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Understanding meat and fish consumption: Socio-demographic and value insights from five European countries

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Electronic supplementary material (ESM)

Supplementary Figures S1–5
Supplementary Tables S1–7

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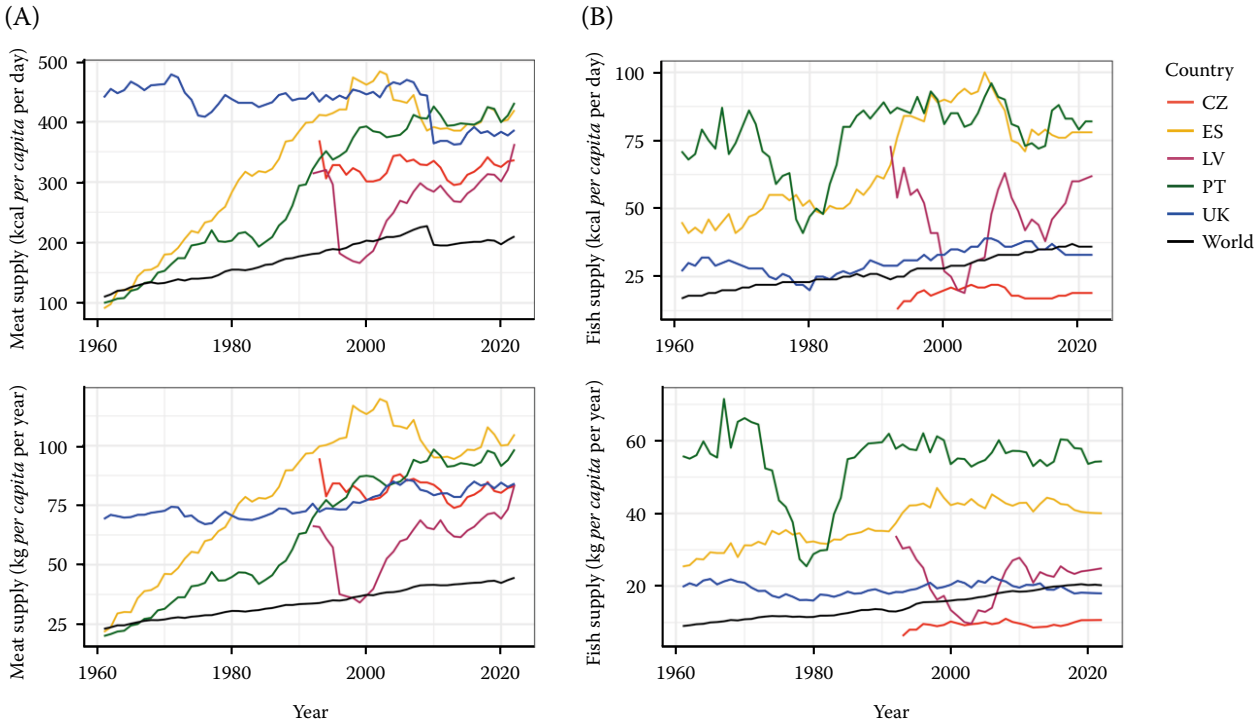

Figure S1. Long-run trends in meat (A) and fish and seafood (B) supply expressed in kcal *per capita* per day (top) and kg *per capita* per year (bottom) by country from 1960 (if applicable) until 2022

Source: Created by authors using data from FAO (2024) for five European countries – Czechia (CZ), Spain (ES), Latvia (LV), Portugal (PT), United Kingdom (UK), and global average (World)

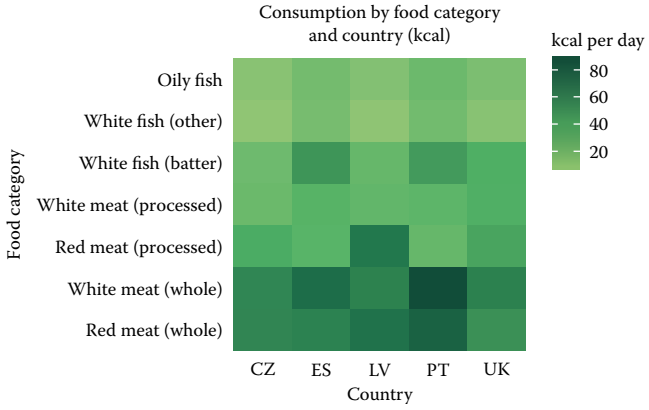

Figure S2. Heatmap of consumption by meat and fish food categories and by country

Source: INHERIT survey data (2018)

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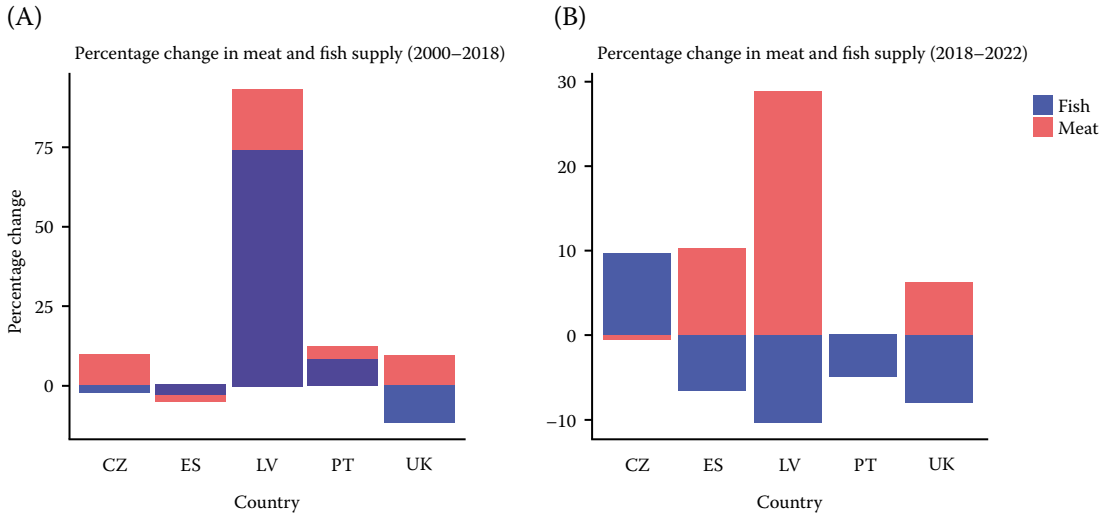

Figure S3. Percentage change in meat and fish supply (kg *per capita* per year) by country from 2000 to 2018 (A) and from 2018 to 2022 (B)

Source: Created by authors using data from FAO (2024) for five European countries – Czechia (CZ), Spain (ES), Latvia (LV), Portugal (PT), United Kingdom (UK)

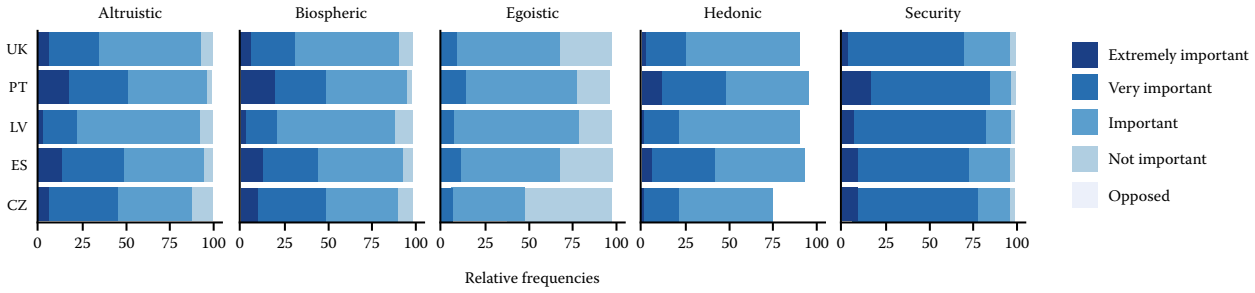

Figure S4. Value importance patterns across countries: Relative frequency distribution

Source: INHERIT survey data (2018)

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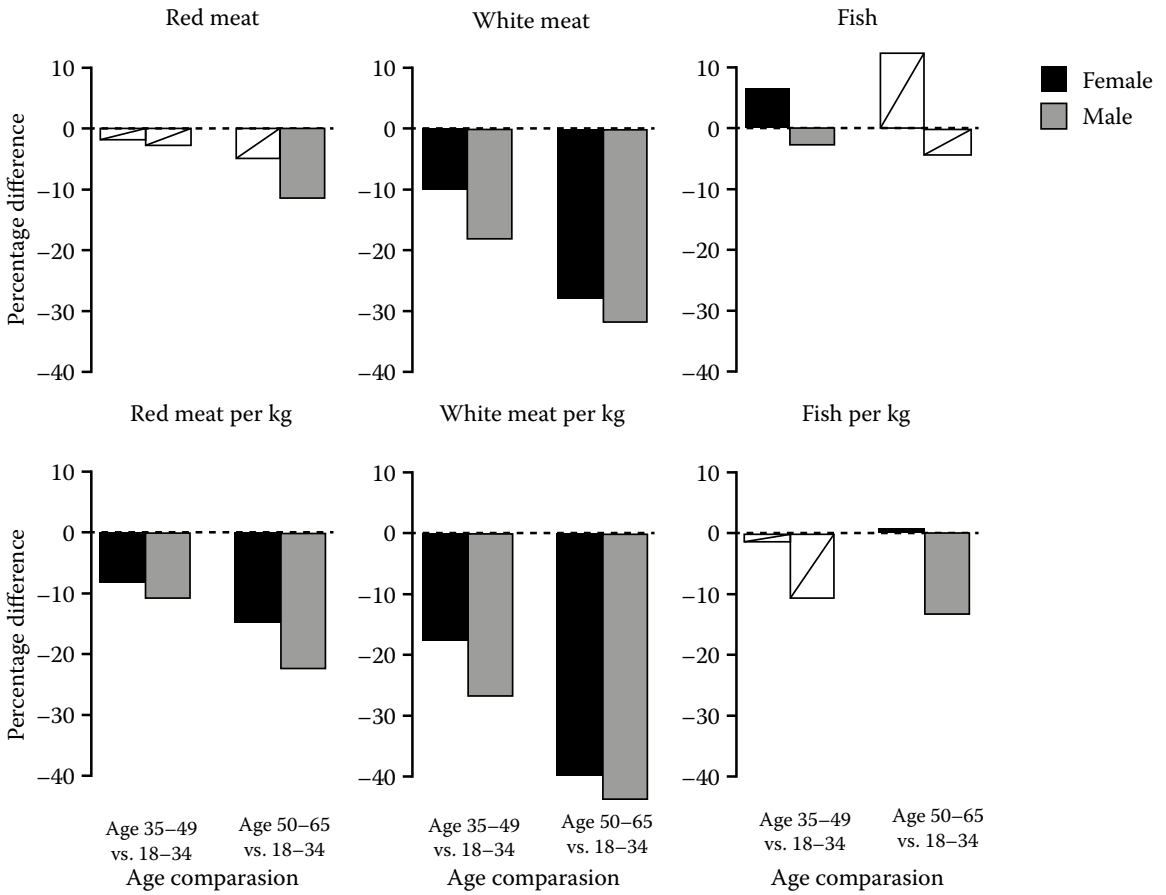

Figure S5. Interaction effects – age differences in meat and fish consumption across gender groups

Visualising significant effects with solid colours, non-significant effects with lines
Source: INHERIT survey data (2018)

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Table S1. Percentage of vegetarians and share of zero consumption of specific meat and fish by non-vegetarians by country (in %)

Diet	All	CZ	ES	LV	PT	UK
Vegetarians	3	2	1	2	1	6
Zero consumption of						
Red meat	3	1	2	2	2	5
White meat	3	2	2	3	1	5
Fish	6	6	3	8	2	8

CZ – Czechia; ES – Spain; LV – Latvia; PT – Portugal; UK – United Kingdom

Source: INHERIT survey data (2018)

Table S2. Mean intakes of red meat, white meat and fish per kg of body mass by country (in kcal per kg per day)

Food item	All	CZ	ES	LV	PT	UK
	overall intake per kg of body mass (means)					
Red meat	1.44	1.19	1.57	1.77	1.46	1.27
White meat	1.37	1.04	1.59	1.18	1.70	1.35
Fish	0.92	0.48	1.33	0.60	1.30	0.90

CZ – Czechia; ES – Spain; LV – Latvia; PT – Portugal; UK – United Kingdom

Source: INHERIT survey data (2018)

Table S3. Summary statistics of continuous variables in the analysis (the dataset consists of 10 070 observations)

Variable	Coding name	Unit	Mean	SD	Min.	Max.	Imputed
Income	inc.1000	EUR 1 000	1.86	1.16	0.06	6.49	1 384
Body weight	body.weight.NO	kg	77.02	18.50	1	200	877
Altruistic	altru	9-point scale ranging from 7 (of supreme importance) to 0 (not important) to –1 (opposed to my values)	4.84	1.36	–1	7	2 733
Biospheric	biosph		4.78	1.43	–1	7	2 742
Egoistic	egoist		3.02	1.36	–1	7	2 747
Hedonic	hedon		4.45	1.33	–1	7	2 749
Security	secur		5.26	1.19	–1	7	2 730

SD – standard deviation

Source: INHERIT survey data (2018)

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Table S4. Summary of categorical and binary data used in the analysis, presenting both unconditional proportions (All) and conditional proportions for the Czechia (CZ), Spain (ES), Latvia (LV), Portugal (PT), and the United Kingdom (UK), expressed as percentages (the dataset consists of 10 070 observations)

Variable	Coding name	All	CZ	ES	LV	PT	UK
Gender (binary)							
Female	female	51	51	50	54	47	54
Age (categorical)							
18–34 yrs	base	33	31	30	33	36	35
35–49 yrs	age cat335-49 yrs	38	38	42	35	40	34
50–65 yrs	age cat350-65 yrs	29	31	28	32	24	31
Education (categorical)							
Primary & lower secondary	base	30	43	39	9	38	21
Upper secondary	edu cat3upper secondary	38	37	27	58	34	39
Tertiary	edu cat3tertiary	32	20	34	33	28	40
Municipality size (binary)							
Town or city	town cat2town	75	62	87	69	77	79
Economic factors (dummy variables)							
DK income	DK income	14	13	9	21	15	13
Unemployed	unemployed	8	3	16	6	11	6
Health factors (dummy variables)							
Smoking	smoking	28	33	35	28	26	19
Healthy diet	healthy diet dummy	15	7	19	6	18	20
Food factors (dummy variables)							
Price	*FF*.price	76	77	65	84	85	74
Taste	*FF*.taste	58	61	52	60	28	75
Quality	*FF*.quality	74	73	75	73	80	71
Habit	*FF*.habit	31	45	28	35	28	23
Family	*FF*.family	38	38	39	37	47	31
Health	*FF*.health	35	30	41	29	47	29
Production methods	*FF*.production.methods	14	9	16	14	18	16
Appearance	*FF*.appearance	55	69	52	62	60	42
Safety	*FF*.safety	24	14	30	27	33	20
Convenience	*FF*.convenience	25	26	22	25	15	32
Origin country	*FF*.origin.country	19	29	15	23	18	11

FF – food factor; *DK* – do not know
Source: INHERIT survey data (2018)

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Table S5. Average marginal effects (AME) and average partial effects (APE) from a probit regression for being a vegetarian

Variable	AME	APE
Female	0.274*** (0.057)	0.0159*** (0.0034)
Education (tertiary)	0.211*** (0.071)	0.0124*** (0.0041)
Education (upper secondary)	0.072 (0.071)	0.0037 (0.0036)
Education (35–49)	–0.238*** (0.061)	–0.0163*** (0.0042)
Age (50–65)	–0.494*** (0.077)	–0.0274*** (0.0041)
Altruistic	0.037 (0.032)	0.0022 (0.0019)
Biospheric	0.182*** (0.030)	0.0106*** (0.0018)
Egoistic	–0.057*** (0.022)	–0.0033*** (0.0013)
Hedonic	–0.049* (0.026)	–0.0028* (0.0015)
Security	–0.154*** (0.033)	–0.0090*** (0.0019)
Observations	10 346	–
Log likelihood	–1 188.335	–
Akaike inf. crit.	2 398.670	–

*, ***P< 0.1, 0.01

Source: INHERIT survey data (2018)

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Table S6. Overall and per kg of body mass intake of red meat (RM), white meat (WM) and fish (F), expressed in kcal per day (Heckman Sample Selection model, Participation Equation)

Variable	Overall intake			Intake per kg of body mass		
	RM_{dummy}	WM_{dummy}	F_{dummy}	RM_{dummy}	WM_{dummy}	F_{dummy}
log(income)	0.010	−0.010	0.071**	0.055	0.030	0.076***
	(0.033)	(0.033)	(0.028)	(0.042)	(0.037)	(0.029)
DK income	0.008	−0.067	−0.106*	−0.167**	−0.149*	−0.175***
	(0.067)	(0.071)	(0.062)	(0.084)	(0.080)	(0.064)
Female	−0.242***	−0.227**	−0.213***	−0.437***	−0.212**	−0.226***
	(0.087)	(0.090)	(0.071)	(0.103)	(0.101)	(0.072)
Education (tertiary)	−0.018	−0.079	0.263***	−0.010	−0.043	0.301***
	(0.063)	(0.065)	(0.061)	(0.078)	(0.073)	(0.063)
Education (upper secondary)	−0.005	−0.013	0.126**	0.041	0.034	0.151***
	(0.062)	(0.063)	(0.053)	(0.078)	(0.071)	(0.055)
Age (35–49)	−0.188*	−0.141	0.100	0.029	−0.110	0.132*
	(0.098)	(0.094)	(0.075)	(0.116)	(0.105)	(0.077)
Age (50–65)	−0.065	−0.319***	0.215***	0.107	−0.283***	0.282***
	(0.104)	(0.091)	(0.083)	(0.121)	(0.101)	(0.084)
Female × age (35–49)	0.202*	0.171	0.187*	0.188	0.139	0.182*
	(0.116)	(0.120)	(0.100)	(0.142)	(0.135)	(0.103)
Female × age (50–65)	0.174	0.422***	0.143	0.242	0.450***	0.106
	(0.124)	(0.124)	(0.113)	(0.152)	(0.139)	(0.116)
Town	−0.049	0.017	0.094*	−0.010	0.072	0.115**
	(0.056)	(0.055)	(0.049)	(0.070)	(0.061)	(0.050)
ES	−0.247**	−0.006	0.308***	−0.237*	0.131	0.314***
	(0.099)	(0.096)	(0.085)	(0.122)	(0.105)	(0.086)
LV	−0.282***	−0.021	−0.225***	−0.257**	−0.114	−0.250***
	(0.097)	(0.087)	(0.071)	(0.126)	(0.097)	(0.072)
PT	−0.184*	0.065	0.333***	−0.136	0.236**	0.335***
	(0.103)	(0.107)	(0.092)	(0.130)	(0.120)	(0.094)
UK	−0.447***	−0.247***	−0.255***	−0.761***	−0.336***	−0.338***
	(0.087)	(0.080)	(0.070)	(0.110)	(0.089)	(0.072)
Unemployed	−0.101	0.0004	−0.140*	−0.119	−0.069	−0.148*
	(0.079)	(0.087)	(0.077)	(0.100)	(0.097)	(0.079)
Healthy diet	−0.267***	−0.375***	0.749***	−0.408***	−0.380***	0.757***
	(0.059)	(0.062)	(0.111)	(0.068)	(0.068)	(0.114)
Body weight	0.003**	0.002	0.001	–	–	–
	(0.001)	(0.001)	(0.001)	–	–	–
Smoking	0.011	0.054	−0.126***	0.073	−0.003	−0.121**
	(0.056)	(0.056)	(0.048)	(0.070)	(0.062)	(0.049)
FF.price	0.043	−0.009	−0.034	0.143**	0.067	0.004
	(0.054)	(0.056)	(0.054)	(0.066)	(0.063)	(0.056)
FF.taste	−0.026	0.058	−0.051	0.093	0.037	−0.046
	(0.051)	(0.052)	(0.047)	(0.063)	(0.058)	(0.048)
FF.quality	0.086	0.076	0.147***	0.195***	0.180***	0.172***
	(0.055)	(0.057)	(0.048)	(0.068)	(0.064)	(0.050)

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Table S6. To be continued

Variable	Overall intake			Intake per kg of body mass		
	RM_{dummy}	WM_{dummy}	F_{dummy}	RM_{dummy}	WM_{dummy}	F_{dummy}
FF.habit	−0.089*	0.046	−0.016	−0.045	0.023	−0.015
	(0.053)	(0.057)	(0.048)	(0.067)	(0.062)	(0.049)
FF.family	0.126**	0.065	0.113**	0.269***	0.125**	0.137***
	(0.053)	(0.054)	(0.047)	(0.066)	(0.060)	(0.048)
FF.health	−0.035	−0.028	0.055	−0.110*	0.033	0.058
	(0.051)	(0.056)	(0.054)	(0.065)	(0.063)	(0.055)
FF.production.methods	−0.168***	−0.205***	0.218***	−0.298***	−0.301***	0.224***
	(0.062)	(0.067)	(0.084)	(0.077)	(0.075)	(0.086)
FF.appearance	−0.010	0.032	0.115**	0.102	0.111*	0.131***
	(0.051)	(0.054)	(0.049)	(0.064)	(0.061)	(0.049)
FF.safety	−0.041	0.071	0.011	−0.039	0.006	−0.003
	(0.057)	(0.064)	(0.061)	(0.073)	(0.071)	(0.063)
FF.convenience	−0.005	0.019	−0.015	0.053	0.066	0.004
	(0.056)	(0.059)	(0.051)	(0.071)	(0.066)	(0.053)
FF.origin.country	0.047	−0.018	0.067	0.114	−0.022	0.080
	(0.065)	(0.065)	(0.067)	(0.083)	(0.072)	(0.068)
Altruistic	0.013	0.002	−0.011	0.020	0.002	−0.014
	(0.026)	(0.027)	(0.026)	(0.034)	(0.031)	(0.026)
Biospheric	−0.072***	−0.052**	0.017	−0.104***	−0.076***	0.017
	(0.023)	(0.025)	(0.022)	(0.032)	(0.029)	(0.023)
Egoistic	0.038**	0.043**	0.028	0.038	0.047**	0.019
	(0.019)	(0.020)	(0.018)	(0.024)	(0.022)	(0.019)
Hedonic	0.036	0.013	−0.013	0.034	0.003	−0.004
	(0.024)	(0.025)	(0.023)	(0.031)	(0.028)	(0.023)
Security	0.008	0.031	0.047*	0.037	0.083**	0.060**
	(0.030)	(0.030)	(0.026)	(0.038)	(0.034)	(0.027)
Constant	2.010***	1.843***	0.833***	2.084***	1.608***	0.692***
	(0.192)	(0.195)	(0.167)	(0.195)	(0.172)	(0.134)
Observations	10 070	10 070	10 070	9 248	9 245	9 289
Log likelihood	−12 657.950	−12 212.370	−12 895.430	−11 957.460	−11 499.220	−12 234.010
ρ	−0.953***	−0.907***	−0.053	−0.012	−0.682***	−0.080
	(0.008)	(0.013)	(0.086)	(0.152)	(0.042)	(0.080)

*, **, ***$P < 0.1, 0.05, 0.01$, respectively; robust standard error in parentheses; 10 070 observations; DK – ????; *FF* – food factor; ES – Spain; LV – Latvia; PT – Portugal; UK – United Kingdom

Source: INHERIT survey data (2018)

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Table S7. Interaction effects from the Heckman regression and *P*-value from Wald-type tests of non-linear hypotheses from the interaction model for overall and per kilogram intake of red meat (RM), white meat (WM) and fish (F)

Hypothesis	RM	WM	F	RM per kg	WM per kg	F per kg
Young female × young male	–0.15***	–0.04	–0.22***	–0.04	0.13***	0.00
Middle-aged female × middle-aged male	–0.15***	0.04***	–0.12***	–0.01***	0.22***	0.09***
Old female × old male	–0.09***	–0.00***	–0.05***	0.04***	0.16**	0.14***
Middle-aged female × young female	–0.02	–0.10***	0.07**	–0.08**	–0.18***	–0.01
Old female × young female	–0.03	–0.18***	–0.03***	–0.11***	–0.27***	–0.11
Middle-aged male × young male	–0.05	–0.28***	0.12	–0.15***	–0.40***	0.01***
Old male × young male	–0.12***	–0.32***	–0.04	–0.22***	–0.44***	–0.13***

*, **, ***P < 0.1, 0.05, 0.01, respectively
Source: INHERIT survey data (2018)