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Research Article

Couple migration patterns, gender power relationships and later-life depression in China

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Abstract

BACKGROUND
Although migration is almost always a family decision, the couple's perspective is overlooked in the study of migration and health. In China, family migration patterns have diversified and become more complex, making it vital to understand the consequences of this trend on well-being.

OBJECTIVE
This study aims to investigate: (1) the common migration patterns among Chinese couples; (2) the association between couple migration patterns and the mental health of men and women in later life.

METHODS
Using unique couple-level life history data, this study employs multichannel sequence analysis to identify typical couple migration patterns, and seemingly unrelated regressions to examine the couple migration–mental health nexus.

RESULTS
The results show that wives who reunite with their migrant husbands at the destinations have fewer depressive symptoms in later life than left-behind wives whose husbands migrate alone for a short term or a long term. However, no substantial group differences in depressive symptoms were found between migration groups among men. Wives

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possessing an independent bank account can partly explain the gender differences in later-life depression.

CONCLUSIONS
The findings imply that a family-oriented migration policy is vital to improve the well-being of both migrants and their family members who are left behind.

CONTRIBUTION
This study also contributes to the literature by foregrounding the couple's perspective and gender dynamics in the analysis of migration and later-life mental health.

1. Introduction

Migration decisions are usually made within the context of family, even when not all family members are involved in the resulting migration (Boyle et al. 2008; Cooke 2008). For married people, the members of a couple are likely to plan their migration arrangements together. They may migrate jointly, sequentially, or one spouse might migrate alone (Kofman 2004). Studies have found that when one spouse migrates alone, it can lead to chronic stress due to disturbed family life and a lack of emotional support (Chen et al. 2015; Edelblute and Altman 2021; Guo, Iacovou, and Huang 2021; Lei and Desai 2021; Wu and Ye 2016). For spouses migrating together, the increased living costs, worries about childcare provision, and different gender norms in the post-migration destination can result in anxiety and shifts in gender power relations, both of which then influence spousal relationships and marital quality (Guo et al. 2016; Li, Tong, and Shu 2020; Ortensi 2015). These processes may further impact members' mental health differentially within a couple. Although there has been a growing recognition that experiences of migration are related to mental health (Bhugra et al. 2019; Gong et al. 2011), most studies focus on individual migrants, with only a few studies considering the link between couple migration patterns and the mental health of both spouses simultaneously.

Focusing on the specific case of internal migration in China, this study, guided by life course theory, conceptualises the migration of couples as a dynamic process, investigating the relationship between couple migration patterns and mental health amongst middle-aged and older Chinese adults. China presents a compelling case because, similar to the restrictive regulations around international migration, the household registration system (*hukou*) in China has excluded internal migrants from equal access to citizenship rights in terms of social benefits and public services in destination cities. This has resulted in a large number of migration-related split

households and around 30 million 'left-behind' women (Duan, Cheng, and Qin 2017; Fan and Li 2020). With the gradual relaxation of the *hukou* system, married women have increasingly engaged in migration (Duan, Lv, and Zou 2013). In this context, family migration patterns in China have become increasingly diversified and complex, making it crucial for policymakers to understand the consequences of this trend for family well-being. Despite the focus on China, the lessons learnt from this study may provide valuable insights for other contexts, especially countries experiencing a rapid increase in internal migration or international migration from the Global South to the Global North.

We contribute to previous studies on migration by adopting a dyadic and dynamic approach, focusing on married couple dyads rather than individuals. The data for the study are drawn from the China Health and Retirement Longitudinal Study (CHARLS), which contains rich life history data and couple-level information, enabling a dyadic analysis of longitudinal patterns of a couple's migration. We first employ multichannel sequence analysis to identify the typical couple migration patterns in China. We extend previous models of family migration (Kofman 2004) by distinguishing the gender of migrants. To account for the interdependency of husbands and wives in the same households, we use seemingly unrelated regressions to model the relationship between couple migration patterns and the later-life mental health of both men and women. In addition, we examine the role of gender power relationships to explain potential gender differences in the later-life mental health outcomes of different migration patterns.

2. Background

2.1 Couple migration patterns and linked lives: A life course perspective

An important principle of life course theory is 'linked lives', which states that our lives are lived interdependently and are embedded in interpersonal relationships (Bengtson, Elder, and Putney 2012; Elder, Johnson, and Crosnoe 2003). Individuals' migration decisions depend not only on their own personal goals and socioeconomic conditions but also on their spouses' decisions. Both the New Economics of Labour Migration (NELM) theory (Stark and Bloom 1985) and Mincer's (1978) analysis of family migration foreground the family, rather than the individual, as the unit of migration decision-making. Mincer (1978) argues that migration maximises the welfare of the whole family but does not necessarily optimise opportunities for individuals. Indeed, Stark and Bloom (1985) see migration as a household strategy to diversify income sources and minimise risk at the household level. Moreover, the linked lives principle emphasises that transitions in one person's life can trigger transitions in and, more generally, influence other people's lives (Elder, Johnson, and Crosnoe 2003). For some couples, the husband's

migration marks the start of the wife's left-behind life, which entails changes in roles, such as in family business, caregiving, and household financial responsibilities. Given this, to understand the mechanisms linking migration and mental health it is necessary to account for the migration history of close family members, especially spouses.

Recent research has increasingly explored the role of the family in the migration process and several theoretical models have been proposed. Kofman's (2004) typology of family-related migration identifies three types: (1) family reunification, which involves a primary migrant bringing in immediate family members; (2) marriage migration/family formation, including children of migrant origin bringing in a spouse from their parents' homeland and citizens or permanent residents bringing in a partner they have met while abroad; and (3) entire family migration, referring to primary migrants simultaneously accompanied by family members. Building upon Kofman's typology, King et al. (2004) further specify a category, 'split-family migration', where only one member of the family migrates, leaving others behind. However, Kofman's (2004) and King et al.'s (2004) approaches are gender-neutral. Specifically, the gender of the lead migrant in family reunification and the sole migrant in split-family migration contexts is not distinguished (though typically assumed to be male). The only existing study that considered gender is Smith and Bailey (2006), which extends Kofman's model to a twelve-category typology by incorporating dimensions of the gender and nativity of partners. However, most of these theoretical models have been developed based on international migration. How they might be refined using information from the context of Chinese internal migration has not been explored.

Furthermore, life course theory also acknowledges the importance of contextualising discrete life events within an individual's continuous life trajectory (Abbott 1995; Aisenbrey and Fasang 2010; Elder, Johnson, and Crosnoe 2003). In the context of couples, migration should be seen as an event interlocking both husbands' and wives' life trajectories. However, the limited literature focusing on couple migration patterns has only considered the migration status of spouses at a particular time point, without considering the process and sequence of the migration pattern (Guo et al. 2016; Li, Tong, and Shu 2020). Among the few exceptions to this, Wolf (2016) and Caputo et al. (2022) find that the sequence of a husband's and a wife's migration can impact the couple's fertility behaviours and the risk of hospitalisation. Guided by life course theory, this study conceptualises the migration of couples as a dynamic process and a sequence of migration events across their marital lives. It further uniquely examines the differential impacts of these dynamic processes on the later-life mental health of both members of the couple.

2.2 'Familisation' of internal migration in China

Driven by a fast-growing economy and uneven regional development, the internal migrant population in China has increased dramatically since the 1980s and had reached 376 million people (26.6% of the population) by 2020 (National Bureau of Statistics of China 2021). Rural-to-urban migration remains the dominant pattern in China, accounting for 68% of migrants in 2020. However, urban–urban migration has increased significantly, making up 20% of migrants. The remaining migrants are rural–rural and urban–rural, both of which are less common (Ke et al. 2023). In the 1980s and early 1990s, the most common family migration arrangement in China was men migrating alone, leaving wives and children behind (Fan and Li 2020). This arrangement was largely driven by institutional constraints, such as the *hukou* system, which was put in place in the 1950s to control increasing flows of internal migration. The *hukou* system categorises residents based on *hukou* type (agricultural or non-agricultural) and *hukou* location (place of *hukou* registration), both of which are determined at birth and difficult to change (Song 2014). It ties a person's social welfare and public benefits to their *hukou* location, denying migrants access to state employment and public services in host cities, including healthcare and housing, and increasing the costs and difficulties for migrants, which are further amplified for those who bring their family members with them. Most importantly, until the mid-1990s, children without a local urban *hukou* were not entitled to attend state schools in host cities. To take care of their children, women commonly stayed behind, which resulted in a large number of split households (Fan, Sun, and Zheng 2011; Zhang and Fussell 2017). Therefore, the 'split-household migration' pattern proposed by King et al. (2004) is particularly relevant in the Chinese context.

Since the mid-1990s, a series of reforms of the *hukou* system has eased the restriction of internal mobility. Between 1997 and 2001, the barriers to *hukou* transfers to small cities and towns were gradually reduced. Children and parents of migrants who were or became local citizens were allowed to reunite with them (Chan and Buckingham 2008). The policy reforms, combined with increased demand from the urban economy, led to an increasing prevalence of family migration within China (Du and Zhang 2010; Fan and Li 2020). According to the Chinese census, the percentage of husbands and wives migrating together increased from 7.4% of all migrants in 1990 to 46.1% in 2000 (Duan, Lv, and Zou 2013). More recent data from the China Migrants Dynamics Survey show that in 2017, around 60% of migrants migrated with other family members rather than alone (Hu and Zhao 2021).

Existing studies have examined the patterns of household migration and the process of family migration in China. For instance, some scholars have categorised internal migration patterns in China into sole migration, couple migration, and family migration (Fan and Li 2020; Fan, Sun, and Zheng 2011). Other researchers have investigated the multi-staged nature of family migration and developed typologies based on the total

migration process (Du and Zhang 2010; Hu and Zhao 2021; Sheng 2013; Yang and Chen 2013). They argue that family migration should be further divided into nuclear families migrating together and family members migrating sequentially at different times. In summary, studies focusing on the Chinese context have demonstrated the diverse and complex picture of family migration in China. However, gender is not foregrounded as a focal point of these migration patterns, and few studies have explored the consequences of family migration – for example, its impact on family well-being.

2.3 Couple migration patterns, gender power relationships, and health

There is a growing body of research on family separation due to migration and its impacts on the health of both migrants and left-behind family members, even though couples have rarely been the unit of analysis. For migrants, separating from family members, especially spouses, has been identified as an important post-migration stressor (Letiecq et al. 2014; Mwanri et al. 2022). Family members provide crucial social support to each other, which can buffer the stress experienced when adapting to a new environment. The presence of families, particularly a spouse, helps avoid social isolation, provides emotional support and the meaning of life, and fosters a shared sense of solidarity (Letiecq et al. 2014; Löbel and Jacobsen 2021). In the context of internal migration in China, studies have found that migrating with a spouse facilitates economic and psychological integration at the destination (Li and Ren 2021) and increases healthcare utilisation (Liu 2021).

The majority of studies have found that compared with those who migrate with their spouse, left-behind family members generally have worse physical and mental health outcomes, including higher risks of loneliness and depression, hypertension, lower quality of life, and worse self-rated health (Chen et al. 2015; Guo, Iacovou, and Huang 2021; Huang et al. 2018; Lei and Desai 2021; Li, Tong, and Shu 2020; Lu 2012; Nikoloski et al. 2019; Wu and Ye 2016). One important reason for the health disadvantage of left-behind family members is the disruption of family life, the lack of emotional support, increased loneliness and isolation, and the increased insecurity of marriage (Chen et al. 2015; Guo, Iacovou, and Huang 2021; Lu 2012; Wu and Ye 2016). On the other hand, the strategy of one spouse migrating and leaving the other behind may have beneficial effects on family members' health and well-being (Guo et al. 2016; Lu 2013). This arrangement can maximise household welfare by mitigating the risk of relying on income from agricultural activity, especially for families in less developed countries without reliable credit systems and social insurance (Lu 2012; Stark and Bloom 1985). For urban couples, split-household strategies expand the geographic scope of job opportunities, allowing both husbands and wives to pursue the best possible career prospects in different locations (He-Schaefer and Fan 2024). Despite the

counterarguments, the predominant empirical evidence suggests that the negative impacts of spousal separation outweigh the potential positive impacts of one spouse migrating solely.

Few studies have examined differences in outcomes between family reunification and couples migrating jointly. Although in both circumstances, both spouses experience the migration event, migration could have different implications for the lead migrant and the spouse who migrates later. Similar to solo migrants, lead migrants typically face more stress related to settling in the destination with a relatively limited established social network, support, and resources (Caputo et al. 2022; Ortensi 2015). For those who follow their spouse's footsteps, the risks and difficulties related to the initial phase of migration are minimised because of support from their spouse, especially for those whose spouse is already established in the destination. The social network of established migrants can also make the job-seeking process easier for spouses who join later (Jasso and Rosenzweig 1995).

Migration strategies are shaped by and can reshape gender norms and power relations within couples (Hondagneu-Sotelo 1992; Zhang and Fussell 2017). Resource theory suggests that the structural resources and assets that one partner may make available to the other determine a person's relative power within a relationship (Blood and Wolfe 1960). Migration can influence gender power relationships either directly or indirectly by introducing new or disrupting existing economic and social resources for both men and women, but in different ways (Parrado, Flippen, and McQuiston 2005). Accordingly, the consequences of different couple migration strategies may vary by gender. Studies have found that being left-behind is particularly negatively associated with women's health (Lu 2012; Wu and Ye 2016). One explanation for this is that husbands migrating alone may increase wives' family care burden and reinforce the 'men-outside-women-inside' household gender stereotype (Li, Tong, and Shu 2020). Moreover, the migration of family members reduces the labour capacity of households, with women's assumption of agricultural work vacated by male labourers taking a heavy toll on their physical and mental health (Debnath and Selim 2009; Lei and Desai 2021; Lu 2012). Although some studies have found that both rural and urban left-behind women are empowered by the new experience of budgeting, public negotiation, learning new skills, expanding their social circles, and fostering personal growth (He-Schaefer and Fan 2024; Hondagneu-Sotelo 1992; Lei and Desai 2021; Lu 2013; Zhang and Fussell 2017), these experiences do not necessarily translate into increased decision-making power. Men, as the main breadwinners, often have the final say in major decisions, and the control of in-laws also restricts women's physical and financial autonomy, leading to household conflict (Jacka 2012; Lei and Desai 2021; Li, Tong, and Shu 2020). Additionally, husbands' migration can increase the risk of women who are left behind being harassed (Debnath and Selim 2009; Wu and Ye 2016).

By contrast, migrating with a spouse might have a more positive impact on women's mental health than men's. For married women in rural areas, moving away from a traditional cultural environment, characterised by deep-rooted patriarchy and the authority of parents-in-law, can be a liberating experience. Although less pronounced, migration is also found to be liberating for urban–urban female migrants, as they often move from less developed or smaller cities to more developed megacities where gender attitudes tend to be more progressive (Yi and Shangguan 2024). When women move from villages or small cities to larger cities they have more opportunities to engage in paid employment, access economic resources, and achieve financial independence, which has been considered vital in undermining patriarchy (Blood and Wolfe 1960). This can lead to a more egalitarian household division of labour, an increase in women's bargaining power at home, and women's status in the family being enhanced (Connelly, Roberts, and Zheng 2010; Murphy 2002: 199–200). Choi and Peng (2016) find that migrant men in China make masculinity compromises – they have to renegotiate their responsibility for work and domestic chores due to their wives' participation in paid work and reduced involvement in childcare. Li, Tong, and Shu (2020) find that women migrating with a spouse have higher happiness levels than women whose spouses migrate alone. The higher happiness level could be explained by increased satisfaction with the husband's economic contribution.

Apart from the direct impacts of migrating with a spouse, the selection effect may also account for the better mental health outcomes of women who migrate with a spouse rather than being left behind. In societies where traditional attitudes and gender divisions of labour prevail, women, especially married women, tend to have less agency and decision-making power in family migration decisions and are more likely to be left behind rather than migrate with their spouses (Fan 2003; Hoang 2011). A lack of control and agency, lower social status, and experiencing gender discrimination may also explain the poorer mental health of women who are left behind. Taken together, compared to couples where only the husband migrates, couples who migrate together are more likely to come from contexts with less traditional gender role expectations, be exposed to less patriarchal gender norms at their migration destination, and have a more egalitarian household division of labour. These factors are likely to be associated with better mental health outcomes for women.

Parallel to women migrating with spouses, women migrating alone may also have more opportunities for economic empowerment than those who stay behind. Additionally, distance from their husbands and in-laws can provide them with increased autonomy. However, it is important to recognise that in the Chinese context, a married woman migrating alone leaving her husband behind deviates from traditional gender role expectations (Li, Tong, and Shu 2020), potentially leading to societal stigmatisation in areas where traditional gender norms prevail (Jacka 2005:187; Liu 2012). Moreover,

women who choose to migrate alone are often already in a disadvantaged and vulnerable position before migration. Such migration is frequently driven by the need to support a family in dire financial conditions. For some women, migration may be an outlet to escape an unhappy marriage (Liu 2012). Migrating alone could also involve more risks in the course of migration because unaccompanied women are more susceptible to violence and harassment (Piper 1999). These stressors and risks associated with sole migration may lead to poorer mental well-being for married women compared to those who migrate with their spouses. Husbands who are left behind may also experience more disadvantages. They might be perceived as failures who are unable to fulfil their family responsibilities (Chen et al. 2015; Choi and Peng 2016; Li, Tong, and Shu 2020; Lu 2013), resulting in adverse effects on their psychological well-being. On the contrary, Mu and van de Walle (2011) find that not all left-behind men experience lower well-being because some men may choose not to migrate due to favourable local non-farm job opportunities. In summary, couples in which only the wife migrates with the husband left behind may come from more disadvantaged family backgrounds, face greater challenges and discrimination, and experience poorer mental health outcomes compared to those who migrate together.

2.4 Hypotheses

Given the evidence outlined above, this study tests the following hypotheses:

H1: Couples migrating jointly have better mental health in later life than couples where only one spouse migrates.

H2: Couples reuniting in the migration destination have better mental health in later life than couples where only one spouse migrates. Among reunited couples, the mental health advantage is more pronounced for the follower migrants than for the lead migrants.

H3: The positive mental health outcomes associated with migrating jointly or reuniting at the migration destination, compared to only one spouse migrating, are more pronounced among wives than husbands.

H4: The gendered association between couple migration patterns and mental health in later life can be explained by gender power relationships within couples.

3. Methods

3.1 Data and sample

The data used in this study were taken from the 2015 wave of the China Health and Retirement Longitudinal Survey (CHARLS) and the 2014 life history CHARLS survey (see Zhao et al. (2020) and the Appendix for details). The survey includes people aged 45 and over and their spouses, which enables us to link the information of members of a couple. Partnered couples who were both 45 years old and above, who had migrated after marriage, and for whom there were complete migration histories, were included in the analysis. Cohabitating couples are not included in the analytical sample because the timing of when their relationship started is unavailable in the CHARLS. There are a total of 20,654 individuals in the original dataset. 386 observations were excluded because their residential histories were not reported or incomplete. 4,124 observations were excluded because they were not partnered at the time of interview. As we focus on couple dynamics in migration, couples in which both spouses had completed migration before marriage or had not changed migration status (as defined in 3.2.2) after marriage were excluded from the sample (N = 13,984). 146 observations were further excluded because they were younger than 45 years old or had not been married for 20 years. We needed to specify the length of marriage because the method we used to categorise couple migration patterns (sequence analysis) requires that each migration trajectory be of the same length. We used 20 years as a cut-off point because studies have shown that most people in China complete their internal migration by the age of 50, by which time they have typically been married for 20 to 30 years (Zhou and Chen 2023). We also used 30 years as a cut-off point for robustness checks and found that the distribution of the migration trajectories and their association with later-life mental health were largely comparable (see Table A-2 and Figure A-3), yet the longer time frame results in a reduction in sample size and statistical power. Therefore, we opted for 20-year histories in the subsequent analysis. The final analytical sample size is 1,846 individuals (923 couples).

3.2 Variables

3.2.1 Outcome variables

Depressive symptoms are derived from the 10-item Centre for Epidemiologic Studies Depression Scale (CESD). Each item of the scale asks about the frequency of experiencing a depression-related symptom over the past week, ranging from 0 (rarely experienced) to 3 (experienced most of the time). After reverse coding two positive items,

the total of the ten items was calculated. The total score ranges from 0 to 30, with higher scores indicating higher depression symptomatology (Cronbach's α =.79). A CESD-10 score of 12 or higher represents the likely presence of clinically significant depression (Cheng and Chan 2005).

3.2.2 Explanatory variables

Couple migration patterns: couple migration trajectories are measured as longitudinal sequences of migration/residential states in yearly intervals from the 1st year of marriage to the 20th year of marriage. Migration is defined as moving to a city (city here does not imply an urban area but indicates the level of administrative boundary) that is different from the city of birth. This definition aligns with the existing literature on internal migration in China (Chan 2013). We did not use the city of residence at the time of marriage to define migration, as this would prevent us from distinguishing between moves to a new city and returns to one's home city, differences that may have distinct implications for gender power dynamics and household economic resources (Connelly, Roberts, and Zheng 2010). For each spouse, three residential/migration states were specified. The first is living in the 'home' city (H), which is the birth city of an individual or their spouse. We did not further distinguish 'own home' and 'spousal home' because we considered the concept of home at the couple level. We conducted additional analysis by specifying 'own home' and 'spousal home' (see Figure A-4 in the Appendix), which resulted in a more complex classification of migration trajectories and smaller group sizes for important hypothetical groups. The second is living away from the home city either as a sole migrant or with a spouse (A). The third is where both spouses live away from their home city but have migrated to different cities (D) (a rare event). After deriving each couple migration trajectory, multichannel sequence analysis and cluster analysis were used to identify couple migration patterns (described below).

Ever lived in spouse's city (after marriage): When defining the couple migration trajectories, a couple moving to the spouse's home city was not treated as migration. However, living close to home or a spouse's home shapes intergenerational relationships, gender roles, and social support from kinship networks, and thus can influence a person's family status and well-being (Davin 2005; Zhang 2009). To account for the effects of moving to a spouse's home city after marriage, a life course summary measure with two categories was used: 'has lived in spouse's home city after marriage' (when spouse's home city and own home city are not the same) and 'has only lived in own city or cities other than spouse's home city'.

Early life factors and socioeconomic characteristics: Previous review studies have identified that human capital, family resources, and previous migration experiences are

key individual drivers of migration (Czaika and Reinprecht 2022; Massey et al. 1993). Childhood socioeconomic status and health have also been found to have long-term impacts on mental health (Hempel et al. 2021; Zhang, Nazroo, and Zhang 2023). Therefore, we included these early-life factors in the model to account for their confounding effects: early-life socioeconomic status (SES) ('worse than others', 'same as others', 'better than others'), early-life health ('worse than others', 'same as others', 'better than others'), education ('primary school and below', 'middle school', 'high school and above'), and migration experience before marriage ('migrated before marriage' or 'remained in the home city before marriage'). For migration before marriage, migration is defined as moving to a city other than a person's home city. As *hukou* status is a key determinant of economic resources and social benefits in China, we controlled for *hukou* status at birth ('agricultural' vs. 'non-agricultural') (Chan and Buckingham 2008). Pre-marital work experience influences not only the resources available for migration but also the gender division of labour after marriage and attitudes toward gender roles (Pittman and Blanchard 1996). In particular, engagement in non-agricultural work may enhance women's household status, bargaining power, and influence over migration decisions (MacPhail and Dong 2007). Therefore, we included the variable 'work before marriage' and distinguished the nature of this work ('no', 'yes, agricultural work', 'yes, non-agricultural work').

Spousal characteristics: Spousal characteristics can have spill-over effects on own health and migration intention (Falba and Sindelar 2007). To capture this possibility, we included in the analysis spousal education, spousal *hukou* at birth, and spousal self-rated health. Self-rated health is based on a 5-point Likert scale, ranging from 1 (excellent) to 5 (poor health). It was treated as a continuous variable in this study.

Couple-level characteristics: The number of children and household consumption per capita were included in the analysis. Household consumption is composed of household expenditure on food, utilities, transportation, household and personal items, healthcare and entertainment. It has a skewed distribution, so the natural logarithm of household consumption was used.

Gender power relationships: Whether the wife held an independent bank account and parents' son preferences are used as measures for gender power relationships. The former variable is a proxy for women's financial independence and for having responsibility for household financial affairs (Lei and Desai 2021). As suggested by resource theory, women's access to economic resources is a key determinant of relationship power (Blood and Wolfe 1960). A binary variable is derived from the question: 'What is the total amount of deposits currently held in financial institutions legally in your name?' If the amount is 0 the variable is coded as no; if the amount is more than 0 the variable is coded as yes. Son preference is rooted in the patriarchal and patrilineal kinship system in China, and it reflects the gender hierarchy and bias within

society (Das Gupta et al. 2003). It is well established that parents transfer their gender attitudes to their children as part of the gender socialisation process (Perales et al. 2021). Therefore, parents' preference for sons was used as a proxy for holding more traditional gender ideology and lower female power within the household. This measure was derived from two questions: whether the male guardian and the female guardian respectively prefer boys over girls. If either parent expressed at least a slight preference for boys, the response was coded as 'yes'; otherwise, 'no'.

3.3 Analytical methods

3.3.1 Multichannel sequence analysis

We used sequence analysis to categorise couple migration patterns over the life course. Sequence analysis is a statistical method to analyse the successions of states or events taking the order of states and events into account (Abbott 1995; Gauthier, Bühlmann, and Blanchard 2014). It focuses on the holistic trajectories of social life rather than discrete life transitions or events, making it a useful method to describe life course migration or residential patterns (Aisenbrey and Fasang 2010; Gauthier, Bühlmann, and Blanchard 2014). As couple migration status can change over time, a simple categorisation based on a single point in time risks overlooking the broader context and fails to capture the dynamic nature of migration across the life course. Accounting for changes could result in numerous possible combinations of couple migration statuses over time, making traditional analysis challenging. Sequence analysis offers a solution by taking a long-term, process-oriented perspective. This approach allows for a summary of migration histories over time and the identification of meaningful ideal types. Moreover, by incorporating the timing, order, and duration of migration episodes, sequence analysis makes it possible to capture the temporal dimensions of migration as a life course process. A key step in conducting sequence analysis is to compute the distance between sequences across individuals. The computation of distance is based on the costs, or the number and types of operations (deletions, insertions, and substitutions), required to transform one sequence into another.

Sequence analysis can only quantify the distance between sequences in one domain at a time (Gauthier et al. 2010). To account for the interdependency of husbands' and wives' migration trajectories, we applied an extension of sequence analysis, multichannel sequence analysis (MSA), which is designed to study parallel process and has been applied to analyse dyadic data (Liao et al. 2022). MSA provides us with a tool to operationalise 'linked lives' and couple migration patterns, the key theoretical concept in this study. MSA creates combined sequence states and calculates the distance matrix

based on several channels, rather than just one, and has been shown to analyse multiple trajectories efficiently and yield parsimonious and distinct clusters (Gauthier et al. 2010).

The application of MSA involves three steps (Gauthier et al. 2010). First, MSA creates the following combined sequence states for each year: the husband has migrated but the wife has not (AH), the wife has migrated but the husband has not (HA), the husband and wife have migrated jointly (AA), both the husband and wife have migrated, but to different cities (DD). By combining each couple's yearly migration status in order from the start of their marriage over a 20-year period, we construct their migration trajectories.

Second, each pair of couple migration trajectories within the data is compared and the 'distance' between each pair is calculated. As the order of the husband's and wife's migration pattern is theoretically meaningful, to measure the similarity between couple trajectories we used the OMstran approach, a method that is highly sensitive to state order (Studer and Ritschard 2016). Distance is calculated using substitution 'costs' (the change of one state to another; for example, AH to AA), which are set based on the relative frequencies of the combined states.

Third, a partitioning around medoids approach (PAM) was used for cluster analysis, which is based on a pairwise distant matrix derived from MSA. Several cluster cut-off criteria, such as Average Silhouette Width and Point Biserial Correlation, were applied to identify the optimal number of couple migration clusters.

3.3.2 Seemingly unrelated regressions (SUR)

Considering that husbands' and wives' migration patterns and their health levels are closely related, the modelling strategy needs to incorporate this dependency to avoid spurious results. Hence, we employed the SUR model, which relaxes the independence assumption of linear regressions and enables error terms to be correlated across the equations. By using information across models, this approach increases the efficiency of model estimation (Zellner 1962). In this study, we specified the equations of husbands and wives separately but correlated the errors of the two equations.

3.3.3 Modelling strategy

We built nested regression models in this study. Model 1 includes only age and couple migration patterns. Model 2 further adjusts for individual early-life characteristics, spousal characteristics, and couple-level factors, given that these variables relate to both migration tendencies and health status. Model 3 additionally includes wives holding

independent savings and parental son preferences to examine the role of gender power relationships in explaining the potential linkage between couple migration patterns and later-life health outcomes. To deal with the missing data in the covariates, we used full information maximum likelihood (FIML) for estimation. The MSA was carried out in R using the package TraMineR (Gabadinho et al. 2011; R Core Team 2021). The other analyses were conducted in Stata 17 (StataCorp 2021).

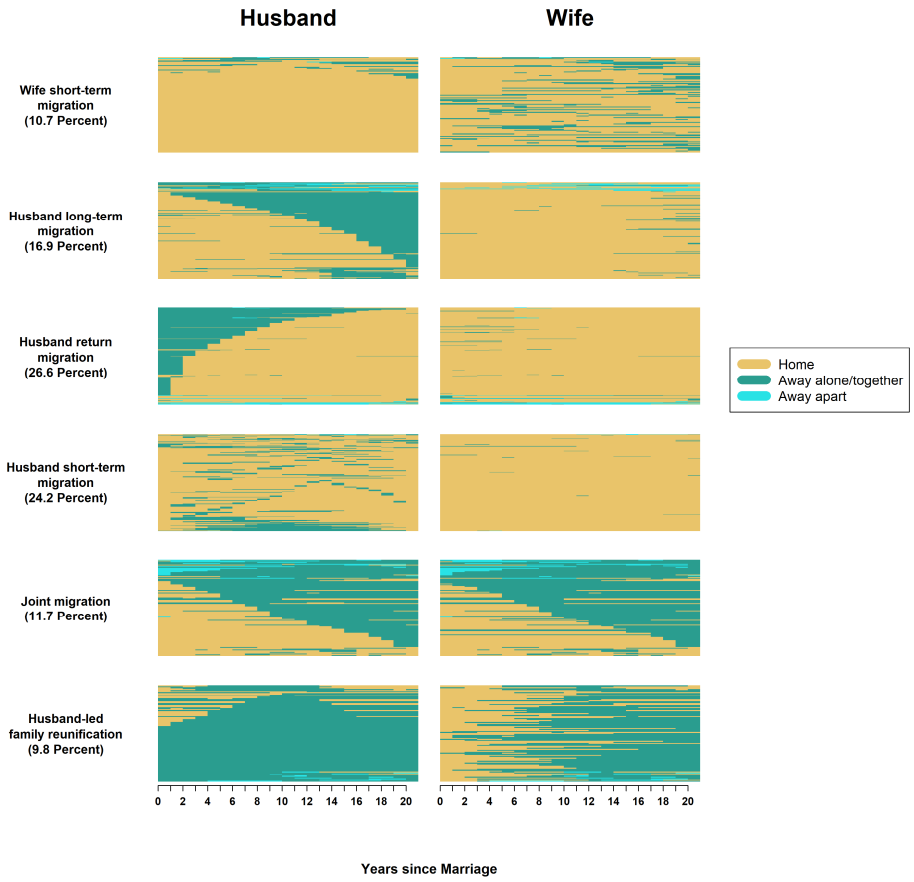
4. Results

4.1 Couple migration patterns in China

Sequence analysis of participants' residential histories identified 6 types of trajectories, a solution that has relatively good clustering quality according to several cut-off criteria (see Figure A-1 in the Appendix). It also neatly aligns with our theoretical expectation of couple migration patterns and hence demonstrates sufficient construct validity. Figure 1 shows the sequence index plots of the 6 trajectories of couple migration in China. It visualises the actual sequences of each couple with a husband's sequence corresponding to his wife's sequence horizontally. The medoid sequence is also presented (see Figure A-2 in the Appendix) to show a representative illustration of couple migration patterns from each cluster.

As Figure 1 shows, 11.7% of husbands and wives migrated simultaneously ('joint migration'). 9.8% of the husbands first migrated and reunited with their wives at their migration destination at a later stage ('husband-led family reunification'). Three trajectories involve only husbands migrating with their wives remaining behind, patterns that echo the traditional 'men-outside-women-inside' gender norm in Chinese culture. Among these trajectories, the 'husband return migration' is the most common pattern, characterised as the husband migrating at the beginning of the marriage and returning home afterwards, making up 26.6% of the total couples. This is followed by 'husband short-term migration' (24.2%) and 'husband long-term migration' (16.9%). These two categories differ in the duration and destination of the husband's migration. The former illustrates a pattern where the husband migrated temporarily after getting married but subsequently returned home, whereas the latter pattern involves the husband settling at the destination and largely not returning over the 20-year period. Compared to cases where the husband migrated alone, instances of the wife migrating alone while the husband remained behind were less common. These cases were grouped together as 'wife short-term migration', accounting for 10.7% of the sample. In this group, most wives migrated only temporarily and intermittently, with the majority experiencing short migration spells before eventually returning to their hometown.

Figure 1: Sequence index plot of couple migration patterns (N = 1,846)



Note: Each row represents a type of couple migration pattern.

Table 1 reports the characteristics of the members of each group by gender. In general, both husbands and wives in the 'husband-led family reunification' group experienced more favourable early life conditions compared to other groups. Specifically, a higher proportion of this group completed at least middle school (58.7% of men, 33.7% of women) and reported better SES during childhood (14.8% of men, 23.1% of women). Additionally, 80.2% of men and 29.3% of women in this group held non-agricultural jobs before marriage, substantially higher than the average. They were also better-off in later

life, with higher household consumption levels and a greater proportion of wives holding an independent bank account (47.2%). While less pronounced than in the first group, members of 'joint migration' trajectories were also positively selected based on their educational attainment, childhood SES, and urban *hukou* at birth.

Table 1: Descriptive statistics on couple migration patterns

	Wife short-term migration	Husband long-term migration	Husband return migration	Husband short-term migration	Joint migration	Husband-led family reunification	Test
Men							
Depressive symptoms (0–30), mean (SD)	5.714 (5.114)	7.000 (5.590)	6.764 (5.707)	6.708 (6.018)	6.329 (4.662)	6.200 (5.487)	0.629
Age, mean (SD)	57.538 (8.800)	58.280 (9.405)	62.910 (9.600)	57.935 (9.382)	60.613 (11.884)	65.717 (10.007)	<0.001
Education, %							
Primary school and below	53.8	51.6	55.3	56.5	55.7	41.3	0.007
Middle school	28.0	36.6	22.4	25.9	25.5	27.2	
High school and above	18.3	11.8	22.4	17.6	18.9	31.5	
Childhood health, %							
Worse than others	9.8	15.5	11.8	16.3	9.4	10.1	0.405
Same as others	48.9	45.3	45.9	51.6	47.2	49.4	
Better than others	41.3	39.1	42.4	32.1	43.4	40.4	
Childhood SES, %							
Worse than others	46.2	38.8	40.4	45.6	37.7	35.2	0.490
Same as others	47.3	51.9	51.4	47.9	51.9	50.0	
Better than others	6.5	9.4	8.2	6.5	10.4	14.8	
Urban *hukou* at birth, %	14.6	5.1	8.7	5.6	14.3	12.0	0.015
Migrated before marriage, %	19.4	20.5	83.5	15.7	38.7	78.3	<0.001
Work before marriage, %							
No	6.5	9.9	3.9	13.4	3.8	7.7	<0.001
Yes, agricultural work	44.1	41.0	11.8	44.4	49.1	12.1	
Yes, non-agricultural work	49.5	49.1	84.3	42.1	47.2	80.2	
Ever lived in spouse's home city, %	5.4	3.7	5.9	3.7	5.7	3.3	0.796
Self-rated health, mean (SD)	3.584 (0.991)	3.845 (0.793)	3.825 (0.856)	3.723 (0.905)	3.696 (0.925)	3.800 (0.910)	0.263
Parents' son preference, %	21.7	23.7	18.8	26.7	17.3	27.7	0.211

Table 1: (Continued)

	Wife short-term migration	Husband long-term migration	Husband return migration	Husband short-term migration	Joint migration	Husband-led family reunification	Test
Women							
Depressive symptoms (0–30), mean (SD)	8.895 (6.636)	9.815 (7.441)	8.504 (6.240)	10.141 (6.894)	9.639 (6.612)	6.640 (4.991)	0.002
Age, mean (SD)	55.000 (8.356)	56.565 (9.411)	60.635 (8.745)	56.352 (9.216)	58.330 (10.945)	63.054 (9.575)	<0.001
Education, %							
Primary school and below	76.3	77.0	72.2	80.1	68.9	66.3	0.002
Middle school	14.0	16.8	20.8	16.7	17.0	16.3	
High school and above	9.7	6.2	7.1	3.2	14.2	17.4	
Childhood health, %							
Worse than others	10.8	11.2	12.9	16.8	15.1	12.2	0.444
Same as others	50.5	54.0	52.2	50.5	55.7	42.2	
Better than others	38.7	34.8	34.9	32.7	29.2	45.6	
Childhood SES, %							
Worse than others	35.5	37.5	37.8	38.0	28.6	25.3	0.020
Same as others	44.1	50.0	53.5	47.9	57.1	51.6	
Better than others	20.4	12.5	8.7	14.1	14.3	23.1	
Urban *hukou* at birth, %	15.7	3.8	8.5	5.2	15.2	14.1	<0.001
Migrated before marriage, %	16.1	1.2	9.0	4.2	30.2	7.6	<0.001
Work before marriage							
No	12.9	21.1	8.6	16.7	19.8	19.6	<0.001
Yes, agricultural work	59.1	68.9	65.1	70.4	51.9	51.1	
Yes, non-agricultural work	28.0	9.9	26.3	13.0	28.3	29.3	
Ever lived in spouse's home city, %	8.6	6.8	6.3	6.0	10.4	2.2	0.292
Self-rated health, mean (SD)	3.921 (0.829)	3.897 (0.948)	3.803 (0.929)	4.075 (0.840)	3.988 (0.917)	3.893 (0.863)	0.063
Parents' son preference, %	31.2	29.1	28.1	21.9	29.1	26.1	0.498
Couple-level							
Number of children, mean (SD)	2.530 (1.328)	2.592 (0.972)	2.598 (1.177)	2.589 (1.145)	2.533 (1.424)	2.380 (1.136)	0.784
Log per capita household consumption, mean (SD)	9.446 (0.909)	9.167 (1.000)	9.190 (0.818)	9.039 (0.889)	9.420 (0.960)	9.650 (0.735)	<0.001
Wife holding an independent bank account, %	25.3	28.0	29.8	28.9	37.5	47.2	0.026
N (couple)	93	161	255	216	106	92	

Note: SES: Socioeconomic status; SD: standard deviation. The column 'test' reports results of F-tests for continuous variables and Chi-square test for categorical variables.

Although members of the 'husband return migration' group reported lower childhood SES compared to others (40.4% of men, 37.8% of women), 91.4% of wives in this group worked before marriage, and 84.3% of husbands held non-agricultural jobs prior to marriage, both figures higher than those in other groups. By contrast, men and women in 'husband short-term migration' had the least favourable early life conditions. A larger proportion of this group had lower educational attainment, poorer childhood SES, and fewer members engaged in non-agricultural work before marriage. Notably, 13.4% of men in this group had no work experience prior to marriage, the highest among all groups. It is noteworthy that the Chi-squared tests show no significant differences in parental son preference or childhood health status among husbands and wives across different couple migration patterns. This suggests that post-marriage migration is unlikely to be selected based on parental gender ideology or childhood health.

These bivariate analyses suggest that age, education, early-life migration, *hukou* type at birth, and work experience were key determinants of post-marriage migration strategies for both men and women. Childhood SES was associated with couple migration strategies for women but not for men.

4.2 The association between couple migration patterns and mental health in later life

Table 2 reports the results for the association between couple migration patterns and mental health in later life. The husband-led family reunification trajectory is used as the reference group, because it is relevant to H2 and H3. To further investigate H1, we also estimated the models using 'joint migration' as the reference group and present the results in Table A-3 in the Appendix. The estimated covariances of the error terms in all of the models are substantially larger than 0, which suggests that the later-life depressive symptoms of husbands and wives are correlated, and using seemingly unrelated regressions can potentially improve the efficiency of the models. To aid the interpretation of comparison across multiple groups, we plotted the adjusted predicted mean depression scores by group and gender for both Model 1 and Model 2 (Figure 2).

To examine H1 and H2, which postulate that couples of joint migration or family reunification have better mental health in later life than couples where the husband or wife migrates alone, we compare groups which involve only one spouse migrating and groups in which both spouses migrate. As Figure 2 shows, there was no substantial variation in levels of depressive symptoms between men of these different groups. Among women, the 'husband-led family reunification' group had the fewest depressive symptoms in later life according to the base model. Their CESD-10 score was 3.39 ($p = .000$), 2.97 ($p = .002$), 2.15 ($p = .048$), and 1.80 ($p = .040$) points lower than the

wives in the 'husband short-term migration' trajectory, the 'husband long-term migration', the 'wives short-term migration', and the 'husband return migration' trajectories, respectively.

Table 2: Seemingly unrelated regression of husbands' and wives' later-life depressive symptoms

	Depressive symptoms					
	Model 1: Base Model		Model 2: + Early life / couple-level factors		Model 3: + Gender power relationships	
Variable	Husband	Wife	Husband	Wife	Husband	Wife
Age	0.016	–0.025	–0.024	–0.038	–0.024	–0.037
	(–0.025, 0.056)	(–0.075, 0.025)	(–0.070, 0.023)	(–0.095, 0.018)	(–0.070, 0.022)	(–0.093, 0.019)
Couple migration patterns (ref: husband-led family reunification)						
Wife short-term migration	–0.370	2.153	–1.569	1.671	–1.779	1.313
	(–2.187, 1.447)	(0.019, 4.286)	(–3.423, 0.286)	(–0.419, 3.760)	(–3.633, 0.074)	(–0.769, 3.396)
Husband long-term migration	0.850	2.967	–0.241	2.137	–0.349	1.932
	(–0.758, 2.459)	(1.109, 4.825)	(–1.899, 1.416)	(0.310, 3.965)	(–2.002, 1.303)	(0.115, 3.749)
Husband return migration	0.540	1.802	0.285	1.107	0.154	0.869
	(–0.946, 2.026)	(0.083, 3.521)	(–1.172, 1.742)	(–0.589, 2.802)	(–1.300, 1.608)	(–0.817, 2.555)
Husband short-term migration	0.677	3.387	–0.557	2.440	–0.624	2.332
	(–0.862, 2.216)	(1.612, 5.162)	(–2.182, 1.068)	(0.673, 4.207)	(–2.244, 0.995)	(0.574, 4.089)
Joint migration	0.343	2.979	–0.818	2.380	–0.854	2.165
	(–1.451, 2.137)	(0.909, 5.048)	(–2.606, 0.969)	(0.336, 4.424)	(–2.636, 0.928)	(0.133, 4.196)
Education (ref: <=primary school)						
Middle school			–1.216	–1.834	–1.216	–1.695
			(–2.107, –0.325)	(–3.063, –0.605)	(–2.106, –0.325)	(–2.916, –0.473)
>= high school			–1.988	–1.141	–1.989	–0.645
			(–3.089, –0.886)	(–3.037, 0.755)	(–3.087, –0.891)	(–2.543, 1.253)
Childhood health (ref: worse than others)						
Same as others			–0.385	–1.948	–0.319	–1.838
			(–1.517, 0.747)	(–3.235, –0.661)	(–1.449, 0.812)	(–3.121, –0.556)
Better than others			–1.102	–2.414	–1.051	–2.262
			(–2.260, 0.056)	(–3.753, –1.075)	(–2.213, 0.110)	(–3.599, –0.925)
Childhood SES (ref: worse than others)						
Same as others			–0.731	–1.411	–0.691	–1.384
			(–1.496, 0.033)	(–2.347, –0.476)	(–1.455, 0.073)	(–2.316, –0.451)
Better than others			–1.227	–2.608	–1.276	–2.540
			(–2.608, 0.155)	(–3.959, –1.257)	(–2.656, 0.105)	(–3.883, –1.197)
Urban *hukou* at birth			0.730	–1.602	0.820	–1.443
			(–0.940, 2.399)	(–3.733, 0.530)	(–0.844, 2.485)	(–3.559, 0.673)
Migrated before marriage			–0.398	–0.140	–0.347	0.087
			(–1.442, 0.647)	(–1.880, 1.600)	(–1.392, 0.698)	(–1.649, 1.824)

Table 2: (Continued)

	Depressive symptoms					
	Model 1: Base Model		Model 2: + Early life / couple-level factors		Model 3: + Gender power relationships	
Variable	Husband	Wife	Husband	Wife	Husband	Wife
Work before marriage (ref: No)						
Yes, agricultural work			0.131	–1.026	0.217	–1.041
			(–1.372, 1.634)	(–2.259, 0.208)	(–1.288, 1.722)	(–2.271, 0.190)
Yes, non-agricultural work			–0.469	–0.781	–0.403	–0.640
			(–1.946, 1.008)	(–2.373, 0.810)	(–1.878, 1.071)	(–2.224, 0.944)
Ever lived in spouse's home city			–2.029	1.688	–2.007	1.664
			(–3.896, –0.162)	(–0.108, 3.484)	(–3.870, –0.144)	(–0.122, 3.450)
Number of children			0.637	0.255	0.651	0.282
			(0.258, 1.016)	(–0.202, 0.712)	(0.273, 1.029)	(–0.173, 0.737)
Log per capita household consumption			0.145	–0.030	0.218	0.026
			(–0.401, 0.691)	(–0.657, 0.597)	(–0.329, 0.766)	(–0.598, 0.650)
Spousal self-rated health			0.456	0.450	0.439	0.405
			(0.001, 0.910)	(–0.090, 0.991)	(–0.015, 0.894)	(–0.134, 0.943)
Spousal education (ref: <=primary school)						
Middle school			–0.343	–0.392	–0.266	–0.340
			(–1.396, 0.711)	(–1.441, 0.658)	(–1.318, 0.785)	(–1.386, 0.705)
>= high school			0.744	0.090	1.038	0.093
			(–0.840, 2.328)	(–1.182, 1.362)	(–0.558, 2.634)	(–1.172, 1.358)
Spouse urban *hukou* at birth			0.334	0.156	0.481	0.220
			(–1.458, 2.127)	(–1.785, 2.097)	(–1.308, 2.270)	(–1.707, 2.147)
Parents' son preference					0.103	0.332
					(–0.837, 1.042)	(–0.658, 1.323)
Spousal parents' son preference					0.375	–0.548
					(–0.474, 1.223)	(–1.632, 0.535)
Wife holds an independent bank account					–1.188	–1.867
					(–2.064, –0.312)	(–2.860, –0.874)
Constant	5.216	8.229	4.781	13.297	4.064	13.100
	(2.290, 8.142)	(4.784, 11.674)	(–1.930, 11.492)	(5.628, 20.966)	(–2.663, 10.790)	(5.478, 20.722)
Covariance (husband, wife)	13.121		10.411		10.112	
	(10.315, 15.928)		(7.559, 13.263)		(7.300, 12.924)	
Observations	923	923	923	923	923	923

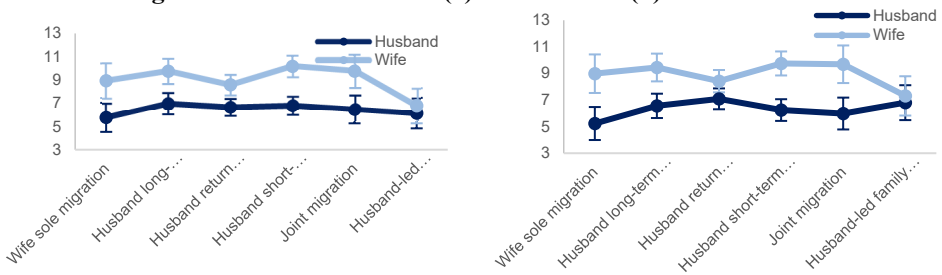
Note: 95% confidence intervals in parentheses; SES: socioeconomic status.

After adding early-life and couple-level factors, the group differences in later-life depressive symptoms were partly attenuated. The difference in CESD-10 score between wives in the 'husband-led family reunification' and 'husband short-term migration' trajectories reduced to 2.44 points (p = .007), the difference with the 'husband long-term migration' trajectories reduced to 2.14 (p = .022), the difference with 'wife short-term migration' trajectories reduced to 1.67 points (p = .117), and the difference with 'husband return migration' trajectories reduced to 1.11 points (p = .201). Table 1 shows that

women in the 'husband-led family reunification' trajectory had, on average, a higher educational level and better childhood SES than women in the 'husband-short-term migration' trajectory. Given that these early-life factors are key predictors of later-life mental health, the results suggest that the better mental health outcomes observed among women in the husband-led family reunification group may partly be explained by positive selection based on their early-life socioeconomic status and family resources. In sum, only among women was the mental health of the husband-led family reunification group better than most 'sole migration' groups, after accounting for the covariates. Moreover, the mental health advantage was observed only among the followers in the reunited couples, not the lead migrants. Therefore, H2 was partially supported.

As Table A-3 in the Appendix further shows, the differences in CESD-10 scores between members of the 'joint migration' trajectory group and those from groups involving only one migrating spouse are minimal. Therefore, H1 was not supported.

Figure 2: Prediction of depressive symptoms by couple migration pattern and gender based on Model 1 (a) and Model 2 (b)



Note: The error bars indicate a 95% confidence interval.

4.3 Gender differences in the associations and gendered mechanisms

Figure 2 already provides preliminary evidence that the association between couple migration patterns and mental health was more pronounced among women. To examine H3, we further conducted a likelihood-ratio test to formally examine whether the association between migration trajectories and mental health differ by gender. This involves comparing the model fit of the freely estimated model (adjusted Model 2 in Table 2) and the constrained models (in which the coefficients for certain couple migration patterns were constrained to be equal across genders in Model 2). A $\chi 2$ larger than the critical value ($\alpha = 0.05$) indicates that the freely estimated model fits better than the constrained models, and the coefficients for certain groups differ by gender. H3 states

that the mental health advantage of both spouses migrating, compared to only one spouse migrating, is more pronounced among women. We tested the gender differences in coefficients across these groups. As 'joint migration' does not differ substantially from the groups where only one spouse migrates, we only focus on the comparison between 'husband-led family unification' and other sole migration groups (see Table 3).

The likelihood ratio tests indicate significant gender differences in the association between couple migration patterns and mental health. Specifically, wives in the 'wife short-term migration' ($\chi2 = 7.07$, $p = 0.008$), 'husband long-term migration' ($\chi2 = 4.91$, $p = 0.027$), and 'husband short-term migration' ($\chi2 = 8.18$, $p = 0.004$) groups were more likely to report poorer mental health outcomes compared to those in the 'husband-led family reunification' group, and this negative association was stronger for women than for men in these same groups, which partially supports H3.

Table 3: Likelihood-ratio test for within-couple gender gaps in mental health (N = 1,846)

Group with constrained parameters	Reference group	Likelihood-ratio test
Wife short-term migration	Husband-led family reunification	**χ^2=7.07, p=0.008**
Husband long-term migration	Husband-led family reunification	**χ^2=4.91, p=0.027**
Husband return migration	Husband-led family reunification	**χ^2=0.73, p=0.394**
Husband short-term migration	Husband-led family reunification	**χ^2=8.18, p=0.004**

Note: Based on adjusted model controlling for early life and couple-level factors (Model 2).

To further examine the role of gender power relationships in explaining the differences in depressive symptoms across couple migration patterns, we added variables to model 3 such as own parents' son preference, parents-in-law's son preference, and whether the wife held an independent bank account (Table 2). Wives who held an independent bank account had a CESD-10 score that was 1.87 lower (p =.000) than for those who did not, suggesting that financial independence was associated with better mental health. However, neither own parents' nor parents-in-law's son preference showed a strong correlation with wives' depressive symptoms. After including variables related to gender power relationships, the differences in CESD-10 scores between wives in 'husband-led family reunification' trajectories and those in 'husband short-term migration' and 'husband long-term migration' trajectories were further attenuated, with the differences reduced to 2.33 (p = .009, 4.4% reduction) and 1.93 (p = .037, 9.6% reduction) respectively, but remain substantial.

In sum, these results show that the better later-life mental health outcome for wives in the 'husband-led family reunification' trajectory might be attributed to their higher

likelihood of holding an independent bank account (47.2%) compared to other groups where only one spouse migrated. This finding highlights that gender power dynamics help explain some of the differences in mental health outcomes across couple migration patterns and partially supports H4.

5. Discussion

With the evident 'familisation' of migration inside China and around the world, there is an increasing need to take the family as the unit of analysis in studies examining the implications of migration for both migrants and their family members. This article provides a first step. Using unique life history data, we identified typical couple migration patterns in China. A dyadic analysis was also conducted to examine how couple migration patterns impacted husbands' and wives' health outcomes in later life. Overall, our study finds that: (1) wives in the 'husband-led family reunification' trajectory had better mental health in later life than those in the 'husband short-term migration' and 'husband long-term migration' trajectories, which partly supports H2 and H3; (2) Husbands and wives migrating jointly did not have better mental health in later life than their counterparts where only one spouse migrates, which does not support H1; (3) The lower levels of later-life depressive symptoms for wives in the 'husband-led family reunification' trajectory might be partly, but not fully, explained by their higher likelihood of holding an independent bank account, providing evidence for H4.

One innovation of the study is applying Multichannel Sequence Analysis to study couple-level migration arrangements over the life course and account for the interdependent nature of a couple's migratory behaviours. This is enabled by a specific advantage of the data we used, which is that it includes information on the residential histories of both spouses. The MSA approach is also consistent with the 'linked life' principle of the life course perspective. This data-driven approach identified six trajectories that correspond with the ideal types we expected based on Kofman's family migration typology and the Chinese context. Moreover, the MSA captured three subtypes of 'husband sole migration' (short-term, long-term, and return migration). This demonstrates the diversity of 'husband sole migration' in terms of the timing and duration of the migration, providing more nuanced insights into couple migration patterns.

This study also contributes to the literature by foregrounding a couple's perspective and gender dynamics in the analysis of migration and later-life mental health. First, we distinguished the gender of migrants when developing the couple migration typology and extended the existing family migration model (Kofman 2004). Second, our study evidenced that the association between couple migration patterns and mental health varied by gender. Overall, we found that men had fewer depressive symptoms than

women across nearly all migration trajectories (except for 'husband-led family reunification'), which is consistent with extensive literature on the gender gap in mental health (Neitzke 2016; Piccinelli and Wilkinson 2000). While it is partly attributed to women's greater likelihood of perceiving and reporting higher levels of depression due to cultural ideals of femininity and masculinity, it is crucial not to overlook the significant role of social and structural disadvantages experienced by women throughout the life course. These disadvantages experienced by women are especially pronounced among older generations in China, where gender discrimination remains deeply entrenched (Pearson 1995). Another overarching pattern is that the variation in depressive symptoms across couple migration patterns was larger among men than women. A stronger association between migration and mental health among women compared to men has also been observed in other studies (Preston and Grimes 2019; Zhang, Nazroo, and Zhang 2023). One possible explanation is that men are likely to maintain and conform to traditional gender role expectations as breadwinners, regardless of whether they migrate or whether the migration is accompanied or unaccompanied. By contrast, women's experiences with care responsibilities, financial independence, employment opportunities, and autonomy are more closely shaped by specific migration strategies.

We found that the 'husband-led family reunification' trajectories were associated with better mental health in later life than 'husband short-term migration' and 'husband long-term migration' for wives, but not for husbands. This result also concurs with previous studies demonstrating the benefits of migrating with spouses for women (Jin, Zhao, and Tong 2021; Preston and Grimes 2019). This is possibly because wives, as followers, can benefit from the social networks, information, and material resources of their spouses who are already settled in the destination (Ortensi 2015). In the Chinese context, if husbands have settled smoothly in the destination and succeed in obtaining a local *hukou*, their wives will share the social benefits of *hukou* such as housing and public childcare, which are important for their mental well-being (Song and Smith 2021), something which has strong parallels in international migration. However, the husband, who is the first migrant of the couple, is exposed to the risks and stressors associated with the initial stage of migration, such as social isolation and lack of resources and support, which might dampen the positive impact of family reunification on the mental well-being of the husband at a later stage (Spallek, Zeeb, and Razum 2019). This may explain why the husbands in this trajectory did not have fewer depressive symptoms in later life than husbands in other groups and the gender gap in depressive symptoms is the smallest in this group.

The fewer depressive symptoms of wives in the 'husband-led family reunification' trajectory compared with wives in the 'husband short-term migration' trajectory also highlights the significant role of gender power relationships. Our sequentially adjusted models indicate that the higher likelihood of holding an independent bank account for

wives in the 'husband-led family reunification' trajectory might contribute to their lower levels of depressive symptoms. In line with resource theory, financial independence reduces women's reliance on their husbands and enhances their confidence and assertiveness, and thus their bargaining power, benefitting women's mental well-being and reducing the mental health gaps within couples (Jacka 2005; Jin, Zhao, and Tong 2021; Parrado et al. 2005). However, parents' son preferences were not associated with couple migration patterns and failed to explain gender differences in mental health. It is likely that parents' son preferences cannot fully capture the gender ideology of individuals, and social desirability bias may also affect the accuracy of the responses to these questions.

Selection can also play an important role in explaining the variation in mental health outcomes across different couple migration patterns. The descriptive analysis shows that couples' migration strategies are shaped by both partners' early-life characteristics as well as their work and migration experiences prior to marriage. Specifically, couples in the 'husband-led family reunification' group are positively selected based on early-life SES and education. For women, better family economic resources and higher levels of education are also associated with more egalitarian gender role attitudes and greater bargaining power after marriage (Du, Xiao, and Zhao 2021; Marks, Lam, and McHale 2009), which may help explain the better mental health outcomes observed among women in this group.

However, our findings suggest that couples in the 'joint migration' group did not have better later-life mental health than other groups, which does not fully support H1. While the lack of significance may be partly due to the small sample size of some groups, it may also suggest that the stress and obstacles that couples face when migrating together could offset the social support benefits of joint migration. Unlike unaccompanied migrants or couples migrating sequentially, couples migrating together are unable to diversify the risks and may experience more financial difficulties, leading to increased stress for migrant couples (Wong and Song 2008). Due to the *hukou* system, most migrants are not eligible for state-subsidised housing and childcare (Chan and Buckingham 2008; Feng et al. 2017). Whereas single migrants usually live in dormitories or shared accommodation provided by their employers (Shen and Huang 2003), migrant couples bear the considerable financial burden of paying for their accommodation in cities. Without both public and kinship support, migrant couples have more worries about childcare. In addition, the results echo some studies on international migration, which find that discriminatory residence and employment regulations (comparable to the *hukou* system in China) can make a migrant woman's rights contingent on her relationship with her husband, who is in effect her sponsor, thus weakening her bargaining power at home (Kraler and Bonizzoni 2010; Parrado, Flippen, and McQuiston 2005). These complex

gender dynamics may partly explain why couples migrating together may not necessarily lead to more advantages in later-life mental health for women.

Future studies could benefit from addressing some of the limitations of this study. First, the spousal residential histories of those who were not partnered (separated, divorced, widowed, and never married) at the time of interview are not available in the CHARLS. Therefore, our sample is restricted to couples who were still married, which might hinder the extrapolation of the results to more diverse older populations. This group might also be subject to health selection because married people tend to be healthier in later life (Robards et al. 2012). Second, ideally, the migration status of children should be considered in the conceptualisation of family migration. The health consequences of different couple migration patterns might differ by whether children migrate with their parents or are left behind. However, the complete residence histories of children are not available in CHARLS, which prevents us from identifying if parents migrated with children or left children behind. To partly address this limitation, we used the number of children as a proxy of childcare burden and interacted this variable with couple migration patterns to explore the role of children in the relationships between migration and later-life depression for couples (see Table A-1 in the Appendix). However, we did not find any meaningful interaction effects between the number of children and couple migration patterns. Future studies should integrate children into the family migration framework to better understand the mechanisms linking family migration and health. Third, the sample size for migrant couples in CHARLS is relatively small, potentially affecting the statistical power of the analysis. Therefore, the results should be interpreted with caution. The limited sample size also hinders further exploration of important subgroup differences, such as distinguishing between rural–rural, rural–urban, and urban–urban migration, as well as differentiating between migration with and without *hukou* conversion (Zhang, Nazroo, and Vanhoutte 2021; Zhang, Nazroo, and Zhang 2023). The sample size also limits the length of the migration trajectories we analysed, as sequence analysis requires sequences of equal length. As a result, we are unable to account for migration events that occur after 20 years of marriage. Moreover, due to the lack of information on gender relationships, our analysis only includes two aspects of gender power relationships. During the exploration process, we also considered other measurements of gender relationships, such as household ownership and couple employment arrangements, but these were not suitable measures because the proportion of dual-career couples and joint household ownership is very high in China. Future studies might adopt more comprehensive measurements of gender relationships, such as decision-making power, gender role expectations, and indicators of relative resources within a couple. Lastly, the observational non-experimental study design makes it difficult to draw causal conclusions, but nevertheless the findings are suggestive of particular effects of couple migration patterns on later-life mental health, particularly

given the range of explanatory processes that we tested by taking account of early life and current circumstances.

Despite these limitations, our study has policy implications for family migration in a broader context. In 2015, family migration comprised nearly 40% of all permanent entries into OECD countries (OECD 2017). It accounts for two-thirds of immigration into the US and has been the main channel of immigration into the European Union (IOM 2008). Compared with traditional labour migration, women and children play a more significant role in family-related migration, introducing additional challenges to migration and immigration policies in different countries. Our study highlights the increasing need to recognise the significance of households in migrant-receiving countries or regions, rather than focusing on individuals (especially labour migrants and men) in migration policy. In the Chinese context, although more couples have migrated together in recent years, there are around 30 million left-behind wives (Duan, Cheng, and Qin 2017). Our study suggests that facilitating family reunification is key to improving the well-being of migrant families and promoting women's welfare. Major migration destinations should consider replacing discriminatory regulations and policies for migrants without a local *hukou* (or permanent residency in the context of international migration), such as restrictions on housing, childcare, healthcare, and education, with more family-friendly social policies. Specifically, targeted measures should be implemented to facilitate the labour market participation of migrant women. This includes access to vocational training and job-seeking assistance to improve their economic integration. Additionally, migrant children must be guaranteed equal rights to access public, high-quality preschool education to alleviate the economic and caregiving burdens associated with joint family migration. Our study also has theoretical and methodological implications for the literature on migration and health. Although many large-scale surveys worldwide are household-based, there is still inadequate exploitation of household-level information in the analysis of the consequences of migration. This study demonstrates the value of using couple-level data and using the couple as a unit of analysis, and it also encourages future studies to further develop this approach to enrich our understanding of the mechanisms that underlie the links between health, gender, and migration.

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Appendix

Data source

The China Health and Retirement Longitudinal Study (CHARLS) is a national survey of adults aged 45 and over in mainland China. It employs a stratified multi-stage probability proportional to size (PPS) random sampling strategy, covering 28 provinces, 150 counties, and 450 villages/urban communities. With the baseline survey conducted in 2011, three follow-up waves have been conducted (2013, 2015, and 2018). The CHARLS contains a wide range of information on demographics, socioeconomic status, family, and health of older adults. In 2014, a life history survey was conducted which collected retrospective information on participants' previous work, family formation, health, and residence history, using an event history calendar method. The detailed residence history module enabled us to identify the time of participants' migrations throughout the life course. As people aged 45 and above and their spouses are included in the sample, we are able to link the information on the members of the couple and conduct dyadic analyses.

Technical details of MCA

To use a distance measure sensitive to ordering (e.g., OMstran), we used the Multichannel Sequence Analysis additive trick to first derive the combined states, and costs for multidomain sequences by linear combining costs of the individual channels. More specifically, the INDELSLOG method was used to derive substitution and indel costs for the combined sequence. This method calculates costs based on state relative frequencies (f_i). Indel costs are set as $indel_i=\log[2/(1+f_i)]$. Substitution costs are set as $SC(i,j)=indel_i+indel_j$ (Gabadinho et al. 2011). We also used other cost schemes to calculate the dissimilarity matrix, but the INDELSLOG method yielded the best solution according to the cluster cut-off criteria. For clustering method, we employed the partitioning around medoids approach (PAM), which has the advantage of optimising a global criterion and not only a local criterion (as in hierarchical clustering). One drawback of this method is that the result is dependent on the initial choice of medoids. To address this problem, we initialised the PAM algorithm using the hierarchical clustering procedure. This allowed us to make use of the advantages of both clustering methods.

Table A-1: The interaction effect of the number of children of couple migration patterns

	Model 1: Base model		Model 2: + early life/SES	
Variable	Husband	Wife	Husband	Wife
Age	–0.028	–0.055	–0.024	–0.035
	(–0.073, 0.017)	(–0.110, 0.000)	(–0.070, 0.022)	(–0.092, 0.021)
Couple migration patterns (ref: husband-led family reunification)				
Wife short-term migration	–4.337	2.438	–5.199	2.961
	(–8.356, –0.318)	(–2.426, 7.302)	(–9.156, –1.242)	(–1.782, 7.704)
Husband long-term migration	–1.900	1.232	–1.985	1.320
	(–5.887, 2.088)	(–3.375, 5.838)	(–5.910, 1.939)	(–3.159, 5.798)
Husband return migration	–1.866	4.177	–1.615	3.952
	(–5.344, 1.611)	(0.183, 8.171)	(–4.991, 1.762)	(0.094, 7.810)
Husband short-term migration	–3.827	5.997	–4.322	5.320
	(–7.436, –0.219)	(1.794, 10.199)	(–7.864, –0.780)	(1.242, 9.397)
Joint migration	–1.560	3.851	–1.801	4.212
	(–5.497, 2.376)	(–0.695, 8.397)	(–5.633, 2.030)	(–0.245, 8.669)
Number of children	–0.264	1.202	–0.319	1.004
	(–1.435, 0.906)	(–0.113, 2.517)	(–1.460, 0.822)	(–0.277, 2.284)
Migration patterns number of children (ref: husband-lead family reunification * number of children)*				
Wife short-term migration	1.482	–0.286	1.511	–0.572
	(–0.014, 2.977)	(–2.099, 1.526)	(0.061, 2.962)	(–2.336, 1.193)
Husband long-term migration	0.982	0.477	0.776	0.236
	(–0.503, 2.467)	(–1.227, 2.181)	(–0.674, 2.225)	(–1.415, 1.888)
Husband return migration	0.931	–1.052	0.830	–1.178
	(–0.385, 2.246)	(–2.545, 0.441)	(–0.446, 2.106)	(–2.624, 0.268)
Husband short-term migration	1.657	–1.198	1.551	–1.194
	(0.305, 3.009)	(–2.760, 0.364)	(0.241, 2.861)	(–2.703, 0.315)
Joint migration	0.696	–0.468	0.465	–0.779
	(–0.766, 2.157)	(–2.161, 1.226)	(–0.952, 1.882)	(–2.429, 0.871)
Education (ref: <=primary school)				
Middle school			–1.188	–1.823
			(–2.076, –0.299)	(–3.049, –0.598)
>= high school			–1.999	–1.200
			(–3.095, –0.903)	(–3.090, 0.690)
Childhood health (ref: worse than others)				
Same as others			–0.346	–1.880
			(–1.474, 0.782)	(–3.160, –0.599)
Better than others			–1.082	–2.350
			(–2.233, 0.068)	(–3.680, –1.019)
Childhood SES (ref: worse than others)				
Same as others			–0.795	–1.339
			(–1.556, –0.034)	(–2.270, –0.408)
Better than others			–1.334	–2.599
			(–2.710, 0.042)	(–3.948, –1.250)
Urban *hukou* at birth			0.879	–1.529
			(–0.786, 2.544)	(–3.658, 0.601)
Migrated before marriage			–0.417	–0.118
			(–1.455, 0.621)	(–1.847, 1.611)

Table A-1: (Continued)

	Model 1: Base model		Model 2: + early life/SES	
Variable	Husband	Wife	Husband	Wife
Work before marriage (ref: No)				
Yes, agricultural work			0.091	–0.945
			(–1.410, 1.591)	(–2.172, 0.282)
Yes, non-agricultural work			–0.463	–0.677
			(–1.936, 1.010)	(–2.262, 0.909)
Ever lived in spouse's home city			–2.007	1.765
			(–3.864, –0.150)	(–0.019, 3.549)
Log per capita household consumption			0.156	–0.068
			(–0.387, 0.699)	(–0.693, 0.557)
Spousal self-rated health			0.437	0.425
			(–0.015, 0.889)	(–0.115, 0.965)
Spousal education (ref: <=primary school)				
Middle school			–0.331	–0.424
			(–1.382, 0.721)	(–1.469, 0.621)
>= high school			0.716	0.066
			(–0.865, 2.298)	(–1.201, 1.333)
Spouse urban *hukou* at birth			0.228	0.108
			(–1.557, 2.013)	(–1.832, 2.047)
Constant	8.624	7.293	6.970	11.647
	(4.596, 12.652)	(2.597, 11.989)	(–0.151, 14.091)	(3.382, 19.912)
Observations	923	923	923	923

Note: Data source: CHARLS 2015, CHARLS life history data. Confidence intervals in parentheses.

Figure A-1: Cut-off criteria of cluster analysis

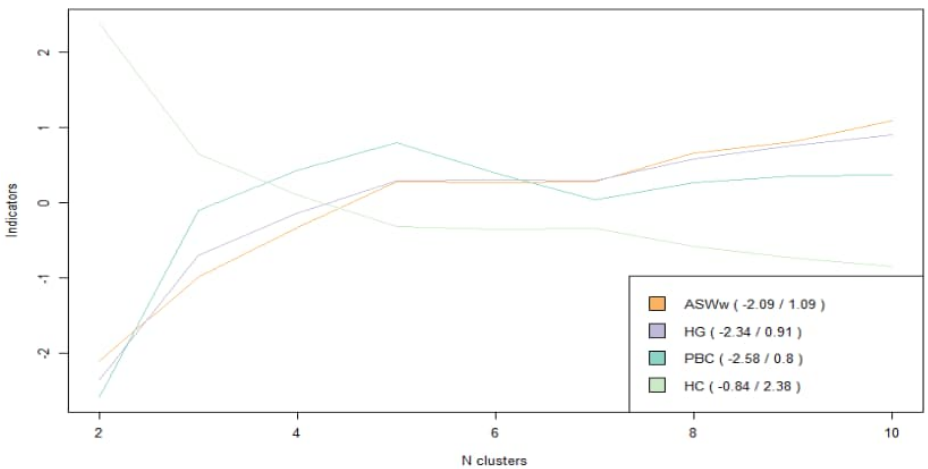
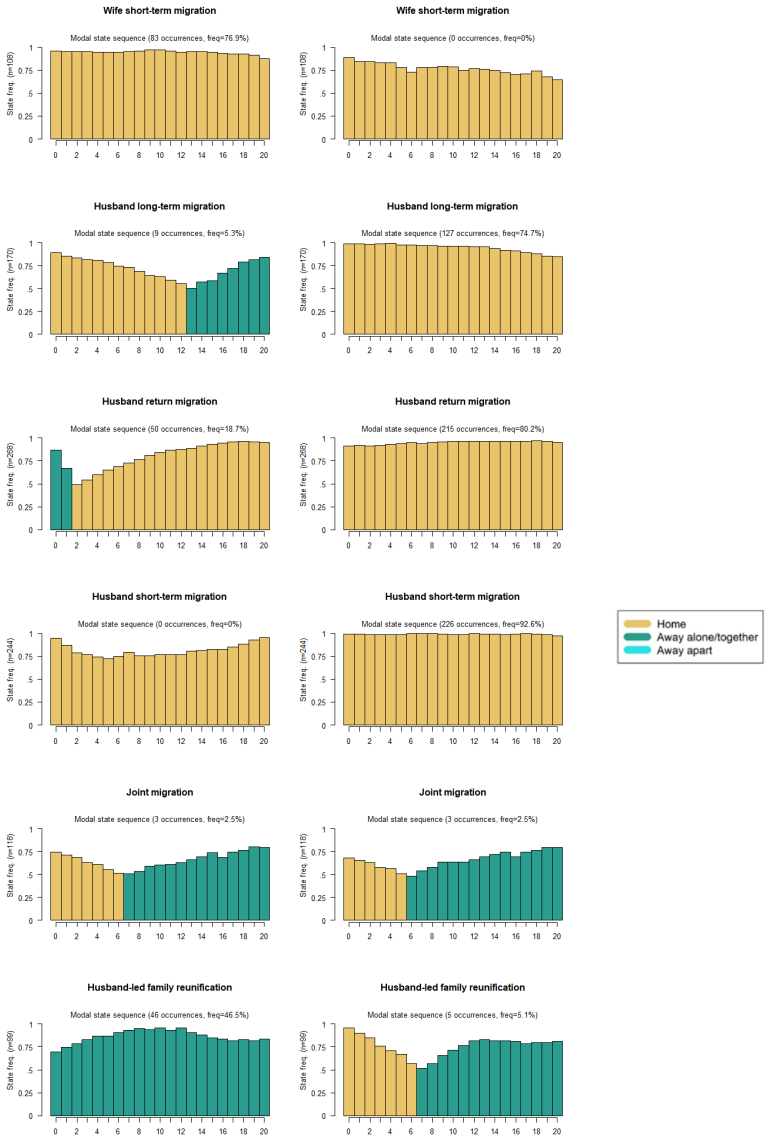


Figure A-2: Medoid plot of couple migration patterns



Note: the left-hand side is husbands' migration trajectories, the right-hand side is wives' migration trajectories.

Figure A-3: Sequence index plot of couple migration patterns (using 30 years as a cut-off point for the time axis)

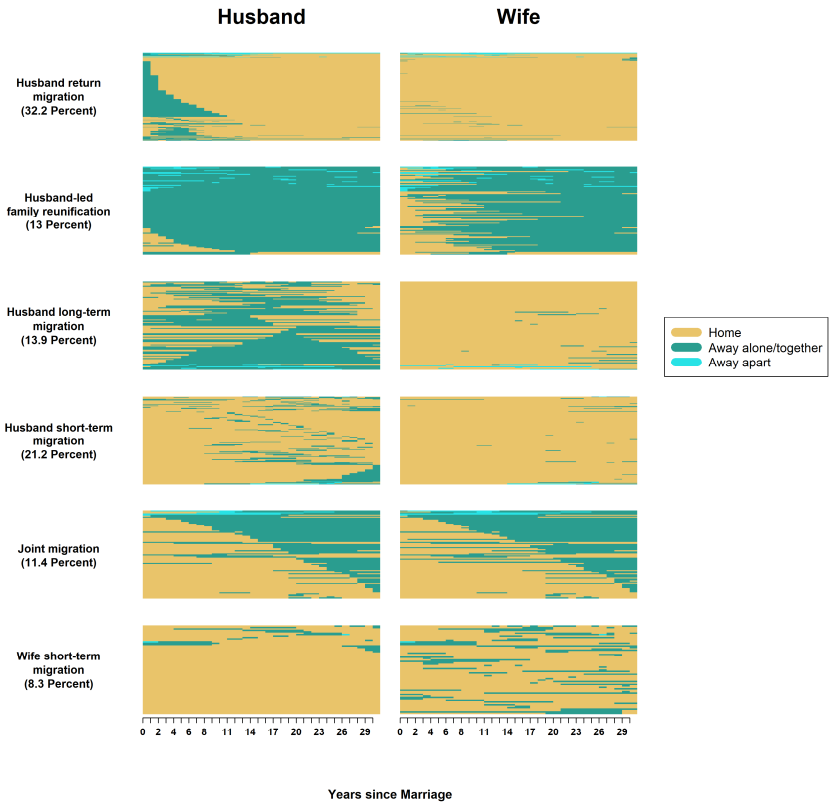


Table A-2: Descriptive analysis of CESD-10 score by couple migration pattern and gender (using 30 years as a cut-off point for the time axis)

	CESD-10 score Mean (SD)		
	Men	Women	%
Wife short-term migration	5.549 (5.100)	8.722 (6.238)	8.3
Husband long-term migration	6.922 (6.040)	9.968 (7.538)	13.9
Husband return migration	6.779 (5.490)	9.134 (6.380)	32.2
Husband short-term migration	7.300 (6.197)	9.196 (6.800)	21.2
Joint migration	7.304 (6.392)	10.186 (6.935)	11.4
Husband-led family reunification	5.577 (5.087)	6.480 (5.111)	8.3
p-value	0.211	0.011	

Note: F-tests were conducted to examine the differences in CESD-10 score across couple migration trajectories for men and women; P-values for F-tests are reported. The relative frequency distribution of couple migration trajectories are reported in the last column.

Figure A-4: Sequence index plot of couple migration patterns (differentiating own home and spousal home)

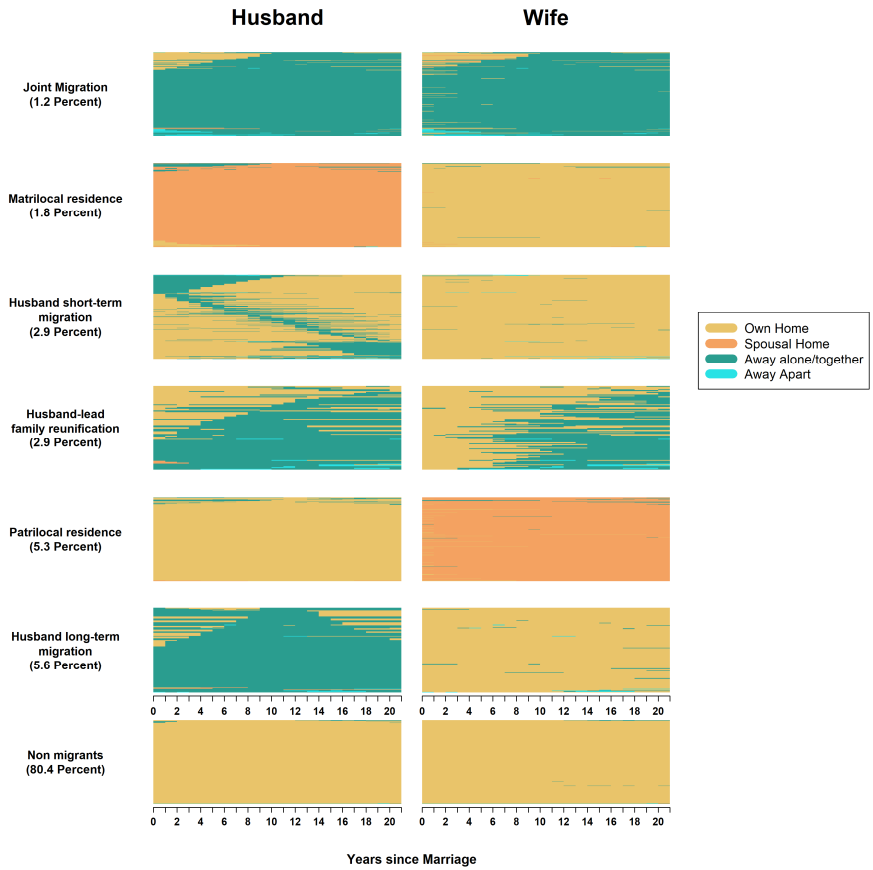


Table A-3: Seemingly unrelated regression of husbands' and wives' later-life depressive symptoms (Joint migration as reference group)

	Model 1: Base model		Model 2: + Early life / couple-level factors		Model 3: + Gender power relationships	
Variable	Husband	Wife	Husband	Wife	Husband	Wife
Couple migration pattern (ref: Joint migration)						
Wife short-term migration	–0.713	–0.826	–0.750	–0.709	–0.925	–0.852
	(–2.457, 1.031)	(–2.875, 1.223)	(–2.438, 0.938)	(–2.706, 1.288)	(–2.613, 0.763)	(–2.837, 1.134)
Husband long-term migration	0.507	–0.012	0.577	–0.242	0.505	–0.233
	(–1.020, 2.035)	(–1.784, 1.761)	(–0.920, 2.074)	(–2.015, 1.530)	(–0.988, 1.998)	(–1.993, 1.527)
Husband return migration	0.197	–1.176	1.103	–1.273	1.008	–1.296
	(–1.229, 1.623)	(–2.835, 0.483)	(–0.366, 2.573)	(–2.931, 0.385)	(–0.458, 2.474)	(–2.941, 0.349)
Husband short-term migration	0.334	0.408	0.261	0.060	0.230	0.167
	(–1.118, 1.786)	(–1.277, 2.093)	(–1.180, 1.703)	(–1.634, 1.754)	(–1.209, 1.669)	(–1.521, 1.856)
Husband-led family reunification	–0.343	–2.979	0.818	–2.380	0.854	–2.165
	(–2.137, 1.451)	(–5.048, –0.909)	(–0.969, 2.606)	(–4.424, –0.336)	(–0.928, 2.636)	(–4.196, –0.133)
Constant	5.559	11.207	3.962	15.677	3.210	15.265
	(2.842, 8.276)	(8.028, 14.387)	(–2.645, 10.569)	(8.222, 23.131)	(–3.409, 9.828)	(7.858, 22.671)
Observations	923	923	923	923	923	923

Note: 95% confidence intervals in parentheses; SES: socioeconomic status. The covariates adjusted for in Models 1–3 in this table are the same as the covariates in Models 1–3 in Table 2. The results for the covariates are not reported, as the models in Table 2 and Table A-3 are essentially identical, with all covariate coefficients remaining the same.