.001]
martial 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]
labor 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

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]	
apartment size	0.004 [0.001]	0.004 [0.001]	0.003 [0.001]	0.004 [0.001]
martial 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]
labor 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]
teritary	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

Table 6. Estimation results - evaluation of the past year.

variables	model I	model II	model III	model IV
lagged dependnet variable	0.150 [0.099]	0.161 [0.095]	0.165 [0.092]	0.126 [0.090]
intercept	0.657 [0.192]	0.953 [0.279]	0.261 [0.179]	1.205 [0.186]
female	-0.053 [0.044]	-0.026 [0.045]	-0.041 [0.043]	-0.047 [0.044]
age	-0.015 [0.024]	-0.022 [0.025]	-0.038 [0.024]	-0.018 [0.024]
relative household income:				
level	0.244 [0.096]			
logarithm				0.268 [0.076]
squared	-0.019 [0.013]			
personal income:				
logarithm		-0.004 [0.006]		
equivalent income			0.213 [0.069]	
apartment size	0.004 [0.001]	0.003 [0.001]	0.003 [0.001]	0.004 [0.001]
labor status: married	0.028 [0.048]	0.017 [0.048]	0.017 [0.048]	0.016 [0.048]
divorced	0.016 [0.095]	0.005 [0.096]	0.014 [0.095]	0.023 [0.096]
number of friends	0.012 [0.005]	0.012 [0.005]	0.011 [0.005]	0.011 [0.005]
religious practice	-0.004 [0.011]	-0.004 [0.011]	-0.006 [0.011]	-0.006 [0.011]
health:				
problems (often)	-0.631 [0.092]	-0.632 [0.094]		
problems (sometimes)	-0.243 [0.070]	-0.246 [0.071]		
disability (often)			-0.631 [0.096]	-0.644 [0.094]
disability (sometimes)			-0.206 [0.067]	-0.217 [0.067]
mental	-0.335 [0.132]	-0.344 [0.134]	-0.329 [0.133]	-0.332 [0.135]
labor status:				
inactive	-0.356 [0.111]	-0.377 [0.110]	-0.348 [0.111]	-0.325 [0.111]
unemployed	-0.538 [0.123]	-0.562 [0.123]	-0.534 [0.125]	-0.516 [0.123]
regional unemployment	-0.025 [0.007]	-0.026 [0.008]	-0.029 [0.007]	-0.025 [0.007]
education:				
secondary	0.043 [0.045]	0.050 [0.045]	0.041 [0.045]	0.045 [0.045]
teritary	0.132 [0.064]	0.143 [0.064]	0.130 [0.063]	0.133 [0.064]
sigma	0.628 [0.105]	0.653 [0.104]	0.600 [0.099]	0.641 [0.094]
log-likelihood	-5500	-5608	-5462	-5474
Halton draws	500	500	500	500

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