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Well-being paradox:

Comparing the age-happiness relationship across Japan, China, and the US

by

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Abstract

Many researchers have discussed the "well-being paradox," that subjective well-being tends to be stable or even improving in later life despite worsening health and social losses. Using repeated cross-sectional survey data from Japan (2000–2018), China (2003–2021), and the US (2000–2022) and controlling for period and cohort effects, we compared the trajectory of happiness over age across the three countries. We observed U-shaped age-happiness curves across the three countries, despite different troughs (at age 58 years in Japan somewhat later than at age 49 years in China and at age 42 years in the US) and curvatures (sharper in Japan and China than in the US). We also examined how and to what extent changes in marital status, job status, and self-rated health affected the impact of age on happiness and found that spousal loss was a dominant intervening factor in all countries. The slope of the U-shaped curve becomes steeper after controlling for these intervening variables in all three countries, confirming the robustness of the well-being paradox.

Keywords: well-being paradox, happiness, Japan, China, United States

JEL classification codes: I12, I31, J14

1. Introduction

Many researchers have discussed the "well-being paradox" that subjective well-being (SWB), in terms of life satisfaction, happiness, and other subjective measures, tends to be stable or even improving in later life, despite worsening health and social losses (Biermann et al. 2021; Blanchflower & Oswald, 2004; Blanchflower & Oswald, 2008; Stone et al., 2010). This paradox, if valid, can be graphically demonstrated using a U-shaped age-SWB curve. U-shaped curves, often depicted with life satisfaction as an SWB measure, have been generally observed across many countries, with non-negligible exceptions that also vary across studies (Beja, 2018; Bittmann, 2021; Blanchflower, 2021; Lopez Ulloa et al., 2013). However, the shape of the curve – in other words, the relevance of the well-being paradox – varies from country to country, probably depending on economic contexts as well as cultural and institutional frameworks (Graham & Ruiz Pozeulo, 2017; Steptoe et al., 2014; Swift et al. 2014), and the cases in Asian countries have been largely understudied.

Using repeated cross-sectional survey data from Japan (2000–2018), China (2003–2021), and the US (2000–2022), this study compared the trajectory of happiness over age across the three countries. Following previous studies conducted outside Asia, we address three issues concerning assessing the relevance of the well-being paradox.

The first issue is how to identify the age-happiness relationship. Ideally, the age-happiness association should be investigated using fixed-effect models with longitudinal data, which can control for time-invariant individual attributes (Biermann et al., 2022; Frijters & Beatton, 2012; Kratz & Bruderl, 2021; Hansen, 2020; Hansen & Blekesaune, 2022). These studies tended to show relatively cautious or mixed views on the validity of the paradox. However, many other studies used (repeated) cross-sectional data because of limited data availability. If the number of cross-sectional survey waves is limited, it becomes difficult to disentangle the precise association between age and happiness from the period and cohort effects. Period effects must be controlled because, for instance, recession experiences may have an adverse impact on happiness for all age groups at that time. Similarly, cohort effects should not be ignored because earlier generations may have experienced good or bad times, which are likely to affect the trajectory of happiness over time (Jivraj et al., 2014). This study used repeated cross-sectional data from 12 survey waves (over approximately 20 years) from each country. The long period covered by the surveys helped us adjust for period and cohort effects, although individual-level fixed attributes could not be controlled.

The second issue concerns how to treat the intervening variables linking age to happiness, which was addressed by Glenn (2009) and Hellevik (2017). Health, marital status, and socioeconomic factors may affect the

actual age-happiness association. Some researchers, including Bartram (2020), argue that regression models should not control for such intervening factors and should instead control only for confounding variables, which are causally prior to both SWB and the core independent variables of interest. In this study, we first controlled for sex and educational attainment, which were predetermined in the study sample, in addition to the survey year and cohort effects. Second, following Hansen and Blekesaune (2022), we separately estimated two models; the first was to capture entire aging effects without intervening variables, and the second was to capture "pure" aging effects – that is, genuine direct effects of age – by adjusting for intervening variables. Based on the results of these two models, we identified the mechanisms that explain the age pattern of happiness and examined the relative importance of each intervening variable. We hypothesized that the positive impact of aging on happiness would be partly offset by the negative intervening effects of worsening health and social losses. If this were the case, the slope of the U-shaped curve would be steeper in later life after controlling for such intervening variables.

The third issue concerns specifying a regression model to explain happiness by age. Many studies have assumed that happiness is a quadratic function of age and have estimated the age at which happiness reaches a minimum. However, such a specification lacks rigorous reasoning, and the estimated quadratic curve or its trough may be incorrectly specified (Bittman, 2021; Kratz & Bruderl, 2021). To address this issue, we consider two model specifications, following Hansen and Blekesaune (2022): (1) assuming a cubic age function specification, which includes a set of age and its quadratic and cubic terms, and (2) using binary variables for each age without any specific assumption of the function form. The first specification, which included the cubic terms, allowed for the possibility of reduced happiness later in life. The second specification enabled us to explore the shape of age–happiness more flexibly. Comparing the results of the two specifications is expected to help assess the validity of the cubic function of age specification.

2. Methods

We employ repeated cross-sectional data from Japan, China, and the US over many years because comparisons of these three countries allow for a comprehensive analysis of trends and changes in well-being over time, providing a robust understanding of the well-being paradox. First, these three countries represent different cultural contexts, allowing researchers to investigate whether the well-being paradox holds true across diverse societies with varying social values and norms. Second, these countries are at different stages of economic development. This variation helps to understand how economic factors and living conditions affect the trajectory of happiness and well-being. Third, each country has unique demographic characteristics, such as age structures, life expectancy,

and family composition. Studying these differences can provide insights on how demographic factors impact well-being. Finally, the healthcare, pension, and elderly care systems and policies in Japan, China, and the US differ substantially. Comparing these systems and policies can shed light on how access to and quality of social systems and policies for older individuals affect well-being, especially in later life.

2.1 Study sample

We used microdata collected from the Japanese Social Survey (JGSS) for Japan, the Chinese Social Survey (CGSS) for China, and the General Social Survey (GSS) for the US. The JGSS and CGSS are each country's version of the GSS, originally designed and conducted by the National Opinion Research Center at the University of Chicago in the US. These surveys provide a comprehensive collection of respondents' demographics, socioeconomic status, and other aspects. They were designed almost uniformly and used common questionnaires, making them comparable.

As summarized in Table 1, we used repeated cross-sectional data from 12 waves in Japan (2000–2018), China (2003–2021), and the US (2000–2022). We focused on participants aged 30–89 in each wave, and the total number of participants was 23,495, 99,483, and 24,290 in Japan, China, and the US, respectively.

Dependent variable: happiness

The primary dependent variable was happiness, used as an SWB measure. JGSS asked the respondents to answer ‘‘Are you happy now?’’ on a five-point scale (1 = ‘‘happy’’ to 5 = ‘‘unhappy’’). CGSS asked the respondents to answer the question ‘‘On the whole, how do you feel about your life?’’ on a five-point scale (1 = ‘‘very unhappy’’ to 5 = ‘‘very happy’’). Meanwhile, GSS presented three optional answers, ‘‘very happy,’’ ‘‘pretty happy,’’ and ‘‘not too happy,’’ to the question ‘‘Are you happy with life?’’ We reversed the order of the scores for the JGSS and GSS and standardized the JGSS, CGSS, and GSS scores by means and standard deviations of the original scores.

Independent variables

Age was the most important independent variable. We subtracted 60 from each age and divided the residuals by 100. Subsequently, we computed the quadratic and cubic values. We also constructed binary variables for each age group. To control for the period (calendar year) effect, binary variables were constructed for each survey year. Regarding the cohort effect, we constructed binary variables for each of the nine cohorts born before 1920, in

1920–1929, ..., 1980–1989, and in 1990 and later. This treatment made the analysis free, even if not fully, from the identity problem owing to the linear dependence among age, period, and cohort.

Regarding the time-invariant individual-level variables, we constructed binary variables for sex (female = 1) and educational attainment (graduated from junior college or above = 1), which were largely predetermined for the study sample aged 30 or above. In China, we additionally considered *hukou*, a Chinese system of household registration (rural *hukou* = 1), considering the possibility of a substantial difference in the socioeconomic contexts between urban and rural *hukou*s.

Regarding the time-variant individual-level variables, which are expected to intervene in the association between age and happiness, we considered binary variables for marital status (married = 1), job status (having a paid job = 1), and self-rated health (SRH) (good = 1). As for SRH, the JGSS asked the respondents to answer ‘‘How are your current health conditions?’’ on a five-point scale (1 = ‘‘good’’ to 5 = ‘‘poor’’). The CGSS provides a similar question about SRH on a five-point scale (1 = ‘‘very poor’’ to 5 = ‘‘very good’’). The GSS asked respondents, “Would you say your own health, in general, is excellent, good, fair, or poor?” We constructed a binary variable of having good SRH by allocating one to 1 or 2 in JGSS, 4 or 5 in CGSS, and “excellent” or “good” in GSS.

Regression models

We estimated three regression models to explain standardized happiness variables. Model 1 included age and its quadratic and cubic terms, as well as a set of control variables, which consisted of binary variables for time-invariant variables (being female and having higher educational attainment [i.e., graduated from junior college or above]) and each survey year and cohort:

$$\text{Model 1: } Happiness = \beta_0 + \beta_1 age + \beta_2 age^2 + \beta_3 age^3 + (controls),$$

where $\beta_1 age + \beta_2 age^2 + \beta_3 age^3$ indicates the estimated age-happiness curve (with happiness equal to zero when age is equal to 60 years).

Model 2 included binary time-variant individual-level variables (having a spouse, a paid job, and a good SRH).

$$\text{Model 2: } Happiness = \beta_0' a + \beta_1' age + \beta_2' age^2 + \beta_3' age^3 + \gamma_1 having\ a\ spouse + \gamma_2 having\ a\ paid\ job + \gamma_3 good\ SRH + (controls),$$

where $\beta_1' age + \beta_2' age^2 + \beta_3' age^3$ corresponds to the age-happiness curve adjusted for marital and job statuses and health, in other words, the "pure" aging effect, which means the genuine, direct effect of age (Hansen & Blekesaune, 2022).

In addition, we estimated three auxiliary models to explain having a spouse, having a paid job, and good SRH using the same set of explanatory variables as in Model 1.

$$Having\ a\ spouse = \theta_{10} + \theta_{11} age + \theta_{12} age^2 + \theta_{13} age^3 + (controls)$$

$$Having\ a\ paid\ job = \theta_{20} + \theta_{21} age + \theta_{22} age^2 + \theta_{23} age^3 + (controls)$$

$$Good\ SRH = \theta_{30} + \theta_{31} age + \theta_{32} age^2 + \theta_{33} age^3 + (controls).$$

The product of γ_i in Model 2 and $\theta_{i0} + \theta_{i1} age + \theta_{i2} age^2$ in these auxiliary models indicates the trajectory of the effect of age intervened by variable *i* over age (*i* = 1, 2, 3), assuming that the impact of each intervening factor was the same across ages. In general, it can be expected that all three variables are decreasing functions of age and are positively associated with happiness, suggesting that these variables may negatively influence the link between age and happiness.

Finally, Model 3 replaced a set of ages and their quadratic and cubic terms with a set of binary variables for each age (taking 60 years old as a base case) without any specific assumption of the function form:

Model 3: $Happiness = \delta_0 + \sum_{j=30}^{89} \delta_j I(age = j) + (controls)$,

where $I(age = j)$ is a function of allocating 1 to age = *j* years and zero otherwise. By comparing the results of Models 1 and 3, we can evaluate the validity of the specification of the cubic function of age.

3. Results

Descriptive analysis

Table 2 summarizes the key features of the respondents used in this study, pooled for the entire study period. Figure 1 compares the trajectory of happiness with age across the three countries using raw, pooled data over all survey years without controlling for any factors. U-shaped curves were roughly observed in Japan and China, while an increase in happiness was more remarkable in China. The curve in the US indicates a less clear pattern over age, with a shallow trough in the mid-50s, followed by first increases and then decreases in later life.

Figure 2 plots the age-happiness combinations for three groups of consecutive survey years for each country. No clear difference is observed across survey year groups in Japan. In China, happiness has been

increasing over the years, especially between 2000– 2010 and 2011–2015, while recent years show a modest reduction in happiness in the US. The results suggest the need to control for the period effect, especially in China and the US.

Figure 3 compares the trajectory of happiness over age across the four birth year cohorts (born in 1910–1929, 1930–1949, 1950–1969, and after 1970), instead by the nine cohorts used in the regression analysis, to highlight differences between the cohorts. As shown in this figure, there is no clear difference between the cohorts in Japan. By contrast, happiness was substantially improved in each consecutive cohort in China, whereas the opposite pattern was observed in the US, albeit less clear. These results suggest that cohort effects are substantial in China and, to a lesser extent, in the US.

Table 3 summarizes the estimation results of Models 1 and 2 for each country, after controlling for period and cohort effects.[1)] In Japan and China, the quadratic terms of age are significantly positive, and the cubic terms are non-significant, suggesting that age-happiness curves are closely U-shaped. In contrast, the quadratic term is non-significant, and the cubic terms are significant in the US, pointing to a non-U-shaped curve. For Models 1 and 2 and all countries, being female and highly educated was positively associated with happiness, while having a spouse, a paid job, and a good SRH had positive relationships with happiness.

We further estimated Model 3, which had no specification of the function form, and compared the age-happiness relationships derived from Model 1 (expressed by a curve) and Model 3 (expressed in dots) in Figure 4. The height of the curve in Figure 4 corresponds to the estimated value of $\beta_1 age + \beta_2 age^2 + \beta_3 age^3$ in Model 1, in which age is adjusted by subtracting 60 from it and dividing the difference by 100, meaning that the height is equal to zero at age 60. The height of each dot corresponds to the estimated coefficient of the binary variable for each year (with the age of 60 as a reference) in Model 3. In both models, happiness was zero at 60 years of age.

As seen in Figure 4, the results of Model 1 indicated that Japan and China exhibited U-shaped curves bottoming at age 58 and 49 years, respectively. In contrast, the US curve was “S-shaped,” with a trough and peak at 42 and 74 years, respectively. By comparing the curves derived from Model 1 with the distribution of the dots derived from Model 3, we can argue that the specification of the cubic function had no serious bias.

Figure 5 compares the age-happiness relationship derived from Model 1 between men and women (see Table S1 in the Supplementary Material). In both Japan and China, there is no substantial difference between

[1] We further estimated Models 1-3 in China without controlling for rural *hukou*, and found that the results remained virtually unchanged.

sexes, but happiness reaches a minimum at a slightly lower age for men (55 years for men, 61 years for women in Japan, and 46 and 51 in China). In the US, men exhibit a deeper S-shaped curve than women, with earlier troughs (40 years for men vs. 46 years for women) and peaks (72 years for men vs. 77 years for women)

Figure 6 compares the age-happiness relationships derived from Models 1 and 2. In all countries, Model 2 produced steeper U-shaped or S-shaped curves (dotted) than the Model 1 curves (solid), and the Model 2 curve was located above the Model 1 curve above the age of 60 years, a benchmark year in the regression models. This indicates that the positive impact of age on happiness was negatively intervened by the three variables (marital status, job status, and health). The vertical distance between the two curves indicates the magnitude of the total intervening effects. The dotted curve, derived from Model 2, indicates the "pure" aging effects, which are not intervened by any factor.

Lastly, Figure 7 illustrates how marital status, job status, and health intervened in the impact of age on happiness, based on the results of Models 1 and 2 and the auxiliary models, which explained the three intervening variables using a cubic function of age. The "Total intervened effect" curve corresponds to the horizontal distance between the Model 1 and Model 2 curves shown in Table 6. Marital status was the dominant intervention variable in all countries. The risk of spousal loss, divorce, or separation increased with age in all countries, as seen in Table S2 in the Supplementary Material, and correspondingly had a negative effect on the age-happiness relationship. SRH was another important negative intervening variable in China, but its effect was much smaller in Japan and offset, albeit only slightly, the impact of age in the US. Job-status had a limited effect in all countries.

4. Discussion

We examined the validity of the well-being paradox that SWB tends to be stable or even improve in later life despite worsening health and social losses. We focused on perceived happiness as an SWB measure and compared the results among Japan, China, and the US using repeated cross-sectional data obtained from the JGSS, CGSS, and GSS, which are largely comparable. Although not free from limitations related to cross-sectional analysis, twelve-wave survey data helped us disentangle the age-happiness association effect from period and cohort effects.

In line with many previous studies, including Biermann et al. (2022), Blanchflower and Oswald (2004; 2008), and Stone et al. (2010), we observed U-shaped curves for the age-happiness association in Japan and

China. The US data exhibited an S-shaped curve over the entire age span (ages 30-89), but it was U-shaped when age was limited to less than 70s. These curves do not show any substantial bias in the results obtained without any specific form of the function. The results underscored the validity of the well-being paradox and the U-shaped relationships between age and happiness in the three countries.

Yet, this result should be interpreted cautiously. We also employ the semi-parametric regression model of Robinson (1988), i.e., the double residual estimator which estimates the nonlinear relation between the age variable and the dependent variable, i.e., happiness. The Härdle and Mammen (1993) test allows us to assess whether a polynomial function can be used to approximate the nonparametric part. For all three countries, the Härdle and Mammen's (1993) specification test rejected the null hypothesis that parametric (quadratic or cubic) and non-parametric fits were not different. It should be also noted that Model 3 was not non-parametric, assuming parametric associations between each age and happiness, even though the model did not assume any specific form of the function.

We also observed that beyond the age of minimum happiness, the upward slope of the U-shaped curve became substantially steeper in Model 2 than in Model 1, particularly for Japan and China. The risks of spousal loss, retirement, and worsening health – all of which tend to increase with age – decrease happiness. After controlling for negative intervening effects, the genuine direct effect of aging became more remarkable, as evidenced by the enhanced U-shapedness by including negative intervening variables. In other words, the observed positive association between age and happiness may underestimate the purely positive impact of age on happiness, underscoring the validity of the well-being paradox.

Among the three intervening variables, marital status was found to play a dominant role across the three countries. Spousal loss tended to offset a substantial portion of the positive impact of aging on happiness. SRH was a key intervening factor in China, unlike in Japan and the US, implying that limited availability of healthcare services for older people may fail to mitigate the adverse impact of deteriorating health on happiness in China.

We also found that the age-happiness relationship differed by country regarding the curvature of the curve, the age when happiness reached a minimum, and differences between men and women.[2)] Most notably, the U-shaped curve was clearer for Japan and China than for the US. The factors behind these changes were not uncovered in this study. However, the results of decomposing the intervening effects

[2] Imrohoroglu and Yu (2024) showed that older women had more depressive symptoms than older men in China, suggesting that sex differences may differ between SWB and subjective ill-being.

suggest that healthcare and other social security programs, labor market conditions for older adults, family settings, and other sociodemographic and economic backgrounds may at least partly account for the differences in the age-happiness association across countries.

This study has several limitations and issues to be addressed in the future, in addition to the limitations of cross-sectional analysis. First and most importantly, we did not identify the reason for the counterintuitive well-being paradox. Several researchers have attempted to explain this phenomenon, as reviewed by Hansen and Blekesaune (2022). It has been argued, for instance, that (i) older adults use accommodative strategies, including rescaling goals and adjusting aspirations (George, 2006); (ii) they easily adapt to changing life circumstances (Lucas, 2007); (iii) they attend to and remember positive information and memories better than negative ones (Carstensen & Mikels, 2005); and (iv) they exhibit higher levels of psychological characteristics or interpersonal character strengths such as gratitude, compassion, forgiveness, and tolerance (Beadle & De la Vega, 2019; Chopik et al. 2019). We cannot assess the validity of these arguments, which are not mutually exclusive. The survival bias may be another factor that may explain the paradox. If happier people live longer, as argued by Frey (2011), it is reasonable to predict a positive relationship between age and happiness among older adults. It also suggests the need for further research on the impact of happiness on longevity.

Second, we focused on marital status, job status, and health, but many other factors may potentially intervene in the age-happiness relationship. For instance, household income, social participation (or interaction with neighbors, friends, and others), and caregiving of parents or other family members are likely to be major intervening variables. However, as Bartram (2020) discussed, to evaluate the "total" effect of age, the regression model should include only confounders and exclude intervening variables. Expanding the scope of the intervening variables must be aimed at identifying the mechanisms – in other words, "happiness (or more broadly, SWB) production function" – that explain the observed dynamism of happiness changes with age.

Third, the analysis should be extended to other aspects of SWB. While we focused on happiness, given the availability of survey data across the three countries, many researchers have focused on life satisfaction. Moreover, satisfaction with specific aspects of life, including marriage, family life, and jobs, may exhibit different trajectories with age. We can expand the analysis to mental health, such as depression, as well as to the subjective assessment of health, which was treated as an intervening variable.

5. Conclusion

We observed U-shaped age-happiness curves across the three countries and found that spousal loss was the dominant intervening variable. This suggests that spousal loss significantly impacts happiness, contributing to the dips observed in the U-shaped curves. The slope of the U-shaped curve became steeper after controlling for the intervening variables in all three countries, confirming the robustness of the well-being paradox. This means that, even when accounting for factors like changes in marital status, job status, and self-rated health, the overall pattern of happiness improving in later life despite worsening health conditions remains consistent and robust.

The well-being paradox itself is encouraging for social welfare under an aging population, which places strong pressure on social system and policies. As populations age, ensuring the well-being of older adults becomes increasingly important. The paradox suggests that subjective well-being can remain stable or even improve despite physical and social losses, which is a positive sign for aging societies. However, more in-depth analysis is needed to identify the mechanisms behind the well-being puzzle. Understanding why and how subjective well-being improves or remains stable in later life despite deteriorating health conditions is crucial for developing effective policies. Researchers need to investigate further into factors such as social support systems and psychological resilience toward aging.

Policy support needs to take full advantage of the potentially favorable age effect on well-being in later life. Governments and policymakers should consider implementing programs that enhance social support, provide opportunities for meaningful engagement, and promote mental health among older adults. By doing so, they can help maximize the positive aspects of the well-being paradox, ensuring that older adults maintain a high quality of life even as they age. This holistic approach can help address the challenges posed by an aging population and contribute to the overall stability and sustainability of resilient socioeconomic systems.

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Table 1. Study sample

Survey year	Japan	China	US
2000	2,499	n/a	2,247
2001	2,456	n/a	n/a
2002	2,623	n/a	1,100
2003	1,741	4,948	n/a
2004	n/a	n/a	1,072
2005	1,798	8,659	n/a
2006	1,814	8,146	2,450
2008	1,886	4,848	1,647
2010	2,266	10,033	1,661
2011	n/a	4,795	n/a
2012	2,117	10,915	1,629
2013	n/a	10,435	n/a
2014	n/a	n/a	2,134
2015	1,884	9,786	n/a
2016	n/a	n/a.	2,369
2017	668	11,037	n/a
2018	1,742	11,184	1,939
2021	n/a	4,697	3,278
2022	n/a	n/a	2,764
Total	23,494	99,483	24,290

Table 2. Key features of the respondents in the surveys

		Japan	China	US
Proportion (%)				
Females		54.2	52.1	55.3
College graduates		29.6	12.5	59.6
Having a spouse		77.7	86.5	50.2
Having a paid job		60.6	45.4	51.9
Good self-rated health		49.7	54.1	55.5
Rural *hukou*		n/a	55.3	n/a
Birth year	*M*	1950.7	1960.7	1959.2
	SD	(15.5)	(13.8)	(16.3)
Age (years)	*M*	56.4	53.0	53.3
	SD	(14.7)	(14.0)	(15.2)
Total		23,494	99,483	24,290

Fig 1. Trajectory of happiness over age: pooled sample

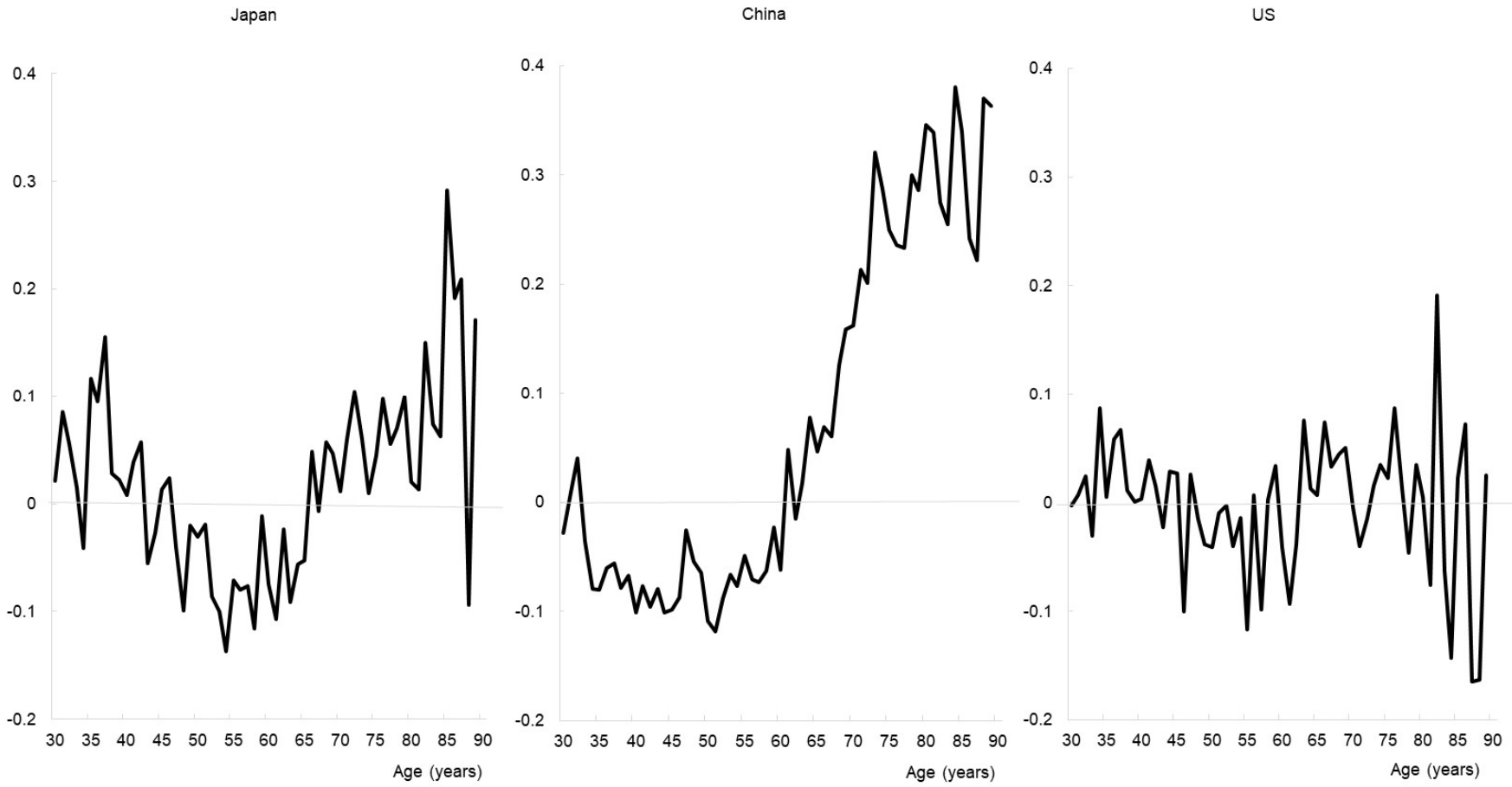


Fig 2. Trajectory of happiness over age by survey year

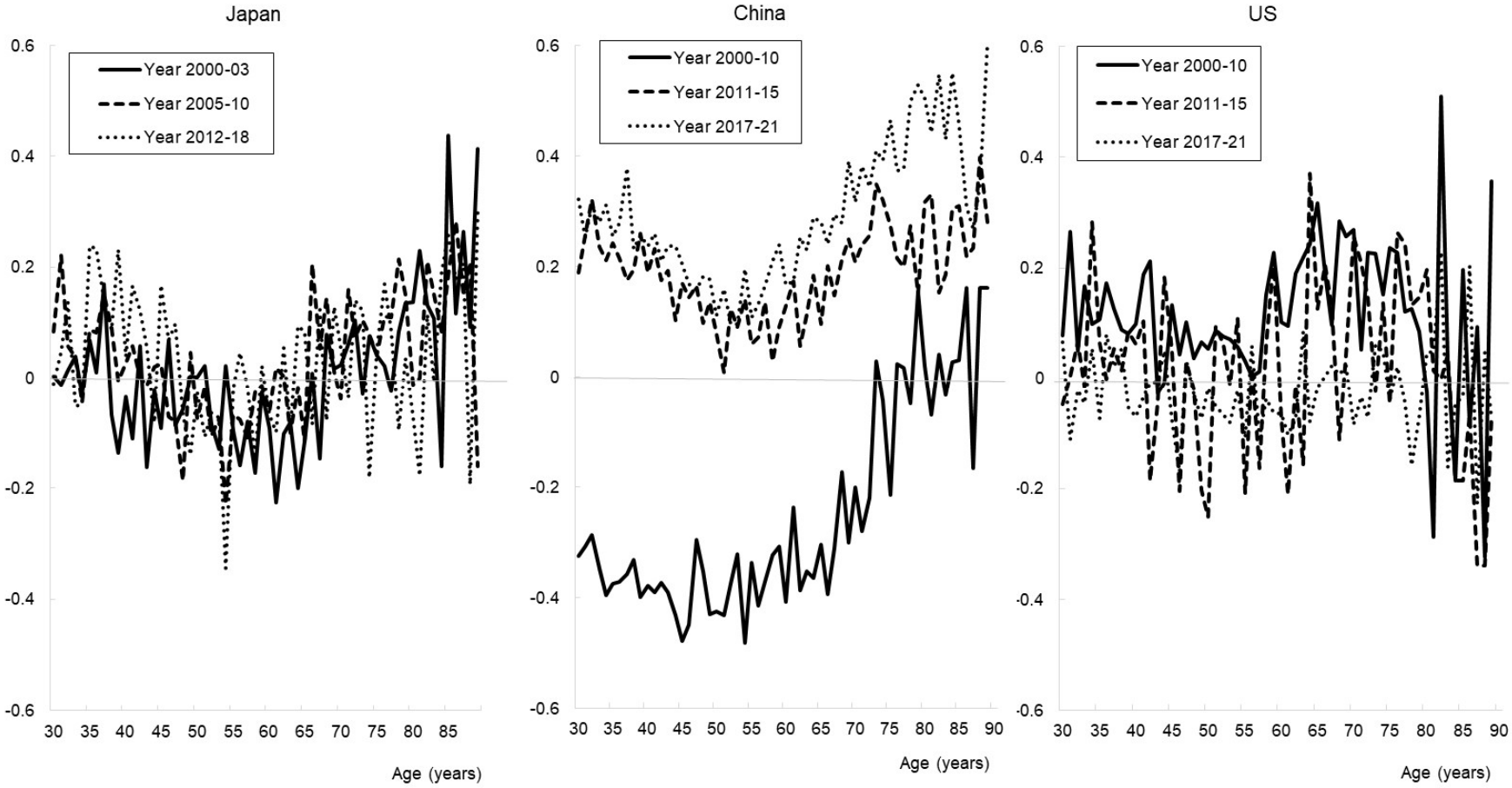


Fig 3. Trajectory of happiness over age by birth year cohort

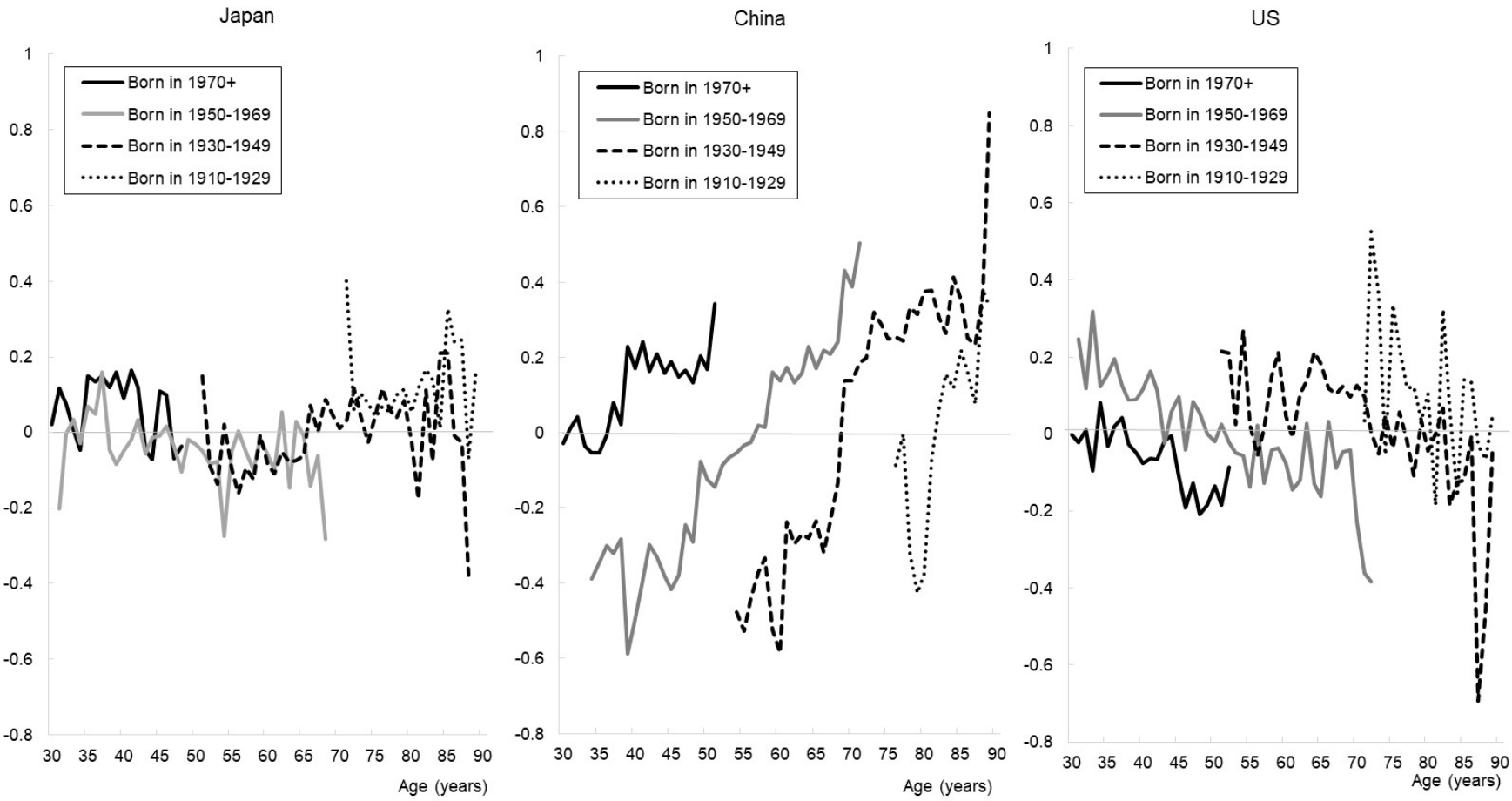
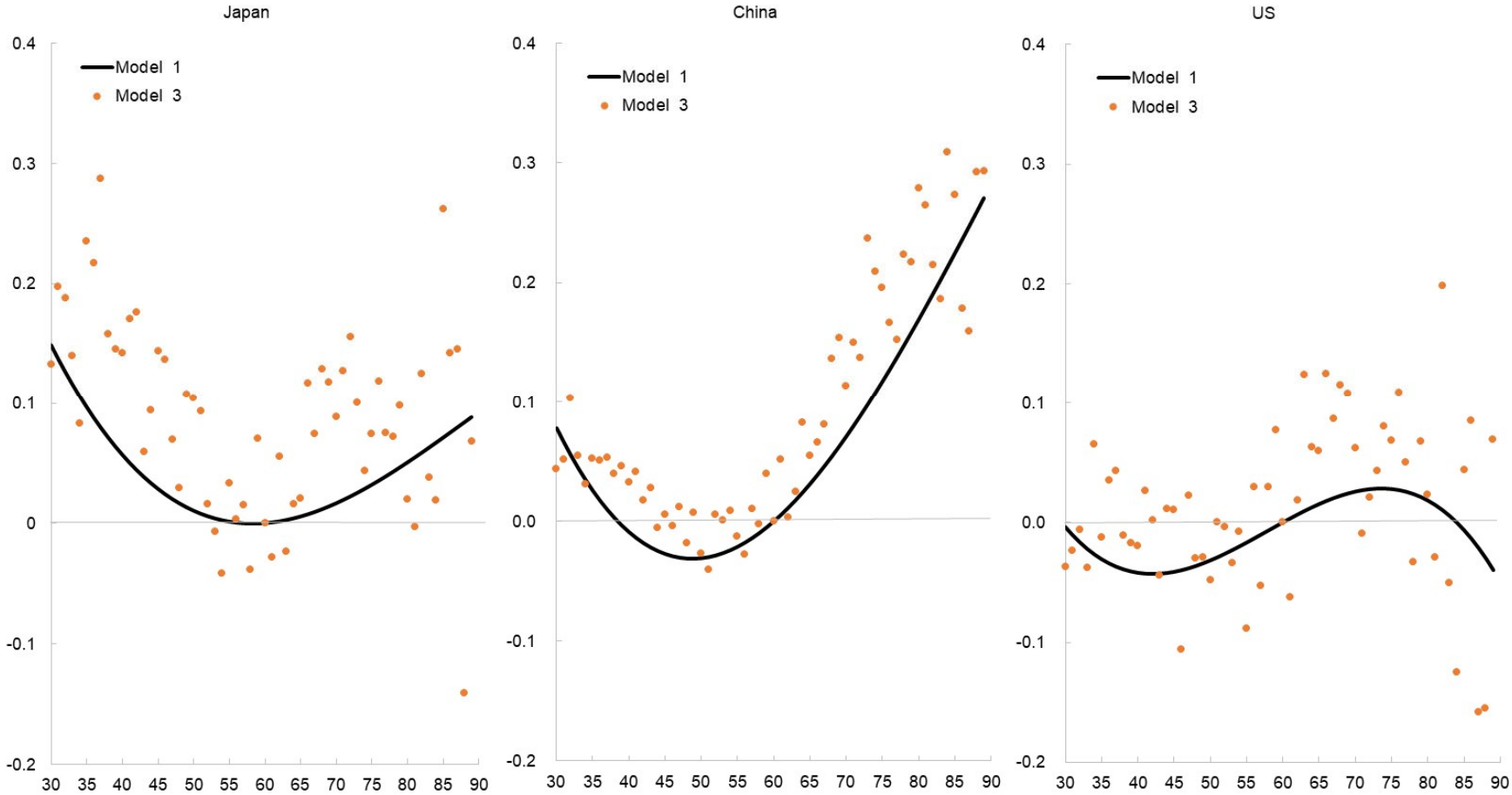


Table 3. Results of Models 1 and 2 to explain happiness

	Japan			China			US		
	Coef.		SE	Coef.		SE	Coef.		SE
Having a spouse									
Age	–0.520	***	(0.091)	-0.659	***	(0.042)	-0.229	*	(0.115)
Age^2	–2.915	***	(0.177)	–2.759	***	(0.083)	–1.501	***	(0.198)
Age^3	0.963		(0.860)	–0.084		(0.383)	–0.263		(0.929)
Female	–0.073	***	(0.005)	–0.034	***	(0.002)	–0.082	***	(0.006)
College	0.039	***	(0.005)	–0.008	*	(0.003)	0.074	***	(0.006)
Rural *hukou*				0.011		(0.002)			
Having a paid job									
Age	–2.410	***	(0.090)	-1.780	***	(0.055)	–1.944	***	(0.092)
Age^2	–2.889	***	(0.175)	1.673	***	(0.108)	–0.215		(0.158)
Age^3	14.449	***	(0.848)	10.117	***	(0.498)	13.378	***	(0.743)
Female	–0.217	***	(0.005)	–0.180	***	(0.003)	–0.088	***	(0.005)
College	–0.017	***	(0.005)	0.130	***	(0.004)	0.097	***	(0.005)
Rural *hukou*				–0.137		(0.003)			
Good self-rated health									
Age	–0.088		(0.119)	–1.265	***	(0.069)	0.077		(0.111)
Age^2	0.140		(0.231)	–2.080	***	(0.138)	0.509	**	(0.192)
Age^3	–2.585	*	(1.122)	2.415	***	(0.634)	–0.745		(0.901)
Female	0.025	***	(0.006)	–0.054	***	(0.003)	–0.006		(0.006)
College	0.064	***	(0.007)	0.057	***	(0.005)	0.132	***	(0.006)
Rural *hukou*				–0.043		(0.003)			
N	23,494			84,145			24,290		

Further controlled for period and cohort effects.
*** $p < .001$, ** $p < .001$, * $p < .05$.

Fig 4. Comparing the results of Models 1 and 3



Note. Curves and dots were drawn using the estimated coefficients in Models 1 and 3, respectively.

Fig 5. Comparing the results of Model 1 between men and women

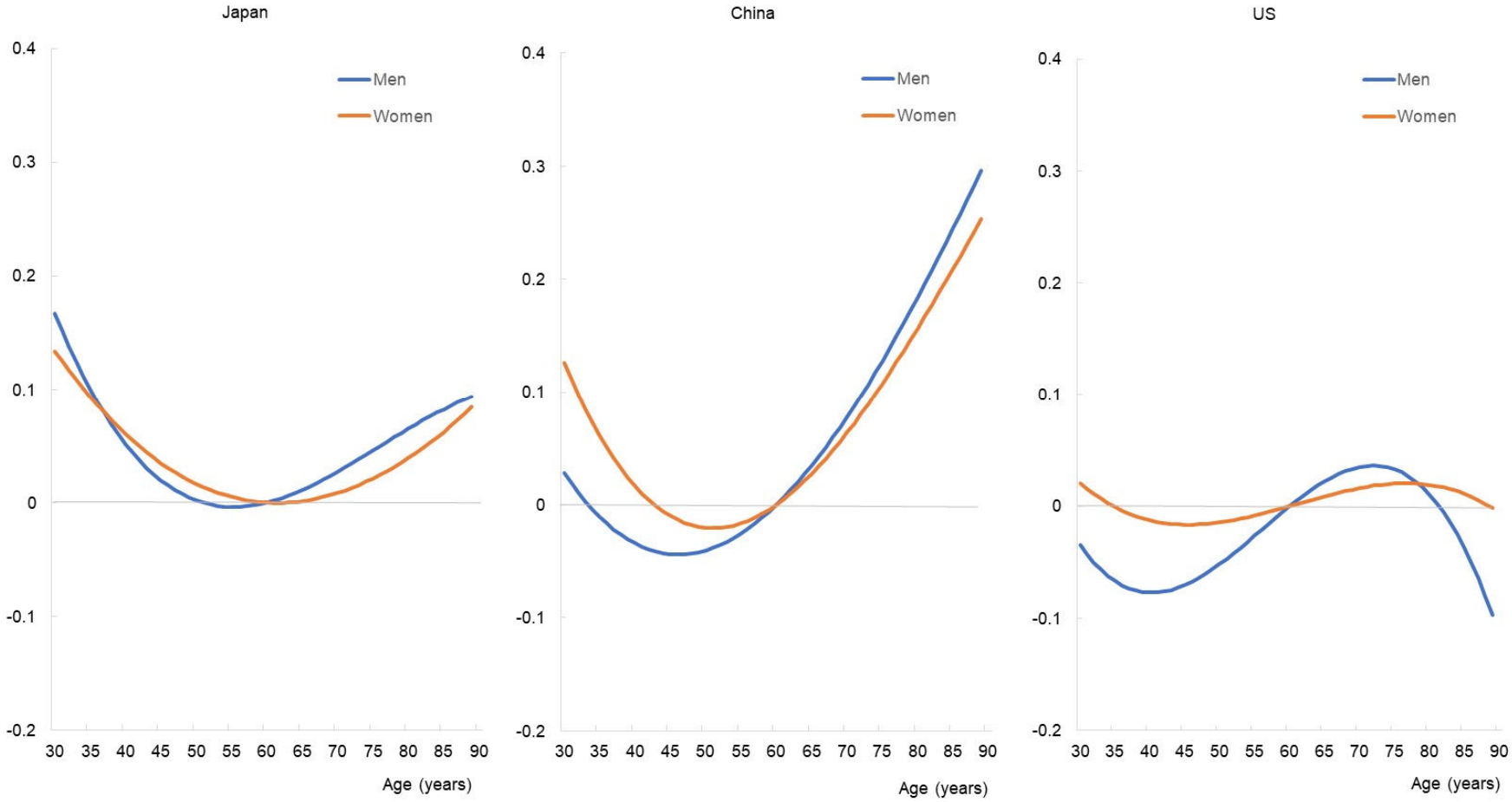


Fig 6. Comparing the results of Models 1 and 2

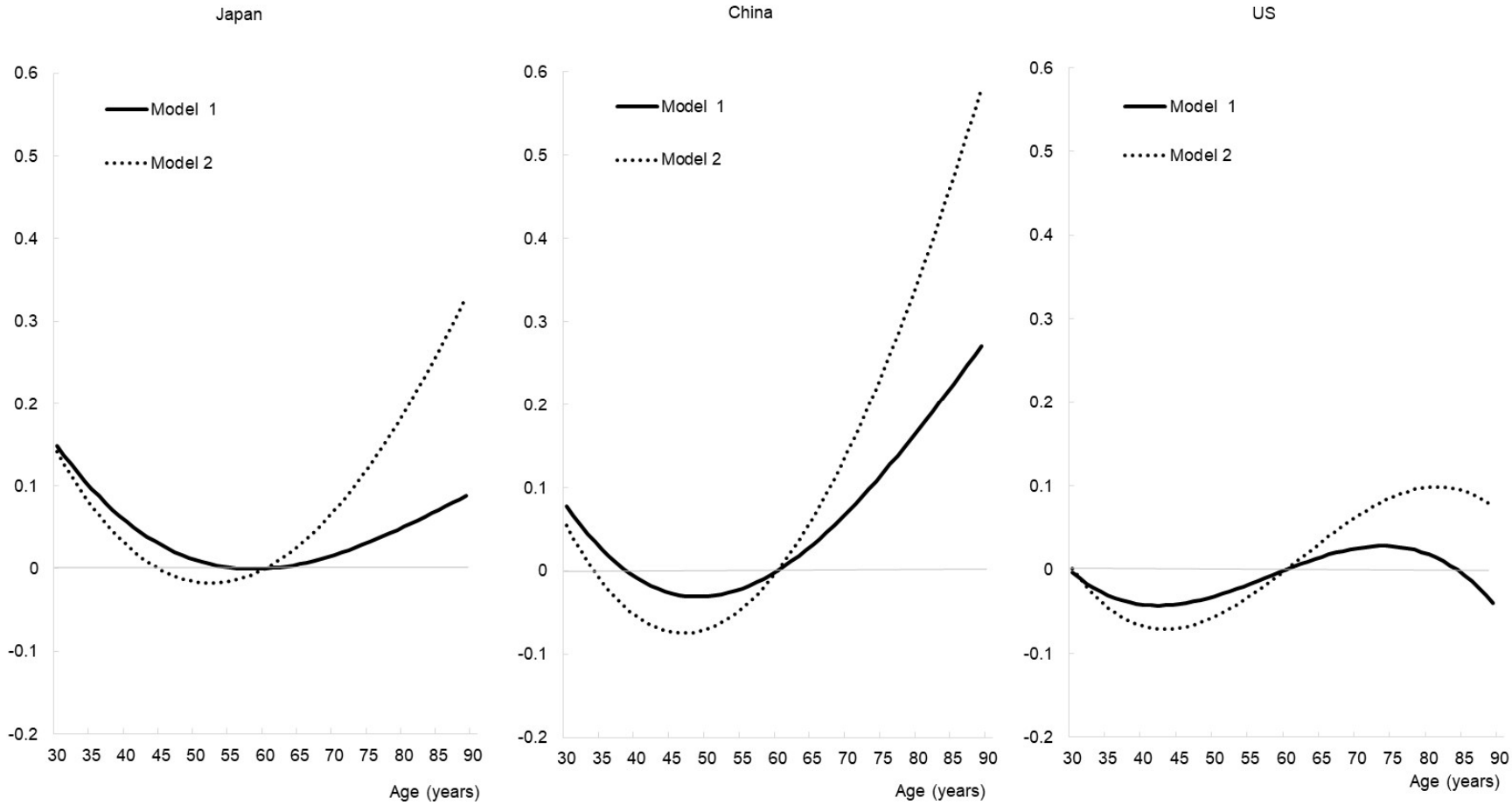
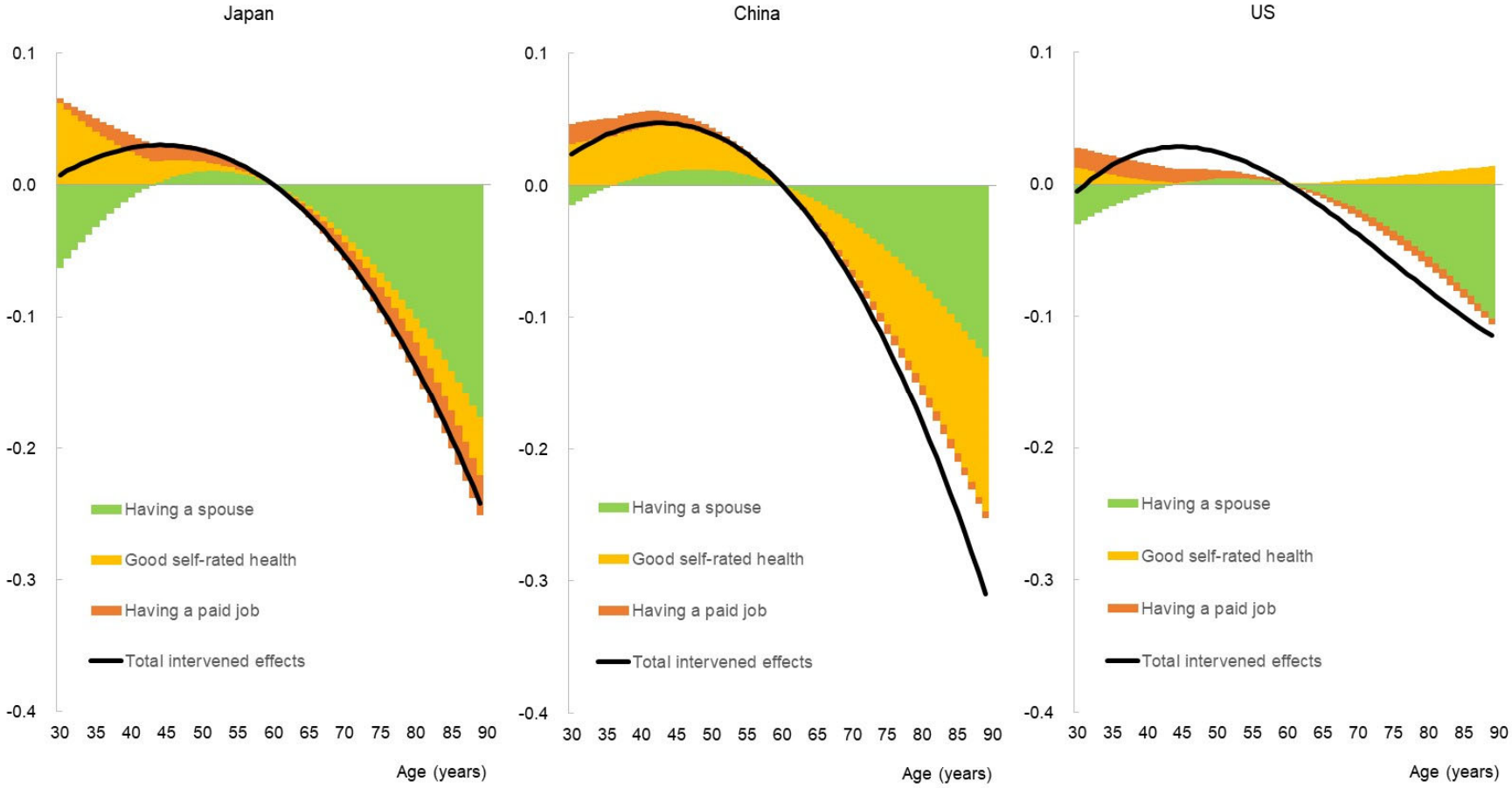


Fig 7. The impact of age on health intervened by marital and job statuses and health



Supplementary material

Table S1. Estimation results of Model 1 by sex

	Men			Women		
	Coef.		SE	Coef.		SE
Japan						
Age	0.157		(0.379)	–0.035		(0.345)
Age^2	1.456	†	(0.747)	1.243	†	(0.643)
Age^3	–3.066		(3.633)	–0.424		(3.148)
College graduates	0.168	***	(0.021)	0.189	***	(0.021)
N	10,767			12,727		
China						
Age	0.606	***	(0.171)	0.445	***	(0.168)
Age^2	1.873	***	(0.333)	2.167	***	(0.333)
Age^3	–1.518		(1.549)	–2.391		(1.510)
College graduates	0.189	***	(0.013)	0.182	***	(0.014)
Rural *hukou*	–0.034		(0.009)	–0.066		(0.009)
N	47,629			51,854		
US						
Age	0.504		(0.371)	0.178		(0.334)
Age^2	–0.832		(0.644)	0.082		(0.560)
Age^3	–7.103	*	(3.039)	–2.476		(2.640)
College graduates	0.185	***	(0.020)	0.197	***	(0.018)
N	10,856			13,434		

Further controlled for period and cohort effects.

$^{***}p < .001$, $^{**}p < .001$, $^{*}p < .05$, $^{\dagger}p < .1$.

Table S2. Estimation results of auxiliary models to explain having a spouse, having a paid job and good self-rated health

	Japan			China			US		
	Coef.		SE	Coef.		SE	Coef.		SE
Having a spouse									
Age	-0.520	***	(0.091)	–0.659	***	(0.042)	–0.229	*	(0.115)
Age^2	–2.915	***	(0.177)	–2.759	***	(0.083)	–1.501	***	(0.198)
Age^3	0.963		(0.860)	–0.084		(0.383)	–0.263		(0.929)
Female	–0.073	***	(0.005)	–0.034	***	(0.002)	–0.082	***	(0.006)
College	0.039	***	(0.005)	–0.008	*	(0.003)	0.074	***	(0.006)
Rural *hukou*				0.011		(0.002)			
Having a paid job									
Age	–2.410	***	(0.090)	–1.780	***	(0.055)	–1.944	***	(0.092)
Age^2	–2.889	***	(0.175)	1.673	***	(0.108)	–0.215		(0.158)
Age^3	14.449	***	(0.848)	10.117	***	(0.498)	13.378	***	(0.743)
Female	–0.217	***	(0.005)	–0.180	***	(0.003)	–0.088	***	(0.005)
College	–0.017	***	(0.005)	0.130	***	(0.004)	0.097	***	(0.005)
Rural *hukou*				–0.137		(0.003)			
Good self-rated health									
Age	–0.088		(0.119)	–1.265	***	(0.069)	0.077		(0.111)
Age^2	0.140		(0.231)	–2.080	***	(0.138)	0.509	**	(0.192)
Age^3	–2.585	*	(1.122)	2.415	***	(0.634)	–0.745		(0.901)
Female	0.025	***	(0.006)	-0.054	***	(0.003)	–0.006		(0.006)
College	0.064	***	(0.007)	0.057	***	(0.005)	0.132	***	(0.006)
Rural *hukou*				–0.043		(0.003)			
N	23,494			84,145			24,290		

Further controlled for period and cohort effects.

*** $p < .001$, ** $p < .001$, * $p < .05$.