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Research Article

Education Inequality and Successful Ageing in China: Historical Legacies and Policy Implications

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Abstract

Did historical access to education, or lack thereof, make Chinese older adults' perception of themselves unique as compared to their counterparts across the world? We consider the impacts of idiosyncratic institutional development, particularly in terms of access to formal education, on objective and subjective ageing in China. Using data from a 2018 survey of 6118 aged Chinese, we endogenously identify and generate three composite latent factors representing objective cognitive ability, subjective self-evaluation of health and well-being, and incidence of age-related ailments. We define two linear simultaneous equations representing subjective and objective successful ageing to find that Chinese adults maintain an observable distinction between the two. We further observe the consequences of China's historical lack of access to formal education amongst this age group and its impact on their ageing. While those directly affected by the Great Leap Forward (1958-1962) and the Cultural Revolution (1966-1976) do not show any direct negative impact on the cognitive ability as older adults, being subject to these policies has permanently impaired their self-esteem, thereby exerting a discernible indirect effect on the cognitive ability of Chinese older adults. Our results demonstrate the importance of multidimensional evaluation of ageing and identify the potential impact of promoting lifelong learning as a Chinese policy response. We suggest that the government recognise the value of cognitive rehabilitation to compensate for the insufficient educational opportunities when young.

Keywords

Successful Ageing, Subjective and Objective Ageing, Education Access, Cognitive Ability, Self-esteem, China, Historical Institutional Context, Structural Equation Modelling

1. Introduction

The institutional history of education in China is unique. During the Cultural Revolution, China underwent a significant period between 1966 and 1976, when Chinese students were deprived of access to higher education. The economic and social impacts of this period are well documented [16, 31, 36]. The generation anecdotally most affected are those born between 1950 and 1960, who are today between 65 and 75 years old. For those born before and after this period, while access to education was heterogeneous, it was at least notionally available.

We ask whether historical educational availability discernibly impacts subjective versus objective ageing among Chinese adults. Did historical access to education, or lack thereof, make Chinese older adults' perception of their own wellbeing unique as compared to their counterparts across the world? As such, is ageing in China discernibly different from ageing

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elsewhere? If so, what makes them different?

What does it mean to age successfully? Although one may live to be 100 years old, his or her quality of life may have long since deteriorated. Conversely, anecdotal evidence suggests that a significant number reach 100 years of age and appear to maintain a quality of life commensurate with their younger years. Longevity alone cannot define successful ageing (SA); it is but one component of human existence [29].

We define three composite latent factors from a pool of 16 individual health and behaviour indicators using a 2018 survey of 6118 Chinese aged over 45 years, across 150 county-level units and 450 village-level units. We define objective cognitive capacity, reflecting objective SA, as a combination of memory, arithmetic, and learning capacities. We define subjective SA as the composite self-evaluation of one's own health and well-being, whose elements are self-assessed life satisfaction, health, and life expectancy. A third composite factor, which captures age related ailments among respondents, consists of the incidence of Parkinson's Disease, Alzheimer's Disease, and memory problems.

We use structural equation modelling (SEM) to identify and generate composite factor series with heteroskedasticity robust standard errors that are used in subsequent standard econometric experiments following Barreto et al. (2022) [3] and Kostov and Le Gallo (2018) [28]. We specify two linear equations representing subjective and objective aging under a set of rigid assumptions. The endogeneity between the two is addressed through instrumentation and direction of bias. We find that Chinese adults, broadly speaking, like their international counterparts, maintain an observable distinction between objective and subjective ageing. We also observe the consequences of the idiosyncratic institutional development in China, particularly in terms of the impact of education on ageing.

We are motivated by the stylised facts on ageing common to the entire world and their idiosyncratic implications on China. We observe that while the world is rapidly ageing, China is among the fastest-growing countries globally. The World Health Organisation estimates that Chinese over 60 years will reach 28 percent by 2040 as compared to estimates for the entire world, suggesting that by 2050, only 22 percent will be over 60 years. In addition, the current estimate of age-related ailments in China suggests that 75 percent of people over 60 years in 2019 suffer noncommunicable diseases such as cardiovascular disease, diabetes, and hypertension.[1]

We observe that health in older age is not random. Most of the variation in older people's health is behavioural due to access to opportunities within their respective physical and social environment.[2] Given the idiosyncratic nature of Chinese institutional development, we expect some idiosyncratic behaviour from Chinese older adults. Given the demographic future of China, comprehensive public health action will be required. That action needs to specifically understand the difference between ageing, the gradual functional decline of the human body, and healthy ageing, the process that enables older people to continue to lead constructive lives during this decline. Our results demonstrate the importance of multidimensional evaluation of ageing and identify the potential impact of promoting lifelong learning as a Chinese policy response. We suggest that the government recognise the value of psychological, social, and self-perceptual aspects to compensate for the insufficient educational opportunities during youth.

We contribute to the growing literature on ageing and education. Given the scope and speed of social changes in China throughout the 20th century, it is notable the relatively few papers on SA in China. We expand the previous study by Pruchno et al. (2010) [39], Rowe (1997) [40], Tom ás et al. (2016) [50], and Kahng (2008) [25], and concentrate on structural equation modelling (SEM) to find and produce composite factor series with robust standard errors for heteroskedasticity that are utilised in standard econometric experiments that follow. Unlike most ageing related statistical research, we also explicitly consider the multicollinearity amongst the regressors and correct for endogeneity issues.

We are the first to consider China's unique institutional history in education within a structural model of SA. We find that after controlling for age-related diseases and living circumstances, Chinese adults' objective age is mostly influenced by their own self-esteem. Furthermore, it is their capacity to reason and think clearly that drives subjective perception of age. Chinese adults confront similar difficulties to their peers in other countries. However, we observe an overly large influence of education—or lack thereof—on subjective ageing. Our research suggests that due to their historical lack of access to education, Chinese older adults seem to have significant issues with self-esteem. As such, we observe a substantial conditional correlation between formal educational achievement and self-assessed health and life satisfaction.

2. Ageing Within the Data

Successful ageing (SA) is loosely characterised as a multidimensional structural concept with subjective and objective qualities, yet a consensus for its definition and measurement criteria has yet to emerge. It is initially defined as a steady, positive and efficient ageing process [38]. Life satisfaction, subjectively determined, is a popular and widely used definition throughout the 1960s [42]. The components of zest versus indifference, intended versus attained objectives, resolution, fortitude, self-conceptualisation, and emotional tone are all included in this dimension [37]. The inclusion of physical, mental, and social dimensions of health as crucial components of SA is introduced by Rowe (1997) [40]. They propose three fundamental elements to define SA: low risk of sickness and

1 https://www.who.int/china/health-topics/ageing

2 https://www.who.int/news-room/fact-sheets/detail/ageing-and-health

disease-related impairment, good mental and physical function, and active engagement with life. Crowther et al. (2002) [14] as well as Tomas et al. (2016) [50] add a fourth major component, positive spirituality.

Matsumoto and Watanabe (2004) [35] and Matsumoto and Wakasaki (2005) [34] explore five structures that govern successful aging among Japanese based on health, satisfaction, ambition, self-confidence, participation, and self-protection. Sato-Komata et al. (2015) [44] identify three features of SA in Japanese older adults: the process of accepting functional loss, daily thought after making a choice, and spirituality. Most people can be aware of making flexible and adaptable lifestyle modifications when coping with the disadvantages of ageing in life and psychology. When faced with age related ailments, they can alleviate their psychological pain through self-regulation and remain subjectively positive. Using the multivariate analytic approach, Tovel and Carmel (2014) [51] show that change in health/function, self-efficacy, decision of preferences, concrete planning and social support are the most significant predictors of effective ageing in Israel. Araujo et al. (2015) [1] address the concepts of active ageing and SA defined fundamentally by health, emotion, cognition, biological behaviour state, social network, and personality and use the dichotomy to conduct an empirical study of data from the older adults in Portugal.

The aged are a diverse group. Although all people have some intrinsic variability, as we age, the degree of uniformity between us in terms of physiological function, psychology, and society declines. The increased variation is observable by the disparity between objective and subjective success in ageing. Pruchno et al. (2010) [39] examine SA within a two-factor model of objective success sample functional abilities, little or no pain, and few chronic diseases and subjective success perceptions of ageing successfully, ageing well, and overall evaluation of one's current state of health.

We presume that SA, although not directly observable, is a statistically observable composite of age and quality of life factors. We consider SA as a composite factor of observed characteristics in a vein similar to Tomas et al. (2016) [50] and Kahng (2008) [25], both of which define SA as a latent factor. We define the composition of the otherwise unobservable concepts of objective and subjective SA by both latent factor analysis and composite factor analysis. The former focuses on the construction and component makeup of the latent factor, in exclusion of other factors, and the latter considers the combined effect of all measured variables simultaneously.

Our sample is drawn from the 2018 China Health and Retirement Longitudinal Study (CHARLS), which aims to collect a set of high-quality micro data representing families and individuals of Chinese people aged 45 and above in order to analyse issues of population ageing in China and to promote interdisciplinary research on ageing. The CHARLS national baseline survey was conducted from 2011 on approximately 17,000 persons living among roughly 10,000 families, including 150 county-level units and 450 village-level units. Subsequent updates are published every two to three years.

The survey questionnaire is divided into eleven sections. Cover Screen (CV), Demographic Backgrounds (B), Family (C), Health Status and Functioning (D), Cognition and Depression (DC), Informants Information (DD), Health Care and Insurance (E), Work and Retirement (F), Pension (FN), Income, Expenditures and Assets (G&H), and House Property and Housing Characteristics (HA&I). While the survey covers a wide breadth of topics, questions in one section often directly or indirectly relate to questions from other sections. This is important considering the gaps in time between sections as well as other circumstances underpinning data collection.

There is no discernible conflict of interest between investigators and respondents in CHARLS. To ensure privacy, each respondent has their own unique number (ID). While the loss of data from initial survey size of 17,000 to a balanced sample of 6118 observations is sizeable, it is typical of Chinese survey data [8, 33].

Our sample of Chinese aged over 45 years is slightly younger than those used to represent other countries. For example, Bowling and Iliffe (2006) [7] considers British older adults 65 years and over, Hsu (2010) [22] consider people in Taiwan over 60 and Araujo et al. (2015) [1] consider Portuguese over 55 years old to name a few.

3. Research Design and Methodology

We undertake a principal component analysis (PCA) comprised of an exploratory factor analysis (EFA) on a random sample of half the dataset followed by a confirmatory factor analysis on the remaining half. The composite factors, with robust standard errors, are then re-estimated from the entire dataset.

Table 1 maps the model variables to the corresponding questions from the CHARLS2018.[3] Table 2 summarises the data. Most of the data is made up of dummy and sorted variables, whereas the continuous variables are the age when respondents finish schooling, the amount of cash they hold and their real age in 2018.

Table 1. *Correspondence between Variables and CHARLS2018.*

Variable Name	CHARLS2018 Questions Used
AGE	BA004 W3, BA005 W4, BA002
CASH	HC001
GENDER	BA000 W2 3
AGE FINISH SCHOOL	BD006

3 CHARLS 2018 Household Questionnaire

Variable Name	CHARLS2018 Questions Used
LIVING AREA	BB000 W3 2
MARITAL STATUS	BE001
EDUCATION LEVEL	BD001 W2 4
RELIGIOUS	BG002 W4
POLICY	BA004 W3, BA005 W4, BA002
ABILITY LEARNING	DD025 W4
ABILITY MATH	DD036 W4
AILMENT ALZHEIM	DD010 W4
AILMENT PARKINS	DD009 W4
MEMORY PROBLEMS	DD011 W4
MEMORY CHILDHOOD	DD026 W4
SATISFIED HEALTH	DC042 W3
SATISFIED LIFE	DC028
SOCIALISE GAMES	DA056
SOCIALISE HELP	DA056
SOCIALISE FRIENDS	DA056
SOCIALISE CLUBS	DA056
SELFREPORT HEALTH	DA002
SUBJ LIFE EXP	DA081

The survey is represented by 4- and 5-point Likert scales for ordered categorical variables as per each individual question. Respondents agree with the question's assertion either "very agree," "agree," "not necessarily," "disagree," or "very disagree" and they are recorded as 5, 4, 3, 2, and 1 accordingly. The literature is replete with examples of this methodological norm. In the study of psychological well-being, Ryff (1989) [43] employs a 6-point Likert Scale style to quantify locus of control, ranging from strongly agree to strongly disagree. Respondents in Schutt and Mej´ıa (2017) [46] are asked to rate the intensity of three positive happiness, interest, satisfaction and negative-depression, sadness, boredom adjectives, from 0 to 6. Bowling and Iliffe (2006) use open-ended questions to elicit respondents' descriptions of their quality of life, and then use a 7-point Likert scale to measure overall quality of life, ranging from "So excellent, could not be better" to "So horrible, could not be worse."

Our demographic variables include age, gender, education attainment, living area, marital status, cash, when finished school, and religious beliefs.[4] Since respondents were not directly asked their ages, we construct the variable, AGE by calculating each respondent's age based on their date of birth recorded on their ID card and the timing of the 2018 interview. We construct a gender dummy variable, GENDER, which takes the value 1 for males and 0 for females. The demographic distinction, LIVING AREA, distinguishes between those living in urban centres versus those living in rural environs. We generate a variable, CASH to represent the amount of cash that respondents hold at home as the proxy for income, because the direct income question elicits a significantly lower incidence of response. MARITAL STATUS is a dummy variable indicating whether an individual has a partner, coded as 1 if partnered and 0 otherwise. Another dummy variable, RELIGIOUS, reflects whether or not the responder holds any convictions about religion. AGE FINISH SCHOOL represents the age when the respondent finishes schooling. POLICY is a binary indicator set to 1 for individuals born between 1940 and 1968, capturing cohorts whose access to formal education was curtailed by the Great Leap Forward and Cultural Revolution, and 0 otherwise.[5]

Table 2. *Descriptive Statistics.*

Control Variables					
Obs.6118	**Mean**	**SD**	**Min**	**Max**	**Type**
AGE	68.329	6.536	48.000	108.000	Scalar
CASH	2.047	6.725	0.000	150.000	Scalar
GENDER	0.507	0.500	0.000	1.000	Binary
AGE FINISH SCHOOL	11.591	8.301	0.000	55.000	Scalar
LIVING AREA	0.258	0.438	0.000	1.000	Binary
MARITAL STATUS	0.188	0.391	0.000	1.000	Binary
EDUCATION LEVEL	2.650	1.334	1.000	5.000	Pref.

4 A more detailed explanation of the education attainment is provided in the next section.

5 A more detailed explanation of the construction and historical background of this variable is provided in the next section.

Control Variables					
Obs.6118	**Mean**	**SD**	**Min**	**Max**	**Type**
RELIGIOUS	0.101	0.301	0.000	1.000	Binary
POLICY	0.914	0.280	0.000	1.000	Binary
Index					
ABILITY LEARNING	1.402	0.932	0.000	4.000	Pref.
ABILITY MATH	1.589	0.811	0.000	4.000	Pref.
AILMENT ALZHEIM	0.015	0.123	0.000	1.000	Binary
AILMENT PARKINS	0.017	0.129	0.000	1.000	Binary
MEMORY PROBLEMS	0.057	0.232	0.000	1.000	Binary
MEMORY CHILDHOOD	1.446	0.829	0.000	4.000	Pref.
MEMORY RECENT	1.597	0.763	0.000	4.000	Pref.
SATISFIED HEALTH	1.946	0.936	0.000	4.000	Pref.
SATISFIED LIFE	2.305	0.790	0.000	4.000	Pref.
SOCIALISE GAMES	0.180	0.385	0.000	1.000	Binary
SOCIALISE HELP	0.119	0.324	0.000	1.000	Binary
SOCIALISE FRIENDS	0.321	0.467	0.000	1.000	Binary
SOCIALISE CLUBS	0.080	0.272	0.000	1.000	Binary
SELFREPORT HEALTH	1.963	1.017	0.000	4.000	Pref.
SUBJ LIFE EXP	1.859	1.259	0.000	4.000	Pref.

We draw on a range of indexes to capture multiple dimensions of respondents' cognitive functioning, health conditions, subjective well-being, and social engagement. To assess cognitive health and related changes, we include measures such as ABILITY LEARNING and ABILITY MATH, which respectively reflect how respondents perceive their current ability to learn new things and to handle everyday numerical problems, relative to approximately a decade ago. Memory-related aspects (MEMORY CHILDHOOD) indicates changes in recalling childhood or adolescent events, and MEMORY RECENT, which reflects changes in recalling recent experiences. Clinical indicators such as MEMORY PROBLEMS, AILMENT ALZHEIM, and AILMENT PARKINS, which identify whether respondents have ever been diagnosed by a doctor with memory issues, Alzheimer's disease, or Parkinson's disease.

In terms of individual subjective well-being, SATISFIED HEALTH and SATISFIED LIFE, which measure respondents' satisfaction with their current health and overall life, respectively. SELFREPORT HEALTH provides a self-rated assessment of general health status, while SUBJ LIFE EXP captures respondents' subjective expectations regarding their remaining lifespan.

We incorporate indexes including SOCIALISE GAMES, SOCIALISE HELP, SOCIALISE FRIENDS, and SOCIALISE CLUBS to explore social dimensions. All of them are derived from the same survey module that records whether respondents engage in activities such as playing cards or mahjong, providing help to others, socialising with friends, or participating in clubs and organised groups.

Table 2 reveals that the average respondent is a 68-year-old male without partner, has completed primary school, holds no strong religious beliefs and is living in a rural centre. The ordered variables that range from very poor (0) to very good (4) include respondents' self-reported health, SUBJ HEALTH, which is on average fair, and respondents' capacity to learn new things in general, LEARNING ABILITY, which is on average poor to fair, possibly reflecting learning capacities falling with age.

The correlation matrix shown in Table 3 reveals that many of the variables are related to one another. Those factors whose correlations are above [+-.3] are highlighted. For example, one might infer that arithmetic ability, learning ability, and memory all belong in the same composite factor.

Table 3. *Correlations.*

N=6118	AbL	AM	AA	AP	MC	MP	MR	SatH	SatL	SG	SuH	SuL	SF	SH	SC	P
ABILITY_LEARNING (AbL)	1.00															
ABILITY_MATH (AbM)	0.53	1.00														
AILMENT_ALZHEIM (AA)	-0.11	-0.12	1.00													
AILMENT_PARKINS (AP)	-0.09	-0.09	0.36	1.00												
MEMORY_CHILDHOOD (MC)	0.56	0.55	-0.10	-0.10	1.00											
MEMORY_PROBLEMS (MP)	-0.18	-0.21	0.35	0.26	-0.18	1.00										
MEMORY_RECENT (MR)	0.46	0.48	-0.12	-0.10	0.48	-0.21	1.00									
SATISFIED_HEALTH (SatH)	0.13	0.12	-0.05	-0.05	0.12	-0.09	0.13	1.00								
SATISFIED_LIFE (SatL)	0.07	0.07	-0.01	0.00	0.08	-0.05	0.05	0.45	1.00							
SOCOIALIZE_GAMES (SG)	0.05	0.05	0.01	-0.02	0.07	-0.03	0.05	0.03	0.02	1.00						
SUBJ_HEALTH (SuH)	0.18	0.17	-0.05	-0.05	0.17	-0.10	0.17	0.51	0.26	0.05	1.00					
SUBJ_LIFE_EXP (SuL)	0.18	0.16	-0.03	-0.03	0.16	-0.07	0.14	0.29	0.16	0.06	0.33	1.00				
SOCIALIZE_FRIENDS (SF)	0.05	0.05	0.00	0.01	0.05	-0.02	0.03	0.01	-0.01	0.17	0.04	0.06	1.00			
SOCIALISE_HELP (SH)	0.03	0.03	-0.02	-0.01	0.03	-0.02	0.02	0.04	0.03	0.12	0.06	0.08	0.20	1.00		
SOCIALISE_CLUBS (SC)	0.08	0.06	-0.02	-0.01	0.07	-0.03	0.06	0.06	0.05	0.10	0.09	0.13	0.12	0.13	1.00	
POLICY (P)	0.08	0.05	-0.05	-0.02	0.04	-0.04	0.07	-0.02	-0.03	0.04	0.01	0.16	0.04	0.08	0.05	1.00

Bartlett test of sphericity,$\chi 2(276)=31505.475$, Prob($>\chi 2$)=0.000; Kaiser-Meyer-Olkin Measure of Sampling Adequacy, KMO = 0.719

When each index is evaluated independently, the analysis is frequently isolated and is unable to fully utilise the information contained within the data. For example, if two variables that address similar characteristics are highly correlated, in traditional linear regression analysis, one might drop one series, thereby potentially losing important information and biasing conclusions.

We endogenously decrease the number of indicators, thereby reducing the dimensionality of the evaluated data while minimising the loss of information contained in the original indexes to analyse the entire set of acquired data without any subjective parsing, by PCA and factor analysis (FA). PCA is a multivariate statistical strategy for lowering the dimension and losing as little information as possible by transforming several indicators into a few comprehensive indicators. FA is related to PCA but primarily focuses on modelling the underlying relationships among the original variables. FA's relevance is that it can extract a few key factors from a set of complicated interactions, with each key factor representing an interdependent role among the original variables. Within the literature, FA is utilised in the well-being measure by Ryff (1989) [42]. We assess the statistical quality of our data with a Kaiser Meyer Olkin (KMO) test and the Bartlett sphericity test [11, 26].

PCA extracts a collection of mutually orthogonal coordinate axes from a given region. The choice of a new coordinate axis is inextricably linked to the data. The first new coordinate axis choice is the one with the greatest variance in the original data, the second new coordinate axis choice is the one with the greatest variance in the plane orthogonal to the first coordinate axis, and the third axis choice is the one with the greatest variance in the plane orthogonal to the first and second axes. By

this method, n similar coordinate axes can be produced. We focus on the first k<n axes, which contain most of the variation. We effectively keep the fewest dimensional features that account for most of the variation, disregarding the feature dimensions that contain essentially little variance.

The dataset, consisting of 6,118 observations, is randomly divided into two halves. Exploratory Factor Analysis (EFA) is then conducted on the correlation matrix of the first half to identify the principal component factors. Component loading values greater than 0.4 provide the basis for variables of practical relevance to each composite factor [3, 7]. Table 4 describes the first five composite factors with eigenvalues greater than 1 as depicted in Figure 1.

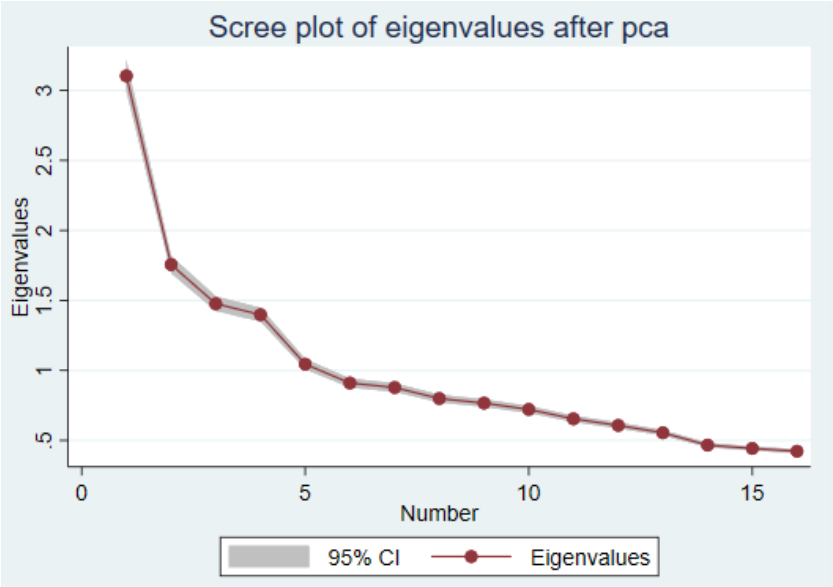

Figure 1. *Eigenvalues after PCA.*

Notes: This figure displays the eigenvalues associated with each principal component, along with 95% confidence intervals. The sharp decline after the first five components suggests that most of the variation in the dataset can be explained by the first five principal components.

Table 4. *Exploratory Factor Analysis.*

Obs.=3059	Factor1	Factor2	Factor3	Factor4	Factor5	Uniqueness	KMO
ABILITY_LEARNING	0.797					0.356	0.833
ABILITY_MATH	0.818					0.345	0.829
AILMENT_ALZHEIM			0.772			0.403	0.671
AILMENT_PARKINS			0.738			0.473	0.686
MEMORY_PROBLEMS			0.638			0.514	0.797
MEMORY_CHILDHOOD	0.833					0.325	0.817
MEMORY_RECENT	0.733					0.438	0.868
SATISFIED_HEALTH		0.855				0.294	0.663
SATISFIED_LIFE		0.708				0.513	0.688
SUBJ_HEALTH		0.712				0.450	0.738
SOCOIALIZE_GAMES				0.585		0.651	0.687
SOCIALISE_HELP				0.629		0.584	0.645
SOCIALISE_FRIENDS				0.698		0.524	0.642
SOCIALISE_CLUBS				0.471		0.715	0.725

Obs.=3059	Factor1	Factor2	Factor3	Factor4	Factor5	Uniqueness	KMO
SUBJ_LIFE_EXP		0.484			0.474	0.460	0.812
POLICY					0.889	0.227	0.610
Eigenvalue	3.146	1.716	1.460	1.363	1.042		
% of Variance	35.611	31.607	0.713	1.913	5.166		
Cronbach's alpha	0.808	0.641	0.496	0.398	0.119		

The order of the factors is also indicative of the statistical confidence that we hold in the component makeup of each composite factor relative to the next. Figure 1 and Table 4 suggest the existence of five compost factors. While intuitively plausible and valid, we nevertheless consider the composite factors' internal consistency in measuring the specific phenomenon that we intuitively identify [48, 52]. We note from Table 4, the Cronbach's alpha of factors 4, which is marginally reliable while the Cronbach's alpha of factors 5 is below 0.5, rendering its latent construction too unreliable for analysis.

We define three composite factors. Factor 1, COG ABIL represents cognitive ability and is our proxy for objective SA. The composite factor is defined by four elements arithmetic ability, learning ability, short-term memory remembering recent events, and long-term memory remembering things happened in childhood. Our objective measure of ageing reflects a standardised evaluation of respondents' cognitive functioning, specifically their arithmetic ability, capacity to acquire new information, and memory performance. Factor 2, SELF EVAL, the composite self-evaluation of ageing is our proxy for subjective SA. It is derived from respondents' subjective assessment of their health, self-health tests, and life expectancy. It is a subjective evaluation of the respondents' present health state and a self-determined forecast of their life expectancy. Factor 3, SENILE DISEASE, is a composite of respondents' three possible diagnosed age-related ailments: Parkinson's disease, Alzheimer's disease, or memory loss.

We test the efficacy of the composite factors' composition on the remaining half of the data by CFA via SEM. Columns 1 and 2 of Table 5 present the results of the CFA experiment. Columns 3 and 4 of Table 5 represent the same model specification imposed on the entire data. For indicators whose load affects multiple latent variables, the standardised load is comparable to the standardised beta coefficient in multiple regressions. Factor loadings in the range of +/-0.30 to 0.40 are deemed to fulfil the lowest level for structural interpretation [19]. This is the same as a latent variable predicting an indicator ceteris paribus with respect to other latent factors. For example, the index for arithmetic ability loads significantly on the latent construct of cognitive ability (COG ABIL), with a standardised loading of 0.730. When there is no indication of cross load in the model, the standardised load factor of 0.730 can be interpreted as the correlation coefficient between indicators and latent variables [9]. The square of the factor load implies that the latent composite variable for cognitive ability accounts for roughly 53.3 percent of the variation in arithmetic ability. Similarly, 53.0 percent of the variation in learning ability, 41.7 percent of the variation in remembering recent events, and 56.6 percent of the variation in remembering childhood events are captured respectively in the composite factor for objective SA.

Subjective SA explains between 71.1 percent of the variations in self-reported health status, 52.0 percent of the variations in subjective life expectancy, 37.0 percent of the variation in health satisfaction, and 5.4 percent of the variations in life satisfaction. The most important element of the age-related ailments composite is diagnosed memory impairment of which 61.0 percent of its variation is explained. To a lesser extent, the variation in those diagnosed with Alzheimer's, 19.6 percent, and diagnosed with Parkinson's, 11.4 percent, are explained by the composite factor.

Table 5. *Confirmatory Factor Analysis / Composite Factor Approximations.*

	Approximation Method	[1] SEM		[2] SEM	
		Coef.	Std. Err.	Coef.	Robust Std. Err.
Factor 1	ABILITY_MATH	0.725	(0.012)	0.730	(0.011)
COG_ABLT	_CONS	1.953	(0.031)	1.960	(0.027)
Objective Cognitive Ability	ABILITY_LEARN	0.726	(0.012)	0.728	(0.010)

	Approximation Method	[1] SEM		[2] SEM	
		Coef.	Std. Err.	Coef.	Robust Std. Err.
(Objective Successful Aging)	_CONS	1.518	(0.027)	1.505	(0.018)
	MEMORY_RECENT	0.639	(0.013)	0.646	(0.012)
	_CONS	2.087	(0.032)	2.093	(0.029)
	MEMEORY_CHILDHOOD	0.748	(0.011)	0.752	(0.011)
	_CONS	1.774	(0.029)	1.745	(0.023)
	SUBJ_LIFE_EXP	0.785	(0.085)	0.721	(0.056)
Factor 2	_CONS	1.483	(0.026)	1.477	(0.015)
SUBJ_EVAL	SATISFIED_LIFE	0.199	(0.032)	0.233	(0.026)
Subjective Evaluation	_CONS	2.879	(0.041)	2.917	(0.036)
(Subjective Successful Aging)	SUBJ_HEALTH	0.880	(0.047)	0.843	(0.030)
	_CONS	1.943	(0.031)	1.931	(0.019)
	SATISFIED_HEALTH	0.601	(0.034)	0.608	(0.024)
	_CONS	2.066	(0.032)	2.080	(0.024)
	AILMENT_PARKINS	0.358	(0.028)	0.338	(0.034)
Factor 3	_CONS	0.133	(0.018)	0.132	(0.007)
SENILE_DISEASE	AILMENT_ALZHEIM	0.474	(0.030)	0.443	(0.033)
Age Related Ailments	_CONS	0.122	(0.018)	0.125	(0.006)
	MEMORY_PROBLEMS	0.802	(0.046)	0.781	(0.040)
	_CONS	0.244	(0.018)	0.246	(0.007)
cov(MEMEORY_CHILDHOOD*SATISFIED_LIFE)		0.080	(0.019)	0.042	(0.014)
cov(MEMEORY_CHILDHOOD*MEMORY_PROBLEMS)		0.101	(0.036)	0.065	(0.025)
cov(SUBJ_LIFE_EXP*SUBJ_HEALTH)		-1.208	(0.675)	-0.749	(0.260)
cov(SUBJ_LIFE_EXP*SATISFIED_HEALTH)		-0.373	(0.161)	-0.270	(0.083)
cov(SATISFIED_LIFE*SUBJ_HEALTH)		0.227	(0.070)	0.113	(0.041)
cov(SATISFIED_LIFE*SATISFIED_HEALTH)		0.439	(0.024)	0.397	(0.020)
cov(AILMENT_PARKINS*AILMENT_ALZHEIM)		0.306	(0.023)	0.254	(0.048)
cov(COG_ABLT*SELF_EVAL)		0.259	(0.024)	0.289	(0.017)
cov(COG_ABLT*SENILE_DISEASE)		-0.328	(0.026)	-0.356	(0.023)
cov(SELF_EVAL*SENILE_DISEASE)		-0.117	(0.024)	-0.145	(0.020)
	Log likelihood	-24509.498		-49243.395	
	Observations	3059		6118	
Likelihood ratio: Model vs. saturated~		52.15**		66.26***	
	Tucker-Lewis index	0.996		0.996	
	SRMR	0.014		0.011	
	Comparative fit index	0.996		0.998	

Approximation Method	[1] SEM		[2] SEM	
	Coef.	Std. Err.	Coef.	Robust Std. Err.
RMSEA	0.013		0.012	

All coefficients are significant at less than 1% apart from the shaded ones which are significant at less than 10%; ~ Statistics based on uncorrected standard errors; ** prob(xx)<0.01; *** prob(xx)<0.001

We may infer that the model fits well based on several statistical factors [21, 30, 45]. The Tucker Lewis Index (TLI) and comparative fit index (CFI) are both above 0.996. The standardised root mean squared residual (SRMR) is the quantity obtained by subtracting the predicted correlation coefficient matrix from the sample. An SRMR less than 0.05 is typically associated with a good fit [24]. Finally, the root mean squared error of the approximation (RMSEA) is 0.012, which is substantially lower than 0.05, further indicative of the model's fit [6].

Table 6 shows the correlation between the three latent variables. It shows that subjective SA and objective SA are positively correlated. As we might expect, age related ailments and state of mind are both negatively correlated with both subjective and objective SA.

Table 6. *Composite Latent Factors: Descriptive Statistics.*

Correlation Table						
Obs.=6118		**CA**	**SE**	**SD**		
COG_ABLT (CA)		1.000				
Objective successful aging						
SELF_EVAL (SE)		0.325	1.000			
Subjective successful aging						
SENILE_DISEASE (SD)		-0.457	-0.180	1.000		
Age related ailments						
Educational Attainment: Mean / (Standard Deviation)						
		Illiterate	**Some Primary**	**Primary school**	**Middle school**	**High school+**
Obs.	6118	1608	1386	1351	1092	681
COG_ABLT	0.000	-0.109	-0.023	-0.009	0.093	0.174
Objective successful aging	(0.536)	(0.564)	(0.542)	(0.537)	(0.486)	(0.447)
SELF_EVAL	0.000	-0.145	-0.045	-0.051	0.179	0.248
Subjective successful aging	(0.886)	(0.902)	(0.894)	(0.855)	(0.870)	(0.841)
SENILE_DISEASE	0.000	0.032	0.015	-0.011	-0.026	-0.043
Age related ailments	(0.359)	(0.397)	(0.372)	(0.326)	(0.328)	(0.314)

Reported categorical means are significantly different from the sample means at 5% unless shaded.

4. Analysis

We consider several group fixed effects within the sample.[6] They include location of residence, marital status and education. We particularly focus on education-group fixed effects. The relevance of living areas has received significant academic attention [15]. Respondents reported either living in the central business district of the city/town, in a combined urban and rural zone, a village or a unique area. We reassigned the alternatives and separated the four types of residential types by rural versus urban. Of the 6118 observations, 74.17 percent live in rural areas and 25.83 percent in non-rural areas. The impact of married status is treated in the same way. There are six different marital statuses, which are married and living with spouse, married but not living with spouse temporarily for reasons such as work, separated or no longer living together as a couple, divorced, widowed, or never married. We grouped them into two groups, those with partners, 18.85 percent, and those without, 81.15 percent.

Many of the respondents in the sample were born between 1920 and 1970. We have two measures of educational attainment within the sample, a categorical measure of formal attainment and a continuous measure. Respondents selected their education level among nine categories: no formal education, did not complete primary school, home school, elementary school, middle school, high school, vocational school, associate degree, bachelor degree, master degree, or PhD. The anecdotal evidence of limited educational opportunities beyond basic schooling between 1930 and 1980 bears out in the difference between the maximum population array, where 22.7 percent did not complete primary school and the minimum population array, where only 0.02 percent hold a doctorate. Given the low incidence of higher degree holders, we arrange the eleven categories into five groups: those being illiterate, 26.28 percent, those with some primary education, 22.65 percent, those finish primary education, 22.08 percent, those with a middle school degree, 17.85 percent, and those with high school upwards to a PhD, 11.13 percent. Table 6 also reports the categorical means of composite factors by educational attainment. Note the patterns amongst composite factors with respect to education. Those with the least education, on average, have a lower cognitive ability, lower subjective ageing, and suffer more from age related ailments.

The Cultural Revolution, between 1966 and 1976, when no higher education was available nationwide, is when most of our sample were at their educational prime. Before the Cultural Revolution in 1966, many teachers and students in primary, secondary, and tertiary schools across the country had already suspended classes in response to the government call to participate in the large-scale steel refining movement initiated in September 1958. We differentiate between those individuals born before 1940 who had access to higher education, those born between 1940 and 1968 who had no access, and those born after 1968 who were unaffected by the education policies of the Cultural Revolution that ended in 1976. The dummy variable ($POLICY_i$) assigns a 1 to those born between 1940 and 1968, indicative of the treatment group subject to the policies of the Great Leap and Cultural Revolution in terms of access to education.

The categorical treatment of educational attainment is correlated only with subjective ageing as measured by individual self-evaluations. While the level of educational attainment only marginally influences older adults' self-esteem, these same people appear to be keenly aware of having experienced the Great Leap Forward and/or the Cultural Revolution as noted by the significance of the Policy variable in Table 8. Anecdotally, while China endured decades of distributional inequality in educational resources as compared with other nations, the distribution of health services did not appear to follow the same pattern. We lend support to Yin and Lu (2007) [54] as well as Yi et al. (2002) [53], who suggest that education level is not a good predictor of activities of daily living (ADL) in Chinese aged people due to the lack of educational variation among Chinese aged. This result is notable considering the aged in other nations, such as Singapore, show a high correlation between objective ageing and high education, high income, and high skilled occupations [12]. Similarly, less education is shown to be negatively correlated with the overall successful ageing in American society [25], which encompasses the physical domain, mental domain, and life participation domain.

Columns 1 and 2 in Tables 7 and 8 respectively depict the baseline regression results for objective and subjective successful ageing. Note that the education-group fixed effect is only significant when applied to subjective ageing. Grouping individuals by their educational attainment is correlated with people's self-perception and not with their objective well-being. We note that participation in social games is only significant in objective SA while gender, cash, and religious belief are only significant in subjective SA. Notice that in both SA regressions, the coefficients on age are negative, indicating that being younger is associated with better outcomes. In subjective ageing, being male is also positively associated with outcomes, whereas in objective ageing, gender is not significant.

Typical of survey data analysis, we suspect that there exists endogeneity among the composite variables. We note that age related ailments are significantly and negatively conditionally correlated with both objective and subjective SA. Following Karlsson et al. (2021) [27], who report that age related ailments such as Alzheimer's disease exhibit substantial genetic components with heritability estimates ranging from 45% to 80%, we assume a unidirectional causality, given the primary influence of genetic variation on these conditions. Sato-Komata et al. (2015) [44] find that most older adults can have

6 Although our analysis is based on cross-sectional data, we include a set of education level dummies to control for differences across education groups. Throughout the paper, we refer to these as "education-group fixed effects" for simplicity.

self-awareness and adopt flexible lifestyle changes while dealing with the negative impacts of subjective and objective ageing. Tovel and Carmel (2014) [51] demonstrate that one of the most significant indicators of effective ageing in Israel is self-efficacy. Thus, his respondents with age related diseases can address failures in subjective and/or objective successful ageing through self-regulation. While agerelated diseases have significant negative impacts on both objective and subjective SA, we assume that their incidence is independent of a person's quality of life, whether subjectively or objectively measured.

The fundamental problem lies with the observation that objective SA is conditionally correlated with subjective SA and vice versa. We address the endogeneity with instrumentation. We note within the specification of objective ageing in column 1 of Table 7, social interactions including joining clubs, helping others, and socialising with friends do not necessarily impact objective ageing. These same elements are all significantly correlated with subjective ageing as illustrated in column 1 of Table 8. In the other direction, playing chess, cards or ma-jong, is only conditionally correlated with objective ageing.

We consider social interaction including joining clubs, helping others, and socialising with friends as instruments for subjective SA. We ask the following: would a person who identifies as outgoing also identify as subjectively ageing well? If not, then it follows that the outgoing individual who does not associate his or her social interactivity with subjective ageing is also likely to be unaware that his or her condition is positively affecting his or her subjective health. We assume that people who are more comfortable interacting with others will also hold a more positive self-image and maintain better subjective health.

We rely on playing chess as an instrument for objective ageing to address the endogeneity in the other direction. This variable is a dummy indicating participation in chess, cards, or ma-jong, all of which involve mental exercise. We assume participation in these mental exercises is indicative of cognitive capacity. However, it is indicated by the negative R squared in Table 8 column 4 that the instrument is weak and the treatment of cognitive ability within the determination of subjective well-being is unsatisfactory.

The typical strategy to statistically address endogeneity relies on a two stage least squares (TSLS) approach following Theil (1953) [49] and Basmann (1957) [4]. Unfortunately, TSLS requires relatively good instruments that are simultaneously conditionally correlated with the factor being represented but not the other factor. Given the limited selection of instruments that can be drawn from our dataset, we likely suffer from this limitation. New research by Dzhumashev and Tursunalieva (2025) [17] proposes a synthetic instrumentation methodology that exploits the geometric properties of a two-stage regression to create a synthetic instrument from its orthogonal vector. So long as the regression or system of equations is sensibly constructed, all of the endogeneity amongst factors can theoretically be removed into a synthetic instrument. Equation 1 depicts the components conditionally correlated with objective ageing where SELF_EVALi is the fitted result from the first stage regression in equation (3), $\overrightarrow{Policy_i}$ is our variable of interest, and $\vec{C}_{Ci}$ represents the control and other variables.

$$COG\_ABIL_i = \alpha_0 + \alpha_1 SELF\_EVAL_i + \overrightarrow{POLICY}_i + \alpha_C \vec{C}_{Ci}' + \varepsilon_i \quad (1)$$

$$\vec{C}_{Ci}' = \begin{bmatrix} SENILE\_DISEASE_i \\ D1_i ... D7_i \end{bmatrix} \quad (2)$$

D_{1i} to D_{7i} represent seven demographic-related control variables including age, gender, cash, when finished school, dummy living area, dummy marital status, and religious belief. The traditional IV approach, reported in column 4 of Table 7, treats participation in clubs, helping others, and interacting with friends as instruments for subjective ageing. The SIV uses the synthetic instrument created from equation (1) as the instrument in equation (2).

$$SEL\_EVAL_i = \gamma_0 + \gamma_1 SIV_i + \vec{\gamma}_C \vec{C}_{Ci} + \varepsilon_i \quad (3)$$

Similarly, equation (4) depicts the components conditionally correlated with subjective ageing where COG_ABIL_i is the fitted result from the first stage regression in equation (6), and C_{Si} represents the control and other variables.

$$SELF\_EVAL_i = \beta_0 + \beta_1 COG\_ABIL_i + \beta_2 \overrightarrow{POLICY}_i + \beta_S \vec{C}_{Si}' + \varepsilon_i \quad (4)$$

$$\vec{C}_{Si}' = \begin{bmatrix} SENILE\_DISEASE_i \\ D1_i ... D7_i \end{bmatrix} \quad (5)$$

$$COG\_ABIL_i = \theta_0 + \theta_1 SIV_i + \alpha_S \vec{C}_{Si}' + \varepsilon_i \quad (6)$$

The traditional IV regression results are reported in columns 4 and the synthetic IV regression results are reported in columns 5 in Tables 7 and 8. We note that instruments are necessarily weak in both traditional IV regressions, reported in column 4. As such, we expect the estimates of the OLS regression in column 3 to be consistent but biased. Furthermore, although the traditional IV estimates are consistent, we have limited confidence in the instrumentation. The SIV estimates reported in column 5 in Tables 7 and 8 are necessarily both consistent and unbiased representing an improvement over the OLS regression reported in column 3.

Evidence of our hypothesis can be seen in the lack of significance of the variable 'age at highest level of education attained' in both Tables 7 and 8. Just like their counterparts in Taiwan [22], the cumulative advantages or drawbacks of formal schooling are replaced by other variables throughout the course of life among the aged in mainland China.

Table 7. *Objective Successful Aging (COG_ABLT).*

Estimation Method	**[1] OLS**	**[2] OLS/FE**	**[3] OLS/FE**	**[4] IV/FE**	**[5] SIV/FE**
SELF_EVAL	0.134**	0.134**	0.135**	0.236**	0.141**
Subjective successful aging	(0.007)	(0.007)	(0.007)	(0.060)	(0.007)
SENILE_DISEASE	-0.577**	-0.577**	-0.578**	-0.538**	-0.576**
Age related ailments	(0.017)	(0.017)	(0.017)	(0.029)	(0.017)
AGE	-0.007**	-0.007**	-0.007**	-0.004*	-0.007**
Real age in 2018	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
LIVING_AREA	0.100**	0.094**	0.098**	0.082**	0.098**
Urban vs village inhabitant	(0.014)	(0.015)	(0.015)	(0.018)	(0.015)
MARRITAL_STATUS	0.073**	0.073**	0.074**	0.077**	0.074**
Married versus unmarried	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
GENDER	-0.016	-0.017	-0.020	-0.033*	-0.020
Gender	(0.013)	(0.013)	(0.013)	(0.015)	(0.013)
CASH	0.001	0.001	0.001	0.001	0.001
Cash at home	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
RELIGIOUS	0.018	0.018	0.017	0.008	0.016
Religious belief	(0.019)	(0.019)	(0.019)	(0.020)	(0.019)
SOCIALIZE_GAMES	0.032*	0.032*			
Play chess, cards or Ma-jong	(0.016)	(0.016)			
WHEN_FINISH_SCHOOL	0.005**	0.003	0.003	0.002	0.003
Age at highest attainment	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
SOCIALISE_CLUBS	0.027	0.026			
Took part in clubs or organizations	(0.022)	(0.022)			
SOCIALISE_HELP	-0.010	-0.010			
Provide help to others	(0.019)	(0.019)			
SOCIALISE_FRIENDS	0.021	0.020			
Interacted with friends	(0.013)	(0.013)			
POLICY	-0.031	-0.027	-0.025	-0.008	-0.024
Great Leap + Cultural Revolution	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)
Constant	0.402**	0.448**	0.465**	0.289~	0.456**

Estimation Method	[1] OLS	[2] OLS/FE	[3] OLS/FE	[4] IV/FE	[5] SIV/FE
	(0.102)	(0.107)	(0.107)	(0.151)	(0.107)
Fixed Effect ~ Educational Attainment	**NO**	**YES**	**YES**	**YES**	**YES**
Weak instruments				27.800**	
Wu-Hausman				2.930~	1.273e+32**
Sargan				2.537	
Observations	6,118	6,118	6,118	6,118	6,118
R^2	0.283	0.283	0.282	0.257	0.282
Adjusted R^2	0.281	0.281	0.281	0.255	0.281
Residual Std. Error	0.454 (df = 6103)	0.454 (df = 6099)	0.454 (df = 6103)	0.473 (df = 6103)	0.487 (df = 6103)
F Statistic	171.906** (df = 14; 6103)	133.973** (df = 18; 6099)	171.406** (df = 14; 6103)		

Reported Means / (Robust Standard Errors). Significance: ** 0.01, * 0.05, ~ 0.10.

Table 8. *Subjective Successful Aging (SELF_EVAL).*

Estimation Method	[1] OLS	[2] OLS/FE	[3] OLS/FE	[4] IV/FE	[5] SIV/FE
COG_ABLT	0.434**	0.433**	0.442**	1.682*	0.609**
Objective successful aging	(0.022)	(0.022)	(0.022)	(0.729)	(0.023)
SENILE_DISEASE	-0.114**	-0.115**	-0.118**	0.665	-0.013
Age related ailments	(0.033)	(0.033)	(0.033)	(0.462)	(0.033)
AGE	-0.021**	-0.020**	-0.020**	-0.008	-0.019**
Real age in 2018	(0.002)	(0.002)	(0.002)	(0.008)	(0.002)
LIVING_AREA	0.099**	0.087**	0.112**	-0.038	0.092**
Urban vs village inhabitant	(0.026)	(0.026)	(0.026)	(0.094)	(0.026)
MARRITAL_STATUS	-0.055~	-0.056*	-0.057*	-0.145*	-0.069*
Married versus unmarried	(0.028)	(0.028)	(0.028)	(0.062)	(0.028)
GENDER	0.149**	0.149**	0.131**	0.133**	0.131**
Gender	(0.023)	(0.024)	(0.023)	(0.029)	(0.024)
CASH	0.005**	0.005**	0.005**	0.003	0.005**
Cash at home	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
RELIGIOUS	0.066~	0.066~	0.072*	0.037	0.067~
Religious belief	(0.035)	(0.035)	(0.035)	(0.048)	(0.035)
SOCIALIZE_GAMES	0.023	0.024			
Play chess, cards or Ma-jong	(0.028)	(0.028)			
WHEN_FINISH_SCHOOL	0.001	0.002	0.002	-0.001	0.002
Age at highest attainment	(0.001)	(0.003)	(0.003)	(0.004)	(0.003)

Estimation Method	[1] OLS	[2] OLS/FE	[3] OLS/FE	[4] IV/FE	[5] SIV/FE
SOCIALISE_CLUBS	0.258**	0.256**			
Took part in clubs or organizations	(0.040)	(0.040)			
SOCIALISE_HELP	0.117**	0.117**			
Provide help to others	(0.033)	(0.033)			
SOCIALISE_FRIENDS	0.046*	0.045*			
Interacted with friends	(0.023)	(0.023)			
POLICY	-0.170**	-0.160**	-0.148**	-0.089	-0.140**
Great Leap + Cultural Revolution	(0.050)	(0.050)	(0.051)	(0.071)	(0.051)
Constant	1.391**	1.348**	1.442**	0.572	1.325**
	(0.183)	(0.192)	(0.193)	(0.563)	(0.194)
Fixed Effect ~ Educational Attainment	NO	YES***	YES***	YES	YES
Weak instruments				8.702**	
Wu-Hausman				4.347~	1.709e+30**
Sargan					
Observations	6,118	6,118	6,118	6,118	6,118
R^2	0.151	0.153	0.143	-0.285	0.133
Adjusted R^2	0.149	0.150	0.141	-0.288	0.135
Residual Std. Error	0.818 (df = 6103)	0.817 (df = 6099)	0.822 (df = 6103)	1.006 (df = 6103)	0.822 (df = 6103)
F Statistic	77.779** (df = 14; 6103)	61.137** (df = 18; 6099)	72.644** (df = 14; 6103)		

Reported Means / (Robust Standard Errors). Significance: ** 0.01, * 0.05, ~0.10. *** Hausman test of Fixed Effect is significant at <0.05.

We noted earlier that the categorisation of respondents by their educational attainment is significant in the determination of subjective ageing in China. This is of little surprise given the relatively high proportion of aged in China with no formal schooling whatsoever, as compared to other countries. Yet when we impose the education-group fixed effect on either instrument regression, we find that categorisation by formal education no longer improves the estimates.[7]

Comparing the education fixed effect in column 3 of Table 7 to its estimate with traditional instrumentation in column 4, neither one is necessarily preferable to the other.[8] Nevertheless, the OLS/FE regression estimates are consistent but biased due to endogeneity while the IV/FE estimates are consistent and unbiased, although the instruments are weak. Columns 3 and 4 of Table 7 appear to capture related aspects of the heterogeneity in successful subjective ageing. We note the unbiased synthetic instrument variable results in column 5 confirms this.

Comparing the IV estimations of objective ageing in column 4 and 5, Table 8, with the OLS estimation in column 3, the bias corrected SIV estimates are preferable. Note the bias exerted on age related ailments in the OLS regression is corrected in the SIV regression. While age related ailments impact objective ageing directly, as to be expected, their impact on subjective ageing is indirect. Chinese older adults appear to accept the degenerative aspect of ageing as a fact of life and only allow age related ailments to indirectly impact their self-esteem through their over-all objective well-being.

Age significantly and negatively impacts subjective and objective successful ageing. This result differs somewhat from Iwasa et al. (2005) [23] who suggest that while physical and cognitive functions deteriorate with age, individuals proactively inhibiting the decline of their own facilities suggests that even the oldest adult is still hopeful about ageing. When dealing with the negative impacts of ageing, Japanese older adults may remain subjectively optimistic, even while their

7 Hausman test considering the education-group fixed effects in columns 4 and 5 of Table 8 suggest the no fixed effect null hypothesis should not be rejected.

8 The lack of significant improvement in the TSLS approach over the OLS is evident from the unchanged R-squared and root means squared error statistics, and is confirmed by a Hausman Test.

objective health level is declining [44]. In China, while age has a direct impact on both objective and subjective ageing, as noted earlier, age related ailments do not directly influence self-esteem, only entering indirectly through their negative objective health effects. This suggests that Chinese older adults may not necessarily exhibit as significant health deterioration as they age as compared to other countries, or that other factors—such as lifestyle and social support—have a greater impact on health, thereby masking the psychological effects of age-related diseases.

Men in China and those without partners, age subjectively better, possibly due to more optimistic self-perceptions, stronger independence, and a more positive sense of freedom in life. This suggests that physical health and psychological experience may diverge during the ageing process. Respondents who live in cities objectively and subjectively age better than those who live in the countryside, which is consistent with the stylised fact that urban dwellers have historically had better access to health care than rural dwellers [32] and cities provide more clubs, community centres, and activities, helping older adults stay socially connected and avoid loneliness. Urban older adults are also more likely to do volunteer work or part-time jobs, which gives them a sense of purpose and boosts self-esteem.

While we can identify the source of the bias in the above case educational attainment and its direction, we cannot necessarily determine its scale. Following Barreto et al. (2022) [3], Table 9 describes the direction of bias of the coefficient estimates. If the bias of an estimate is negative, then the coefficient's true value is greater than what is estimated thus adding to our confidence in our estimates. A negative bias suggests the coefficient value, albeit significant, is the upper bound of the estimate. Table 9 also reports the economic significance of a one-standard-deviation change in the independent variables. Column 1 shows that respondents' subjective self-perception and age-related ailments have the most substantial impact on objective ageing. In terms of bias direction, the effect of subjective ageing is underestimated, while the effect of age-related ailments appears to be overestimated. Specifically, a one-standard-deviation increase in age related ailments is conditionally associated with at most a 38.40% decline in objective ageing, while a one-standard-deviation improvement in subjective ageing corresponds to at least a 23.24% improvement in objective ageing. Column 2 shows that objective ageing and age are the strongest predictors of subjective self-perception. A one-standard-deviation improvement in objective ageing is associated with at least a 36.95% improvement in subjective ageing, while a one-standard-deviation decrease in age ailments corresponds to at most a 13.96% improvement in subjective ageing.

Table 9. *Economic Significance of Variation in the Independent Variable = 1 Std. Dev. in the Independent Variable x coefficient value / 1 Std. Dev. in the Dependent Variable.*

Dependent Variable	**mean/(SD)**	**[1]** **COG_ABLT**	**[2]** **SELF_EVAL**
Estimation Method		**Stage 2: SIV/FE**	**Stage 2: SIV/FE**
SELF_EVAL	0.00	23.24%	
Subjective successful aging	(0.89)		36.95%
COG_ABLT	0.00		
Objective successful aging	(0.54)		
SENILE_DISEASE	0.00	-38.40%	
Geriatric ailments	(0.36)		
AGE	68.33	-8.48%	-13.96%
Real age in 2018	(6.54)		
LIVING_AREA	0.26	7.99%	4.55%
Urban versus village	(0.44)		
MARRITAL_STATUS	0.19	5.34%	-3.02%
Married versus unmarried	(0.39)		
GENDER	0.51		7.36%
Gender	(0.50)		

Dependent Variable	mean/(SD)	[1] COG_ABLT	[2] SELF_EVAL
Estimation Method		**Stage 2: SIV/FE**	**Stage 2: SIV/FE**
CASH	2.05		3.78%
Cash at home	(6.72)		
RELIGIOUS	0.10		
Religious belief	(0.30)		
WHEN_FINISH_SCHOOL	11.59		
Age at highest attainment	(8.30)		
SIV	0.32		
Synthetic Instrument Variable	(0.47)		
POLICY	0.91		-4.40%
Great Leap + Cultural Revolution	(0.28)		
Shaded areas represent coefficients that are underestimated.			

Although living area, marital status, gender, and cash are statistically significant, their marginal impacts on subjective and objective health outcomes are limited. Regarding marital status, partnered individuals in China exhibit better objective health, even though they tend to report lower subjective evaluations of ageing. This positive effect of partnership may be underestimated. Men show better subjective ageing outcomes, and this gender effect appears to be overestimated. Urban residence is associated with an improvement down to 7.99% in objective ageing, and an improvement up to 4.55% in subjective ageing, indicating that the influence of living area is more pronounced on objective successful ageing than on subjective successful ageing. This suggests that urban living provides a more supportive environment for older adults' health than the estimates alone imply, potentially due to better healthcare access, infrastructure, or social services. Policy exposure (e.g., during the Great Leap Forward or Cultural Revolution) is associated with a small and negatively signed effect on subjective ageing (-4.40%), which is overestimated. These findings highlight the multifaceted and interlinked nature of successful ageing in China, emphasising the importance of accounting for both direct and indirect pathways through which socio-demographic and policy factors shape health trajectories in later life.

5. Discussion and Summary

We present a detailed characterisation healthy ageing amongst the Chinese older adults. We develop two models of subjective and objective SA in China. Our hypothesis is comparable to those of Rowe (1997) [40], Rowe and Kahn (1998) [41], Baltes and Baltes (1990) [2], and Pruchno et al. (2010) [39]. Objective ageing is determined by functional capacity, chronic illnesses, and socioeconomic, whereas subjective success in ageing is determined by objective health, living conditions, and healthy ageing practices.

We assume that the objective and subjective components of effective ageing are connected, and that each part will yield distinct information. Of our subjective ageing model is based on the self-reported health satisfaction, health level and expected life expectancy. Our objective ageing model is based on long-term and short-term memory, learning ability and arithmetic ability. Our covariates, age related ailments and age have significant negative effects on objective SA, while living area and marital status have significant positive effects on objective SA. Men have worse objective health conditions though they have higher self-perceptions. Subjective SA and objective SA remain strongly positively correlated.

We identify three endogenously determined composite factors that represent the otherwise directly unobservable structure of ageing. Consistent with the literature [5, 13, 18, 20], the most influential factor determining objective SA, represented by cognitive ability, is long-term memory of childhood. The most influential factor determining subjective SA is self-reported health status. Memory-related disease is the most significant component of the composite of age related ailments.

We find that age, marriage, and urbanisation are significantly correlated with both objective and subjective SA. Males are subjectively healthier than females. Although objective ageing remains relatively stable across different age groups, chronological age still exerts a modest negative influence on objective outcomes. In contrast, subjective successful

ageing is more evidently and adversely affected by increasing age, suggesting that individuals tend to perceive themselves as ageing less successfully as they age. These findings indicate that age plays an important role in shaping both objective and subjective dimensions of the ageing process. Marriage partners positively correlate with objective ageing and negatively correlate with subjective ageing. The positive association with objective ageing may be explained by the presence of a spouse who can provide care during illness and offer companionship during times of loneliness, thereby enhancing physical and functional well-being. However, the negative correlation with subjective ageing may reflect complex psychological dynamics within marital relationships, such as unmet emotional expectations, caregiving burdens, or inter-generational stressors, which may diminish individuals' subjective evaluation of their own ageing experience. Urbanisation is significant to both objective and subjective ageing, which could be explained by the fact that urban inhabitants have greater access to health care than rural residents, consistent with the longitudinal survey in Beijing [56].

Despite the potential long-term impact of limited early educational opportunities on individual development, empirical results suggest that the variable $POLICY_i$, indicating cohort exposure to education restrictions during the Great Leap Forward and Cultural Revolution, is not significantly associated with objective successful ageing. This finding suggests that although the cohort born between 1940 and 1968 faced substantial educational deprivation during their formative years, such disadvantages do not necessarily manifest in late-life physical functioning or cognitive capacity—key indicators of objective health. This may be attributed to improvements in living conditions, advancements in healthcare infrastructure, and broader access to medical services later in life, which could mitigate the direct effects of early educational disadvantages on aged health outcomes.

In contrast, $POLICY_i$ exhibits a significant negative relationship with subjective successful ageing. This outcome reflects that individuals affected by historical education policies are more likely to hold negative evaluations of their own ageing process in later life. The deprivation of educational opportunities not only limited early human capital accumulation and social mobility but may also have enduring adverse effects on self-identity, self-esteem, and social engagement. As a multidimensional construct integrating psychological, social, and self-perceptual aspects, subjective ageing appears to be more sensitive to the inequalities imposed by historical policies and their long-term psychological consequences.

Therefore, while historical education policies have not left a significant imprint on objective health indicators, their impact on subjective ageing underscores how early institutional inequalities may shape individuals' perceptions and experiences of ageing through non-physiological pathways, ultimately affecting their subjective well-being in later life.

6. Conclusion

Successful ageing (SA) in China is not so different from that in other countries. Chinese older adults' objective age is determined predominantly by their own self-perception given common age-related illnesses and living conditions. Subjective SA in China is driven by older adults' cognitive ability.

Chinese aged face challenges not unlike their counterparts across the rest of the world. Chinese older adults face the same ailments, the same demographic challenges, and the same insecurities as other older adults. They also respond to these challenges much like everyone else.

What makes Chinese aged unique is the institutional environment in which they were raised as well as the one they currently inhabit. For example, Chinese institutional development greatly limited the availability of formal education between 1940 and 1968. In our sample of 6118 Chinese people over 45 years old, 71 percent have only primary education. While an interesting demographic observation, we nevertheless find no categorical correlation between the left tale of the education distribution and objective SA. In other words, while there exists a large proportion of Chinese aged with very limited formal education, as a group, they are not less successful in objective ageing than their better educated counterparts elsewhere.

The impact of education, or lack thereof, on subjective ageing is nevertheless significant. There appears to be significant categorical self-esteem issues amongst Chinese individuals due to their historical lack of education access. We find that formal educational attainment is significantly correlated with self-assessed life satisfaction and self-assessed health.

Given the demographics of Chinese society, an improvement in the health of individuals over 60 years old is by extension an improvement in the welfare of the leadership of most Chinese institutions. The policy implications of the research are reasonably clear. Foremost is the promotion of objective SA. As a policy premise, consider the positive correlation between the cost of health care and healthy ageing as opposed to one's numerical age. Policy might also more explicitly consider quality of life. As in Japan [10, 55], China could actively promote participation in social activities as a policy instrument whose explicit goal is SA.

The historical time factor plays a role in the diversity of ageing experience [47]. Most predictive factors are unable to make inferences about an individual's internal changes as people shift from young to old. For example, we are unable to investigate the influence of respondents' views while young on their ultimate health outcome. SA is a helpful term that should be applied to the young, the aged, and the very aged [39]. We propose future research to consider a dynamic SA model by merging subjective and objective dimensions, time dimensions, and geographical dimensions.

Abbreviations

SA	Successful Ageing
SEM	Structural Equation Modelling
CHARLS	China Health and Retirement Longitudinal Study
PCA	Principal Component Analysis
FA	Factor Analysis
KMO	Kaiser Meyer Olkin
EFA	Exploratory Factor Analysis
TLI	Tucker Lewis Index
CFI	Comparative Fit Index
SRMR	Standardised Root Mean Squared Residual
RMSEA	Root Mean Squared Error of the Approximation
TSLS	Two Stage Least Squares

Conflicts of Interest

The authors declare no conflicts of interest.

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