Family Life Courses and Later-life Wellbeing in China

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Doctoral Thesis in Demography

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May 2025

Abstract

China's rapidly aging population poses significant challenges for the wellbeing of older adults, as the country navigates growing demographic pressures while still undergoing economic development. In 2024, 208 million Chinese residents were aged 65 and older, accounting for 25% of the global older population. At the same time, although declining fertility rates and shifting family structures have weakened traditional caregiving systems, many older adults are still reliant on family support.

This doctoral thesis provides insights into the wellbeing of older populations in China by examining how family dynamics shape later-life outcomes. A key contribution is the application of a life course perspective—widely used in Western research—to capture the cumulative and evolving nature of family influences over time. Additionally, the thesis addresses structural inequalities by analyzing how gender and social-spatial disparities intersect with family processes to shape wellbeing in older ages.

Three empirical essays study the ways in which family structures, transitions, and relationships affect health, social integration, and financial security in later life, drawing on data from two longitudinal surveys. The first essay explores the associations between work-family trajectories (from ages 16 to 50) and health outcomes of older adults (aged 51 to 80), using holistic life course concepts and methods to capture the interplay between work and family trajectories and their joint effects on wellbeing. The second essay studies the role of grandchild caregiving for social integration among grandparents aged 50–80, assessing how different caregiving arrangements (in terms of care hours and coresidence) influence participation in social activities. The third essay examines the economic wellbeing of older adults (aged 65+) following widowhood, analyzing shifts in the likelihood of maintaining adequate household income before and after spousal loss, with particular attention to how coresidence with adult children moderates these effects.

Findings from these essays provide a comprehensive picture of how later-life wellbeing is shaped by family dynamics over the life course. These reveal significant disparities in later-life health across diverse family trajectories, underscoring the long-term health advantages of traditional family roles and the long-term disadvantages of non-normative trajectories (e.g. childlessness and non-marital parenthood). Additional findings highlight the critical role of

intergenerational relations in supporting older adults' wellbeing. Results show that grandchild caregiving can enhance social participation, while co-residence with adult children helps maintain financial stability after widowhood. However, structural inequalities moderate these associations. Women and rural populations face greater vulnerability and experience persistent disadvantages, even when following normative family pathways, reflecting deeper societal inequalities that shape ageing experiences.

Acknowledgements

Finally. I've been waiting for this moment, day and night, night and day :)

These past four years have been a whirlwind, filled with challenges, growth, and unforgettable experiences. Along the journey, I've been incredibly lucky to have so many amazing people supporting me, both academically and personally.

First and foremost, a huge thank you to my supervisors, Sergi and Jeroen. Sergi, I am grateful for your full support from the very start, including my PhD and scholarship applications, and my changing research ideas every now and then. I especially appreciate your generous financial support that has allowed me to attend conferences, research training, a research visit at the Sciences Po in Paris, and maintain a life during the unexpected extension of my PhD. Jeroen, thank you for joining my supervisory team, guiding me through my thesis, sharing your skills in journal submission, and constantly checking in on my mental wellbeing.

I also appreciate the CED researchers: Diederick, Elisenda, Maike, Pilar, and Sergi Trias-Llimós, who served on my evaluation committees and gave me valuable feedback along the way of my thesis.

To the CED research assistant staff—Candi, Eulàlia, Hermínia, Inés, Miquel, Sergio, Soco, Toni, and Xavi—thank you for helping me navigate all the administrative hurdles and making sure I could focus on my research. Quiero dar las gracias a Candi, que siempre ha estado pendiente de mí y me ayudó a sentirme parte del CED. Candi, ¡qué suerte haber empezado mi aventura en el CED desde la biblioteca contigo!

To my wonderful CED friends and fellow PhD warriors (mis CEDientos): Anna, Carlos, Laura, Maida, Min, Nico/Pati, Octavio, Osama, Paula, and Silvia. You've been there from the very beginning, making my life at CED and in Barcelona so much brighter. Thank you for helping me integrate into CED, improve my Spanish, and most importantly, for all the laughs, support, and companionship. Without you, I don't think I would have easily made it this far! A big shoutout to my Chinese comrades Huifen and Simin (and again, Min) for always understanding my struggles and having my back, as well as to Eugenia, Mariana, Parminder, Sabi and all other fellows for their encouragement and companionship.

Beyond CED, I'm lucky to have so many friends who have stuck by me through this PhD journey. Siyuan, thanks for reading my second essay and giving me feedback. Lucas, thanks for patiently listening to my endless complaints and cheering me up whenever I felt down. Budi, thank you for the moments when we vented our frustrations but also lifted each other up. Miaoling, Yiwen, Chengwei, Xiaolu, Yuling, and Yangyang, even from afar, your support has meant the world to me.

I also thank Dr. Zachary Van Winkle for mentoring me during my research stay at Sciences Po and giving me advice on my study of the economic outcomes of widowhood.

With all the love and strength my family has given me, I dedicate this thesis to them. Even though they have no clue what exactly I've been working on, their love and support have been unwavering. To my grandma, whose life trajectory has inspired my research and guided me through this PhD. To my parents, who always let me chase my dreams during the past ten years even though it has been tough for them to see me move so far away. To my little sister Yingxue, who is fearlessly exploring life and inspiring me along the way. To my cousins, Yuping, Shuijun, Yuxia, and Junying, thank you for your constant care, understanding, and even financial help. A special thanks to all the incredible women in my huge family—many of them have not received any formal education, but all are full of wisdom, strength, and the kind of love that holds families together.

This research received funding support from the China Scholarship Council (202006140010; grant holder: Jianji Chen); from the Spanish Government under grant agreements RTI-2018-097664-A-100 (I+D+i Retos de la investigación; Instablefam; PI: Sergi Vidal), PID-2021-125351-B-I00 (I+D+i Generación del Conocimiento; Spatialmobbio; PI: Sergi Vidal), and PID2023-152779OB-I00 (I+D+i Generación del Conocimiento; WELLHEALTHFAM; PI: Jeroen Spijker); and from the European Research Council (ERC) under the European Union's Horizon Europe research and innovation programme under grant agreement 101043981 (ERC Consolidator Grant; Lifelongmove; PI: Sergi Vidal).

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Chapter 1 Introduction

1.1 Overview

Population aging is a defining demographic trend in China, presenting significant challenges to the wellbeing of older adults. As a middle-income country, China is experiencing rapid aging while still undergoing economic development—often described as "old before being rich" and "not ready to get old" (Peng, 2021). In 2024, China's population aged 65 and older reached 208 million, comprising 25% of the global older population. This is combined with the total fertility rate declining from a low level around 1.6 in the early 2000s to a "lowest low" of 1 in 2024. Accordingly, the proportion of older adults in China has risen from 7% in 2000 to 15% in 2024 and is projected to reach 31% by 2050 and 46% by 2100 (UN, 2024).

At the same time, social and policy practices in China aimed at improving and safeguarding the quality of life for older adults are fraught with challenges such as limited access to long-term eldercare, inadequate financial security, restricted social participation, and evolving family dynamics that weaken traditional caregiving systems. These challenges are further exacerbated by gender and rural-urban disparities, creating unequal opportunities for aging well (Zhu & Walker, 2022). As China transitions toward an increasingly aged society, addressing these issues is essential to ensuring the wellbeing of its older population.

Family ties and relationships play an important role in the wellbeing of older adults in China. Most notably, despite being increasingly strained by individualistic values, declining fertility, and employment-related geographic mobility, the eldercare system continues to rely heavily on family support. The family-centered support system of China is underpinned by insufficient public funding and Confucian values that emphasize filial piety and family responsibilities (Fang et al., 2015; Zhu & Walker, 2022). The spouse, adult children, and even grandchildren often serve as the primary caregivers for older adults, providing daily care, emotional support and financial assistance in the absence of comprehensive institutional care systems (Mayston et al., 2017). While spouses typically provide immediate companionship and daily care, adult children contribute financially, facilitate healthcare and often share a residence with older adults. Grandchildren, although less directly involved in caregiving, contribute to the subjective wellbeing of older adults by fostering a sense of purpose and connection.

Family transitions over the life course, thus, shape support for wellbeing in older ages. Entering marriage and having children not only establishes the relational aspect or the foundation for spousal, adult child and grandchild support in later years, but also influences the need for support by shaping socioeconomic and health trajectories. Established research findings suggest that stable marriages and parenthood underlie the accumulation of economic resources, health benefits, social networks, and emotional support, all of which enhance wellbeing in later life (Carmichael & Ercolani, 2016; Kapelle & Lersch, 2020). Conversely, adverse experiences such as divorce, widowhood, or strained childbearing can deplete these resources, increasing financial insecurity and poor health in old age (Weng & Yang, 2023; Zissimopoulos et al., 2015).

Increasingly, research acknowledges the importance of family transitions and trajectories as important factors underlying wellbeing in older ages. However, key aspects remain underexplored, and this thesis will address three of them.

First, greater attention and appropriate research designs are needed to unveil the dynamic and cumulative nature of family transitions and trajectories. Still many studies rely on cross-sectional data or use longitudinal data in static ways, underplaying temporal dynamics such as short- and long-term impacts of family transitions, or dealing with one-time events rather than evolving processes or trajectories. This limits our understanding of how family dynamics and individual wellbeing interact over the life course.

Second, research remains disproportionately focused on Western societies, where older adults benefit from more robust welfare systems. In contrast, less developed contexts—in low- and middle-income regions—not only rely on family-centered eldercare to a larger extent, but also kin relations and family dynamics over the life course are distinct (e.g., low prevalence of lifelong childlessness, singlehood, and nonmarital childbirth, see Lesthaeghe, 2022) and often rely on family-centered eldercare. Expanding research into these settings is crucial for addressing the challenges and opportunities of aging in less developed societies.

Third, heterogeneity in how family shapes older adults' wellbeing remains insufficiently examined, including differences by gender and socio-spatial position. While gendered patterns in family life courses are well-documented, recent studies predominantly focus on women, overlooking mechanisms underlying inequalities between men and women (Machů et al., 2022). Similarly, the rural-urban divide introduces significant social-spatial variations in older adults' life courses and wellbeing, particularly in developing countries (e.g., Zhang et al., 2021), yet

its influence on the association between family dynamics and wellbeing remains poorly understood. Addressing these gaps is critical for advancing knowledge on the interplay between family dynamics and wellbeing in later life across diverse contexts.

In response to these research gaps, this thesis aims to answer two primary research questions in the context of China:

How do family dynamics over the life course shape individual wellbeing at older ages?

How do these associations vary by gender and socio-spatial position?

China offers a unique and compelling context for advancing our understanding of these questions in a rapidly aging, non-Western society. Compared to Western counterparts—where much of the existing literature originates—older adults in China generally report poorer wellbeing in various dimensions (e.g., economic security, mental health, social participation, see Xiong & Wiśniowski, 2018), and rely on economic support from adult children rather than the other direction of transfer (Albertini et al., 2007; Cai et al., 2012). Their family life courses are also less complex, often characterized by earlier marriage and childbearing. Marriages generally last until widowhood, since separation is rather uncommon (Van Winkle & Wen, 2023). Also, support to their children through grandchild caregiving is more common (Xiong & Wiśniowski, 2018). It is worth noting that heterogeneity in individual life course is substantive, with gender and socio-spatial disparities being particularly relevant. Compared to older women in western countries, older Chinese women have faced a more profound double burden of paid work and unpaid caregiving because of combining higher female labor market participation and more rigid traditional gender roles (Djundeva et al., 2019; J. Feng & Zhang, 2018). Additionally, China's longstanding rural-urban divide leads to socioeconomic disadvantages of rural older adults (most used to mainly engage in agricultural occupations) compared to those living in urban areas (most used to mainly engage in non-agricultural occupations) (D. T. Yang, 1999). This inequality is further complicated by rural-to-urban migrations of the younger populations seeking better career opportunities, which challenges family support for rural older adults (Song, 2017). These gender and socio-spatial heterogeneities provide a valuable lens through which to explore how structural and contextual factors influence the interplay between family dynamics and wellbeing.

In the following sections of this chapter, I first outline the conceptual and theoretical framework of this research, focusing on family dynamics and wellbeing in old age from a life course

perspective. Next, I provide background information on the study context. I then introduce the longitudinal methods and datasets employed in this thesis. Finally, I conclude with an overview of the three empirical essays that address the proposed research questions.

1.2 Theoretical background: a life course perspective on family dynamics and wellbeing at older ages

1.2.1 The life course perspective

The life course perspective is a theoretical framework that views human development and aging as a chronological process shaped by patterns of age-graded behaviors and events (Dannefer, 2003; Elder et al., 2003). These patterns are influenced not only by biological conditions but also by social structures and historical contexts. This framework provides a lens to analyze the dynamics of individual wellbeing and its relation to family processes over time.

Elder et al. (2003) outlined five guiding principles of the life course perspective. The first, *life-span development*, posits that human development and aging are lifelong processes, with individual behaviors and life events exerting cumulative and long-term effects on wellbeing. The second, *context*, emphasizes that life courses are shaped by the historical times and places individuals experience, highlighting the role of social and natural contexts. The third, *agency*, underscores the capacity of individuals to construct their life course through actions and decisions, constrained and enabled by specific contextual opportunities. The fourth, *timing*, asserts that the impact of life events and behaviors on wellbeing varies depending on the stage of life at which they occur. Lastly, *linked lives,* highlights the interdependence of individual lives, suggesting that life events can influence the wellbeing of others through shared social networks and relationships.

1.2.2 Multiple dimensions of wellbeing in later life

Despite debates on the conceptualization of wellbeing persist, there is consensus that it represents a multidimensional description of individuals' life situations and overall quality of life (McGillivray, 2007). This thesis examines three dimensions of individual wellbeing as life course outcomes: health conditions, economic resources, and social participation.

Health is a foundational dimension, as it determines the existence and length of the life course. Although human longevity has increased, physical health deterioration and multimorbidity

after age 50 are prevalent, with older adults facing greater health inequalities by income, education, and geography (Afshar et al., 2015; Jiang & Zhang, 2020; Kyu et al., 2018; Prus, 2007). Additionally, mental health trends reveal that older adults show resilience yet experience high rates of depression (Luppa et al., 2012).

Economic resources constitute a second dimension, serving as the material basis of wellbeing. While wealth tends to accumulate over time, income declines sharply in later years (Kooiman et al., 2019; Varghese et al., 2021), increasing poverty risks and economic inequality among older populations (ADB, 2024; OECD, 2023; Roig & Maruichi, 2023).

The third dimension, *social participation*, reflects the socialization of wellbeing and encompasses interpersonal relationships and activities. Social roles and engagement shift across life stages, from education and work in earlier phases to retirement and leisure in later years (Riley & Riley, 1994). However, declining physical health and shrinking social networks often reduce participation in old age, with significant inequalities persisting (Naud et al., 2019; Pinto & Neri, 2017b).

The three dimensions of wellbeing are interrelated and together provide a comprehensive framework for understanding wellbeing as a life course outcome. For instance, economic hardship is associated with higher risks of morbidity and mortality among older adults (Huisman et al., 2003; Tucker-Seeley et al., 2009), while social participation has been shown to enhance mental health (Sun & Lyu, 2020). Conversely, adverse health conditions often lead to increased medical expenses, reduced labor market participation, and diminished economic resources (Polanco et al., 2024). Informal social networks, such as friends and neighbors, can provide vital economic support for low-income older adults (Dobarrio-Sanz et al., 2023). However, poor health and limited financial resources frequently constrain older adults' ability to engage in social activities (Pinto & Neri, 2017a).

Wellbeing is particularly precarious among vulnerable populations such as older adults. It follows that wellbeing over the life course is more unequally distributed in low- and middle-income countries (Smith & Wesselbaum, 2024), posing significant challenges to aging well from both individual and policy perspectives (WHO, 2002). Understanding the life course determinants of these inequalities in wellbeing is essential for improving the wellbeing of older adults.

1.2.3 Family dynamics in the life course

Family membership and engagement in various familial roles are fundamental to socialization across the life course, significantly influencing individual wellbeing (Uhlenberg & Mueller, 2003). While other social institutions—such as education, workplace, and recreational settings—also shape social life (Riley & Riley, 1994), this thesis focuses on family dynamics and their implications for wellbeing. Specifically, it examines two key dimensions: family structure and family interactions.

Family structure refers to the composition of family members and their specific family roles shaped by partnership and childbearing dynamics. This thesis explores two critical aspects of the present and past family roles of older adults: (1) *marital status* (never married, married, separated, divorced, widowed) and (2) *parental status* (childless, parent). These statuses evolve over the life course, as individuals may experience multiple partnership formations (e.g., cohabitation, marriage) and dissolutions (e.g., separation, divorce, widowhood). Family structures also vary across populations, with increasing complexity in modern societies particularly those in Western countries, including non-marital cohabitation, remarriage, step-parenting, delayed family formation, lifelong singlehood, non-marital childbearing, and voluntary childlessness (Van Winkle, 2018). Despite growing family complexity, in this thesis I focus on marital rather than partnership status as marriage was the almost universal partnership type among the Chinese older adults under study.

Family interactions encompass interpersonal relationships among family members that influence living arrangements, emotional bonds, financial transfers, and instrumental support. This thesis examines two intergenerational aspects of family interaction in older adulthood: *coresidence with their adult children* and *grandchild caregiving*. Intergenerational coresidence—i.e., among young children, parents, and grandparents—varies across cultural and economic contexts (Russell & Breaux, 2019). Fertility decline and economic development have generally reduced household sizes and intergenerational coresidence among older populations (Esteve & Reher, 2024; Russell & Breaux, 2019). However, in some lower-income societies, economic growth has enabled more flexible living arrangements driven by preference, leading to increased intergenerational coresidence (Ruggles & Heggeness, 2008). Grandparenting may involve coresidence with grandchildren or not. Cultural norms often emphasize the role of grandparents, while socioeconomic factors, such as dual-earner households and single parenthood, may necessitate grandparents' caregiving support

(Buchanan & Rotkirch, 2018). Additionally, grandparenting may serve as an intergenerational reciprocal practice, as older adults providing childcare might receive economic or caregiving support from their adult children in return (Bui, 2019; S. Tang et al., 2022).

1.2.4 Associations between family dynamics and wellbeing in prior research

Marriage and wellbeing

Marriage serves as a key institution promoting economic security, physical and mental health, and social integration. Economically, marriage facilitates the pooling of income and wealth, enabling couples to share household expenses and benefit from "economies of scale" (Cherchye et al., 2020; Waite, 1995). Additionally, spousal support provides financial stability, helping couples better navigate economic shocks such as unemployment (Jacob & Kleinert, 2014). Regarding health, marriage fosters mutual support, encouraging healthier lifestyles, stress management, and the avoidance of risky behaviors like smoking and excessive drinking, leading to better self-rated health and lower risks of physical illness, mental health issues, and mortality (M. R. Lee et al., 2024; Lewis et al., 2006; Manzoli et al., 2007; Mata et al., 2015; Robards et al., 2012). Socially, marriage expands individual networks by connecting partners to extended kin, friends, neighbors, and religious communities, which enhances social support and engagement (Haggerty et al., 2023; Stolzenberg et al., 1995). While contact with old friends may decline post-marriage due to shifting social needs, interactions with mutual friends and family members increase, fostering a sense of belonging and emotional support (Haggerty et al., 2023; Kalmijn, 2012).

On the contrary, marital dissolution often leads to a decline in individual wellbeing by eroding economic, health, and social benefits. The loss of a spouse eliminates the economic advantages of marriage, including pooled resources and economies of scale, leading to financial strain (Cherchye et al., 2020; Waite, 1995; Zissimopoulos et al., 2015). Divorce and widowhood also induce emotional distress, increasing the likelihood of risky behaviors such as smoking and excessive drinking, which, in turn, deteriorate mental and physical health and heighten mortality risk (Bourassa et al., 2019; Bulanda et al., 2016; Kendler et al., 2017; Whisman et al., 2022). While marital dissolution can lead to increased interactions with friends and greater social support due to emotional and financial needs (De Vries et al., 2014), it may also result in social exclusion from couple-centered activities, such as neighborhood gatherings, religious

participation, and outings to clubs, bars, or theaters, thereby intensifying loneliness and hindering social engagement (Kalmijn & Van Groenou, 2005).

Parenthood and wellbeing

Parenthood has complex effects on individual wellbeing, influencing economic resources, health, and social engagement in both positive and negative ways. Economically, parenthood often results in wage penalties for women due to career breaks and part-time or lower-paid employment (Cukrowska-Torzewska & Matysiak, 2020). However, families with young children may receive tax deductions and public subsidies to offset childcare and education costs (Ruhm, 2011). In terms of health, parenthood enhances mental health by fostering a sense of purpose and fulfillment, while also encouraging healthier lifestyles, such as improved diets, increased physical activity, and reduced substance use, as parents serve as role models for their children (Fergusson et al., 2012; Görlitz & Tamm, 2020; Hansen, 2012; Kalucza et al., 2015; Reczek et al., 2014). Nonetheless, parenting can be mentally and physically stressful, especially for those with multiple young children, leading to mental health issues and physical health deterioration (d'Errico et al., 2024; Saxbe et al., 2018). Socially, parenthood alters interaction patterns by reducing friendships while strengthening ties with family members and neighbors due to childcare responsibilities and shared emotional bonds (Kalmijn, 2012; Rözer et al., 2017). Additionally, parents often expand their social networks through their children's activities, such as school events and recreational programs, fostering new relationships with other parents and teachers and enhancing social engagement (Moreau Shmatenko, 2024).

Grandchild caregiving and wellbeing

Grandchild caregiving has both positive and negative implications for grandparents' wellbeing, influencing their health, social engagement, and economic stability. Providing care for grandchildren fosters emotional bonds, enhances happiness, and reduces feelings of loneliness, particularly in contexts of increased social isolation, such as during the COVID-19 pandemic (Bünning & Huxhold, 2024; Notter, 2022). Additionally, caregiving strengthens grandparents' social networks by connecting them to their grandchildren's activities and offering more opportunities for social participation (Arpino & Bordone, 2017; Bulanda & Jendrek, 2016; Gage, 2013). Intensive caregiving, however, can impose financial strain, limit labor market participation—especially for custodial grandparents—and increase childcare-related expenses (Y. Chen & Lyu, 2025; Y. Xu et al., 2022). The stress of intensive caregiving may also

accelerate health deterioration, including biological aging (Notter, 2022; Xie & Wang, 2024). These negative effects can further reduce motivation and opportunities for social interactions beyond the family (Arpino & Bordone, 2017; Bulanda & Jendrek, 2016).

1.2.5 Family life course dynamics and wellbeing at older ages

Family roles and interactions play a crucial role in shaping wellbeing in older adulthood by influencing economic stability, health outcomes, and social support networks. Their effects, however, are not uniform; they vary based on the dynamics of stability and change in family circumstances across the life course. In the following, I discuss several key dimensions of family life course dynamics—the duration of exposure, the timing of family transitions, the degree of interdependence among family members, and structural heterogeneity by gender and socio-spatial position—that I will deal with in this thesis to provide a comprehensive understanding of their long-term implications for wellbeing in later life.

Temporality of family dynamics

The life-span development principle suggests that early and sustained exposures to protective or risk factors shape wellbeing in later stages by accumulating their effects over time (Dannefer, 2003). Long exposures to protective family dynamics foster long-term wellbeing, while persistent exposures to negative dynamics compound stress and adverse outcomes. For instance, long-term marriage is associated with greater wealth accumulation and lower mortality risk compared to long-term singlehood (Dupre et al., 2009; Kapelle & Lersch, 2020). Conversely, high fertility levels resulting in prolonged periods with young children in the household have been linked to larger wage penalties and increased health risks, including lower labor income and more diseases (Cukrowska-Torzewska & Matysiak, 2020; Grundy & Read, 2015).

The timing of family events is essential to assess their influences on wellbeing in older age. Adolescence and early adulthood are critical periods for successful life transitions (Wood et al., 2018). For example, early parenthood, particularly during the teenage years and early twenties, often disrupts education and employment, increases financial and mental stress, and weakens social ties, leading to compounded negative effects in later life (Driscoll, 2014; Lacey et al., 2017; Rözer et al., 2017). The timing of marital dissolution also produces distinct consequences. While early-life divorce or widowhood induces short-term financial hardship and mental distress, later-life dissolution often results in greater long-term wellbeing declines due to labor market exit and health deterioration (Bíró, 2013; H. Liu, 2012).

Linked lives among family members

The life course perspective highlights the interdependence of family members' trajectories through the principle of "linked lives", where shared events create reciprocal support patterns (Silverstein et al., 2002). In this thesis, I examine the linked lives of older adults focusing on intergenerational interdependence—specifically, their relationships with both their adult children and their grandchildren. Beyond spousal, parent-young child, and grandparent-young grandchild relationships, intergenerational interdependence extends to relationships between older adults and their adult children and grandchildren in later adulthood. Older adults often provide housework assistance and grandchild caregiving to their adult children, while also receiving economic and care support from their adult children (Verbrugge & Ang, 2018). Support from adult children becomes particularly crucial in times of adversity, such as health decline or spousal loss (Hanum et al., 2024).

Structural heterogeneity

Gendered life course trajectories reflect societal norms that differentially shape men's and women's wellbeing in later life (Machů et al., 2022). The traditional "male breadwinner" model assigns women primary caregiving responsibilities, limiting their labor market attachment (Patterson & Margolis, 2019). Despite increased female workforce participation, women continue to experience employment disruptions due to family caregiving burdens, resulting in economic disadvantages, particularly after marital dissolution (Anxo et al., 2011; Hochschild & Machung, 1989; McMunn et al., 2015; Zissimopoulos et al., 2015). Parenthood further exacerbates gender disparities, with substantial wage penalties for mothers but minimal or even positive effects on fathers' earnings (Glauber, 2018). In older age, these patterns persist, as grandmothers bear greater grandchild caregiving responsibilities, heightening their risk of wellbeing decline compared to grandfathers (F. Chen et al., 2018; Floridi, 2022; Horsfall & Dempsey, 2015).

I will also address heterogeneity in rural/urban residence and agricultural/non-agricultural occupations—two socio-spatial disparities closely linked to urbanicity that significantly influence individual wellbeing over the life course, particularly in less developed societies. These two socio-spatial dimensions are interrelated, as agricultural workers predominantly reside in rural areas, while non-agricultural workers are concentrated in urban areas. In many low- and middle-income countries, public socioeconomic resources are disproportionately

allocated to urban areas and non-agricultural industries, resulting in weaker socioeconomic institutions in rural areas and the agricultural sector. Consequently, rural residents and agricultural workers face disadvantages in education, healthcare, income, consumption, housing, social welfare benefits, and other socioeconomic resources (Araujo, 2004; Lagakos, 2020; Oruç & Çağlar, 2022). Research indicates that the rural-urban divide exacerbates wellbeing inequalities across the life course, with prolonged rural residence being associated with greater precarity in old age (Orsholits et al., 2022; Saenz, 2020; N. Zhang et al., 2021).

1.3 The context of China

1.3.1 Recent trends in older adults' wellbeing

Despite improvements in economic wellbeing and health conditions over recent decades, older adults in China continue to face significant challenges in financial security, health status, and social engagement compared to their counterparts in high-income countries. Pension coverage remains limited, with fewer than 30% of adults aged 60 or older receiving adequate benefits. Over 60% live in relative poverty, relying heavily on financial transfers from adult children, irrespective of coresidence (X. Lei et al., 2015; Lu & Zhang, 2017; X. Yu et al., 2021; R. Zhao & Zhao, 2018). Health challenges among older Chinese adults are also pressing. Approximately 20% of individuals aged 60 and above experience disabilities in daily activities and about 15% have unmet medical treatment needs (Q. Gao et al., 2022; Wu et al., 2024). The mental health of older populations has also declined over the past two decades, with an increasing prevalence of psychological distress (X. Li et al., 2024). Regarding social engagement, formal participation in activities such as volunteering, educational courses, political participation and community events remains low among Chinese older adults, who primarily focus on providing family support, particularly grandchild caregiving (Xiong & Wiśniowski, 2018). Additionally, sedentary lifestyles are becoming increasingly common among older populations, further reducing their interpersonal social interactions outside the family (Q. Feng et al., 2020).

1.3.2 Family dynamics over the life course

China has witnessed both continuity and transformation in family dynamics over recent decades. Regarding family formation, marriage remains a near-universal experience, with an increasing trend of delayed but stable unions and declining fertility rates (Djundeva et al., 2019).

Although singlehood and cohabitation are rising among younger generations, lifetime nonmarriage remains uncommon and largely involuntary. Divorce rates within the first decade of marriage remain low compared to Western countries and other East Asian societies such as Japan and South Korea (J. Yu & Xie, 2021). Among the current older adults, most have remained in their first marriage until widowhood, with remarriage being rare (F. Yang & Gu, 2021). Fertility patterns have also shifted, with married couples increasingly having only one child, while nonmarital childbirth and voluntary childlessness remain uncommon (Van Winkle & Wen, 2023; J. Yu & Xie, 2021). These trends have led to delayed grandparenting roles and fewer grandchildren for older adults.

Compared to Western countries, grandchild caregiving is prevalent among older Chinese adults, with many coresiding with their grandchildren, particularly in cases of "skip-generation" households where parents are absent due to employment-related migration (F. Chen et al., 2011; Xiong & Wiśniowski, 2018). Grandparental caregiving is driven by both altruistic and reciprocal motivations, facilitating adult children's labor market participation, especially for mothers (Ko & Hank, 2014). In return, grandparents who provide childcare tend to receive more financial support from their adult children.

Despite a decline in coresidence between older adults and their children due to internal migration, living arrangements remain crucial for their wellbeing (Song, 2017). Many older adults eventually return to coresidence with their adult children, especially during periods of health deterioration or widowhood, underscoring the enduring role of family support in later life (Kooiman et al., 2019; Zimmer & Korinek, 2010).

Overall, the family life course of current Chinese older adults is characterized by culturally and contextually rooted patterns. Early adulthood is typically marked by near-universal marriage and childbearing, reflecting deep-seated social norms emphasizing family as the foundation of life. In later adulthood, many extend their caregiving responsibilities to grandchildren, reinforcing intergenerational bonds and traditional filial obligations. Widowhood is a common experience, often occurring after a lifelong monogamous marriage. Additionally, coresidence with adult children remains a critical support mechanism for financial security and daily care, highlighting the enduring importance of family in the aging process.

1.3.3 Heterogeneity in family life course and wellbeing among older adults

Gender heterogeneity

Significant gender disparities exist in Chinese older adults' family life course and wellbeing outcomes. Women experience a double burden of paid labor and unpaid domestic work, with labor force participation rates higher than in many high-income countries (Djundeva et al., 2019). Women also retire earlier than men due to legal retirement age policies, contributing to lower pension benefits and increased economic precariousness in later life (R. Zhao & Zhao, 2018). In older adulthood, women continue to bear greater caregiving responsibilities, particularly for grandchild caregiving, leading to compounded economic and health disadvantages (J. Feng & Zhang, 2018; Xie & Wang, 2024). Consequently, older women face greater financial insecurity and steeper health declines than men (Xie & Wang, 2024; R. Zhao & Zhao, 2018).

Hukou system and socio-spatial heterogeneity

China's *Hukou* household registration system was initially institutionalized to control internal migration and allocate resources. It classifies individuals by *Hukou type* (agricultural vs. non-agricultural by economic nature, or rural vs. urban by residential nature) and *Hukou location* (place of registration), both typically inherited from parents at birth. Access to welfare and public services is linked to one's registered Hukou location—usually the birthplace—rather than the place of current residence (Wing Chan & Buckingham, 2008; J. Zhang et al., 2019).

Formalized in 1958, the Hukou system supported industrialization by restricting rural-to-urban migration and agricultural-to-non-agricultural occupational mobility, which preserved a low-cost industrial workforce in urban areas and stable agricultural production in rural areas. During this *Planned Economy* period, urban/non-agricultural Hukou holders received state-sponsored benefits through their work units (*danwei*), including subsidized housing, healthcare, and pensions, whereas rural/agricultural Hukou holders were largely excluded from such welfare schemes and relied on family and collective mechanisms for subsistence. The economic reforms in the late 1970s and 1980s, especially the Household Responsibility System—shifted responsibility for agricultural production from collective/state-planned faming units/villages to individual households, allowing agricultural households to retain surplus produce after meeting state quotas—stimulated agricultural production and surplus labor in rural areas, and facilitated increased labor mobility. By the 1990s, massive rural-to-urban migration and agricultural-to-

non-agricultural occupational mobility emerged, but these migrants—with rural/agricultural Hukou—remained classified as "temporary residents" with limited access to social welfare and public services. In response to growing socioeconomic inequalities and labor market demands, the Chinese government introduced gradual Hukou reforms in the 2000s. Pilot programs allowed a limited number of rural migrants to obtain urban hukou in small and medium-sized cities, whereas major metropolitan areas like Beijing and Shanghai maintained strict controls. Recent policies since 2014 have signaled state efforts to further relax Hukou restrictions, such as introducing and institutionalizing a unified category of "Resident Hukou" that tries to break the dual nature of rural/urban or agricultural/non-agricultural Hukou divide. Nevertheless, significant institutional and regional disparities persist (Cui & Cohen, 2015; Y. Tang et al., 2024; X. Wang, 2020; Wing Chan & Buckingham, 2008; J. Zhang et al., 2019; N. Zhang et al., 2021).

The Hukou system has created a long-standing socio-spatial divides in rural/urban residence and agricultural/non-agricultural occupations, significantly shaping family life trajectories and wellbeing inequalities, particularly for the current older population (D. T. Yang, 1999). Urban and non-agricultural residents have benefited from superior infrastructure, education, healthcare, income, and pension systems, while rural and agricultural residents have faced systemic disadvantages. Since the late 1970s, urbanization and industrialization have exacerbated these disparities, as rural-to-urban migrants often lack access to comprehensive social welfare benefits. Although post-2003 reforms have expanded public health insurance to rural and agricultural residents, urban and non-agricultural workers continue to receive more generous benefits, particularly those with formal (non-agricultural) employment contracts (Y. Tang et al., 2024). Similarly, pension system reforms since 2009 have extended coverage to rural and agricultural residents, but benefit levels remain significantly lower than those of their urban and non-agricultural counterparts (Shen et al., 2020). These disparities contribute to pronounced wellbeing inequalities across the life course, with urban and non-agricultural older adults enjoying higher incomes, better pensions, superior health conditions, and greater social participation, while rural and agricultural older adults face greater economic insecurity, poorer health, and limited social engagement (Cai et al., 2012; W. Lin, 2017; Shen et al., 2020; Wu et al., 2024; N. Zhang et al., 2021). These inequalities are further compounded by current migration patterns, as many rural older adults lack adequate support from their adult children, who have moved to urban areas for career advancement (Song, 2017). This shift challenges traditional family-based support systems and raises concerns about the wellbeing of rural older populations.

1.4 Methodology

1.4.1 Life course and longitudinal methods

This thesis employs advanced quantitative methods to analyze longitudinal data to assess the relationship between individual wellbeing and family dynamics over the life course. Longitudinal analysis in life course research typically follows either a holistic or transition-centered approach, depending on the analytical objectives.

The *holistic* approach examines entire life trajectories, capturing patterns in timing, duration, transitions, and the order of life events. I apply sequence and cluster analysis, an increasingly used holistic method that enables intuitive visualization and typology construction (Aisenbrey & Fasang, 2010). While researcher subjectivity in weighting life event characteristics remains a potential limitation, combining this method with regression models allows for a nuanced assessment of how wellbeing disparities in later life relate to distinct family trajectories.

The *transition-centered* approach focuses on specific life events and their impacts, analyzing correlations, causal relationships, and variations in life course outcomes (Mayer, 2009). In line with this approach, I use fixed-effects regression analysis, a robust method for identifying the effects of family role transitions on changes in individual wellbeing over time (Allison, 2009).

1.4.2 Data sources

The primary data source for this thesis is the *China Health and Retirement Longitudinal Study* (CHARLS), a nationally representative survey of individuals aged 45 and older and their spouses across 28 provinces in China. Supported by institutions such as Peking University, the National Natural Science Foundation of China, and the World Bank, CHARLS provides five waves of data (2011, 2013, 2015, 2018, 2020) and a 2014 life course survey with retrospective information. The questionnaire covers demographics, family structure, health, biomarkers, insurance, employment, retirement, income, consumption, assets, social participation, and community-level factors. These data comprehensively support analyses of older adults' wellbeing, marital and fertility history, intergenerational relationships, caregiving, employment, and other family dynamics over the life course. The dataset is publicly available on the CHARLS website (CHARLS, 2011, 2013, 2014, 2015, 2018).

To address the high rates of missing data on older adults' economic resources in the CHARLS dataset, this thesis also incorporates the *Chinese Longitudinal Healthy Longevity Survey* (CLHLS). Jointly administered by Peking University and Duke University, CLHLS has been conducted since 1998, initially surveying individuals aged 80 and older across 22 provinces, and later expanding to include those aged 65 and above in 23 provinces since 2002. The dataset, comprising eight waves (1998, 2000, 2002, 2005, 2008, 2011, 2014, 2018), offers extensive demographic, socioeconomic, and health information, making it particularly suited for examining the effects of family dynamics on older adults' economic wellbeing. The dataset is publicly accessible via the Peking University Open Research Data Platform (CLHLS, 2020).

1.5 Thesis outline

The remainder of this thesis consists of three empirical chapters (Chapters 2 to 4) and an overarching discussion and conclusion (Chapter 5). The empirical chapters examine the relationship between family dynamics and wellbeing among older adults in China, addressing different dimensions of wellbeing and family dynamics. These chapters can be read as individual essays. **Table 1-1** presents an overview of the key content of the empirical chapters.

Table 1-1 Main content of three essays in this thesis

Chapters	Family dynamics	Wellbeing	Data	Quantitative methods
2	Work-marriage-parenting trajectories (ages 16-50)	Health conditions (ages 51-80)	CHARLS (2014-15)	Sequence & cluster analysis OLS & Poisson regressions
3	Grandchild caregiving (ages 50-80)	Social participation (ages 50-80)	CHARLS (2011-18)	Fixed-effects regressions
4	Widowhood (ages 65+)	Economic resources (ages 65+)	CLHLS (2002-18)	Fixed-effects regressions

Chapter 2 investigates the associations between work-family trajectories and health outcomes of Chinese older adults, incorporating a holistic life course perspective. It integrates work histories into family trajectories, recognizing their influence on family trajectories and their combined impacts on wellbeing. Additionally, rather than a binary categorization of employment, this study differentiates between non-employment, agricultural employment, and non-agricultural employment, allowing for a nuanced analysis of socio-spatial disparities in family life courses and their long-term health effects. Using CHARLS data (2014–2015), I apply sequence and cluster analysis to reconstruct combined work-marriage-parenting

trajectories from ages 16 to 50 for individuals born between 1935 and 1964. I then deploy multivariate linear regressions separately for men and women to assess the associations between identified work-family trajectories and physical and mental health outcomes in later life (recorded in 2015). This study offers an overarching picture of how Chinese older adults' health inequalities are related to their earlier work-family trajectories, which are more pronounced for women.

Chapter 3 examines how grandchild caregiving influences non-family-based social participation among older Chinese adults. This study is the first to explore the mechanisms through which family dynamics shape older adults' social engagement in China. Prior research has largely focused on health and economic outcomes, neglecting social participation, a crucial aspect of wellbeing for the older population. Using CHARLS data (2011–2018) and fixed-effects models by gender and rural/urban residence, I analyze how shifts in caregiving intensity affect the frequency of participation in social activities among people aged 50–80 who have grandchildren under 16 years old. The findings reveal the role of grandchild caregiving in promoting social engagement for older adults in China where non-family-based social participation is substantially limited.

Chapter 4 examines economic wellbeing dynamics around widowhood. It is the first study to analyze widowhood effects for older adults as a process rather than a single event in China. Applying fixed-effects models to a sample of Chinese adults aged 65 and older from CLHLS data (2002-2018), I examine changes in the likelihood of income adequacy before and after spousal loss, considering heterogeneity in gender and previous occupation (agricultural/non-agricultural). In addition, I focus on the role of coresidence with adult children as an important factor underlying the study associations. Although the results show increased likelihood of income adequacy over the widowhood process, I argue that they shed light on the precarious economic wellbeing of Chinese older adults and their dependence upon adult children under a family-centered welfare system.

Finally, Chapter 5 summarizes the main findings of the three empirical essays, discusses the theoretical and methodological contributions of the thesis, outlines policy implications, and highlights limitations and future research directions.

Chapter 2 Work-family Trajectories and Later-life Health in China

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Previous versions of this study were presented at the *13th Conference of Young Demographers* (4 February 2022, online), the *European Population Conference 2022* (30 June, Groningen, The Netherlands), and the *ECSR Spring School 2023 on "Changing families and social inequality over the life course"* (28 March, Turin, Italy).

Abstract

The academic recognition that work-family roles are relevant determinants of health over the life course lacks empirical evidence from contexts in the Global South, such as China, where rapid social changes and widening health inequalities among the older population coexist. This research aims to explore the associations between combined work-family trajectories and health outcomes among Chinese older adults from life course and gender perspectives. Using data from the China Health and Retirement Longitudinal Study (CHARLS), this study used sequence and cluster analysis on individuals' work-family trajectories from age 16 to 50 among those born between 1935 and 1964. Multivariate linear regressions were then utilized to assess associations between work-family trajectories and health outcomes (chronic diseases and depressive symptoms). Results show that distinctive life course paths underlie health inequalities at older ages, with varying effects on men and women. Individuals following work-family trajectories characterized by protective roles and transitions—such as employment in non-agricultural occupations and enduring marriages—experience better health outcomes in later life. Conversely, trajectories involving disadvantageous roles, including employment in agricultural occupations, economic inactivity, higher fertility, and unmarried childbearing, are associated with poorer health. Notably, health variations across work-family trajectories are greater for women than men, and women face worse health outcomes than men, though this gender disparity narrows with employment in non-agricultural occupations.

Key words

Work; marriage; parenthood; chronic diseases; depressive symptoms; life course; gender

2.1 Introduction

There is growing recognition that work and family roles are critical determinants of health over the life course. Stable employment, marriage and parenthood are linked to protective health factors such as higher income, healthier lifestyles, and broader social support networks (Greenhaus & Powell, 2006). Conversely, experiences such as unemployment or teenage and single parenthood often deprive individuals of the necessary resources that foster good health (McKetta et al., 2018; O'Flaherty et al., 2016). Such differing exposures to work and family roles result in cumulative health inequalities over time that become particularly pronounced in old age (Carmichael & Ercolani, 2016; Engels et al., 2019; Ice et al., 2020). These associations become more complex when considering the interplay between work and family roles (Greenhaus & Powell, 2006).

Traditional life course analyses, which emphasize discrete event transitions, often neglect the cumulative impact of life experiences (Umberson et al., 2010). Recently, researchers have adopted a holistic life course approach that presents long-term life trajectories, making it plausible to examine how health disparities in old age are related to earlier work and family trajectories (Aisenbrey & Fasang, 2010; Tosi & Grundy, 2021). However, most studies have focused on high-income countries, where combined work-family life courses are sensitively shaped by work intensity (i.e., part-time vs. full-time) and marital instability (Machů et al., 2022). Less is known about these associations in contexts in the Global South, where work-family life patterns and their implications for health may be distinct.

This study aims to explore the relationships between individuals' earlier work-family trajectories and later-life health outcomes in China, where health inequality has increased substantially over the past two decades (H. Wang & Yu, 2016). In the Chinese context, economic activity type (i.e., agricultural or non-agricultural employment) captures richer information of socioeconomic inequalities than work intensity (i.e., part-time or full-time) (M. Xu et al., 2021). Additionally, family life course among the older Chinese population is less complex than in the Global North, characterized by stable marriage with childbearing (Van Winkle & Wen, 2023). Studies have highlighted significant health disparities among older adults in China, with factors such as gender, family socioeconomic status (SES), and geographical origin playing pivotal roles (Evandrou et al., 2014; Z. Feng et al., 2012). However, a comprehensive understanding of how individuals' health is structured by work-family life courses is still lacking. Such relationship also needs to consider the differences between men

and women, given the gendered nature of work-family trajectories (M. Xu et al., 2021). Nevertheless, recent studies often focus on women, limiting our understanding about how gender inequality is interwoven in this association (Machů et al., 2022).

To address the research gaps mentioned above, we aim to answer two questions: *What are the relationships between work-family trajectories since early adulthood and health status among older adults in China?* (**RQ1)** *How do these associations vary by gender?* (**RQ2**)

To answer these questions, we examined hypotheses informed by life course epidemiology theories and previous research findings. Our empirical analysis utilized life history data, spanning 35 years (ages 16–50), along with both physical and mental health indicators measured at older ages (51–80) in 2015 from the China Health and Retirement Longitudinal Study (CHARLS). We deployed sequence analysis to identify representative work-family trajectories for our study population, and regression models to examine the relationships between work-family trajectories and health outcomes.

This study makes three essential contributions. First, it adopts a holistic life course approach to address underexplored mechanisms leading to health inequalities in older ages. The long sequences of yearly work-family states enable the assessment of the timing, duration and order of work-family roles and transitions as key factors underlying health disparities at older ages, which develop as a dynamic process. Second, the study addresses gender differences in the associations under investigation, which have been largely overlooked, even though life courses often exhibit gender-specific patterns. Third, it adds empirical evidence to the relationships between health and work-family trajectories in the context of the Global South.

2.2 Theoretical framework & hypotheses

Work and family roles are critical to individual health outcomes through economic resources, health behaviors and social support (Uhlenberg & Mueller, 2003). Individual economic resources are assured by employment and can be pooled and benefit from shared expenses through marriage, while both work and family roles extend social networks that foster potential support (Greenhaus & Powell, 2006). Marriage and parenthood also motivate individuals to maintain mental quality and healthy lifestyles such as diet and exercise, and to avoid risky behaviors such as alcohol and substance abuse/independence (Fergusson et al., 2012; Lewis et al., 2006; Tanaka & Johnson, 2016). On the other hand, family caregiving related to

childbearing and marriage may also cause economic and mental stress, particularly when combined with intensive paid work (Greenhaus & Powell, 2006).

The life course perspective emphasizes the dynamic nature of health over a chronological process of human development and aging, underlining the long-term impact of positive and negative exposures to health and the interplay between physiological and socioeconomic resources over time (Dannefer, 2003). It offers a lens to examine how the duration, sequencing and timing of work and family roles in earlier adulthood shape health outcomes in old age. This section introduces these theoretical dimensions with empirical evidence from previous studies, incorporating a gendered perspective.

2.2.1 Duration of work-family roles and health in later life

Accumulation models from life course epidemiology posit that prolonged exposures to advantaged or disadvantaged life experiences have accumulative effects on health over time, leading to increased health disparities among older adults (Dannefer, 2003). Empirical studies have shown that stable labor market participation and partnership with parenthood during earlier adulthood are linked to better self-rated health and lower risks of physical and cognitive decline in old age (Carmichael & Ercolani, 2016; Lacey et al., 2016; Mayeda et al., 2020). Conversely, long-term unemployment, singlehood and childlessness correlate with poorer self-rated health, increased risks of cognitive decline, inflammation and mortality, as well as higher body mass index (BMI) and depression rates during older adulthood (Carmichael & Ercolani, 2016; Engels et al., 2019; Ice et al., 2020; Lacey et al., 2016, 2017; Mayeda et al., 2020; McKetta et al., 2018). While cumulative disadvantages explain many long-term health disparities, some may also stem from deviations from socially encouraged work and family trajectories.

2.2.2 Normative work-family paths and health in later life

Individuals typically follow normative life course patterns that are encouraged or regulated by cultural and institutional expectations, where transitions of work and family roles aligning with these patterns—such as parenthood following stable marriage and stable employment after education—are considered successful socialization processes that increase socioeconomic resources promoting individual health (Riley & Riley, 1994). Conversely, “unscheduled” and “out-of-sequence” deviations, such as single parenthood and unemployment, are often discouraged and linked to stressful economic situations and worse health outcomes

(Furstenberg, 2005). Empirical evidence suggests that compared to childbearing within marriage, non-marital childbearing transitions are associated with higher risks of smoking, alcohol consumption, poor self-rated health and depression (Barban, 2013). Similarly, trajectories with multiple or long-term employment breaks are associated with adverse physical and mental health outcomes in old age (Tosi & Grundy, 2021).

2.2.3 Timing of work-family roles and health in later life

Certain life stages represent sensitive periods where exposures to risks or resources trigger greater influence on health, making the timing of transitions critical for understanding the long-term health impact of work-family roles (Kuh et al., 2003). Early life stages, including adolescence and early adulthood, have gained more attention because individuals' biological conditioning and health behaviors are easily shaped by environmental exposures, social roles, and related transitions, which also determine whether they experience successful transitions into adulthood (Blakemore & Mills, 2014; Wood et al., 2018). Early parenthood often results in education terminations, mental and financial stress, and decreased social engagement due to the demands childbearing, increasing the risk of poor health in old age (Fergusson et al., 2014; Lacey et al., 2016, 2017). Such sensitive effects also apply to unemployment during early adulthood, which is linked to higher risks of violence, substance abuse, and depression (Fergusson et al., 2014; J. O. Lee et al., 2015; Strandh et al., 2014). Studies also suggest that unemployment during midlife (ages 45–54) is more detrimental than at younger ages, as it is often followed by prolonged unemployment and financial instability (Deelen et al., 2018).

2.2.4 Gender differences in work-family paths and health in later life

Work-family trajectories and their impact on health outcomes are gendered. Compared to men, women often experience discontinuous career pathways due to family caregiving responsibilities imposed by traditional "male breadwinner" model, resulting in weaker labor market attachment and poorer economic security (Patterson & Margolis, 2019; Zimmermann, 2021). Despite increasing female workforce participation, men's contributions to family caregiving remain limited, reinforcing persistent gender inequalities in work-family experiences and their influence on health (Machů et al., 2022). Though still underexplored, recent research has shown that both older men and women benefit in health from traditional family formation (i.e., marriage with children) and stable employment trajectories (Uccheddu et al., 2022). However, work-family conflicts are more detrimental for women who follow

trajectories characterized by full-time family caregiving or by combining full-time employment and high fertility, regardless of marital status (Engels et al., 2019; Greenhaus & Powell, 2006). In contrast, poor later-life health of men is more likely to be related to employment instability or singlehood rather than childless trajectories (Lacey et al., 2017; O'Flaherty et al., 2016).

2.2.5 The study context

Our study focuses on Chinese population born between 1935 and 1964. These cohorts exhibit consistent patterns of stable marriages with children, though younger cohorts have experienced delayed marriage and declining fertility (J. Yu & Xie, 2021). Van Winkle and Wen (2023) found that for this population, typical family trajectories between ages 16 and 40 shifted from early marriage with three or more children (1930–1949 cohort) to two children (1950–1959 cohort), and then to one child (1960–1960 cohort). However, non-traditional family trajectories remain limited across cohorts.

Among the study cohorts, life courses were primarily defined by rural residence and agricultural employment. However, socioeconomic inequalities between rural and urban areas, as well as between agricultural and non-agricultural occupations, persist. These disparities have been exacerbated by industrialization policies favoring investment in urban areas and non-agricultural sectors, manifesting in lower education, income and social welfare in rural areas and agricultural occupations (D. T. Yang, 1999). This has been strengthened by the *Hukou* household registration system, which used to identify individuals as either rural/agricultural or urban/non-agricultural residents based on birth origin and restrict rural-to-urban and agricultural-to-non-agricultural mobility (X. Meng, 2012). Since the late 1970s, policy relaxation has enabled increasing residential and occupational mobility, yet structural inequalities remain (M. Xu et al., 2021).

Research on the intersection of later-life health and combined work-family trajectories in China remains limited. Previous studies have suggested that marriage is associated with better self-rated health compared to singlehood and marital disruptions (L.-C. Hu, 2021). Research focused women has found complex health effects of fertility: while mothers generally face poorer health than childless women, higher fertility is linked to worse health in old age. Additionally, both earlier and later than average-timing childbearing are associated with poorer health outcomes (Z. Hu et al., 2021; X. Li et al., 2018; H. Yang et al., 2020). Trajectories characterized by stable or transitioning to non-agricultural employment and urban residence

present better income security and mental health in old age than those involving agricultural employment and rural residence. (Z. Chen et al., 2022; M. Xu et al., 2021; N. Zhang et al., 2021).

Gender heterogeneity in work-family life is pronounced in China, reflecting broader societal expectations in Chinese culture. Though Chinese women maintain high rates of labor market participation compared to their counterparts in Western countries, their participation has declined, and the gender gap in earing has widened (Ge & Yang, 2014). This trend reflects China's transition from a centrally planned economy, which promoted gender equality, to a market-driven system that reinforces traditional gender roles (X. Chen & Ge, 2018). Women predominantly shoulder family responsibilities, often facing a double burden of employment and caregiving, sometimes leading to workforce withdrawal (X. Meng, 2012; Y. Zheng, 2014). Men benefit from marriage through spousal support, particularly in caring for their parents, while unmarried men often face economic hardship and social pressures (Y. Meng et al., 2021).

2.2.6 Research hypotheses

In line with these theoretical life course mechanisms and the existing empirical literature, we propose a set of hypotheses that link previous life course trajectories and later-life outcomes in the Chinese context. These hypotheses pertain to advantageous and disadvantageous work-family roles for health within each proposed mechanism (See **Table 2-1**).

In accordance with the accumulation mechanism, we expect *prolonged exposures to health-promoting roles in work and family domains to be associated with better health, while prolonged exposures to health-damaging roles are associated with worse health* (**H1**).

Considering the mechanism of normative paths, we expect that *socially accepted work-family paths are associated with better health, whereas socially unexpected work-family paths are associated with worse health* (**H2**).

Regarding the mechanism of timing, we expect *adverse exposures to family roles during specific periods are related to worse health conditions in later life* (**H3**).

Concerning gendered life courses in China, we expect women to benefit less from traditional family life and to struggle more regarding work-family life balance than men. In particular, we

hypothesize that *the adverse effect of higher fertility is greater among women than men* (**H4a**); and that *the adverse effect of singlehood is greater among men than women* (**H4b**).

Table 2-1 Advantageous and disadvantageous work-family roles for health in later life

Mechanisms (Hypotheses)	Advantageous roles	Disadvantageous roles
Accumulation (H1)	Employment	Non-employment
	Non-agricultural employment	Agricultural employment
	Married	Non-married
	Average fertility	High fertility and childlessness
Normative paths (H2)	Steady employment (particularly non-agricultural occupations)	Never employed and transitions into non-employment
	Childbearing within marriage	Unmarried childbearing
Timing (H3)	Employment at prime ages (20–50) of labor force participation	Non-employment at prime ages of labor force participation
	Stable marriage at prime ages (20–35) of family formation	Instable marriage at prime ages of family formation
	Parenthood at prime ages of family formation	Parenthood out of prime ages of family formation
Gender (H4a, H4b)	High fertility is less adverse for men	High fertility is more adverse for women
	Singlehood is less adverse for women	Singlehood is more adverse for men

2.3 Methodology

2.3.1 Data & sample

We used data from the China Health and Retirement Longitudinal Study (CHARLS), a nationally representative longitudinal survey of individuals aged 45 years or older and their partners. The 2011 baseline sample comprises about 17,500 respondents. CHARLS is useful for this research because of its (i) widely representative sample of older people; (ii) rich information on health indicators and social determinants of health (collected in 2011, 2013, 2015 and 2018); and (iii) retrospective histories of partnership, fertility, employment, and childhood backgrounds collected in 2014, enabling the reconstruction of full work-family trajectories and the control of early life conditions.

For analysis, we used respondents' health information from 2015, as well as life histories and background information collected in 2014 (CHARLS, 2014, 2015). The original sample included 20,654 individuals who completed the biographical questionnaire in 2014. We excluded 5,703 respondents born before 1935 or after 1964 to alleviate cohort-related

variations, and 127 cases with unreliable reports (e.g., marriage or first childbirth before age 10). Additionally, we dropped 1,200 respondents who were absent in the 2015 wave, which did not significantly change the distributions of key variable values (see **Table A 2-1**, Appendix). The sample for constructing work-family trajectories consists of 13,624 respondents (6,687 men; 6,937 women) aged 51–80 in 2015. For regression analysis, we further excluded 3,114 respondents with missing values on model variables, which did not significantly change the distributions of key variable values (see **Table A 2-1**, Appendix). The sample for regression analysis consists of 10,510 respondents (5,378 men; 5,132 women). Descriptive statistics for model variables by gender are presented in **Table A 2-2** (Appendix).

2.3.2 Variables

Health outcomes

This study examines both physical and mental health outcomes in later life. Physical health is measured by the number of chronic diseases, which tend to occur in older adults and are often detrimental to health overtime as they cannot be cured (Lynch & Smith, 2005). CHARLS 2015 asked respondents if they had been diagnosed with chronic diseases by a doctor across 14 conditions: hypertension, dyslipidaemia, diabetes, cancer, lung diseases, liver diseases, heart diseases, stroke, kidney diseases, digestive diseases, arthritis/rheumatism, asthma, memory-related diseases, and emotional/nervous/psychiatric problems. We dropped the last two conditions to focus on physical health.

Mental health is assessed using the depressive score from the Center for Epidemiologic Studies Depression Scale (CES-D-10; Andresen et al., 1994). Depression is a key health outcome in life course studies, reflecting chronic mental health problems caused by personal histories (Colman & Ataullahjan, 2010). CHARLS 2015 asked eight questions on negative symptoms and two on positive symptoms during the past week, with four response options recorded on a 1–4 scale from lowest to highest frequency. We first reversed the codes for positive symptoms and then recorded responses to a 0–3 scale for all symptoms, generating a total depressive score between 0 and 30 (See **Table A 2-3**, Appendix).

Work-family trajectories

Work-family trajectories were extracted from retrospective information recalled by respondents in CHARLS 2014, covering the timing of start and end of all their marriages,

childbirths, and employments. We retrieved yearly statuses of partnership, parenthood and employment from age 16 to 50 for each respondent. Partnership status is categorized as either married or not. The non-married category includes singlehood and unmarried cohabitation (3.3% of men and 3.8% of women ever entered cohabitating relationships) and conflates periods before and after marriage (divorce was uncommon: 2.4% of men and 1.9% of women ever experienced divorce). Parenthood status includes three categories based on the number of biological children: childless, 1–2 child(ren), and 3+ children (higher fertility). Work status includes economic inactivity (including unpaid household business help; see Xu et al., 2021), employment in agricultural occupations, and employment in non-agricultural occupations.

We combined these states into eight categories (See **Table A 2-4**, Appendix, for the detailed variable structure). Common work-family states of our study population feature employment and marriage with children, including four categories: "agriculture, married, 1–2 child(ren)"; "agriculture, married, 3+ children"; "non-agriculture, married, 1–2 child(ren)"; "non-agriculture, married, 3+ children". Three categories feature less conventional family arrangements: "non-married, childless"; "non-married, with child(ren)"; "married, childless". Employment statuses are not specified for these three groups due to their relatively small representation in our sample. Our study population married and had children at relatively early ages, and very few of them remained in any of these three family statuses for long during our observation period. Despite losing some specificity regarding employment statuses within these non-traditional family statuses, this has little impact on our results. Lastly, one category of economic inactivity conflates marriage with any number of children: "inactivity, married, with child(ren)".

Socio-demographic and background characteristics

To contextualize work-family trajectories and control for confounders of their association with health outcomes, we included socio-demographic and childhood background factors from CHARLS 2014. Individuals were categorized as "1st Hukou is urban" if their first Hukou type was "non-agricultural Hukou" or "unified Residence Hukou". Respondents' parents were classified as literate if they had received any education. Childhood neighbourhood safety status, family economic status, and health status were self-rated by respondents in comparison to other neighbourhoods, families, and their peers during childhood.

2.3.3 Analytic strategy

The analysis proceeded in two stages: (1) sequence and cluster analysis to identify typical work-family trajectories, and (2) multivariable linear regression analysis to examine their associations with later-life health.

Sequence and cluster analysis

We conceptualized work-family trajectories as sequences of yearly work-family roles from age 16 to 50. **Figure 2-1** illustrates three example sequences over a ten-year period. Sequence A depicts a transition to marriage at age 24, and to parenthood combined with economic inactivity at age 25; sequence B features a transition to single parenthood at age 22; and sequence C features a transition to marriage and parenthood combined with agricultural employment at age 22, and to high fertility (3+ children) at age 26.

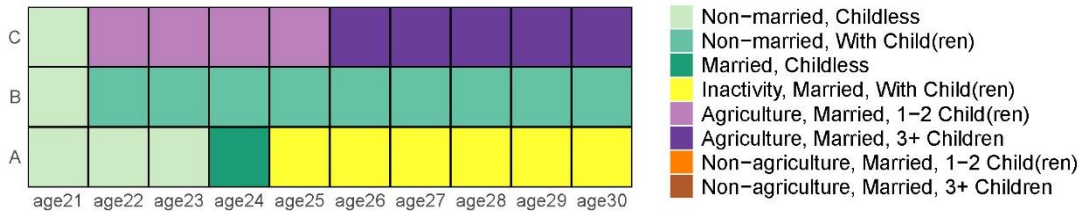


Figure 2-1 Fictional sequences of work-family states at ages 21–30

Note: Sequences are chronological successions of categorical work and family states.

We used algorithmic methods to identify underlying pathways among the sequences of work-family roles. To this end, we computed pairwise distances across all pairs of sequences using Optimal Matching (OM). The OM distance between two sequences is the minimum cost of transforming one sequence into the other by substituting, inserting and deleting the elements of a sequence (work-family states at each age), with each operation assigned a cost (Abbott & Tsay, 2000). Because the original OM distance is insensitive to the temporal context of sequence elements (Aisenbrey & Fasang, 2010), we used the novel OMstran variant (a.k.a. Optimal matching of transition sequences) considering that two sequences are more similar if they follow comparable sets of transitions between states (Studer & Ritschard, 2016). This renders an OM distance that is more sensitive to temporality, in general, and the sequencing or order of states, in particular. We considered substitution costs that describe relationships between different work-family states along a continuum, ranging from no family formation to

high fertility, as well as from economic inactivity to non-agricultural employment (See **Table A 2-5**, Appendix). This cost structure contributed to the generation of distance measures that reflect relevant distinctions in work-family trajectories.

We used hierarchical cluster analysis with the Ward link on the matrix of pairwise OM distances to group sequences, which rendered a typology of internally consistent groups of sequences. We decided the number of groups based on empirical fit measures using cluster stopping rules (see **Figure A 2-1**, Appendix) as well as the theoretical interpretation of the smallest group. Although 11 groups formed the preferred solution in accord with the empirical fit criteria, we chose a 12-group solution because the additional partition renders a theoretically relevant group. The new group features early-than-average fertility, which is often found to hold an association with health outcomes.

For the subsequent analysis, we combined four groups—marginal in terms of sample size, but similar in terms of trajectory features—into two: "From agriculture to (middle adulthood) inactivity" (3.4%) and "From non-agriculture to (middle adulthood) inactivity" (2.2%) were combined into "Middle adulthood economic inactivity"; and "Left agriculture, lower fertility" (3.1%) and "Left agriculture, higher fertility" (3%) were combined into "Left agriculture". Therefore, our final solution is a 10-group typology that displays substantive variation in work-family trajectory pathways theoretically relevant for our hypotheses.

Sequence and cluster analysis were executed on RStudio (R version 4.2.2), using the packages "TraMineR" (Gabadinho et al., 2011), "TraMineRextras" (Ritschard et al., 2024) and "WeightedCluster" (Studer, 2013).

Regression analysis

We regressed health outcomes—chronic conditions and depressive scores—on previous work-family pathways to test our hypotheses. We used Poisson and OLS regressions respectively for the number of chronic diseases and depressive scores. We included interactions between gender and trajectory pathways in the models to assess gender differences. We adjusted for socio-demographic and childhood backgrounds, including age, education, and the set of family SES and health during childhood. We used unweighted sample for regressions due to minimal difference from the weighted sample regarding variable values (see **Table A 2-1**, Appendix). We presented model results as predicted margins for clear comparisons of health outcomes across work-family trajectory pathways by gender.

2.4 Results

2.4.1 Typical work-family trajectories

Figure 2-2 visually illustrates ten typical work-family trajectory pathways between ages 16 and 50 using sequence index, status distribution, and representative sequence plots for each cluster. The sequence index plots visualize individual trajectories, with each horizontal line representing one person. The status distribution plots display age-specific proportions for each work-family status. The representative sequence plots display the most frequent sequence within each cluster. We arranged clusters in, arguably, a descending order with regard to their association with favorable health outcomes, prioritizing traditional family arrangements (childbearing in marriage) and non-agricultural employment over economic inactivity and non-traditional family arrangements. **Table A 2-6** (Appendix) summaries key trajectory features, socio-demographic and childhood background for each cluster.

Three clusters characterize traditional family arrangements and non-agricultural employment. Cluster a1 "non-agriculture, lower fertility" (n = 2,205, 16.2%) features lower fertility (1-2 children) within marriage and non-agricultural employment. This cluster uniquely has a higher proportion of urban-origin individuals (first Hukou registration was urban) among all clusters (see **Table A 2-6**, Appendix). Cluster a2 "non-agriculture, higher fertility" (n = 939, 6.9%) shares similar features but with earlier and higher fertility (3+ children). Cluster a3 "Left agriculture" (n = 827, 6.1%) represents individuals, higher or lower fertility, transitioning from agricultural to non-agricultural occupations around their 30s. These three clusters are dominated by men (over 66%) and exhibit the highest levels of education.

About half of the sample (n = 6,944, 51%) followed trajectories of traditional family arrangements and steady agricultural employment. Clusters b1 "agriculture, lower fertility" (n = 2,781, 20.4%) and b2 "agriculture, higher fertility" (n = 2,015, 14.8%) feature sustained agricultural employment, differing in fertility levels. Cluster b3 "agriculture, early higher fertility" (n = 2,148, 15.8 %) mirrors Cluster b2 but features earlier family formation with most individuals marrying and having children by age 20. These clusters feature largely rural backgrounds (99%), and Cluster b3 is dominated by women (71%).

Two clusters combine traditional family arrangements and economic inactivity. Cluster c1 "middle adulthood economic inactivity" (769, 5.6%) includes individuals leaving paid work

around age 40. Cluster c2 “long-term economic inactivity” (759, 5.6%) comprises individuals who remain economically inactive throughout adulthood, primarily women (71%).

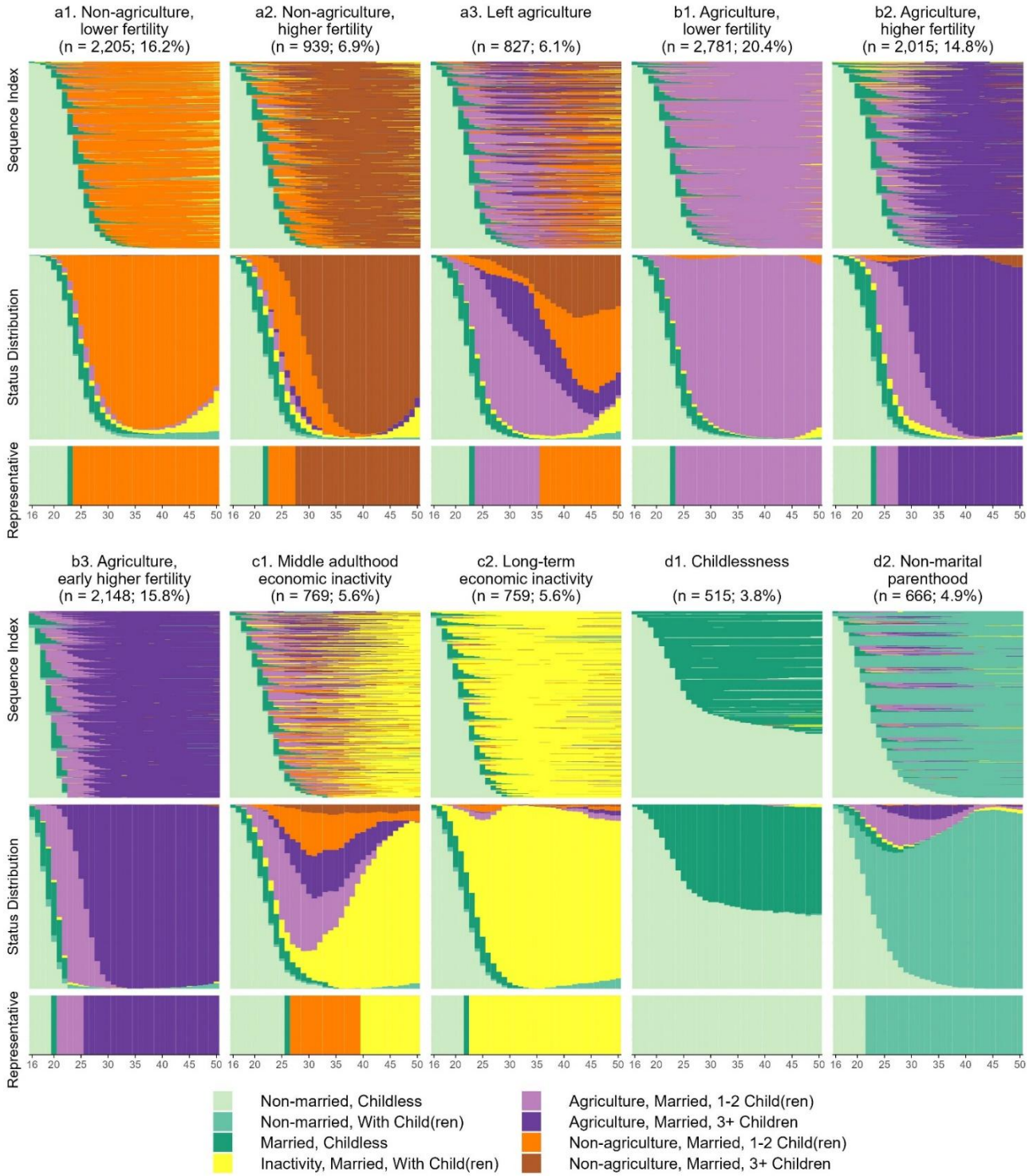


Figure 2-2 Representations and summaries of typical work-family trajectory pathways (ages 16–50)

Note: authors’ calculations based on unweighted data from CHARLS 2014 (N = 13,624).

Two clusters characterize long-lasting non-traditional family arrangements that are uncommon in the study population. Cluster d1 "childlessness" (n = 515, 3.8%) features childless individuals, with slightly over half marrying by age 50, mostly men (68%). Cluster d2 "non-marital parenthood" (n = 666, 4.9%) comprises unmarried parents who ever divorced or never married. These two clusters display the highest divorce rates across all clusters (6.3% and 8.3% in clusters d1 and d2, respectively) and similar work trajectories predominantly agricultural employment with limited variations.

2.4.2 The relationships between work-family paths and later-life health

Figure 2-3 presents predicted chronic disease occurrences and depressive scores for both men and women across work-family pathways. Full results are available in **Table A 2-7** (Appendix).

Trajectory pathways involving long spells in non-agricultural employment (Clusters a1 "non-agriculture, lower fertility" and a2 "non-agriculture, higher fertility") or transitions into non-agricultural employment (Cluster a3 "left agriculture") show clear associations with depressive symptoms but not with chronic diseases, both for men and women. Predicted depressive scores for these groups are lower than any other groups, especially among women. Concerning chronic diseases, women in group a3 "left agriculture" show a lower occurrence than the average level, while those in group a2 "non-agriculture, higher fertility" display a higher occurrence. Occurrences of chronic diseases in all three groups among men, and in group a1 "non-agriculture, lower fertility" among women, do not differ from the average.

Trajectories combining agricultural employment with traditional family arrangements also display clearer associations with depressive symptoms than chronic conditions, for both men and women. Clusters b2 "agriculture, higher fertility" and b3 "agriculture, early higher fertility" predict higher depressive scores than the average, while this effect is not found in Cluster b1 "agriculture, lower fertility". Regarding chronic conditions among these groups, only women in Cluster b3 show a higher predictive number of chronic diseases than the average, whereas the other two groups among women and all three groups among men do not exhibit differences.

Trajectories combining economic inactivity and traditional family arrangements show limited associations with health outcomes for both men and women. Cluster c1 "middle adulthood economic inactivity" shows higher occurrence of chronic diseases than average for both men and women, while this association does not exist for depressive scores. Women in group c2 "long-term economic inactivity" exhibit higher depressive scores and chronic disease

prevalence than average (though not at the 5% significance level), while such associations do not exist among men.

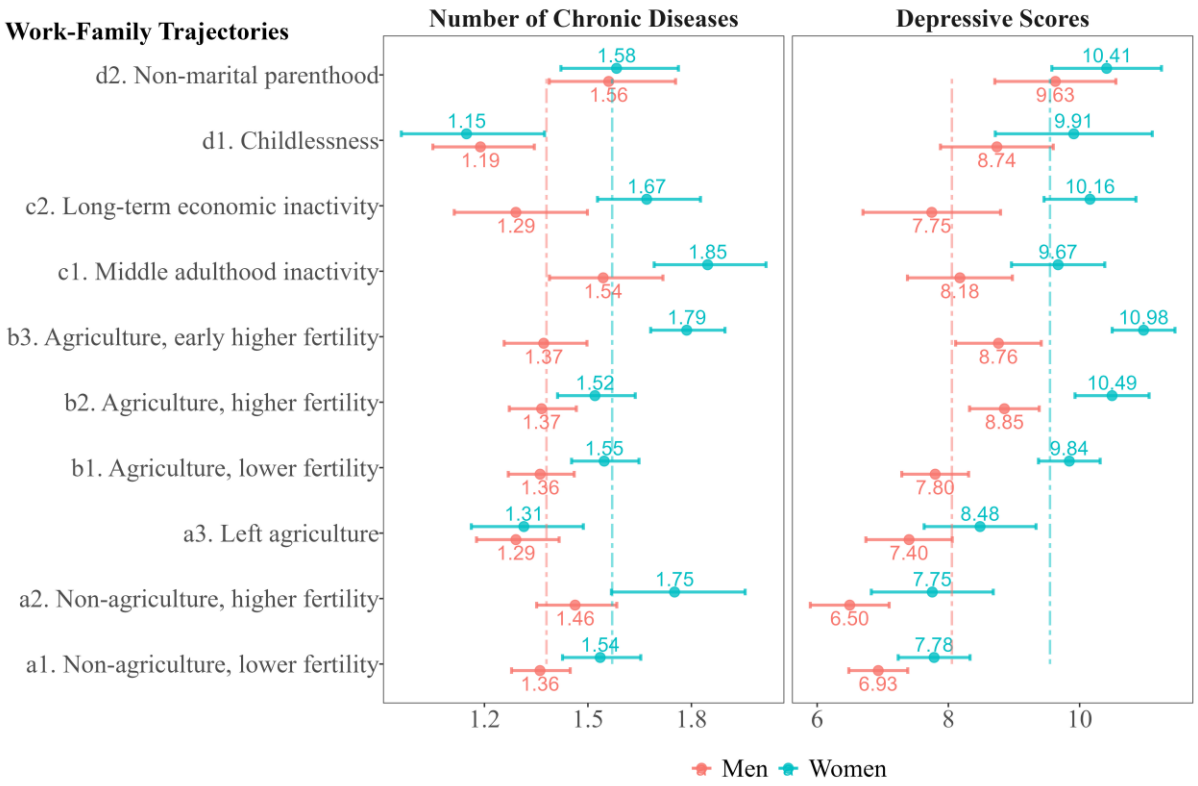


Figure 2-3 Predicted margins of health conditions of men and women aged 51–80 across work-family trajectory pathways

Notes: (1) Source: authors' calculations based on unweighted data from CHARLS (2014, 2015). (2) Whiskers indicate 95% confidence intervals. (3) Predictions are based on gender-interaction multivariable linear regressions presented in **Table A 2-7** (Appendix). (4) Dashed lines are margin means across clusters by gender. (5) Estimated health levels across trajectory pathways are net of individuals' background characteristics. (6) The number of chronic diseases ranges from 0 to 12 and depressive scores from 0 to 30.

Trajectories featuring non-traditional family arrangements display some associations with health conditions. For both men and women, Cluster d1 "childlessness" predicts the lowest occurrence of chronic diseases among all groups. However, this group presents a higher depressive score than average among men, which is not substantive among women. Group d2 "non-marital parenthood" predicts more chronic diseases and higher depressive scores than the average among men. Long-term non-married mothers have higher depression scores than the average, but such an association does not apply to chronic conditions.

Overall, health variations across work-family trajectories are more pronounced among women than men. An exception is cluster d2 “non-marital parenthood”, where men exhibit worse health outcomes than the average, while the effects are less clear for women. This cluster predicts the highest depressive score and the most chronic conditions for men, along with Cluster c1 “middle adulthood economic inactivity”. Among women, Cluster c1 predicts the most chronic conditions, while Cluster b3 “agriculture, early higher fertility” shows the highest depressive scores. For both men and women, clusters a1 “non-agriculture, lower fertility” and a2 “non-agriculture, higher fertility” predict the lowest depressive scores, while Cluster d1 “childlessness” predicts the fewest chronic conditions.

To verify the sensitivity of our results to age differences, we conducted regressions interacting age groups (51–65 and 66–80) with work-family trajectories (See **Figure A 2-2**, Appendix). The results remained largely consistent. No significant age differences emerged for depressive symptoms, though chronic conditions increased with age as expected (as physical health tends to deteriorate over time in later life).

2.5 Conclusion & discussion

By adopting a holistic life course approach to present work-family trajectories and examine their impact on later-life health outcomes among older Chinese populations, this study advances our understanding of the life course dynamics underlying health inequality. Our findings highlight distinctive life course pathways associated with health disparities in older ages. Specifically, trajectories combining non-agricultural employment with traditional family formations relate to better mental health, while trajectories of childlessness corelate with better physical health. In contrast, trajectories combining agricultural employment with high fertility and trajectories of middle adulthood economic inactivity are associated with worse mental and physical health outcomes, respectively.

We now assess our proposed hypotheses on life course mechanisms linking work-family trajectories to later-life health. Empirical evidence generally supports our hypotheses, particularly for mental health outcomes. The accumulation mechanism (H1) posits that prolonged exposure to advantageous or disadvantageous work-family roles leads to health disparities in later life. This is verified by trajectories combining steady employment in non-agricultural occupations (often associated with higher incomes and job security) with

traditional family arrangements (marriage with children, often associated with healthier lifestyles), which are associated with better mental health than average in later life. Contrary to our expectations, permanent childlessness (typically associated with economic disadvantages and social stigma) correlates with the fewest chronic diseases at older ages.

The normative paths mechanism (H2) suggests that adherence to socially expected roles and transitions benefits health in later life, while deviation from these expectations has adverse effects. Supporting this, trajectories with transition from employment in agricultural to non-agricultural occupations—often associated with improved employment conditions and moves to (urban) areas with better healthcare—are related to improved mental health. In contrast, unmarried childbearing trajectories—often associated with education and career disruptions, and restricted access to prenatal care or social benefit for parents—relate to worse mental health (and worse physical health for women).

The sensitive periods mechanism (H3) proposes that the timing of exposure to protective or adverse work-family roles is critical for better or worse later-life health outcomes, respectively. This is supported by trajectories of earlier-than-average fertility that display substantively worse mental health (and worse physical health, but only for women), and by trajectories of economic inactivity during middle adulthood that display worse physical health.

While our results show no gender differences in the direction (i.e., positive or negative) of the study associations, women experience greater health discrepancies across work-family trajectories. Concerning specific gender differences, hypothesis H4a, which posits that higher fertility trajectories have greater adverse effects on women, is partially supported—higher fertility trajectories with agricultural employment result in greater physical and mental health adversities for women than for men. Hypothesis H4b, which suggests that non-marital trajectories have greater adverse effects on men, is also partially supported—non-marital childbearing trajectories show the worst physical and mental health outcomes among men, though women with such trajectories also exhibit worse mental health. Regarding gender differences in employment that we did not initially hypothesize, we found that trajectories featuring agricultural employment, and to some extent those featuring economic inactivity, display health disadvantages for women relative to men. This is not the case for trajectories featuring non-agricultural employment, suggesting that women's health benefits from the conditions associated with this type of employment.

Our findings align with Western studies showing that early childbearing and non-marital family arrangements are linked to poorer later-life health. Notably, the impact of childbearing is substantively gendered: compared to men, childbearing has more pronounced penalties on women's education and career attainments that foster individual health (Furstenberg, 2005; Hansen, 2012). In the context of China, our results reveal that early childbearing and single parenting trajectories are associated with particularly poorer health conditions for women in their later adulthood. For men, the health disadvantages of single fatherhood seem to be linked to their socio-spatial background. Unmarried men, especially those from rural areas, often experience social stigma and lower family SES, leading to reduced subjective wellbeing. These disadvantages stem from, and are reinforced by, the stress of adhering to traditional family norms and values, along with a relative lack of support and assistance with eldercare compared to married men, who typically benefit from spousal support (Y. Meng et al., 2021). Interestingly, both lifelong childless men and women report the lowest risk of chronic diseases, with this effect being more pronounced in women than in men. Although societal stigma and mental stress may be associated with childlessness (Tanaka & Johnson, 2016), this positive physical health outcome may be attributed to the relief of economic costs and stress associated with childbearing, especially for women who not only give birth but also typically shoulder a larger share of childcare responsibilities than men (Hansen, 2012).

In the occupational domain, health inequalities in China are predominantly driven by SES inequalities between agricultural and non-agricultural occupations, rather than simply by being employed or not. This contrasts with Western studies, which focus on the binary distinction of being in paid work or not. Opportunities for social mobility among older Chinese have been influenced by their urban and rural backgrounds. Relatedly, persistent SES inequalities between rural and urban areas, as well as between agricultural and non-agricultural occupations, have further contributed to health disparities within this population. A critical concern is the stark pension inequality between agricultural and non-agricultural workers, as well as between rural and urban residents, exacerbating economic insecurity and eldercare challenges for rural/agricultural older populations (M. Xu et al., 2021; N. Zhang et al., 2021).

Our results highlight relevant issues regarding gender, occupations and health. Engaging in non-agricultural occupations has a profound positive impact on women's health, narrowing the health gap between men and women. However, non-agricultural career paths are dominated by men, as observed in this and other studies (M. Xu et al., 2021). It appears that older Chinese

women faced barriers to entering or maintaining such non-agricultural career trajectories, which might transcend the possession of an urban Hukou or educational qualifications.

Our findings underscore three policy implications concerning the relationships between work-family trajectories and later-life health inequalities. First, addressing persistent rural/urban and agricultural/non-agricultural SES inequalities is essential to mitigating lifelong health disparities. Second, institutional gender equality measures are crucial for enhancing women's wellbeing by enabling their engagement in education and formal employment. Lastly, increased public support for eldercare is imperative, particularly for specific groups like rural residents.

Several limitations warrant caution. First, while we identified associations between work-family trajectories and later-life health, causality cannot be inferred. Though we controlled socio-demographic and childhood backgrounds, reverse causation remains possible, as previous health disparities may lead to different work-family trajectory pathways. Future research could deploy more complicated approaches to assess causality, such as incorporating the role of early-life conditions (including health) in shaping work-family trajectories and assessing their moderating role in our study's associations (Arpino et al., 2018). Second, our categories of work-family roles were necessarily simplified, limiting analysis of more nuanced trajectories. For instance, marital status was classified as married or not due to low sample sizes in more specific categories, though widowed, divorced, and never-partnered individuals may experience distinct health outcomes. These categories are also rare between ages 16 and 50 for our study cohorts. Similarly, childbearing and employment states were categorized broadly, preventing finer-grained analyses. Nevertheless, this allowed us to focus on necessary trajectory patterns to test our hypotheses. Third, retrospective recall bias on work-family trajectories is a potential concern, given the extensive life histories reported by respondents. However, we believe such bias is minor because respondents recalled only major life events, and we recorded the start and end of an event using ages rather than exact dates.

2.6 Appendices

Table A 2-1 Model variables summaries by type of sample

Variables	Sample (weighted)	Sample for final regressions (unweighted)	Sample for sequence analysis	Sample before excluding respondents not in wave 2015
Number of chronic diseases (min 0; max 12)	1.46 (1.50)	1.50 (1.49)	1.49 (1.49)	
Depression Scores (min 0; max 30)	7.79 (6.34)	8.11 (6.47)	8.20 (6.50)	
Age in 2015 (min 51; max 80)	62.27 (7.58)	62.22 (7.49)	62.65 (7.71)	62.61 (7.75)
Gender				
Men	5,294 (50.8%)	5,378 (51.2%)	6,687 (49.1%)	7,295 (49.2%)
Women	5,131 (49.2%)	5,132 (48.8%)	6,937 (50.9%)	7,529 (50.8%)
1st Hukou was urban	1,453 (13.9%)	1,040 (9.9%)	1,257 (9.3%)	1,516 (10.4%)
Education attainment				
None	1,863 (17.9%)	2,083 (19.8%)	3,024 (22.3%)	3,242 (22.0%)
Some	3,965 (38.0%)	4,215 (40.1%)	5,550 (40.9%)	5,942 (40.3%)
Middle school or higher	4,596 (44.1%)	4,212 (40.1%)	5,001 (36.8%)	5,549 (37.7%)
In a safer neighbourhood before age 17	9,624 (92.3%)	9,682 (92.1%)	12,084 (92.0%)	13,045 (91.9%)
In a richer family before age 17	6,510 (62.4%)	6,425 (61.1%)	8,104 (60.0%)	8,809 (60.3%)
Mother was literate	1,266 (12.1%)	1,098 (10.4%)	1,281 (9.9%)	1,437 (10.2%)
Father was literate	4,423 (42.4%)	4,249 (40.4%)	4,970 (39.8%)	5,447 (40.3%)
Healthier than peers before age 15	3,814 (36.6%)	3,858 (36.7%)	4,797 (35.6%)	5,172 (35.4%)
Never married	363 (3.5%)	358 (3.4%)	607 (4.5%)	691 (4.7%)
Ever separated (divorced and widowed)	1,438 (13.8%)	1,455 (13.8%)	1,975 (14.5%)	2,173 (14.7%)
Ever divorced	251 (2.4%)	230 (2.2%)	291 (2.1%)	330 (2.2%)
Ever cohabitated	323 (3.1%)	322 (3.1%)	480 (3.5%)	523 (3.5%)
Number of children				
0	377 (3.6%)	323 (3.1%)	500 (3.7%)	607 (4.1%)
1	1,810 (17.4%)	1,497 (14.2%)	1,804 (13.2%)	2,042 (13.8%)
2	3,631 (34.8%)	3,651 (34.7%)	4,569 (33.5%)	4,958 (33.4%)
3+	4,607 (44.2%)	5,039 (47.9%)	6,751 (49.6%)	7,217 (48.7%)
Never worked in paid employment	194 (1.9%)	194 (1.8%)	394 (2.9%)	467 (3.2%)
Ever jobless (6+ months)	9,410 (90.3%)	9,449 (89.9%)	12,135 (89.1%)	13,179 (88.9%)
Ever economically inactive	6,238 (59.8%)	5,932 (56.4%)	7,671 (56.3%)	8,482 (57.2%)
Ever had non-agricultural work	4,914 (47.1%)	4,379 (41.7%)	5,394 (39.6%)	5,986 (40.4%)
Work-family trajectories				
a1. Non-agriculture, lower fertility	2,369 (22.7%)	1,840 (17.5%)	2,205 (16.2%)	

Variables	Sample (weighted)	Sample for final regressions (unweighted)	Sample for sequence analysis	Sample before excluding respondents not in wave 2015
a2. Non-agriculture, higher fertility	827 (7.9%)	762 (7.3%)	939 (6.9%)	
a3. Left agriculture	715 (6.9%)	683 (6.5%)	827 (6.1%)	
b1. Agriculture, lower fertility	1,893 (18.2%)	2,232 (21.2%)	2,781 (20.4%)	
b2. Agriculture, higher fertility	1,312 (12.6%)	1,520 (14.5%)	2,015 (14.8%)	
b3. Agriculture, early higher fertility	1,379 (13.2%)	1,595 (15.2%)	2,148 (15.8%)	
c1. Middle adulthood inactivity	633 (6.1%)	610 (5.8%)	769 (5.6%)	
c2. Long-term economic inactivity	485 (4.7%)	501 (4.8%)	759 (5.6%)	
d1. childlessness	388 (3.7%)	331 (3.1%)	515 (3.8%)	
d2. Non-marital parenthood	423 (4.1%)	436 (4.1%)	666 (4.9%)	
Observations	10,425	10,510	13,624	14,824

Notes: (1) Source: authors' calculations based on unweighted data from CHARLS 2014–2015. (2) Frequencies (percentages) or means (standard errors) are shown.

Table A 2-2 Descriptive statistics by gender

Variables	Overall	Men	Women
Number of chronic diseases (min 0; max12)	1.50 (1.49)	1.40 (1.44)	1.61 (1.54)
Depression Scores (min 0; max 30)	8.11 (6.47)	6.98 (5.91)	9.29 (6.81)
Age in 2015 (min 51; max 80)	62.22 (7.49)	62.55 (7.56)	61.87 (7.40)
1st Hukou was urban	1,040 (9.9%)	548 (10.2%)	492 (9.6%)
Education attainment			
None	2,083 (19.8%)	402 (7.5%)	1,681 (32.8%)
Some	4,215 (40.1%)	2,216 (41.2%)	1,999 (39.0%)
Middle school or higher	4,212 (40.1%)	2,760 (51.3%)	1,452 (28.3%)
In a safer neighbourhood before age 17	9,682 (92.1%)	4,990 (92.8%)	4,692 (91.4%)
In a richer family before age 17	6,425 (61.1%)	3,220 (59.9%)	3,205 (62.5%)
Mother was literate	1,098 (10.4%)	563 (10.5%)	535 (10.4%)
Father was literate	4,249 (40.4%)	2,179 (40.5%)	2,070 (40.3%)
Healthier than peers before age 15	3,858 (36.7%)	2,002 (37.2%)	1,856 (36.2%)
Observations	10,510	5,378	5,132

Notes: (1) Source: authors' calculations based on unweighted data from CHARLS 2014–2015. (2) Frequencies (percentages) or means (standard errors) are shown.

Table A 2-3 Center for Epidemiologic Studies Depression Scale, 10-item version (CES-D-10)

	Frequency during the last week			
	< 1 day	1-2 days	3-4 days	5-7 days
1. I was bothered by things that usually don't bother me.	0	1	2	3
2. I had trouble keeping my mind on what I was doing.	0	1	2	3
3. I felt depressed.	0	1	2	3
4. I felt that everything I did was an effort.	0	1	2	3
5. I felt hopeful about the future.	3	2	1	0
6. I felt fearful.	0	1	2	3
7. My sleep was restless.	0	1	2	3
8. I was happy.	3	2	1	0
9. I felt lonely.	0	1	2	3
10. I could not "get going."	0	1	2	3

Notes: (1) Items 5 and 8 are reverse coded. (2) The total score is calculated by totaling all items scored after reversing the positive mood items. (3) The possible range for scores is 0-30 with higher scores representing greater degrees of depressed mood.

Table A 2-4 Variable structure of yearly work-family status

Yearly work-family status	Employment status	Marital status	Parenthood status
1. non-married, childless	All types	Non-married	Childless
2. non-married, with child(ren)	All types	Non-married	Parent
3. married, childless	All types	Married	Childless
4. inactivity, married, with child(ren)	Unemployment	Married	Parent
	Unpaid household business help		
5. agriculture, married, 1-2 child(ren)	Own agricultural production and business activities	Married	1-2 children
	Agricultural employment		
6. agriculture, married, 3+ children	Own agricultural production and business activities	Married	≥3 children
	Agricultural employment		
7. non-agriculture, married, 1-2 child(ren)	Non-agricultural employment	Married	1-2 children
	Non-agricultural self-employment		
	Army service		
8. non-agriculture, married, 3+ children	Non-agricultural employment	Married	≥3 children
	Non-agricultural self-employment		
	Army service		

Notes: (1) When generating the yearly work, fertility and marital status, we gave priorities to some statuses if there were different states in the same dimension during the same year. This is because in the CHARLS 2014 survey most respondents only gave the occurrence information of year without month. Therefore, we could not use an exact date or month as the cutoff when an individual has several different work or family status during the same year (e.g., divorced and then remarried in the same year). The priorities are: (1 more child(ren) (due to new births) > less for child number; (2 non-married > married for marital status; and (3 economic inactivity > non-agricultural work > agricultural work.

(2) The collection of information on parenthood refers exclusively to the birth of children that are still alive at the time of the survey. Despite underestimating the number of children ever born, the distortion is not substantive, particularly for the younger birth cohorts. As there was no information on the presence of children in the household, we use parenthood as a proxy for resources and provision of care for children in and outside the household.

(3) Original job types in the CHARLS 2014 wave were recorded into 6 categories. We treat "unpaid household business help" together with unemployment as "*economic inactivity*" indicating that respondents were not engaging in any paid work. We combine "own agricultural production and business activities" and "agricultural employment" into "*agricultural work*". The contemporary Chinese military service system includes compulsory and voluntary recruitment, and the selection process in both types are competitive. Consequently, military service experience in China is generally beneficial regarding individual SES attainment. Thus, we combine "army service", "non-agricultural employment", and "non-agricultural self-employment" into "*non-agricultural work*".

Table A 2-5 Matrix of substitution costs across work-family states

	S1	S2	S3	S4	S5	S6	S7	S8
Non-married, Childless (S1)	0	2	1	3	3	3	3	3
Non-married, With Child(ren) (S2)	2	0	2	3	3	3	3	3
Married, Childless (S3)	1	2	0	3	3	3	3	3
Inactivity, Married, With Child(ren) (S4)	3	3	3	0	4	4	6	6
Agriculture, 1-2 Child(ren) (S5)	3	3	3	4	0	2	6	6
Agriculture, 3+ Children (S6)	3	3	3	4	2	0	6	6
Non-agriculture, 1-2 Child(ren) (S7)	3	3	3	6	6	6	0	2
Non-agriculture, 3+ Children (S8)	3	3	3	6	6	6	2	0

Notes: (1) "S1" is the abbreviation of "Status 1", "S2", "S3", …, and so on. (2) Among the three non-traditional family status, between "non-married, childless" and "married, childless" the substitution cost is 1, while the cost of changes between "non-married, with child(ren)" and the other two is 2 due to more difficulties for single parenthood.

Table A 2-6 Summary of characteristics of work-family trajectory pathways

Variables	Non-agriculture, lower fertility	Non-agriculture, higher fertility	Left agriculture	Agriculture, lower fertility	Agriculture, higher fertility	Agriculture, early higher fertility	Middle adulthood inactivity	Long-term economic inactivity	Child-lessness	Non-marital parenthood
Age in 2015 (min 51; max 80)	59.51 (6.51)	66.25 (8.55)	61.18 (7.76)	59.13 (5.65)	65.42 (7.15)	64.86 (6.83)	60.34 (7.42)	62.30 (8.01)	63.52 (7.60)	64.67 (7.84)
Women	625 (34.0%)	187 (24.5%)	231 (33.8%)	1,248 (55.9%)	668 (43.9%)	1,125 (70.5%)	343 (56.2%)	356 (71.1%)	107 (32.3%)	242 (55.5%)
Never married	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	91 (27.5%)	267 (61.2%)
Ever separated (divorced and widowed)	194 (10.5%)	109 (14.3%)	88 (12.9%)	195 (8.7%)	206 (13.6%)	270 (16.9%)	90 (14.8%)	81 (16.2%)	66 (19.9%)	156 (35.8%)
Ever divorced	77 (4.2%)	12 (1.6%)	10 (1.5%)	29 (1.3%)	12 (0.8%)	12 (0.8%)	13 (2.1%)	8 (1.6%)	21 (6.3%)	36 (8.3%)
Ever cohabitated	17 (0.9%)	9 (1.2%)	8 (1.2%)	18 (0.8%)	16 (1.1%)	12 (0.8%)	8 (1.3%)	9 (1.8%)	15 (4.5%)	210 (48.2%)
Age at 1st marriage	24.62 (3.32)	22.30 (3.10)	22.58 (3.08)	23.14 (3.41)	23.24 (3.16)	19.47 (2.17)	22.54 (3.29)	22.08 (3.02)	26.20 (7.87)	24.44 (8.13)
Number of children										
0	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	323 (97.6%)	0 (0.0%)
1	816 (44.3%)	0 (0.0%)	80 (11.7%)	388 (17.4%)	0 (0.0%)	0 (0.0%)	102 (16.7%)	63 (12.6%)	4 (1.2%)	44 (10.1%)
2	994 (54.0%)	0 (0.0%)	273 (40.0%)	1,831 (82.0%)	0 (0.0%)	0 (0.0%)	239 (39.2%)	186 (37.1%)	2 (0.6%)	126 (28.9%)
3+	30 (1.6%)	762 (100.0%)	330 (48.3%)	13 (0.6%)	1,520 (100.0%)	1,595 (100.0%)	269 (44.1%)	252 (50.3%)	2 (0.6%)	266 (61.0%)
Age at 1st childbirth	26.06 (3.47)	23.83 (3.13)	24.24 (3.26)	24.77 (3.70)	25.16 (2.93)	20.51 (1.92)	23.99 (3.60)	23.68 (3.40)	42.38 (5.40)	23.94 (4.45)
Never worked in paid employment	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.2%)	166 (33.1%)	7 (2.1%)	20 (4.6%)
Ever jobless (6+ months)	1,684 (91.5%)	717 (94.1%)	646 (94.6%)	1,972 (88.4%)	1,377 (90.6%)	1,470 (92.2%)	581 (95.2%)	326 (65.1%)	304 (91.8%)	372 (85.3%)
Ever economically inactive	1,460 (79.3%)	577 (75.7%)	388 (56.8%)	874 (39.2%)	643 (42.3%)	467 (29.3%)	610 (100.0%)	501 (100.0%)	187 (56.5%)	225 (51.6%)
Ever had non-agricultural work	1,616 (87.8%)	639 (83.9%)	634 (92.8%)	341 (15.3%)	299 (19.7%)	69 (4.3%)	383 (62.8%)	147 (29.3%)	137 (41.4%)	114 (26.1%)
Age at 1st job	17.64 (3.61)	17.70 (3.93)	15.57 (3.53)	15.17 (3.56)	15.58 (4.23)	14.60 (3.25)	16.95 (5.69)	18.89 (10.45)	15.84 (4.36)	15.68 (4.98)
Years at inactivity	3.87 (3.86)	3.63 (3.74)	2.27 (3.15)	1.36 (2.60)	2.00 (3.95)	0.74 (1.53)	14.99 (6.02)	30.24 (5.02)	4.66 (8.02)	5.02 (9.24)
Years at agriculture	3.25 (4.77)	3.20 (4.51)	20.66 (5.45)	32.77 (3.76)	31.56 (5.00)	34.11 (1.69)	13.48 (9.93)	3.03 (4.15)	21.52 (14.15)	26.09 (12.30)

Variables	Non-agriculture, lower fertility	Non-agriculture, higher fertility	Left agriculture	Agriculture, lower fertility	Agriculture, higher fertility	Agriculture, early higher fertility	Middle adulthood inactivity	Long-term economic inactivity	Child-lessness	Non-marital parenthood
Years at non-agriculture	27.88	28.17	12.07	0.87	1.44	0.14	6.53	1.73	8.82	3.89
	(5.30)	(4.81)	(5.07)	(2.47)	(3.12)	(0.70)	(6.94)	(3.20)	(12.31)	(8.27)
1st Hukou was urban	663	145	22	19	19	16	69	36	31	20
	(36.0%)	(19.0%)	(3.2%)	(0.9%)	(1.3%)	(1.0%)	(11.3%)	(7.2%)	(9.4%)	(4.6%)
Education attainment										
None	46	45	73	483	389	608	81	129	72	157
	(2.5%)	(5.9%)	(10.7%)	(21.6%)	(25.6%)	(38.1%)	(13.3%)	(25.7%)	(21.8%)	(36.0%)
Some	385	234	268	1,033	742	745	262	215	147	184
	(20.9%)	(30.7%)	(39.2%)	(46.3%)	(48.8%)	(46.7%)	(43.0%)	(42.9%)	(44.4%)	(42.2%)
Middle school or higher	1,409	483	342	716	389	242	267	157	112	95
	(76.6%)	(63.4%)	(50.1%)	(32.1%)	(25.6%)	(15.2%)	(43.8%)	(31.3%)	(33.8%)	(21.8%)
In a safer neighbourhood before age 17	1,732	710	638	2,070	1,381	1,441	557	460	296	397
	(94.1%)	(93.2%)	(93.4%)	(92.7%)	(90.9%)	(90.3%)	(91.3%)	(91.8%)	(89.4%)	(91.1%)
In a richer family before age 17	1,257	514	440	1,285	878	898	377	323	184	269
	(68.3%)	(67.5%)	(64.4%)	(57.6%)	(57.8%)	(56.3%)	(61.8%)	(64.5%)	(55.6%)	(61.7%)
Mother was literate	410	67	72	204	93	73	67	59	32	21
	(22.3%)	(8.8%)	(10.5%)	(9.1%)	(6.1%)	(4.6%)	(11.0%)	(11.8%)	(9.7%)	(4.8%)
Father was literate	1,006	342	304	882	529	478	272	184	124	128
	(54.7%)	(44.9%)	(44.5%)	(39.5%)	(34.8%)	(30.0%)	(44.6%)	(36.7%)	(37.5%)	(29.4%)
Healthier than peers before age 15	729	315	269	777	535	561	234	188	98	152
	(39.6%)	(41.3%)	(39.4%)	(34.8%)	(35.2%)	(35.2%)	(38.4%)	(37.5%)	(29.6%)	(34.9%)
Observations	1,840	762	683	2,232	1,520	1,595	610	501	331	436

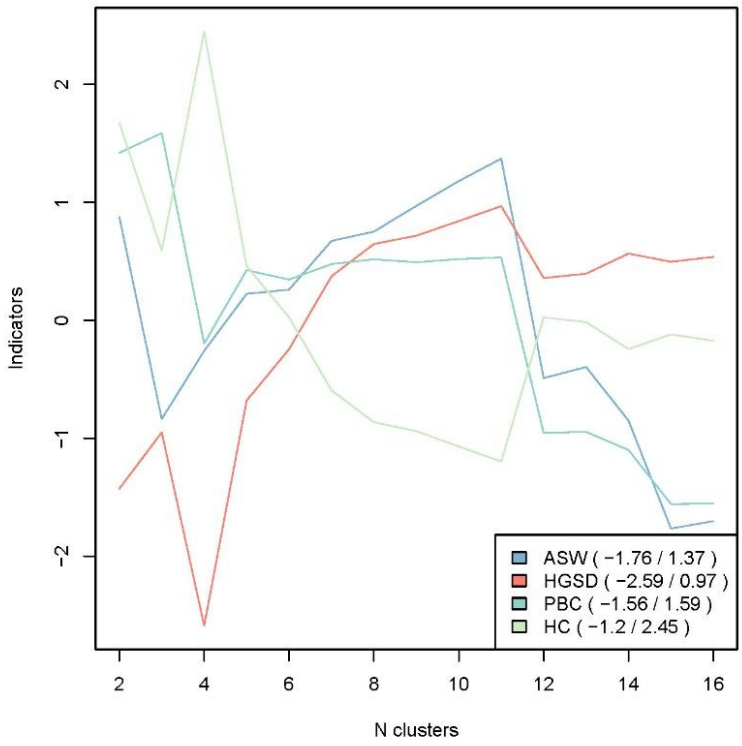
Notes: (1) Source: authors' calculations based on unweighted data from CHARLS 2014–2015. (2) Frequencies (percentages) or means (standard errors) are shown.

Table A 2-7 Regression models of health outcomes in older ages

Variables	Chronic Disease Number (Poisson model)	Depression Scores (OLS model)
	Incidence Rate Ratio [95% confidence intervals]	Beta [95% confidence intervals]
(Intercept)	0.49 [0.41, 0.58]	9.3 [8.0, 11]
Age in 2015 (min 51; max 80)	1.02 [1.02, 1.02]	0.00 [-0.01, 0.02]
Gender		
Men	—	—
Women	1.13 [1.04, 1.23]	0.85 [0.25, 1.4]
1st Hukou was urban (ref.: rural)	1.04 [0.98, 1.10]	-0.11 [-0.57, 0.34]
Education attainment		
None	—	—
Some	1.09 [1.05, 1.14]	-0.33 [-0.68, 0.01]
Middle school or higher	1.03 [0.98, 1.08]	-1.2 [-1.6, -0.84]
In a safer neighbourhood before age 17 (ref.: no)	0.96 [0.91, 1.02]	-1.7 [-2.1, -1.3]
In a richer family before age 17 (ref.: no)	0.89 [0.86, 0.92]	-1.2 [-1.4, -0.94]
Mother was literate (ref.: illiterate)	0.97 [0.91, 1.02]	-0.20 [-0.62, 0.22]
Father was literate (ref.: illiterate)	0.99 [0.96, 1.02]	-0.13 [-0.38, 0.13]
Healthier than peers before age 15 (ref.: no)	0.91 [0.88, 0.94]	-0.97 [-1.2, -0.72]
Work-family trajectories		
Non-agriculture, lower fertility	—	—
Non-agriculture, higher fertility	1.07 [0.99, 1.17]	-0.44 [-1.1, 0.19]
Left agriculture	0.95 [0.86, 1.04]	0.47 [-0.21, 1.1]
Agriculture, lower fertility	1.00 [0.93, 1.08]	0.87 [0.33, 1.4]
Agriculture, higher fertility	1.00 [0.93, 1.09]	1.9 [1.4, 2.5]
Agriculture, early higher fertility	1.01 [0.92, 1.11]	1.8 [1.1, 2.5]
Middle adulthood inactivity	1.13 [1.01, 1.27]	1.2 [0.42, 2.1]
Long-term economic inactivity	0.95 [0.81, 1.10]	0.81 [-0.25, 1.9]
Childless	0.87 [0.77, 0.99]	1.8 [0.92, 2.7]
Non-marital parenthood	1.15 [1.01, 1.29]	2.7 [1.8, 3.6]
Gender * Work-family trajectories		
Women * Non-agriculture, higher fertility	1.06 [0.92, 1.23]	0.41 [-0.77, 1.6]
Women * Left agriculture	0.90 [0.76, 1.06]	0.23 [-0.91, 1.4]
Women * Agriculture, lower fertility	1.01 [0.90, 1.12]	1.2 [0.40, 2.0]
Women * Agriculture, higher fertility	0.99 [0.88, 1.11]	0.79 [-0.08, 1.7]
Women * Agriculture, early higher fertility	1.15 [1.02, 1.30]	1.4 [0.46, 2.3]
Women * Middle adulthood inactivity	1.06 [0.91, 1.23]	0.65 [-0.51, 1.8]
Women * Long-term economic inactivity	1.15 [0.96, 1.38]	1.6 [0.23, 2.9]
Women * Childlessness	0.86 [0.68, 1.07]	0.32 [-1.2, 1.9]
Women * Non-marital parenthood	0.90 [0.76, 1.07]	-0.07 [-1.4, 1.2]
Observations	10,510	10,510

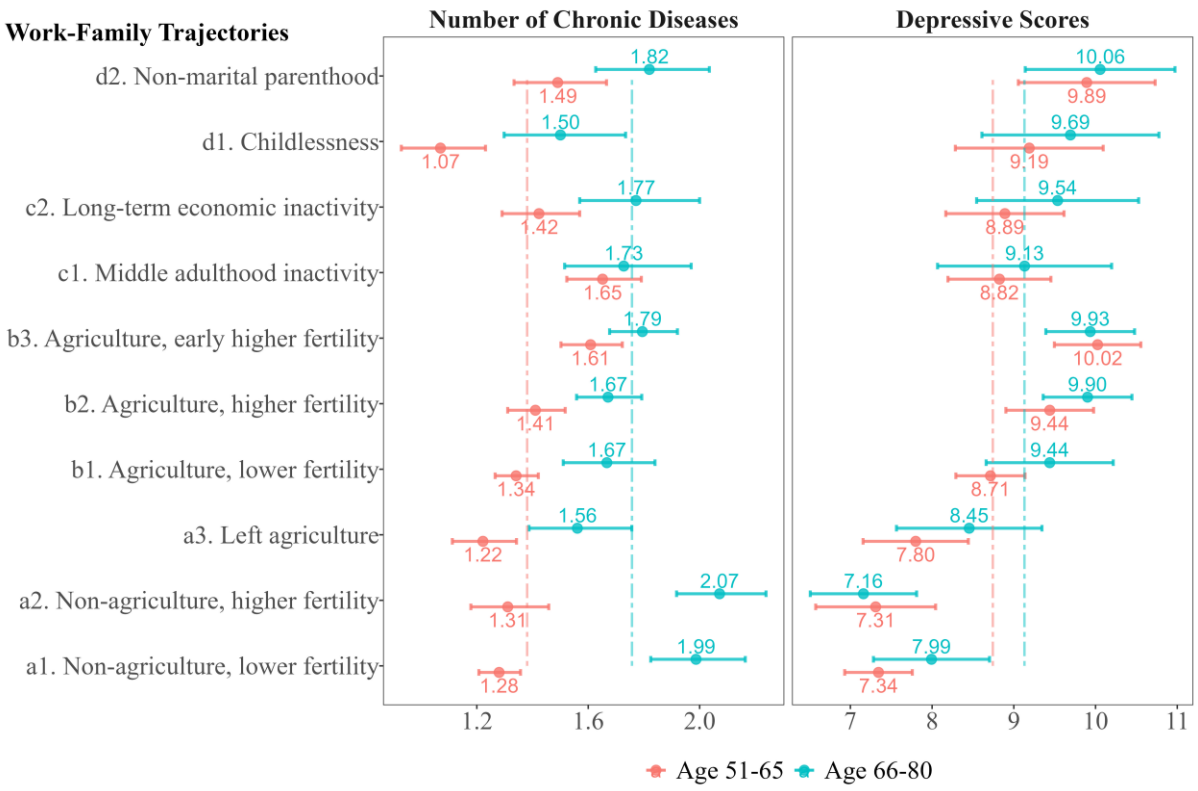
Notes: (1) Source: authors' calculations based on unweighted data from CHARLS 2014–2015. (2) The number of chronic diseases ranges from 0 to 12 and depressive scores from 0 to 30.

Figure A 2-1 Cluster cut-off criteria for hierarchical clustering



Notes: (1) “ASW”, “HGSD”, “PBC”, and “HC” are respectively abbreviations of “Average Silhouette Width”, “Hubert’s Somers’ D”, “Point Biserial Correlation”, and “Hubert’s C”. (2) All the score values are standardized. (3) All measures indicate a higher clustering quality when the score is higher, except the HC which functions contrarily.

Figure A 2-2 Predicted margins of health outcomes across work-family trajectory pathways by respondents' age groups at survey time



Notes: (1) Source: authors' calculations based on unweighted data from CHARLS (2014, 2015; N = 10,510). (2) Whiskers indicate 95% confidence intervals. (3) Dashed lines are margin means across clusters by gender. (4) Estimated health levels across trajectory pathways are net of individuals' background characteristics. (5) The number of chronic diseases ranges from 0 to 12 and depressive scores from 0 to 30.

Chapter 3 Grandchild Caregiving and Social Participation in China

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A previous version of this study was presented at the *European Population Conference 2024* (13 June, Edinburgh, Scotland).

Abstract

As people move into old age, social life becomes more centered around family-based activities. However, it is still unclear whether and how the increased focus on family-based interactions affects non-family-based social engagement. This study explores this question in China by examining whether grandchild caregiving influences non-family-based social participation among older adults, and how these relationships differ by gender and between urban and rural settings. Using data from the China Health and Retirement Longitudinal Study (2011-2018), we deployed fixed-effects models to analyze the frequency of participation in social activities associated with individual' shifts in the nature and intensity of grandchild caregiving. The results suggest that caring for grandchildren generally has a positive effect on social participation, particularly when grandparents are the primary caregivers. This aligns with the spillover hypothesis, indicating that caregiving duties can increase opportunities for social interaction in various contexts. However, the magnitude of this effect is influenced by urbanicity and gender, with urban women experiencing the strongest spillover benefits. Overall, our study indicates that grandchild caregiving might not necessarily hinder the social lives of Chinese grandparents. It also underscores the need to consider gender and rural/urban differences when developing policies to promote social participation among older adults.

Key words

Grandchild care; social participation; gender; rural/urban inequalities

3.1 Introduction

A common trend in contemporary societies is the increasing "social disengagement" of ageing populations. This signals that a growing share of people exhibit reduced participation in productive and social activities as they age, often connected to declines in physical health and a higher reliance on their families (Carr & Moorman, 2011; Pinto & Neri, 2017b). Such disengagement may undermine the quality of life for older adults, as studies have shown that active social involvement correlates with better mental health and overall wellbeing (M. Gao et al., 2018; Sun & Lyu, 2020).

Despite policies encouraging them to engage in social activities, Chinese older adults exhibit low levels of social participation beyond familial interactions while continuing to play a central role in family support, notably through grandchild caregiving (W. Lin, 2017; H. Wang & Chen, 2022; Xiong & Wiśniowski, 2018). There is also a noticeable trend towards increasingly sedentary lifestyles among them (Q. Feng et al., 2020; Fong et al., 2022). While the reliance on grandparents for childcare among Chinese families might influence older adults' social lives, and while older adults' lives are largely centered around the family (M. Gao et al., 2018; Gold et al., 2002), existing research has not yet clarified whether the nature and intensity of caregiving ultimately undermine broader social participation. On the one hand, grandchild caregiving may enhance social integration and increase participation in social activities through diverse social roles (*spillover hypothesis*). On the other hand, it could restrict social engagement due to constraints on time, energy, and socioeconomic resources, particularly in instances of intensive care (*competition hypothesis*). Against this backdrop, our study aims to answer the following research question: *How does grandchild caregiving affect social participation among older Chinese adults?* (**RQ1**)

As in virtually all national contexts, Chinese women shoulder more grandchild caregiving responsibilities than men, which may lead to less time and energy for grandmothers to engage in social activities than grandfathers. The poor infrastructures for social, economic and cultural activities in rural areas may impede older adults' opportunities for social participation, despite the potential for an extending social network through grandchild caregiving. Indeed, studies have found that urban older adults generally engage in social activities more frequently than those in rural areas (Z. Feng et al., 2020; W. Lin, 2017). Since family and social lives are importantly stratified by gender and spatial context, we additionally address the following

research question: *How does the role of grandchild caregiving in non-family-based social participation intersect with gender and urban/rural residence?* (**RQ2**)

We empirically address these questions analyzing a sample of 12,007 grandparents aged 50–80 from the China Health and Retirement Longitudinal Study (CHARLS, 2011–2018). We deploy fixed-effects models to establish the frequency of participation in six social activities in relation to shifts in grandchild caregiving, and how these associations vary by gender and across rural and urban areas.

Social engagement or participation typically refers to individuals' engagement in various activities that involve interaction with others within their social environment (Levasseur et al., 2022). It is often seen as a multidimensional construct that includes both formal and informal activities, such as volunteering, caregiving, attending social events, participating in group activities, and maintaining social relationships. Our study contributes to this field in line with life course and aging research by deepening the understanding of interactions between family-based participation (i.e., caregiving activities within the family) and non-family-based participation (i.e., social interactions outside the family) among older adults. First, we acknowledge that caregiving and non-family social participation (from now on just "social participation") are both crucial components of social engagement for older adults, and are interrelated in ways that can either compete with or complement each other (Arpino & Bordone, 2018; Kohli et al., 2009; WHO, 2002). Second, we assess participation frequency—rather than merely whether individuals participate—as our outcome variable, as this provides a more nuanced understanding of social engagement patterns and how these change with life circumstances. Additionally, the frequency of social engagement displays stronger links to individual wellbeing such as health or life satisfaction. Third, we consider gender and urban/rural differences, acknowledging the relevant heterogeneity in the study associations. Lastly, we address these associations in an unexplored context where older adults' social engagement is predominantly kinship- and informally- oriented (M. Gao et al., 2018; Gold et al., 2002), providing insights relevant to China's social and policy practices to promote social participation among older adults.

3.2 Conceptual framework & hypotheses

3.2.1 Grandchild caregiving and social participation: spillover vs. competition effects

The investigation of the relationship between grandchild care and social participation is situated within the broader literature examining the interrelation of various forms of social connectedness among the older population (Kohli et al., 2009). This line of inquiry stems from discussions surrounding how older adults strategically maintain social engagement in the face of declining physical abilities, limited energy, and diminishing social contacts as they age (Pinto & Neri, 2017b).

Guided by the life course perspective—which conceptualizes aging and human development as a cumulative process influenced by age-graded norms and events—we focus on the principle of *linked lives* (Dannefer, 2003; Elder et al., 2003). This principle highlights the interdependence among family members and its influence on older adults' wellbeing. This perspective allows us to situate grandchild caregiving within the broader context of intergenerational dependencies that shape individual family trajectories and opportunities for social engagement. The caregiving role assumed by older adults is neither an isolated choice nor a singular burden; rather, it emerges through ongoing interdependencies with adult children and grandchildren (Silverstein et al., 2002).

Two key hypotheses arise in the life course and aging literature underscoring opposed associations between grandchildren caregiving and social participation, and how these relate to the nature and intensity of caregiving.

The *spillover hypothesis* posits that grandchild caregiving positively influences social participation, enhancing opportunities and motivations for social engagement. Caregivers benefit from expanded social roles and resources, leading to the development of larger social networks and connections beyond their immediate family circle, which prove valuable for engaging in both formal and informal social activities (Aalto et al., 2023; Burr et al., 2005; Kohli et al., 2009; Lancee & Radl, 2014; Quirke et al., 2019). Particularly, caregivers of young children facing health challenges exhibit a heightened likelihood of connecting with other caregivers, care recipients, and organizations through interactions related to childcare and school, thereby expanding their social circles (Gage, 2013; McCabe, 2008). This increased social network creates more opportunities for involvement in social activities (Dury et al.,

2020). Moreover, older adults providing grandchild care receive more economic support from their adult children, augmenting their economic capital for social participation (Hong et al., 2023; S. Tang et al., 2022). The enrichment of social roles resulting from grandchild caregiving aligns with the general motivation for active social participation (Hank & Stuck, 2008). Caregivers report feeling younger, experiencing reduced loneliness, better overall health, and greater satisfaction with their aging process compared to non-caregivers, which serves as a motivating factor for their active engagement in social activities (Aalto et al., 2023; Bordone & Arpino, 2016; F. Chen & Liu, 2012; Lakomý, 2020; Quirke et al., 2019; R. Yang et al., 2020; Ye et al., 2020).

Empirical findings demonstrate spillover effects among informal care providers, with increased engagement observed in volunteering activities and various forms of social interaction (Burr et al., 2005; Glaser et al., 2006; Hank & Stuck, 2008). Similar results have been reported when focusing on older adults providing grandchild care, who are more inclined to participate in volunteer activities and pursue leisure activities (Arpino & Bordone, 2018; Ates et al., 2022; Bulanda & Jendrek, 2016).

Conversely, the *competition hypothesis* contends that grandchild care might hinder social participation by placing strain on social roles (Goode, 1960). This strain manifests in limitations on personal time, energy, and socioeconomic resources, especially in cases of intensive care (Arpino & Bordone, 2018). Intensive grandchild care, particularly custodial care, necessitates significant lifestyle adjustments, potentially reducing social contact with friends (Jendrek, 1993). Moreover, intensive caregiving may also limit opportunities for paid work, leading to financial difficulties, especially in the absence of sufficient economic support from adult children (Di Gessa & Grundy, 2017; Silverstein & Zuo, 2021). Caregivers dealing with intensive care responsibilities often report high levels of burden and obligation, coupled with poorer health status, which could diminish their motivation and energy for social participation outside the family (F. Chen & Liu, 2012; Grünwald et al., 2024).

Empirical findings substantiate competition effects, particularly in situations of intensive caregiving. For instance, intensive spousal caregiving was found to be associated with reduced volunteering activities among women in the U.S. (Choi et al., 2007), while grandparents providing intensive care were found to be less socially active in several European countries (Arpino & Bordone, 2017, 2018).

Research exploring the nexus between grandchild care and social participation remains limited to Global North contexts such as the U.S. (Bulanda & Jendrek, 2016) and Europe (Arpino & Bordone, 2017, 2018; Ates et al., 2022). This leaves a noticeable gap in research within the context of the Global South, particularly in regions experiencing rapid population ageing, as observed in countries like China. Two studies focusing on Chinese older adults found that social participation mediated the relationship between grandchild care and depressive symptoms (X. Yang & Yin, 2022) and between grandchild care and cognitive scores (Hou et al., 2023). However, these studies provided neither theoretical perspectives nor empirical assessments on the relationships between grandchild care and social participation. Nevertheless, evidence among Chinese older adults indicates that those engaged in grandchild caregiving generally report better physical and mental health, higher life satisfaction, and lower feelings of loneliness (F. Chen & Liu, 2012; Luo et al., 2019; H. Xu, 2019; J. Zhang et al., 2022). However, intensive grandchild care, particularly custodial care, has been linked to declines in physical and mental health (F. Chen & Liu, 2012; Silverstein & Zuo, 2021).

We address all these considerations, and empirically tests the hypotheses associated with spillover and competition effects in the Chinese context, expecting that *non-intensive grandchild caregiving increases social participation among older adults* (**H1a**), while *intensive grandchild caregiving decreases social participation among older adults* (**H1b**). We consider the intensity of grandchild caregiving in terms of involved time and responsibilities, which is related to living arrangements. Grandparents taking care of the coresidential grandchildren without the presence of parents are the custodians of the grandchildren and bear abundant caregiving responsibilities (Silverstein & Zuo, 2021), whereas such responsibilities are mostly shouldered by the children's parents when the three generations live in the same household.

3.2.2 Gender differences

Grandmothers often assume the primary caregiver role for grandchildren, engaging in a wide range of caregiving tasks more frequently than grandfathers (Hasmanová Marhánková & Štípková, 2015). The caregiving responsibilities also vary by gender, with grandmothers engaging in cooking, feeding, cleaning, and caring for sick grandchildren, while grandfathers tending to participate in recreational activities with their grandchildren (Di Gessa et al., 2020; Horsfall & Dempsey, 2015). This gendered division of grandparenting roles can strain grandmothers, increasing their likelihood of leaving the labor market and experiencing dissatisfaction with leisure time (Horsfall & Dempsey, 2015; Y. Lee & Tang, 2015).

The impact of gendered grandparenting roles extends to social participation, as evidenced by studies on European grandparents. Regular involvement in grandchild caregiving among grandmothers is linked to a decrease in social activities such as volunteering, training, and political/organizational participation, unlike grandfathers who benefit more (Arpino & Bordone, 2017). A study on German grandparents finds that grandmothers reported lower satisfaction with social activities when engaged in intensive grandchild caregiving, a phenomenon not observed among grandfathers (Ates et al., 2022).

While research specifically addressing the caregiving activities of Chinese grandfathers and grandmothers is lacking, gendered roles persist. Both grandfathers and grandmothers respond to familial needs, yet grandmothers often assume a caregiving role driven by demand (F. Chen et al., 2011; J. Feng & Zhang, 2018). Such a gendered pattern may have implications for grandmothers' participation in the labor market, given that their contributions to the family are often undervalued and economically disregarded (Y. Wang & Zhang, 2018). The strain on grandmothers may be exacerbated by gender-based pension disparities, with older women typically receiving half the pension of older men (R. Zhao & Zhao, 2018). Regarding the protective effects of grandchild caregiving on grandparents' wellbeing, studies show that grandfathers tend to experience greater benefits than grandmothers in terms of reduced risks of cognitive decline, lower probabilities of depression and hypertension, and greater life satisfaction (Luo et al., 2019; H. Xu, 2019).

In accordance with these considerations, we hypothesize that grandmothers experience more role strain in caregiving compared to grandfathers, leading to *greater spillover effects on social participation for grandfathers* (**H2a**) and *greater competition effects for grandmothers* (**H2b**).

3.2.3 Rural/urban differences

Rural and urban differentials in social participation among older adults are multifaceted. In rural settings, a strong sense of trust and community familiarity fosters tight-knit neighborly ties, motivating older residents to engage in community activities. This has been observed in some rural areas of developed countries like Norway and Canada, but not in sparsely populated regions in countries like the US, Canada, and Australia (Carver et al., 2018). Conversely, rural areas in developing countries contend with limited socioeconomic resources, resulting in poor economic, social and cultural facilities, and thus restricted access to social participation opportunities for older adults, as seen in contexts like China and Sri Lanka (Carver et al., 2018).

Along these lines, research has also shown that Chinese urban older adults exhibit a higher participation rate (52.5%) in entertainment activities compared to their rural counterparts (42.8%) (W. Lin, 2017).

Despite these rural/urban dynamics, extant research has yet to explore potential variations in the relationship between grandchild caregiving and social participation across these settings. In the Chinese context, rural social participation tends to be more homogenous, primarily involving informal interactions with relatives and neighbors, whereas urban areas offer a more diverse array of formal activities owing to stronger economic and social support systems (Z. Feng et al., 2020; W. Lin, 2017; Sun & Lyu, 2020). Additionally, with rural-urban socioeconomic inequalities, rural grandparents exhibit greater economic vulnerability, and are more likely to view grandchild caregiving as reciprocal strategy for eldercare as they often rely on support from adult children (Silverstein & Zuo, 2021). Conversely, urban grandparents derive more health benefits from grandchild caregiving, including higher self-rated health, life satisfaction, and lower risks of depression, hypertension, and diabetes (F. Chen & Liu, 2012; H. Xu, 2019).

Consequently, we expect that *spillover effects of grandchild caregiving on social participation are more pronounced among urban grandparents* (**H3a**), while *competition effects are accentuated among rural grandparents* (**H3b**).

3.3 Methodology

3.3.1 Data & sample

This study utilizes longitudinal data from the *China Health and Retirement Longitudinal Study* (CHARLS). CHARLS surveys a nationally representative sample of individuals aged 45 years and older and their spouses, drawn from 450 neighborhoods across China. The baseline survey wave (2011) contains 17,708 individuals, who are subsequently followed up every two or three years, with new respondents being recruited at each wave (Y. Zhao et al., 2014).

To test our research hypotheses, we used data from four waves of the CHARLS (2011, 2013, 2015, 2018). In each household, both the main respondent and their spouse (if applicable) were interviewed, but only the main respondent provided detailed information on some aspects related to other family members and family transfers, including the nature and intensity (i.e.

time devoted to) of grandchild caregiving separately for themselves and for their spouse. We assumed that the information provided by the main respondent on the existence of and coresidence with grandchildren was also applicable to his or her spouse. Such an approach may cause bias for a few couples who do not share the exact same grandchildren due to remarriages. However, this bias is minimal, as remarriage rate among the older population in CHARLS data is less than 0.1% (X. Li et al., 2023). As a robustness check, we also excluded partners of main respondents from our analyses, and this did not affect the conclusions of our study (see results in **Figure A 3-1**, Appendix).

The original sample comprised 25,588 individuals from main respondents or their spouses across all four waves, yielding a total of 102,352 individual-wave observations. Initially, 28,715 individual-wave observations were excluded due to individuals being either younger than 50 or older than 80 years. Subsequently, 26,085 observations were excluded for lacking grandchildren under 16 years of age, and 888 observations were excluded from respondents residing in nursing homes, hospitals or other institutional housing. Further exclusions involved 6,731 observations with missing values on key model variables and 4,636 observations from individuals participating in less than two waves, as our modelling strategy requires repeated observations per individual. Sample attrition appears unrelated to our key study variables (see **Table A 3-1**, Appendix, for a comparison of samples). The analytical sample comprises 12,007 individuals (35,297 individual-wave observations), consisting of 3,723 rural men (11,274, observations), 3,890 rural women (11,487 observations), 2,087 urban men (5,979 observations), and 2,307 urban women (6,557 observations).

3.3.2 Variables

Social participation

We measured social participation using the frequency of engagement in non-family-based on-site social activities. As commented before, participation frequency provides a more nuanced understanding of social engagement patterns and how these change with grandchild caregiving practices. CHARLS collected information on four levels of participation frequency (i.e. never, not regularly, weekly, or daily) in 11 social activities over the month before the interview. We selected six of the activities as they were not strictly family-based social activities. These included (1) “interacted with friends” (henceforth labelled as *meeting friends*); (2) “Played Ma-jong, chess, cards, or went to community club” (*card/board games*); (3) “Went to dance,

exercise or practice Qi Gong in the park or other places" (*physical activities*); (4) ("Took part in a community-related organization" (*community activities*); (5) "Done voluntary or charity work" (*volunteering*); (6) "Attended an educational or training course" (*taking courses*). Physical activities among older adults in China are considered social due to their group-oriented nature and the social interactions they facilitate (Guo et al., 2016; J. Yang & Qin, 2023).

Grandchild caregiving

Our primary independent variable, grandchild caregiving, encompasses both the intensity of care and residential arrangements. Within the CHARLS dataset, the main respondent of each household reported the number of weeks and hours of grandchild caregiving per week devoted to each child over the past year, separately for themselves and for their spouse (i.e., "Myself X weeks, XX hours per week; My spouse Y weeks, YY hours per week"). We computed the average weekly caregiving duration and weeks for each child, and then aggregated these two figures to determine the annual caregiving hours per grandparent. Residential arrangements were defined based on information about coresidence with grandchildren under 16 years of age, adult children (18 years or older) and their children-in-law. We considered caregiving over 2,080 hours per year as intensive care because it is over 40 hours weekly, which is the amount of legal labor hours per week in China.

Based on this information, we generated the variable grandchild caregiving that comprises five categories: (1) *not providing grandchild care*; (2) *non-coresidential non-intensive care* (≤ 2,080 hours/year, not residing with grandchildren); (3) *non-coresidential intensive care* (> 2,080 hours/year, not residing with grandchildren); (4) *multi-generational coresidential care* (> 0 hours/year, residing with both grandchildren and adult children/-in-law); and (5) *skipped-generational coresidential care* (> 0 hours/year, residing with grandchildren but not with adult children/-in-law).

Control variables

Among Chinese older adults, social participation tends to decline with age, a trend that appears minimally influenced by personal socio-economic status (SES) and health (Ye et al., 2020). Regression models incorporate a control framework encompassing various demographic and SES variables to mitigate confounding effects on the relationship between grandchild caregiving and social participation. Our control variable set includes age, marital status, the count of grandchildren under age 16, employment status (i.e., employed (> 2,800 hours/year),

employed (≤ 2,080 hours/year) or non-employed), and health indicators relating to depression, disability, chronic disease and functional limitations. Detailed definitions and descriptive statistics for all variables by gender and rural/urban residence are presented in **Table A 3-2** (Appendix).

3.3.3 Analytic approach

We employed linear fixed-effects regression models for panel data to gauge the impact of grandchild caregiving on the likelihood of social activity participation. Fixed effects regression models, also known as within-group regression models, utilize panel data to analyze how deviations from an individual's typical characteristic relate to deviations from their typical outcomes (Allison, 2009). In our study, the model quantifies the average within-person variations in an individual's probability of engaging in social activities when providing different types of grandchild caregiving, compared to not providing such care. This approach involves estimating a standard regression model using time-demeaned explanatory and outcome variables. By doing so, it effectively controls for all time-invariant unobserved and unobservable factors that might be correlated with the explanatory and outcome variables, thereby minimizing omitted variable bias.

We fit different sets of models, which all contain grandchild caregiving and the above-mentioned control variables. To assess the extent to which individuals engage in social participation overall, the first model predicts whether older adults participate weekly or daily in at least one of six social activities. To assess patterns of participation across types of social activities, a second set of models predicts weekly or daily participation in specific activities, such as meeting friends, playing card/board games, and engaging in physical activities. Results from models predicting community activities, volunteering, and taking courses are not reported in the results sections due to very low participation rates (below 2% for ever participating in the last month, and less than 1% for weekly or daily participation); however these can be consulted in **Figure A 3-2** (Appendix). To assess heterogeneity in the study association by gender and urbanicity, we replicated the previous sets of models in four subsamples: rural men, rural women, urban men, and urban women.

Models were performed using RStudio software (R version 4.2.2) with the "PLM" package (Croissant & Millo, 2018).

3.4 Results

3.4.1 Descriptive analysis

Table 3-1 outlines the descriptive information on grandchild caregiving and social participation in the sample categorized by gender and rural/urban residence. Approximately 46% of the population engages in grandchild caregiving, primarily providing "non-intensive" care, including non-coresidential non-intensive care and multi-generational coresidential care. Women exhibit an 8% higher involvement in grandchild caregiving compared to men, aligning with known gender differences in caregiving. Similarly, urban grandparents' participation in grandchild care surpasses that of their rural counterparts by 8%. Specifically, urban grandparents are more likely to be involved in non-coresidential care (about 7% more) and multi-generational coresidential care (2–3% more) while being less inclined towards skipped-generational coresidential care (1–2% less) than their urban counterparts.

Table 3-1 Percentages of grandchild caregiving and social participation

Variables	Overall sample	Rural men	Rural women	Urban men	Urban women
Grandchild care provision					
Not providing grandchild care	54.0%	60.5%	53.3%	52.9%	45.2%
Non-coresidential non-intensive care	16.0%	13.9%	14.7%	18.5%	19.6%
Non-coresidential intensive care	9.0%	6.8%	9.7%	8.8%	11.7%
Multi-generational coresidential care	12.8%	10.6%	13.1%	13.0%	16.2%
Skipped-generational coresidential care	8.1%	8.2%	9.2%	6.8%	7.3%
Frequency of at least 1 (in 6) social activity					
Never	52.1%	55.2%	55.1%	45.8%	47.0%
Not regularly	14.0%	15.6%	12.3%	15.3%	13.1%
weekly	10.7%	11.5%	9.2%	12.6%	10.1%
Daily	23.3%	17.8%	23.4%	26.3%	29.9%
Individual-wave observations	35,297	11,274	11,487	5,979	6,557
Individuals	12,007	3,723	3,890	2,087	2,307

Note: authors' calculations based on unweighted data from CHARLS 2011–2018.

Overall, nearly half (48%) of grandparents participate in at least one social activity, with half engaging daily. The most prevalent activities include meeting friends, playing card/board games, and engaging in physical activities, with participation rates of 36%, 20%, and 7%, respectively. Conversely, fewer grandparents (less than 2%) participate in community activities, volunteering, and taking courses (refer to **Table A 3-2**, Appendix, for details on specific social

activities). Urban grandparents exhibit a 9% higher participation rate in at least one activity, primarily due to elevated daily participation rates in card/board games and physical activities. Gender differences are minor, with men generally having higher participation rates, except in daily participation rates where women have a 4–6% higher frequency, primarily driven by frequent meetings with friends and engaging in physical activities.

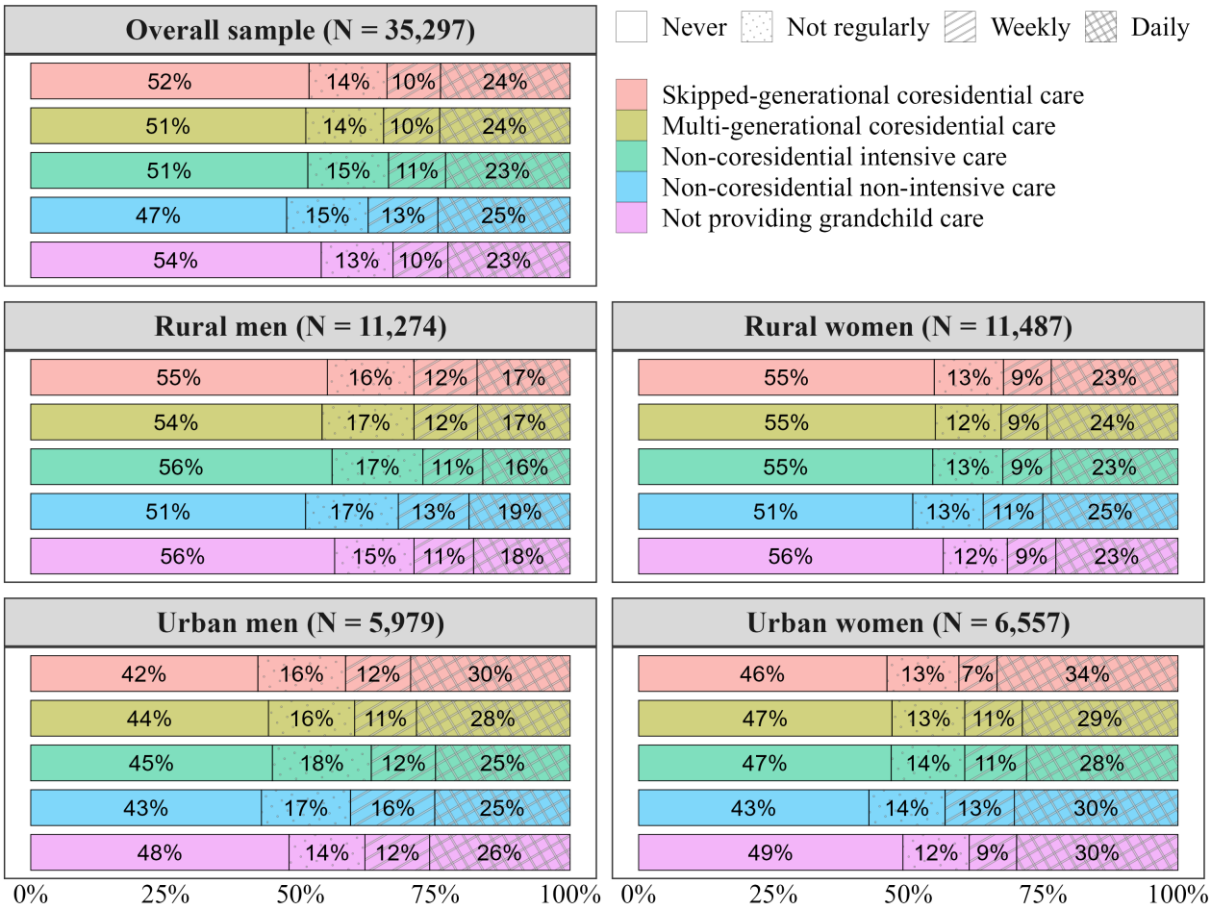


Figure 3-1 Frequency of participation in at least 1 (in 6) social activity by grandchild care types

Notes: (1) Source: authors' calculations based on unweighted data from CHARLS 2011–2018. (2) N is the number of individual-wave observations.

Figure 3-1 displays percentages of social participation by frequency across different types of grandchild caregiving. Social participation differences by grandchild caregiving status are minor for the overall sample. Those offering non-coresidential non-intensive care have the highest participation rate (53%), while those not providing care have the lowest (46%). Similar patterns can be observed for frequent (daily or weekly) participation in at least one social activity across four subgroups: rural men, rural women, urban men, and urban women. In all

subgroups except urban men, grandparents providing non-coresidential non-intensive care display slightly higher rates of frequent participation. Among rural and urban men, those providing non-coresidential intensive grandchild care exhibit the lowest rates of frequent social participation. No group stands out among women in terms of the lowest rate of frequent participation.

3.4.2 The effects of grandchild caregiving on social participation

Figure 3-2 shows the estimates from fixed effects models of grandchild caregiving on individuals' frequent social participation for the entire sets of models proposed in the analytical strategy section (for coefficients of other model variables, see **Table A 3-3**, **Table A 3-4** and **Table A 3-5**, Appendices). This includes models predicting whether older adults participate frequently in at least one of six social activities as well as models predicting frequent participation in the three more common social activities. Additionally, models were estimated for the overall sample as well as for four subsamples. We note that our model outcome—frequent social participation—is based on our original social participation variable, coding "daily" and "weekly" as 1 (labeled "frequently") and "nor regularly" and "never" as 0 (labeled "not or rarely").

In the overall sample, providing non-coresidential non-intensive care and skipped-generational coresidential care increases the probability of frequent participation in at least one social activity by 2.7% ($p < 0.01$) and 4.5% ($p < 0.001$), respectively (reference: not providing care). The coefficient for non-coresidential intensive care and multi-generational coresidential care are smaller and not statistically significant. Regarding participation in common social activities, we find significant coefficients for skipped-generational coresidential care across all three social activities, with increased probabilities of frequently meeting friends, playing card/board games, and engaging in physical activities by 3.5% ($p < 0.01$), 1.6% ($p < 0.05$), and 1.2% ($p < 0.05$), respectively. Additionally, multi-generational coresidential care also increases the probability of frequently engaging in physical activity by 1% ($p < 0.05$). All other coefficients are small and non-statistically significant.

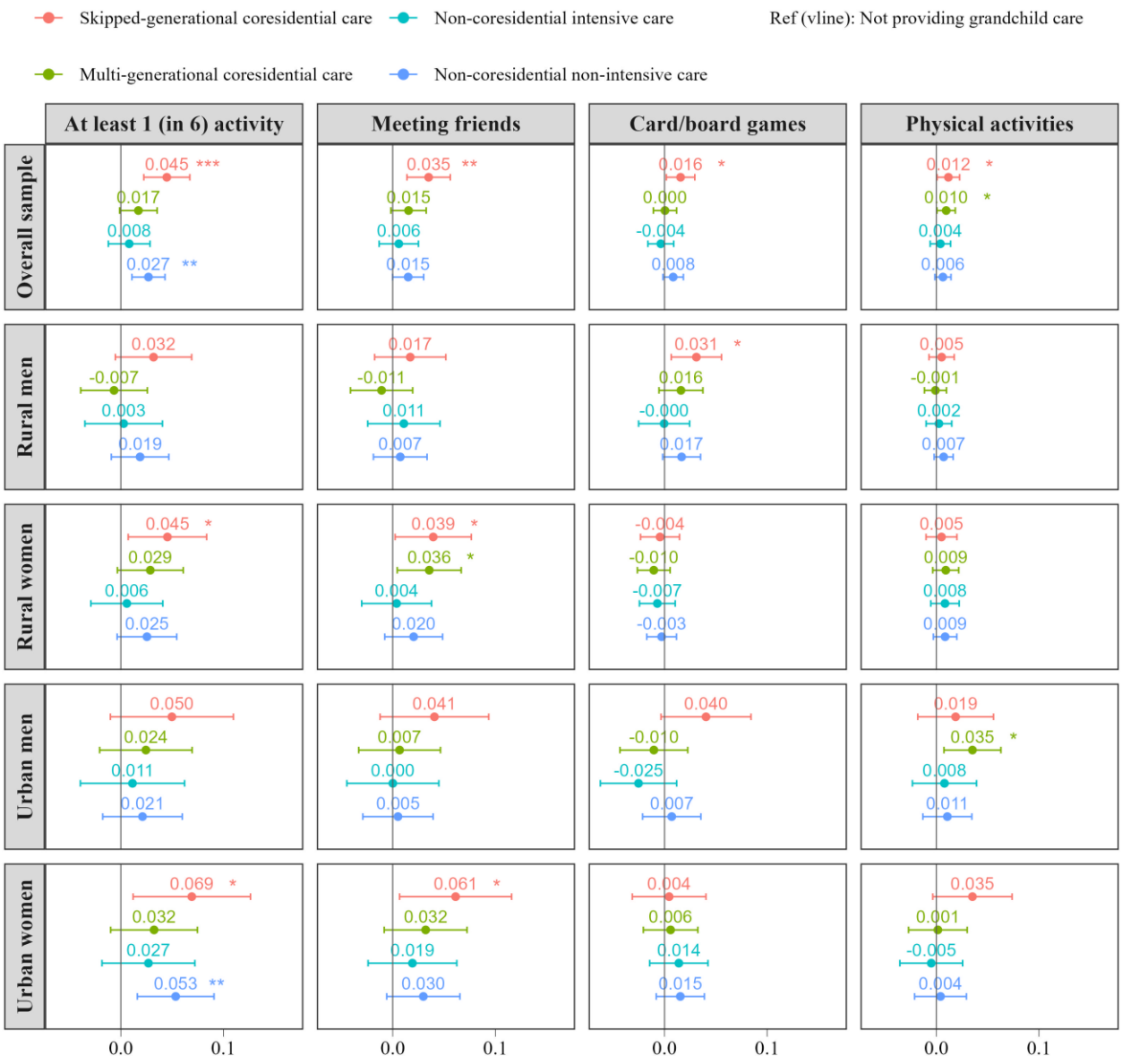


Figure 3-2 Estimates of grandchild care's effects on probability of frequent social participation

Notes: (1) Source: authors' calculations based on unweighted data from CHARLS 2011–2018. (2) Estimated values are the coefficients (betas) in linear fixed-effects regressions with control variables, presented in **Table A 3-3**, **Table A 3-4** and **Table A 3-5** (Appendices). (3) Whiskers indicate 95% confidence intervals. (4) * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Regarding heterogeneity across population groups, we find that the most substantial effects of caregiving on social participation are observed among women, particularly urban grandmothers. Non-coresidential non-intensive care and skipped-generational coresidential care significantly enhance the probability of frequent participation in at least one social activity by 5.3% ($p < 0.01$) and 6.9% ($p < 0.05$), respectively. Non-coresidential intensive care and

multi-generational coresidential care also elevate the probabilities by 2.7% and 3.2%, but these effects are not significant. For urban grandmothers, providing skipped-generational coresidential care also significantly increases the probability of meeting friends frequently by 6.1% ($p < 0.05$). For rural women, skipped-generational coresidential care significantly increases the probability of frequent participation in at least one social activity by 4.5% ($p < 0.05$). Non-coresidential non-intensive care and multi-generational coresidential care also enhance the probability by 2.5% and 2.9%, respectively, but these effects are not significant. Rural grandmothers engaging in multi-generational coresidential care and skipped-generational coresidential care, show increased probabilities of frequently meeting friends by 3.6% ($p < 0.05$) and 3.9% ($p < 0.05$), respectively

Coefficients for men are generally smaller, but there are some relevant associations. Among rural men, non-coresidential non-intensive care and skipped-generational coresidential care increase the probability of frequent participation in at least one social activity by 1.9% and 3.2%, respectively, but these effects are not significant. Rural grandfathers show a significant 3.1% ($p < 0.05$) increase in playing card/board games frequently with skipped-generational coresidential care. Among urban men, non-coresidential non-intensive care, multi-generational coresidential care, and skipped-generational coresidential care increase the probability of frequent participation in at least one activity by 2.1%, 2.4%, and 5.0%, respectively, but these effects are not significant. Urban grandfathers exhibit a significant 3.5% ($p < 0.05$) increase in doing physical activities frequently when providing multi-generational coresidential grandchild care.

3.5 Conclusion & discussion

The engagement of Chinese older adults in non-family social activities has declined over the past two decades, leading to increased sedentary and solitary lifestyles (Q. Feng et al., 2020; Fong et al., 2022). This study addresses a gap in previous research by investigating how grandchild caregiving interacts with social participation among Chinese grandparents, and how these associations intersect with gender and urban/rural divides.

The results underscore how social participation among Chinese older adults is influenced by the linked lives with their grandchildren (and with their adult children in the sense of helping them with childcare). Our findings show that grandchild caregiving, regardless of diverse

nature and intensity, is more likely to enhance rather than undermine social participation among Chinese grandparents. This supports the spillover hypotheses (H1a), which posits that grandchild caregiving offers opportunities for social participation. Contrary to our expectation, intensive grandchild caregiving—where grandparents dedicate extensive time or are main caregivers of grandchildren—does not significantly diminish social participation among Chinese older adults. This does not support our competition hypothesis (H1b) that suggests intensive grandchild caregiving squeezes out grandparents' time and energy for social participation. Instead, we also find a spillover effect for those engaging in intensive caregiving, which is most pronounced when grandparents are the custodians of their grandchildren (i.e. parents are absent in the same household). Overall, differences in the role of nature and intensity of grandchild caregiving in social participation are small.

This result contrasts with empirical findings from the US and Europe, where intensive caregiving within linked lives is typically associated with reduced social participation for older adults. This divergence may stem from the comparatively lower baseline rates of social participation among Chinese older adults (Xiong & Wiśniowski, 2018). Despite their limited engagement in both informal and formal social activities, there is potential for improvement, indicating that intensive grandchild caregiving can enrich the social lives of Chinese grandparents. Such enriching effects are more pronounced among custodial grandparents, suggesting that being a primary caregiver may directly or indirectly involve grandparents in the schooling and social activities of their grandchildren, which are usually the responsibilities of parents. This involvement has been shown particularly pronounced among more educated grandparents coresiding with their grandchildren (Zeng & Xie, 2014). This is not often found in the US and Europe, where grandparents are not commonly custodians or coreside with their grandchildren (Bulanda & Jendrek, 2016). In Western contexts, where older adults already exhibit higher levels of social participation, the demands of intensive grandchild caregiving often lead to a decline in social engagement (Arpino & Bordone, 2017; Ates et al., 2022; Bulanda & Jendrek, 2016).

In assessing the heterogeneity of the study associations across the rural/urban divide, we find that spillover effects are more pronounced among urban grandparents, as hypothesized (H3a). This result is consistent with prior research indicating that urban older adults derive greater wellbeing benefits from grandchild care compared to their rural counterparts, including increased physical and mental health and enhanced life satisfaction (F. Chen & Liu, 2012; H.

Xu, 2019). This phenomenon is tied to existing health disparities between rural and urban older adults in China, driven by SES inequalities (M. Li & Katikireddi, 2019; Song & Smith, 2019). Concurrently, SES disparities at both regional and individual levels also contribute to lower social participation among older adults residing in rural areas (W. Lin, 2017). Our findings also suggest, therefore, that the potential for promoting social participation and aging well is less promising in rural communities, especially concerning grandchild caregiving.

Additionally, we observe gender heterogeneity in the study associations at odds with our expectations. We expected that women's caregiver role would limit their social participation (H2a), but our findings do not support his hypothesis. Instead, we found that spillover effects are most pronounced among women, particularly urban women, generally exceeding those seen among men. Contrary to our expectation (H2b), men do not experience a significant increase in social participation from grandchild caregiving. This may be attributed to women's greater involvement in caregiving responsibilities, regardless of the similar amount of time spent on grandchild care (Di Gessa et al., 2020; Y. Wang & Zhang, 2018). Consequently, grandmothers may find more enrichment in their social lives due to increased involvement in grandchild care, leading to expanded social connections. Another contributing factor may be the lower rate of labor force participation among older urban women, affording them more flexibility to arrange social activities both within and outside the family.

It is important to note that our study only controlled for respondents engaging in intensive work, which may not fully capture the time availability of older adults. Under current policy, retirement age in China is 60 for men, 55 for white-collar women and 50 for blue-collar women (Starting 1st January 2025, they will gradually increase over 15 years to 63, 58 and 55, respectively). However, this policy does not apply to most rural older individuals, as their agricultural work does not qualify them for the occupational pension program. Therefore, many rural older adults continue working in agricultural sectors even after reaching 60 years old. In contrast, urban men typically exit the labor market around age 60, while urban women often cease working after reaching 55 (K. Feng, 2023; M. Xu et al., 2021). Nevertheless, the difference in labor market participation does not necessarily imply that urban women benefit more than urban men from leaving the labor market earlier. It should be emphasized that women face higher risks of financial insecurity and poverty in later life than men due to longer periods of family caregiving, shorter durations of paid work, and consequently, lower pension amounts (K. Feng, 2023; Y. Wang & Zhang, 2018).

Our findings suggest three policy implications for enhancing social participation among older adults in China. First, increasing support for community infrastructure may encourage older adults to participate in social activities beyond family settings. This includes developing child-care-friendly spaces, such as public childcare centers, where grandparents can enhance their social interactions by connecting with other caregivers. Second, economic support is needed to enhance social participation among older adults at risk of poverty who provide care for grandchildren or other family members, especially those who are custodians to their grandchildren (Silverstein & Zuo, 2021). It is also essential to address rural/urban economic inequalities to minimize social participation gaps faced by rural older adults. Lastly, when promoting participation in both family- and non-family-based social activities, policymakers should account for gender differences. These measures would be particularly effective for older women, whose contributions to family care are culturally required but economically underrated (Y. Wang & Zhang, 2018) yet powerfully correlated to their social engagement outside the family institution.

Finally, this study has three potential methodological limitations that future research should address. First, our findings may be affected by sample selection bias. The absence of information on respondents' social participation before their involvement in the CHARLS survey makes it difficult to control their previous social engagement. This is particularly significant for comparison between periods before and after respondents took on grandchild caregiving responsibilities, as individuals providing grandchild care may have had higher levels of social participation before becoming grandparents. Second, the measurement of the dependent variable, frequency of social participation, may be subject to bias. CHARLS inquires only about social participation over the past month rather than over an entire year. Responses could be influenced by seasonal factors, such as public and school holidays and vacations, especially since individuals were interviewed in different months throughout the year. This could lead to measurement variations at both cross-sectional and longitudinal levels. Third, it should be noted that potential reporting biases may exist for caregiving hours provided by spouses of the main respondents, who were included in the analysis sample but did not self-report their grandchild caregiving hours. Including these spouses allowed us to examine gender and urbanicity heterogeneity with sufficient sample size. While the main respondents might not have accurately reported their spouses' caregiving hours, our robust check showed that the results remained consistent when analyzing only the main respondents. Fourth, the study could not assess the quality of social participation. Although social participation can enhance the

wellbeing of older individuals, the extent of participation and its quality or impact may not always correlate. For instance, a study by Ates et al. (2022) found that while intensive grandchild care among German grandmothers increased their leisure activities, it reduced their satisfaction with these engagements. Future research should delve deeper into the complex relationships between grandchild care and social participation among older adults by examining various dimensions of social engagement.

3.6 Appendices

Table A 3-1 Comparison of samples: before and after attrition

Variables	Sample 1: Individuals aged 50–80 living in a family house and having young grandchildren (including missing values)	Sample 2: Sample 1 with attrition (participating in at least 2 waves, without missing values)
Women (ref: men)	24,231 (51.9%)	18,044 (51.1%)
Urban residence (ref: rural)	17,087 (36.6%)	12,536 (35.5%)
Age (50–80)	62.16 (7.40)	62.08 (6.95)
Occupation Pension Program participation (ref: no)	5,229 (11.3%)	4,018 (11.4%)
With intensive work (ref: no)	7,414 (16.0%)	5,718 (16.2%)
Married (ref: no)	41,120 (88.2%)	31,410 (89.0%)
Number of grandchildren aged < 16	2.82 (2.03)	2.87 (2.01)
Depression Level (0–30) (3)	8.45 (6.36)	8.42 (6.34)
With disability problems (ref: no) (4)	6,979 (15.0%)	4,894 (13.9%)
With chronic diseases (ref: no)	14,099 (30.3%)	9,914 (28.1%)
Functional limitation level (0–60)	5.78 (8.22)	5.13 (6.90)
Grandchild care provision		
Not providing grandchild care	26,188 (56.1%)	19,071 (54.0%)
Non-coresidential non-intensive care	7,226 (15.5%)	5,647 (16.0%)
Non-coresidential intensive care	4,101 (8.8%)	3,179 (9.0%)
Multi-generational coresidential care	5,610 (12.0%)	4,532 (12.8%)
Skipped-generational coresidential care	3,539 (7.6%)	2,868 (8.1%)
Frequency of at least 1 (in 6) social activity		
Never	25,669 (55.2%)	18,373 (52.1%)
Not regularly	6,116 (13.1%)	4,939 (14.0%)
weekly	4,628 (9.9%)	3,764 (10.7%)
Daily	10,128 (21.8%)	8,221 (23.3%)
Individual-wave observations	46,664	35,297
Individuals	17,686	12,007

Notes: (1) Source: authors' calculations based on unweighted data from CHARLS 2011–2018. (2) Frequencies (percentages) or means (standard errors) are shown. (3) Derived as the cumulative score (scale 0–3) from 10 questions following the Center for Epidemiologic Studies Depression Scale (CES-D-10). (4) The presence of disability issues encompassing physical disabilities, brain damage/mental retardation, vision problems, hearing problems, and speech impediments.

Table A 3-2 Descriptive statistics by gender and rural/urban residence

Variables	Overall sample	Rural men	Rural women	Urban men	Urban women
Age (50–80)	62.08 (6.95)	62.56 (7.01)	61.35 (6.86)	62.93 (7.03)	61.75 (6.80)
Occupation Pension Program participation (ref: no)	4,018 (11.4%)	790 (7.0%)	150 (1.3%)	1,751 (29.3%)	1,327 (20.2%)
With intensive work (ref: no)	5,718 (16.2%)	2,335 (20.7%)	1,532 (13.3%)	1,170 (19.6%)	681 (10.4%)
Married (ref: no)	31,410 (89.0%)	10,413 (92.4%)	9,843 (85.7%)	5,648 (94.5%)	5,506 (84.0%)
Number of grandchildren aged < 16	2.87 (2.01)	3.11 (2.11)	3.14 (2.11)	2.42 (1.72)	2.40 (1.74)
Depression Level (0–30) [3]	8.42 (6.34)	7.77 (5.84)	10.28 (6.83)	6.25 (5.35)	8.27 (6.24)
With disability problems (ref: no) [4]	4,894 (13.9%)	1,704 (15.1%)	1,681 (14.6%)	756 (12.6%)	753 (11.5%)
With chronic diseases (ref: no)	9,914 (28.1%)	2,979 (26.4%)	3,271 (28.5%)	1,713 (28.7%)	1,951 (29.8%)
Functional limitation level (0–60)	5.13 (6.90)	4.28 (6.64)	6.85 (7.42)	3.33 (5.84)	5.24 (6.60)
Grandchild care provision					
Not providing grandchild care	19,071 (54.0%)	6,826 (60.5%)	6,120 (53.3%)	3,160 (52.9%)	2,965 (45.2%)
Non-coresidential non-intensive care	5,647 (16.0%)	1,564 (13.9%)	1,692 (14.7%)	1,108 (18.5%)	1,283 (19.6%)
Non-coresidential intensive care	3,179 (9.0%)	766 (6.8%)	1,115 (9.7%)	529 (8.8%)	769 (11.7%)
Multi-generational coresidential care	4,532 (12.8%)	1,196 (10.6%)	1,500 (13.1%)	776 (13.0%)	1,060 (16.2%)
Skipped-generational coresidential care	2,868 (8.1%)	922 (8.2%)	1,060 (9.2%)	406 (6.8%)	480 (7.3%)
Frequency of at least 1 (in 6) social activity					
Never	18,373 (52.1%)	6,224 (55.2%)	6,331 (55.1%)	2,738 (45.8%)	3,080 (47.0%)
Not regularly	4,939 (14.0%)	1,756 (15.6%)	1,412 (12.3%)	914 (15.3%)	857 (13.1%)
weekly	3,764 (10.7%)	1,292 (11.5%)	1,058 (9.2%)	753 (12.6%)	661 (10.1%)
Daily	8,221 (23.3%)	2,002 (17.8%)	2,686 (23.4%)	1,574 (26.3%)	1,959 (29.9%)
Frequency of meeting friends					
Never	22,747 (64.4%)	7,613 (67.5%)	7,161 (62.3%)	3,840 (64.2%)	4,133 (63.0%)
Not regularly	4,188 (11.9%)	1,328 (11.8%)	1,246 (10.8%)	802 (13.4%)	812 (12.4%)
weekly	2,693 (7.6%)	857 (7.6%)	850 (7.4%)	520 (8.7%)	466 (7.1%)
Daily	5,669 (16.1%)	1,476 (13.1%)	2,230 (19.4%)	817 (13.7%)	1,146 (17.5%)
Frequency of card/board games					
Never	28,373 (80.4%)	8,797 (78.0%)	10,065 (87.6%)	4,302 (72.0%)	5,209 (79.4%)
Not regularly	2,691 (7.6%)	1,108 (9.8%)	568 (4.9%)	542 (9.1%)	473 (7.2%)
weekly	2,112 (6.0%)	777 (6.9%)	404 (3.5%)	522 (8.7%)	409 (6.2%)
Daily	2,121 (6.0%)	592 (5.3%)	450 (3.9%)	613 (10.3%)	466 (7.1%)
Frequency of physical activities					
Never	32,781 (92.9%)	10,989 (97.5%)	10,942 (95.3%)	5,350 (89.5%)	5,500 (83.9%)
Not regularly	445 (1.3%)	57 (0.5%)	143 (1.2%)	84 (1.4%)	161 (2.5%)
weekly	355 (1.0%)	44 (0.4%)	74 (0.6%)	92 (1.5%)	145 (2.2%)
Daily	1,716 (4.9%)	184 (1.6%)	328 (2.9%)	453 (7.6%)	751 (11.5%)
Frequency of community activities					
Never	34,568 (97.9%)	11,097 (98.4%)	11,382 (99.1%)	5,750 (96.2%)	6,339 (96.7%)
Not regularly	427 (1.2%)	113 (1.0%)	46 (0.4%)	164 (2.7%)	104 (1.6%)
weekly	212 (0.6%)	49 (0.4%)	49 (0.4%)	48 (0.8%)	66 (1.0%)
Daily	90 (0.3%)	15 (0.1%)	10 (0.1%)	17 (0.3%)	48 (0.7%)
Frequency of volunteering					
Never	34,884 (98.8%)	11,154 (98.9%)	11,432 (99.5%)	5,849 (97.8%)	6,449 (98.4%)

Variables	Overall sample	Rural men	Rural women	Urban men	Urban women
Not regularly	320 (0.9%)	93 (0.8%)	46 (0.4%)	105 (1.8%)	76 (1.2%)
weekly	62 (0.2%)	18 (0.2%)	5 (0.0%)	17 (0.3%)	22 (0.3%)
Daily	31 (0.1%)	9 (0.1%)	4 (0.0%)	8 (0.1%)	10 (0.2%)
Frequency of taking courses					
Never	35,162 (99.6%)	11,218 (99.5%)	11,478 (99.9%)	5,934 (99.2%)	6,532 (99.6%)
Not regularly	73 (0.2%)	38 (0.3%)	3 (0.0%)	29 (0.5%)	3 (0.0%)
weekly	54 (0.2%)	18 (0.2%)	5 (0.0%)	13 (0.2%)	18 (0.3%)
Daily	8 (0.0%)	0 (0.0%)	1 (0.0%)	3 (0.1%)	4 (0.1%)
Individual-wave observations	35,297	11,274	11,487	5,979	6,557
Individuals	12,007	3,723	3,890	2,087	2,307

Notes: (1) Source: authors' calculations based on unweighted data from CHARLS 2011–2018. (2) Frequencies (percentages) or means (standard errors) are shown. (3) Derived as the cumulative score (scale 0–3) from 10 questions following the Center for Epidemiologic Studies Depression Scale (CES-D-10). (4) The presence of disability issues encompassing physical disabilities, brain damage/mental retardation, vision problems, hearing problems, and speech impediments.

Table A 3-3 Results of fixed-effects regressions on probability of frequently participating in at least one (in six) social activity

Variables	Overall sample	Rural men	Rural women	Urban men	Urban women
Grandchild care provision					
Not providing grandchild care (ref)	—	—	—	—	—
Non-coresidential non-intensive care	0.027**	0.019	0.025	0.021	0.053**
	(0.008)	(0.014)	(0.015)	(0.020)	(0.019)
Non-coresidential intensive care	0.008	0.003	0.006	0.011	0.027
	(0.010)	(0.019)	(0.018)	(0.026)	(0.023)
Multi-generational coresidential care	0.017	-0.007	0.029	0.024	0.032
	(0.009)	(0.017)	(0.016)	(0.023)	(0.022)
Skipped-generational coresidential care	0.045***	0.032	0.045*	0.050	0.069*
	(0.011)	(0.019)	(0.020)	(0.031)	(0.029)
Age (50–80)	-0.007***	-0.010***	-0.003	-0.011***	-0.008**
	(0.001)	(0.002)	(0.002)	(0.003)	(0.003)
Occupation Pension Program participation (ref: no)	0.007	0.011	-0.099*	0.018	0.029
	(0.012)	(0.024)	(0.048)	(0.021)	(0.022)
With intensive work (ref: no)	-0.031***	-0.033**	-0.035*	-0.034	-0.018
	(0.008)	(0.013)	(0.016)	(0.021)	(0.025)
Married (ref: no)	-0.057**	-0.098**	-0.044	0.024	-0.070
	(0.019)	(0.038)	(0.030)	(0.056)	(0.040)
Number of grandchildren aged < 16	-0.003	0.002	-0.005	-0.001	-0.012*
	(0.002)	(0.003)	(0.003)	(0.006)	(0.005)
With disability problems (ref: no)	-0.005	-0.007	-0.014	0.012	0.002
	(0.008)	(0.013)	(0.013)	(0.020)	(0.020)
With chronic diseases (ref: no)	-0.012*	-0.011	-0.004	-0.011	-0.022
	(0.006)	(0.010)	(0.010)	(0.014)	(0.013)
Functional limitation level (0–60)	-0.003***	-0.002	-0.003**	-0.003	-0.006***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Depression Level (0–30)	-0.003***	-0.002	-0.001	-0.005**	-0.004**
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Individuals	12,007	3,723	3,890	2,087	2,307
Within R2	0.007	0.007	0.006	0.010	0.016

Notes: (1) Source: authors' calculations based on unweighted data from CHARLS 2011–2018. (2) Coefficients (standard errors) are shown. (3) *p<0.05; **p<0.01; ***p<0.001.

Table A 3-4 Results of fixed-effects regressions on probability of frequently meeting friends

Variables	Overall sample	Rural men	Rural women	Urban men	Urban women
Grandchild care provision					
Not providing grandchild care (ref)	—	—	—	—	—
Non-coresidential non-intensive care	0.015	0.007	0.020	0.005	0.030
	(0.008)	(0.013)	(0.014)	(0.017)	(0.018)
Non-coresidential intensive care	0.006	0.011	0.004	0.000	0.019
	(0.010)	(0.018)	(0.017)	(0.023)	(0.022)
Multi-generational coresidential care	0.015	-0.011	0.036*	0.007	0.032
	(0.009)	(0.015)	(0.016)	(0.020)	(0.021)
Skipped-generational coresidential care	0.035**	0.017	0.039*	0.041	0.061*
	(0.011)	(0.018)	(0.019)	(0.027)	(0.028)
Age (50–80)	-0.009***	-0.011***	-0.008***	-0.009***	-0.007**
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Occupation Pension Program participation (ref: no)	0.024*	0.009	-0.098*	0.038*	0.038
	(0.011)	(0.022)	(0.047)	(0.019)	(0.021)
With intensive work (ref: no)	-0.018*	-0.015	-0.033*	-0.015	0.005
	(0.008)	(0.012)	(0.015)	(0.019)	(0.024)
Married (ref: no)	-0.067***	-0.098**	-0.070*	0.009	-0.065
	(0.018)	(0.035)	(0.029)	(0.049)	(0.038)
Number of grandchildren aged < 16	-0.003	0.000	-0.006	0.004	-0.011*
	(0.002)	(0.003)	(0.003)	(0.005)	(0.005)
With disability problems (ref: no)	-0.005	-0.004	-0.016	0.023	-0.012
	(0.007)	(0.012)	(0.013)	(0.018)	(0.019)
With chronic diseases (ref: no)	0.000	0.001	0.002	-0.006	0.002
	(0.005)	(0.009)	(0.010)	(0.012)	(0.013)
Functional limitation level (0–60)	-0.002**	-0.001	-0.002*	-0.001	-0.002
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Depression Level (0–30)	-0.002**	-0.002	-0.001	-0.003	-0.003*
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Individuals	12,007	3,723	3,890	2,087	2,307
Within R2	0.006	0.008	0.008	0.006	0.009

Notes: (1) Source: authors' calculations based on unweighted data from CHARLS 2011–2018. (2) Coefficients (standard errors) are shown. (3) *p<0.05; **p<0.01; ***p<0.001.

Table A 3-5 Results of fixed-effects regressions on probability of frequently playing card/board games

Variables	Overall sample	Rural men	Rural women	Urban men	Urban women
Grandchild care provision					
Not providing grandchild care (ref)	—	—	—	—	—
Non-coresidential non-intensive care	0.008	0.017	-0.003	0.007	0.015
	(0.005)	(0.009)	(0.007)	(0.014)	(0.012)
Non-coresidential intensive care	-0.004	0.000	-0.007	-0.025	0.014
	(0.006)	(0.013)	(0.009)	(0.019)	(0.014)
Multi-generational coresidential care	0.000	0.016	-0.010	-0.010	0.006
	(0.006)	(0.011)	(0.008)	(0.017)	(0.014)
Skipped-generational coresidential care	0.016*	0.031*	-0.004	0.040	0.004
	(0.007)	(0.012)	(0.010)	(0.022)	(0.018)
Age (50–80)	-0.001	-0.002*	0.002*	-0.001	-0.003
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Occupation Pension Program participation (ref: no)	-0.002	0.003	-0.030	-0.008	0.016
	(0.007)	(0.016)	(0.024)	(0.015)	(0.014)
With intensive work (ref: no)	-0.014**	-0.018*	-0.009	-0.023	-0.006
	(0.005)	(0.008)	(0.008)	(0.016)	(0.016)
Married (ref: no)	-0.030*	-0.060*	-0.007	0.024	-0.061*
	(0.012)	(0.025)	(0.015)	(0.041)	(0.025)
Number of grandchildren aged < 16	-0.001	0.002	0.000	-0.004	-0.006
	(0.001)	(0.002)	(0.002)	(0.004)	(0.003)
With disability problems (ref: no)	0.000	-0.007	0.005	0.005	-0.003
	(0.005)	(0.008)	(0.007)	(0.015)	(0.013)
With chronic diseases (ref: no)	-0.008*	-0.016*	-0.003	-0.007	-0.003
	(0.003)	(0.006)	(0.005)	(0.010)	(0.008)
Functional limitation level (0–60)	-0.001***	-0.001	-0.001	-0.002	-0.003**
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Depression Level (0–30)	-0.001	-0.001	0.000	-0.001	-0.001
	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)
Individuals	12,007	3,723	3,890	2,087	2,307
Within R2	0.002	0.005	0.002	0.004	0.006

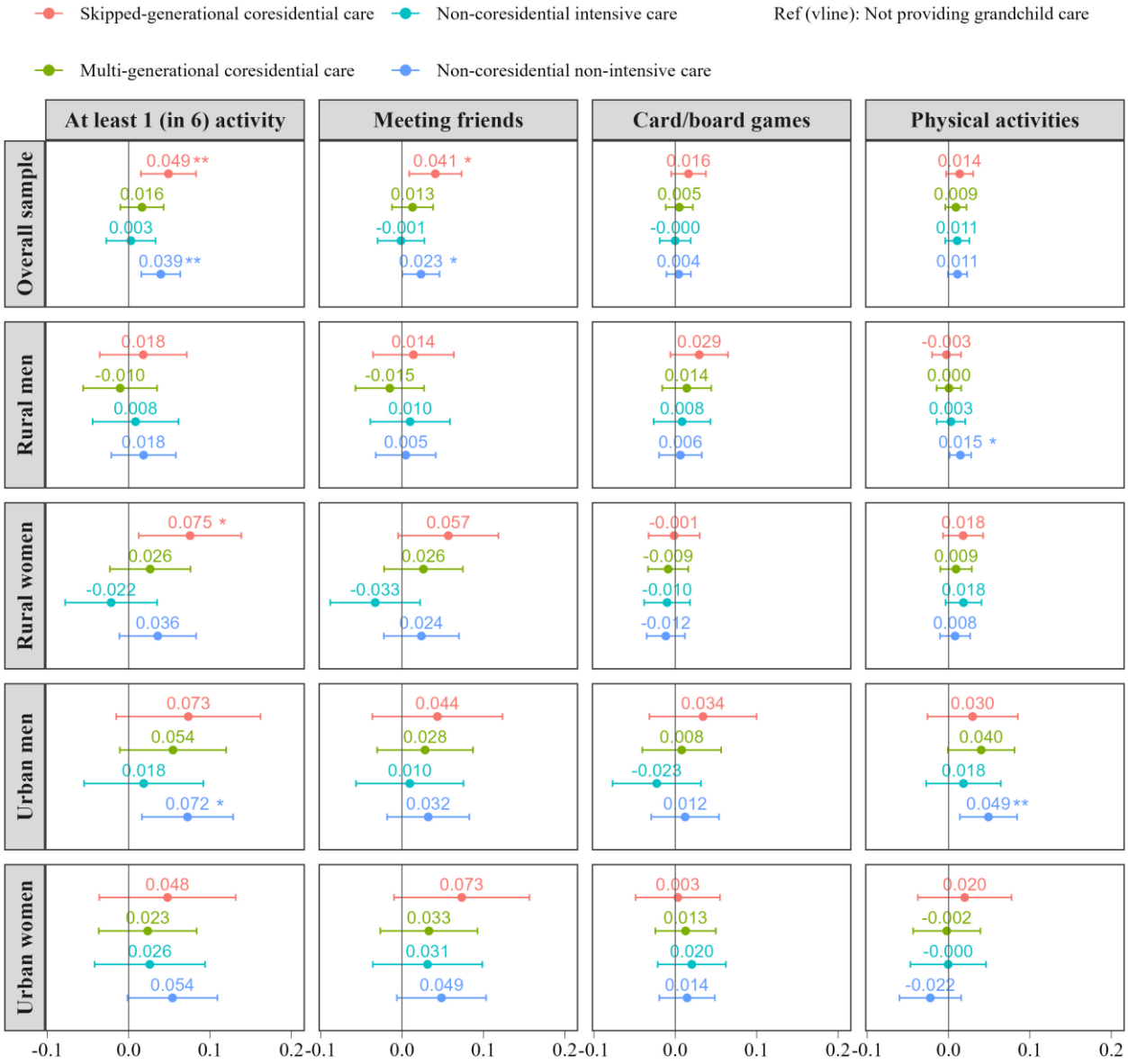
Notes: (1) Source: authors' calculations based on unweighted data from CHARLS 2011–2018. (2) Coefficients (standard errors) are shown. (3) *p<0.05; **p<0.01; ***p<0.001.

Table A 3-6 Results of fixed-effects regressions on probability of frequently doing physical activities

Variables	Overall sample	Rural men	Rural women	Urban men	Urban women
Grandchild care provision					
Not providing grandchild care (ref)	—	—	—	—	—
Non-coresidential non-intensive care	0.006	0.007	0.009	0.011	0.004
	(0.004)	(0.005)	(0.006)	(0.012)	(0.013)
Non-coresidential intensive care	0.004	0.002	0.008	0.008	-0.005
	(0.005)	(0.006)	(0.007)	(0.016)	(0.016)
Multi-generational coresidential care	0.010*	-0.001	0.009	0.035*	0.001
	(0.005)	(0.005)	(0.006)	(0.014)	(0.015)
Skipped-generational coresidential care	0.012*	0.005	0.005	0.019	0.035
	(0.006)	(0.006)	(0.008)	(0.019)	(0.020)
Age (50–80)	0.000	0.000	0.005***	-0.010***	-0.005**
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Occupation Pension Program participation (ref: no)	-0.022***	-0.001	0.005	-0.023	-0.005
	(0.006)	(0.008)	(0.019)	(0.013)	(0.015)
With intensive work (ref: no)	-0.007	-0.005	0.008	-0.027*	-0.031
	(0.004)	(0.004)	(0.006)	(0.013)	(0.017)
Married (ref: no)	-0.008	-0.017	0.006	-0.003	-0.013
	(0.009)	(0.012)	(0.012)	(0.034)	(0.027)
Number of grandchildren aged < 16	0.001	0.001	0.001	0.000	0.003
	(0.001)	(0.001)	(0.001)	(0.004)	(0.004)
With disability problems (ref: no)	0.006	0.002	0.011*	0.005	0.006
	(0.004)	(0.004)	(0.005)	(0.012)	(0.014)
With chronic diseases (ref: no)	-0.013***	-0.007*	-0.010**	-0.011	-0.028**
	(0.003)	(0.003)	(0.004)	(0.009)	(0.009)
Functional limitation level (0–60)	-0.001**	0.000	-0.001	-0.002	-0.002
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Depression Level (0–30)	-0.001***	0.000	-0.001***	-0.002*	-0.003**
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Individuals	12,007	3,723	3,890	2,087	2,307
Within R2	0.004	0.002	0.012	0.019	0.011

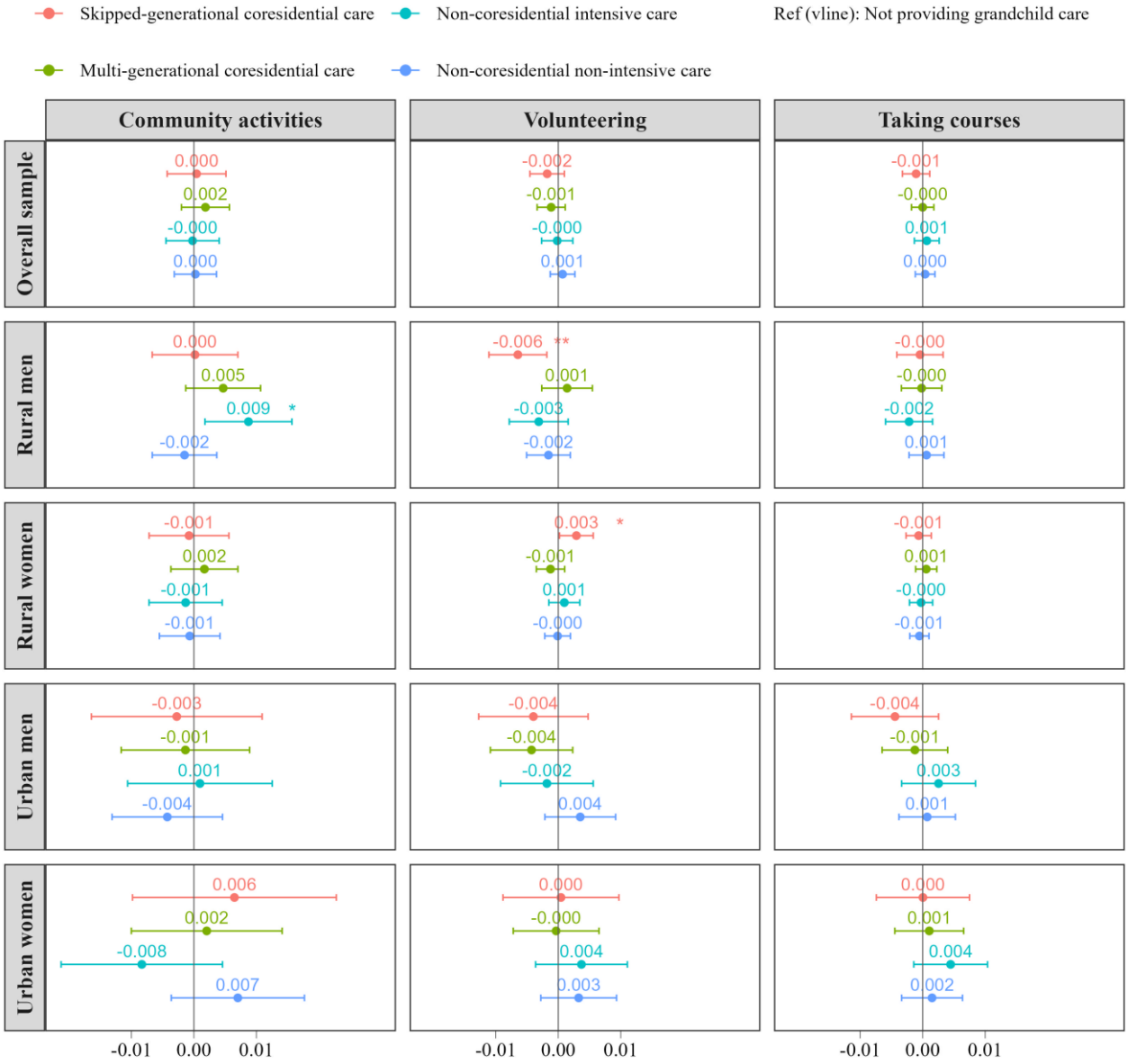
Notes: (1) Source: authors' calculations based on unweighted data from CHARLS 2011–2018. (2) Coefficients (standard errors) are shown. (3) *p<0.05; **p<0.01; ***p<0.001.

Figure A 3-1 Estimates of grandchild care's effects on probability of frequently participating in social activities, with sample only including main respondents



Notes: (1) Source: authors' calculations based on unweighted data from CHARLS 2011–2018. (2) The overall sample includes 6,896 individuals. (3) The estimated values are the coefficients (betas) in linear fixed-effects regressions with control variables. (4) Whiskers indicate 95% confidence intervals. (5) * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Figure A 3-2 Estimates of grandchild care's effects on probability of frequently participating in uncommon social activities



Notes: (1) Source: authors' calculations based on unweighted data from CHARLS 2011–2018. (2) The overall sample includes 12,007 individuals. (3) The estimated values are the coefficients (betas) in linear fixed-effects regressions with control variables. (4) Whiskers indicate 95% confidence intervals. (5) * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Chapter 4 Later-life Widowhood and Economic Wellbeing in China

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Abstract

Previous research on the economic outcomes of widowhood for older adults has often treated spousal death as a single event rather than a process and has therefore neglected the dynamics of economic wellbeing throughout this process. This study explores changes in economic wellbeing over the widowhood process among Chinese adults aged 65 and older, and how these changes are influenced by coresidence with adult children. Data were drawn from the Chinese Longitudinal Healthy Longevity Survey (CLHLS 2002-2018). Multivariate linear regressions with individual fixed effects were used to assess changes in the likelihood of income adequacy before and after spousal death. The results indicate that economic wellbeing generally improves during the widowhood process, even before spousal death and in the long term after it. However, this improvement largely depends on coresidence with adult children. Our findings also highlight variations in changes in economic wellbeing by gender and early-life occupation. We suggest that the improvement in economic wellbeing is due to the limited personal income resources of older adults and their reliance on economic support from adult children in a familistic welfare system with insufficient public support for eldercare.

Key words

Spousal death; adequate income; older adults; coresidence; adult children; gender; occupation

4.1 Introduction

Widowhood in later life often brings grief, health decline, and economic hardship to the surviving spouse. Recent studies suggest that widowhood in old age is a gradual process, marked by spousal health decline rather than a sudden loss (Kapelle & Van Winkle, 2024; Streeter, 2020). In modern societies, deaths at older ages are usually due to chronic diseases requiring long-term care (Wu et al., 2024; Z. Zheng & Zhou, 2019), making it essential to consider widowhood's effects even before the spouse's death. This prolonged period entails stressful healthcare and funeral costs and the loss of the spouse's income, while daily living expenses for the survivor remain steady (Cherchye et al., 2020; C. Liu et al., 2021). Caregiving burdens and grief also increase the surviving spouse's risks of health decline, mortality, and poverty (Bíró, 2013; Sullivan & Fenelon, 2014).

Research on the economic wellbeing of older adults during the widowhood process remains limited, with most empirical evidence coming from the US and Europe. Given the financial hardships widowhood imposes in these economically developed contexts, it is crucial to explore the situation in China, where older adults are generally poorer, marriages typically last until death, and old-age pensions are less accessible (R. Wang et al., 2019; F. Yang & Gu, 2021; X. Yu et al., 2021). While funeral grants have recently become available, most individuals lack eligibility for survivor benefits, and pensions are often minimal (Ouyang & Knapp, 2024). Thus, this study poses our first research question: *How does economic wellbeing change over the widowhood process among Chinese older adults?* (**RQ1**) Given that older adults in China rely heavily on economic support from adult children and often coreside with them in later life for financial and caregiving needs (Q. Li et al., 2023; Zimmer & Korinek, 2010), we put forward our second research question: *What role does coresidence with adult children play in the economic impacts of widowhood?* (**RQ2**)

Previous research suggests that women and those from lower socioeconomic status (SES) backgrounds are more economically vulnerable to widowhood due to fewer resources both before and after spousal death (Bernard & Li, 2006; Holden & Smock, 1991). In China, economic inequality is pronounced: older women receive only half the pension benefits of men, and agricultural workers earn significantly less and receive lower pensions compared to non-agricultural workers (R. Zhao & Zhao, 2018). Additionally, female and agricultural older adults are more likely to rely on economic support from their adult children than their male and non-agricultural counterparts (Cai et al., 2012; X. Lei et al., 2015). This leads to our third and fourth

research questions: *How do the economic impacts of widowhood vary by gender* (**RQ3**) *and occupation?* (**RQ4**)

This article examines how widowhood affects the economic wellbeing of Chinese adults aged 65 and over. Drawing on previous research and contextual knowledge of China, we proposed hypotheses for our research questions. Using data from the Chinese Longitudinal Healthy Longevity Survey (CLHLS) and fixed-effects models, we tested these hypotheses. Our results show that economic wellbeing generally increases during the widowhood process, particularly among those who coreside with adult children. We also observed heterogeneities in the effects of widowhood based on gender and early-life occupation.

This research contributes to the life course literature on widowhood and economic wellbeing among older adults in four ways. First, our findings highlight the importance of conceptualizing widowhood as a process, rather than a singular event, to better understand its impact on economic wellbeing. While many studies use longitudinal data to assess widowhood effects, most treat it as a one-time event, ignoring its gradual nature. Second, we incorporate coresidence with adult children into the widowhood process, offering insights into the situations in which economic outcomes are underlined by widowhood, especially in familistic welfare systems. Third, we address gender and occupation heterogeneities in widowhood's economic effects, a gap in recent literature that often focuses on women. Fourth, we provide new empirical evidence on widowhood and economic wellbeing in a context where widowhood is nearly the only form of marital dissolution among the older population, and older adults face greater economic vulnerability compared to those in North America and Europe.

4.2 Previous research on widowhood and economic wellbeing in old age

Research has shown that widowed older adults face significant economic inequalities compared to their married counterparts. Cross-sectional studies have revealed lower income among widowed individuals (e.g., Morgan, 1981), and studies with retrospective marital information have confirmed that widowhood, particularly in later life, is linked with less earnings, wealth, and higher poverty risks (I.-F. Lin et al., 2017; Zissimopoulos et al., 2015). These disparities are partly due to the pre-widowhood economic status, as poorer individuals are more likely to experience spousal death (Holden et al., 1986).

While cross-sectional data often fails to accurately assess the effects of widowhood on economic wellbeing, longitudinal studies have shown a general decline in economic wellbeing after widowhood. Hungerford (2001) found that older women are more likely to fall into poverty after their husband's death, and Holden et al. (1986) observed that widows are less likely to escape poverty compared to married individuals. Some studies have found that the decline in household income and increased poverty risk are greater for the newly widowed than for those who have been widowed longer (Bernard & Li, 2006; Bíró, 2013), while the reduction in wealth holdings is more pronounced over the long term (Zick & Holden, 2000). Following the idea of including the pre-widowhood period (Zick & Smith, 1991), a few recent studies have further indicated that the decline in income and wealth begins even before spousal death (Kapelle & Van Winkle, 2024; Streeter, 2020; Van Winkle & Leopold, 2022). On the one hand, studies have found that the economic decline is mainly attributed to the loss of income sources from the deceased spouse, such as earnings, pensions, and financial assets (Burkhauser et al., 2005; Hungerford, 2001). On the other hand, public transfers, such as survivor benefits, can mitigate some of these effects, especially in countries with stronger public support for widowed individuals (Bíró, 2013; Van Winkle et al., 2024).

The economic effects of widowhood vary based on gender. Holden and Smock (1991) summarized that women bear greater economic costs due to gender income gaps and weaker labor market attachment, as the male-breadwinner model often leaves women more dependent on their spouses. As a result, older women experience larger declines in household income and pensions, and higher poverty risks after widowhood compared to men (I.-F. Lin et al., 2017; Zissimopoulos et al., 2015). Streeter (2020) also found that these effects persist longer for women, while men recover more quickly. In some cases, men's household income even increases after the death of their wives (Bernard & Li, 2006).

SES also plays a significant role in the economic impact of widowhood. Lower-income individuals are more likely to experience widowhood earlier due to higher mortality risks among those with lower SES (Bíró, 2013; Morgan, 1981; Sullivan & Fenelon, 2014). These individuals also have fewer assets, such as life insurance, leading to greater economic losses post-widowhood (Hurd & Wise, 1989). Bernard and Li (2006) found that the economic decline due to widowhood for men is only pronounced among lower-income groups. In contrast, Burkhauser et al. (2005) suggested that women in higher-income groups face greater losses, though those in the lowest income group see increases in household income due to social

security benefits. Van Winkle et al. (2024) also found that survivor benefits more effectively alleviate income loss for individuals with lower lifetime labor market attachment than for those with higher attachment.

4.3 The context of China

The economic situation of China's older population is challenging, with many relying heavily on adult children for financial support. A study by Wang et al. (2019) suggested that only 26% of adults aged 65 and older had income primarily from labor or pensions between 2005 and 2014, and 23% reported financial hardship. Yu et al. (2021) found that 64% of older adults lived in relative poverty, within the lowest 20% income bracket among Chinese households. These issues are largely due to the limited coverage and benefits of public pension schemes. It is reported that fewer than 30% of adults aged 60 or older receive adequate pensions, and the benefits of the urban and rural resident pension schemes introduced in 2009 to expand pension coverage are insufficient for basic living costs (Shen et al., 2020; R. Zhao & Zhao, 2018). In response, adult children are the main source of economic support for people aged 65 and older, regardless of coresidence, and more than 50% of them coreside with adult relatives, primarily children (Lu & Zhang, 2017). Even for those not coresiding, many have children nearby, and financial transfers from non-coresident children are common (X. Lei et al., 2015).

Gender and SES inequalities significantly affect the economic wellbeing of Chinese older adults. One of the most pronounced SES gaps exists between agricultural and non-agricultural occupations. Historically, China's household registration system (*Hukou*) divided the labor force into agricultural workers in rural areas and non-agricultural workers in urban areas, restricting mobility between these sectors. This division led to urban-centered economic infrastructures that provided non-agricultural residents with formal employment, retirement pensions, better income, education, and living conditions (D. T. Yang, 1999). Consequently, non-agricultural older adults typically receive sufficient pensions, while agricultural workers were excluded until reforms since 2009, which have granted them pensions substantially lower than those of their non-agricultural counterparts, increasing their poverty risk (Shen et al., 2020). Women in China also face significant economic disadvantages, with labor force participation declining in recent decades due to earlier retirement policies and domestic care responsibilities (Connelly et al., 2018). For those over 60 years old, women's pensions are, on average, half the amount received by men, primarily due to low lifetime income and limited

pension eligibility (R. Zhao & Zhao, 2018). These gender and occupational disparities contribute to higher economic dependence on adult children among older women and agricultural workers (Cai et al., 2012; X. Lei et al., 2015).

Research on the direct effects of widowhood on the economic wellbeing of Chinese older adults is limited. Most studies have treated economic status as a confounder or mediator when examining the impact of widowhood on health (e.g., Q. Li et al., 2023). These studies suggested that spousal death is linked to a decline in economic resources, which can be mitigated by coresidence with or financial support from adult children. Zimmer and Korinek (2010) found that older Chinese adults often move in with or remain coresiding with their adult children due to financial and care needs. Thus, older adults likely receive increased support from their children before the death of their spouse. However, this support may not fully restore their economic wellbeing to pre-widowhood levels, particularly for agricultural women, who also tend to take on greater grandchild care responsibilities after widowhood (Q. Li et al., 2023).

4.4 Conceptual framework & hypotheses

Regarding widowhood among older adults, we adopt the life course perspective, which considers aging as a chronological process formed by patterns of aged-graded behaviors and events. This approach emphasizes the temporal nature of family events, including widowhood and its long-term consequences—particularly the accumulative effects on wellbeing over time (Dannefer, 2003; Elder et al., 2003). Within the life course perspective, we conceptualize widowhood in older ages as a process spanning three stages: pre-widowhood, bereavement, and post-widowhood. This framework suggests that widowhood effects occur throughout these stages (Zick & Smith, 1991). The "bereavement" stage refers to the first two years following spousal death, as grief and health decline following spousal death typically last two years (Bíró, 2013; Prigerson et al., 1997), while the "post-widowhood" stage represents the long-term period after these initial two years. The "pre-widowhood" stage is considered anticipatory, as many older adults in China suffer from chronic diseases or disabilities leading to predictable deaths, often involving informal caregiving from family members (Z. Zheng & Zhou, 2019). In 2019, about 94% of deaths among people aged 60 or over in China were due to chronic non-communicable diseases such as stroke, heart disease, and cancer (Wu et al., 2024).

Table 4-1 outlines the main mechanisms driving changes in economic wellbeing during the widowhood process. Initially, economic loss arises from the deteriorating health of the deceased spouse, leading to high out-of-pocket medical and care expenses, often pushing families into debt and poverty (C. Liu et al., 2021). The surviving spouse also experiences a reduction in labor income due to their own health issues or caregiving responsibilities. Unlike younger adults, older adults often cannot return to the labor market post-widowhood due to health problems (Bíró, 2013; Sullivan & Fenelon, 2014).

Table 4-1 Conceptual mechanisms of changes in Chinese older couples' economic wellbeing during the process of spousal death and related economic factors

Economic factors	Widowhood process		
	Pre-widowhood	Bereavement	Post- widowhood
Medical and care expenses	-	-	-
Labor earnings	-	-	-
Retirement pension and social benefits		-	-
Economies of scale from marriage		-	-
Bequest distribution		-	
Funeral expenses		-	
Survivor benefits (2)		+	+
Coresidence with adult children	+	+	+
Heterogeneities	Widowhood effects		
	Loss of income and pension from spouse (-)	Gain of survivor benefits (+)	Dependent on support from children (+)
Women vs. men	>	>	>
Agricultural vs. non-agricultural occupations	<	<	>

Notes: (1) "-" indicates economic loss, "+" indicates economic gain, ">" indicates more, "<" indicates less. (2) Survivor benefits are available only since 2011, with accessibility based on the deceased spouse's pension scheme.

Upon the spouse's death, further economic loss occurs with the loss of retirement pensions and social benefits from the deceased spouse, as well as the loss of marital economies of scale where joint expenses become relatively higher for a single individual (Cherchye et al., 2020). Additionally, funeral costs and the redistribution of wealth through inheritance further deplete the surviving spouse's resources (Qi, 2018; Zhan & Wu, 2015).

Survivor benefits for the surviving spouse in China vary significantly by province and year. Prior to 2011, no such benefits were provided. Since then, surviving spouses of deceased

participants in the *Basic Pension for Enterprise Employees* (BPEE; covering a small portion of older adults, mainly those working in non-agricultural occupations in urban areas) and the *Urban and Rural Resident Pension* (URRP; covering most older adults) systems have been eligible for limited support. Regarding *eligibility*, under the BPEE, the surviving spouses may receive both a survivor grant and a funeral grant, whereas those under the URRP are typically eligible only for a funeral grant. The *generosity* of these benefits depends largely on the deceased's contribution history to the pension schemes and provincial policies. BPEE provides more generous benefits, whereas URRP benefits are generally limited to inheriting the deceased spouse's individual pension account balance. In terms of benefit *duration*, both the survivor and funeral grants are usually one-time payments, reflecting a policy focus on short-term bereavement support rather than ongoing financial assistance. As for *conditions* of claiming benefits, the surviving spouse must apply through local social insurance agencies, providing documentation of pension participation (of themselves and their deceased spouses) and marital status. For example, in 2016, a deceased BPEE participant's surviving spouse in Shanghai—where the scheme of survivor benefits is better established and benefits are more generous than most other provinces—could receive: (1) a one-time survivor grant equivalent to 6–12 months of the deceased spouse's final wages, depending on the number of financial dependents on the surviving spouse; (2) a one-time funeral grant equal to two months of the deceased spouse's final wages; (3) a monthly ¥570 subsistence subsidy, if eligible; and (4) a one-time ¥6,000 retirement subsidy if the deceased had been retired—though the latter two benefits were not common in other provinces. In contrast, the surviving spouse of a deceased URRP participant was typically eligible only for a one-time funeral grant of ¥3,600. For detailed information on post-2011 survivor benefit policies in China, see Ouyang & Knapp (2024). While these benefits can ease the economic burden, the funeral grant is insufficient to cover actual costs, and survivor grants have limited coverage due to eligibility restrictions.Considering the mechanisms discussed above, we hypothesize that, *on average, Chinese older adults experience a decline in economic wellbeing throughout the widowhood process.* (**H1**)

The life course framework underlines the principle of linked lives—interpersonal relationships that may serve as either a source of support or a constraint on individual wellbeing (Elder et al., 2003). This study examines how such linked lives among family members shape widowhood outcomes. Specifically, we focus on the moderating role of coresidence with adult children in the widowhood process, as it provides both economic support and caregiving

resources for the deceased and surviving spouse (Li et al., 2023; Zimmer & Korinek, 2010). We expect that *the economic loss over the widowhood process is less severe for older adults who coreside with adult children.* (**H2**)

We also examine heterogeneity in widowhood effects on economic wellbeing. Given that women and agricultural couples generally have lower labor and pension income than men and non-agricultural couples (Shen et al., 2020; R. Zhao & Zhao, 2018), we assume women and non-agricultural couples experience greater losses in labor earnings and pension benefits, but also receive more survivor benefits. Additionally, women and agricultural older adults tend to be more dependent on their adult children for economic support (Cai et al., 2012; X. Lei et al., 2015). While we do not propose specific hypotheses, *we expect gender and occupation heterogeneity in the effects of widowhood on economic wellbeing by gender* (**H3**) *and early-life occupation.* (**H4**)

4.5 Methodology

4.5.1 Data & sample

This study uses data from the Chinese Longitudinal Healthy Longevity Survey (CLHLS), a nationally representative longitudinal study on healthy longevity administered by Peking University and Duke University (Yi, 2008). The CLHLS began in 1998 with face-to-face interviews of 8,959 individuals aged 80 and older from 22 provinces, adding new participants in each wave (2000, 2002, 2005, 2008, 2011, 2014, and 2018). Since 2002, the target population has been expanded to individuals aged 65 and older from 23 provinces. The dataset contains extensive information on demographics, socioeconomic background, economic wellbeing, and health status, making it ideal for examining the effects of widowhood on economic wellbeing.

For this study, we used data from six waves of the CLHLS from 2002 to 2018 (CLHLS, 2020), as income data has only been collected since 2002. The original dataset included 47,130 distinct respondents aged 65 or older across these waves. To focus on the effects of widowhood, we excluded 3,879 individuals who never married or married more than once, and 1,352 individuals who were neither married nor widowed during the survey waves. To capture the widowhood process longitudinally, we further excluded 28,380 individuals who were already widowed in their first wave, 132 individuals who remarried after widowhood, and 7,408 individuals who participated in only one wave of the CLHLS. Additionally, we excluded 78

individuals who lived in a nursing home instead of a household, and 127 individuals with missing values for essential variables. **Figure A 4-1** (Appendix) provides details on the sample selection process. The final analytical sample consists of 5,441 respondents (3,503 men and 1,938 women), of whom 3,794 were continuously married (2,719 men, 1,075 women) and 1,647 were eventually widowed (784 men, 863 women). Sample characteristics are detailed in **Table A 4-1**(Appendix).

4.5.2 Variables

Our outcome variable is *income adequacy*, a binary variable that equals 1 if the respondent's per capita household income exceeds 50% of the local per capita disposable income, and 0 otherwise. Per capita household income data was sourced from the CLHLS, while local per capita disposable income by province, survey year, and rural/urban areas was obtained from the National Bureau of Statistics of China (NBSC, n.d.). This approach allows for comparability of economic wellbeing across regions and over time. The concept of relative income adequacy is adapted from relative income poverty, where a person is considered to be in relative income poverty if their income falls below a local threshold (Gustafsson & Sai, 2020). We measured income adequacy rather than poverty to facilitate a more intuitive analysis of economic wellbeing, where higher values indicate better economic wellbeing.

The key explanatory variable is *years around widowhood*, categorized into five groups: (1) 4+ years before widowhood (2+ waves), (2) 1–3 years before widowhood (1 wave), (3) 0–2 years since widowhood (the wave when widowhood was first observed), (4) 3–5 years since widowhood (1 wave), and (5) 6+ years since widowhood (2+ waves).

To test the moderation effect of *coresidence with adult children*, we created a dummy variable indicating whether the respondent lived with any children aged 18 or older in the same household.

For examining *gender* and *occupational* heterogeneity, we categorized individuals based on their *main occupation before age 60*. Occupations in agriculture, forestry, animal husbandry, and fishery were classified as "agricultural occupation", while all others were "non-agricultural occupation". To focus on agricultural versus non-agricultural differences, we excluded economically inactive individuals—primarily engaged in housework or unemployment—from our main analysis of occupational differences. This group is small (4.6%) and differs

substantially from the other two groups, particularly in the higher proportions of women and daily activity limitations (see **Table A 4-2**, Appendix)—factors that may bias regression results.

Time-variant covariates include survey year, age group, urban/rural residence, homeownership, and daily activity limitations. Detailed variable characteristics are provided in **Table A 4-1** (Appendix).

4.5.3 Analytic strategy

We employed linear fixed-effects regression models to estimate the impact of widowhood on the likelihood of income adequacy. Fixed-effects regression models are ideal for longitudinal data, as they assess how changes in an individual's predictors affect changes in their outcomes within the same individual (Allison, 2009). In this study, we used this method to estimate within-individual variations in the probability of income adequacy across different stages of widowhood. The models were specified with time-demeaned explanatory and outcome variables, which effectively control for all time-invariant factors (both observed and unobserved) that might influence the variables, minimizing omitted variable bias. For the continuously married group, we included the variable "years since widowhood" and marked it as the category for 4+ years before widowhood, which is time-invariant for them. Including this group allows us to account for factors that could affect economic wellbeing and ensures that the widowhood effects are not overstated (Streeter, 2020).

We fit several models to address different aspects. First, to examine the changes in the probability of income adequacy over the widowhood process, we included the variable "years since widowhood" along with time-variant controls. Next, to explore the moderation effect of coresidence with adult children, we introduced an interaction term between years around widowhood and coresidence. Finally, to assess gender and occupational heterogeneities in widowhood effects, we conducted the same analysis separately for different subgroups: men, women, individuals with agricultural backgrounds, and those with non-agricultural backgrounds. As a robust check, we also conducted separate regressions for the economically inactive group.

Models were performed using RStudio software (R version 4.4.1) with the "fixest" package (Bergé, 2018).

4.6 Results

4.6.1 Descriptive analysis

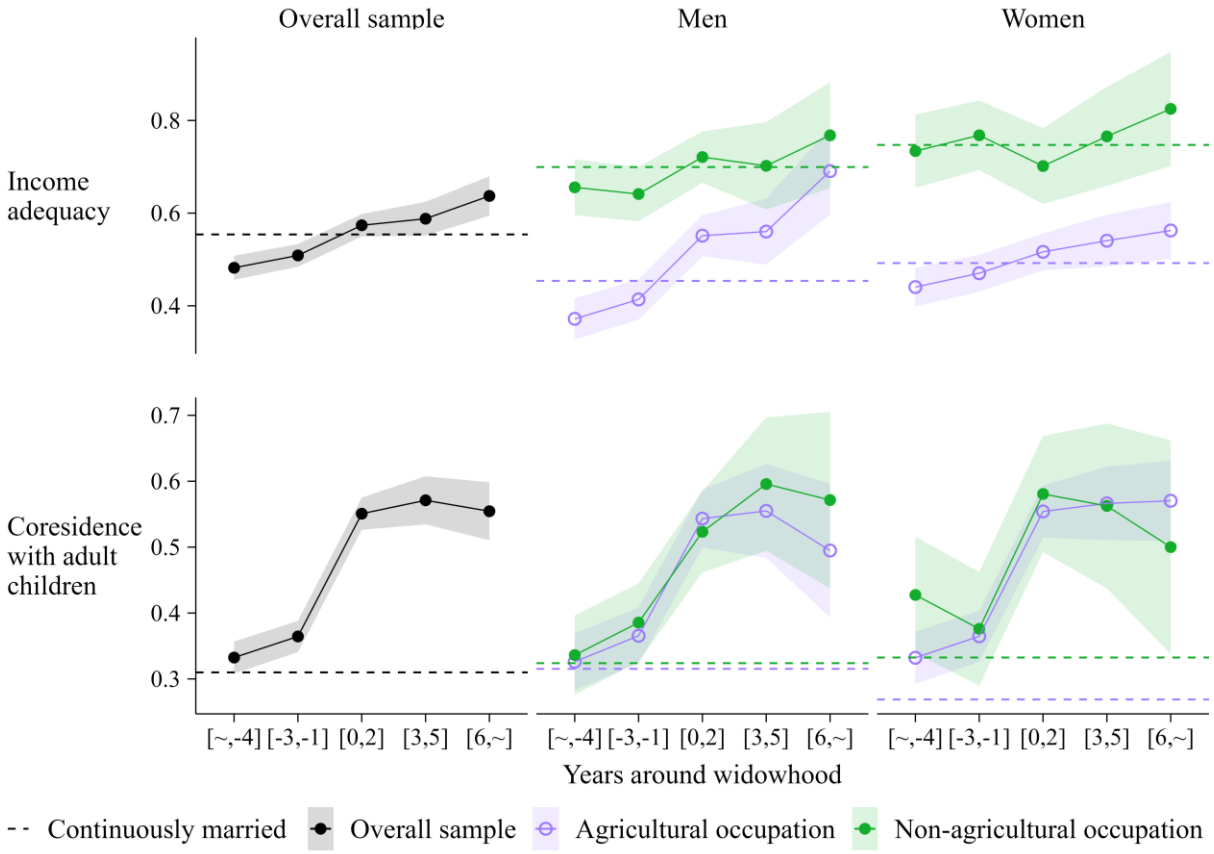

Figure 4-1 Proportions of income adequacy and coresidence with adult children by years around widowhood

Notes: (1) Source: authors' calculations based on unweighted data from CLHLS 2002-2018. (2) Individuals mainly with economic inactive trajectories before age 60 were included in the overall sample but excluded from all the subgroups. (3) Dashed lines represent the proportions for the continuous married sample. (4) Ribbons represent the 95% confidence intervals.

Figure 4-1 shows that, while the rate of income adequacy is similar in both the continuously married and widowed samples (around 55%, see **Table A 4-1**, Appendix), the eventually widowed group experience an increase over time, from 48% over 4 years before widowhood to 57% within 2 years since widowhood, and 64% over 6 years post-widowhood. Women generally have slightly higher rates of income adequacy than men, but significant disparities exist between previously agricultural and non-agricultural groups. The increase in income adequacy is more pronounced for men and those primarily engaged in agricultural occupations.

For men, income inequality between different occupation groups decreases over the widowhood process.

The proportion of coresidence with adult children is higher among the widowed (45%, see **Table A 4-1**, Appendix) than the married (31%). It rises from 33% over 4 years before widowhood to 55% within 2 years since widowhood and remains stable thereafter. Trends in coresidence are consistent across all subgroups.

4.6.2 Changes in economic wellbeing over the widowhood process

Table 4-2 presents the results of linear regressions with individual fixed effects on changes in economic wellbeing over the widowhood process. Model O1 addresses the general effects of widowhood on economic wellbeing. It shows that the probability of income adequacy increases for surviving spouses. Compared to over 4 years before widowhood, the probability increases by 3.7% 1-3 years before widowhood. The greatest increase occurs by 7.2% within 2 years since widowhood, then slightly declines to 6.5% 3-5 years since widowhood. This effect gradually decreases and becames insignificant after 6 years since widowhood.

Table 4-2 Fixed-effects regression results on the likelihood of income adequacy, overall sample

Variables	O1	O2
Years around widowhood		
[~, -4]	—	—
[-3, -1]	0.037** (0.019)	0.026 (0.022)
[0, 2]	0.072*** (0.021)	0.028 (0.026)
[3, 5]	0.065** (0.028)	0.029 (0.036)
[6, ~]	0.045 (0.035)	-0.088** (0.044)
Coresidence with adult children		0.024* (0.014)
Years around × Coresidence		
[-3, -1] × Yes		0.025 (0.030)
[0, 2] × Yes		0.072** (0.031)
[3, 5] × Yes		0.053 (0.042)
[6, ~] × Yes		0.220*** (0.049)
Observations	17,540	17,540

Notes: (1) Source: authors' calculations based on unweighted data from CLHLS 2002–2018. (2) Coefficients and standard errors in parentheses are displayed. (3) *p<0.1, **p<0.05, ***p<0.01. (4) Covariates were controlled in the models.

Model O2 examines the moderation effect of coresidence with adult children. Coresidence slightly increases the probability of income adequacy by 2.4% over 4 years before widowhood.

For non-coresiding individuals, income adequacy remains stable initially but declines by 8.8% over 6 years since widowhood. Coresidence with adult children leads to a greater improvement in economic wellbeing during the widowhood process. This moderation effect is significant in the short run within 2 years since widowhood, with coresidence associated with a 7.2% enhancement in the increased likelihood of income adequacy. The effect is even more pronounced in the long run over 6 years since widowhood, with coresidence linked to a 22% enhancement in the estimated likelihood of income adequacy. Such a moderation effect of coresidence maintains an increase of income adequacy by 13.2% (22% - 8.8%) over 6 years since widowhood.

Table 4-3 presents the results of individual fixed-effects regressions on income adequacy for men and women. Models M1 and W1 reveal that probability of income adequacy increases over the widowhood process for men but remains unchanged for women. For men, the probability increases by 4.3% 1–3 years before widowhood, 13.1% within 2 years since widowhood, 11.8% 3–5 years since widowhood, and 17.5% over 6 years since widowhood. In contrast, women do not experience significant changes, though a slight decrease of 3.9% in the probability of income adequacy is observed over 6 years since widowhood.

Table 4-3 Fixed-effects regression results on the likelihood of income adequacy, by gender

Variables	Men		Women	
	M1	M2	W1	W2
Years around widowhood				
[~, -4]	—	—	—	—
[-3, -1]	0.043* (0.026)	0.035 (0.030)	0.029 (0.028)	0.015 (0.032)
[0, 2]	0.131*** (0.028)	0.105*** (0.035)	0.015 (0.032)	-0.051 (0.039)
[3, 5]	0.118*** (0.039)	0.112** (0.053)	0.020 (0.042)	-0.039 (0.051)
[6, ~]	0.175*** (0.055)	0.090 (0.069)	-0.039 (0.051)	-0.201*** (0.060)
Coresidence with adult children		0.027 (0.017)		0.017 (0.026)
Years around × Coresidence				
[-3, -1] × Yes		0.018 (0.042)		0.037 (0.044)
[0, 2] × Yes		0.038 (0.043)		0.116*** (0.045)
[3, 5] × Yes		-0.002 (0.063)		0.099* (0.057)
[6, ~] × Yes		0.143* (0.080)		0.275*** (0.063)
Observations	10,996	10,996	6,544	6,544

Notes: (1) Source: authors' calculations based on unweighted data from CLHLS 2002–2018. (2) Coefficients and standard errors in parentheses are displayed. (3) *p<0.1, **p<0.05, ***p<0.01. (4) Covariates were controlled in the models.

Models M2 and W2 highlight that the moderation effect of coresidence with adult children is more pronounced for women. For both genders, coresidence does not impact income adequacy over 4 years before widowhood. Among men, those not coresiding with children experience a 10.5% increase in income adequacy within 2 years since widowhood, 11.2% 3–5 years since widowhood, and 9% (though not significant) over 6 years since widowhood. Coresidence, however, leads to a 14.3% greater improvement in income adequacy for men in the long run over 6 years since widowhood. For women, without coresidence, income adequacy slightly decreases by 5.1% within 2 years since widowhood, 3.9% 3–5 years since widowhood, and significantly by 20.1% over 6 years since widowhood. In contrast, women who coreside with adult children experience consistent increases in income adequacy throughout the widowhood process: 5.2% (3.7% + 1.5%) 1–3 years before widowhood, 6.5% (11.6% - 5.1%) within 2 years since widowhood, 6% (9.9% - 3.9%) 3–5 years since widowhood, and 7.4% (27.5% - 20.1%) over 6 years since widowhood.

Table 4-4 Fixed-effects regression results on the likelihood of income adequacy:, by main occupation before age 60

Variables	Agricultural occupation		Non-agricultural occupation	
	A1	A2	N1	N2
Years around widowhood				
[~, -4]	—	—	—	—
[-3, -1]	0.040* (0.024)	0.017 (0.027)	0.032 (0.033)	0.072* (0.040)
[0, 2]	0.092*** (0.026)	0.041 (0.032)	0.050 (0.037)	0.045 (0.049)
[3, 5]	0.082** (0.036)	0.024 (0.046)	0.036 (0.046)	0.074 (0.059)
[6, ~]	0.067 (0.044)	-0.074 (0.055)	0.021 (0.060)	0.003 (0.075)
Coresidence with adult children		0.074*** (0.018)		-0.060*** (0.023)
Years around × Coresidence				
[-3, -1] × Yes		0.053 (0.037)		-0.097* (0.055)
[0, 2] × Yes		0.065* (0.038)		0.035 (0.059)
[3, 5] × Yes		0.073 (0.052)		-0.039 (0.074)
[6, ~] × Yes		0.211*** (0.059)		0.054 (0.095)
Observations	11,088	11,088	5,649	5,649

Notes: (1) Source: authors' calculations based on unweighted data from CLHLS 2002–2018. (2) Coefficients and standard errors in parentheses are displayed. (3) *p<0.1, **p<0.05, ***p<0.01. (4) Covariates were controlled in the models.

Table 4-4 presents the results of individual fixed-effects regressions on income adequacy by main occupation before age 60. Models A1 and N1 show that the probability of income

adequacy increases over the widowhood process among older adults primarily engaged in agricultural occupations in earlier adulthood, but remains unchanged among those mainly with non-agricultural occupations. For the agricultural group, the probability of income adequacy increases by 4% 1–3 years before widowhood, 9.2% within 2 years since widowhood, and 8.2% 3–5 years since widowhood. Such an increase is no longer significant after 6 years since widowhood.

Models A2 and N2 reveal different moderation effects of coresidence with adult children for the agricultural and non-agricultural groups, with the effect being stronger for the former. For the agricultural group, coresidence with adult children increases the probability of income adequacy by 7.4% over 4 years before widowhood. Without coresidence, their probability of income adequacy remains unchanged until over 6 years since widowhood, when a decrease of 7.4% is observed—though not statistically significant. Coresidence is linked to an enhancement of the estimated increase in probability of income adequacy, especially by 6.5% within 2 years since widowhood, and 21.1% over 6 years since widowhood. In contrast, for the non-agricultural group, coresidence decreases the probability of income adequacy by 6% over 4 years before widowhood. Without coresidence, non-agricultural older adults experience an increase in income adequacy of 7.2% 1–3 years before widowhood, but those coresiding with adult children experience a slight decrease of 2.5% (9.7% - 7.2%). However, the moderation effect of coresidence for the non-agricultural group is no longer significant since widowhood.

Table A 4-3 (Appendix) presents sensitivity analyses for respondents with inactive occupational backgrounds. No statistically significant changes in economic wellbeing are observed—similar to the non-agricultural group. However, six years or more after widowhood, coresidence significantly improves income adequacy, while non-coresidence is associated with a marked decline—paralleling the pattern seen among the agricultural group.

4.7 Conclusion & discussion

This study addresses three research questions: (1) How does economic wellbeing change over the widowhood process among Chinese older adults? (2) What is the role of coresidence with adult children in this process? (3) How does the effect of widowhood on economic wellbeing vary by gender and earlier occupation? Using data from the Chinese Longitudinal Healthy Longevity Survey (CLHLS), we conducted individual fixed-effects regressions to examine

changes in the probability of income adequacy before and after spousal death. We found that income adequacy generally improves throughout the widowhood process, with coresidence with adult children amplifying this effect. Additionally, gender and occupation differences were observed in the impacts of widowhood on income adequacy.

Our findings highlight the temporal nature of later-life widowhood and its accumulative consequences over time. We found an increase in the probability of income adequacy throughout the widowhood process among Chinese older adults, which contradicted our hypothesis (H1) that widowhood would lead to economic decline. This increase begins even before spousal death and persists in the long run. Unlike studies in developed industrial societies, where economic wellbeing typically declines after widowhood, the relief of caregiving burdens on the surviving spouse and family members in China may explain this improvement in our findings. Previous research has shown that the reduction in care responsibilities after spousal death, especially for long-term, stressful care, can improve the mental health of the surviving spouse (Keene & Prokos, 2008). Our results suggest that this "relief" model also applies to economic outcomes in contexts like China, where many older adults lack sufficient savings or pensions. This aligns with findings by Zhou et al. (2023), which indicate that married older adults in China are less likely to consider their financial resources adequate compared to their widowed counterparts.

Our findings also suggest the critical role of linked lives among family members in framing widowhood consequences for older adults. The results reveal that coresidence with adult children significantly enhanced the probability of income adequacy throughot the widowhood process, supporting our hypothesis (H2) that coresidence would mitigate the negative economic impacts of widowhood. This moderating effect is present throughout the widowhood process, which also helps explain the observed economic improvement even before spousal death. This pre-widowhood increase aligns with research by Zimmer and Korinek (2010), who noted that Chinese older adults often coreside with their adult children for care and financial security in their final years. Coresidence becomes even more crucial in the long run since spousal death—those who coreside continue to see improvements, while those who do not experience a decline in the probability of income adequacy. These findings underscore the vital role of family support, particularly from adult children, in older adults' economic wellbeing over the widowhood process. Such a protective model of linked lives between older adults and younger generations is especially relevant in familistic welfare contexts like China, where eldercare and

economic stability are primarily family responsibilities. The economic improvement we observed may thus reflect a proactive, familistic strategy—coresidence—to secure older adults' economic wellbeing.

We found significant gender heterogeneity. Men show a consistent increase in economic wellbeing throughout the widowhood process, with the benefits becoming more pronounced over time. In contrast, women do not experience this increase, and their economic wellbeing declines in the long run. This aligns with Western research indicating that women tend to face greater financial losses during widowhood, while men often face fewer losses or even benefit economically (Bernard & Li, 2006; Streeter, 2020). Additionally, the protective function of linked lives among family members is more crucial for older women than for older men. Among women, coresidence with adult children is the key to the observed economic improvement, while non-coresidence leads to a long-run decline following widowhood. Contrarily, coresidence does not significantly moderate the economic effects of widowhood for men. This echoes previous findings that older Chinese women are more financially dependent on their adult children than men (X. Lei et al., 2015). These gender differences reflect the traditional male-breadwinner model where women are often economically dependent on their husbands (Holden & Smock, 1991). Following widowhood, older men may see improved economic wellbeing as they no longer support a spouse, whereas older women often face declines after losing a spouse who financially provides for them unless they coreside with others, i.e., adult children.

Our results also highlight occupation-based differences in the impact of widowhood on economic wellbeing. Older adults who have primarily agricultural backgrounds see improvements in economic wellbeing, while those with non-agricultural backgrounds show no significant change. This finding seems to contrast with prior research suggesting that non-agricultural older adults generally have more economic resources (Cai et al., 2012). However, our focus was on changes in economic wellbeing, not absolute levels. For households with a deceased agricultural older member, the economic strain may lessen, as these individuals often lack substantial income from pensions or savings. Conversely, the loss of a non-agricultural older adult may not relieve economic pressure due to their likely contributions from personal financial resources. The protective function of linked lives among family members—the moderation effect of coresidence with adult children—also varies by early-life occupation. For previously agricultural older adults, economic improvement is closely tied to coresiding with

adult children. In contrast, for non-agricultural older adults, coresidence with adult children is linked to a decrease in economic wellbeing, aligning with prior findings that rural and agricultural older adults are more dependent on their children's economic support, whereas urban, non-agricultural older adults may financially support their adult children (Park et al., 2012).

Our findings offer two key implications for social and policy practice in China. First, greater public support is needed, especially a shift from a family-centered eldercare model to a more integrated family-public scheme for the future older populations. Although our results suggest that coresidence with adult children mitigates the economic insecurity across the widowhood process, this familistic approach is increasingly unsustainable in China due to rapid population aging, declining fertility, and increased geographic separations driven by internal migration of younger generations (Peng, 2021). Second, structural inequalities call for targeted policy interventions, with particular attention to more vulnerable groups such as women and those with agricultural occupation backgrounds.

There are two main methodological limitations of this study. The first is the potential sample bias, as our sample may include older adults who are generally wealthier than the average in China. This is due to the longitudinal selection of individuals over 65 years old who were still in their first marriage at their initial participation in the CLHLS survey. This bias was compounded by selecting those who participated in two or more waves, thereby excluding individuals who were previously widowed or left the survey due to death or health issues—typically from lower socioeconomic backgrounds. However, our study focuses on changes in economic wellbeing over the widowhood process, not on comparing economic levels between widowed and married individuals, making it essential to observe the widowhood process. Additionally, our analysis of occupation heterogeneity offers insights into socioeconomic diversity in China. Future research could employ innovative quantitative methods to explore the heterogeneity among continuously married, continuously widowed, and eventually widowed individuals (e.g., Van Winkle & Leopold, 2022).

The second limitation concerns the measurement of older adults' economic wellbeing. We assessed income adequacy by comparing per capita household income to the local per capita disposable income, enabling comparisons across regions and over time. However, this approach may introduce three potential biases. First, per capita household income assumes equal income sharing within households, which may overestimate the economic resources

available to older adults—especially women (Frémeaux & Leturcq, 2020). This limitation is based on the CLHLS data, which only reports income at the household level, preventing analysis of intra-household income distribution. Second, this measure does not account for equivalence in household size and composition, thereby overlooking how these factors influence living costs and economic benefits captured by income (Gustafsson & Sai, 2020). Third, using the mean (per capita) rather than the median local income may misrepresent typical income levels in areas with high inequality, where a small number of households hold most of the income (Ravallion & Chen, 2019). Unfortunately, official statistics report only the per capita disposable income at the local level, with no median values available. Accordingly, we used the per capita household income so that the measurements at both levels are consistent for comparisons. Despite these possible biases, our income measure provides a useful proxy for assessing the economic resources potentially accessible to older adults, especially in a context where they rely financially on adult children—blurring the boundary between individual and household levels of economic resources.

4.8 Appendices

Table A 4-1 Sample characteristics

Variables	Overall sample	Continuously married	Eventually widowed
Income adequacy	9,637 (54.9%)	6,467 (55.4%)	3,170 (54.0%)
Coresidence with adult children	6,250 (35.6%)	3,618 (31.0%)	2,632 (44.9%)
Marital status			
Married	14,726 (84.0%)	11,674 (100.0%)	3,052 (52.0%)
Widowed	2,814 (16.0%)	0 (0.0%)	2,814 (48.0%)
Years around widowhood			
[~, -4]	13,118 (74.8%)	11,674 (100.0%) [3]	1,444 (24.6%)
[-3, -1]	1,608 (9.2%)		1,608 (27.4%)
[0, 2]	1,607 (9.2%)		1,607 (27.4%)
[3, 5]	711 (4.1%)		711 (12.1%)
[6, ~]	496 (2.8%)		496 (8.5%)
Gender			
Men	10,996 (62.7%)	8,315 (71.2%)	2,681 (45.7%)
Women	6,544 (37.3%)	3,359 (28.8%)	3,185 (54.3%)
Main occupation before age 60			
Economic inactivity [4]	803 (4.6%)	394 (3.4%)	409 (7.0%)
Agricultural occupation	11,088 (63.2%)	7,019 (60.1%)	4,069 (69.4%)
Non-agricultural occupation	5,649 (32.2%)	4,261 (36.5%)	1,388 (23.7%)
Age			
65–74	6,752 (38.5%)	5,172 (44.3%)	1,580 (26.9%)
75–84	6,634 (37.8%)	4,322 (37.0%)	2,312 (39.4%)
85+	4,154 (23.7%)	2,180 (18.7%)	1,974 (33.7%)
Residence in urban areas	8,148 (46.5%)	5,522 (47.3%)	2,626 (44.8%)
Own housing	11,041 (62.9%)	7,918 (67.8%)	3,123 (53.2%)
With daily activity limitation problems	8,064 (46.0%)	4,853 (41.6%)	3,211 (54.7%)
Individual-wave observations	17,540	11,674	5,866
Individuals	5,441	3,794	1,647

Notes: (1) Source: authors' calculations based on unweighted data from CLHLS 2002–2018. (2) Frequencies and percentages in parentheses are shown. (3) Here this categorization "[~, -4]" for the continuously married is only applied to fixed-effects regressions. (4) This group "economic inactivity" is excluded when analyzing differences of widowhood effects by occupational backgrounds.

Figure A 4-1 Sample selection from CLHLS 2002–2018

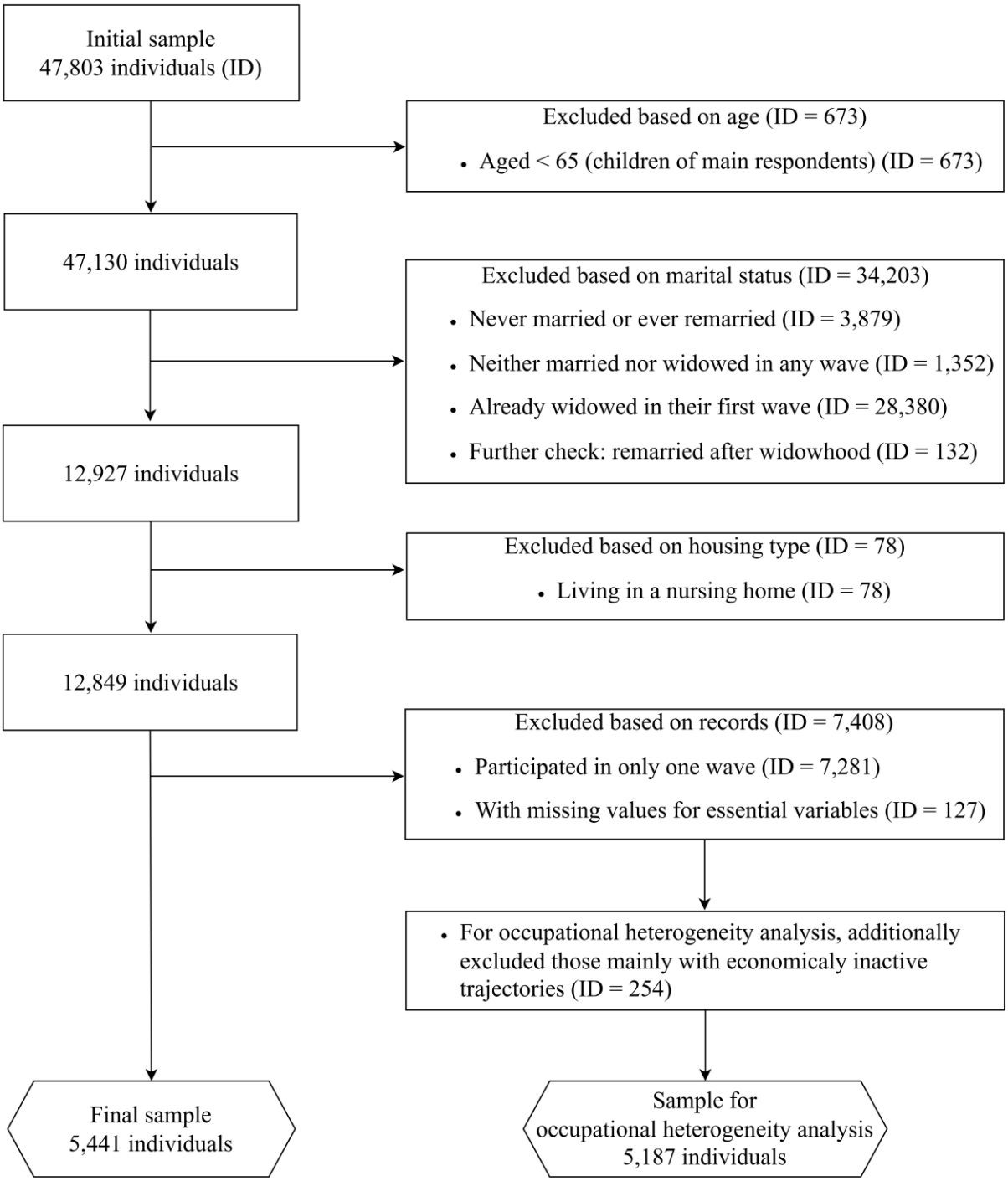

Table A 4-2 Sample characteristics, by main occupation before age 60

Variables	Economic inactivity	Agricultural occupation	Non-agricultural occupation
Income adequacy	395 (49.2%)	5,247 (47.3%)	3,995 (70.7%)
Coresidence with adult children	304 (37.9%)	3,926 (35.4%)	2,020 (35.8%)
Marital status			
Married	585 (72.9%)	9,128 (82.3%)	5,013 (88.7%)
Widowed	218 (27.1%)	1,960 (17.7%)	636 (11.3%)
Transition to widowhood			
Continuously married	394 (49.1%)	7,019 (63.3%)	4,261 (75.4%)
Eventually widowed	409 (50.9%)	4,069 (36.7%)	1,388 (24.6%)
Years around widowhood			
[~, -7]	421 (52.4%)	7,461 (67.3%)	4,435 (78.5%)
[-6, -4]	47 (5.9%)	563 (5.1%)	191 (3.4%)
[-3, -1]	117 (14.6%)	1,104 (10.0%)	387 (6.9%)
[0, 2]	118 (14.7%)	1,107 (10.0%)	382 (6.8%)
[3, 5]	53 (6.6%)	500 (4.5%)	158 (2.8%)
[6, ~]	47 (5.9%)	353 (3.2%)	96 (1.7%)
Gender			
Men	96 (12.0%)	6,519 (58.8%)	4,381 (77.6%)
Women	707 (88.0%)	4,569 (41.2%)	1,268 (22.4%)
Age			
65-74	249 (31.0%)	4,182 (37.7%)	2,321 (41.1%)
75-84	311 (38.7%)	4,200 (37.9%)	2,123 (37.6%)
85+	243 (30.3%)	2,706 (24.4%)	1,205 (21.3%)
Residence in urban areas	466 (58.0%)	3,369 (30.4%)	4,313 (76.3%)
Own housing	458 (57.0%)	6,666 (60.1%)	3,917 (69.3%)
With daily activity limitation problems	481 (59.9%)	5,277 (47.6%)	2,306 (40.8%)
Individual-wave observations	803	11,088	5,649
Individuals	254	3,392	1,795

Notes: (1) Source: authors' calculations based on unweighted data from CLHLS 2002–2018. (2) Frequencies and percentages in parentheses are shown.

Table A 4-3 Fixed-effects regression results on the likelihood of income adequacy, for individuals mainly in economical inactivity before age 60

Variables	E1	E2
Years around widowhood		
[~, -4]	—	—
[-3, -1]	0.015 (0.082)	-0.013 (0.087)
[0, 2]	-0.026 (0.098)	-0.097 (0.120)
[3, 5]	0.017 (0.132)	0.045 (0.152)
[6, ~]	-0.062 (0.156)	-0.379** (0.181)
Coresidence with adult children		-0.043 (0.070)
Years around widowhood × Coresidence		
[-3, -1] × Yes		0.101 (0.135)
[0, 2] × Yes		0.147 (0.128)
[3, 5] × Yes		-0.033 (0.166)
[6, ~] × Yes		0.524*** (0.167)
Observations	803	803

Notes: (1) Source: authors' calculations based on unweighted data from CLHLS 2002–2018. (2) Coefficients and standard errors in parentheses are displayed. (3) *p<0.1, **p<0.05, ***p<0.01. (4) Covariates were controlled in the models.

Chapter 5 Conclusion & Discussion

The main objective of this thesis was to investigate the relationship between family life course dynamics and wellbeing among older adults in China, considering structural differences by gender and socio-spatial position. Through three empirical essays, it examined different aspects of family dynamics across adulthood and their impact on various dimensions of wellbeing in later life. Together, these empirical studies provide a comprehensive understanding of how family institutions and socio-spatial structures shape individual life courses and wellbeing outcomes for men and women.

Building on the research gaps identified in Chapter 1, this thesis makes three key contributions to the family life course literature. First, by conceptualizing family life as a dynamic process, it highlights the significance of long-term trajectories over single time-point events. The three essays explored marital and parenting trajectories in early adulthood (Chapter 2), extended parenting roles in later life (grandchild caregiving in Chapter 3), and the widowhood process in old age (before and after spousal death in Chapter 4). The latter two chapters extend the themes introduced in Chapter 2, emphasizing how early family experiences—such as childbearing, which leads to the presence of adult children and grandchildren—shape later-life wellbeing through intergenerational relationships and social networks.

Second, this research provides empirical insights from a non-Western aging society. China's rapid aging transition and limited elder welfare system present unique challenges to securing and improving the wellbeing of older adults. The family life course of the current older generation—marked by stable marriage, universal childbearing, and common grandchild caregiving—offers an opportunity to analyze a nearly complete family trajectory from young to old adulthood. By incorporating an underrepresented context, this study enriches life course and aging research.

Third, the findings reveal significant variations in how family dynamics affect older adults' wellbeing across gender and socio-spatial positions marked by rural/urban and agricultural/non-agricultural differences. These heterogeneities highlight the need for context-specific research and policies to promote the wellbeing of older adults, especially in less developed regions.

In this concluding chapter, I first summarize the key findings of the three empirical studies and then situate them within the life course framework, comparing them with previous research in both Chinese and international contexts. Based on my findings, I also reflect the social and policy practices for older adults' wellbeing in China. Finally, I discuss the main limitations of my studies and suggest directions for future research.

5.1 Summary of key findings

5.1.1 Health disparities across work-family trajectories

Chapter 2 examined how combined work, marriage, and childbearing trajectories from earlier adulthood (ages 16–50) influence health in later life (ages 51–80) among individuals born between 1935 and 1964 in China. Using an empirical typology of work-family trajectories with sequence-cluster analysis and multivariate linear regressions, I assessed how variations in duration, timing, and sequencing of combined work-family roles impact chronic disease prevalence and depressive scores for older men and women.

The findings highlight significant health disparities linked to work-family life course patterns. On the positive side, individuals who followed traditional family trajectories (stable marriage with childbearing) combined with jobs in non-agricultural occupations—either consistently or after transitioning from agricultural occupations—have lower depressive scores. Meanwhile, those who remained childless had the lowest prevalence of chronic diseases. On the negative side, pathways involving high fertility alongside long-term agricultural work, as well as economic inactivity in midlife, are associated with higher depressive scores and increased chronic conditions. These health disparities are more pronounced among women than men.

5.1.2 Increased social participation while caring for grandchildren

Chapter 3 explored how grandchild caregiving affects non-family-based social participation among individuals aged 50–80 with grandchildren under 16. Using fixed-effects regressions, I analyzed how transitions from non-caregiving to various grandchild caregiving roles (differentiated by care hours and coresidence) influence the likelihood of frequent social participation. I also examined variations by gender and rural/urban residence.

The results indicate that grandchild caregiving generally enhances social participation. Compared to non-caregivers, grandparents who provide care to their grandchildren—

regardless of care hours or coresidence—are more likely to frequently engage in social activities. The effect is strongest for those in skipped-generation households, where grandparents coreside with grandchildren without the parents. Urban grandmothers experience the greatest increase in social participation while caregiving.

5.1.3 Improved economic wellbeing over the widowhood process

Chapter 4 analyzed changes in economic wellbeing around widowhood among Chinese adults aged 65 and older. Using fixed-effects regressions, I examined shifts in the likelihood of having adequate household income before and after spousal death, considering the moderating role of coresidence with adult children and variations by gender and agricultural/non-agricultural occupational background.

Surprisingly, economic wellbeing tends to improve during widowhood. The likelihood of having adequate household income increases before spousal death, peaking within two years of widowhood, and gradually declining after six years. Coresidence with adult children plays a key role in sustaining income adequacy, particularly in the long term. However, gender differences are stark: men experience a steady rise in income adequacy regardless of coresidence with adult children, while women benefit only if they coresid with adult children. Occupational background also matters—those mainly with agricultural occupations or economic inactivity in earlier adulthood show economic improvements, particularly when coresiding with adult children, whereas individuals from non-agricultural backgrounds exhibit little improvement and, in some periods, decline in income adequacy when coresiding with their adult children.

5.2 Discussion and reflection: insights into the life course framework

This section reflects findings from the three empirical chapters to previous research, highlighting key aspects of the life course framework introduced in Chapter 1.

5.2.1 Temporality of family dynamics

Chapter 2 underscores the role of temporality in family dynamics over the life course and wellbeing outcomes. The first aspect of temporality is the duration of family roles and their accumulative effects on wellbeing. Long-term engagement in traditional family roles—stable marriage with childbearing—is generally linked to better health, while long-term non-

traditional family roles, such as childlessness and non-marital parenthood, correlate with poorer outcomes. This aligns with previous research in both Western and Chinese contexts (L.-C. Hu, 2021; Lacey et al., 2016; H. Yang et al., 2020). However, an exception emerges: lifelong childlessness is associated with the best physical health outcomes in old age, with the lowest prevalence of chronic diseases among all work-family trajectories. While underexplored by previous studies, this suggests that the lack of childbearing-related stress may offer long-term physical health benefits. Nevertheless, as indicated by this study and previous research, childless individuals suffer lasting disadvantages in mental health, possibly exerted by traditional family norms and social stigma against those failing to fulfill their parenthood roles (Tanaka & Johnson, 2016).

The timing of family role transitions also matters. In Chapter 2, the only group of trajectories characterized by early family formation (marriage with first childbirth around age 20, and with three or more children around age 25) is linked to worse later-life health, particularly for women. While this is partly due to intensive childbearing, early transition to parenthood contributes to adverse wellbeing. This is consistent with findings from Western societies, where transition to parenthood around age 20 or earlier usually disrupts education and employment and causes long-term socioeconomic stress and health problems (Driscoll, 2014; Furstenberg, 2005; Lacey et al., 2017; Rözer et al., 2017). While family formation among Chinese older adults has generally occurred earlier than in Western contexts (Djundeva et al., 2019), my findings indicate that even earlier transitions appear to exacerbate health disadvantages.

5.2.2 Linked lives among family members

Chapter 3 highlights how individual wellbeing is shaped by family interactions. Findings suggest that grandchild caregiving enhances Chinese grandparents' social participation regardless of care intensity differentiated by care hours and coresidence. This counters the competition effect observed in the US and European countries, where intensive grandchild caregiving reduces social engagement (Arpino & Bordone, 2017; Bulanda & Jendrek, 2016). Instead, I found that for Chinese grandparents, custodial grandchild caregiving—coresiding with grandchildren, yet without parents—is associated with the highest likelihood of frequent participation in social activities beyond family interactions. This divergence likely reflects contextual differences. In China, older adults generally have low levels of non-family-based social participation (Xiong & Wiśniowski, 2018), so grandchild caregiving may serve as a gateway to greater social engagement. In contrast, in Western contexts, where older adults are

already more socially active and less involved in intensive caregiving for their grandchildren, increased childcare responsibilities can be stressful and squeeze social participation.

5.2.3 Integrating temporality and linked lives

Chapter 4 integrates the perspectives of temporality and linked lives by examining economic wellbeing before and after widowhood, and the moderating role of coresidence with adult children. Unlike Western studies that often report financial decline following widowhood (e.g., Kapelle & Van Winkle, 2024; Streeter, 2020), my findings suggest that Chinese older adults experience an overall improvement in economic wellbeing during the widowhood process. I argue that this trend is primarily due to two factors: (1) generally precarious economic conditions before widowhood among Chinese older adults and (2) the transition to coresidence with adult children, which provides financial and care support for the surviving spouse (Zhou et al., 2023; Zimmer & Korinek, 2010). While economic wellbeing tends to improve in the short term since widowhood, the disparities between those who coreside with adult children and those who do not widen over time. This underscores the critical role of family ties in securing economic wellbeing in later life, particularly among vulnerable populations such as older women in a family-centered eldercare system.

5.2.4 Structural heterogeneity

Structural heterogeneity by gender and socio-spatial position has been addressed in all three empirical chapters.

In terms of gender, compared to men, women's life courses are more closely tied to family roles, making their wellbeing more sensitive to family dynamics. In Chapter 2, we saw that women experience stronger health effects from work-family trajectories, like evidence from Western contexts (Machů et al., 2022). Particularly, high fertility at a young age (three or more children by age 25) is linked to worse physical and mental health, while lifelong childlessness is associated with better physical health—both effects being more pronounced for women. These findings highlight the disproportionate toll of childbearing on women (Glauber, 2018; Lacey et al., 2017). In Chapter 3, findings suggest that women benefit more from grandchild caregiving in terms of social participation, contrary to findings from Europe, where men tend to benefit more (Arpino & Bordone, 2017). This may be due to Chinese grandmothers' stronger caregiving involvement and weaker labor market attachment, making caregiving a key medium of social interaction beyond the family sphere. In Chapter 4, the results indicate that changes

in economic wellbeing over the widowhood process are gendered. Men experience steady improvements regardless of whether they coreside with adult children, while women only benefit when coresiding. This suggests that gender disparities in economic security worsen during widowhood in the absence of family support, consistent with Western studies (Bernard & Li, 2006; Zissimopoulos et al., 2015).

Regarding socio-spatial heterogeneity, compared to backgrounds of urban residence and non-agricultural occupations, life courses with rural and agricultural experiences are linked to greater wellbeing disadvantages over time. Chapter 2 has shown that the intersection of family roles and occupation type plays a crucial role in health disparities. Agricultural workers and economically inactive individuals experience worse health outcomes in old age than those in non-agricultural sectors, reflecting the rural-urban inequalities documented in China (F. Chen & Liu, 2012; N. Zhang et al., 2021). These findings also highlight the need to consider occupation types rather than broadly categorizing individuals as employed or not—a distinction often overlooked in previous studies (Machů et al., 2022). Chapter 3 reported that rural grandparents benefit less from grandchild caregiving regarding in social participation compared to urban grandparents, likely due to limited access to formal and community-based social activities in rural areas where infrastructure for social activities is less developed. This echoes previous research on health stratification between rural and older adults caring for their grandchildren (F. Chen & Liu, 2012; H. Xu, 2019). In Chapter 4, findings suggest that older adults with agricultural backgrounds experience greater economic improvement after widowhood compared to those with non-agricultural backgrounds. However, this does not imply a disadvantage for non-agricultural older adults. Rather, it reflects their greater financial independence—urban and non-agricultural older adults are more likely to provide financial support to their adult children (Park et al., 2012). In contrast, for rural and agricultural older adults, coresidence with adult children is essential for economic security, given limited individual economic resources and public social welfare support (Cai et al., 2012; Shen et al., 2020).

5.3 Reflections on social and policy practices

Current demographic dynamics in China, characterized by rapid population aging, declining fertility, and increased internal migration of young populations, call for a transition from a family-centered eldercare system to a more integrated family-public scheme. The findings from

this thesis have highlighted how the wellbeing of older adults in China is closely related to their family life course. However, traditional family structures, which have always been providing primary support for older adults, are becoming less sustainable due to fewer children, and spatial separation caused by internal migration especially from rural to urban areas. With this demographic background, the empirical results from this thesis suggest the urgency of reconsidering the financial and caregiving responsibilities for eldercare in society for the future. Although family members, especially adult children, continue to contribute the most, public support—such as pension systems, community-based services, and long-term care programs—must be expanded to fill the gaps left by undermining family-based support. Beyond financial and healthcare support, accessible and aging-inclusive social engagement facilities for older adults also need to be strengthened to promote the quality of life among older adults. Additionally, changing narratives upon aging from a care burden to a contribution (such as caregiving and labor market participation) will enhance societal attention and policy engagement for older adults' wellbeing.

Structural inequalities further demand targeted policy interventions. Despite marginal benefit of social participation from grandchild caregiving, women experience greater health and economic disadvantages from their family roles in later life due to compounded caregiving burdens and weaker attachment to the labor market compared to men. Similarly, older adults from rural and agricultural backgrounds suffer from worse health and economic conditions and limited social engagement, particularly when lacking family support. These inequalities can be mitigated by improving public pension schemes and fostering sustainable long-term care insurance. Gender-sensitive policies need to improve women's economic security including their employment protections and pension benefits against economic penalties due to family caregiving. Meanwhile, these social security benefits and community-based care facilities should be expanded to ensure that older adults, particularly those in rural areas, have access to necessary financial help and healthcare regardless of family circumstances. Moreover, policies should try to improve the socioeconomic infrastructure in rural areas, facilitating more accessible and inclusive community engagement schemes that meet rural older adults' social needs.

5.4 Limitations and directions for future research

This section discusses three main limitations regarding conceptual and theoretical perspectives and methodological designs in all three empirical chapters, apart from other limitations that were specifically discussed in each empirical chapter.

The first limitation is potential selection bias in examining the relationship between family life course dynamics and older adults' wellbeing. While the findings suggest strong associations, the reverse effect—where individual wellbeing shapes family dynamics—cannot be ruled out. For instance, are healthier individuals more likely to have stable marriages and children? Are socially engaged older adults more likely to provide grandchild care? Does the increased economic wellbeing during widowhood result from an already advantaged sample? Additionally, survival bias may distort results, as individuals with poorer wellbeing are less likely to reach old age, which usually contributes to sample attrition in longitudinal surveys. Despite these concerns, this research mitigated bias by using longitudinal life course approaches and adjusting statistical models for key confounders. This included controlling for childhood health and socioeconomic background (Chapter 2) and using fixed-effects regression models to track wellbeing changes over time (Chapters 3 and 4). Future research should further strengthen causal analysis, by exploring how health and socioeconomic trajectories shape family life courses (Arpino et al., 2018), controlling for pre-grandparenting wellbeing when assessing grandchild caregiving effects, and comparing different groups of marital trajectories when checking widowhood effects (e.g., continuously married vs. eventually widowed, see Van Winkle & Leopold, 2022).

The second limitation is the underrepresentation of non-traditional/non-typical family dynamics. These include cohabitation, divorce, repartnering, lifelong childlessness, and non-marital childbearing. Although some were addressed (i.e., childlessness and non-marital childbearing in Chapter 2), they were not fully explored due to their low prevalence among Chinese older adults and small sample sizes. To some extent, this offered me an opportunity to focus on wellbeing outcomes of a nearly complete traditional family life course from early to older adulthood in China. However, younger generations in China are experiencing delayed marriage and higher rates of cohabitation, singlehood, voluntary childlessness, divorce and repartnering (Djundeva et al., 2019; J. Yu & Xie, 2021). Though less progressive compared to Western countries with the dominant expectation of marriage with one child, such shifts will lead to more complex family life courses in China (Van Winkle, 2018; Van Winkle & Wen,

2023). Future research should capture evolving family dynamics and examine how these changes impact wellbeing, particularly in non-Western contexts like China, where such research remains limited.

The third limitation lies in the narrow perspective on linked lives. This thesis primarily addressed direct aspects of linked lives among family members in the life course, i.e., marital formation and dissolution, childbearing, grandchild caregiving, and coresidence with adult children. However, indirect mechanisms of linked lives also shape wellbeing, such as age and socioeconomic differences between spouses (Gumà & Spijker, 2021) and differences between sons and daughters in intergenerational support (L. Lei et al., 2023; Y. Zhang & Harper, 2022). The directions of intergenerational support also matter. For example, while rural Chinese older adults typically receive net financial transfers from adult children, their urban counterparts (like those in Western countries) often provide net financial support to their adult children, potentially affecting their economic and mental wellbeing (Albertini et al., 2007; Park et al., 2012). Additionally, older adults may experience economic and psychological stress due to their children's marital transitions (D. Chen & Tong, 2021; Tosi & Albertini, 2019). Future studies should adopt a broader perspective of linked lives, considering characteristics of family members and how older adults both give and receive support through intergenerational relationships. Expanding the scope of linked lives will provide a more comprehensive understanding of how family dynamics shape wellbeing in later life.

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