An Analysis of Subjective Well-being and Individual Comparison under Structural Equation Model

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Abstract. Objective: To analyze the directional effects of individual comparison on subjective well-being in the elderly in the diachronic data, which aims to provide theoretical exploration for the subjective well-being(SWB) of old age. Methods: Based on the data of the follow-up survey on the influencing factors of health and longevity of the elderly in China from 2008 to 2018. The MPLUS multi-level growth model is used to analyze the longitudinal relationship between subjective well-being and individual comparison, including the influence of control strategies on subjective well-being. Results: The model shows that the change of individual comparison of the elderly can significantly predict the level of subjective well-being. In individual comparison, temporal comparison has a significant predictive effect on subjective well-being, and the elderly will use temporal comparison more. The influence of social comparison on the intercept is significant, but not on the slope, so it is presumed that social comparison is a short process. Overall, the individual comparison is a dynamic process. Conclusion: It is feasible for the elderly to adjust their cognition and use "comparison" to cope with negative emotions.

Keywords: multi-level growth model;the elderly; subjective well-being;individual comparison

1 Introduction

According to the Ministry of Civil Affairs (MCA), China will enter a moderate aging society during the 14th Five-Year Plan period, and the absolute number of the elderly population will exceed 300 million nationwide, but the growth curve of the elderly population is relatively flat, which is a valuable "window period" to actively deal with population aging[22]. This large group of people needs more attention to their lives and physical and mental health, and with the empty nest problem brought about by the one-child policy of the previous generation, and even the problem of losing one's family[18], the subjective well-being(SWB) of the elderly in their old age is particularly important as a group of people who created the era. There is a long history of research on well-

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being, and subjective well-being can improve health and longevity. There is substantial evidence that subjective well-being predicts a range of successful outcomes, including longer healthy lifespan and psychological functioning [2], happier people tend to live longer[8], have better cardiovascular health[3], and stronger immune systems[13]. Howell, Kern and Lyubomirsky[12] in a meta-analysis of 150 studies found that SWB affects short and long-term health through a variety of objective indicators.

The subjective well-being of older adults in both the top and bottom provinces of China's overall competitiveness ranking was surprisingly at a high level, a phenomenon that researchers tend to favor as a cognitive evaluation model of "less than the top and more than the bottom" among older adults[23]. Can this comparison model really have an impact on the subjective well-being of older adults? In this paper, we investigate whether horizontal social and temporal comparisons among individual comparisons have an impact on subjective well-being of older adults through the tracking survey data of factors influencing healthy longevity of older adults in China. As an important secondary control strategy to enhance the sense of control, "social comparison" can also provide some feasible ideas for interventions to enhance the sense of control.

2 Data processing and analysis methods

2.1 Data sources

This study uses data from the Chinese Longitudinal Healthy Longevity Survey (CLHLS), which is the most extensive and longest-running social science survey in China, covering 22 Han provinces, and is repeated every three years with high data quality[17]. Considering the construction of variables and the consistency of data, only the tracking data from 2008 to 2018 were selected, and the topic information of these four tracking data is exactly the same, and the question types of the remaining years have been changed, which cannot meet all the information needed for the study, and the structure of people has also changed.

2.2 Methodology

2.2.1 Handling of Missing Values

CLHLS data are longitudinal data, and comprehensive experience in processing CLHLS data [19]. A total of 2453 persons who were still alive during 2008-2018 were retained, and the data were filled manually by means of control filling to ensure that the data came from the same subjects to reduce errors. The data from the year of the missing year were filled with data from the year after the subject, and then the data from the year before the missing year were used to fill in the data from the missing year, and finally, the remaining part that could not be filled in was less than 5% univariate and total missing rate.

2.2.2 Model selection

Although the CLHLS data are equidistant in the year of repeated measurements, they are not strictly in accordance with the specific time interval. The multilevel model does not require strict time intervals, and since the curve model requires a minimum of six observations, there are only four observations that meet the required data. Therefore, this paper adopts Multilevel Linear Growth Model (MLGM) for analysis, and adopts Maximum Likelihood (ML) for estimation, without excluding data with missing values and without interpolation.

The Level 1 sub-model is a measurement level, describing the development of individuals over time.

$$Y_{ti}=\pi_{0i}+\pi_{1i}T_{ti}+\pi_{2i}X_{ti}+e_{ti} \quad (1)$$

The Level 2 sub-model is at the individual level and explains the differences in growth between individuals.

$$\pi_{0i}=\beta_{00}+\beta_{01}W_i+r_{0i} \quad (2)$$

$$\pi_{1i}=\beta_{10}+\beta_{11}W_i+r_{1i} \quad (3)$$

$$\pi_{2i}=\beta_{20}+\beta_{21}W_i+r_{2i} \quad (4)$$

Where T_{ti} is the indicator variable for the observation time, such as four observations in this paper, is assigned as [1, 2, 3, 4]; the initial level π_{0i} and growth trajectory of each individual π_{1i} are expressed as a linear combination of expected mean β_{00}、β_{10}, random deviation r_{0i} 、 r_{0i}, respectively. β_{01}, β_{11} denote the effects of non-temporal variables on the initial level and growth trajectory W_i, respectively, and π_{2i} represent the effects of time-varying covariates X_{ti} .

The composite model is:

$$Y_{ti}=\beta_{00}+\beta_{01}W_i+\beta_{10}T_{ti}+\beta_{20}X_{ti}+\beta_{11}W_i\times T_{ti}+\beta_{21}W_i\times X_{ti}+r_{0i}+r_{1i}T_{ti}+r_{2i}X_{ti}+e_{ti} \quad (5)$$

The Model I of this study is an unconditional growth model of subjective well-being, incorporating time variables to explore the interaction between subjective well-being and time, and if there are significant differences in residual variance, a complex model is needed for further explanation; The Model II incorporates individual comparisons (social comparison and temporal comparison) as latent variables to establish the regression relationship between subjective well-being on both, and to explore the effects of slope and intercept, etc. Models III and IV incorporate non-time-varying covariates and time-varying covariates, respectively, to explore the effects of slope and intercept, etc.

2.2.3 Model evaluation metrics

ICC refers to the proportion of inter-individual variance (τ_{00}) among the total variance of the outcome variables.

$$ICC=\tau_{00}/(\tau_{00}+\sigma^2) \quad (6)$$

ICC reflects both between-group variance and between-individual correlation within a group, and when ICC tends to zero, it indicates that there is no group effect. The smaller the absolute value of the maximum likelihood estimate (Loglikelihood), the better the fit. The smaller the value of Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC), the better the fit.

2.3 Variables Measurement

2.3.1 Measurement of main variables

The measurement of subjective well-being of CLHLS has been studied many times before[5] and is relatively mature. A total of six questions were used to measure SWB, including three aspects of life satisfaction, positive emotions, and negative emotions. Life satisfaction measured as "self-reported quality of life". Positive emotions were measured as "look on the bright side of things" and "be happy as younger", while negative emotions were measured as "feel fearful or anxious", "feel lonely and isolated" and "feel useless with age". After inverting the reverse responses, the higher the final score, the higher the SWB.

The Cronbach' alpha of subjective well-being of the elderly in this study for the four follow-up data was 0.663, 0.699, 0.710, and 0.683, respectively.

The main ways of individual comparison are social comparison and temporal comparison. Social comparison refers to the process of comparing one's abilities, feelings, situations, and opinions with others, while temporal comparison refers to the comparison of one's self-quality over different time periods, which together constitute individual comparison[20]. Since the data used in this paper are from the same group of subjects tracked over different time periods, both social and temporal comparisons can be conducted using the same topic. The final question for the "individual comparison" was "How do you rate your economic level compared to others?" The scale itself is based on Liket5. The scale itself was scored using Liket5, which was simplified to Liket3 in this study, with 1 being "rich", 2 being "average", and 3 being "poor".

2.3.2 Variable Coding and Dummy Variable Setting

According to the model setting, the variables in this study are divided into time-variant covariates, which are time-invariant covariates with reference to individuals (level 1), and non-time-invariant covariates, which are not time-invariant covariates with reference to different groups (level 2). According to previous studies on the factors influencing SWB, the variables studied are mainly classified as economic level, social relationship, health status and individual situation, among which economic level, social relationship and health status are time-invariant covariates and individual situation is a non-time-invariant covariate. Since the topic of "individual comparison" was selected as the content of economic comparison, we classified the content of longitudinal time comparison in "individual comparison" as "economic level" and the content of cross-sectional temporal comparison in "individual comparison" as "economic level". The cross-sectional social comparisons in the "individual comparison" are grouped into "individual situation".

Table 1. Coding table of variables related to SWB

		Assignment		
Classification	Variable	Reference		
Economic level （level 1）	Individual comparison(temporal comparison)	1 rich	2 average	3 poor
	Absolute income	0 Low	1 High	
	Economic sources	0 other	1 pension	
Social relations （level 1）	Social support	0 other	1 family	
	Residence status	0 other	1 living with family	
	Marital status	0 living alone	1 living with spouse	
Health status （level 1）	Physical health	0 poor	1 good	
	MMSE	0 poor	1 good	
Individual status （level 2）	Sex	1 male	2 female	
	Education level	0 uneducated	1 educated	
	Basline age	1=60-69; 2=70-79;3=80-89; 4=90+		
	Individual comparison (social comparison)	1 rich	2 average	3 poor

Among the time-varying covariates, the physical and MMSE of the elderly group cannot be neglected as part of the "physical health" composite of Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL). A total of 14 questions were used to measure overall physical health[4]. The Mini-Mental State Examination (MMSE) was also used as a measure of cognitive health, and a score of 27 or more was regarded as "1", indicating good cognitive health, while the rest was regarded as "0". The rest of the scale is classified as "0". The dummy variables were also used to classify the marital status as "living alone" and "living with partner" to reduce the model coefficients were reduced. Since the absolute income does not conform to the normal distribution, the median is used as the cut-off point, with "high income" above the median and "low income" below the median. The question chosen for "Social support" was "Who takes care of you when you are sick?" The remaining items were recorded as "other"(Table 1).

The age structure of the base-period participants in this study was 61-108 years, and age was not categorized as a continuous variable, with a mean age of 75.06 years; 46.7% (n=1146) of men and 53.3% (n=1307) of women; 48% (n=1178) of uneducated and 52% (n=1275) of educated.

3 Results

The residual covariance of Model I(Table 2) responded to the relationship between initial SWB and rate of change without controlling for other covariates, and the relationship between initial SWB and rate of change was negative and statistically significant (τ=-0.697, SE=0.182, $p<0.01$). The rate of change over time did not increase significantly (β=0.118, SE=0.030, $p>0.05$), and there was no time effect for SWB without the

inclusion of covariates. While the residual variance decreased from 8.547 in the initial model to 7.256 in the final model, the proportion of variance reduction was 15.1%, which means that 15.1% of unexplained SWB was explained after the inclusion of time-varying covariates and non-time-varying covariates.

After adding individual comparisons to Model II (Table 2), it can be seen that at the level of cross-sectional social comparisons, the worse one feels one's economic condition compared to others, the lower one's SWB (β=-0.530, SE=0.170, p<0.01). In terms of longitudinal temporal comparisons, the rate of change in SWB was lower for those who felt worse off financially (β = -1.664, SE = 0.075, p < 0.01), and it is particularly noteworthy that the variance of SWB at level 2 was no longer significant once individual comparisons were included (τ_{00} = 2.710, SE = 1.410, p > 0.05), indicating that without considering other factors individual comparisons can basically explain all the differences in SWB in cross-sectional comparisons. The ICC is 0.25 at this point, indicating that the differences in subjective well-being clusters across individual comparison groups are small.

Table 2. Multilevel growth model fitting results (I)

Parameter	Coefficient (standard error)	
	Model I	Model II
Intercept part		
SWB	22.249** (0.085)	26.784** (0.320)
Social comparison		-0.530** (0.170)
Slope part		
Temporal comparison		-1.664** (0.075)
Social comparison		0.027 (0.057)
Time	0.118 (0.030)	-0.003 (0.119)
Random effects		
SWB τ_{00} (level 2)	5.039** (0.572)	2.710 (1.410)
Slope of SWB	0.423** (0.070)	0.390** (0.067)
SWB σ^2 (level 1)	8.547** (0.173)	8.141** (0.173)
Fitted indicators		
N:	2453	2453
ICC:	0.371	0.250
Loglikelihood:	-26013.688	-25585.704
AIC:	52039.375	51195.408
BIC:	52082.517	51281.692

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

With the inclusion of non-time-varying covariates in Model III (Table 3), the baseline level of subjective well-being was 0.827 (SE=0.176, p<0.01) lower for women than for men, ceteris paribus, but the growth rate of subjective well-being was 0.141 (SE=0.064, p<0.05) higher than for men. Initial age had a significant effect on the initial level and rate of change of subjective well-being, with the older group having lower baseline subjective well-being (β=-0.326, SE=0.095, p<0.01) but having a higher rate of change (β=0.073, SE=0.032, p<0.05). Relative income, at the social comparison

level, did not have a significant effect on the rate of change of subjective well-being, but had a significant effect on the intercept of subjective well-being (β=-0.454, SE=0.170, p<0.05). Relative income at the level of temporal comparison, the poorer the group felt, the lower the subjective well-being (β=-1.652, SE=0.075, p<0.01). The variance of SWB at level 2 remained insignificant (τ_{00} =2.661, SE=1.394, p>0.05), indicating that individual comparisons continue to explain all differences in SWB in cross-sectional comparisons

Table 3. Fitting results of multilevel growth model (II)

Parameter	Coefficient (standard error)	
	Model III	Model IV
Intercept part		
SWB	28.238** （0.518）	27.062** （0.569）
Relative income(social comparison)	-0.454* （0.170）	-0.378* （0.167）
Gender	-0.827** （0.176）	-0.663** （0.173）
Education	0.568* （0.182）	0.287 （0.096）
Baseline age	-0.326** （0.095）	-0.180 （0.010）
Slope part		
Relative income(temporal comparison)	-1.652** （0.075）	-1.410** （0.074）
Relative income(social comparison)	0.029 （0.058）	0.045 （0.057）
Residence style		0.502** （0.110）
Social support		0.167 （0.167）
Marital status		0.524** （0.096）
Economic source		0.531** （0.106）
Absolute income		0.365** （0.096）
MMSE		0.506** （0.086）
Physical health		-0.108** （0.008）
Gender	0.141* （0.064）	0.207** （0.063）
Education	0.026 （0.066）	0.025 （0.065）
Baseline age	0.073* （0.034）	0.152** （0.035）
Time	-0.385* （0.191）	-0.475* （0.187）
Random effects		
SWB τ_{00} (level 2)	2.661 （1.394）	9.140** （2.117）
Slope of SWB τ	0.382** （0.067）	0.311** （0.072）
SWB σ^2 (level 1)	8.123** （0.172）	7.256** （0.185）

Fitted indicators		
N：	2453	2439
ICC：	0.247	0.557
Loglikelihood：	-25510.727	-25093.355
AIC：	51057.454	50278.711
BIC:	51186.881	50609.189

Note: * indicates $p < 0.05$; ** indicates $p < 0.01$

when only the non-temporal covariates of the study are included. At this point, the AIC and BIC indicators are not very different compared to model II, and the model needs to include more variables to explain the results.

After model IV(Table 3) included time-varying covariates, the ICC reached 0.557, which could already explain 55.7% of the differences in SWB. subjective well-being varied widely across groups but had high intra-cluster consistency. evaluation indicators such as AIC and BIC decreased significantly, indicating a better model fit. The mean value of subjective well-being in the control group was 27.062 (SE=0.569, $p<0.01$), which was consistent with model III. Subjective well-being at this time showed a significant time effect, with a decreasing subjective well-being of 0.385 (SE=0.191, $p<0.05$) for each follow-up. For temporal comparisons, the rate of increase in subjective well-being was lower for groups who perceived themselves as poorer (β=-1.410, SE=0.074, $p<0.01$). As in Model III, the social comparison had a significant predictive effect on the initial value of subjective well-being (β=-0.378, SE=0.167, $p<0.05$) and no effect on the rate of change of subjective well-being (β=0.045, SE=0.057, $p>0.05$).

Regarding the economic level, both economic source (β=0.531, SE=0.106, $p<0.01$) and absolute income (β=0.365, SE=0.096, $p<0.01$) were significant predictors of subjective well-being in the elderly group. In other words, the subjective well-being was higher for the group with pension and high income.

Regarding social relationships, living with family (β=0.502, SE=0.110, $p<0.01$) and partner (β=0.524, SE=0.096, $p<0.01$) had higher subjective well-being. In contrast, being sick or not being cared for by close relatives (β=0.167, SE=0.167, $p>0.05$) did not have a significant effect on the level of subjective well-being.

For physical health, subjective well-being was higher in the cognitively healthy group (β=0.506, SE=0.086, $p<0.01$) and lower the subjective well-being the worse the physical health (β=-0.108, SE=0.008, $p<0.01$). The individual condition aspect remained largely consistent with model III.

4 Conclusions

Humans assign meaning to life through comparison and do not rely exclusively on objective criteria to measure their positioning in social groups. Subjective well-being, on the other hand, is characterized by wholeness, subjectivity, and relative stability, and

subjectivity itself determines that groups compare themselves to others when they cannot meet objective criteria[9].

This paper explores the psychological mechanism of subjective well-being in old age by, first, exploring the orienting effect of individual comparison on subjective well-being of old age groups through tracking data in both cross-sectional and longitudinal dimensions. Secondly, we consider previous studies and add several factors that have a greater impact on subjective well-being in previous studies for simultaneous research, such as economic level, physical health and individual differences, in order to more reasonably explore the factors that influence the generation of subjective well-being in older adults.

Among individual comparisons, temporal comparisons have a significant predictive effect on subjective well-being, that is, a benign self-economic evaluation compared to one's own upbringing leads to higher subjective well-being, and previous studies have also pointed out that older adults use more temporal comparisons as their social ties decrease and their ability to gain perspective decreases[15], which is also known as "knowing what to expect". Relative to temporal comparisons, social comparisons explain almost all of the cross-sectional subjective well-being variance if covariates are not included, and after the inclusion of covariates, the effect of social comparisons on the slope of subjective well-being is no longer significant. Thus, we conjecture that social comparison itself is short-lived, individual comparison is a dynamic process, and subjective well-being is a stable trait, and social comparison at a certain time period does not have a long-term effect on subjective well-being, but more of a dynamic effect on subjective well-being at a certain time period in a short period.

Among the factors influencing subjective well-being in previous studies, in terms of economic level, enjoying a pension and having a relatively high absolute income can make older people happier[21]. This implies that the abundance of life is also an important source of SWB for the elderly group[14]. In the study of social relationships, being able to live with family, especially being able to live with a partner, was also a source of stable SWB for older adults, which is consistent with the previous findings of Vivaldi and Barra[16]. In terms of physical health, fewer limitations in somatic functioning lead to higher SWB, and previous studies have shown that changes in somatic conditions can alter life satisfaction [4], which is an important component of subjective well-being. The lower subjective well-being of older adults with poorer MMSE may be due to the fact that MMSE affects a person's positive emotions, which affects subjective well-being[6].

For studies on individual differences, being educated did not affect subjective well-being in older age groups, and some studies suggest that this may be due to social expectations and cultural differences[1]. In contrast, subjective well-being is lower in women, considering that it is because women experience positive and negative emotions more frequently and intensely than men[10]. The time effect of subjective well-being was significant and tended to decline in the final model, which is consistent with previous findings by Clemente and Sauer[7], suggesting that subjective well-being tends to decline with age, and that this change may not be solely due to age itself, but may also be due to a combination of causes associated with aging.

5 Implications and shortcomings of the study

The difference in subjective well-being caused by "comparison" has been a topic of research for many years. This paper, starting from local tracking data and using a longitudinal model, examines both the horizontal and vertical effects of individual comparison itself on subjective well-being from a new research framework, providing directions for interventions to enhance subjective well-being in older age groups, and suggesting that living an affluent life for the elderly may be a favorable way to enhance SWB. The disadvantage is that due to the large data sample, the measures of subjective well-being and individual comparisons are relatively single measures, and the results are relatively poor compared to multi-scale tests. This mainly lies in the fact that single measures are not very sensitive to subtle changes in the measured phenomena and therefore can limit the range of observed changes[11]. And due to database content limitations, the combined effects of various aspects of subjective well-being have not been comprehensively studied, especially the lack of institutional-level data makes the study inadequate.

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