State-Level Trends in Lifespan Variability in the United States, 1960–2019: A Research Note

(Brown D.C., Lariscy J.T., Walker B.H., 2023)

Summary in Chinese

1、概述

第一，美国经历了长期寿命不均（Lifespan Disparity）的下降后，在最近五年出现了反弹，且这一反弹在州级层面非常普遍。

第二，各州内部的寿命不均南高北低，南部高如密西西比州，东北部、中北部、西海岸低如明尼苏达州、犹他州。同时，州间的寿命不均差值在加速扩大。

2、评价

描述性研究，缺乏进一步实证讨论，尤其是为什么最近五年有如此大规模反弹。

Author Introduction

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An Assistant Professor of Sociology and Research Fellow at Mississippi State University. He has a Ph.D. in Sociology from the University of Texas at Austin in 2013.

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Associate Professor of Sociology and the Director of Graduate Studies at the University of Memphis. He has a Ph.D. in Sociology from the University of Texas at Austin in 2013.

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Outline

1. Methods

2. Results

3. Discussion

1. Methods

1. Data

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UC Berkeley Department of Demography
INED
HMD
NCHS

United States Mortality DataBase

Magali Barbieri, Director
University of California, Berkeley & INED, France

John Wilmoth, Founding Director
United Nations & formerly University of California, Berkeley

**** Disclaimer **** The USMDB mortality data for years 2010-2021 are preliminary as the US Census Bureau has yet to revis inter-censal (2010-2019) and post-censal (2020-2021) population estimates using the complete and final results of the 2020 Population Census. These new estimates are expected to be published for all geographic levels (national, state, and county). will update and extend the USMDB data series as soon as the US Census Bureau has released new population estimates. We expect these revised data to create noticeable changes in all lifetable indicators for years 2010 onward.

Updated December 2, 2022 US State life table series for years 1959-2020 (link here).
Updated Sep, 28 2021 US County life table series for years 1982-2018 (link here).

Link to map-based data visualization tool for comparing US Mortality Database lifetable indicators across- and by state: https://usa.mortality.org/uploads/Private/ShinyInfo.php **Note, USMDB user name and password required for access.**

General Project Description: The United States Mortality DataBase (USMDB) brings you the first clearly documented historical set of complete state-level life tables, updated to the latest year of available data, designed to foster research on geographic variations in mortality across the United States and to monitor trends in health inequalities. This data set currentl includes complete and abridged life tables by sex for each of the US 9 Census Divisions, 4 Census Regions, 50 States and th District of Columbia, for each year since 1959 with mortality values up to age 110. The data are available for free to all inter upon registration.

The USMDB is an outgrowth of the Human Mortality Database (HMD) project. It was developed to provide detailed mortali and population data to researchers, students, journalist, policy analysists, and others interested in state-level mortality trends geographic variations in the length of life within the United States. The USMDB has been created by the HMD team at the University of California, Berkeley in collaboration with the Mortality Branch at the National Center for Health Statistics, Ce for Disease Control (NCHS) and with support from the Center on the Economics and Development of Aging (CEDA) and fr the French Institute for Demographic Studies (INED). It has been funded by grants from the National Institutes of Health (R AG040245) and from the Society of Actuaries-REX Pool Fund.

For more information, please begin by reading an overview of the database. If you have comments or questions, or trouble

Geographic Level: State

AL: Alabama	KY: Kentucky	ND: North Dakota
AK: Alaska	LA: Louisiana	OH: Ohio
AZ: Arizona	ME: Maine	OK: Oklahoma
AR: Arkansas	MD: Maryland	OR: Oregon
CA: California	MA: Massachusetts	PA: Pennsylvania
CO: Colorado	MI: Michigan	RI: Rhode Island
CT: Connecticut	MN: Minnesota	SC: South Carolina
DE: Delaware	MS: Mississippi	SD: South Dakota
DC: District of Columbia	MO: Missouri	TN: Tennessee
FL: Florida	MT: Montana	TX: Texas
GA: Georgia	NE: Nebraska	UT: Utah
HI: Hawaii	NV: Nevada	VT: Vermont
ID: Idaho	NH: New Hampshire	VA: Virginia
IL: Illinois	NJ: New Jersey	WA: Washington
IN: Indiana	NM: New Mexico	WV: West Virginia
IA: Iowa	NY: New York	WI: Wisconsin
KS: Kansas	NC: North Carolina	WY: Wyoming

1. Methods

2. Measures

$$e_0^{\dagger} = \frac{\int_0^{\omega} d(x)e(x)dx}{l(0)}$$

Age	l_x		d_x		L_x		T_x		e_x				e_x+	
	男	女	男	女	男	女	男	女	男	女	男	女	男	女
0	100000	100000	166	138	99849	99875	7923451	8422997	79.2345	84.2300	=L3*R3	11600.9518	11.57409578	9.85885314
1	99834	99862	42	35	99813	99845	7823602	8323122	78.3661	83.3460	3303.096916	2912.690972	11.46163952	9.756280899
2	99792	99827	30	23	99777	99816	7723789	8223277	77.3989	82.3750	2284.724699	1873.344644	11.43338078	9.730519029
3	99762	99805	22	17	99751	99796	7624012	8123462	76.4217	81.3937	1700.028203	1421.455744	11.41386216	9.713966117
4	99740	99787	20	16	99730	99779	7524261	8023666	75.4386	80.4078	1527.438968	1253.711139	11.39936326	9.701421297
5	99720	99772	17	14	99711	99765	7424531	7923886	74.4538	79.4203	1282.558626	1082.31663	11.38636052	9.690371576
6	99703	99758	16	13	99695	99752	7324820	7824122	73.4666	78.4311	1170.45249	986.1791047	11.37546398	9.680845923
7	99687	99745	15	11	99679	99740	7225125	7724370	72.4783	77.4409	1092.823436	870.4119522	11.36554068	9.672179313
8	99672	99734	15	11	99664	99728	7125446	7624630	71.4892	76.4496	1036.621214	873.7759508	11.35629578	9.664542008
9	99657	99723	15	10	99650	99717	7025781	7524902	70.4995	75.4583	1044.721291	781.6659711	11.34754628	9.656887622
10	99642	99712	16	12	99634	99706	6926132	7425184	69.5099	74.4661	1131.946231	881.2587877	11.33874918	9.650051644
11	99626	99700	17	13	99618	99694	6826497	7325478	68.5212	73.4749	1167.469497	961.1986988	11.32924064	9.642358033
12	99609	99687	19	15	99599	99680	6726880	7225784	67.5328	72.4844	1298.681511	1092.223861	11.31945799	9.633981272
13	99590	99672	25	18	99577	99664	6627280	7126104	66.5458	71.4953	1660.989217	1251.84352	11.30860342	9.624479584
14	99565	99655	30	18	99550	99646	6527703	7026441	65.5623	70.5078	1935.976196	1283.973216	11.29475591	9.613608816
15	99535	99637	33	19	99519	99627	6428153	6926795	64.5816	69.5206	2141.95886	1327.305718	11.27865654	9.602479312

2. Results

1. Lifespan Variability Trends in the United States

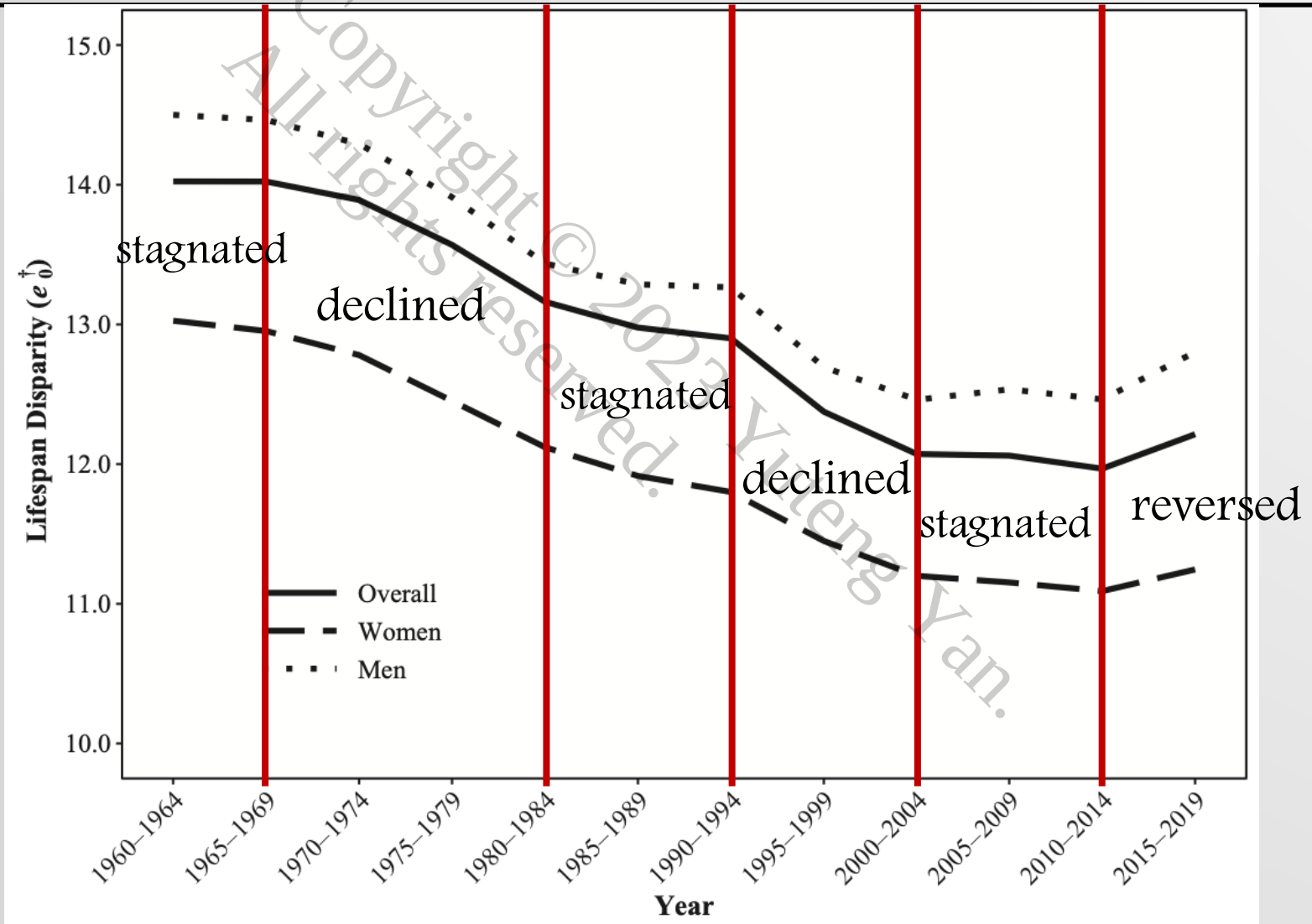

Fig. 1 Overall and sex-specific trends in lifespan disparity at birth ($e_0^\dagger$) in the United States, 1960–2019

2. Results

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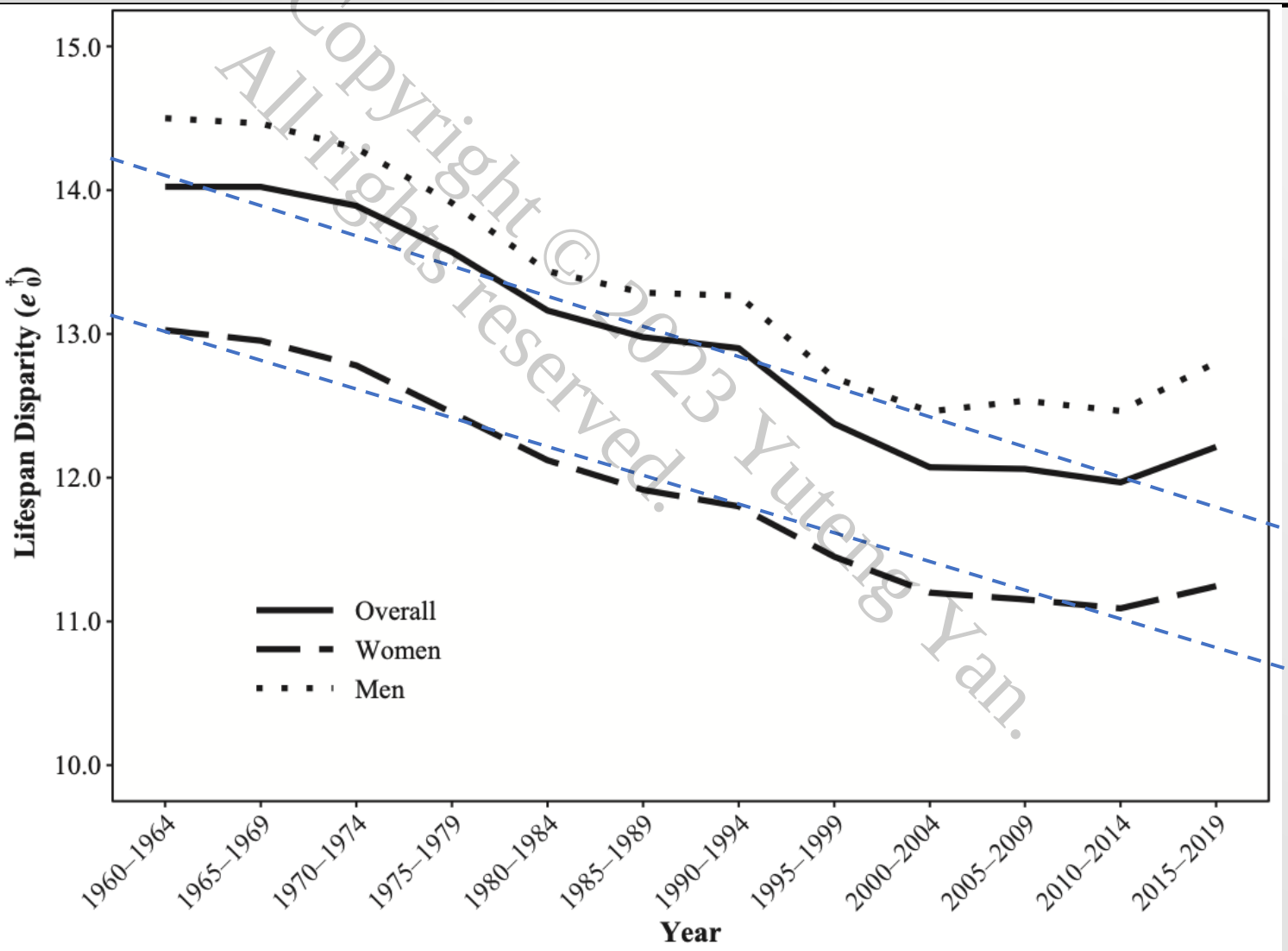

1.5 years

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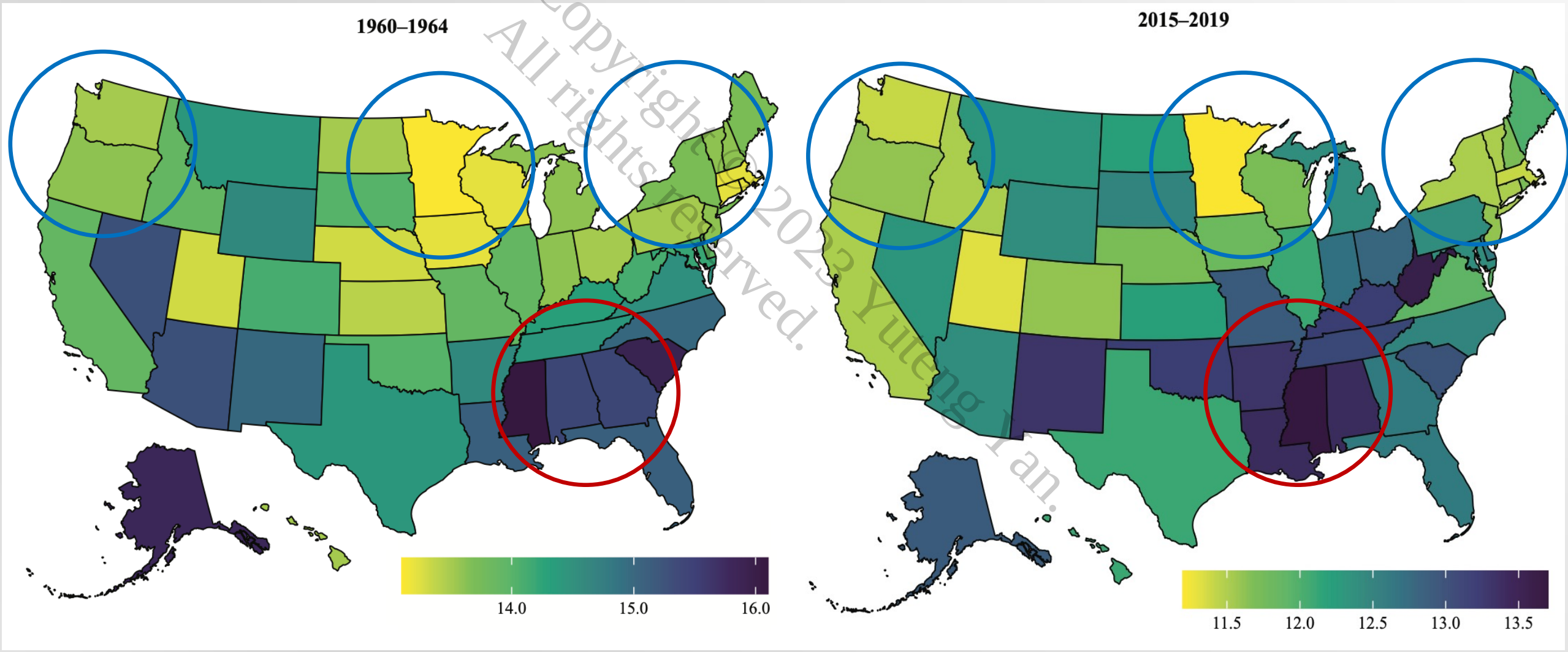
2. Results

2. State-Level Trends in Lifespan Variability



2. Results

2. State-Level Trends in Lifespan Variability

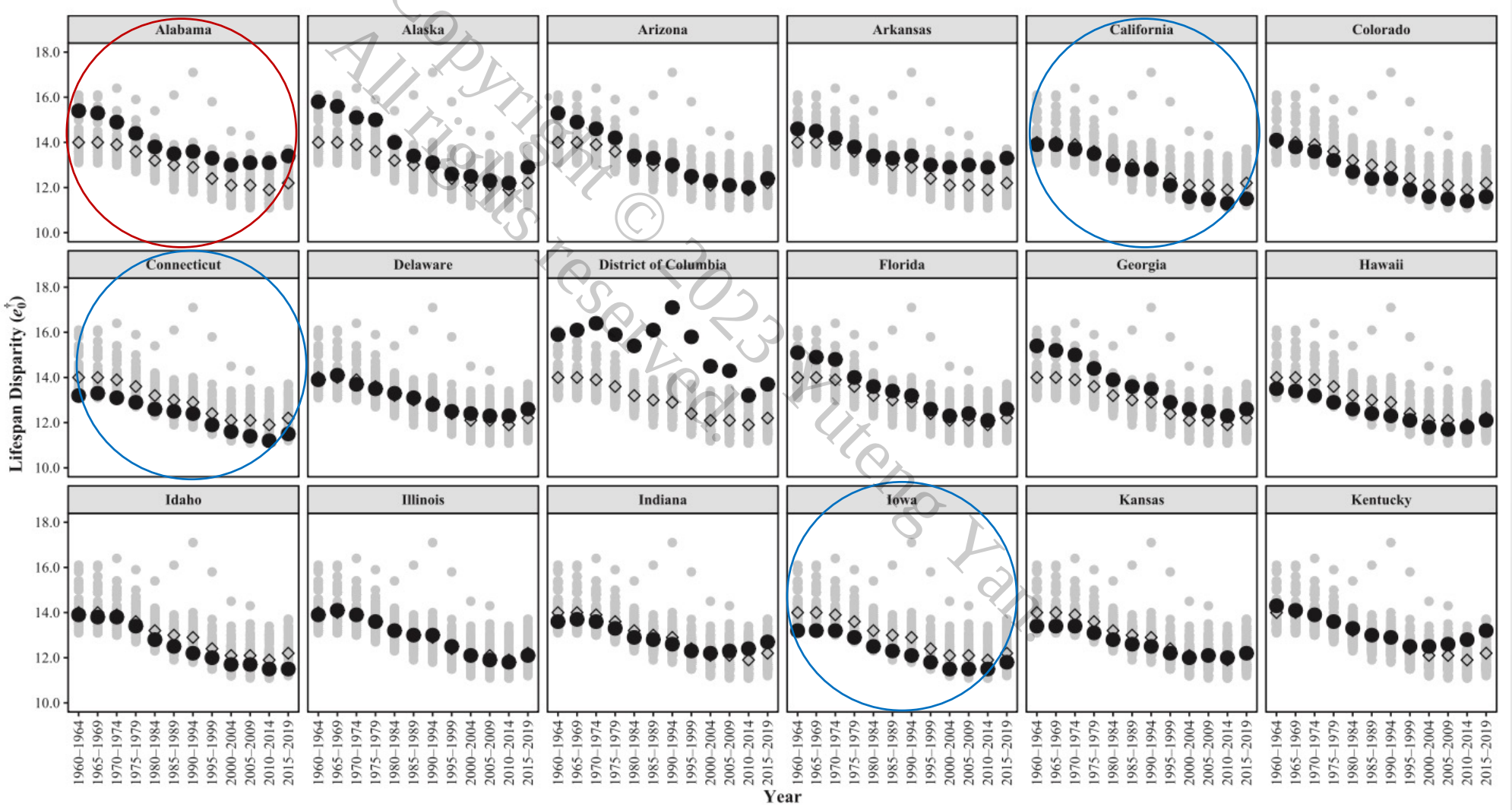
2. Results

2. State-Level Trends in Lifespan Variability

Individual State (Black Circles)

All Other States (Gray Circles)

National Average (Diamonds)



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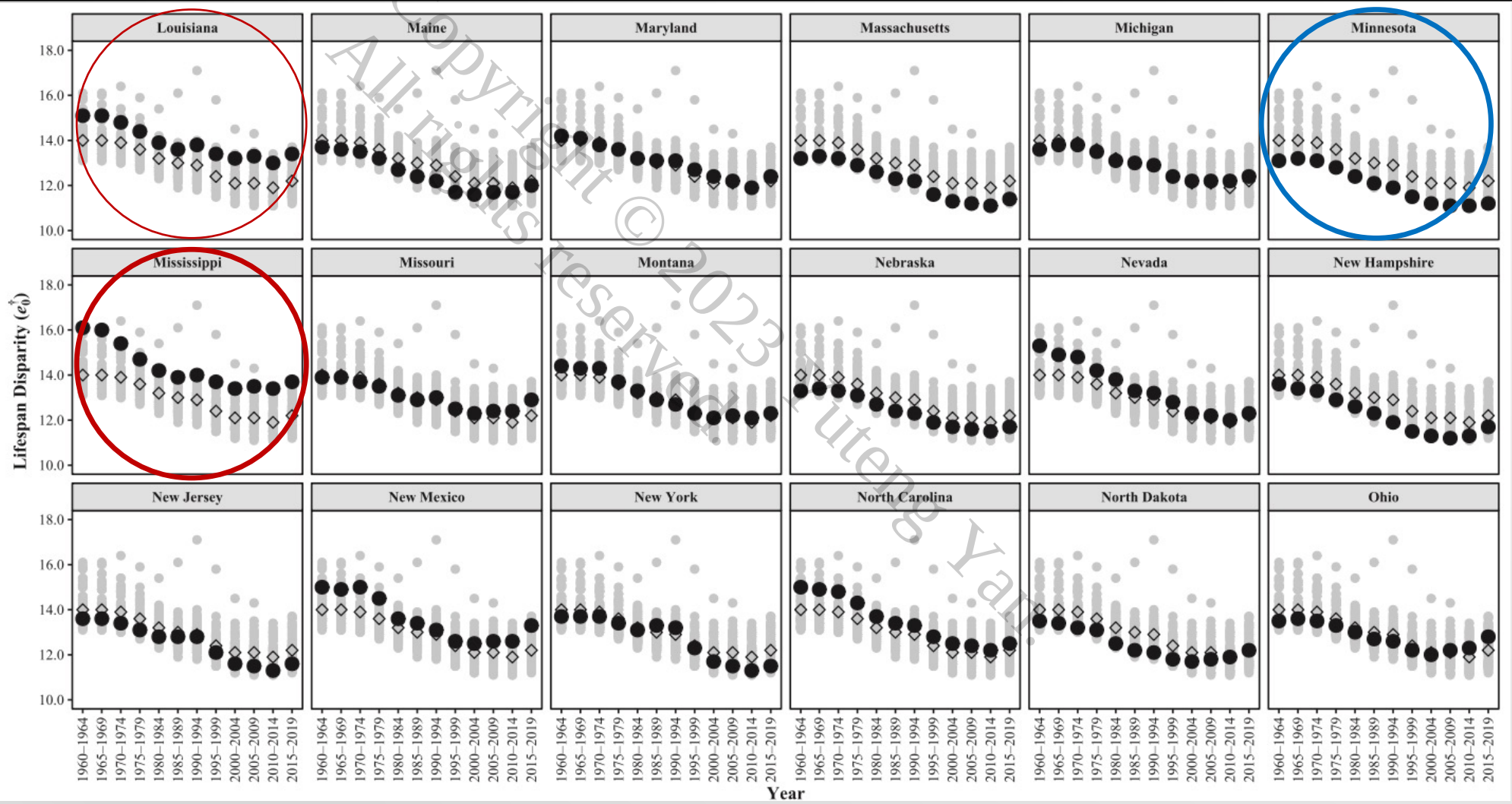

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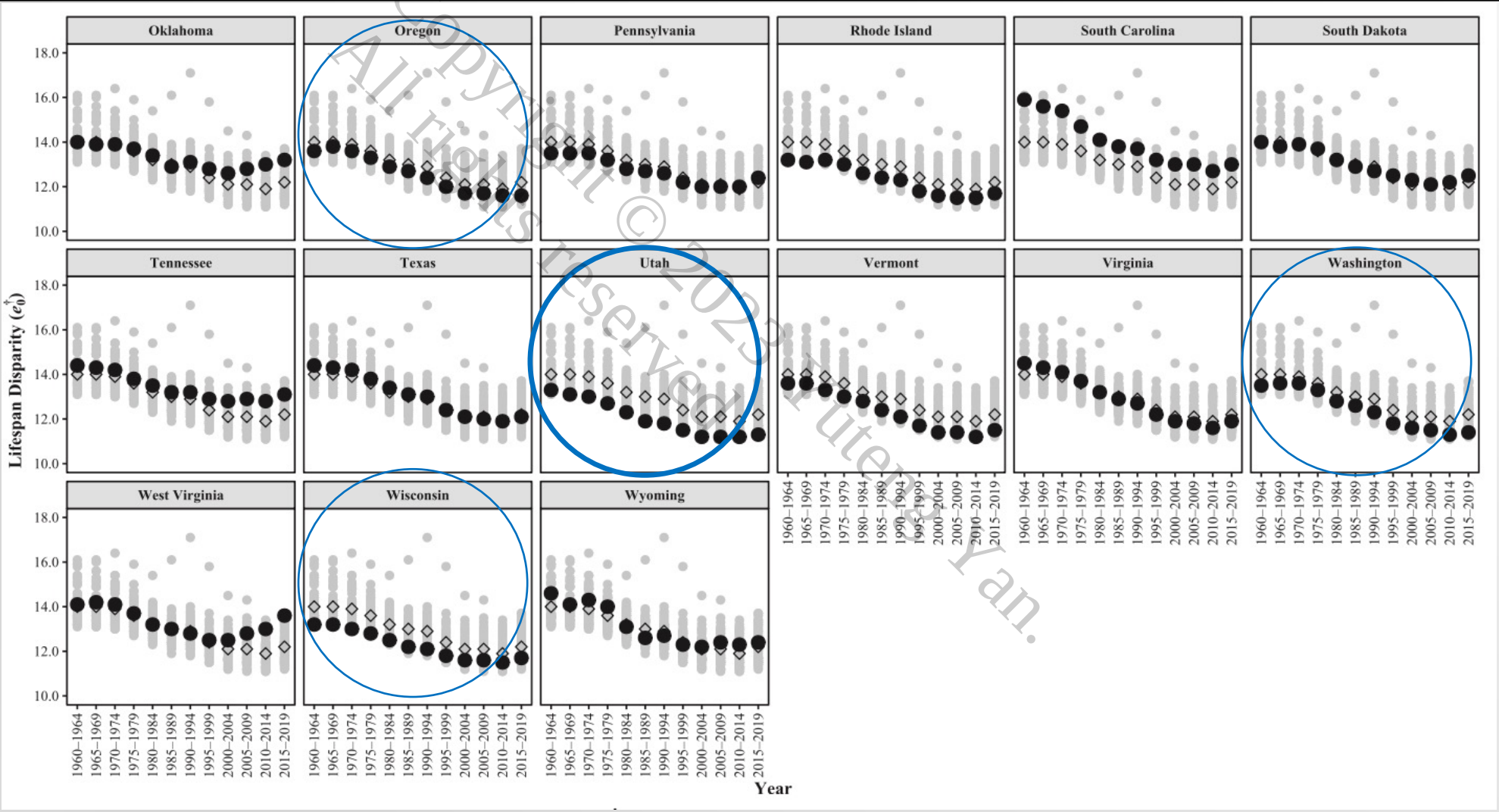

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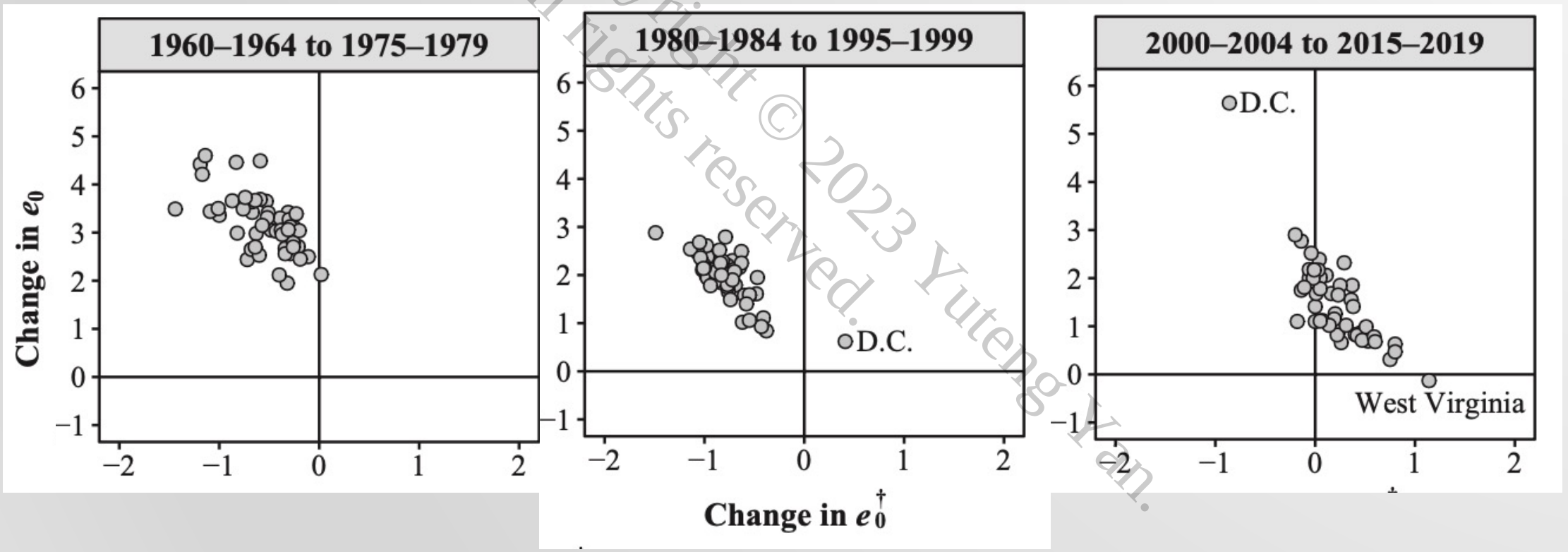


Negative Association

Negative Association

Positive Association
(4/5 states)

3. Discussion

The gap in lifespan disparity between these states was highest in 1960–1964 (3.0 years), fell to its lowest level in 1985–1989 (1.8 years), and increased thereafter until 2015–2019 (2.5 years) …… the spread between the highest and lowest e0† values widened in recent decades. Indeed, the worst-performing state in 2015–2019 (Mississippi, e0† = 13.7 years) had higher levels of lifespan variability than the best-performing state almost six decades earlier in 1960–1964 (Minnesota, e0† = 13.1 years).

Several states with high lifespan variability throughout the six-decade period are concentrated in the southern United States, particularly Alabama, Louisiana, Mississippi, and South Carolina …… As noted earlier, clusters of states in the Northeast, Upper Midwest, and West displayed consistently low lifespan variability throughout the study period.

4. Debate

1. Measure eo+

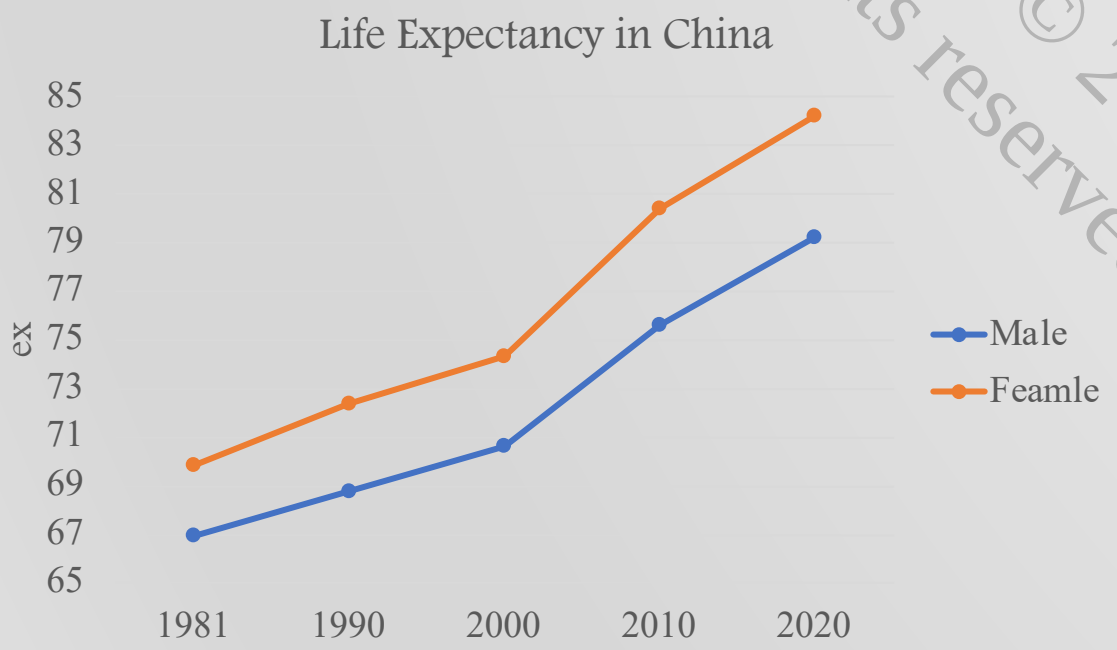
$$e^{\dagger} = \underbrace{\int_{0}^{a^{\dagger}} e(x) f(x)\, dx}_{\text{前期不均等}} + \underbrace{\int_{a^{\dagger}}^{\omega} e(x) f(x)\, dx}_{\text{后期不均等}}$$

1. Vaupel J.W., Romo V.C., 2003, "Decomposing change in life expectancy: A bouquet of formulas in honor of Nathan Keyfitz' s 90th birthday", Demography, 40(2), 201—216.
2. Zhang Z., Vaupel J., 2009, "The age separating early deaths from late deaths", Demographic Research, 20, 721—730.
3. Vaupel J.W., Zhang Z., Van Raalte A.A., 2011, "Life expectancy and disparity: an international comparison of life table data", BMJ Open, 1(1), e000128—e000128.
4. Aburto J.M., Villavicencio F., Basellini U., et al., 2020, "Dynamics of life expectancy and life span equality", Proceedings of the National Academy of Sciences, 117(10), 5250—5259.
5. Fernandez O.E., Beltrán-Sánchez H., 2022, "Life span inequality as a function of the moments of the deaths distribution: Connections and insights", PLOS ONE, 17(1), e0262869.

4. Debate

2. Mainland China: Current Status

张震，2016：《1950年代以来中国人口寿命不均等的变化历程》，《人口研究》第1期。



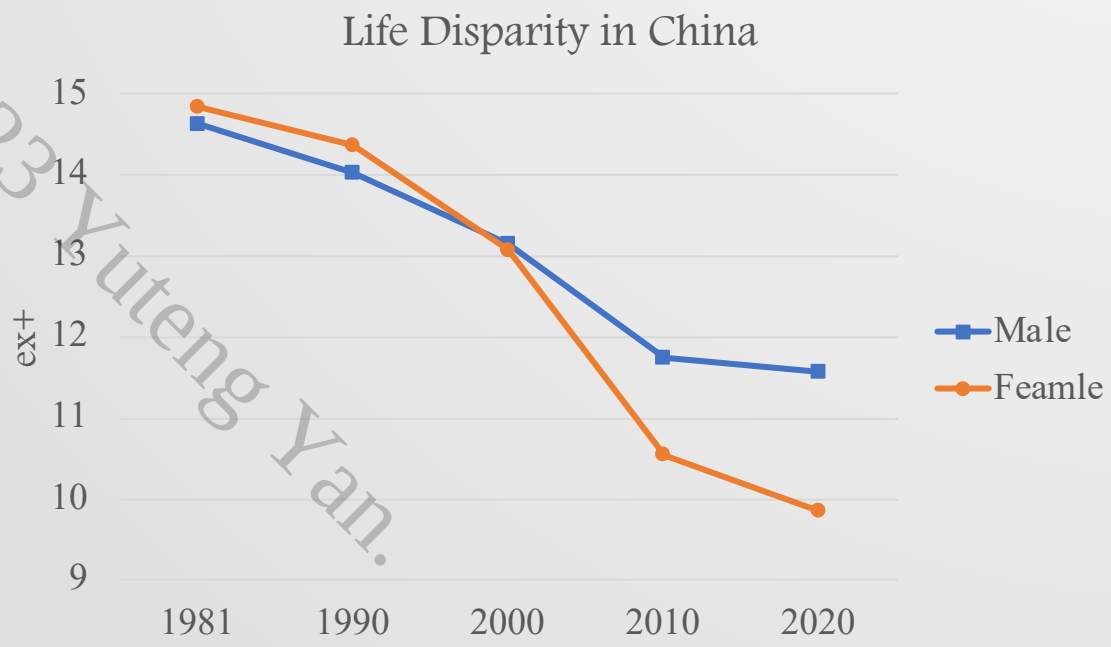


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图 4　1840～2013 年世界主要发达国家与中国女性人口的寿命不均等

Figure 4　Life Disparity in Selected Countries, Female, 1840-2013

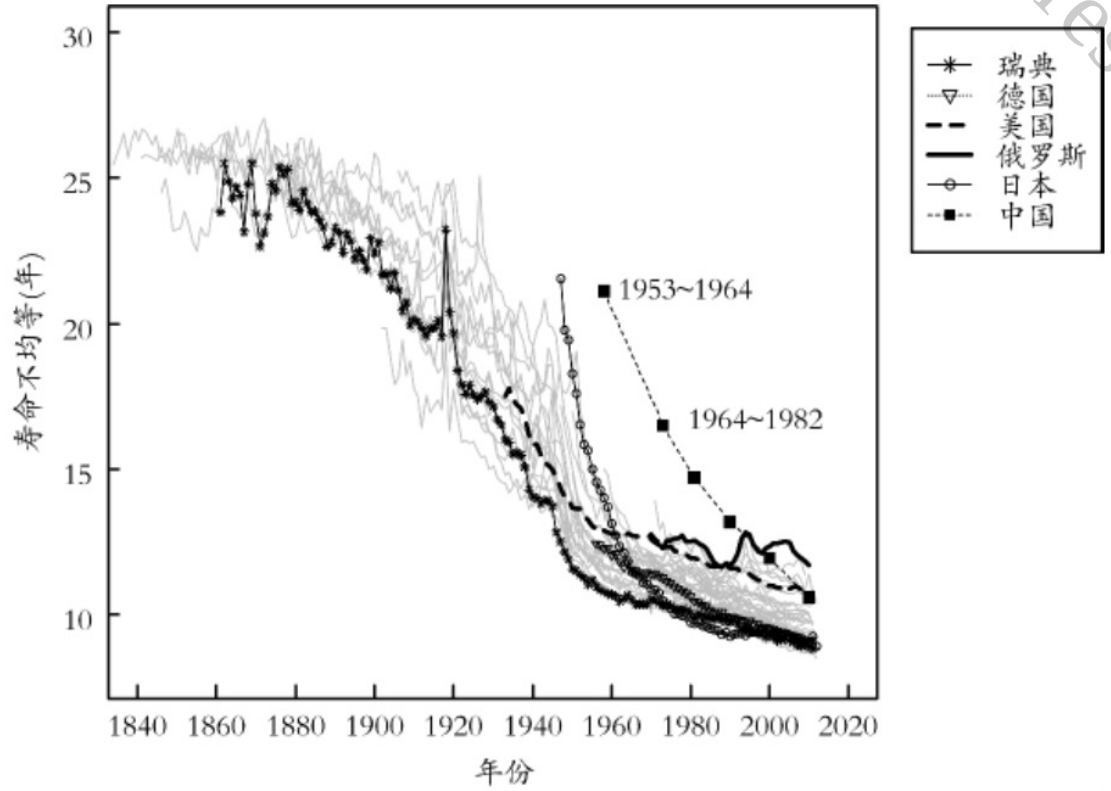
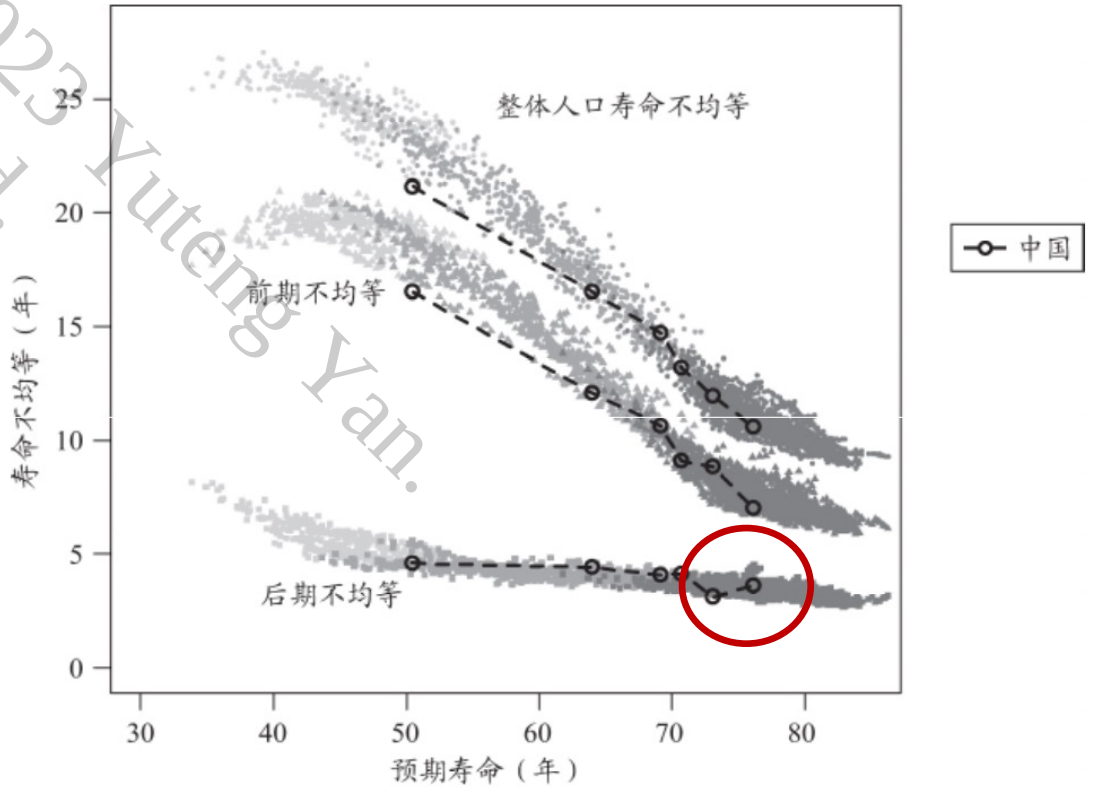


图 5　1840～2013 年世界主要发达国家同中国的预期寿命与寿命不均等

Figure 5　Life Disparity, Early Disparity and Late Disparity in Selected Countries, Female, 1840-2013



4. Debate

2. Mainland China: Why?

李婷、闫誉腾，2023：《1980年代以来中国分地区死亡水平差异及其演变——医疗投入与社会经济发展的分期协同作用》，待刊

Second, our analyses do not examine how contextual and compositional differences contribute to divergent trends in lifespan variability between states. (Brown D.C., Lariscy J.T., Walker B.H., 2023)

$$\frac{ln\left(Y_{t_{i+n},j}\right)-ln\left(Y_{t_i,j}\right)}{X_{t_{i+n},j}-X_{t_i,j}}=\alpha+\beta\times Y_{t_i,j}+\gamma\times Z_{t_i,j}+e_j$$

表 1 死亡水平相关影响因素暨本文维度指标选取

Table 1 Related Influencing Factors of Mortality Level and Selection of Indicators in This Paper

维度	具体指标	本文数据来源	本文数据预处理方式
医疗设施	千人床位数、千人医生数	《新中国 60 年统计汇编》、国家统计局网站（查询日期 2022.12.1）	缺失值使用线性插补法
经济水平	人均 GDP	1991 年及以前数据来源为《新中国 60 年统计资料汇编》、1992 年至今数据来源为国家统计局网站（查询日期 2022.12.1）	基于 1981 年 GDP 指数平减
	（城、乡）人均可支配收入	国家统计局网站（查询日期 2022.11.11）	基于 1981 年 CPI 平减。其中，可支配收入缺失值仅海南 1981 至 1987，由广东与广西均值替代；CPI 缺失值中，重庆 1981 至 1995 年间，除 1991 为统计局数值外，使用重庆城镇 CPI 值替代，西藏 1981 至 1990，使用青海值替代
教育水平	平均受教育年限	普查年使用人口普查数据，其余年份使用历年《中国统计年鉴》	缺失值使用线性插补法，1981 年，重庆缺失值由四川替代、海南缺失值由广东与广西均值替代
	高等教育人口比重	普查年使用人口普查数据，其余年份使用历年《中国统计年鉴》	同上
地理环境	年均降水量	NCDC（美国国家气候数据中心，National Climatic Data Center）ISD-Lite 中国各地面气象站基本气象要素观测资料台站逐日数据	计算各省年度均值并作 Ln 处理

注：医疗设施、经济水平、教育水平使用了 1981 年至 2020 年逐年份数据的主成份提取法作为维度变量，提取第一成份贡献率均高于 85%

4. Debate

李婷、闫誉腾，2023：《198
入与社会经济发展的分期协同

Second, our analyses do not
contribute to divergent tren
Lariscy J.T., Walker B.H., 202

$$\frac{ln\left(Y_{t_{i+n},j}\right)-ln\left(Y_{t_i,j}\right)}{X_{t_{i+n},j}-X_{t_i,j}}=\alpha+\beta$$

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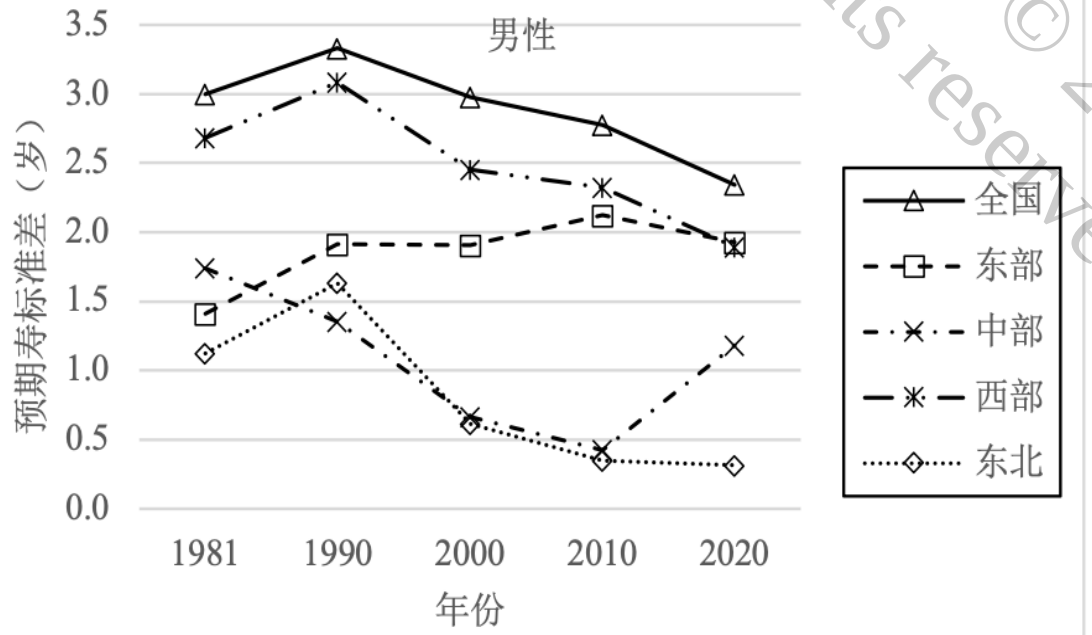
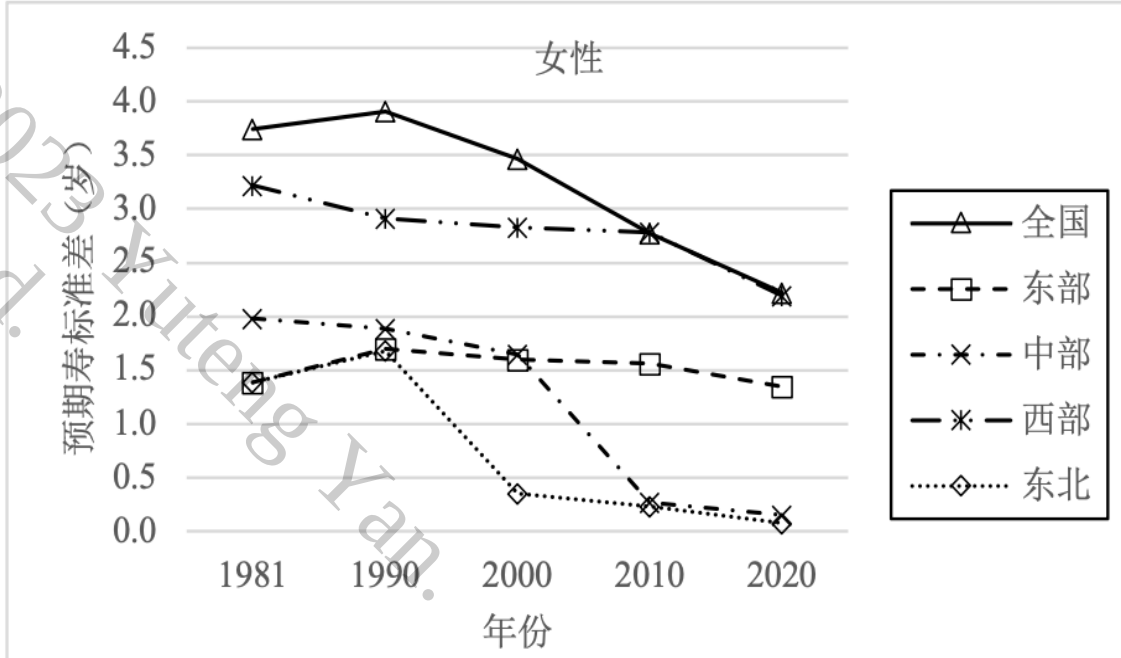
4. Debate

2. Mainland China: Why?

图 2 1981 年至 2020 年全国与分地区 0 岁人口预期寿命离散情况

Figure 2 Standard Deviation of Life Expectancy of 0-Year-Old Population in China and its Sub-Regions from 1981 to 2020





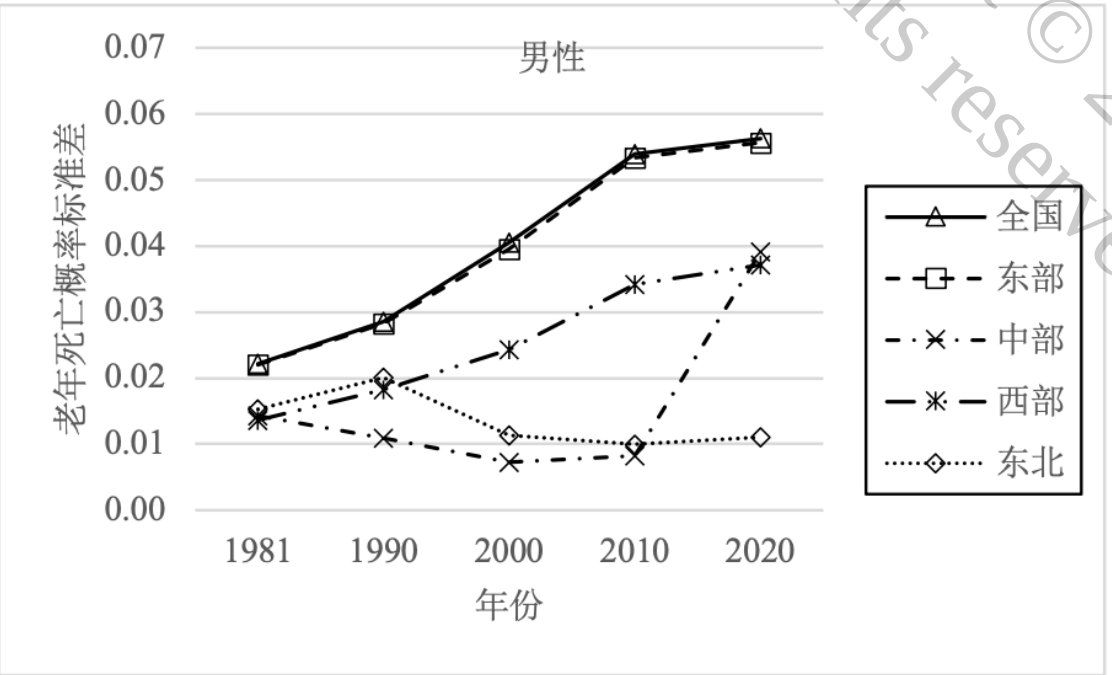
资料来源：第三次人口普查原始值与历次《中国人口与就业统计年鉴》

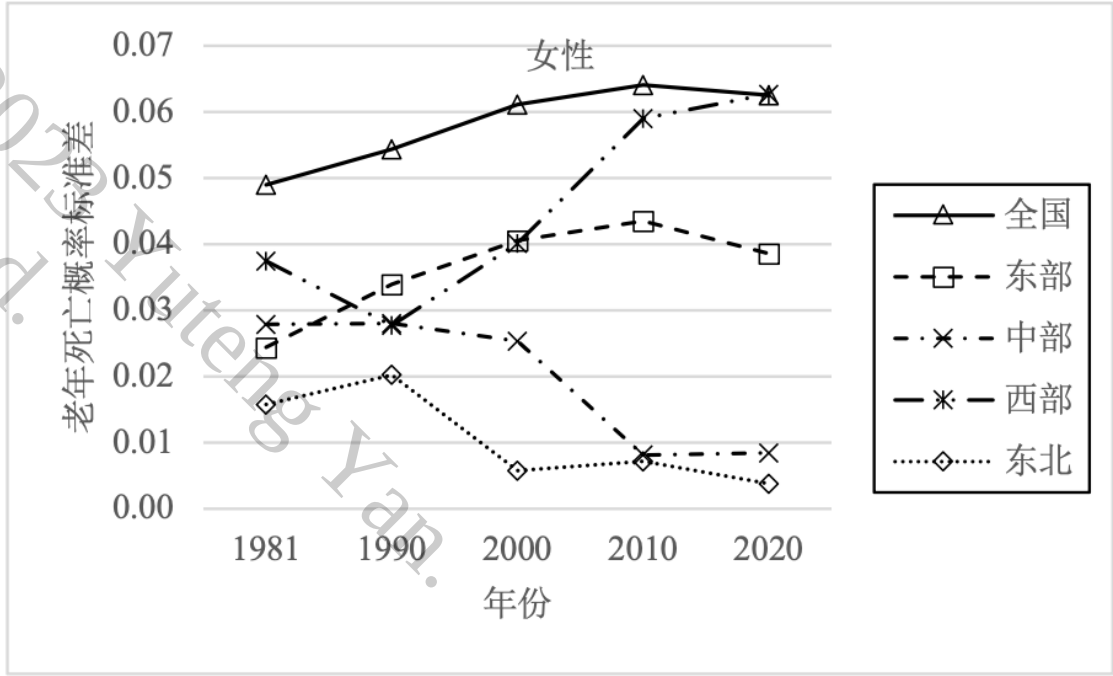
4. Debate

2. Mainland China: Why?

图 6 1981 年至 2020 年全国与分地区 60 岁至 80 岁老年死亡概率离散情况

Figure 6 Standard Deviation of Death Probability of the Elderly Aged 60 to 80 in China and its Sub-Regions from 1981 to 2020





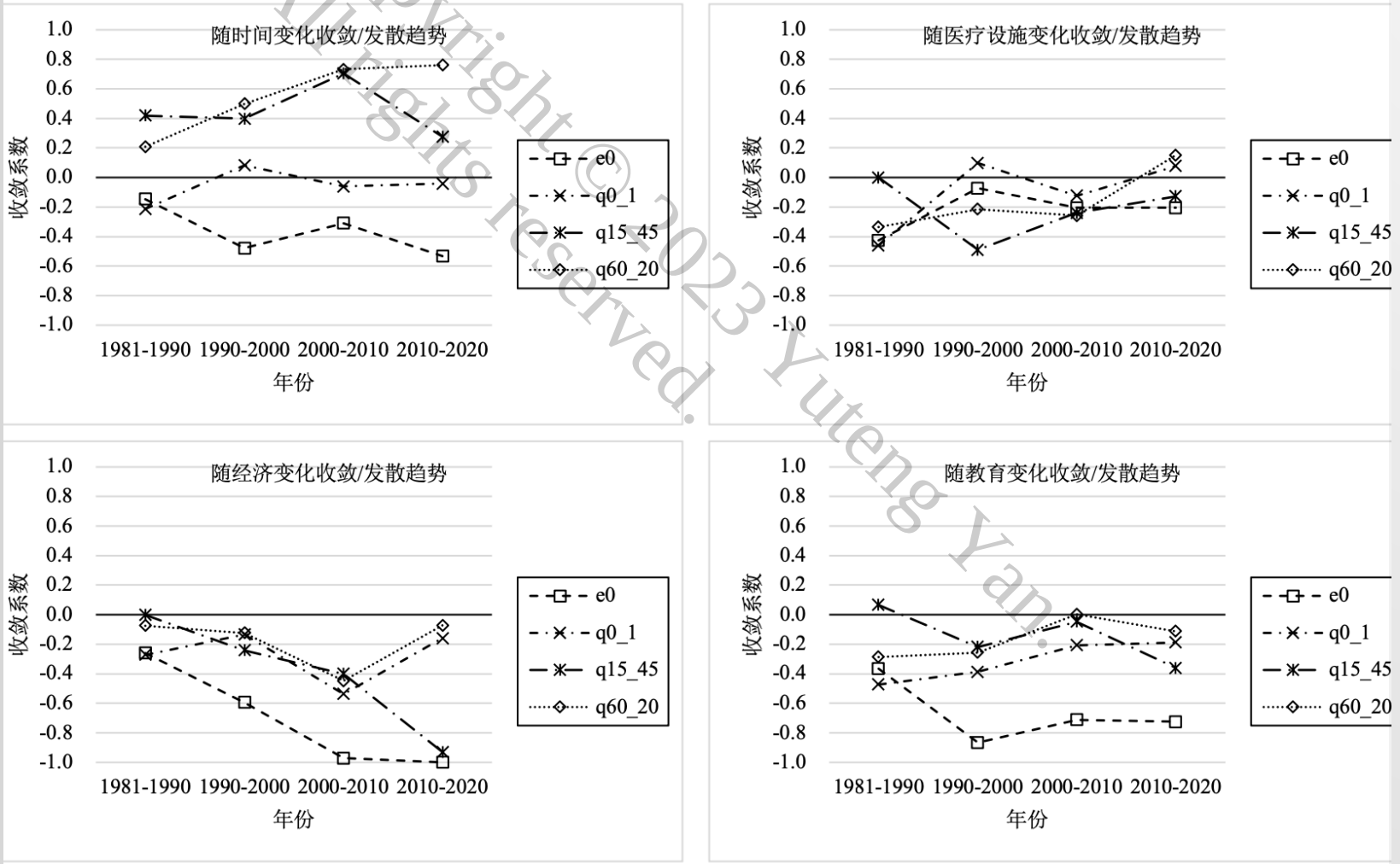
资料来源：本文基于对数二项模型计算的估计值

4. Debate

2. Mainland China: Why?

图 8 1981 年至 2020 年全国死亡水平随时间、医疗设施、经济发展及教育发展的收敛情况

Figure 8 Convergence of China's Mortality Level over Time, Medical Facilities Investment, Economic Development and Educational Development from 1981 to 2020



资料来源：该图基于对数二项模型估计值计算

4. Debate

2. Mainland China: Why?

表 3 1981 年至 2020 年各维度婴儿死亡率、老年死亡概率收敛系数

Table 3 Convergence Coefficient of Infant Mortality and Elderly Mortality Probability in Different Dimensions from 1981 to 2020

死亡指标	维度	时期	全国	排除性分析			
				东部	中部	西部	东北
q0_1	医疗设施	1981-2000	-0.1635	-0.0830	-0.1712	-0.2131	-0.1574
		2000-2020	-0.0060	-0.0584	-0.0026	0.1654	-0.0475
	经济水平	1981-2000	-0.3312 *	-0.3999 *	-0.3327 +	-0.1822	-0.3216 +
		2000-2020	-0.5915 ***	-0.2101	-0.5101 *	-0.8853 ***	-0.6748 ***
	教育水平	1981-2000	-0.4027 *	-0.5040 *	-0.3685 +	-0.3637 +	-0.4011 *
		2000-2020	-0.3542 +	-0.1190	-0.1260	-0.9218 ***	-0.4659 *
q15_45	医疗设施	1981-2000	0.2152	0.3007	0.2344	-0.0076	0.2320
		2000-2020	-0.0855	-0.4612 *	-0.0662	0.5387	-0.0948
	经济水平	1981-2000	-0.4128 ***	-0.2310 *	-0.3729 ***	-0.6834 ***	-0.4154 ***
		2000-2020	-0.3550 +	-0.1708	-0.4073 *	-0.6100	-0.3779 +
	教育水平	1981-2000	-0.4226 ***	-0.2577 *	-0.3609 **	-0.7018 ***	-0.4012 **
		2000-2020	-0.1584	-0.2492	-0.1864	-0.3309	-0.1415
q60_20	医疗设施	1981-2000	-0.1506	-0.0133	-0.1696	-0.7030	-0.1369
		2000-2020	0.0197	0.2558	0.0408	0.4593	-0.0087
	经济水平	1981-2000	-0.1712	-0.4164 +	-0.0916	-0.3346	-0.1426
		2000-2020	-0.4141 *	0.1363	-0.337 +	-1.0109 ***	-0.4557 *
	教育水平	1981-2000	-0.2893	-0.4936 +	-0.2016	-0.6187	-0.2693
		2000-2020	0.0907	0.2928 +	0.2513	-0.4956 +	0.0420

注：①*** $p < .001$. ** $p < .01$. * $p < .05$. + p < .1. ②上表系数均为标准化系数，且为控制各因素后的净效应模型；为保持表格简洁，未报告标准误系数。

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(Brown D.C., Lariscy J.T., Walker B.H., 2023)

Thanks! 闫誉腾