Living alone and subjective well-being among the young and middle-aged in China

Abstract

Over the past decades, China has been experiencing a significant increase in the number and proportion of young and middle-aged people living alone (one-person households). Living alone is becoming a noticeable living arrangement in China, a country traditionally characterized by the prevalence of extended families and marriage. However, the understanding of how it relates to one's subjective well-being, particularly for the young and middle-aged, is limited. To address this gap, our study used six waves of cross-sectional data from the Chinese General Social Survey (2010, 2012, 2013, 2015, 2017, and 2018) to explore how living alone shapes subjective well-being (i.e., self-rated happiness) among the young and middle-aged (20-59). It also explores how gender, marital status, and education levels moderate this relationship. The findings reveal that living alone is negatively correlated with happiness. Furthermore, moderation analysis shows that the negative correlation is stronger among men (vs. women), never-married men of rural and urban origin (vs. their married counterparts), and college-educated men of rural origin (vs. their primary-educated counterparts). However, compared to married women, living alone is associated with an increase in happiness for unmarried women of urban origin and even significantly boosts happiness for divorced women of urban origin. This study offers valuable insights for developing policies aimed at improving the well-being of the expanding group of individuals living alone in China.

Keywords: living alone, happiness, young and middle-aged, CGSS, gender differences

Introduction

One-person households are becoming increasingly common in many countries across the world. Until the 19th century, the share of one-person households among all households was below 10%, and then growth started in the 20th century, accelerating in the 1960s (Ortiz-Ospina, 2020). Data show that people in developed countries are more likely to live alone. For example, in 2018, the percentage of one-person households among all households in Northern Europe was over 40%, while it was only below 9% in South Asia (Ortiz-Ospina, 2020).

People of different ages find themselves living alone for various reasons, with their solitary living status being either temporary or permanent. For example, older adults often live alone permanently due to the departure of their children from the parental home or the death of their spouse (Djundeva et al., 2019; Esteve et al., 2020). Young people, however, often opt for living alone temporarily when seeking educational or professional opportunities away from home, a lifestyle choice particularly common before marriage and cohabitation (Cheung and Yeung, 2015; Xiao and Liu, 2023). In comparison, middle-aged individuals' living alone is more likely derived from divorce or other types of family dissolution. To date, a large body of research focuses on older adults living alone (Hsu and Chang, 2015; Chen, 2019; Matsuura and Ma, 2022). Although young and middle-aged individuals living alone have traditionally received less attention, there has recently been a notable uptick in focus on this group in both academic research and public discourse (Ho, 2015; Raymo, 2015; Xiao and Liu, 2023).

Since 1990, there has been a significant increase in the number and proportion of young and middle-aged individuals (ages 20-59) living alone in China. As shown in **Figure 1**, from 1990 to 2020, the number of young and middle-aged people living alone increased from 7.18 million to nearly 80 million, and the proportion of those living

alone as a share of all population increased from 1.6% to 10.6% (PCOSC, 2022; Xiao and Liu, 2023). In addition, in 2020, this group (aged 20-59) accounted for over 60% of all one-person households in China (PCOSC, 2022). This substantial demographic shift is attributed to a blend of factors, with internal population migration taking the lead, alongside influences from socio-economic and cultural shifts, as well as the dynamics of the housing market (Xiao and Liu, 2023). Despite the expansion of the young and middle-aged living alone, our understanding of this group remains relatively nascent. Considering their growing size, it is essential to explore how living alone is associated with their subjective well-being (Fritsch et al., 2023). This is the issue that the present article aims to address.

(Figure 1 is about here)

Existing research indicates that the relationship between living alone and subjective well-being is complex and can be positive or negative (Ho, 2015; Raymo, 2015; Wen et al., 2019; Matsuura and Ma, 2022). It varies across different groups, such as gender (male or female), age (e.g., older adults or young people), marital status (e.g., married or not), and cultural background (e.g., European or East Asian). It is also influenced by the reference group (e.g., living alone vs. living with children or a spouse). Although living alone offers advantages such as freedom, autonomy, and personal space, it poses challenges, including reduced social interactions, increased isolation, and financial stress. Personal preferences towards living alone also play a crucial role (Chen, 2019). These factors together shape the links between living alone and individuals' well-being. We will discuss this further in the literature review section.

Research also demonstrates that some variables, such as gender, education levels, and attitudes toward marriage, moderate the relationship between living alone and subjective well-being (Ho, 2015; Raymo, 2015; Matsuura and Ma, 2022). In Japan and

China, the correlation between living alone and subjective well-being is less negative for older women than for their male counterparts (Matsuura and Ma, 2022). Among young adults aged 25-39, those who are married and cohabiting exhibit higher life satisfaction than their unmarried counterparts living alone, a correlation further reinforced by positive marriage attitudes (Ho, 2015). For young adults, the negative correlation between living alone while unmarried and happiness is mitigated among those with junior college or vocational school education, but it is intensified in the university-educated group (though not significantly) (Raymo, 2015). To conclude, the relationship between living alone and subjective well-being is not uniform and is shaped by various factors.

China provides an appealing context for analyzing the relationship between living alone and well-being among young and middle-aged adults. First, the substantial number of young and middle-aged individuals living alone in China, notably larger than other countries or regions, provides a solid foundation for analysis. Second, the motivations for living alone in China are often driven more by livelihood needs than the pursuit of freedom (differ from those in developed countries) (Ronald, 2017; Xiao and Liu, 2023), which might lead to varying correlations with their well-being. Third, China continues to uphold a culture of universal marriage (Yeung and Hu, 2016) and maintains a relatively low incidence of non-marital cohabitation, which has experienced a slight increase in recent years (Xie, 2013). Therefore, unmarried (or single) adults often experience strong pressure to marry. Fourth, family formation is closely related to educational background in Chinese culture because education largely signifies a person's social class, which further determines their mating choice and lifestyle (Xie et al., 2003). Meanwhile, obtaining higher education is a crucial goal for a person and their family (often viewed as the most important path to climbing the

social ladder) (Kong, 2015). This results in higher expectations for those with higher education, and the gap between expectations and reality likely influences people's well-being. The unique aspects mentioned above in Chinese culture makes the examinations of the relationship between living alone and subjective well-being compelling. In the Chinese context section, we will discuss these cultural characteristics in more depth.

Literature review

Measuring Subjective Well-Being

The notion of "well-being" is pivotal across different strata of society, encompassing the individual, communal, and broader societal levels. This paper focuses on individual well-being, which pertains to the person's subjective experience of their overall quality of life.

Well-being measures are generally classified into two broad categories: objective and subjective measures (Campbell, 1976). Objective well-being generally refers to *material well-being*, and it can be measured by income, residence, education, social and natural environment, safety, and so on (Alatartseva and Barysheva, 2015). Since 1973, psychologists and sociologists have increasingly used terminologies such as happiness and life satisfaction to describe subjective well-being (Diener, 1984), which generally refers to *psychological well-being*. Subsequently, many indicators were employed to measure and analyze subjective well-being. Dolan et al. (2011) categorize them into three categories: (1) evaluative well-being (involves *global* assessments, e.g., happiness or life satisfaction), (2) experience well-being, which focuses on assessing short-term emotional states, such as depression frequency over the past four weeks, and (3) 'eudemonic' well-being (reports of purpose and meaning, and worthwhile things in life).

In this study, we choose to focus on subjective well-being rather than objective well-being. Generally, subjective well-being is determined by objective well-being, but

conceptually, subjective well-being is not limited to its objective counterpart (Alatartseva and Barysheva, 2015). For example, someone living alone might have a good income and education but still feel unhappy. More importantly, subjective well-being is a personal feeling that depends on the gap between expectations and reality (Veenhoven, 1991). Finally, measuring subjective well-being can provide policymakers with insights into which policies should be prioritized to improve the public's subjective well-being.

In this study, we use self-rated happiness as the primary measure of subjective well-being, which has been widely used in recent research (Raymo, 2015; Chen, 2019; Wen et al., 2019; Matsuura and Ma, 2022).

Living Alone and Subjective Well-Being

Living alone can be positively or negatively associated with subjective well-being. Research indicates that living alone brings personal space, autonomy, freedom, and self-reliance, all of which result in better subjective well-being. For example, Hughes and Gove (1981) found that, compared to their counterparts living with others, unmarried individuals living alone experience comparable or even better mental health, according to certain indicators. Klinenberg (2012) found that people living alone enjoy better mental health and have more environmentally sustainable lifestyles. Ho (2015) noted that among young Koreans aged 25-39, unmarried people living alone had higher life satisfaction than people living with family.

Somewhat unexpectedly, these positive correlations also exist among older adults. Vasile et al. (2024) found that European older people living alone had a higher level of mental well-being, although their mental health changed with their social interactions. Matsuura and Ma (2022) found that Japanese women (65+) living alone are likely to have higher levels of happiness. In China, those aged 60-69 living alone have greater

happiness than those residing in skipped-generation households (Wen et al., 2019).

In contrast, other studies highlight the negative effects of living alone, such as financial stress, loneliness, and isolation, all of which are not good for mental health and overall well-being. Among older adults, Matsuura and Ma (2022) found that living alone is significantly negatively related to the happiness of Japanese men (65+). Similarly, in Wales, those aged over 65 living alone are more isolated and report greater feelings of emotional loneliness than those living with others (Evans et al., 2019). For young people, the negative effects of living alone are also observed. Raymo (2015) found that unmarried young Japanese adults (aged 20-39) living alone are unhappier than those who live with others. In Korea, Ho (2015) noted that unmarried young people (ages 25-39) living alone report lower life satisfaction than their married counterparts who live with family members.

In summary, we found that the relationship between living alone and subjective well-being is not uniform and may vary with various factors, including age group (young and older adults), gender, marital status, cultural context, reference groups, physical health, and so on.

Moderating Effects: Gender, Marriage, and Education

Gender

The link between living alone and subjective well-being may significantly differ by gender, as women and men tend to be different in social support and networking, avenues of emotional support, gender roles, housework, and so on. First, women are generally better at social support and networking than men (Flaherty and Richman, 1989; De Vaus and Qu, 2015). In addition, Vandervoort (2000) found that men typically rely on spouses or partners for emotional support, while women often turn to their female friends. In other words, living alone might cut off men's avenues for emotional

support, while its impact on women is relatively less. Considering social interaction skills and various avenues for emotional support, women are more likely to achieve better subjective well-being than men once living alone. Second, women's gender roles typically encourage them to express negative emotions (e.g., sadness and depression) compared to men's gender roles (Brody, 2000). Therefore, in the face of emotional challenges associated with living alone, women commonly demonstrate greater proficiency in obtaining external support to alleviate these adverse emotions compared to men. Lastly, men typically do less housework than women worldwide across almost all marital status and living arrangements (more importantly, the gender gap is widest among married couples) (South and Spitze, 1994; Treas and Drobnič, 2010). This implies that an increase in housework, resulting from the transition of living together to living alone, may have a negative impact on men's subjective well-being. Based on the three previous points, we hypothesize that the negative relationship between living alone and subjective well-being will be strengthened among men (or mitigated among women).

Marriage

The relationship between living alone and subjective well-being may differ by marital status. Ho (2015) found that never-married individuals living alone, with positive attitudes and expectations of marriage, have lower life satisfaction than married family co-residents. This negative relationship due to being unmarried tends to be stronger in societies that highly value marriage (such as in China). In addition, marriage is often regarded as a marker of prestige and personal achievement in some cultures (Cherlin, 2004; Ho, 2015). Consequently, it means living alone due to being unmarried might be significantly related to one's subjective well-being, especially in China where marriage is universal (Yeung and Hu, 2016).

Additionally, married people have richer emotional support than unmarried people (Ross et al., 1990; Waite, 1995). It means that married people, even living alone, are able to access rich emotional support from families via various resources (e.g., internet). Moreover, the emotional impact associated with living alone due to divorce may be related to whether the divorce was active or passive. Similarly, widowed persons may find them live alone passively, a circumstance that can harm their subjective well-being.

Education

In developing countries, the likelihood of gaining access to higher education is competitive and costly. First, the enrollment ratio in tertiary education in developing countries is relatively low. For example, in 2000, the gross enrollment ratio in tertiary education in East Asia and the Pacific was only 15.6%, while it was 71.4% in North America (Our World in Data, 2024a). Even though higher education has rapidly developed in East Asia and the Pacific in the last two decades (UNESCO, 2023), the gross enrollment rate in tertiary education in East Asia and the Pacific region in 2022 was still 24.8 percentage points lower than that in North America (59.4% vs. 84.2%) (Our World in Data, 2024a). Second, the costs of attending college in developing countries are relatively high. Except in low-income countries, governments account for the bulk of education spending; for example, households in low-income countries contributed to 38% of total education spending in 2018-2019, compared to only 16% in high-income countries (UNESCO, 2021). Therefore, based on these two points, obtaining a college degree in developing countries can be considered a form of "status symbol."

People with higher education are likely to exhibit higher expectations for their personal lives (Kristoffersen, 2018). Consequently, if the gap between expectations and reality becomes too large, it will inevitably affect individuals' subjective well-being. In

addition, Schieman and Plickert (2008) found that higher-educated people tend to have a stronger sense of control. In other words, if their living arrangements do not meet their expectations, it will influence their subjective well-being.

The Present Study

Based on the above elaborations, this study examines how living alone relates to subjective well-being (i.e., self-rated happiness), focusing on young and middle-aged adults. Meanwhile, it also explores how the relationship varies with gender, marital status, and education levels. Specifically, the paper aims to address the following three research questions.

Research question 1: The characteristics and changes of self-rated happiness among young and middle-aged Chinese people by living arrangements (living alone vs. living with others) from 2010 to 2018?

Research question 2: Is self-rated happiness positively, negatively, or not related to living alone among young and middle-aged Chinese people?

Research question 3: Does the relationship between self-rated happiness and living alone vary by gender, marital status, and education levels?

This research contributes to the existing literature in three ways. First, it shifts the research lens from older adults to young and middle-aged individuals, a group that has previously garnered less attention in studies on living arrangements and subjective well-being. Second, the study examines the relationships between living alone and happiness, an area that requires more focus, particularly in the context of developing nations such as China. Lastly, China's unique context of gender, marriage, and higher education differs significantly from that of developed countries, particularly when these factors are combined with the *Hukou* background. Therefore, this paper further deepens the understanding of the roles that gender, marital status, and education levels play in

the relationships between living alone and subjective well-being.

We employed data from the Chinese General Social Survey (2010-2018) to address the above questions. The paper is organized as follows: The next section provides an overview of the Chinese context. This is followed by a section that introduces the data, variables, and analytical strategies. The fifth section presents the analysis results for the overall samples and sub-samples, with further discussion on the findings in the subsequent section. The seventh section outlines the limitations of this paper, while the final section presents the conclusions.

The Chinese context

Marriage Culture: *hukou* and gender difference

In this section, we will introduce the fact that China remains a society where marriage is still universal and that Chinese men, especially those of rural origin, face greater pressure to marry.

China remains the only country in East Asia where marriage is nearly universal today (Yeung and Hu, 2016). Data shows that in China, by age 35-39, almost all women are married, with less than 5% of men remaining single (Ji and Yeung, 2014). In this context, marriage is considered an important milestone in life, and it is often associated with filial piety and conforming to social norms (Gui, 2023). As a result, young adults of marriageable age often experience strong pressure to marry, especially in rural areas where traditional culture is more pronounced than in urban areas; rural parents often regard their children's marriage as a crucial event in their lives (Zhang, 2005). Therefore, unmarried youths of rural origin experience greater pressure to marry than those of urban origin.

In addition, the skewed sex ratio at birth results in gender imbalance (far more men than women) in the marriage market, increasing the pressure on men to marry (Yang et

al., 2020; Wang et al., 2022). The normal sex ratio at birth should be around 105, but China's sex ratio at birth began to rise from 107.0 in 1979 (when the one-child policy was implemented), reached 117.8 in 2005, and then gradually declined to 111.8 (in 2021) (Our World in Data, 2024b). We used census data to illustrate the marriage squeeze on Chinese men in both absolute and relative values: in the 20-39 age group, men exceeded women by 15.34 million in 2000 (accounting for 4.7% of the men in this age group); by 2020, this excess decreased to 10.70 million, but the relative proportion increased to 7.6% (PCOSC, 2002, 2022). This means that from 2000 to 2020, a larger proportion of men was not able to find a spouse.

Furthermore, the "high" cost of marriage puts men of rural origin at a disadvantage compared to men of urban origin. Men are usually expected to buy housing for the newlyweds before marriage (Wrenn et al., 2019). Due to the high price of commercial housing, young people often need financial support from their parents to pay for it. At the same time, urban families are more affluent than rural ones (Xie and Zhou, 2014). Additionally, men from poorer areas (especially rural areas in the northwest region) need to pay a higher bride price to get married, which impoverishes their already low-income families (Jiang et al., 2015). As a result, compared to men of urban origin, men of rural origin are disadvantaged in the marriage market, making it more challenging for them to find a spouse.

The circumstances for women differ markedly. While men are primarily concerned with the possibility of remaining single, women are more focused on the quality of their marriage. Liu et al. (2013) found that marital quality significantly influences life satisfaction for Chinese women, whereas marital status plays a more crucial role in life satisfaction for Chinese men. Furthermore, a nuanced distinction exists between urban and rural women. Women of urban origin, often benefiting from a more inclusive social

environment, a wider range of career options, and greater financial independence (Qing, 2020), enjoy more autonomy and flexibility in their marital choices compared to their rural counterparts. Although, highly educated urban single women face parental pressure to marry (Gui, 2023), the higher prevalence of postponed marriages in urban areas (Gui, 2023) leads to a greater societal tolerance for marrying late than in rural areas, which in turn somewhat alleviates their pressure. In summary, we believe that rural women are more concerned about being labeled as the so-called "leftover women" compared to urban women.

Based on the above elaborations, from a comparative view, we expect that women of urban origin might experience the least pressure to marry, followed by women of rural origin, then men of urban origin, and men of rural origin.

Educational Expectations: *hukou* and gender difference

In this section, we delve into the Chinese higher education landscape, drawing attention to the fierce competition in college admissions, the great importance of a college degree to Chinese families, and the high cost of higher education. Further, we analyze how the experience differs for males of rural origin, males of urban origin, females of rural origin, and females of urban origin.

Access to colleges is very limited in China, especially before 2010. The Chinese college entrance exam (also known as *Gaokao*) involves intense competition (Liu and Wu, 2006). For example, the gross enrollment ratio in higher education was a mere 0.3% in 1949 and rose to only 3.4% by 1990 (MOE, 2020). Starting in 1999, when China expanded its higher education, the gross enrollment ratio of higher education rapidly increased: in 2010, the ratio exceeded one-quarter for the first time (26.5%) and further climbed to 59.6% in 2022 (MOE, 2020, 2023). This expansion, while impressive, has not diminished the value of higher education, which continues to be regarded as a

gateway to high-quality employment opportunities.

Attending college holds significant value for Chinese families and individuals, serving as a cornerstone for personal futures, a symbol of familial pride, or an indicator of social status and recognition (Kim, 2014; Liu et al., 2020). Higher education is often regarded as a route to secure jobs that offer both stability and a substantial income. Educational success is broadly recognized as a key means to ascend the social hierarchy (Kong, 2015). Consequently, aspirations regarding post-college life have also intensified.

The cost of college education in China is relatively high. Attending college requires tuition fees and living costs provided by parents, resulting in the loss of earning opportunities. Tuition fees are expensive for many families. For example, in 1998, the average college tuition fees accounted for 29.5% of the per capita GDP and 62.3% of the per capita disposable income, peaking in 2001 at 42.7% and 91.5%, respectively, and then gradually declining (Liu et al., 2021). Furthermore, for low-income families (especially in poor rural areas), investing resources in their children's education often means sacrificing potential earnings, particularly during times when wages for unskilled labor were rising rapidly (Mo et al., 2013). Supporting a college student is significantly costlier for rural families than for urban families (Liu et al., 2011). Therefore, the cost of attending college is more burdensome for rural families, which means that children from urban families have greater opportunities to attend college than those from rural families. For example, in 2002, the average college tuition fees accounted for 54.3% of the disposable income per capita in urban areas, compared to a staggering 162.0% in rural areas (Liu et al., 2021).

In addition, men have priority over women in education, especially in rural families. Census data show that, from 1990 to 2020, for individuals over the age of six,

the average years of education were consistently higher for males than for females (e.g., 7.4 vs. 5.5 in 1990, 9.7 vs. 9.2 in 2020) (PCOSC, 1993, 2022). The gender bias is more severe in rural areas than in urban areas. For instance, in rural families with both boys and girls, priority for attending school is often given to boys (Wang, 2005; Song et al., 2006), especially when resources are limited. In this context, when a boy is the only family member attending college or the family's only hope, he faces higher expectations for his future from both himself and his family.

In urban families, girls experience less gender bias, which results in them having not only better educational opportunities than rural girls but also opportunities that are often equal to those of urban boys (Tsui and Rich, 2002; Wang, 2005). This is due to better economic conditions and stronger concepts of gender equality in urban areas. In addition, the one-child policy was more strictly enforced in urban areas than rural areas (Hesketh et al., 2005), contributing to more equal educational opportunities for boys and girls in urban families (Tsui and Rich, 2002; Lee, 2012).

Research Hypothesis

Based on the above literature review and the Chinese context, we formulate the following hypotheses regarding the relationship between subjective well-being and living alone. **Hypothesis 1:** Living alone is negatively related to the happiness of young and middle-aged people in China. Additionally, the negative relationship varies according to gender, marital status, and education levels. **Hypothesis 2a:** The negative relationship between living alone and happiness is stronger for males than females. **Hypothesis 2b:** The negative relationship between living alone and happiness is stronger for the never-married group, particularly for never-married men. **Hypothesis 2c:** The negative relationship between living alone and happiness is stronger for college-educated men, particularly college-educated men of rural origin.

Data and methods

Data

We used the six waves of data from the Chinese General Social Survey (CGSS) collected in 2010, 2012, 2013, 2015, 2017, and 2018. CGSS was launched in 2003 and is the Chinese national representative cross-sectional survey[1]. The survey subjects are individuals aged 15 years and above. The survey collects data on various aspects of contemporary Chinese society, including demographic information, economic status, education levels, health, social interactions, social attitudes, and other related information. The data are ideal for studying the relationship between living arrangements and subjective well-being.

Considering that the variables are consistent throughout the study, we did not use CGSS data before 2010 (specifically, 2003, 2005, 2006, and 2008) and 2011. For example, in some years of CGSS surveys, there are missing variables: living arrangements (not available in 2003), self-rated health (not available in 2005 and 2006), and social interactions (not available in 2008). Additionally, there was an inconsistency in self-rated health variables between 2011 (including physical and mental health) and other years (including only physical health). Therefore, we don't include data pre-2010 and the data in 2011 into our analysis. Finally, because we focused on the young and middle-aged group, observations that are younger than 20 or older than 59 are excluded from the sample.

It is worth noting that respondents who were still at school at the time of the survey were excluded from the analytical sample. This exclusion is justified by the fact that the vast majority of Chinese college students reside in dormitories, a living arrangement

[1] For further information, please visit the website: http://cgss.ruc.edu.cn/English/Home.htm

that is atypical and does not align with the general population (Xu, 2023). Additionally, in China, the likelihood of college students entering into marriage prior to graduation is comparatively low, with marriage—and the associated expectations—usually taking place post-graduation (Huang, 2012). In addition, individuals with incomplete information on selected variables were excluded to ensure the analysis was based on complete cases. The final study sample consisted of 46,597 respondents, distributed across several years as follows: 8573 in 2010, 8091 in 2012, 7726 in 2013, 6893 in 2015, 7710 in 2017, and 7604 in 2018.

Variables

Dependent variables

Self-rated happiness. The mainstream literature has used the term "self-rated happiness" as a reflection of "a person's subjective well-being" (Chyi and Mao, 2012; Wen et al., 2019; Matsuura and Ma, 2022). Self-rated happiness is derived from respondents' subjective feelings in response to the survey question, "Overall, do you feel happy with your life?". As in Hsu and Chang (2015), we treated self-rated happiness as a dummy variable implying whether people feel happy, with "1" indicating "happy, including very happy and somewhat happy" and "0" indicating "non-happy, including very unhappy, somewhat unhappy, and neutral." When interpreting the results, it is important to keep in mind that people's perception of happiness may include not only cognitive evaluations of how good their lives are going but also the disparity between their emotional expectations of happiness and reality (Veenhoven, 1991).

Independent variables

Living arrangement. Living arrangement is a key independent variable in our research, determined by the question, "How many people currently live in the residence (including yourself)?" (in 2012, 2013, 2015, 2017, 2018). This question was not

included in the 2010 survey. Therefore, in 2010, the living arrangements were assessed based on whether the respondents lived with their family members. It is important to clarify that "living alone" means a household is occupied by only one person, whether an adult or a child. Thus, an adult residing with a child does not qualify as living alone. We coded "0" as "living with others, which refers to two or more people living together", and "1" as "living alone".

Moderator Variables

The moderator variables are gender (0 = female; 1 = male), marital status (1 = married, including cohabiting and married; 2 = never-married; 3 = divorced, including separated but not divorced and divorced; 4 = widowed), and education levels. To identify how the relationship between living alone and happiness changes across higher and lower levels of education, we created a three-category variable for education levels. We coded "primary and below" as "1", "secondary education" as "2", and "college and above" as "3".

We introduce the interaction between living arrangements and gender to test the hypothesis that the negative relationship between living alone and happiness is stronger among men than among women. In addition, we introduce the interaction terms between living arrangements and marital status, as well as between living arrangements and education levels. In addition, considering the different social expectations and demands for men and women in rural and urban societies, we discuss separately for males of rural origin, males of urban origin, females of rural origin, and females of urban origin, and similarly introduce the interaction of living arrangements with marital status and education levels.

Control variables

We controlled for potential confounders in the relationship between the living

arrangements and self-rated happiness. These include survey year, individual, socio-economic, social interactions, health, and regional characteristics.

Individual characteristics. Based on previous studies of living arrangements and subjective well-being, the following variables were controlled in the analysis: age group (1 = 20-29; 2 = 30-39; 3 = 40-49; 4 = 50-59), ethnicity (0 = ethnic minorities; 1 = Han Chinese), religious belief (0 = no, indicating no religious belief; 1 = yes, indicating at least one religious' belief), *hukou* (0 = rural *hukou*, refers to people of rural origin; 1 = urban *hukou*, refers to people of urban origin), sibship (0 = without siblings; 1 = with siblings), migration. Migration is determined based on the response to the survey question, "In which year did you move your household registration (*hukou*) to the local area?" (0 = non-migrant, refers to respondents who have had a local *hukou* since birth; 1 = migrant).

Socio-economic characteristics. Employment status (0 = unemployed; 1 = employed). Based on the research by Dommaraju (2015), homeownership is an important indicator of economic status. Homeowner type is determined based on the response to the survey question, "Who owns part or full of the property at your current residence (multiple selections allowed)?" (0 = non-homeowner, refer to the respondent and their spouse are not homeowners; 1 = homeowner, refer to the respondent or their spouse is a homeowner).

Social interaction characteristics. One reason for the negative societal perception of living alone is that it reflects an unhealthy social network and implies loneliness and isolation (De Vaus and Qu, 2015). Based on this, we controlled for the social frequency with friends and non-cohabitating relatives. Social interactions (1 = get together socially with relatives living elsewhere or with friends a few times a week or daily; 0 = get together socially with relatives living elsewhere or with friends a few times a month

or less frequently).

Health and regional characteristics. Physical health is also an important variable related to subjective well-being. Self-rated physical health (0 = unhealthy, including very unhealthy and somewhat unhealthy; 1 = healthy, including very healthy, somewhat healthy, and average).

Regional characteristics from 31 prefecture-level regions, including provinces, autonomous regions, and municipalities, are considered in all analyses. These regions comprise Inner Mongolia, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang, Shanxi, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei, Hunan, Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, and Hainan.

(Table 1 is about here)

Descriptive Statistics

Table 1 shows the descriptive statistics for the variables used in the analysis by living arrangements (**Research question 1**). In the second column of **Table 1**, the Chi-square test results indicate significant differences between the two groups (living alone vs. living with others) across almost all variables, with the exception of ethnicity and religious belief, which are not significant.

The proportion of people living alone who feel happy is lower than those living with others (62.8% vs. 75.8%). This indicates that people living with others (compared to those living alone) are more likely to rate their happiness as feeling happy. In addition, the proportion of people who feel happy has increased in both groups between 2010 and 2018 (**Figure 2**). Based on the results above, we aim to determine if the lower happiness levels among individuals living alone, compared to those living with others, persist after controlling for survey year, individual, socioeconomic, social interactions,

health, and regional characteristics.

(Figure 2 is about here)

Descriptive statistics present a different picture of individuals living alone compared to those living with others. For the moderating variables, compared to people living with others, those living alone are more likely to be males (54.9% vs. 46.9%), never-married (34.8% vs. 7.1%), divorced (13.1% vs. 2.1%), widowed (8.9% vs. 1.6%), college-educated (22.3% vs. 12.8%). This is consistent with our expectations that men and never-married groups are likely to live alone. In addition, those with college degrees are also more likely to live alone. This is mainly because, for individuals, living alone is costlier than cohabiting. As a result, individuals with a college degree, who have greater financial capability, are capable of living alone.

For the control variables, compared to people living with others, those living alone are more likely to have urban household registration (44.4% vs. 38.8%), with siblings (6.1% vs. 4.6%), migrants (41.4% vs. 30.3%), employed (76.2% vs. 73.7%), non-homeowners (50.4% vs. 35.7%), rate their health as unhealthy (16.0% vs. 12.6%). Research shows that from 1990 to 2010, over 40% of the increase in young and middle-aged adults living alone in China was attributable to migrants (Xiao and Liu, 2023).

(Figure 3 is about here)

The results of social interactions are worth noting (**Figure 3**). Among those living alone, the frequency of meeting friends or non-cohabitating relatives is higher than that of those living with others. In other words, young and middle-aged adults living alone are more socially active than those living with others. Compared to older adults, younger people often have more resources and opportunities—such as through work, study, and social activities—to establish and maintain social interactions outside the family even when they are living alone (Victor et al., 2000). Therefore, it is important

to control for social interactions when exploring the relationship between living alone and subjective well-being among the young and middle-aged.

In addition, **Figure 3** shows that individuals meet friends more frequently than they meet non-cohabitating relatives, regardless of whether they live alone or with others. This indirectly supports the above argument: the social networks of young and middle-aged adults are more likely to rely on people outside of their family relationships (such as friends).

Analytical Strategy

We use binary logistic regression to estimate the relationship between living arrangements and happiness. Logistic regression is particularly suitable for analysis where the dependent variable is categorical (like feeling happy in our case), and it enjoys widespread application across demographic and sociological research. That is, it only requires the dependent variable to be categorical, while the independent variables can be either categorical or continuous (Frees et al., 2014). Additionally, logistic regression provides a straightforward understanding of event occurrence probabilities. We use the logit command in Stata for binary regression analysis.

In the first part of the regression analysis (**Research question 2**), we progressively add variables such as living arrangements, gender, marital status, and education levels (**Table 2**, models 1 to 4). These models, controlling for all control variables, as shown in Eq. (1), also serve as the primary model for our analysis:

$$Happy_i = \alpha + \beta_1 Liv.Arr._i + \gamma X_i \quad (1)$$

In Eq. (1), where $Happy$ is a dummy variable equal to 1 if the respondent is feeling happy, $Liv.Arr.$ is also a dummy variable equal to 1 if the respondent is living alone, X_i includes gender, marital status, education levels, and a set of control variables.

Furthermore, as shown in Eqs. (2) to (4), we include an interaction term to examine the variations in how living arrangements are linked to happiness across different genders, marital status, and education levels (**Table 2**, models 5 to 7). This approach investigates the potential moderation of this relationship by these factors. For example, the interaction between living alone and gender might reveal that the correlation between living alone and happiness is stronger or weaker for men than women.

$$Happy_i = \alpha + \beta_1 Liv.\,Arr._i + \beta_2 Gen._i + \beta_3 Liv.\,Arr. \times Gen._i + \gamma X_i \quad (2)$$

$$Happy_i = \alpha + \beta_1 Liv.\,Arr._i + \beta_2 Mar.\,Status + \beta_3 Liv.\,Arr. \times Mar.\,Status_i + \gamma X_i \quad (3)$$

$$Happy_i = \alpha + \beta_1 Liv.\,Arr._i + \beta_2 Edu.\,Level_i + \beta_3 Liv.\,Arr. \times Edu.\,Level_i + \gamma X_i \quad (4)$$

In the analysis of this section, we pay particular attention to the coefficient β_3. Where β_3 represents the coefficient of the living arrangements with the moderating variables, indicating the differences between genders, marital status, and education levels in the relationship between living arrangements and happiness.

Next, we introduce the strategy for the second part of the regression analysis (**Research question 3**). Based on the different social expectations and needs of men and women in rural and urban societies, we divide the entire sample into four subgroups: males of rural origin, males of urban origin, females of rural origin, and females of urban origin. Similar to Eqs. (3) and (4), we analyze the four subgroups separately, focusing mainly on the heterogeneity of the interaction between living arrangements and marital status, as well as between living arrangements and education levels. During the analysis, we control for all covariates. This division considers the unique social and cultural contexts that might influence people's happiness. We expect that living arrangements will exhibit varying associations with happiness across groups with different marital status and education levels within the four subgroups.

Results

In our two-step regression analysis, we first address the relationship between living alone and happiness by sequentially adding key independent variables to the entire sample. We then introduce interaction terms between living arrangements and factors such as gender, marital status, and education levels (**Research question 2**). In the second step, we categorize the sample into males of rural origin, males of urban origin, females of rural origin, and females of urban origin. This categorization aims to explore the diverse patterns of these interaction terms (**Research question 3**).

Full sample

Table 2 displays the estimates of the associations between living arrangements and happiness. Models 2 to 4 sequentially add gender, marital status, and education levels. The objective is to examine how variables introduced in subsequent blocks account for those introduced in earlier ones. Models 5 to 7 include the interaction terms, exploring the relationships between living arrangements and gender, as well as marital status and education levels. All models are based on the total sample and control for variables such as survey year, individual (age, ethnicity, religious belief, *hukou*, sibship, migration), socio-economic (employment status and homeowner type), social interactions (get together socially with relatives living elsewhere or with friends), health and regional characteristics.

(Table 2 is about here)

The results from Model 1 to Model 4 (**Table 2**) support **Hypothesis 1** by showing that living alone is associated with lower self-rated happiness. Model 1 indicates a clear negative association between living alone and happiness. Conditional on the control variables, declines amount to 0.64 scale points. Model 2 shows that males are at a disadvantage in terms of happiness compared to females. In Model 3, the never-married,

divorced, and widowed individuals are less happy than those who are married. In addition, marital status in Model 3 reduces the negative coefficient of living alone compared to Model 2, which is unsurprising that marital status is a key variable in predicting happiness. It is often observed that those who live alone tend to be single, divorced, or widowed (Xiao and Liu, 2023). Therefore, when we add marital status, the negative correlation between living alone and happiness is somewhat mitigated. Model 4 suggests that happiness significantly increases with higher levels of education. This is expected, as the positive association between education levels and happiness is widely recognized (Ho, 2015; Matsuura and Ma, 2022).

In Model 5, the interaction shows a significant difference between females and males in the happiness profile across living arrangements. The negative interaction between living alone and males supports our expectation that drops in happiness are greater among males, which supports our **Hypothesis 2a**. To facilitate understanding, we used **Figure 4** to visually display the predicted probabilities of feeling happy for females and males across living arrangements with all covariates held at their mean values. As shown in Figure 4, men experience a more pronounced decrease in happiness than women when they live alone. Specifically, for men, the probability of feeling happy when living alone decreases by 0.08 scale points compared to living with others (0.67 vs. 0.76). In contrast, for women, the probability decreases by only 0.04 scale points when living alone compared to living with others (0.74 vs. 0.78).

Model 6 adds the interaction between living arrangements and marital status. It indicates that the negative relation between living alone and happiness is stronger for never-married individuals than for those who are married. This is also consistent with **Hypothesis 2b**, but we are still interested in whether this hypothesis differs by gender and *hukou*, which we will explore in the subgroup regression analysis. Model 7 adds an

interaction between living arrangements and education levels. We do not find a significant variation in the association between living alone and happiness by college education, which is inconsistent with **Hypothesis 2c**. However, despite the interaction term being insignificant, the direction was in line with our hypothesis. In other words, those with a college education experience a more severe decline in their self-rated happiness when living alone compared to those with primary education or less. In the next step, we will continue to explore how the negative relationship between living alone and happiness varies across groups with different education levels. We hope the subgroup analysis yield interesting findings.

At last, regarding the control variables listed in **Table 2**, we found that people were happier in 2012 and in the years from 2015 to 2018 compared to 2010. Migrants, employed individuals, homeowners, and those who frequently meet friends and relatives living elsewhere, as well as individuals in good physical health, tend to be happier. Conversely, relatively older people and Han Chinese tend to be less happy.

Subsamples by gender and *hukou*

To further clarify the gender pattern in the relationship between living alone and happiness, particularly based on the differing societal expectations for men and women from rural and urban backgrounds, we conducted separate analyses for four distinct groups: males of rural origin, males of urban origin, females of rural origin, and females of urban origin. We employed strategies for the subsample models similar to those used for the entire sample.

Table 3 presents the results of the subsample analysis. Models 1 includes living arrangements. Based on this, Models 2 add the interaction between living arrangements and marital status, while Models 3 add the interaction between living arrangements and education levels. All models include marital status, education levels, and the control

variables, which are the same as those listed in **Table 2**. To save space, the coefficients of control variables are not shown in **Table 3** but are provided in Appendix Table A1.

(Table 3 is about here)

The results from Models 1 are similar to those of Model 5 in **Table 2**, indicating that men experience a greater decline in happiness from living alone compared to women. Specifically, in **Table 3**, the absolute value of coefficients of living alone for males (-0.37 and -0.39) is larger than that for females (-0.27 and -0.27). Models 2 show that the negative relationship between living alone and happiness is only strengthened for never-married men of rural and urban origin (the coefficient is negatively significant at the 0.05 level). This further supports **Hypothesis 2b**; in other words, the negative correlation between living alone and happiness is significantly stronger for unmarried men (not for unmarried women). Surprisingly, among women of urban origin, this negative relationship is mitigated for those who are never married or divorced. Somewhat unexpectedly, this mitigating trend is most pronounced among divorced women, who show greater happiness than those who are married after living alone. Specifically, the coefficient on the interaction of living alone and divorce (in Model 2) is 0.70 and significant at the 0.01 level.

Models 3 revealed interesting findings, which partly supports **Hypothesis 2C**. From the interaction term between living alone and college education, we discovered that among men of rural origin, the negative association between living alone and happiness is significantly strengthened among those with a college degree. However, for women of urban origin, this negative relation is mitigated among those with a college education.

Discussion

Living alone is becoming increasingly common among the young and middle-aged

in China, a demographic shift that reflects broader social changes. Using the China General Social Survey data from 2010 to 2018, the study employs the binary logistic regression model to examine the relationship between living alone and happiness, with a particular focus on controlling for factors such as social interactions and self-rated physical health. In addition, the negative link between living alone and happiness is stronger in specific groups: males (vs. females), never-married males of rural and urban origin (vs. their married counterparts), and college-educated males of rural origin (vs. their primary-educated counterparts).

The first objective of this study is to describe the characteristics and changes in happiness over time among young and middle-aged individuals, comparing those living alone with those living with others. Descriptive analysis (**Table 1**) shows that from 2010 to 2018, those living alone consistently reported lower happiness levels than those living with others. However, there was an increase in the percentage of individuals feeling happy in both groups (**Figure 2**). Compared to those living with others, the group living alone has a significantly higher percentage of males, never-married individuals, college-educated individuals, and migrants. This contrasts with the situation among older adults, where more women than men live alone (Victor et al., 2000). Meanwhile, our study found that young and middle-aged individuals living alone had more frequent social interactions with friends and relatives (living elsewhere) than those living with others, as shown in **Figure 3**. This is in line with the findings of De Vaus and Qu (2015), who also found that individuals who live alone have higher levels of social interactions than those who live with others.

It is worth noting that a high proportion (43.2%) of individuals living alone is actually married (**Table 1**). In the Chinese context, the proportion of married individuals living alone is mainly a result of large-scale internal rural-to-urban migration (Xiao and

Liu, 2023). This system categorizes Chinese citizens into agricultural (rural) and non-agricultural (urban) sectors, preventing rural residents from accessing numerous resources and welfare benefits readily available to their urban counterparts (Chan, 2009). The lure of greater employment prospects and higher wages in urban centers has drawn vast numbers of rural migrant workers into cities (Cheung and Yeung, 2015). This migration often results in the formation of split households, as migrants and their families are separated by distance. Consequently, one-person households have become a prominent manifestation of this demographic shift (Xiao and Liu, 2023). Facing steep living costs in their urban destinations, rural migrant workers frequently opt for less expensive housing in lower-cost neighborhoods, prioritizing economic survival over the pursuit of independence and privacy.

Most of these migrants are young and middle-aged men. Data show that, in 2022, 68.9% of the migrants[2] were male, 67.0% were married, and 69.5% were 21-50 years old (NBS, 2023). To further confirm that married persons living alone are mainly due to rural-to-urban migration, we further analyzed our data (CGSS 2010-2018). This analysis showed that among those living alone with rural *hukou*, there are more married persons than unmarried persons (52.4% vs. 29.2%); in contrast, among those living alone with urban *hukou*, there are fewer married than unmarried persons (31.7% vs. 41.8%). The above distinction in the data also explains why there are many married individuals among those who live alone.

The second objective of this study is to explore the link between living alone and happiness, focusing on the moderating effects of gender, marital status, and education levels. Full sample regression analysis (**Table 2**) indicates that living alone is negatively

[2] The report categorizes migrant workers into two groups: those who work away from their hometowns and local migrant workers. The data used in this article pertains to the former group, those who work away from their hometowns.

associated with happiness. In addition, moderation analysis showed that the negative association is more pronounced in men than women, which may be attributed to the fact that women are better at social support and networking than men (Flaherty and Richman, 1989; De Vaus and Qu, 2015). In addition, solitary women's higher happiness may benefit from their wider paths of social interactions (including friends) than men, whose social networking is limited to their spouse or partner (Vandervoort, 2000). Research has highlighted the importance of social interactions with friends and neighbors in enhancing the mental health of individuals who live alone (Vasile et al., 2024).

In addition, we considered the differences in emotional expression between males and females. Specifically, whether the options they chose truly reflected their feelings. Studies show that men are more likely than women to underreport negative emotions (e.g., depression), but there is no significant difference between them in reporting positive emotions (e.g., happiness) (Fujita et al., 1991; Sigmon et al., 2005). In our study, we used "feeling happy (a positive emotion)" as the outcome variable, and we think the results are reliable. In the meantime, the negative associations between living alone and happiness are stronger among the never-married group. This finding is consistent with the study results of Japanese youth aged 20-39 (Raymo, 2015). This may be related to the traditional East Asian cultures of China and Japan, which emphasize the importance of marriage. In China, getting married is still universal (Yeung and Hu, 2016); in Japan, it is regarded as the basic mark of adulthood (Tokuhiro, 2010).

The subsample regression analysis by gender and *hukou* also yielded some interesting findings (**Table 3**). The negative relationship between living alone and happiness is significantly stronger only for never-married men of both rural and urban

origin (compared to their married counterparts). The association is stronger, though not statistically significant, for never-married women of rural origin, and significantly weaker for never-married women of urban origin (compared to their married counterparts). First, in China, societal expectations place significant pressure on men (rather than on women), especially those of rural origin, to "continue the family line", echoing the old saying, "Among the three unfilial acts, to have no descendants is the worst" (Ebrey, 1990). However, establishing marriage is a prerequisite for childbearing in China and almost all children are born within wedlock (Xie, 2013). This cultural norm results in considerably greater pressure on men to marry compared to women. Therefore, never-married men may face higher pressure from parents or social norms than never-married women for being unmarried. Second, men's social interactions are often primarily through their spouses or partners (Vandervoort, 2000), making the inability to marry more influential on their happiness. Therefore, living alone accompanied by being never married inevitably amplifies the negative correlation with men's happiness. The study by Liu et al. (2013) also supports our speculation that marital status (married or not) is more important to men's life satisfaction and marital quality is more important to women's life satisfaction in the Chinese context.

Why is the association between living alone and the well-being of unmarried urban women less prominent than that of their married counterparts, and why does it even boost happiness for divorced women? One possible explanation lies within the traditional Chinese marital system, where married women often take on the role of homemakers, shouldering a significant burden of domestic chores (Leong et al., 2015). In the absence of marriage, these women tend to perform fewer household tasks, which mitigates the potential negative association between living alone and their happiness. Conversely, although living alone, married women still experience a heavier housework

load than their unmarried counterparts, leading to a decrease in happiness. Furthermore, the concept of marriage encompasses a pledge between two individuals to cohabit within a distinctive and enduring union (Barber, 1974). This implies that married persons typically exhibit a more profound inclination to reside with their spouses as compared to their unmarried counterparts. This tendency is particularly pronounced among women, who may harbor a greater emotional dependence on the marital bond. In contrast, unmarried women may not feel the need to live with others, which might help clarify, at least in part, why living alone has a mitigated association with the subjective well-being of unmarried women.

We also found that the negative relationship between living alone and happiness is significantly amplified for college-educated men of rural origin, while it is weaker for college-educated women of urban origin. This disparity may be partly explained by the high competition in Chinese college entrance exams (Liu and Wu, 2006). According to the MOE (2020), the gross enrollment rate was only 3.4% in 1990, and it was not until 2010 that it exceeded one-quarter for the first time (26.5%). This competitive landscape sets high expectations for college graduates at both family and individual levels, often resulting in significant pressures on them. In addition, the burden of college tuition fees is particularly heavier for rural families than for urban families (Liu et al., 2011). Meanwhile, because of the son preference culture, rural boys are given priority over girls in attending college (Wang, 2005; Song et al., 2006). Therefore, living alone is associated with significantly lower levels of happiness among college-educated males of rural origin. This is because they are under pressure to marry and have high life expectations from family and society. Consequently, college-educated men of rural origin often face enormous pressure to succeed. When there is a huge gap between reality and expectations (e.g., in cases of difficulty in marrying), their

happiness is significantly affected. In contrast, women from urban backgrounds experience a different set of circumstances. Urban families are in a better economic position and hold more modern views. Thus, girls have the same opportunities to attend college as boys (Tsui and Rich, 2002; Lee, 2012). Through education, females will gain broader perspectives and more various life choices, thus being enabled to pursue desired lifestyles, such as challenging traditional roles and choosing to live alone.

Limitation

While this article innovatively explores the relationship between living alone and subjective well-being among young and middle-aged adults, it does have certain limitations. First and foremost, the cross-sectional data constrain our pursuit of causal relationships. Future studies should consider using national longitudinal data to better infer causality between living alone and happiness. Secondly, due to limitations of the data, we are unable to control for the variable “number of children”. In addition, it is hard to identify the cohabitants of respondents who are not living alone, whether they are parents, spouses, children, or others. For example, a married couple living together might theoretically be happier than a divorced person living with their child, while both situations are considered cohabitation. However, distinguishing between different forms of cohabitation presents a challenge in our study. An analysis distinguishing between different types of cohabitants could perhaps shed more light on how living arrangements relate to subjective well-being among young and middle-aged adults.

Conclusion

This study offers unique contributions to understanding the relationship between living alone and subjective well-being among young and middle-aged people in China. First, our data indicate that young and middle-aged people living alone are generally unhappier compared to those living with others in China. Moreover, the percentage of

people in both groups who reported feeling happy increased from 2010 to 2018. Second, the results of the regression analysis illustrate that men, unmarried men, and men (only of rural origin) with college degrees are more likely to be disadvantaged in well-being when living alone. The findings underline the importance of considering gender, marital status, education levels, and urban-rural origins when addressing the subjective well-being of individuals living alone in contemporary China. In conclusion, our study underscores the need for policy development and enhancement. It is imperative that the government pays particular attention to individuals living alone who are vulnerable, as they are at a heightened risk of facing more severe challenges due to their solitary living circumstances.

Data Availability

This study uses publicly accessible data from the Chinese General Social Survey (CGSS) for the years 2010, 2012, 2013, 2015, 2017, and 2018. For more information, visit the CGSS website at http://cgss.ruc.edu.cn/English/Home.htm.

References

Alatartseva, E., & Barysheva, G. (2015). Well-being: Subjective and objective aspects. *Procedia - Social and Behavioral Sciences, 166*, 36-42. Retrived from https://doi.org/10.1016/j.sbspro.2014.12.479

Barber, C. J. (1974). What is marriage? *Journal of Psychology and Theology, 2*(1), 48-60. Retrived from https://doi.org/10.1177/009164717400200108

Brody, L. R. (2000). The socialization of gender differences in emotional expression: Display rules, infant temperament, and differentiation. *Gender and emotion: Social psychological perspectives, 2*(11), 122-137. Retrived from https://doi.org/10.1017/CBO9780511628191.003

Campbell, A. (1976). Subjective measures of well-being. *American psychologist, 31*(2), 117-124.

Retrived from https://psycnet.apa.org/doi/10.1037/0003-066X.31.2.117

Chan, K. W. (2009). The Chinese hukou system at 50. *Eurasian Geography and Economics, 50*(2), 197-221. Retrived from https://doi.org/10.2747/1539-7216.50.2.197

Chen, T. (2019). Living arrangement preferences and realities for elderly Chinese: implications for subjective wellbeing. *Ageing and Society, 39*(8), 1557-1581. Retrived from https://doi.org/10.1017/s0144686x18000041

Cherlin, A. J. (2004). The deinstitutionalization of American marriage. *Journal of Marriage and Family, 66*(4), 848-861. Retrived from https://doi.org/10.1111/j.0022-2445.2004.00058.x

Cheung, A. K. L., & Yeung, W.-J. J. (2015). Temporal-spatial patterns of one-person households in China, 1982–2005. *Demographic Research, 32*, 1209-1238. Retrived from https://doi.org/10.4054/DemRes.2015.32.44

Chyi, H., & Mao, S. Y. (2012). The determinants of happiness of China's elderly population. *Journal of Happiness Studies, 13*(1), 167-185. Retrived from https://doi.org/10.1007/s10902-011-9256-8

De Vaus, D., & Qu, L. (2015). *Living alone and personal wellbeing*. Retrieved from https://aifs.gov.au/research/research-reports/living-alone-and-personal-wellbeing

Diener, E. (1984). Subjective well-being. *Psychological Bulletin, 95*(3), 542-575. Retrived from https://doi.org/10.1037/0033-2909.95.3.542

Djundeva, M., Dykstra, P. A., & Fokkema, T. (2019). Is living alone "aging alone"? solitary living, network types, and well-being. *The Journals of Gerontology: Series B, 74*(8), 1406-1415. Retrived from https://doi.org/10.1093/geronb/gby119

Dolan, P., Layard, R., & Metcalfe, R. (2011). *Measuring subjective wellbeing for public policy: recommendations on measures*. Retrieved from https://ideas.repec.org/p/cep/cepsps/23.html

Dommaraju, P. (2015). One-person households in India. *Demographic Research, 32*, 1239-1266. Retrived from https://doi.org/10.4054/DemRes.2015.32.45

Ebrey, P. (1990). The Chinese family and the spread of confucian values. In R. Gilbert (Ed.), *The East Asian Region* (pp. 45-83). Princeton: Princeton University Press.

Esteve, A., Reher, D. S., Treviño, R., Zueras, P., & Turu, A. (2020). Living alone over the life course: Cross-national variations on an emerging issue. *Population and Development Review, 46*(1), 169-189. Retrived from https://doi.org/10.1111/padr.12311

Evans, I. E. M., Llewellyn, D. J., Matthews, F. E., Woods, R. T., Brayne, C., & Clare, L. (2019). Living

alone and cognitive function in later life. *Archives of Gerontology and Geriatrics, 81*, 222-233. Retrived from https://doi.org/10.1016/j.archger.2018.12.014

Flaherty, J., & Richman, J. (1989). Gender differences in the perception and utilization of social support: Theoretical perspectives and an empirical test. *Social Science & Medicine, 28*(12), 1221-1228. Retrived from https://doi.org/10.1016/0277-9536(89)90340-7

Frees, E. W., Derrig, R. A., & Meyers, G. (2014). *Predictive modeling applications in actuarial science*. Cambridge: Cambridge University Press.

Fritsch, N.-S., Riederer, B., & Seewann, L. (2023). Living alone in the city: Differentials in subjective well-being among single households 1995–2018. *Applied Research in Quality of Life, 18*(4), 2065-2087. Retrived from https://doi.org/10.1007/s11482-023-10177-w

Fujita, F., Diener, E., & Sandvik, E. (1991). Gender differences in negative affect and well-being: the case for emotional intensity. *Journal of personality and social psychology, 61*(3), 427–434. Retrived from https://doi.org/10.1037/0022-3514.61.3.427

Gui, T. (2023). Coping with parental pressure to get married: Perspectives from Chinese "leftover women". *Journal of Family Issues, 44*(8), 2118-2137. Retrived from https://doi.org/10.1177/0192513X211071053

Hesketh, T., Lu, L., & Xing, Z. W. (2005). The effect of China's one-child family policy after 25 years. *The New England Journal of Medicine, 353*(11), 1171-1176. Retrived from https://doi.org/10.1056/NEJMhpr051833

Ho, J. H. (2015). The problem group? Psychological wellbeing of unmarried people living alone in the Republic of Korea. *Demographic Research, 32*, 1299-1328. Retrived from https://doi.org/10.4054/DemRes.2015.32.47

Hsu, H. C., & Chang, W. C. (2015). Social connections and happiness among the elder population of Taiwan. *Aging Ment Health, 19*(12), 1131-1137. Retrived from https://doi.org/10.1080/13607863.2015.1004160

Huang, Y. (2012). Transitioning challenges faced by Chinese graduate students. *Adult Learning, 23*(3), 138-147. Retrived from https://doi.org/10.1177/1045159512452861

Hughes, M., & Gove, W. R. (1981). Living alone, social integration, and mental health. *American journal of sociology, 87*(1), 48-74. Retrived from https://doi.org/10.1086/227419

Ji, Y., & Yeung, W.-J. J. (2014). Heterogeneity in contemporary Chinese marriage. *Journal of Family*

Issues, 35(12), 1662-1682. Retrived from https://doi.org/10.1177/0192513X14538030

Jiang, Q., Zhang, Y., & Sánchez-Barricarte, J. J. (2015). Marriage expenses in rural China. *The China Review, 15*(1), 207-236. Retrived from https://www.jstor.org/stable/24291934

Kim, E. (2014). When social class meets ethnicity: College-going experiences of Chinese and Korean immigrant students. *The Review of Higher Education, 37*(3), 321-348. Retrived from https://doi.org/10.1353/rhe.2014.0015

Klinenberg, E. (2012). *Going solo: The extraordinary rise and surprising appeal of living alone*. London: Penguin Press.

Kong, P. A. (2015). *Parenting, education, and social mobility in rural China: Cultivating dragons and phoenixes*. New York: Routledge.

Kristoffersen, I. (2018). Great expectations: Education and subjective wellbeing. *Journal of Economic Psychology, 66*(C), 64-78. Retrived from https://doi.org/10.1016/j.joep.2018.04.005

Lee, M. H. (2012). The one-child policy and gender equality in education in China: Evidence from household data. *Journal of family and economic issues, 33*, 41-52. Retrived from https://doi.org/10.1007/s10834-011-9277-9

Leong, J. L. T., Chen, S. X., & Bond, M. H. (2015). Housework allocation and gender (in)equality: The Chinese case. In S. Safdar & N. Kosakowska-Berezecka (Eds.), *Psychology of Gender Through the Lens of Culture: Theories and Applications* (pp. 77-91). Cham: Springer International Publishing.

Liu, C., Zhang, L., Luo, R., Wang, X., Rozelle, S., Sharbono, B., . . . Glauben, T. (2011). Early commitment on financial aid and college decision making of poor students: Evidence from a randomized evaluation in rural China. *Economics of Education Review, 30*(4), 627-640. Retrived from https://doi.org/10.1016/j.econedurev.2011.02.003

Liu, H., Li, S., & Feldman, M. W. (2013). Gender in marriage and life aatisfaction under gender imbalance in China: The role of intergenerational support and SES. *Social Indicators Research, 114*(3), 915-933. Retrived from https://doi.org/10.1007/s11205-012-0180-z

Liu, H., & Wu, Q. (2006). Consequences of college entrance exams in China and the reform challenges. *KEDI Journal of Educational Policy, 3*(1), 7-21.

Liu, S., Wang, E., & Wang, X. (2021). Changes in the affordability of 4-year public higher education in China during massification. *Asia Pacific Education Review, 22*(2), 273-289. Retrived from

https://link.springer.com/article/10.1007/s12564-020-09666-6

Liu, Y., Jiang, Q., & Chen, F. (2020). Children's gender and parental educational strategies in rural and urban China: the moderating roles of sibship size and family resources. *Chinese Sociological Review, 52*(3), 239-268. Retrived from https://doi.org/10.1080/21620555.2020.1717942

Matsuura, T., & Ma, X. (2022). Living arrangements and subjective well-being of the elderly in China and Japan. *Journal of Happiness Studies, 23*(3), 903-948. Retrived from https://doi.org/10.1007/s10902-021-00430-0

Mo, D., Zhang, L., Yi, H., Luo, R., Rozelle, S., & Brinton, C. (2013). School dropouts and conditional cash transfers: Evidence from a randomised controlled trial in rural China's junior high schools. *The Journal of Development Studies, 49*(2), 190-207. Retrived from https://doi.org/10.1080/00220388.2012.724166

MOE (Ministry of Education of China). (2020). 2019 China education development statistical bulletin. Retrieved from http://www.moe.gov.cn/jyb_sjzl/sjzl_fztjgb/202005/t20200520_456751.html

MOE (Ministry of Education of China). (2023). 2022 China education development statistical bulletin. Retrieved from http://www.moe.gov.cn/jyb_sjzl/sjzl_fztjgb/202307/t20230705_1067278.html

NBS (National Bureau of Statistics of China). (2023). 2022 China migrant workers monitoring survey report. Retrieved from https://www.stats.gov.cn/sj/zxfb/202304/t20230427_1939124.html

Ortiz-Ospina, E. (2020). The rise of living alone: How one-person households are becoming increasingly common around the world. Retrieved from https://ourworldindata.org/living-alone#historical-perspective-on-people-living-alone-evidence-from-rich-countries

Our World in Data. (2024a). Data page: Gross enrolment ratio in tertiary education. Retrieved from https://ourworldindata.org/grapher/gross-enrollment-ratio-in-tertiary-education

Our World in Data. (2024b). Sex ratio at birth, 1950 to 2021. Retrieved from https://ourworldindata.org/grapher/sex-ratio-at-birth?tab=chart

PCOSC (Population Census Office under the State Council). (1993). *China Population Census Yearbook in 1990*. Retrieved from https://data.cnki.net/yearBook/single?nav=%E6%99%AE%E6%9F%A5%E8%B5%84%E6%96%99&id=N2008040085

PCOSC (Population Census Office under the State Council). (2002). *China Population Census Yearbook in 2000*. Retrieved from https://www.stats.gov.cn/sj/pcsj/rkpc/5rp/index.htm

PCOSC (Population Census Office under the State Council). (2022). *China population census yearbook in 2020*. Retrieved from https://www.stats.gov.cn/sj/pcsj/rkpc/7rp/indexch.htm

Qing, S. (2020). Gender role attitudes and male-female income differences in China. *The Journal of Chinese Sociology, 7*, 1-23. Retrived from https://doi.org/10.1186/s40711-020-00123-w

Raymo, J. M. (2015). Living alone in Japan: Relationships with happiness and health. *Demographic Research, 32*, 1267-1298. Retrived from https://doi.org/10.4054/DemRes.2015.32.46

Ronald, R. (2017). The remarkable rise and particular context of younger one–person households in Seoul and Tokyo. *City & Community, 16*(1), 25-46. Retrived from https://doi.org/10.1111/cico.12221

Ross, C. E., Mirowsky, J., & Goldsteen, K. (1990). The impact of the family on health: The decade in review. *Journal of Marriage and the Family, 52*(4), 1059-1078. Retrived from https://doi.org/10.2307/353319

Schieman, S., & Plickert, G. (2008). How knowledge is power: Education and the sense of control. *Social forces, 87*(1), 153-183. Retrived from https://doi.org/10.1353/sof.0.0065

Sigmon, S. T., Pells, J. J., Boulard, N. E., Whitcomb-Smith, S., Edenfield, T. M., Hermann, B. A., . . . Kubik, E. (2005). Gender differences in self-reports of depression: The response bias hypothesis revisited. *Sex Roles, 53*, 401-411. Retrived from https://doi.org/10.1007/s11199-005-6762-3

Song, L., Appleton, S., & Knight, J. (2006). Why do girls in rural China have lower school enrollment? *World Development, 34*(9), 1639-1653. Retrived from https://doi.org/10.1016/j.worlddev.2005.12.009

South, S. J., & Spitze, G. (1994). Housework in marital and nonmarital households. *American sociological review, 59*(3), 327-347. Retrived from https://doi.org/10.2307/2095937

Tokuhiro, Y. (2010). *Marriage in contemporary Japan* (Vol. 26). New York: Routledge.

Treas, J., & Drobnič, S. (2010). *Dividing the domestic: Men, women, and household work in cross-national perspective*. California: Stanford University Press.

Tsui, M., & Rich, L. (2002). The only child and educational opportunity for girls in urban China. *Gender & Society, 16*(1), 74-92. Retrived from https://doi.org/10.1177/0891243202016001005

UNESCO (United Nations Educational, Scientific and Cultural Organization). (2021). *Education finance watch 2021*. Retrieved from https://en.unesco.org/gem-report/education-finance-watch-2021

UNESCO (United Nations Educational, Scientific and Cultural Organization). (2023). *Higher education:*

figures at a glance. Retrieved from https://uis.unesco.org/sites/default/files/documents/f_unesco1015_brochure_web_en.pdf

Vandervoort, D. (2000). Social isolation and gender. *Current Psychology, 19*(3), 229-236. Retrived from https://doi.org/10.1007/s12144-000-1017-5

Vasile, M., Aartsen, M., Precupetu, I., Tufă, L., Dumitrescu, D.-A., & Radogna, R. M. (2024). Association between social isolation and mental well-being in later life. What is the role of loneliness? *Applied Research in Quality of Life, 19*(1), 245-267. Retrived from https://doi.org/10.1007/s11482-023-10239-z

Veenhoven, R. (1991). Is happiness relative? *Social Indicators Research, 24*, 1-34. Retrived from https://doi.org/10.1007/BF00292648

Victor, C., Scambler, S., Bond, J., & Bowling, A. (2000). Being alone in later life: loneliness, social isolation and living alone. *Reviews in Clinical Gerontology, 10*(4), 407-417. Retrived from https://doi.org/10.1017/S0959259800104101

Waite, L. J. (1995). Does marriage matter? *Demography, 32*(4), 483-507. Retrived from https://doi.org/10.2307/2061670

Wang, S., Yang, X., & Eklund, L. (2022). Discrimination and quality of life among marriage-squeezed men in rural China: Unexpected functions of structural and functional social support. *Social Indicators Research, 159*(3), 885-905. Retrived from https://doi.org/10.1007/s11205-021-02776-7

Wang, W. (2005). Son preference and educational opportunities of children in China - "I wish you were a boy!". *Gender Issues, 22*(2), 3-30. Retrived from https://doi.org/10.1007/s12147-005-0012-4

Wen, M., Ren, Q., Korinek, K., & Trinh, H. N. (2019). Living in skipped generation households and happiness among middle-aged and older grandparents in China. *Social Science Research, 80*, 145-155. Retrived from https://doi.org/10.1016/j.ssresearch.2019.01.004

Wrenn, D. H., Yi, J., & Zhang, B. (2019). House prices and marriage entry in China. *Regional Science and Urban Economics, 74*, 118-130. Retrived from https://doi.org/10.1016/j.regsciurbeco.2018.12.001

Xiao, F., & Liu, Y. (2023). Understanding living alone among the young- and middle-aged in China (1990-2010): A gender perspective. *The History of the Family, 28*(3), 572-600. Retrived from https://doi.org/10.1080/1081602X.2023.2219250

Xie, Y. (2013). *Gender and family in contemporary China*. Retrieved from https://e-tarjome.com/storage/btn_uploaded/2019-12-17/1576561239_378-etarjome%20English.pdf

Xie, Y., Raymo, J. M., Goyette, K., & Thornton, A. (2003). Economic potential and entry into marriage and cohabitation. *Demography, 40*, 351-367. Retrived from https://doi.org/10.1353/dem.2003.0019

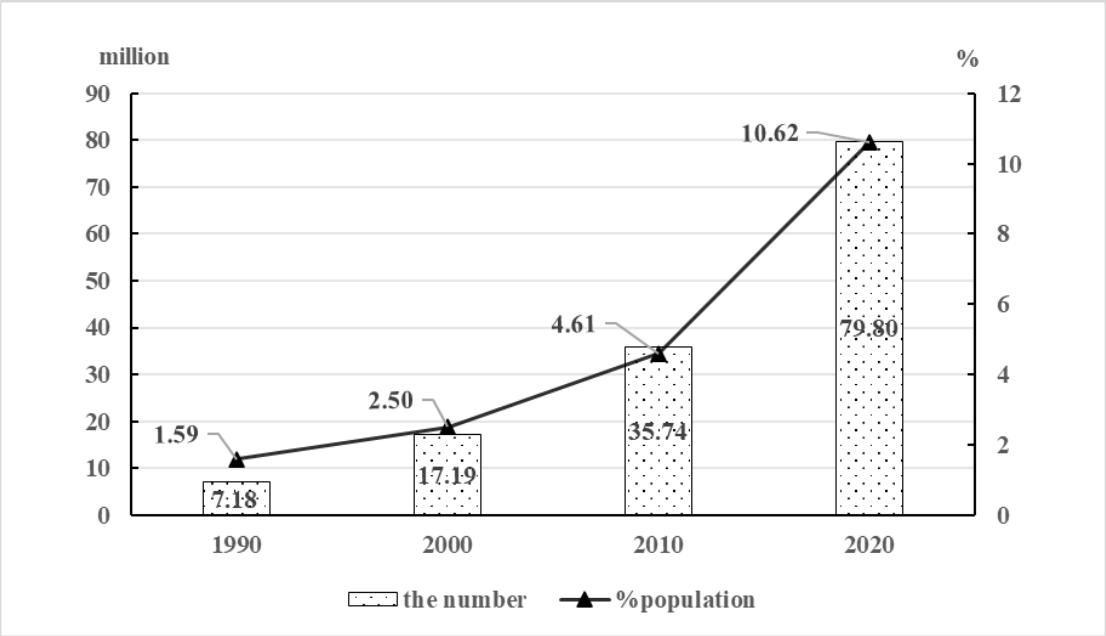
Xie, Y., & Zhou, X. (2014). Income inequality in today's China. *Proceedings of the national academy of Sciences, 111*(19), 6928-6933. Retrived from https://doi.org/10.1073/pnas.1403158111

Xu, G. (2023). *Roommate relationships in Chinese university dormitories: students' life experience and perception.* (Doctoral dissertation). University of Sheffield, Retrieved from https://etheses.whiterose.ac.uk/34689/

Yang, X., Wang, S., & Eklund, L. (2020). Reacting to social discrimination? Men's individual and social risk behaviors in the context of a male marriage squeeze in rural China. *Social Science & Medicine, 246*, 112729. Retrived from https://doi.org/10.1016/j.socscimed.2019.112729

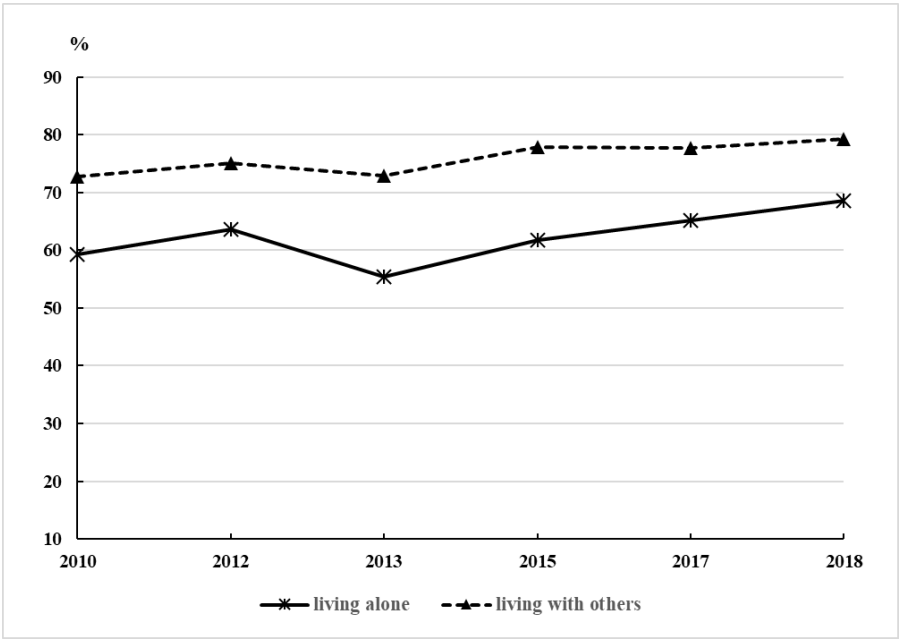
Yeung, W.-J. J., & Hu, S. (2016). Paradox in marriage values and behavior in contemporary China. *Chinese Journal of Sociology, 2*(3), 447-476. Retrived from https://doi.org/10.1177/2057150X16659019

Zhang, H. (2005). Bracing for an uncertain future: a case study of new coping strategies of rural parents under China's birth control policy. *The China Journal, 54*, 53-76. Retrived from https://doi.org/10.2307/20066066



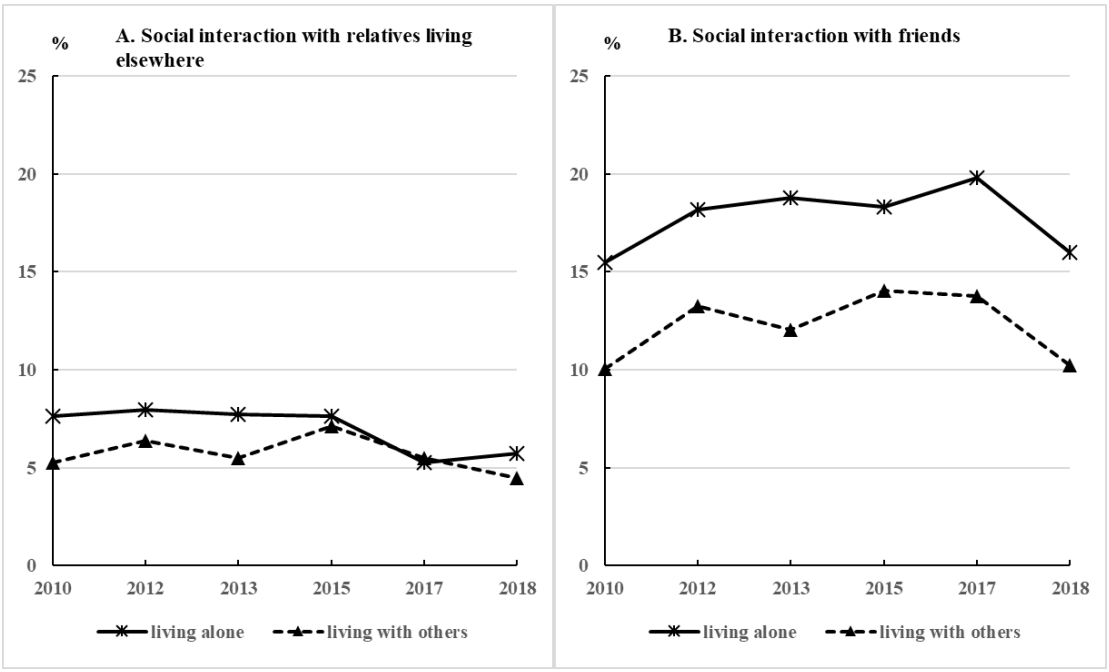
Note: Calculated based on census data from 1990, 2000, 2010, and 2020. The value includes only domestic households (not including collective households, which refer to people living in the dormitory and without family relationships (e.g. college students)). The values 1.59% and 2.50% are from Xiao and Liu (2023).

Figure 1 The number and percentage of young and middle-aged people (20-59) living alone (one-person household) in China.



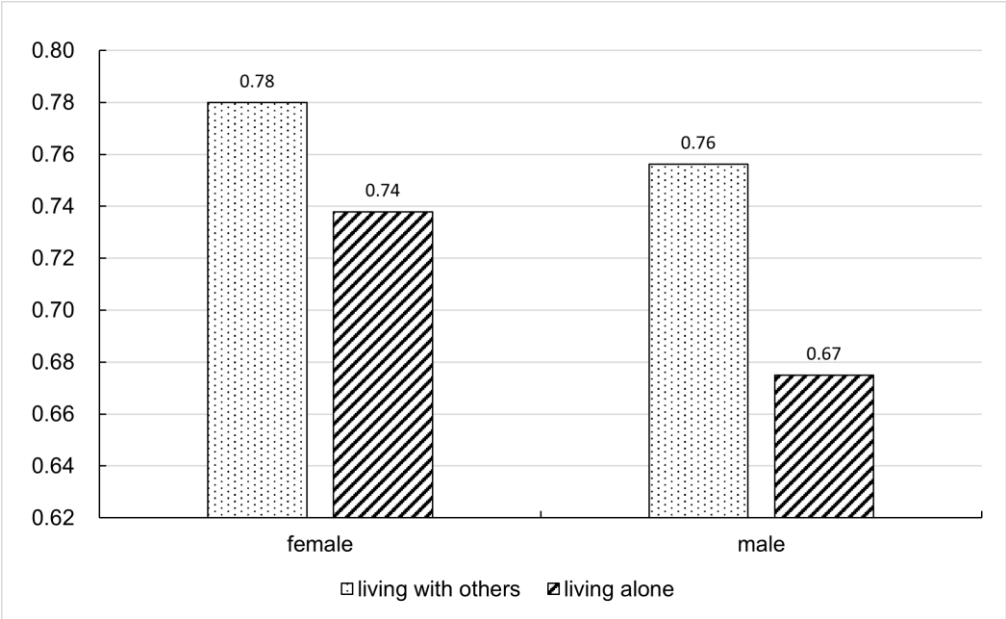
Note: Calculated based on 2010, 2012, 2013, 2015, 2017, and 2018 CGSS data.

Figure 2 Trends in **feeling happy** for young and middle-aged adults (20-59): living alone vs. living with others (2010-2018)



Note: Calculated based on 2010, 2012, 2013, 2015, 2017, and 2018 CGSS data. The line chart displays the frequencies of social interactions categorized as 'a few times a week or daily' in **Table 1**.

Figure 3 Getting together socially with relatives living elsewhere or friends **a few times a week or daily** for young and middle-aged adults (20-59): living alone vs. living with others (2010-2018)



Note: we visually displayed the gender moderating effects (model 5 in **Table 2**) in the form of predicted probabilities with other variables at their means.

Figure 4 Gender-based differences in predicted probabilities of feeling happy across living arrangements

Table 1 Descriptive statistics of young and middle-aged people (20–59), 2010-2018, by living arrangement

	Difference	living alone							living with others						
		All	2010	2012	2013	2015	2017	2018	**All**	2010	2012	2013	2015	2017	2018
Panel A: Dependent variable															
Self-rated happiness	***														
non-happy **[ref.]**		37.25	40.72	36.31	44.56	38.26	34.86	31.50	24.18	27.21	24.98	27.04	22.08	22.25	20.69
happy		62.75	59.28	63.69	55.44	61.74	65.14	68.50	75.82	72.79	75.02	72.96	77.92	77.75	79.31
Panel B: Moderating variables															
Gender	***														
female **[ref.]**		45.11	46.02	47.29	42.63	43.75	44.13	46.23	53.07	53.48	50.26	50.68	54.72	54.83	54.95
male		54.89	53.98	52.71	57.37	56.25	55.87	53.77	46.93	46.52	49.74	49.32	45.28	45.17	45.05
Marital status	***														
married **[ref.]**		43.22	49.37	42.20	39.47	40.85	42.46	42.86	89.19	89.99	90.08	89.37	88.68	88.31	88.43
never married		34.76	30.10	31.21	37.54	37.20	37.21	35.77	7.05	6.31	6.22	7.17	7.78	7.41	7.68
divorced		13.14	10.61	14.97	13.68	12.80	12.63	14.74	2.13	2.17	1.85	1.86	1.97	2.58	2.40
widowed		8.88	9.92	11.62	9.30	9.15	7.71	6.64	1.63	1.53	1.85	1.61	1.57	1.70	1.49
Education level	***														
primary and below **[ref.]**		25.17	28.37	27.39	26.49	26.68	19.33	24.41	26.80	28.98	27.83	25.43	26.98	24.72	26.57
secondary		52.52	52.60	55.25	54.74	52.90	51.96	49.38	60.44	61.69	61.24	62.28	59.92	59.18	57.94
college and above		22.31	19.03	17.36	18.77	20.43	28.72	26.21	12.75	9.33	10.93	12.28	13.10	16.10	15.49
Panel C: Control variables															
Individual characteristics															
Age	***														
20-29 **[ref.]**		25.06	24.45	23.09	25.96	25.46	27.26	23.96	14.68	14.70	14.83	14.99	16.00	14.00	13.64
30-39		15.01	13.96	12.90	13.86	13.11	17.65	16.99	24.59	26.62	24.45	25.75	22.11	24.45	23.62
40-49		25.70	29.64	29.46	28.77	24.85	21.23	22.38	31.86	32.74	33.70	31.02	32.63	30.11	30.75
50-59		34.23	31.95	34.55	31.40	36.59	33.85	36.67	28.87	25.94	27.01	28.23	29.26	31.45	31.99
Ethnicity															
ethnic minorities **[ref.]**		8.39	10.50	8.76	11.05	7.32	7.26	6.30	8.67	9.71	8.95	8.79	8.34	8.09	7.92
Han Chinese		91.61	89.50	91.24	88.95	92.68	92.74	93.70	91.33	90.29	91.05	91.21	91.66	91.91	92.08
Religious belief															
no **[ref.]**		88.46	87.66	85.03	89.12	87.96	90.50	89.54	88.61	87.89	86.13	89.30	88.66	90.12	89.89
yes		11.54	12.34	14.97	10.88	12.04	9.50	10.46	11.39	12.11	13.87	10.70	11.34	9.88	10.11
Hukou	***														

rural *hukou* **[ref.]**		55.63	48.44	57.01	58.07	56.40	54.53	60.63	61.23	53.59	57.90	61.00	65.74	65.77	65.14
urban *hukou*		44.37	51.56	42.99	41.93	43.60	45.47	39.37	38.77	46.41	42.10	39.00	34.26	34.23	34.86
Sibship	***														
without siblings **[ref.]**		93.94	92.16	93.63	95.26	93.75	93.41	95.73	95.36	94.84	95.03	95.64	94.63	96.33	95.70
with siblings		6.06	7.84	6.37	4.74	6.25	6.59	4.27	4.64	5.16	4.97	4.36	5.37	3.67	4.30
Migration	***														
non-migrant **[ref.]**		58.56	59.98	60.51	62.46	57.01	57.99	55.01	69.74	71.97	70.01	73.57	67.92	67.44	66.81
migrant		41.44	40.02	39.49	37.54	42.99	42.01	44.99	30.26	28.03	29.99	26.43	32.08	32.56	33.19
Socio-economic characteristics															
Employment status	***														
unemployed **[ref.]**		23.82	24.57	19.59	22.46	27.29	24.69	23.51	26.27	25.42	21.64	22.81	29.82	29.27	29.74
employed		76.18	75.43	80.41	77.54	72.71	75.31	76.49	73.73	74.58	78.36	77.19	70.18	70.73	70.26
Homeowner type	***														
non-homeowner **[ref.]**		50.43	45.91	47.29	50.18	48.48	55.64	53.43	35.72	32.62	33.87	34.01	36.72	37.98	39.96
homeowner		49.57	54.09	52.71	49.82	51.52	44.36	46.57	64.28	67.38	66.13	65.99	63.28	62.02	60.04
Social interaction characteristics															
Get together socially with relatives	**														
a few times a month or less **[ref.]**		93.16	92.39	92.04	92.28	92.38	94.75	94.26	94.31	94.76	93.64	94.51	92.87	94.50	95.50
a few times a week or daily		6.84	7.61	7.96	7.72	7.62	5.25	5.74	5.69	5.24	6.36	5.49	7.13	5.50	4.50
Get together socially with friends	***														
a few times a month or less **[ref.]**		82.38	84.54	81.85	81.23	81.71	80.22	84.03	87.81	89.94	86.75	87.94	85.94	86.24	89.75
a few times a week or daily		17.62	15.46	18.15	18.77	18.29	19.78	15.97	12.19	10.06	13.25	12.06	14.06	13.76	10.25
Health and Regional characteristics															
Self-rated physical health	***														
unhealthy **[ref.]**		16.03	17.88	17.83	17.19	14.02	13.85	15.86	12.55	13.33	12.74	10.59	12.23	13.59	12.75
healthy		83.97	82.12	82.17	82.81	85.98	86.15	84.14	87.45	86.67	87.26	89.41	87.77	86.41	87.25
Region	***														
prefecture		YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observation		4,505	867	628	570	656	895	889	42,092	7,706	7,463	7,156	6,237	6,815	6,715

Note: Calculated based on CGSS data from 2010, 2012, 2013, 2015, 2017, and 2018; The difference between living alone and living with others in the second column was determined by Chi-square test; Regional characteristics (at the prefecture level) were accounted for, and the results were not shown.
*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table 2 Coefficients from binary logistic regression predicting living alone on feeling happy among young and middle-aged people (20–59) in China, 2010-2018

	(Dependent variable: feeling happy)						
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Living arrangement [ref.=living with others]							
living alone	-0.64***	-0.63***	-0.31***	-0.32***	-0.23***	-0.25***	-0.32***
Moderating variables							
Gender[ref.=female]							
male		-0.13***	-0.11***	-0.15***	-0.13***	-0.15***	-0.15***
Marital status[ref.=married]							
never-married			-0.69***	-0.71***	-0.71***	-0.64***	-0.71***
divorced			-1.05***	-1.05***	-1.05***	-1.10***	-1.05***
widowed			-0.68***	-0.64***	-0.65***	-0.62***	-0.64***
Education level [ref.=primary and below]							
secondary				0.38***	0.38***	0.38***	0.38***
college and above				0.78***	0.78***	0.78***	0.80***
Interactions							
Living arrangement # Gender							
living alone # male					-0.17*		
Living arrangement # Marital status							
living alone # never-married						-0.25**	
living alone # divorced						0.07	
living alone # widowed						-0.12	
Living arrangement # Education level							
living alone # secondary							0.03
living alone # college and above							-0.12
Control variables							
Survey year [ref.=2010]							
2012	0.11**	0.11**	0.12***	0.11**	0.11**	0.11**	0.11**
2013	-0.05	-0.04	-0.03	-0.06	-0.06	-0.06	-0.06
2015	0.26***	0.26***	0.28***	0.25***	0.25***	0.25***	0.24***
2017	0.28***	0.28***	0.31***	0.26***	0.26***	0.26***	0.26***
2018	0.42***	0.42***	0.45***	0.40***	0.40***	0.40***	0.40***
Individual characteristics							
Age [ref.=20-29]							

30-39	-0.18***	-0.18***	-0.34***	-0.25***	-0.25***	-0.25***	-0.25***
40-49	-0.33***	-0.32***	-0.50***	-0.33***	-0.33***	-0.33***	-0.33***
50-59	-0.29***	-0.28***	-0.45***	-0.25***	-0.25***	-0.25***	-0.25***
Ethnicity [ref.=ethnic minorities]							
Han Chinese	-0.29***	-0.29***	-0.29***	-0.30***	-0.30***	-0.30***	-0.30***
Religious belief [ref.=no]							
yes	0.06	0.05	0.05	0.07+	0.07+	0.07+	0.07+
Hukou [ref.=rural *hukou*]							
urban *hukou*	0.13***	0.13***	0.18***	0.02	0.02	0.02	0.02
Sibship [ref.=without siblings]							
with siblings	-0.29***	-0.28***	-0.06	-0.06	-0.07	-0.08	-0.06
Migration [ref.=non-migrant]							
migrant	0.13***	0.12***	0.08**	0.06*	0.06*	0.06*	0.06*
Socio-economic characteristics							
Employment status [ref.=unemployed]							
employed	0.08**	0.12***	0.11***	0.07*	0.06*	0.07*	0.07*
Homeowner type [ref.=non-homeowner]							
homeowner	0.24***	0.23***	0.17***	0.17***	0.17***	0.17***	0.17***
Social interaction characteristics							
Get together socially with relatives (living elsewhere) [ref.=a few times a month or less]							
a few times a week or daily	0.24***	0.23***	0.21***	0.20***	0.20***	0.20***	0.20***
Get together socially with friends [ref.=a few times a month or less]							
a few times a week or daily	0.27***	0.28***	0.30***	0.29***	0.29***	0.30***	0.29***
Health and Regional characteristics							
Self-rated physical health [ref.=unhealthy]							
healthy	0.91***	0.92***	0.89***	0.85***	0.85***	0.85***	0.85***
Region							
prefecture	YES	YES	YES	YES	YES	YES	YES
Constant	0.46***	0.49***	0.81***	0.47***	0.46***	0.46***	0.47***
Observation	46,597	46,597	46,597	46,597	46,597	46,597	46,597

Note: Calculated based on CGSS data from 2010, 2012, 2013, 2015, 2017, and 2018; Regional characteristics (at the prefecture level) were accounted for, and the results were not shown.

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table 3 Heterogeneous coefficients from binary logistic regression predicting living alone on feeling happy by gender and *hukou*

	(Dependent variable: feeling happy)											
	male of rural origin			male of urban origin			female of rural origin			female of urban origin		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Living arrangement [ref.=living with others]												
living alone	-0.37***	-0.15	-0.24*	-0.39***	-0.18	-0.26	-0.27***	-0.24**	-0.32***	-0.27**	-0.56***	-0.61*
Interactions												
Living arrangement # Marital status												
living alone # never married		-0.53***			-0.43*			-0.13			0.37+	
living alone # divorced		-0.24			-0.02			0.16			0.70**	
living alone # widowed		-0.53+			-0.28			-0.12			0.42	
Living arrangement # Education level												
living alone # secondary			-0.12			-0.07			0.13			0.39
living alone # college and above			-0.67**			-0.25			0.04			0.37
Marital status	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Education level	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Survey year	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Individual characteristics	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Socio-economic characteristics	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Social interaction characteristics	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Health characteristic	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Region	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observation	13,235	13,235	13,235	8,991	8,991	8,991	15,043	15,043	15,043	9,328	9,328	9,328

Notes: Origin was determined by hukou type: rural *hukou* holders referred to people of rural origin, and urban *hukou* holders referred to people of urban origin; Calculated based on CGSS data from 2010, 2012, 2013, 2015, 2017, and 2018; The marital status, education level, survey year, individual, socio-economic, social interaction, health, and region were the same as those controlled in Table 2 (see appendix tables A1 for details)

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Appendix

Table A1 Heterogeneous logistic regressions by gender and *hukou*

	(Dependent variable: feeling happy)											
	male of rural origin			male of urban origin			female of rural origin			female of urban origin		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
living arrangement [ref.=living with others]												
living alone	-0.37***	-0.15	-0.24*	-0.39***	-0.18	-0.26	-0.27***	-0.24**	-0.32***	-0.27**	-0.56***	-0.61*
Marital status [ref.=married]												
never married	-0.85***	-0.72***	-0.84***	-0.77***	-0.65***	-0.76***	-0.49***	-0.45**	-0.50***	-0.48***	-0.52***	-0.48***
divorced	-0.92***	-0.90***	-0.94***	-1.18***	-1.26***	-1.19***	-0.96***	-1.01***	-0.97***	-1.02***	-1.18***	-1.02***
widowed	-0.43**	-0.28	-0.45**	-0.54*	-0.5	-0.57*	-0.78***	-0.75***	-0.77***	-0.63***	-0.70***	-0.62***
Education level [ref.=primary and below]												
secondary	0.42***	0.41***	0.43***	0.22*	0.22*	0.23*	0.40***	0.40***	0.39***	0.34***	0.34***	0.30**
college and above	0.81***	0.83***	0.99***	0.60***	0.60***	0.65***	0.71***	0.71***	0.71***	0.63***	0.63***	0.59***
Interactions												
living arrangement # Marital status												
living alone # never married		-0.53***			-0.43*			-0.13			0.37+	
living alone # divorced		-0.24			-0.02			0.16			0.70**	
living alone # widowed		-0.53+			-0.28			-0.12			0.42	
living arrangement # Education level												
living alone # secondary			-0.12			-0.07			0.13			0.39
living alone # college and above			-0.67**			-0.25			0.04			0.37
Control variables												
Survey year [ref.=2010]												
2012	0.28***	0.28***	0.28***	-0.10	-0.09	-0.10	0.10	0.10	0.10	0.10	0.10	0.10
2013	0.10	0.10	0.10	-0.32***	-0.32***	-0.32***	0.00	0.00	0.00	-0.10	-0.11	-0.10
2015	0.29***	0.29***	0.28***	0.19*	0.19*	0.18*	0.21**	0.21**	0.21**	0.37***	0.37***	0.38***
2017	0.21**	0.21**	0.21**	0.34***	0.33***	0.33***	0.17**	0.18**	0.17**	0.43***	0.43***	0.43***
2018	0.42***	0.42***	0.42***	0.50***	0.50***	0.50***	0.29***	0.29***	0.29***	0.51***	0.51***	0.51***
Individual characteristics												
Age [ref.=20-29]												
30-39	-0.37***	-0.37***	-0.38***	-0.15	-0.13	-0.16	-0.19*	-0.19*	-0.19*	-0.25*	-0.25*	-0.25*
40-49	-0.36***	-0.36***	-0.37***	-0.37***	-0.35**	-0.37***	-0.22**	-0.22**	-0.22**	-0.42***	-0.41***	-0.42***

50-59	-0.22*	-0.21*	-0.22*	-0.44***	-0.43***	-0.45***	-0.07	-0.07	-0.07	-0.34**	-0.34**	-0.35**
Ethnicity [ref.=ethnic minorities]												
Han Chinese	-0.31***	-0.30***	-0.31***	-0.11	-0.11	-0.11	-0.34***	-0.34***	-0.34***	-0.32*	-0.32*	-0.31*
Religious belief [ref.=no]												
yes	0.20**	0.20**	0.20**	0.18+	0.18+	0.18+	-0.06	-0.06	-0.06	0.06	0.06	0.06
Sibship [ref.=without siblings]												
with siblings	-0.15+	-0.18*	-0.15+	-0.14	-0.16	-0.14	-0.03	-0.04	-0.03	0.13	0.14	0.13
Migration [ref.=non-migrant]												
migrant	0.00	0.01	0.00	0.17**	0.18**	0.18**	0.02	0.02	0.01	0.02	0.01	0.02
Social-economic characteristics												
Employment status [ref.=unemployed]												
employed	0.14*	0.15*	0.15*	0.24***	0.24***	0.24***	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04
Homeowner type [ref.=non-homeowner]												
homeowner	0.12*	0.13*	0.12*	0.25***	0.25***	0.24***	0.09*	0.09*	0.09*	0.26***	0.25***	0.26***
Social connection characteristics												
Get together socially with relatives (living elsewhere) [ref.=a few times a month or less]												
a few times a week or daily	0.27*	0.26*	0.27*	0.08	0.08	0.08	0.15	0.15	0.15	0.36**	0.35**	0.36**
Get together socially with friends [ref.=a few times a month or less]												
a few times a week or daily	0.43***	0.44***	0.43***	0.25**	0.25**	0.25**	0.28***	0.28***	0.28***	0.12	0.13	0.12
Health and Regional characteristics												
Self-rated physical health [ref.=unhealthy]												
healthy	0.90***	0.90***	0.90***	0.84***	0.84***	0.84***	0.80***	0.80***	0.80***	0.89***	0.89***	0.89***
Region												
prefecture	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Constant	0.33	0.30	0.34	0.07	0.04	0.06	1.10***	1.10***	1.10***	0.61**	0.63**	0.63**
Observation	13,235	13,235	13,235	8,991	8,991	8,991	15,043	15,043	15,043	9,328	9,328	9,328

Note: Calculated based on CGSS data from 2010, 2012, 2013, 2015, 2017, and 2018; Regional characteristics (at the prefecture level) were accounted for, and the results were not shown.

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1