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IZA DP No. 12370

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ISSN: 2365-9793

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ABSTRACT

Sons or Daughters? The Impact of Children's Migration on the Health and Well-Being of Parents Left Behind*

We study the impact of adult children's internal migration on the health and subjective well-being of elderly parents left behind, distinguishing between the gender of the migrant children. To overcome migration endogeneity, we exploit novel and exogenous variation in children's astrological characteristics and apply instrumental variables methods. We find a positive effect of the migration of daughters on parents' health and life satisfaction, but no such beneficial effects when sons migrate. We further explore the mechanism through which this gender-biased migration effect may arise. Our findings have important implications for regions and countries that have high rates of female emigration.

JEL Classification: O15, I12, J14, J16, R23

Keywords: migration, health, subjective well-being, gender, Chinese zodiac signs

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* We would like to thank Thomas Gall, Corrado Giulietti, Joseph-Simon Goerlach, Hartmut Lehmann, Emmanouil Mentzakis, Héctor Calvo Pardo, Hillel Rapoport, Richard Upward, Michael Vlassopoulos, Jeffrey Zax, and Zhong Zhao for helpful discussion and suggestions. We are also grateful to participants at workshops and seminars at the University of Southampton, the 2016 IAMO Forum (Halle/Saale), the ILO/IZA/Renmin University/UCW Workshop on the Chinese Labor Market in Transition (Beijing), the 11th Migration and Development Conference (Stanford), and the Sino-UK Health Forum (Ningbo) for feedbacks and comments. Chuhong Wang acknowledges financial support from the Economic and Social Research Council (ESRC). Jackline Wahba acknowledges financial support from the ESRC (ES/L015684/1). Any errors are ours alone.

1 Introduction

"Rear sons for help in old age and store up grains against famine."

Chinese Proverb

In developing and emerging countries with rapid population ageing and massive labour migration flows, a large number of elderly people spend their twilight years alone with their children living and working elsewhere. The question of how migration of adult children affects elderly parents left behind continues to be an important issue for researchers and policy makers. Theoretically, it is ambiguous whether children's migration should have a net positive or negative impact on parental welfare. On the one hand, the absence of children may impose emotional stress and greater responsibilities on parents who stay behind. On the other hand, migrant children may send back financial remittances and social remittances (e.g., new ideas, norms, practices, etc.) that benefit their parents at home.

Economists have focused on the impact of adult child migration on the health outcomes of the parents and find rather mixed evidence,[1] thereby neglecting the overall *subjective* consequences of migration. There are certain aspects of old-age welfare that are difficult to capture through health measures. For example, children's migration may directly create a sense of pride among parents of migrants, which consequently leads to higher life satisfaction. In this paper we investigate the impact of child migration on their parents' health and subjective well-being (SWB) outcomes.

Meanwhile, migrant daughters and migrant sons may behave very differently in terms of their contributions (money, time, affection) to elderly parents, depending on their expected roles in old-age support, their conditions at destination, and the strength of their ties to parents at home (Le Goff, 2016). For instance, the impact of migration could be positive for elderly parents of migrant sons in particular, if men are more likely to obtain a well-paid job in the city and hence can send more remittances back home. Alternatively, it could be that migrant daughters maintain stronger links with their parents at origin through more contact, resulting in better health for their left-behind parents. However, previous work has tended to estimate an *overall* effect of child migration and has rarely

[1] While some studies find that the migration of adult children adversely influences the health of the left-behind parents (Antman, 2010, 2016; Ao, Jiang and Zhao, 2015, among others), others document children's migration as having a positive effect on elderly health (Böhme, Persian and Stöhr, 2015, among others).

addressed this issue from a gender-based perspective (exception is Mosca and Barrett, 2016).[2] We aim to bridge the existing gap by explicitly distinguishing between the role of daughters' migration and sons' migration in parental health and well-being.

China provides a useful setting to study this relationship. In Chinese rural society, sons are traditionally the primary caregivers for their aged parents. Recently, however, a few studies have emphasised that the increasing migration of rural females enhances the socio-economic status of women, and daughters play an increasingly critical role in family support (see e.g., Song, Li and Feldman, 2012). The Great Migration in China and the gain in female empowerment that it entails can thus provide a fruitful opportunity to learn about the gender-specific migration effect on elderly parents. We draw data from the China Health and Retirement Longitudinal Study (CHARLS), a nationally representative survey that gathers detailed personal and family information on elderly participants aged 45 and over and their spouses of any age.

The identification of the causal effect of migration is plagued by the fact that children make migration decisions according to the health or well-being status of their parents (reverse causality), or that children self-select into migration on the basis of unobservable characteristics (self-selection). For example, healthier children could have healthier parents, and they also have a higher probability to migrate. Further biases are caused by unobservable third factors simultaneously affecting the migration choice of the child and the outcome of the elderly parent (omitted variable bias[3]).

To address these concerns, we introduce a new instrumental variable strategy based on children's Chinese zodiac signs (*Shengxiao*) associated with their year of birth.[4] To show the link between astrology and migration we combine the following two facts. First, research has shown that risk attitudes and personality traits are important psychological determinants of the migration decision (Ayhan, Gatskova and Lehmann, 2017). Second, considerable evidence exists to suggest a profound influence of birth sign on a person's character, behaviour and real-life outcomes (e.g., Mocan and Yu, 2017).[5] We show that

[2]Their paper compares Irish parents of an emigrating son with those of an emigrating daughter and identifies no systematic differences between the two groups. But since it focuses solely on mental health and the gender analysis is based on a small sample of older parents who have only one migrant child, its findings cannot easily be extrapolated to other health and well-being outcomes and to the general elderly population.

[3]An example of this is a crop failure that encourages young adults to migrate and at the same time worsens the health of family members left behind.

[4]Every Chinese person, according to the date of birth, has a unique zodiac animal that accompanies him/her for life. In order, the twelve animals are Rat, Ox, Tiger, Rabbit, Dragon, Snake, Horse, Goat (Sheep), Monkey, Rooster, Dog and Pig.

[5]In Chinese astrology, different zodiac animals symbolise different characters and Chinese people hold

the Chinese zodiac sign is a strong predictor of internal migration. We subsequently probe into the mechanism behind the predictive power of astrology. Interestingly, we find that a person's Chinese zodiac sign is significantly associated with his attitudes toward risk, and since migration is a risky choice the effect of astrology may operate through this behavioural channel.

This paper contributes to the literature in the following aspects. First, while most studies have concentrated on the health responses of parents left behind, we also examine the effect of migration on parents' subjective well-being outcomes, which paints a more comprehensive picture of how children's migration is associated with various dimensions of the welfare in old age.

Second, we rigorously disentangle the migration effect of daughters and sons on the health and SWB of the rural parents, an important distinction, which has largely been overlooked thus far. We show that daughter migration and son migration have remarkably different impacts on parental outcomes. This highlights the importance of taking into account the gender of the migrant children to better understand the role of child migration in elderly welfare and make informed policy decisions.

The third contribution of this study is to take advantage of the novel variation in children's Chinese zodiac signs as a source of credibly exogenous variation in their propensity to migrate. To the best of our knowledge, this is the first paper to overcome the endogeneity of migration by instrumenting using a person's sign of birth.

Finally, the mechanism underlying the relationship between children's migration and parental welfare remains imperfectly understood. We provide a detailed analysis of a multitude of potential channels that explain the gender-biased migration effect on elderly outcomes, and demonstrate that both pecuniary and non-pecuniary factors matter.

Overall, the results reveal a striking gendered pattern in the migration effect on parental health and well-being. Daughters' rural-urban migration results in an improvement in the self-rated health, physical health and life satisfaction of the left-behind elderly. Contrary to the conventional belief, we find no similar beneficial effects on elderly outcomes when sons migrate. Our findings will be important to policy makers, as we suggest that policies and programmes targeted specifically at female migrants can effectively

a strong belief that they share similar qualities with their birth animal. For example, Tigers always think of themselves as risk-taking, ambitious, extrovert, and so on (which we will refer to as *migration-prone* attributes). Conversely, Goats usually regard themselves as risk-averse, gentle, introvert, and so on (which we will call *migration-averse* attributes). An elderly parent who has more children born in the Year of the Tiger is, therefore, more likely to see a child migrate, compared to an elderly parent who has more Goat children.

promote health and well-being in later life.

The paper proceeds as follows. Section 2 provides the institutional, conceptual, and empirical background. Section 3 describes the data used in the analysis and Section 4 lays out the identification strategy. Estimation results are presented in Section 5 followed by a discussion about possible channels in Section 6. The paper concludes in Section 7.

2 Background

2.1 Institutional Context

China is a major developing country where rapidly ageing population, increasing labour migration and family-based social support networks co-exist. It is estimated that the proportion of elderly Chinese will increase from under 10 percent in 2000 to about 30 percent in 2050 (United Nations, 2002). The growth of the elderly cohort has been happening concurrently with rapid industrialisation and urbanisation since the period of economic reform in 1978. Higher agricultural productivity led to a surplus labour force in rural areas and, in parallel, the rise in the foreign investment inflows in urban areas created high demand for low-priced labour, triggering massive rural-urban migration flows. According to a recent survey (National Bureau of Statistics of China, 2015), there are approximately 274 million rural-urban migrants in China, arguably the largest movement of the labour in human history. The mobility of the Chinese population is regulated by a strict household registration system (*hukou*). Although partially reformed, the *hukou* system remains in place and continues to shape the pattern of internal migration flows. Migrant workers without local *hukou* are restricted in terms of job opportunities and access to social benefits and public services, which effectively discourages them from bringing their whole family to cities (i.e., family migration). As a consequence, a vast number of individuals (mostly children, women and the elderly) are left behind in rural villages.

The social security system in rural parts of China, however, either does not exist or has limited capacity to meet the needs of elderly people. Additionally, the laws[6] and the norm of *filial piety* make it both a legal and moral responsibility for adult children to take care of their aged parents. Therefore, in Chinese rural villages, adult children are the main caregivers for their elderly parents. Statistics from the CHARLS survey reveal that a substantial proportion of elderly respondents rely primarily on their children for

[6]The main pieces of legislation in this regard are the Constitution (Article 49), the Marriage Law (Article 21), and the Law on Protection of the Rights and Interests of the Elderly.

support in old age (Figure A.1).[7] The family separation that migration entails presents a potential disruption to the established patterns of kin-based care for elderly parents. Yet, as economic opportunities are more promising in urban areas, migrant children are able to compensate their parents with more monetary transfers for their absence. So it is possible for elderly parents left behind to maintain good health while their children are working elsewhere. In the next subsection, we build up a simple conceptual framework about the main channels through which children's migration can influence the welfare of the left-behind parents.

2.2 A Simple Conceptual Framework

Motivated by Grossman (1972)'s health production function we extrapolate that there are four main channels through which child migration may influence the health and well-being of elderly parents, consisting of both monetary and non-monetary channels.

Firstly, the income effect of remittances is likely to alter parental health in a positive way. More money allows elderly parents to buy more health-related inputs[8] (since health is a normal good) and to better mitigate the impact of adverse health shocks. The positive relationship between income/wealth and subjective well-being has also long been established. Note that there are other important considerations here, such as incentives to remit, situations in destination cities, and migrants' ties to the left-behinds. As such, the gender of the migrant becomes crucial.[9]

Secondly, an absent child obviously means fewer time inputs into parental health function. Yet this channel is complicated by two important factors. First, children's time support may be close substitutes so that remaining siblings will care for the parents while migrants are away. In China, when a child migrates, it is very common for the remaining household members (normally the spouse of the migrant child or another child) to take care of the household. The second factor is that the migration decision itself might be adjusted among siblings to ensure that elderly parents receive plenty of old-age support (Stöhr, 2015). Therefore, migration of children does not necessarily imply that parents

[7] Notably, this number manifests salient rural-urban disparity (78.2% vs. 46%), reflecting the inadequate power of the institutional support mechanism in China's rural areas.

[8] For example, Böhme, Persian and Stöhr (2015) find that international remittances allow elderly parents in Moldova to improve their diet and to shift time from subsistence farming to leisure and sleep.

[9] For example, it is possible that women are inherently more altruistic and thus migrant daughters tend to be more frequent and generous remitters than migrant sons. Another possibility is that employment opportunities in the city are brighter for men and therefore migrant sons have a better chance of making financial transfers to parents left behind.

lose the instrumental help from children.

Thirdly, there is evidence that the migration of children causes psychological pain for elderly parents left behind (Mosca and Barrett, 2016). In China, however, most of the migration is circular or temporary in nature (due to the *hukou* restrictions), and hence it is possible for migrants to visit their parents several times per year or at least during Chinese New Year. Even if a face-to-face visit is impossible, children can compensate their parents with frequent contact. We show below that migrant daughters are more likely to provide such emotional support to their parents. In fact, rather than being lonely or anxious, it seems more likely that rural parents would feel proud of having children in the city, which not only brings more income but also generates a superior social status among their peer villagers, and in turn influences their mental satisfaction positively. This is especially true in rural China where traditional notions advocate the virtue of "filial piety" and "bring honour to ancestors." Migration may also reduce the trifles of family conflicts and help to build more harmonious family relations. If so, we might expect to observe an increase in SWB among the left-behind parents as a result of child migration.

Finally, there might be a transfer of "social remittances" from migrant children to left-behind parents. Migrants acquire advanced health knowledge and practices, such as new norms about diet, through exposure to urban life. They may transmit such information to their rural parents via modern telecommunication methods or bring it back when they visit or return to their origin villages, leading to greater awareness of health issues and more efficient use of health inputs. Again, if daughters tend to have stronger parental attachments, we can deduce that the positive effect of better knowledge will be concentrated on parents who have daughters in cities.

In theory, it is unclear whether the migration effect on health and well-being status among elderly parents is predominantly positive or negative, as this will depend on the relative importance of the four channels described above as well as the local conditions of the country studied. Importantly, the potential effects may differ by the gender of the migrant children.

2.3 Related Literature

A growing strand of the economic literature has attempted to identify the important consequences of migration for household members at origin, with most of the focus on the human capital of non-migrant children and the labour supply of non-migrant spouses (see Antman, 2013, for an overview). However, much less is known about the effects of

child migration on elderly parents left behind. With regards to the impact of migration on parental health and well-being, the limited literature has come to ambiguous conclusions.

In an experimental study, Gibson, McKenzie and Stillman (2011) exploit a migration lottery to New Zealand and find no evidence that the migration of a household member significantly affects the health outcomes of older adults left behind. Antman (2010, 2016) argue that a child's U.S. migration leads to poorer self-reported health, obesity and worse mental health for elderly parents remaining in Mexico. A negative impact of children's migration on elderly health is also observed in China (Ao et al., 2015; Evandrou et al., 2017) and Ireland (Mosca and Barrett, 2016). In contrast, Böhme, Persian and Stöhr (2015) detect positive results for Moldovan parents left behind by international migrant children, a finding they attribute to the income effect of remittances that allows parents to eat a more nutritious diet as well as allocate more time to leisure and sleep.

Despite interesting explorations, the aforementioned papers have not differentiated the impact of migration based on the characteristics of the migrant children. Whilst it is useful to know *whether* a child's migration affects their left-behind parents, we believe that it is also of paramount importance to understand *who* contributes most to the observed effects of migration on elderly outcome: migrant sons or migrant daughters. This paper adds to the literature by answering the "who" question. Moreover, the causal impact of migration on parents' subjective well-being remains understudied and it is important to open this black box. Furthermore, we attempt to shed light on the underlying mechanism behind the relationship between child migration and parental outcome.

This paper directly relates to a burgeoning body of literature on the migration consequences for the sending communities, and more specifically to the research which looks within the household and aims to identify the migration impact on the outcomes of the left-behind. With increasing focus on the "feminisation of migration", research has acknowledged the differential effects of parental migration on left-behind children's development, health and well-being by parent's gender, suggesting that a mother's absence is more detrimental for children than a father's absence (Lyle, 2006; Cortes, 2015; Meng and Yamauchi, 2015).[10] Still, there is very little evidence that the gender of the migrant child affects the impact on health and well-being outcomes of the parents left behind, and our paper provides a first attempt at addressing this issue. Distinguishing the migration effects based on migrant's gender also connects this paper with literature on the economics of the family which investigates the intra-household heterogeneity related to

[10]This can be explained by the fact that mothers are usually the main caregivers of their children while fathering is restricted to breadwinning and protection. Therefore, children in migrant families will receive lower parental time investments if the mother is the one who migrates (Parreñas, 2005).

gender.[11] As a prominent example, Duflo (2003) finds that more resources in the hands of women improve the outcomes for girls and not boys. In addition, the identification strategy that we employ brings the paper into line with the strand of the migration literature that exploits the variation in fixed demographic composition to instrument for the endogenous migration decision (e.g., Chen, Jin and Yue, 2010; Antman, 2016). While some demographics such as gender mix are often explored, our instrumental variables rely on an unexploited and, we argue, more exogenous source of astrology-induced variation in migration. Finally, we also contribute to the *Astronomics*, a still narrow branch of literature that highlights astrological influences on economics, by presenting fresh evidence that astrology also predicts migration behaviour.[12]

3 Data

3.1 Data Sources and Sample

The data employed originates from the China Health and Retirement Longitudinal Study (CHARLS), a collaborative research project carried out by a team of scholars from the China Center for Economic Research at Peking University, the University of Southern California, and the University of Oxford (see Zhao et al., 2013, for a detailed description of the CHARLS dataset).[13] It is nationally representative and covers 450 rural villages/urban communities (primary sampling units) in 150 counties located in almost all provinces of China.[14] The national baseline was conducted in 2011-2012 (wave I) and a follow-up survey took place in 2013-2014 (wave II). Recently, the 2014 follow-up survey (wave III) has been released, which only contains life history data. We limit our analysis to the 2013 survey for the reason that there appear to be problems in the 2011 survey

[11] The basic idea behind these studies is directly linked to the test of the unitary model of household decision-making.

[12] At the microeconomic level, Bennett and Barth (1973) investigate whether individuals with a horoscope ruled by the planet Mars (i.e., Aries and Scorpio) are more likely to pursue military occupations; Focusing on one of the auspicious Chinese zodiac signs, Dragon, a few papers show that timing of birth affects microeconomic outcomes such as education and earnings (Johnson and Nye, 2011; Sim, 2015; Mocan and Yu, 2017). See, for example, Lucey (2000), for evidence at the macroeconomic level. No previous work has, however, tried to examine the impact of astrology on a person's migration intention.

[13] All data are publicly accessible at the project website: http://charls.ccer.edu.cn/charls/.

[14] The sampling frame covers 28 out of 31 provinces across mainland China. Tibet is excluded from the study. Two other provinces, Hainan and Ningxia, are excluded due to very small size of population. In the Appendix we provide the geographical distribution of the sampled counties.

with the measurement of child migration.[15] The survey interviewed randomly selected elderly respondents (aged 45 and above) and their spouses (of any age), resulting in a total sample of 18,605 elders residing in 10,822 households in 2013. The key benefit of the CHARLS lies in the availability of extensive questions on health and subjective feelings, alongside detailed information about socio-demographics, household characteristics, intergenerational transfers and migration experiences. We also extract information about the village from the accompanying village/community survey (administered to the village/community office). This allows us to control for potential confounding factors that are correlated with both child migration and elderly outcome (e.g., availability of medical facilities).[16]

For the purpose of this study, we restrict the sample to individuals who are aged 55 and older and who reside in rural areas. We only select the subset of parents with working-age children (18 years and above). The reason for this is that we want to focus on children who migrate exclusively for labour-related reasons and that children under 18 years old are still in school and are thus unlikely to fully support their parents. We exclude parents who have any child settled abroad (only 136 cases).[17] Accordingly, we are left with 7,932 observations of elderly parents.

3.1.1 Migration Variables

The independent variables of interest relate to daughters' and sons' rural-urban migration. The CHARLS asks explicitly "Where does the child normally live now?" and the subsequent question asks about the type of location in which the child lives (city, county, town or village). Based on these two questions we define migrant children as those who are living outside their own village and residing in an urban area (city, county or town) at the time of the survey. This yields 53.4 percent of the elderly sample as parents with migrant children. Of this group, 30.1 percent of parents have migrant daughters only,

[15] In the CHARLS, there are two questions that can be used to identify a child's migration status. The first question asks "How many months in the past year did the child live away from home", and the second asks "Where does the child normally live now." The latter question should produce a more instructive measure because it captures *current* migrants as opposed to non-migrants or returnees. This preferred question is available for *all* children in the 2013 survey; however, in 2011 it is only available for *non-coresident* children (for co-resident children the former question was asked). Due to this unfortunate inconsistency, we utilise the cross-section of 2013 to avoid the possibility of introducing noises to the child migration variable.

[16] Village-level variables were constructed using the 2011 village/community survey since the 2013 survey has not yet become available.

[17] International migration is beyond the scope of this research.

40 percent have migrant sons only, and 29.9 percent have both migrant daughters and migrant sons.

3.1.2 Dependent Variables

The outcome variables of interest pertain to parents' health and subjective well-being. We use three different measures of health: self-reported health status (SRH), body mobility and functional health. SRH is known to be a useful composite measure of overall health and an important predictor of other health problems, such as morbidity and mortality (Idler and Benyamini, 1997). Following the standard approach we transform SRH into a dichotomous indicator equal to one if the elderly parent describes his health status as excellent, very good or good (compared to fair, poor or very poor).[18] Due to its intrinsic subjectivity, SRH may be subject to concerns such as perception bias and justification bias. Therefore, we further explore two physical health measures: a mobility index[19] and a functional indicator. The mobility variable is constructed based on answers to nine survey questions regarding body movement. Responses are ranked on a Likert-type scale from "No, I don't have have any difficulty" (3 points) to "I can not do it" (0 points). The mobility index thus ranges from 0 (very poor body mobility) to 27 (very good body mobility).

The other measure of physical health evaluates the respondent's ability to conduct activities of daily living (ADLs) and instrumental activities of daily living (IADLs) independently. Respondents were asked whether they experienced any difficulties with these activities. We obtain a total score between 0 (complete dependence) and 12 (complete independence). A score of 10 or higher is used as the cut-off point for good functional health, corresponding to the elderly parent being able to perform at least ten activities without assistance.[20] The two physical health measures used here are often considered to be more objective than SRH, as they elicit information on very specific facts about daily movement and daily living rather than "opinions on physical well-being".

To gauge the subjective well-being of elderly parents, we create a dummy variable for overall life satisfaction that equal to one if the elderly person is completely satisfied or very satisfied and zero otherwise. Life satisfaction, an evaluative measure of SWB,

[18]It is suggested that the "fair" category be combined with the "poor" category when relatively few respondents declare poor SRH (Antman, 2016).

[19]Mobility-related problems are essential to the elderly because restricted body movement can easily lead to physical inactivity and even unexpected falls and injuries in old age.

[20]The average score for elderly parents in our sample is 10.8. We also replicated our analysis fixing the threshold of this dichotomous indicator at 9 and the results are insensitive to this change.

reflects the combined impact of life circumstances (e.g., income, education and social status) on people's perceptions and feelings. For robustness, we also examine the "experienced (or emotional) well-being" of elderly parents using short-term happiness measure. Respondents in the CHARLS were asked to what extent they felt happy yesterday on a 5-point scale. A dichotomous indicator for hedonic happiness is then built that equals to one if the individual was happy and zero otherwise.

In our sample, approximately 21 percent of elderly parents report good general health, 84 percent report good functional health, and 25 percent report good subjective well-being. The elderly parents score an average of 22.2 points for mobility.

3.2 Descriptive Statistics

Table 1 presents descriptive statistics for the 7,932 elderly parents in our analytical sample, with a *t-test* for differences in means between parents with and without internal migrant children displayed in the last column. A typical elderly parent in our sample is about 65.6 years old and has, on average, 1.5 adult daughters and 1.7 adult sons. Only 7.5 percent of elderly parents report having a single child. This is not surprising because the one-child policy is not strictly implemented in rural areas. Notably, more than half of the rural parents have at least one child currently in the city (4,236 observations), which mirrors the magnitude of the internal migration flows in China. Thereof, 60 percent have at least one internal migrant daughter and about 70 percent have at least one internal migrant son.[21] Elderly parents with migrant children differ systematically from those without along a number of observable dimensions. For instance, those in the former group are better educated, have more daughters and sons, and fewer grandchildren. They are also more likely to be *Han* Chinese, have health insurance, obtain a city *hukou*, have more than one child and are less likely to be in unemployment. The descriptive table indicates that migrant children tend to be better educated than those who do not migrate, as reflected by the significant difference in children's years of schooling (9.0 vs. 7.4). In terms of household attributes, parents with one or more children in the city are more likely to come from poorer households, compared to parents all of whose children are in rural areas. The average household size of elderly parents with and without migrant children is at 3.4 and 3.9, respectively.

There appear to be important differences in outcome measures between elderly parents depending on the migration status of their children. In particular, the unconditional

[21] These percentages do not add up to 100% because overlap is possible, i.e., 29.9 percent of parents have both daughters and sons who have migrated to the city.

means of body mobility, functional health and life satisfaction are significantly higher among parents with emigrating children than those with no migrant children, suggesting a positive correlation between child migration and elderly health and SWB.

Finally, the instrumental variables exhibit significant differences between elderly parents with and without migrant children in the city, showing that parents of migrant children have a higher fraction of daughters and a higher fraction of sons born in the year of the migration-prone Chinese zodiac signs. In the next section, we will explain at length how we construct the zodiac IVs for children's migration.

4 Identification Strategy

In order to investigate the gender-specific effects of children's migration on the health and well-being of their elderly parents left behind we therefore estimate the following regression model:

$$Y_{ihv} = \beta_0 + \beta_D MigDau_{hv} + \beta_S MigSon_{hv} + \mathbf{X_{ihv}}'\gamma + \delta ProvinceFE + \varepsilon_{ihv} \quad (4.1)$$

where the dependent variable, Y_{ihv}, will be either health or SWB of an elderly parent i, in household h, of village v. $MigDau_{hv}$ and $MigSon_{hv}$ are dichotomous indicators of migration: $MigDau_{hv}$ is equal to one if the elderly parent has at least one daughter currently in urban areas and zero otherwise, and $MigSon_{hv}$ is equal to one if the elderly parent has at least one son currently in urban areas and zero otherwise. $\mathbf{X_{ihv}}$ denotes a vector of control variables consisting of parent-, child-, household-, and village-level characteristics which may affect parental welfare: an elderly parent's gender, age (and its square), ethnicity, marital status, highest educational qualification, a dummy indicating whether the parent has any health insurance, an unemployment indicator, a dummy indicating whether the parent has urban registration, number of daughters, number of sons, number of grandchildren, a dummy for whether the parent has only one child; average age of children, average years of schooling of children, fraction of children who are currently working; household income, size of household; and a set of four village-level variables that measure village infrastructure and environment. In the life satisfaction specification, we include an additional dummy variable for whether the respondent reports a disability, given that health condition is a vital determinant of individual SWB. $ProvinceFE$ are province dummies which effectively control for region-specific attributes that may affect

parents' outcomes.[22] ε_{ihv} is the error term, clustered at the household level to allow for arbitrary correlation within households.

The coefficients of interest in Equation 4.1 are β_D and β_S, indicating how daughters' and sons' migration affects the health and well-being outcomes of the elderly parents left behind.[23] As noted in the introduction, the identification of the migration effects is plagued by the endogeneity of migration. First, the causal impact is complicated by the fact that children make migration choices according to the health status of their parents, although the direction is unclear *a priori*. On the one hand, children may respond to adverse parental health by migrating themselves to the city, where they could earn more money and obtain advanced health knowledge for their parents' treatment; On the other hand, children may avoid or postpone migration as they may feel obliged to provide daily care to their ill parents (Giles and Mu, 2007). Second, endogeneity could arise if children self-select into migration on the basis of unobservable characteristics. The well-known "healthy migrant hypothesis" claims that migrants are non-randomly drawn from the upper health distribution. If health and happiness are positively correlated within a household (e.g., due to genetic links and emotional contagion), the selection would bias conventional estimates of the effect of child migration on parental health outcomes. An intuitive example would be a genetically deficient household in which inherited diseases deprive adult children of migration opportunities and predispose their older parents to bad health. Similar bias can arise if happier individuals are less likely to move and if happiness is correlated within families. Third, there could be unobservable third factors that are correlated with both the migration decision of the child and the health of the parent. Potential omitted factors include household- and village-level shocks such as household asset shocks, diseases, crop failures, and sound local policies, which are very difficult to observe even in a rich dataset. Therefore, estimating Equation 4.1 by Ordinary Least Squares will yield biased estimates of β_D and β_S and a credible identification strategy is required.

To bolster the causal impact of migration on elderly health, we propose an instrumental variable (IV) procedure inspired by a novel and credibly exogenous variation in the demographic characteristics of children, that is, their Chinese zodiac sign. The Chinese

[22] Controlling for city-level fixed effects delivers very similar estimates. As the 2013 survey was fielded between July 2013 and January 2014, we also estimated models including a set of dummies for the month of the interview and again the results are very robust. The full set of results controlling for the city and time effects will be available from the authors upon request.

[23] Under linearity and additivity assumptions, the effect of having migrant children of both genders is equal to the sum of the effects of having a daughter and having a son in the city, i.e., $\beta_D+\beta_S$.

zodiac sign, also known as *Shengxiao*, is based on a twelve-year cycle with each year symbolised by an animal. The twelve zodiac animals are Rat, Ox, Tiger, Rabbit, Dragon, Snake, Horse, Goat (Sheep), Monkey, Rooster, Dog and Pig. While the Western zodiac (horoscope) is based on the month of the year, the Chinese zodiac is determined by the lunar year in which a person was born.[24]

Importantly, "the substantive content of astrology is its predictive ability" (Bennett and Barth, 1973, p. 473). Indeed, the Chinese have long believed that the animal ruling the birth year influences a person's temperament, personality and other important characteristics (e.g., Goodkind, 1991). The saying is: "This animal hides in your heart." According to Chinese astrology, each of the zodiac animals is endowed with unique characteristics or qualities, some of which might predict migration behaviour. We divide the twelve signs of the Chinese zodiac into **migration-prone** *versus* **migration-averse** groups based upon personality traits and risk preferences of the animal signs. The former group comprises animals that are more extrovert, aggressive, adventurous, and so forth (Rat, Ox, Tiger, Rabbit, Dragon, Horse, Monkey and Dog), while animals in the latter group are more introvert, gentle, conservative, and so forth (Snake, Goat, Rooster and Pig). The personality traits (or temperament) of the twelve zodiac animals have been well documented and validated in Chinese astrology books. We focus on the "Big Five" traits: Extraversion, Openness to experience, Neuroticism, Conscientiousness, and Agreeableness. Based on previous research, we hypothesise that extraversion, openness and neuroticism all increase propensity to migrate, while conscientiousness and agreeableness decrease propensity to migrate. As for attitudes towards risk, we utilise the Yin-Yang characterisation of signs as a proxy.[25] The ancient Chinese believed that every zodiac sign can occur as either Yin or Yang based on the number of their claws/toes

[24]In the West, despite the fact that polls differ in estimates of how many people actually "believe" in astrology, the average percentage is around 20% to 30%. According to the 2009 Harris Poll, 26 percent of Americans believe in astrology. Estimates from the 2005 Gallup Poll reveal that 26 percent of Americans, 25 percent of Canadians and 24 percent of British people claim that astrology is "something they believe in." According to an astrology awareness survey in England, 100 percent of respondents "know their star sign", 89 percent "know the star signs of people they have relationships with", 70 percent "read their horoscopes regularly", and 85 percent agree that "the description of their star sign accurately reflects their personality" (Blackmore and Seebold, 2001). Although we could not find corresponding official surveys on astrology belief in China, considering that the Chinese zodiac has penetrated into various aspects of the Chinese folk culture and is frequently used by the Chinese in life decisions (such as marriage decisions, fertility decisions, making friends and screening potential employees), the awareness of and belief in astrology should be significantly higher in China, especially in rural areas (where superstition still prevails) and among older generations.

[25]Yin-Yang is an important concept in Chinese philosophy that is used to describe contrary forces in the natural world.

with odd (even) numbers indicating Yang (Yin). Whereas Yin indicates negative, dark, cold, female, etc., Yang is associated with positive, light, hot, male, etc. We attributed the Yang zodiac sign to be risk-loving and the Yin zodiac sign to be risk-averse. A zodiac animal is then defined as being migration-prone if it belongs to the Yang category or has personality traits that increase migration probability, and as being migration-averse otherwise (see Table A.1 for the detailed characteristics of all zodiac signs). It is therefore possible to exploit the astrological variation in children's Chinese zodiac to instrument for the endogenous migration decision. Our instruments for migration are the shares of children that are born in the Year of the migration-prone Chinese zodiac signs, computed separately for male and female children of the elderly parent. Since the CHARLS explicitly asks respondents about their children's Chinese zodiac signs we are able to combine this information with total number of daughters and sons to obtain the respective shares. Note that as there are two endogenous migration variables, we have two first-stage regressions, one for daughters' migration,

$$MigDau_{hv} = \alpha_1 Z_1 + \alpha_2 Z_2 + \mathbf{X_{ihv}}'\gamma + \delta ProvinceFE + \mu_{hv} \tag{4.2}$$

and one for sons' migration,

$$MigSon_{hv} = \pi_1 Z_1 + \pi_2 Z_2 + \mathbf{X_{ihv}}'\gamma + \delta ProvinceFE + \upsilon_{hv} \tag{4.3}$$

where the instruments in these equations are Z_1 and Z_2, indicating the share of daughters and share of sons born in the year of the migration-prone Chinese zodiac signs. It is important to note that in the regression model we have controlled for the number of daughters and the number of sons. The variation we exploit to identify the migration effect thus relies on differences in the zodiac composition (and not in the number) of children across elderly parents.

Why should beliefs in astrological signs, which could be irrational or incorrect, affect the individual's behaviour and in particular – propensity to migrate? To understand the link between astrology and migration, we combine several important facts and arguments. First, there is a growing body of literature investigating the behavioural aspects of migration. Crucially, it has been well established that risk attitudes and personality traits are important psychological determinants of migration (Jaeger et al., 2010; Akgüc et al., 2015; Ayhan et al., 2017), with individuals who have a high risk tolerance, high extraversion, high sociability, greater openness to experience, and low agreeableness being more likely

to migrate. Second, there is ample (scientific and non-scientific) literature documenting the non-negligible role of astrology in human character and human behaviour. Setting aside the voluminous literature on psychology and restricting attention to the economic literature, Johnson and Nye (2011) and Mocan and Yu (2017) cast some light on the underlying mechanism. Appealingly, they find that seemingly irrational superstitious beliefs (i.e., the Dragon is superior to other Chinese zodiacs) can translate into observational behaviour through greater human capital investment in the process of child-rearing and upbringing. Another possibility, which is more subtle, refers to the psychological hints that might be properly launched by astrological beliefs – the simplest story in our context being that a Tiger person decides to give up the familiar environment and migrate for an uncertain but more promising prospect, just because "I am born to be a risk taker." This phenomenon is called self-attribution or self-fulfilling belief (e.g., Johnson and Nye, 2011; Mocan and Yu, 2017).

The rationale that underlies our identification strategy is thus the following: because the Chinese zodiac sign (exogenously given by year of birth) shapes risk attitudes and personality traits, which are important psychological predictors of migration, an elderly parent who has a higher fraction of children born under the migration-prone Chinese zodiacs is also more likely to have at least one migrant child.

Our empirical strategy of using Chinese zodiac sign as IVs rests on the key assumption that the Chinese zodiac is orthogonal to μ_{hv} and υ_{hv}, the so-called exclusion restriction. In other words, the fraction of children born under the migration-prone zodiacs should affect parental outcome only through its effect on the likelihood that the elderly parent has children in urban areas. As a person's sign of birth is exogenously determined by the year he was born, it is very unlikely to be correlated with any unobservable inputs into parental health function. Nevertheless, as the first study that we know of to use astrological variation as IV for migration, we also discuss its potential limitations and perform robustness checks accordingly. In particular, we address the following three arguments: the *business cycle effects*, the *Dragon preference effects*, and the *children generosity effects*.

The first concern relates to the possibility that there are business cycle effects, where children born in certain cohorts exhibit time trends in certain aspects which might also be correlated with parental outcome. We know that children from the same birth cohort are hit by the same shock (e.g., a revolution). If children's attitudes or inputs toward their parents were changed by the shock and if the impact of the shock was persistent, this would amount to cohort-specific time trends which are unobservable and are thus

contained in the error term. Since our zodiac IVs make use of information about the year of birth, the exclusion restriction may be violated.[26] To address this problem, we include a full set of 62 dummies indicating children's years of birth. These birth year dummies should remove any systematic effects on parental welfare that are related to time trends common to all children in a birth cohort. The results are reported in Table 5. It is reassuring to find that adding these powerful controls does not change our conclusions.

Another potential concern is that parents' fertility choices could be endogenous. It might be the case that some parents carefully plan the birth of their children according to the Chinese zodiac because certain creatures are deemed to be more auspicious than others. If, for example, parents who have successfully achieved a "lucky" baby are a selected group of parents who have more advanced health knowledge or who are less satisfied with their lives, this would invalidate our identification strategy. In this regard, we raise the following arguments. First, in China, it is much more likely that parents time fertility in response to the gender, rather than the zodiac sign, of a planned child. This is especially true in rural China where strong boy preferences make it even more likely that fertility timing adjustment is gender-driven, instead of astrology-driven. Second, astrology-based fertility trends are only observed in certain Asian societies such as Hong Kong, Taiwan, Singapore, and South Korea. Such evidence is, however, very lacking in mainland China (Johnson and Nye, 2011). Third, this type of zodiac selection, if anything, should apply only to the sign of Dragon.[27]

Combining the previous points, we argue that the astrology-based fertility decision is unlikely to pose a threat to the exclusion restriction in our context. Nevertheless, we still deal with this issue in two ways. We first provide descriptive statistics on the distribution of children born in each of the twelve Chinese animal years. Encouragingly, we find no evidence of a fertility boom in the Year of the Dragon. We also address the Dragon preferences argument more directly by excluding from our estimation sample elderly parents who have one or more Dragon children. We show below that our results are not affected by a potentially endogenous fertility outcome.

Another worry still remains as to whether a child's sign of birth affects parental health and SWB in ways independent of migration even if the Chinese zodiac can be argued to

[26]To illustrate, children with early life exposure to the *Great Famine* (1959-1961) may wish never to experience again the lack of food and thereby devote a considerable amount of their income to family diet later in life. Another possibility is that children born before and after the *one-child policy* (1979) might be systematically different in their relationship with and their support for their parents.

[27]Whilst Chinese people believe that children born in the Year of the Dragon are more fortuitous and superior (Johnson and Nye, 2011; Sim, 2015), opinions may vary from person to person in terms of the remaining eleven Chinese zodiacs.

be purely exogenous. As discussed by Antman (2016), variation in children's sex and married mix can also be translated into differences in their contributions to the elderly parents. If, for instance, children with certain Chinese zodiac signs are more generous to their parents in nature, we might encounter a similar concern here. We take care of this problem following Antman (2016)'s suggestions. We firstly add children's remittances as an exogenous control variable and, secondly, as an endogenous variable and use the share of married children as a third instrumental variable. It is important to note that the latter model also serves as a more comprehensive specification in which we are able to examine whether children's migration affects elderly outcome in ways other than pure income effect. We find that controlling for children's generosity to parents does not have a large impact on our main results.

To sum up, we believe that our IVs relying on children's Chinese zodiac signs provide us with credibly exogenous variation in the likelihood of children's internal migration.

5 Results

This section is organised as follows. In the first portion of the results we aim to understand how our instrument – share of children with the migration-prone zodiac animals – affects migration, channelled through its influences on the psychological determinants of migration.[28] Before analysing the first stage results, we provide two interesting pieces of evidence that support our identification strategy. In particular, we first utilise the CHARLS child-level data to show that being born under the migration-prone Chinese zodiacs increases a child's probability of migrating to the city. We then focus on one important psychological channel through which this could happen, namely, risk preferences, and use the RUMiC data to assess the relationship between Chinese zodiac signs and individual attitudes towards risk. The second portion of the analysis centres on the estimation of the causal impact of daughters' and sons' rural-urban migration on parental outcomes as well as a number of sensitivity checks to guarantee the robustness of our estimates. In summary, we hope to answer two questions: 1) Does the Chinese zodiac sign reliably predict migration behaviour (first-stage)? 2) Does migration of daughters and sons causally and differently affect the health and SWB of the elderly parents left behind (second-stage)?

[28]For simplicity purposes, we consider a single instrumental variable created for *all* children (i.e., IV=number of children born under migration-prone zodiac signs/total number of children) rather than the corresponding gender-specific shares.

5.1 Does The Chinese Zodiac Sign Affect Migration Propensity?

5.1.1 Chinese Zodiac Signs and Migration: CHARLS Child-Level Data

An interesting starting point for our empirical investigation is to learn about the association between a child's Chinese zodiac and his migration propensity. Ideally, we would need precise variation at the child level to study this relationship.[29] We take advantage of the child level data, where the unit of observation becomes each different child of the elderly parent. Table A.2 in the Appendix displays summary statistics for the sample of 14,137 CHARLS children, comparing between children with migration-prone zodiac signs (N=9,591) and children with migration-averse zodiac signs (N=4,546). Most crucially for our analysis, the probability of migrating to urban areas demonstrates important differences between these two groups.[30] The t-statistic (2.000) implies that the difference between these two groups of children defined by their Chinese zodiac signs is statistically significant at the 5 percent level.

We next run a simple probit regression of a child migration dummy on an indicator for whether the child's Chinese zodiac sign is a migration-prone animal, together with a bunch of standard controls for migration. The probit estimates presented in Table A.3 confirm that the Chinese zodiac sign is a strong and highly significant migration predictor. In particular, being born under the migration-prone zodiac animals leads to approximately 2 percentage point increases in the migration likelihood for an average adult child after controlling for standard migration determinants. These results lend enormous support to the validity of our empirical strategy.

5.1.2 Chinese Zodiac Signs and Risk Attitudes: RUMiC Data

In the following, we resort to another Chinese survey – the Rural-Urban Migration in China (RUMiC; for a detailed description, see Akgüç, Giulietti and Zimmermann, 2014) – in order to study the connection between Chinese zodiac signs and risk attitudes. The RUMiC data represent two major advantages for our purposes. First, it provides a direct measure of individual risk preferences, which is not always available in survey

[29] Yet, the migration variables and the zodiac instruments discussed so far are all measured at the household level, and hence may provide limited information on such variation.

[30] Children who were born under the sign of migration-loving creatures, compared with children born under migration-averse ones, have on average a greater chance of engageing in rural-urban migration (0.292 vs. 0.276).

data (including the CHARLS). Second, the RUMiC contains specific information on a respondent's date of birth (year, month and day). Since we know in the data also the *month* and the *day* of birth, we are able to exploit an additional variation in a person's zodiac sign, that is, his Western horoscope (i.e., Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricorn, Aquarius and Pisces). This merit of the data allows us to dig deeper into the predictive ability of astrology – because we could make a useful comparison between the Chinese animal sign and the Western sun sign. Indeed, using the Western zodiac sign to predict the risk attitudes of a Chinese person amounts to an intuitive placebo experiment.[31] The expectation is that only the Chinese zodiac animals and not the Western horoscopes can predict the risk attitudes of the individuals in our sample. We will show later that this is indeed the case.

We do obtain supportive evidence from the RUMiC results. The most important finding is that the Chinese zodiac sign significantly reflects the risk preferences of the rural Chinese, but the Western zodiac sign does not. This implies the significant role of astrological beliefs in the formation of personal characters. While due to data availability we have to focus on risk attitudes here, this conclusion can easily be generalised to other personal attributes that are related to migration, e.g., personality. Moreover, we are able to attribute causality to our findings, as the Chinese zodiac sign (determined by year of birth) is naturally exogenous with respect to risk preferences. Establishing a causal link between the Chinese zodiac and risk attitudes is the key to understanding the mechanism underlying the astrological prediction of migration behaviour: a person's Chinese zodiac sign *causally* affects their attitudes toward risk, and thus their propensity to migrate to another place. In Appendix B we present and discuss relevant descriptive statistics and estimation results based on the RUMiC sample.

5.1.3 First Stage Results

We now turn to the first stage of the 2SLS estimation. The first stage estimates in the context of this paper are meaningful in their own right because they may have profound

[31] It is worthwhile mentioning that although Western horoscopes have gained some popularity in China, the traditional animal sign is deeply embedded in China's cultural heritage and is typically used by the Chinese in their daily life. In fact, both the knowledge level of and the belief in Western astrology are fairly poor in Chinese villages where traditional cultural beliefs still dominate the value system. In addition, the influence of the Western zodiac should be particularly pronounced among China's younger generations, if anything. Given that our population of interest comprises Chinese rural residents with mean age of around 49 (refer to Table B.1 in the Appendix), it is plausible to expect that only the Chinese zodiac sign would matter here.

implications for behavioural theories of migration. In other words, as we have demonstrated the ability of the Chinese zodiac sign to predict individual risk attitudes, a strong first stage correlation between migration propensity and Chinese zodiac IVs is hence a clear indication of the importance of psychological drives in the migration decision process. Table 2 shows the results from estimating the two first stage regressions for having migrant daughters (Equation 4.2) and for having migrant sons (Equation 4.3), reported in column (1) and (2) respectively. In the case of daughters' migration (column (1)), a one-unit increase in the fraction of daughters born under migration-prone Chinese zodiac signs raises the probability of having a migrant daughter by 11.1 percentage points, whereas the share of sons with migration-prone Chinese zodiac signs generates a positive, but not statistically significant effect. Interestingly, a similar pattern is evident in column (2) where the dependent variable is an indicator for whether the elderly parent has a migrant son in the city. We can see that the fraction of sons born under the sign of migration-loving zodiac animals has a positive (point estimate 0.098) and highly significant impact on the likelihood of seeing a son migrate, while the variation in the parallel measure for daughters does not seem to affect the migration probability of sons. In fact, the coefficient on the daughter-specific zodiac IV in column (2) is very close to zero and not statistically significant. The above pattern is not only reassuring but very useful: since the gender-specific share of children born under migration-seeking zodiac signs appears to be only a strong predictor of having a migrant child of that specific gender (and not of the other), we have derived two orthogonal instruments – one for daughters' migration and one for sons' migration – to explore the gender-specific migration effects on parental outcomes.

One potential concern within the instrumental variable context is the bias resulting from weak instruments. The predictive power of two astrological instruments is confirmed by the Kleibergen-Paap *rk* Wald F statistic which tests the weak identification of the equation as a whole, as well as the standard first-stage F statistics, which are tests of whether the endogenous regressors are separately identified. As reported at the bottom of Table 2 the Kleibergen-Paap *rk* Wald F statistic is around 17.5, well above the corresponding Stock-Yogo critical value at a very conservative threshold (10% maximal IV size), i.e., 7.03. The two standard F statistics provide additional information on the strength of the zodiac IVs, suggesting that the coefficients on the two child migration variables are also individually identified, according to the "larger than 10" rule of thumb. Therefore, we conclude that children's Chinese zodiac signs are a strong predictor of their propensity to migrate and weak identification does not pose a problem in our analysis.

5.2 Does Daughters' and Sons' Migration Affect Parental Outcomes?

5.2.1 Main Results

Table 3 presents the OLS and IV results for elderly health and well-being: self-reported health (column (1)), two measures of physical health (column (2) and (3)) and life satisfaction (column (4)). The linear probability model (LPM) and IV-LPM are employed for the three outcomes which are measured as binary variables: SRH, functional health and SWB. All estimation results use robust standard errors, adjusted for heteroscedasticity as well as correlation of the error term between parents in the same household. For the sake of simplicity, the table reports only the coefficient estimates of daughter migration and son migration variables. The full set of regression estimates are shown in Table A.4 in the Appendix.

As discussed before, the OLS estimates are biased, since migration is endogenous. Therefore, we do not make any causal inferences from the OLS results. They serve as a useful benchmark for comparison purposes. The estimates obtained with OLS, presented in the upper panel of Table 3, indicate that having a daughter currently in the city is significantly positively correlated with the physical health (0.179 for mobility and 0.029 for functionality) and life satisfaction (0.026) of the elderly parents left behind. As for sons column (4) suggests that having an emigrating son significantly improves parents' overall satisfaction with life (0.025), while it is statistically insignificant in every other parental outcome.

We now turn to our 2SLS estimates, where daughters' migration and sons' migration are instrumented with the share of daughters and the share of sons born under the migration-prone Chinese zodiac signs. At a first glance, the coefficients on the daughter migration dummy become larger in size and more significant in general relative to the OLS results, whereas the only significant effect of the migration of sons loses its significance after instrumenting. In column (1) we present the IV results with subjective general health as the outcome variable. We find that having daughters who migrate to urban areas is associated with a statistically significant 33.5 percentage point increase in the likelihood of reporting excellent, very good, or good health. However, when it comes to sons, we find a smaller and insignificant positive effect (6.2 percent increase) of their migration on the self-rated health status of the elderly parents.

As for physical health, we see that elderly parents with daughters living in urban areas are 3.6 points more mobile on the (0-27) scale than parents who do not see their

children migrate (column (2)). The effect is statistically significant at the 5 percent level. Furthermore, the magnitude of the estimate in column (3) implies that elderly parents who have at least one migrant daughter are 30.6 percentage points more likely to be able to perform the ADLs and IADLs independently (significant at the 1 percent level). Although a decline in body functioning is generally deemed as inevitable in old age, this process can be mitigated. Among the most effective methods are those that involve physical activity (e.g., provision of exercise facilities) and better diets (e.g., intake of micro-nutrients), which can obviously be achieved more easily if more money is available. Hence, it is plausible to deduct that the pecuniary channel of migration is most likely to account for the positive findings here. Still, the corresponding coefficients from sons are statistically insignificant and even become negative (–0.404 and –0.150), suggesting that having a migrant son does not have a similar beneficial influence on the physical health of the rural parents. In Appendix Table A.5 we display the results using each individual mobility/ADL/IADL task, instead of mobility index and functional indicator, as the outcome variable. Statistically significant OLS and IV estimates are found for the migration of daughters in terms of many activities, suggesting a reduced likelihood of parents encountering difficulty with these activities while their daughters are away. Consistent insignificant results are seen for migrant sons, again suggesting a lack of the impact of migration on parental physical health associated with the absence of sons.

With regard to subjective well-being, column (4) suggests that the migration of daughters has a positive and strongly significant effect on the life satisfaction of their older parents staying behind. Elderly parents who have emigrating daughters are 36.6 percentage points more likely to feel satisfied with their lives. The effect is significant at the 1 percent level. Once again, we do not find any significant effect from sons. The coefficient of sons' migration is positive (0.097) but not statistically significant. The coefficient for daughter migration remains significant in the IV specification in Table A.5 in the Appendix when happiness is used as an alternative SWB outcome. Parents of migrant daughters are 30.4 percentage points more likely to be happier than parents whose children all reside in villages, while we observe no effect of sons' migration on the hedonic happiness of the left-behind parents.

A comparison of the OLS and IV results shows that the magnitudes of the IV estimates are substantially larger, a common feature of most migration studies. This may be because parents with migrant children have unobserved characteristics (say, a higher poverty rate) that lower their likelihood of having good health or SWB, consistent with the so-called Borjas' negative-selection hypothesis. Thus, without controlling for the

endogeneity of migration, the true effects of migration on elderly outcome are underestimated. The difference in the estimates may also reflect heterogeneous treatment effects in a Local Average Treatment Effect (LATE) interpretation (Imbens and Angrist, 1994). In this case, our IV estimates provide information about the impact of children's migration on parental outcome only for the particular subgroup that has been affected by the instrument, namely those elderly parents who are more (less) likely to have children in the city when they have a higher (lower) share of children born in the year of the migration-prone zodiac animals. Nevertheless, the broad pattern of results suggests that children's migration is associated with better outcomes for their elderly parents in rural China.

Overall, all of the statistically significant coefficient estimates point to an improvement in parental welfare as a result of their daughters' rural-urban migration. In sharp contrast with the traditional belief of "rear sons for help in old age" in Chinese patrilineal rural society, the health and SWB of elderly parents left behind are immune from the migration of their sons. This asymmetric impact may be explained by the increasing importance of daughters in the family support and by the differences between male and female migrants. We will return to this issue in Section 6.

5.2.2 Robustness Checks

In the section that follows, we intend to show that our results are very robust by performing a large number of checks. We focus on the preferred IV estimates.

As a first check, we undertake a placebo test on our identification strategy by running the same IV regression on a set of elderly health outcomes that are very unlikely to be affected by children's migration status. These include the respondent's early life health status which we dichotomise as excellent/very good/good health,[32] a dummy variable indicating the presence of any chronic diseases diagnosed by a doctor[33] and, conditional on having a chronic illness, the total number of chronic diseases the respondent have. Unlike other more general health conditions that may possibly change over a short period of time, chronic diseases such as cancer, diabetes and asthma are more dependent on genetic endowment or long-run factors (e.g., cumulative exposure to toxic substances)

[32]The CHARLS asks "How would you evaluate your health during childhood, up to and including age 15?", again on a five-point scale "Excellent", "Very good", "Good", "Fair" and "Poor."

[33]The fourteen chronic conditions covered by the CHARLS survey are: hypertension, dyslipidaemia, diabetes or high blood sugar, cancer or malignant tumours, lung disease, liver disease, heart problems, stroke, kidney diseases, stomach or other digestive diseases, emotional problems, memory-related diseases, arthritis or rheumatism, and asthma.

than on migration episodes. This placebo exercise follows the same spirit of Antman (2016).[34] The regression results of this test are listed in Table 4. As anticipated, all coefficient estimates on the child migration variable are negligible and not significantly different from zero at any conventional level. This provides great support for the validity of our instrumental variable strategy.

In the second robustness check (Panel A of Table 5), we control for potential business cycle effects by introducing into our regression model a series of dummies that capture the year of birth for all the children of elderly parents. In doing so, we take out any systematic differences in parental health and well-being that are associated with unobserved time trends, such as historic events and macroeconomic conditions commonly experienced by children in the same birth cohort. The specification including the birth year dummies yields remarkably similar results, indicating that differential time trends across birth cohorts could not explain our findings. Because the inclusion of these precise controls effectively rules out almost any other plausible explanation regarding unobserved time effects that are associated with our instruments (and that are correlated with elderly outcome), we have greater confidence in the causal interpretation of our results.

In the third robustness check, we address potential endogeneity in elderly parents' fertility decisions by providing both qualitative (Figure 1) and quantitative (Panel B of Table 5) evidence. Figure 1 shows the distribution of birth rates based on the child-level sample. Each bar indicates the fraction of children born in the year of a given zodiac animal. Reassuringly, we do not detect any obvious spike (boost in fertility) in the Year of the Dragon, suggesting that the Dragon preferences argument is less of a problem in our strategy. Turning to the regression results, we do lose some predictive power in our instruments in the specification after excluding elderly parents of Dragon children.[35] Yet, it is reassuring to find that the pattern of our main results remains the same.

We perform the fourth robustness check in order to lend further credence to the validity of our instrumental variable strategy. One might be concerned with the definition of the zodiac instruments, namely what constitutes a "migration-prone" zodiac sign? In particular, what is the relative importance of risk preferences and personality traits in explaining rural-urban migration? In simple words, if a zodiac animal is risk-taking and introvert, what can we say about the likelihood of migration for individuals with

[34] The basic idea is that if the health gains come from the direct effect of the instruments themselves rather than from children's migration, then we should still expect to observe significant effects on the "fake" outcomes of elderly health.

[35] The reason for this is that the Dragon is a super migration-seeking creature and therefore the new measure of migration-prone zodiac signs is much less precise.

this sign.[36] The two zodiac signs in question pertain to the Ox and the Rabbit, which are currently defined to be migration-seeking. These two animals are conservative and risk-averse (which means they are less likely to migrate) and, at the same time, are endowed with personality traits that make them dissatisfied with current situation, e.g., low agreeableness for Ox or that help better adapt to a new environment, e.g., good social skills for Rabbit (which means they are more likely to migrate). After re-classifying Ox and Rabbit into the anti-migration category, the refined definition is consistent with the Yin-Yang characterisation embedded in Chinese Astrology.[37] The findings in Panel C of Table 5 are robust to considering alternative definition of zodiac IVs and confirm a positive role of daughters in influencing physical health and SWB.

Another concern with the IV strategy may be that ethnic minorities could have different animal signs and zodiacal beliefs, although we think that this is quite unlikely given their assimilation into *Han* culture. We re-estimate all models by combining two restrictions: 1) excluding villages which are located in minority-concentrated provinces, i.e., Xinjiang, Inner Mongolia, Guangxi, Yunnan, Guizhou and Qinghai; and 2) limiting the sample to households in which both the elderly respondent and the spouse are *Han* Chinese.[38] We can see from Panel D of Table 5 that, in all instances, the estimated effects we obtain are very similar to those obtained from the full sample.

The bottom panel of Table 5 reports results from two additional robustness checks – by further controlling for the potential confounding effects from the 1.5 child policy[39] and using the number of migrant daughters and sons as the two endogenous migration variables. The point estimates are quite similar to the benchmark results, despite weak IVs in the latter case. This is not surprising because the zodiacal mix of children that predicts the *incidence* of migration does not necessarily well predict the *intensity* of migration (i.e., having an *additional* child in urban areas).

[36] Among the limited evidence, Ayhan, Gatskova and Lehmann (2017) suggest that personality traits and risk preferences act as complements when explaining the propensity to migrate.

[37] Yin Chinese zodiac sings include Ox, Rabbit, Snake, Goat, Rooster and Pig, and Yang Chinese zodiac sings include Rat, Tiger, Dragon, Horse, Monkey and Dog.

[38] The CHARLS survey does not contain information on the ethnicity of the children of elderly respondents. But if both of the parents are *Han* people, it is almost impossible for the child to be a minority.

[39] In rural areas, parents are allowed to have a second baby if the first child is a girl. The worry is that the positive effect of daughter migration we observed is not due to migration itself, but is because of the substitution effect – parents with a girl firstborn are more likely to have another child to take care of them while the eldest daughter migrates. Since we have controlled for number of daughters and sons as well as whether the parent has a single child, this should not be a big issue. To further address this concern, we also introduce a dummy for whether the first kid of the elderly parent is a girl. Thanks for Zhong Zhao for raising this point.

Finally, we account for children's generosity to their elderly parents by directly controlling for children's remittances (see Table 6). Panel A reports the results when children's economic transfers are treated as an exogenous control variable. We see that the point estimates are almost identical to the ones of our benchmark analysis and the coefficients on the children remittances variable are generally insignificant (except for being marginally significant in self-reported health). In Panel B we report the results of the specification where the remittances variable is regarded as endogenous and instrumented using the married ratio of children. We find the same qualitative results and similarly significant estimates of the impact of having migrant daughters in the city on elderly health and well-being.

5.3 Heterogeneity

We now investigate heterogeneity in the child migration effect according to several parental and household characteristics. In particular, we split the data along the following dimensions: gender, age ($\leq$ 65 and 65+), education (low and high education, with the former representing no formal education), previous migration experience, household income (above and below the median) and living arrangements (live alone or with an elderly spouse, and live with other people).

Table 7 shows that the impact of children's migration on parents' health and well-being differs across groups. We report only the parameter estimates of the daughter migration variable.[40] As is often the case, the strength of the instruments is relatively weaker due to smaller cells in the sub-samples. A word of caution is thus appropriate regarding interpretation of the results. Interestingly, we see that the effect of migration on health and SWB is economically stronger for left-behind parents who are mothers, older, better educated, with no prior migration histories, live in relatively poorer households and live in non-empty-nest households.[41]

Furthermore, the heterogeneity analysis reveals two important aspects about the group of parents. First, it is conceivable that a rich household will invest in the well-being

[40] None of the coefficients on the son migration dummy are statistically significant.

[41] These differences could potentially be explained by the fact that the marginal utility of migration/remittances is higher for certain groups relative to others. For instance, most of the older cohort of the elderly parents are physically and economically inactive and hence migrant remittances are far more important to them than to the younger cohort. Parents with high education are expected to use remittances and newly-acquired health knowledge in a more efficient way as compared to those with low education. Parents without previous exposure to urban life may obtain greater returns to child migration as compared to those who have migrated before.

of the household members provided that benefits outweigh costs, while a poor household will not be able to make such investment even if it promises a positive return. Importantly, our findings indicate that the migration of daughters can be an effective way to relax the credit constraints faced by parents living in these marginal households. Second, as it is rather hard for parents who live on their own to find close substitutes for the absent child, they may represent one of the most vulnerable left-behind groups. In the absence of family support, elderly people who live alone have to resort to social care which, as we discussed earlier, is generally under-provided in rural China. The less pronounced positive effect of migration among the empty-nest elderly highlights the needs of the government to build up a well-established social security system to accommodate the care needs of this disadvantaged group.

6 Mechanisms

In this section, we investigate potential mechanisms underlying our results, with particular emphasis on where the asymmetric effects of migrant daughters and migrant sons are coming from.

6.1 Expectations and Preferences

Firstly, we consider a relatively subtle channel – the role of parents' expectations and preferences – that may be particularly relevant for subjective well-being. Chinese parents have traditional mind-sets that sons should provide elder care and daughters are expected to take care of their parents-in-law after marriage. As such, the absence of daughters is anticipated rather than feared, implying lower psychic costs of daughters' migration on their elderly parents compared with those of sons' migration. Moreover, how parents perceive the gains and losses from children's migration may also vary by child gender. Male migrants are generally put on more expectations from their parents than female migrants in the light of men having greater earning capacity in urban destinations. If so, it is plausible to assume that parents would be more satisfied (forgiving) with successful (unsuccessful) migrant daughters relative to migrant sons. Likewise, the expected gain in the utility of parents to one unit of remittances is likely to be higher if remittances come from migrant daughters versus migrant sons. Thus, the difference in the effect of daughters' migration and sons' migration could be explained by the gender biases in parental hopes and expectations regarding filial obligations and returns to migration.

Another reason for the lack of impact for migrant sons could possibly be due to son preference in rural China. Even if migrant sons may send more money back home, owing to parental favouritism toward boys their absence could have a stronger detrimental effect on the psychological well-being of their parents, and the two effects may offset each other. However, having no information on expectations or preferences of the respondent, we cannot formally test this channel. In Table A.6 in the Appendix, we examine the effect of children's migration on the loneliness feelings of the elderly and find no evidence that the migration of sons significantly influences the probability of parents to feel lonely, suggesting that son preference does not appear to be an important channel in explaining our results.

6.2 Intergenerational Transfers

The second channel that we explore is the intergenerational transfers that parents receive from children. We hypothesise in Section 2 that migration influences the welfare of parents by shaping the intergenerational exchanges of money, time, affection and knowledge between adult children and older parents. The CHARLS collects data on the monetary, instrumental and emotional support from non-coresident children toward their parents.[42]

In Table 8 we examine the unconditional means regarding these three forms of intergenerational support by children's migration status and migrants' gender, focusing on the differences in means between parents of migrant daughters and parents of migrant sons. Panel A illustrates that, compared with non-migrants, both male and female migrants provide more monetary support to their parents but the gender difference in the amount of remittances given to parents is not statistically significant.[43] At the same

[42]The monetary transfer variable (also referred to as remittances) is the sum of regular and irregular cash and in-kind transfers from children to their parents. The instrumental support variable is the result of two questions about the amount of time, namely the number of days during the last month and the number of hours per day, children spend helping their parents, conditional on the elderly parents reporting difficulty with any ADLs or IADLs. Information about emotional support is drawn from the question "How often do you contact with your child either by phone, text message, mail, or email, when you didn't live with the child?" with frequencies of contact being provided as answer options. To gauge psychological support we construct different indicators: whether elderly parents have daily contact with at least one child, whether elderly parents have more than weekly contact with at least one child, and the average annual number of contacts across all children. The latter measure is imputed by assigning numerical values to the original answer choices as below: almost everyday (365), 2-3 times a week (130), once a week (52), every two weeks (26), once a month (12), once every three months (4), once every six months (2), once a year (1) and almost never (0).

[43]Note that the gender difference in children's remittances, i.e., about 305 Chinese yuan throughout the year, is also fairly small in magnitude, corresponding to about 4 US dollars per month according to

time, migrant daughters are significantly more likely to give their parents financial support than migrant sons (88.4% vs. 86.9%). These results are broadly consistent with the global trends in female remittances: women migrants usually send a higher share of their income more frequently, even though they generally earn less than men migrants (IOM-INSTRAW and UNDP, 2010).[44]

In Panel B, the data based on a smaller sample of functionally impaired parents show that parents of migrant daughters are advantaged in terms of instrumental support relative to parents of migrant sons. They appear to have a significantly higher probability of receiving instrumental help from their children (12.8% vs. 9.5%) and also receive care for longer time (2.3 days of help vs. 1.5 and 10.3 hours of help vs. 7.2), although the difference in mean hours of help is statistically insignificant. As instrumental assistance is provided through spatial proximity, we hypothesise that one factor may explain the observed gender inequality: distance of migration.[45] In our data, we find that migrant daughters do possess sort of "geographical advantages" that facilitate their provision of physical care to ill parents.[46]

In terms of emotional support (Panel C), we see that male and female migrants increase both the frequency and amount of contacts to their parents after migration, suggesting that emotional ties can be sustained between migrant children and aged parents even over great geographical distances. Perhaps not surprisingly given women's overwhelming role of kin keepers, migrant daughters are found to have stronger emotional attachment to parents at home than migrant sons. The differences between the two groups are statistically significant regardless of the measure used.

Overall, these results suggest that older parents with their daughters migrated are better off than those with sons migrated, having remittances but also instrumental and emotional support.

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the average exchange rate for year 2012 (1 USD=6.312 RMB) when monetary transfer information refers to.

[44]This disparity could be explained by the altruistic behaviour of women, their greater sense of sacrifice/responsibility towards their families at origin, and the self-insurance motives due to their precarious situations in destination city labour markets (Le Goff, 2016).

[45]Given that females typically face more uncertainty and risk in destination areas (e.g., labour market discrimination), they might tend to migrate shorter distances than males, which will enable them to return home more easily and more often if their parents are in need of help (China's rural-urban migration is often temporary and circular).

[46]To explore this point, we again look into the child-level data and further divide "migrants" into intraprovincial migrants (10.4%) and interprovincial migrants (18%). Among the intraprovincial migrant sample, 53.9 (46.1) percent refers to female (male) migrants, as compared to the case of interprovincial migration in which 40.5 (59.5) percent concerns female (male) migrants.

6.2.1 Use of Remittances

Another factor to consider within the intergenerational support channel would be the use of remittances. The precise income effect depends on how remittances are spent and migrants' gender may come into play here. Research reveals that women and men have different remittanc strategies (IOM-INSTRAW and UNDP, 2010). Women tend to remit a larger proportion of their earnings and keep a strict control over the use of money they send, while men often reserve greater amounts of money for personal use. In addition, the greater control over household's financial resources by women (whether as senders or administrators of remittances), the greater likelihood these are devoted to food, education and health. Furthermore, marriage is one important use of male remittances especially in China where families with a boy may be subject to particular pressure to accumulate more wealth to buy/build a house when the boy is ready to marry. Thus, we deduce that the remittances sent by daughters are more likely to be spent to meet the nutritional and health care needs of household members. In Panel A of Table 9 we test this conjecture by running the same IV regression using as dependent variable the household health expenditures (columns (1)-(3)) and the health care utilisation of elderly parents (columns (5)-(8)). We consider three types of health-related expenditures at the household level: food, fitness and medical care. The estimates suggest that as compared to sons' migration, the migration of daughters causes significant increases in per capita food and fitness expenditures, lending support to the hypothesis that female remittances are more likely to be invested in the well-being of left-behind households. We find no evidence that parents' engagement with health services is particularly affected by having daughters in urban areas – the estimated coefficients on migration variables are unanimously statistically insignificant.

6.3 Social Remittances

Beyond economic remittances, the "social" remittances of migrants (new ideas, skills, attitudes, advanced knowledge, etc.) can also promote the health and well-being of older parents left behind. One test of such non-pecuniary channel can be provided by analysing health behaviours directly, as more advanced health-related knowledge, attitudes and practices from urban destinations are theoretically hypothesised to influence these behaviours. According to the results reported in columns (1)-(5) of Panel B, Table 9 there is no significant gender difference in the estimated migration effect on smoking or binge drinking, which are still done by 31 percent and 16 percent of aged parents, respec-

tively. Having migrant daughters is positively correlated with the time spent sleeping and the probability of doing leisure-time physical activities,[47] albeit being statistically weak. Conversely, the point estimates suggest less sleep and a reduction in physical activity participation for elderly parents who have migrant sons. The most significantly beneficial effect of children's migration that may positively impact on elderly health is that rural parents with daughters in urban areas are 28.5 percentage points more likely to maintain a quantitatively sufficient diet ($\geq$3 meals per day), a finding consistent with the positive effect of migrant daughters on household food expenses we previously found. Our exploration complements the qualitative measure of diet (nutritional diversity) used in Böhme, Persian and Stöhr (2015), stressing the importance of improving both the meal quantity and food quality for left-behind elderly parents.

Another interesting area to explore would be how migrant children influence the social participation behaviour of their remaining parents.[48] We explore this channel by deriving two measures of social participation. We first consider the *extensive margin* of social participation based on the probability of taking part in any social activity. We next consider the *intensive margin* of social participation, capturing how actively the elderly person has participated in social activities. To construct the latter indicator, for each kind of activities in the list provided one unit is added to the social activity diversity index which then ranges between 0 and 11.[49]

The results of this analysis are presented in columns (7) and (8) of Table 9 (Panel B). Interestingly, we find strong positive evidence that elderly parents increase social interactions with non-family members and participate actively in their local community when their daughters migrate. When sons migrate to the city, older parents may not

[47]The measure includes physical activity done for the purpose of entertainments and/or exercise (e.g., walking, dancing, swimming).

[48]The role of social capital in the maintenance and enhancement of the well-being in later life has been well documented. Social activities, by empowering social networking, preventing feelings of loneliness and producing a sense of belonging, are important for older people's mental health and well-being. Due to traditional social and cultural norms rural Chinese women's participation in social activities is highly restricted. Migration not only provides women migrants with economic independence, but also exposes them to new ideas and social norms that can promote their rights and enable them to participate more fully in social life. Indeed, these ideas and norms that migrants have acquired in the urban areas can also be transmitted to their families and communities of origin, producing a shift in their parents'beliefs and behaviours regarding social participation.

[49]Elderly respondents were asked whether during the month before the interview they had interacted with friends; played Ma-jong, chess, cards, or gone to community club; provided help to family, friends, or neighbours; gone to a sport, social, or other kind of club; taken part in a community-related organisation; done voluntary or charity work; cared for a sick or disabled adult; attended an educational or training course; invested in stock market; used the Internet; or involved in other social activities.

change their current involvement with social activities.

According to all of these results, rural-urban migration has reshaped the traditional gender pattern of old-age support and female migrants play an increasingly important role in family support as a result of their improved socio-economic status gained through migration and off-farm employment (Song, Li and Feldman, 2012). The positive effect of migration on health and well-being may be explained by the increased household health expenditures, the adoption of a healthy diet and the increased social participation that are associated with daughters' migration combined with strong emotional ties with and help from migrant daughters.

7 Conclusion

This paper provides new empirical evidence on the impact of child migration on elderly parents' health and subjective well-being by rigorously comparing its effect by gender of the migrant children. Methodologically, this paper contributes to the migration literature by using a person's sign of birth to instrument for the endogenous migration choice. This identification strategy allows us to exploit the Chinese zodiac signs of children as a source of exogenous variation in their propensity to migrate, which are near-randomly determined (by year of birth) and are very unlikely to be correlated with unobserved factors that may affect parental health and well-being.

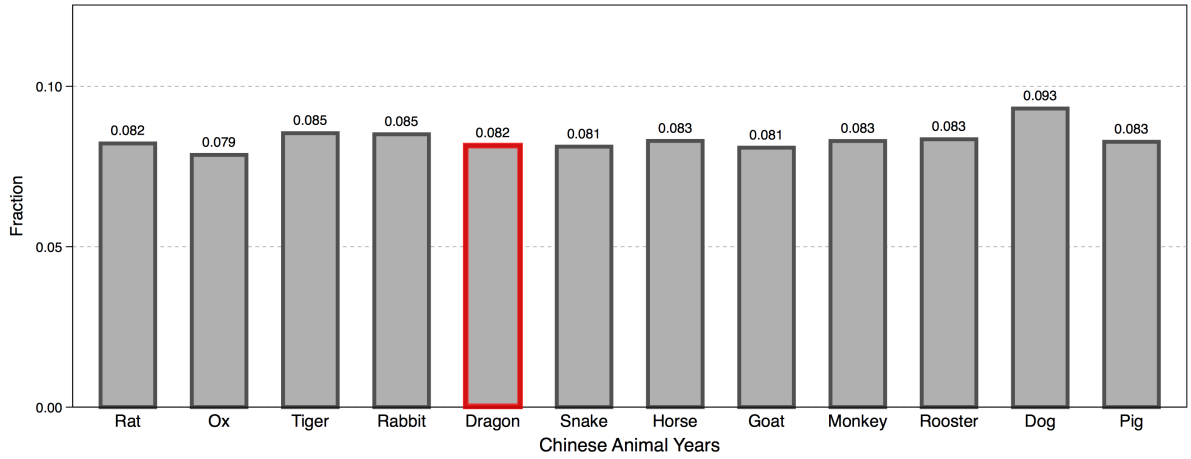
Our estimates reveal two main findings of novelty, which may deserve more attention. First, drawing on astrological characteristics, our first stage results suggest that a one-unit increase in the fraction of daughters (sons) born under the migration-prone Chinese animal signs raises the likelihood of having internal migrant daughters (sons) by 11 (10) percentage points. While it has long been believed that astrology could have an enormous impact on microeconomic behaviour (Bennett and Barth, 1973), there is no direct evidence on whether sign of birth (the Western zodiac and/or the Chinese zodiac) does, in fact, influence individuals' migration decisions. Our results provide first evidence that confirms the ability of astrology to predict human behaviour, and migration behaviour in particular. We argue that child-rearing and self-attribution, combined with the vital role of personality traits and risk preferences in migration choices, contribute to the translation of astrological beliefs into real-life migration outcome. Future research could explore whether such astrological prediction is also found for the Western star sign for Western people, and for other microeconomic outcomes, especially risky behaviours, e.g., entrepreneurial decisions.

Second, our main results add to the current literature on the causal relationship between child migration and parental health and SWB by discovering a remarkable gendered pattern in the estimated migration effects. In particular, we find that left-behind parents benefit from the ability to send their daughters to urban areas, which improves their self-reported health, physical health and overall life satisfaction. The migration of sons, however, creates no similar beneficial effects, which is contrary to traditional expectations in rural areas. We further explore a variety of potential channels behind our gender-specific results. In addition to receiving more instrumental and emotional support from migrant children, parents of migrant daughters are more likely to spend money on food and fitness, to have at least three meals per day and to actively participate in social activities. These results suggest that, beyond financial remittances, the non-pecuniary aspect of migration (such as a transfer of eating norms and social norms) could also play an important part in affecting the outcomes of left-behind members.

From a policy perspective, the potential benefits of daughters' migration on elderly health and well-being point to the need for more detailed gender-based government policies and programmes aimed at, first, promoting equal rights and obligations for old-age support between daughters and sons and, second, broadening the benefits of female migration.

Figures and Tables

Figure 1: Distribution of Birth by the Year of Twelve Chinese Zodiac Animal Signs.



Source. – Authors' own calculations from the CHARLS child-level data (2013).

Table 1: Descriptive Statistics.

	Full Sample		Has Migrant Children		No Migrant Children		Diff. in
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Means
Dependent variables							
Self-reported health†	0.209	(0.407)	0.206	(0.404)	0.212	(0.409)	–0.007
Mobility index (0-27)	22.172	(5.417)	22.345	(5.300)	21.973	(5.543)	0.373***
Functional health†	0.839	(0.368)	0.852	(0.356)	0.824	(0.381)	0.027***
Life satisfaction†	0.249	(0.432)	0.258	(0.438)	0.238	(0.426)	0.020**
Migration variables							
Has migrant daughters†	0.320	(0.467)	0.600	(0.490)			
Has migrant sons†	0.373	(0.484)	0.699	(0.459)			
Parent characteristics							
Female†	0.501	(0.500)	0.493	(0.500)	0.509	(0.500)	–0.015
Age	65.591	(7.778)	65.557	(7.705)	65.629	(7.861)	–0.072
Han ethnicity†	0.929	(0.256)	0.936	(0.245)	0.922	(0.269)	0.014**
Married†	0.854	(0.354)	0.876	(0.330)	0.828	(0.377)	0.047***
Has health insurance†	0.968	(0.175)	0.973	(0.163)	0.963	(0.188)	0.010**
Level of education:							
Illiterate†	0.371	(0.483)	0.347	(0.476)	0.399	(0.490)	–0.052***
Can read or write†	0.223	(0.416)	0.214	(0.410)	0.233	(0.423)	–0.019**
Elementary school†	0.217	(0.412)	0.219	(0.414)	0.214	(0.410)	0.005
Middle school and above†	0.189	(0.392)	0.220	(0.414)	0.154	(0.361)	0.066***
Unemployed†	0.270	(0.444)	0.254	(0.435)	0.288	(0.453)	–0.034***
Urban *hukou*†	0.072	(0.259)	0.093	(0.290)	0.049	(0.216)	0.043***
Number of daughters	1.474	(1.139)	1.565	(1.163)	1.370	(1.102)	0.195***
Number of sons	1.667	(1.036)	1.744	(1.064)	1.580	(0.995)	0.164***
Number of grandchildren	0.681	(1.007)	0.585	(0.965)	0.790	(1.043)	–0.205***
Has only one child†	0.075	(0.263)	0.042	(0.200)	0.113	(0.316)	–0.071***
Child characteristics							
Mean age of children	37.993	(7.343)	37.971	(7.145)	38.019	(7.565)	–0.048
Average education of children (years)	8.294	(3.325)	9.037	(3.329)	7.442	(3.109)	1.594***
Share of working children	0.900	(0.201)	0.898	(0.191)	0.903	(0.212)	–0.005
Household characteristics							
Household income (RMB/10000)	1.700	(3.696)	1.552	(3.410)	1.868	(3.993)	–0.316***
Household size	3.631	(1.948)	3.375	(1.812)	3.926	(2.055)	–0.551***
Village characteristics							
Presence of medical facility†	0.817	(0.387)	0.822	(0.383)	0.812	(0.391)	0.009
Has access to tap water†	0.439	(0.496)	0.413	(0.492)	0.470	(0.499)	–0.058***
Has strategy for waste management†	0.395	(0.489)	0.361	(0.480)	0.435	(0.496)	–0.073***
Located in non-mountainous areas†	0.690	(0.462)	0.697	(0.460)	0.682	(0.466)	0.015
Instruments							
% daughters with migration-prone zodiac signs	0.545	(0.442)	0.573	(0.434)	0.513	(0.449)	0.061***
% sons with migration-prone zodiac signs	0.618	(0.416)	0.637	(0.406)	0.596	(0.426)	0.041***
Observations	7,932		4,236		3,696		

Source.—China Health and Retirement Longitudinal Study. All variables refer to year 2013 (wave II) except village-level characteristics which refer to year 2011 (wave I).
Notes.—The table contains sample means and standard deviations (in parentheses). †Dummy variables.
*/**/*** indicate difference in means between the two groups is statistically significant at the 0.1/0.05/0.01 level.

Table 2: First Stage Results: Having Daughters and Sons in Urban Areas.

Dependent Variable	Has Migrant Daughters	Has Migrant Sons
	(1)	(2)
Z_1: % daughters with migration-prone zodiac signs	0.111***	–0.002
	(0.018)	(0.017)
Z_2: % sons with migration-prone zodiac signs	0.024	0.098***
	(0.019)	(0.017)
Parent and child controls	Yes	Yes
Household controls	Yes	Yes
Village controls	Yes	Yes
Province fixed effects	Yes	Yes
Observations	7,932	7,932
F stat 1^{st} stage Eq. 1	19.91	
Partial R^2 Eq. 1	0.416	
F stat 1^{st} stage Eq. 2		17.18
Partial R^2 Eq. 2		0.426
Kleibergen-Paap rk Wald F stat	17.60	

Source.—China Health and Retirement Longitudinal Study, 2013.
Notes.—Migration-prone zodiac signs refer to any of the eight signs of the Chinese zodiac animal: Rat, Ox, Tiger, Rabbit, Dragon, Horse, Monkey and Dog. The control variables include parent-, child-, household-, and village-level characteristics listed in Table 1.
Robust standard errors clustered at household level are reported in parentheses accounting for survey weights.
* $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table 3: OLS and IV Estimates of Gender-Specific Migration Effects on Parents' Health and Subjective Well-being.

Dependent Variable	Self-Reported Health	Mobility Index	Functional Health	Life Satisfaction
	(1)	(2)	(3)	(4)
OLS				
Has migrant daughters (β_D)	0.002	0.179	0.029**	0.026*
	(0.012)	(0.175)	(0.011)	(0.014)
Has migrant sons (β_S)	0.011	–0.114	0.002	0.025*
	(0.012)	(0.148)	(0.010)	(0.013)
2SLS				
Has migrant daughters (β_D)	0.335***	3.559**	0.306***	0.366***
	(0.126)	(1.580)	(0.109)	(0.130)
Has migrant sons (β_S)	0.062	–0.404	–0.150	0.097
	(0.148)	(1.877)	(0.127)	(0.152)
KP F weak IV test	17.60	17.60	17.60	17.47
Parent and child controls	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes
Village controls	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes
Observations	7,932	7,932	7,932	7,932
Number of clusters	4,894	4,894	4,894	4,894
Mean of dep. var.	0.21	22.17	0.84	0.25

Source.—China Health and Retirement Longitudinal Study, 2013.

Notes.—Self-Reported Health is an indicator for general health status, 1 if the elderly parent reports excellent, very good, or good health. Mobility Index is a measure of the elderly parent's body mobility that ranges between 0 and 27, the higher the better. Functional Health is an indicator for independent living skills, 1 if the elderly parent is able to perform at least 10 out of 12 ADLs and IADLs without help. Life Satisfaction is an indicator for whether the elderly parent is satisfied or very satisfied with life as a whole. The table reports ordinary least squares (OLS) and two-stage least squares (2SLS) estimates of the effect of daughters' and sons' migration on parental outcomes. Instruments are the share of daughters with the migration-prone Chinese zodiac signs and the share of sons with the migration-prone Chinese zodiac signs. All models include the control variables listed in Table 1. Column 4 includes an additional dummy for whether the elderly parent has any disability. Other coefficients from IV models are reported in Appendix Table A.4.

Robust standard errors clustered at household level are reported in parentheses accounting for survey weights.
* $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table 4: Falsification Exercise: IV Estimates of Gender-Specific Migration Effects on Placebo Health Outcomes.

Dependent Variable	Self-Reported Health Before Age 15	Chronic Diseases (dichotomous)	Chronic Diseases (continuous)
	(1)	(2)	(3)
Has migrant daughters (β_D)	0.042	–0.173	0.207
	(0.131)	(0.125)	(0.436)
Has migrant sons (β_S)	0.117	0.128	–0.202
	(0.145)	(0.149)	(0.461)
Parent and child controls	Yes	Yes	Yes
Household controls	Yes	Yes	Yes
Village controls	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes
Observations	7,842†	7,932	5,893
KP F weak IV test	15.57	17.60	15.64
Number of clusters	4,859	4,894	4,128
Mean of dep. var.	0.73	0.74	2.16

Source.—China Health and Retirement Longitudinal Study, 2013.

Notes.—Dependent variable in column 1 is a self-reported indicator for health status before age 15 (1 = excellent, very good or good; 0 = fair or poor); Dependent variable in column 2 is a dichotomous indicator for the presence of any chronic disease diagnosed by a doctor; Dependent variable in column 3 is the total number of chronic diseases diagnosed by a doctor (value ranges between 1 and 10), conditional on having at least one chronic illness. The table reports 2SLS estimates. Instruments: the respective shares of daughters and sons with the migration-prone Chinese zodiac signs. All models include the control variables listed in Table 1.

Robust standard errors clustered at household level are reported in parentheses accounting for survey weights.

†The sample size falls as for 90 observations self-reported childhood health is not available.

Table 5: Robustness Checks.

Dependent Variable	Self-Reported Health	Mobility Index	Functional Health	Life Satisfaction	Self-Reported Health	Mobility Index	Functional Health	Life Satisfaction
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	A. Controlling for Business Cycle Effects				***B. Excluding Parents of Dragon Children***			
Has migrant daughters (β_D)	0.254**	2.745**	0.275***	0.244**	0.314**	3.517**	0.206*	0.240*
	(0.111)	(1.241)	(0.094)	(0.114)	(0.134)	(1.679)	(0.116)	(0.128)
Has migrant sons (β_S)	–0.004	–1.490	–0.182*	–0.012	0.060	–3.266	–0.351*	0.034
	(0.128)	(1.453)	(0.108)	(0.134)	(0.215)	(2.667)	(0.184)	(0.205)
Observations	7,932	7,932	7,932	7,932	5,947	5,947	5,947	5,947
KP F weak IV test	20.56	20.56	20.56	20.37	8.12	8.12	8.12	8.04
No. of clusters	4,894	4,894	4,894	4,894	3,670	3,670	3,670	3,670
	C. Redefining IVs Based on "Yin" vs. "Yang"				***D. Excluding Ethnic Minorities***			
Has migrant daughters (β_D)	0.235*	3.060*	0.345***	0.347**	0.393**	3.791*	0.377***	0.340**
	(0.143)	(1.723)	(0.131)	(0.154)	(0.165)	(1.967)	(0.141)	(0.165)
Has migrant sons (β_S)	0.006	–0.633	–0.239	0.008	0.127	–0.926	–0.078	0.181
	(0.170)	(2.064)	(0.153)	(0.179)	(0.181)	(2.164)	(0.153)	(0.178)
Observations	7,932	7,932	7,932	7,932	6,046	6,046	6,046	6,046
KP F weak IV test	11.84	11.84	11.84	11.71	11.93	11.93	11.93	11.82
No. of clusters	4,894	4,894	4,894	4,894	3,543	3,543	3,543	3,543
	E. Controlling for Having a Girl Firstborn				***F. Number of Migrant Daughters and Sons***			
Has/No. of migrant daughters (β_D)	0.334***	3.522**	0.311***	0.366***	0.537*	6.246*	0.596*	0.573*
	(0.129)	(1.617)	(0.113)	(0.134)	(0.298)	(3.522)	(0.309)	(0.318)
Has/No. of migrant sons (β_S)	0.063	–0.380	–0.154	0.097	0.017	–1.687	–0.349	0.068
	(0.150)	(1.893)	(0.130)	(0.155)	(0.351)	(4.428)	(0.365)	(0.378)
Whether first birth is girl	0.002	0.053	–0.008	–0.001				
	(0.015)	(0.180)	(0.013)	(0.017)				
Observations	7,932	7,932	7,932	7,932	7,932	7,932	7,932	7,932
KP F weak IV test	17.18	17.18	17.18	17.00	2.12	2.12	2.12	2.04
No. of clusters	4,894	4,894	4,894	4,894	4,894	4,894	4,894	4,894
Parent and child controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Village controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Source.—China Health and Retirement Longitudinal Study, 2013.
Notes.—Please refer to Table 3 for detailed notes.
Panel A: includes year of birth dummies for all children of elderly parents. Panel B: sample excludes elderly parents who have at least one child born in the Year of the Dragon. Panel C: uses the respective shares of daughters and sons with Yang Chinese zodiac signs as the instrumental variables. Panel D: sample excludes elderly parents from minority-concentrated provinces and excludes the cases where the elderly respondent or the spouse is a minority. Panel E: additionally controls for whether the eldest child is a girl. Panel F: uses the number of migrant daughters and the number of migrant sons as the endogenous migration variables.
Robust standard errors clustered at household level are reported in parentheses accounting for survey weights.
* $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table 6: Robustness Check: Controlling for Children's Remittances to Elderly Parents.

Dependent Variable	Self-Reported Health	Mobility Index	Functional Health	Life Satisfaction
	(1)	(2)	(3)	(4)
Panel A: Treat Remittances as Exogenous				
Has migrant daughters (β_D)	0.344***	3.580**	0.307***	0.360***
	(0.128)	(1.627)	(0.112)	(0.132)
Has migrant sons (β_S)	0.073	–0.376	–0.149	0.090
	(0.153)	(1.956)	(0.132)	(0.155)
Log (Remittances from children)	–0.006	–0.015	–0.001	0.004
	(0.004)	(0.054)	(0.003)	(0.004)
KP F weak IV test	16.03	16.03	16.03	15.99
Panel B: Treat Remittances as Endogenous				
Has migrant daughters (β_D)	0.302**	2.861*	0.276**	0.278**
	(0.127)	(1.555)	(0.108)	(0.138)
Has migrant sons (β_S)	0.018	–1.304	–0.188	–0.015
	(0.138)	(1.718)	(0.116)	(0.148)
Log (Remittances from children)	0.024	0.488**	0.020	0.061***
	(0.018)	(0.217)	(0.015)	(0.019)
KP F weak IV test	10.26	10.26	10.26	10.15

	First Stage		
Dependent Variable	Has Migrant Daughters	Has Migrant Sons	Receives Remittances
% daughters with migration-prone zodiac signs	0.112***	–0.000	0.124
	(0.018)	(0.017)	(0.120)
% sons with migration-prone zodiac signs	0.023	0.097***	0.231*
	(0.019)	(0.017)	(0.123)
% married children	–0.049*	–0.098***	1.433***
	(0.029)	(0.032)	(0.240)
F stat 1^{st} stage Eq. 1	14.20		
F stat 1^{st} stage Eq. 2		14.57	
F stat 1^{st} stage Eq. 3			13.42
Parent and child controls	Yes	Yes	Yes
Household controls	Yes	Yes	Yes
Village controls	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes
Observations	7,932	7,932	7,932
Number of clusters	4,894	4,894	4,894

Source.—China Health and Retirement Longitudinal Study, 2013.
Notes.—See notes for Table 3 for a detailed description of the dependent variables. In panel A, instruments are the respective shares of daughters and sons with the migration-prone Chinese zodiac signs. In panel B, remittances from children are also considered as endogenous. In this case, an additional instrument is used: the share of married children of elderly parents. All models include the control variables listed in Table 1.
Robust standard errors clustered at household level are reported in parentheses accounting for survey weights.
* $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table 7: Heterogeneous Effects of Daughter Migration.

Dependent Variable		Self-Reported Health	Mobility Index	Functional Health	Life Satisfaction
		(1)	(2)	(3)	(4)
	β_D: Mothers	0.436**	6.566**	0.444**	0.406**
		(0.196)	(2.662)	(0.174)	(0.203)
	N	3,974	3,974	3,974	3,974
	KP F	8.39	8.39	8.39	8.40
Gender					
	β_D: Fathers	0.265*	1.619	0.195*	0.342**
		(0.150)	(1.779)	(0.116)	(0.149)
	N	3,969	3,969	3,969	3,969
	KP F	17.19	17.19	17.19	16.88
	β_D: Aged $\leq$ 65	0.232	0.028	0.018	0.173
		(0.164)	(1.508)	(0.105)	(0.154)
	N	4,587	4,587	4,587	4,587
	KP F	11.31	11.31	11.31	11.27
Age					
	β_D: Aged 65+	0.629**	10.095**	0.883**	0.711**
		(0.292)	(4.440)	(0.349)	(0.323)
	N	3,356	3,356	3,356	3,356
	KP F	2.95	2.95	2.95	2.76
	β_D: Low education	0.585	6.250	0.547	0.906*
		(0.430)	(5.733)	(0.411)	(0.537)
	N	2,947	2,947	2,947	2,947
	KP F	2.80	2.80	2.80	2.77
Education					
	β_D: High education	0.273**	3.471**	0.268***	0.246**
		(0.124)	(1.506)	(0.095)	(0.122)
	N	4,996	4,996	4,996	4,996
	KP F	13.25	13.25	13.25	12.91
	β_D: Not migrated before	0.344***	3.177*	0.281**	0.379***
		(0.133)	(1.670)	(0.112)	(0.134)
	N	6,793	6,793	6,793	6,793
	KP F	13.69	13.69	13.69	13.65
Previous Migration Experience					
	β_D: Migrated before	0.133	6.177	0.453	0.267
		(0.485)	(5.521)	(0.404)	(0.514)
	N	1,150	1,150	1,150	1,150
	KP F	1.75	1.75	1.75	1.72
	β_D: Above median	0.231	3.190*	0.233*	0.353*
		(0.179)	(1.924)	(0.135)	(0.215)
	N	3,971	3,971	3,971	3,971
	KP F	2.90	2.90	2.90	2.87
Household Income					
	β_D: Below median	0.379**	4.051*	0.387**	0.382**
		(0.183)	(2.365)	(0.167)	(0.186)
	N	3,968	3,968	3,968	3,968
	KP F	10.68	10.68	10.68	10.70
	β_D: Alone or with spouse only	0.386	4.289	0.469**	0.265
		(0.257)	(2.864)	(0.229)	(0.249)
	N	2,896	2,896	2,896	2,896
	KP F	5.01	5.01	5.01	5.01
Living Arrangements					
	β_D: With others	0.304**	3.443*	0.239*	0.395**
		(0.146)	(1.848)	(0.128)	(0.155)
	N	5,047	5,047	5,047	5,047
	KP F	6.59	6.59	6.59	6.54

Source.—China Health and Retirement Longitudinal Study, 2013.

Notes.—See notes for Table 3 for a detailed description of the dependent variables. Each table reports 2SLS estimates of the effect of daughters' migration only. Instruments: the respective shares of daughters and sons with the migration-prone Chinese zodiac signs. All models include the control variables listed in Table 1.

Robust standard errors clustered at household level are reported in parentheses accounting for survey weights.

* $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table 8: Potential Mechanism: Intergenerational Transfers.

	Has Migrant Daughters	Has Migrant Sons	No Migrant Children	Diff. in Means	Std. Error
Panel A: Monetary Support					
Receives remittances from children=0/1	0.884	0.869	0.710	0.015*	(0.009)
Total children's remittances in RMB	4483.272	4788.564	2081.359	–305.293	(223.051)
Observations	2,544	2,964	3,704		
Panel B: Instrumental Support					
Receives help from children=0/1	0.128	0.095	0.178	0.033**	(0.014)
Avg. children's days of help per month	2.297	1.508	3.370	0.789***	(0.303)
Avg. children's hours of help per month	10.320	7.211	15.605	3.108	(2.313)
Children are the main helper=0/1	0.155	0.129	0.215	0.026*	(0.015)
Children's spouses are the main helper=0/1	0.132	0.095	0.186	0.037***	(0.014)
Observations†	961	1,111	1,597		
Panel C: Emotional Support					
Has daily contact with children=0/1	0.097	0.072	0.037	0.025***	(0.008)
Has more than weekly contact with children=0/1	0.538	0.514	0.274	0.024*	(0.013)
Avg. # of contacts with children per year	59.719	51.542	32.112	8.177***	(2.046)
Observations	2,544	2,964	3,704		

Source.—China Health and Retirement Longitudinal Study, 2013.

Notes.—The table reports sample means. †Instrumental support from children is reported by a sub-sample of parents who experienced difficulties with one or more ADLs or IADLs.

*/**/*** indicate difference in means between the first two groups—parents who see their daughters migrate and parents who see their sons migrate—is statistically significant at the 0.1/0.05/0.01 level.

Table 9: Potential Mechanisms.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Health Expenditures				***Health Care Utilisation***			
Panel A:	Log p.c. Food Exp.	Log p.c. Fitness Exp.	Log p.c. Medical Exp.		Outpatient Visit	Inpatient Visit	Foregone Health Care	Treat Chronic Diseases
Has migrant daughters (β_D)	1.171**	1.014***	1.564		0.014	–0.022	0.033	0.239
	(0.521)	(0.390)	(1.012)		(0.072)	(0.095)	(0.084)	(0.160)
Has migrant sons (β_S)	0.042	0.278	1.204		0.012	0.025	0.032	0.004
	(0.622)	(0.448)	(1.221)		(0.081)	(0.105)	(0.098)	(0.170)
Observations	7,943	7,943	7,943		7,943	7,943	7,943	5,901†
KP F weak IV test	16.28	16.28	16.05		16.05	16.05	16.05	15.42
Number of clusters	4,902	4,902	4,902		4,902	4,902	4,902	4,133
Mean of dep. var.	3.62	0.21	4.94		0.23	0.14	0.14	0.75
	Health-Related Behaviours						***Social Capital***	
Panel B:	Smoking	Heavy Drinking	Meals ≥ 3	Sleep	Leisure Physical Activities		Social Activities (participation)	Social Activities (diversity)
Has migrant daughters (β_D)	–0.008	–0.099	0.285**	0.154	0.173		0.499***	0.912***
	(0.110)	(0.113)	(0.135)	(0.533)	(0.224)		(0.162)	(0.282)
Has migrant sons (β_S)	0.058	–0.092	0.103	–0.602	–0.212		0.064	0.039
	(0.130)	(0.140)	(0.156)	(0.584)	(0.257)		(0.187)	(0.327)
Observations	7,943	7,943	7,943	7,943	2,766‡		7,943	7,943
KP F weak IV test	16.28	16.28	16.28	16.28	7.29		16.28	16.28
Number of clusters	4,902	4,902	4,902	4,902	1,941		4,902	4,902
Mean of dep. var.	0.31	0.16	0.79	6.18	0.39		0.48	0.69

Source.—China Health and Retirement Longitudinal Study, 2013.
Notes.—See text for detailed definitions of the dependent variables. The table reports 2SLS estimates. Instruments: the respective shares of daughters and sons with the migration-prone Chinese zodiac signs. All models include the control variables listed in Table 1. In panel A, columns 3-7 additionally control for whether the elderly parent has any disability, presence of any chronic diseases diagnosed by a doctor and whether the elderly parent has been ill in the past month.
†The sample size falls as this outcome utilises a sub-sample of parents who have one or more chronic diseases diagnosed by a doctor.
‡The sample size falls as physical activity questions are answered by elderly respondents from a random sample of households.
Robust standard errors clustered at household level are reported in parentheses accounting for survey weights.
* $p<0.1$, ** $p<0.05$, *** $p<0.01$.

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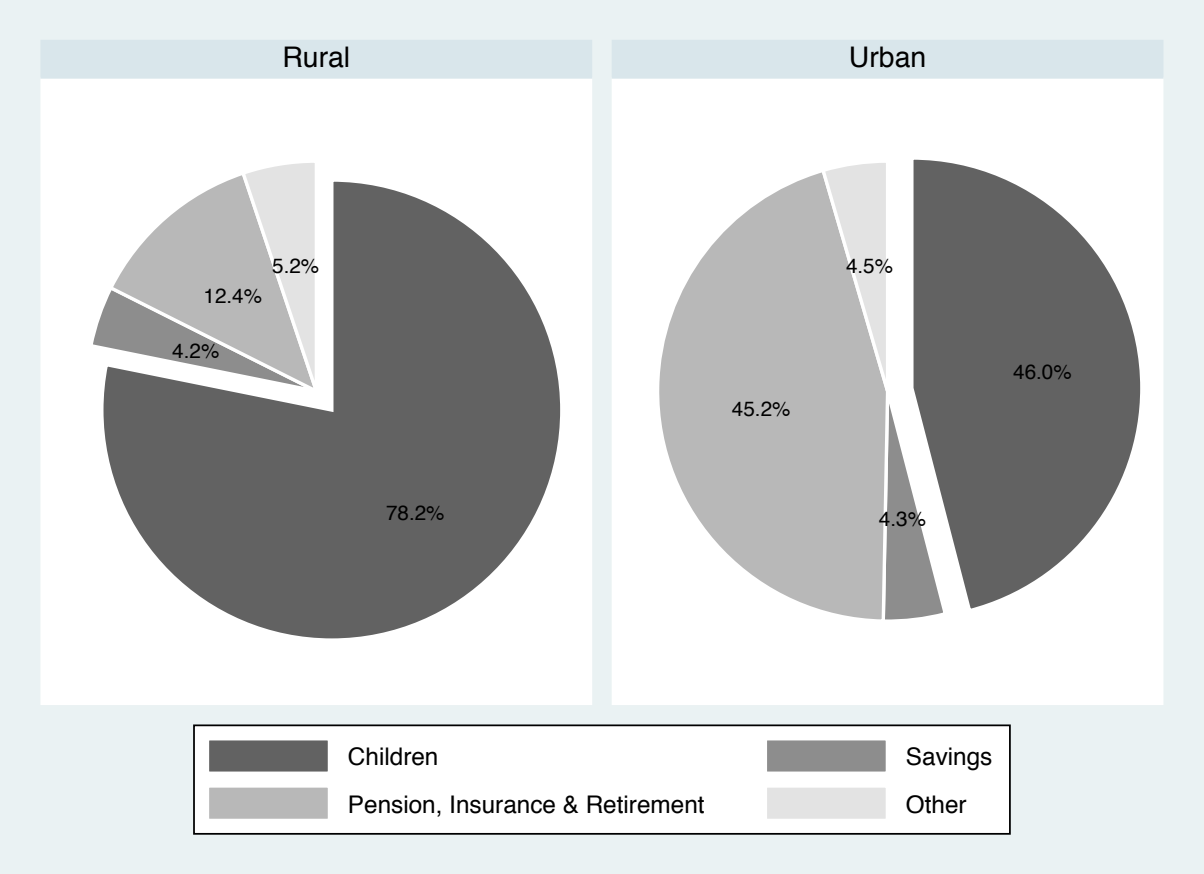
Appendix

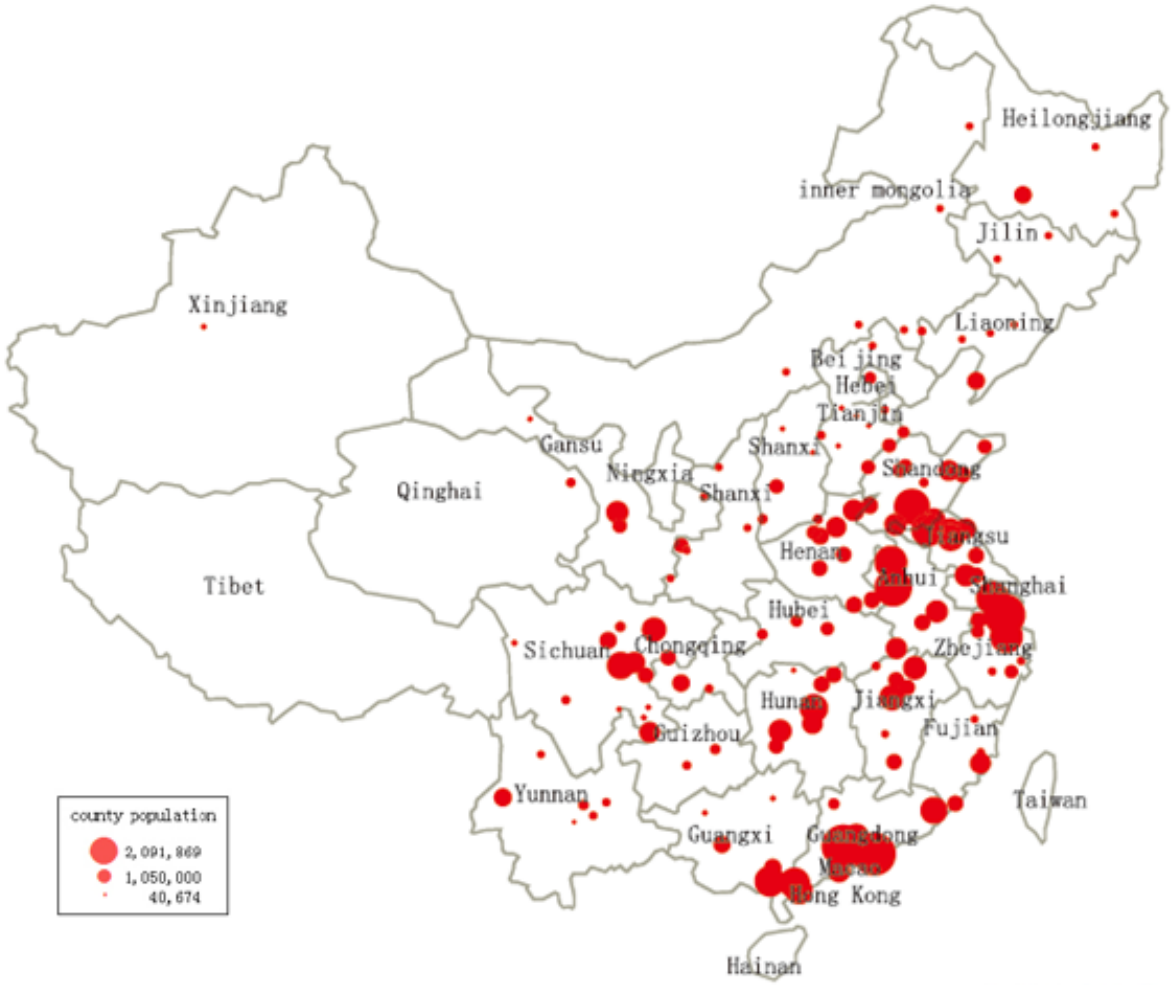
A. Robustness Checks

Figure A.1: Main Sources of Old-Age Support by Rural/Urban Status.



Source. – Authors' own calculations from the CHARLS national survey 2011 (wave I) and 2013 (wave II). The specific questions are frames as: "Whom do you think you can rely on for old-age support?" in 2011 survey questionnaire and "Who do you think you can rely on financially for old-age support?" in 2013 survey questionnaire.

Figure A.2: CHARLS Sampled Counties and Districts.



Source. – A report by the CHARLS Research Team – "Challenges of Population Aging in China: Evidence from the National Baseline Survey of the China Health and Retirement Longitudinal Study (CHARLS)" (May 2013).

Table A.1: Major Migration-Related Characteristics of Twelve Chinese Zodiac Signs.

Zodiac Animal	Big Five Traits	Brief Description of Personality	Yin/Yang
Rat	E, O	Hyper-active, sociable, creative, adaptable	Yang
Ox	A(–)	Stubborn, hard-hearted, conservative	Yin
Tiger	E	Energetic, adventurous	Yang
Rabbit	E, N	Outgoing, sensitive	Yin
Dragon	E	Ambitious, lively, dominant, adventurous	Yang
Snake	N(–), C, A	Calm, hard-working, gentle	Yin
Horse	E	Active, energetic, enthusiastic	Yang
Goat	C, A	Tender, caring, compassionate	Yin
Monkey	E, O	Lively, intelligent, curious, adaptable	Yang
Rooster	C, A	Tender, responsible, trustworthy	Yin
Dog	O	Loyal, intelligent	Yang
Pig	N(–), A	Calm, compassionate, generous	Yin

Note.—The facets of the "Big Five" personality domains are: **E** – Extraversion (outgoing, lively, active, talkative, sociable, forceful, energetic, enthusiastic, adventurous, dominant, etc.); **O** – Openness to Experience (creative, imaginative, intelligent, curious, inventive, broad-minded, sophisticated, artistic, wide interests, unconventional, etc.); **N** – Neuroticism (tense, anxious, nervous, moody, worrying, touchy, fearful, emotional, calm[reversed], etc.); **C** – Conscientiousness (organised, thorough, efficient, responsible, reliable, dependable, conscientious, precise, practical, hard-working, careless[reversed], etc.); and **A** – Agreeableness (sympathetic, kind, appreciative, soft-hearted, hard-hearted[reversed], warm, generous, trusting, helpful, forgiving, pleasant, gentle, caring, not stubborn, etc.).
(–) stands for "low". For example, A(–) means low agreeableness.

Table A.2: Descriptive Statistics for Adult Children of Elderly Parents.

	Migration-Prone Zodiac Signs		Migration-Averse Zodiac Signs		Diff. in Means
	Mean	Std. Dev.	Mean	Std. Dev.	
Dependent variable					
Migrate to urban areas	0.292	(0.455)	0.276	(0.447)	0.016**
Individual and household characteristics					
Female	0.465	(0.499)	0.473	(0.499)	–0.008
Age	39.823	(8.887)	39.725	(8.913)	0.098
Married	0.890	(0.313)	0.890	(0.312)	–0.001
Level of education:					
Illiterate	0.067	(0.250)	0.076	(0.265)	–0.009*
Can read or write	0.123	(0.329)	0.134	(0.341)	–0.011*
Elementary school	0.285	(0.451)	0.260	(0.439)	0.024***
Middle school and above	0.525	(0.499)	0.529	(0.499)	–0.004
Eldest child	0.314	(0.464)	0.330	(0.470)	–0.016
Only child	0.023	(0.151)	0.027	(0.162)	–0.004
Household assets†	–0.197	(2.202)	–0.178	(2.244)	–0.019
Household size	3.524	(2.030)	3.590	(2.084)	–0.065*
Number of children	1.578	(0.918)	1.577	(0.897)	0.001
Number of grandchildren	0.235	(0.764)	0.233	(0.741)	0.002
Village characteristics					
Paved road	0.588	(0.492)	0.602	(0.490)	–0.014
Has road passing through	0.925	(0.264)	0.925	(0.263)	–0.000
Village outmigration rate (%)	0.296	(0.265)	0.283	(0.259)	0.013***
Has access to tap water	0.441	(0.497)	0.445	(0.497)	–0.004
Number of rainy days	54.817	(40.832)	54.194	(40.333)	0.623
Number of snowy days	7.677	(15.449)	7.153	(14.271)	0.524*
Distance to train station (km)	60.479	(122.853)	58.165	(121.573)	2.314
Distance to bus stop (km)	4.305	(10.974)	4.352	(11.359)	–0.047
Located in non-mountainous areas	0.671	(0.470)	0.693	(0.461)	–0.022***
Observations	9,591		4,546		

Source.—CHARLS child-level data. All variables refer to year 2013 (wave II) except village-level characteristics which refer to year 2011 (wave I).

Notes.—This table contains sample means and standard deviations (in parentheses). Migration-prone zodiac signs refer to any of the eight signs of the Chinese zodiac animal: Rat, Ox, Tiger, Rabbit, Dragon, Horse, Monkey and Dog; Migration-averse zodiac signs refer to any of the four signs of the Chinese zodiac animal: Snake, Goat, Rooster and Pig. †To proxy for household wealth, we use the principal components analysis (PCA) to construct a single household asset index that aggregates information on household ownership of consumer durables and housing characteristics.

*/**/*** indicate difference in means between the two groups is statistically significant at the 0.1/0.05/0.01 level.

Table A.3: Probit Estimates of the Effects of Chinese Zodiac Signs on A Child's Migration Propensity.

Dependent Variable	Migrate to Urban Areas			
	(1)	(2)	(3)	(4)
Migration-prone zodiac sign	0.027***	0.026***	0.022**	0.019**
	(0.010)	(0.009)	(0.009)	(0.009)
Female		0.015	0.022**	0.024***
		(0.010)	(0.009)	(0.009)
Age		0.006	0.005	0.004
		(0.005)	(0.004)	(0.004)
Age squared		–0.000**	–0.000	–0.000
		(0.000)	(0.000)	(0.000)
Married		–0.005	–0.003	–0.003
		(0.016)	(0.016)	(0.016)
Can read or write		0.073***	0.083***	0.078***
		(0.027)	(0.028)	(0.028)
Elementary school		0.109***	0.125***	0.121***
		(0.026)	(0.026)	(0.026)
Middle school and above		0.218***	0.243***	0.241***
		(0.024)	(0.022)	(0.022)
Eldest child		0.031***	0.032***	0.033***
		(0.009)	(0.009)	(0.009)
Only child		–0.061***	–0.050**	–0.040
		(0.023)	(0.024)	(0.025)
Household assets		0.003	0.007**	0.009***
		(0.003)	(0.003)	(0.003)
Household size		–0.031***	–0.032***	–0.033***
		(0.003)	(0.003)	(0.003)
Number of children		–0.053***	–0.057***	–0.062***
		(0.007)	(0.007)	(0.007)
Number of grandchildren		–0.026***	–0.028***	–0.033***
		(0.009)	(0.009)	(0.009)
Paved road			–0.031***	–0.034***
			(0.011)	(0.013)
Has road passing through			–0.085***	–0.055**
			(0.023)	(0.023)
Village outmigration rate (%)			0.215***	0.146***
			(0.023)	(0.025)
Has access to tap water			–0.033***	–0.029**
			(0.012)	(0.012)
Number of rainy days			0.000	0.000
			(0.000)	(0.000)
Number of snowy days			–0.001*	–0.002***
			(0.000)	(0.001)
Distance to train station (km)			–0.000	–0.000
			(0.000)	(0.000)
Distance to bus stop (km)			–0.000	–0.000
			(0.001)	(0.001)
Located in non-mountainous areas			–0.032**	–0.042***
			(0.013)	(0.014)
Parent and child controls	No	Yes	Yes	Yes
Household controls	No	Yes	Yes	Yes
Village controls	No	No	Yes	Yes
Province fixed effects	No	No	No	Yes
Observations	14,137	14,137	14,137	14,137
Predicted probability	0.275	0.278	0.284	0.283

Source.—CHARLS child-level data, 2013.

Notes.—Dependent variable is a dichotomous indicator for whether the child of an elderly parent currently migrates to urban areas. The table reports marginal effects for Probit models. Migration-prone zodiac signs refer to any of the eight signs of the Chinese zodiac animal: Rat, Ox, Tiger, Rabbit, Dragon, Horse, Monkey and Dog. All models include the control variables listed in Table A.2.

Robust standard errors clustered at household level are reported in parentheses accounting for survey weights.

* $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table A.4: Full Set of IV Estimates.

Dependent Variable	Self-Reported Health	Mobility Index	Functional Health	Life Satisfaction
	(1)	(2)	(3)	(4)
Has migrant daughters (β_D)	0.335***	3.559**	0.306***	0.366***
	(0.126)	(1.580)	(0.109)	(0.130)
Has migrant sons (β_S)	0.062	–0.404	–0.150	0.097
	(0.148)	(1.877)	(0.127)	(0.152)
Female	–0.043***	–1.429***	–0.033***	–0.010
	(0.012)	(0.152)	(0.011)	(0.012)
Age	–0.027**	0.226	0.034***	0.029***
	(0.011)	(0.172)	(0.011)	(0.010)
Age squared	0.000**	–0.003**	–0.000***	–0.000***
	(0.000)	(0.001)	(0.000)	(0.000)
Han ethnicity	–0.011	–0.122	–0.029	–0.030
	(0.026)	(0.302)	(0.024)	(0.028)
Married	–0.041*	–0.807***	–0.004	–0.031
	(0.023)	(0.292)	(0.020)	(0.024)
Has health insurance	–0.080**	–0.038	–0.034	0.037
	(0.034)	(0.481)	(0.027)	(0.032)
Can read or write	–0.019	0.139	0.030**	–0.020
	(0.014)	(0.180)	(0.013)	(0.016)
Elementary school	–0.002	0.329	0.027*	–0.064***
	(0.016)	(0.201)	(0.014)	(0.017)
Middle school and above	–0.000	0.725***	0.050***	–0.098***
	(0.019)	(0.243)	(0.016)	(0.019)
Unemployed	–0.092***	–3.435***	–0.172***	–0.027*
	(0.014)	(0.210)	(0.014)	(0.016)
Urban *hukou*	–0.060**	–0.422	–0.001	–0.068***
	(0.024)	(0.532)	(0.030)	(0.022)
Number of daughters	–0.043**	–0.453**	–0.040***	–0.030*
	(0.017)	(0.222)	(0.016)	(0.018)
Number of sons	0.003	0.200	0.030**	0.021
	(0.017)	(0.196)	(0.015)	(0.018)
Number of grandchildren	–0.003	0.381**	0.038***	–0.021
	(0.013)	(0.193)	(0.013)	(0.013)
Has only one child	0.118***	0.411	0.018	0.121***
	(0.036)	(0.492)	(0.031)	(0.037)
Mean age of children	0.004**	0.045**	–0.000	0.003*
	(0.002)	(0.021)	(0.001)	(0.002)
Average years of education of children	–0.010	0.095	0.003	–0.012*
	(0.006)	(0.104)	(0.006)	(0.006)
Share of working children	0.029	0.867**	0.062**	–0.038
	(0.032)	(0.391)	(0.027)	(0.036)
Household income (RMB/10000)	0.004**	0.032	0.000	0.004**
	(0.002)	(0.022)	(0.001)	(0.002)
Household size	0.008	–0.102	–0.017*	0.016
	(0.011)	(0.152)	(0.010)	(0.012)
Presence of medical facility	0.014	0.404**	–0.009	–0.013
	(0.016)	(0.199)	(0.014)	(0.017)
Has access to tap water	0.034**	0.306	0.011	0.017
	(0.016)	(0.232)	(0.015)	(0.016)
Has strategy for waste management	0.046**	0.770***	0.030**	0.033*
	(0.018)	(0.201)	(0.015)	(0.018)
Located in non-mountainous areas	0.008	0.226	0.010	0.018
	(0.016)	(0.202)	(0.014)	(0.017)
Any disability				–0.041***
				(0.013)
Province fixed effects	Yes	Yes	Yes	Yes
Observations	7,932	7,932	7,932	7,932
KP F weak IV test	17.60	17.60	17.60	17.47
Number of clusters	4,894	4,894	4,894	4,894

Source.—China Health and Retirement Longitudinal Study, 2013.
Please refer to Table 3 for detailed notes. Robust standard errors clustered at household level are reported in parentheses accounting for survey weights. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table A.5: Robustness Check: Alternative SWB Measure and Specific Health Outcomes.

	OLS		***2SLS***	
	Migrant Daughters	Migrant Sons	Migrant Daughters	Migrant Sons
	(1)	(2)	(3)	(4)
Dependent Variable				
Happiness	0.004	0.017	0.304**	0.079
	(0.015)	(0.014)	(0.143)	(0.169)
Elderly parent has difficulty with...				
Running or jogging 1km	0.019	–0.010	–0.281*	–0.037
	(0.016)	(0.014)	(0.148)	(0.177)
Walking 1km	–0.011	0.005	–0.189*	0.058
	(0.012)	(0.011)	(0.110)	(0.127)
Walking 100 metres	–0.016*	0.013	–0.187**	0.092
	(0.009)	(0.009)	(0.083)	(0.093)
Getting up from chair	–0.008	–0.004	–0.177	–0.103
	(0.015)	(0.014)	(0.134)	(0.159)
Climbing stairs	0.006	0.001	–0.221	–0.033
	(0.017)	(0.014)	(0.152)	(0.179)
Stooping, kneeling or crouching	–0.005	0.021	–0.158	0.087
	(0.016)	(0.014)	(0.140)	(0.166)
Reaching or extending arms	–0.010	0.002	–0.100	–0.146
	(0.011)	(0.010)	(0.100)	(0.114)
Lifting or carrying weights	–0.002	0.014	–0.202*	0.004
	(0.012)	(0.010)	(0.105)	(0.125)
Picking up coin from table	–0.018***	–0.006	–0.057	–0.021
	(0.007)	(0.006)	(0.061)	(0.068)
Elderly parent needs help with...				
Dressing	–0.012**	0.004	–0.040	0.036
	(0.005)	(0.005)	(0.041)	(0.049)
Bathing or showering	–0.004	–0.004	–0.031	0.002
	(0.007)	(0.007)	(0.062)	(0.070)
Eating	–0.007**	–0.002	–0.034	0.007
	(0.004)	(0.004)	(0.034)	(0.041)
Getting into or out of bed	–0.006	0.004	–0.049	0.019
	(0.004)	(0.004)	(0.039)	(0.042)
Using the toilet	–0.011*	–0.006	–0.050	0.007
	(0.006)	(0.005)	(0.055)	(0.061)
Continence	–0.002	–0.001	–0.044	–0.104**
	(0.005)	(0.004)	(0.040)	(0.048)
Housekeeping	–0.009	0.011	–0.131*	0.018
	(0.009)	(0.008)	(0.078)	(0.092)
Cooking	–0.011	–0.003	–0.059	0.066
	(0.009)	(0.008)	(0.076)	(0.088)
Shopping	–0.007	–0.003	–0.134*	0.087
	(0.009)	(0.008)	(0.080)	(0.090)
Managing finance	–0.019**	–0.011	–0.174**	0.061
	(0.009)	(0.008)	(0.087)	(0.100)
Medication	–0.012*	0.003	–0.117**	0.041
	(0.006)	(0.006)	(0.057)	(0.066)
Making telephone calls	–0.026**	0.013	0.022	0.031
	(0.011)	(0.010)	(0.095)	(0.111)
Observations	7,932	7,932	7,932	7,932
Number of clusters	4,894	4,894	4,894	4,894

Source.—China Health and Retirement Longitudinal Study, 2013.
Notes.—The table reports OLS and 2SLS estimates. Instruments: the respective shares of daughters and sons with the migration-prone Chinese zodiac signs. All models include the control variables listed in Table 1. Regressions include an additional dummy for whether the elderly parent has any disability when using happiness as the dependent variable. Robust standard errors clustered at household level are reported in parentheses accounting for survey weights.
* $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table A.6: OLS and IV Estimates of Gender-Specific Migration Effects on Parents' Loneliness Feelings.

Dependent Variable	Loneliness (during past week)	Loneliness (yesterday)
	(1)	(2)
OLS		
Has migrant daughters (β_D)	0.000	0.001
	(0.013)	(0.010)
Has migrant sons (β_S)	0.015	–0.018*
	(0.013)	(0.010)
2SLS		
Has migrant daughters (β_D)	0.079	–0.096
	(0.122)	(0.098)
Has migrant sons (β_S)	0.021	0.036
	(0.136)	(0.112)
KP F weak IV test	17.60	17.60
Parent and child controls	Yes	Yes
Household controls	Yes	Yes
Village controls	Yes	Yes
Province fixed effects	Yes	Yes
Observations	7,932	7,932
Number of clusters	4,894	4,894
Mean of dep. var.	0.25	0.06

Source.—China Health and Retirement Longitudinal Study, 2013.

Notes.—Dependent variable in column 1 is an indicator for whether the elderly parent felt lonely during the past week (1 = some or a little of the time, occasionally or a moderate amount of the time, or most or all of the time; 0 = rarely or none of the time); Dependent variable in column 2 is an indicator for whether the elderly parent felt lonely yesterday (1 = somewhat, quite a bit or very; 0 = not at all or a little). The table reports ordinary least squares (OLS) and two-stage least squares (2SLS) estimates of the effect of daughters' and sons' migration on parents' loneliness feelings. Instruments are the share of daughters with the migration-prone Chinese zodiac signs and the share of sons with the migration-prone Chinese zodiac signs. All models include the control variables listed in Table 1.

Robust standard errors clustered at household level are reported in parentheses accounting for survey weights.

* $p<0.1$, ** $p<0.05$, *** $p<0.01$.

B. Chinese Zodiac Signs and Risk Attitudes: RUMiC Data

To investigate the extent to which the Chinese zodiac sign can influence individual risk attitudes, we obtain data from the second wave of the RUMiC-Urban Migration in China (RUMiC RHS, 2009). This part of the analysis is motivated by two considerations. Firstly, despite the fact that the migration classification of the twelve Chinese zodiac animals (*migration-prone* or *migration-averse*) is built on common knowledge of Chinese astrology as well as conventional wisdom and social experience among the Chinese, one might still worry that such grouping is somewhat arbitrary. We will use the RUMiC data to show that these two groups of individuals are indeed very different in terms of their risk attitudes. Secondly, and perhaps more importantly, we hypothesised in Section 4 that beliefs in one's birth animal can translate into migration behaviour through shaping personal characteristics which are psychological predictors of the migration decision. Among these psychological factors, attitudes toward risk should be the first to bear the brunt because they play a role in almost every important individual decision and migration *per se* is a risky choice. Thereby, the presence of a statistically significant correlation between Chinese zodiac signs and risk attitudes would support the plausibility of this fundamental hypothesis we made for identification. In the questionnaire, there is a general risk question which directly asks interview respondents aged 16 and over about their willingness to take risks:

> *"Generally, some people prefer to take risk, while others try to avoid any risk. If it is to rank the risk from low to high as 0 to 10 (as shown by the following chart), 0 is "never take risk", 10 is "most likely to take risk", which level do you belong to (choose a number from 0 to 10)."*

Crucially, this self-assessed general risk question is the only one of the survey questions that has been experimentally validated, and turns out to be not only behaviourally relevant but also the best global predictor of actual risky behaviour (see e.g., Jaeger et al., 2010). Based on this question we create two measures to capture an individual's underlying attitudes toward risk. Above all, we use a binary measure indicating that an individual is willing to bear *at least some* amount of risk (i.e., the reported value on the general risk scale is greater than 0). We then probe the above question further by exploiting its ordinal structure and construct a second risk measure: the self-reported level of risk that ranges from 0 (very risk-averse) to 10 (very risk-taking). We call the

former *risk indicator* and the latter *risk index* following Jaeger et al. (2010). The 2009 RHS sample covers 32,171 individuals from 7,992 rural households in nine provinces of China.[50] For comparison purposes, we limit our attention to respondents aged between 18 and 79, which perfectly replicates the age window of the adult children in the CHARLS. There are a total of 11,965 observations (7,570 households) in our final sample. Table B.1 summarises the main variables used in the empirical analysis, distinguished broadly by nature of a zodiac sign (Chinese animal sign or Western sun sign) and specifically by the sign's migration type (migration-prone or migration-averse).[51] In our representative sample, roughly 67% of individuals were born under migration-loving Chinese zodiac signs, while a smaller fraction of respondents (about 52%) were born under migration-loving Western zodiac signs. This is not surprising as the migration-prone group defined using Chinese animals incorporates two more zodiac signs than the same group characterised by horoscopes.

Let us now focus on the two variables related to risk attitudes. Looking first at the Chinese zodiac domain, we can see that individuals who were born under migration-seeking animal signs, relative to those born under migration-averse animal signs, have on average a greater propensity to take risks (0.710 vs. 0.674), with the t-test on difference in means strongly rejecting their similarity at the 1 percent level. With regard to risk tolerance level, the animal of birth seems to play a role as well, with individuals born under migration-loving animal signs being willing to take a significantly higher level of risk relative to their migration-averse counterparts (2.504 vs. 2.365). The difference in the subjective risk level between the two groups, albeit not great in magnitude, is highly significant at the 1 percent level. Interestingly though, we find no statistically significant correlation between the zodiac signs and risk attitudes when it comes to the Western sun signs. Therefore, simply a raw comparison of unconditional means reveals that the Chinese zodiac signs are relevant determinants of Chinese people's risk attitudes, whilst the Western zodiac signs do not appear to reflect the risk preferences of the Chinese.

Next we move to regression analysis in order to check whether the unconditional results

[50] The RHS sampled provinces are: Anhui, Chongqing, Guangdong, Hebei, Henan, Hubei, Jiangsu, Sichuan, and Zhejiang.

[51] Referring to our previous argument, the twelve Chinese zodiac signs are treated as migration-loving or migration-averse according to the migration-related traits associated with each animal. Likewise, there are interesting findings in Western astrology that individuals born within a *positive* or *odd-numbered* sun sign (Aries, Gemini, Leo, Libra, Sagittarius, Aquarius) are more extrovert, adventurous, active and aggressive than those born within a *negative* or *even-numbered* sun sign (Taurus, Cancer, Virgo, Scorpio, Capricorn, Pisces) who are more introvert, gentle, conservative and risk-averse (see, for example, Mayo, White and Eysenck, 1978). We thus postulate that persons born under odd numbered star signs are more *prone* to migration and persons born under the even numbered star signs are more *averse* to migration.

outlined above are robust once we control for a number of primary determinants of general risk attitudes. We initially add into regressions only attributes that are purely exogenous (gender, age, height, weight, birth sign, and birth order), and then control additionally for characteristics that are potentially endogenous (marital status, years of education, monthly income, number of children, household size, and province of residence)[52]. The dependent variable is an individual's willingness to take risks – we examine both the probability of taking risks (*risk indicator*, estimated by a probit model) and the self-assessed risk level (*risk index*, estimated by the OLS). The main independent variable refers to a dichotomous indicator for whether a person's Chinese zodiac sign belongs to the migration-prone category. In the placebo exercise, as suggested before, we repeat the same analysis replacing the zodiac variable with a dummy for whether a person's Western sun sign falls within the migration-prone category (i.e., the odd-numbered sun signs).

The estimation results obtained with probit and OLS are presented in Table B.2. As expected, females are less likely to take risks and exhibit a lower level of risk tolerance than males. Taller individuals are more willing to take risks and select a higher value on the general risk scale. Willingness to take risks increases with income, suggesting that wealthier individuals can better buffer "negative shocks." All of these effects are statistically significantly different from zero at the 1 percent significance level (with the exception of the estimates on height in column (3) and (7), yet they are still significant at the 5 percent level). Age and weight also appear to make a difference, but only when the measure of risk attitudes is the risk tolerance level.

Most importantly, in addition to conventional determinants of risk attitudes (e.g., gender, height, and income), a person's birth sign is also found to significantly affect willingness to take risks. Indeed, in column (1) where only exogenous controls are added the coefficient estimate implies that having a migration-prone Chinese zodiac sign results in a greater probability of taking risks in general (3.4 percent effect, significant at the 1 percent level). It is reassuring to see that this point estimate remains similar in size and equally statistically significant (3.2 percent effect, significant at the 1 percent level) once we include additional controls (column (2)). Surprisingly, the astrological effects are also quantitatively significant – corresponding to about 63 percent of the gender effects on risk attitudes. In terms of risk level, column (3) suggests that being born under one of the migration-loving Chinese zodiac signs is associated with a significantly higher level of risk tolerance (point estimate 0.120). Introducing other control variables hardly changes

[52]The results hold pretty well if we replace the province dummies with a bunch of county dummies provided by the RUMiC, which takes into account any geographical patterns in risk preferences at a more local level. Results with county controls will be available upon request.

the results, despite being statistically weaker at the 5 percent significance level (column (4)). In columns (5)-(8) of Table B.2 we perform a placebo test, where we estimate the impact of the Western zodiac signs on a Chinese person's risk attitudes. In neither of the regressions performed does the Western horoscope appear to exert any influence on the person's willingness to take risks. In fact, the estimated coefficients on zodiac variable have unexpected negative signs and are never significantly different from zero.

Taken together, there are two important findings. Firstly, a comparison of the estimates in columns (1)-(4) and those in columns (5)-(8) indicates the importance of cultural beliefs in the formation and cultivation of personal attributes. We focus on the risk attitudes here due to data availability, but this conclusion can easily be generalised to other traits associated with migration (e.g., introversion/extroversion, openness, etc.). Secondly, we not only find that the Chinese zodiac sign is a good reflection of risk attitudes but we are also able to attribute causality to the regression results, as a person's birth sign (determined by year of birth) is exogenous with respect to his attitudes toward risk. Establishing the causal impact of the zodiac sign on risk attitudes is the key to understanding the predictive power of astrology for migration: astrological variation in risk attitudes could be part of the explanation as to how beliefs in zodiac signs can lead to differences in observable migration behaviour.

Table B.1: Descriptive Statistics.

	Chinese Zodiac Sign		Western Zodiac Sign	
	Migration Prone	Migration Averse	Migration Prone	Migration Averse
Dependent variables: Risk attitudes				
Risk indicator (0/1)	0.710	0.674***	0.696	0.701
Risk index (0-10)	2.504	2.365***	2.430	2.490
Individual and household characteristics				
Female	0.407	0.414	0.414	0.405
Age	48.639	49.046*	48.652	48.905
Height (cm)	164.538	164.409	164.476	164.518
Weight (kg)	60.759	60.658	60.737	60.714
Eldest child	0.377	0.350***	0.362	0.375
Married	0.913	0.920	0.913	0.917
Years of education	7.311	7.296	7.292	7.322
Monthly earnings (RMB/100)	5.618	5.593	5.493	5.739
Number of children	1.928	1.975**	1.945	1.941
Household size	3.315	3.323	3.329	3.305
Province dummies				
Hebei	0.052	0.052	0.048	0.057**
Jiangsu	0.108	0.099	0.105	0.105
Zhejiang	0.148	0.155	0.141	0.160***
Anhui	0.096	0.094	0.100	0.091*
Henan	0.103	0.101	0.106	0.097
Hubei	0.127	0.133	0.134	0.124*
Guangdong	0.113	0.127**	0.121	0.115
Chongqing	0.056	0.058	0.056	0.058
Sichuan	0.196	0.181*	0.189	0.194
Observations	8,043	3,922	6,250	5,715

Source.—Rural-Urban Migration in China (RUMiC), RHS 2009.
Notes.—The table reports sample means. In Chinese astrology, migration-prone zodiac signs refer to any of the eight signs of the Chinese zodiac animal: Rat, Ox, Tiger, Rabbit, Dragon, Horse, Monkey and Dog; Migration-averse zodiac signs refer to any of the four signs of the Chinese zodiac animal: Snake, Goat, Rooster and Pig. In Western astrology, migration-prone zodiac signs refer to any of the odd-numbered Western horoscope: Aries, Gemini, Leo, Libra, Sagittarius and Aquarius; Migration-averse zodiac signs refer to any of the even-numbered Western horoscope: Taurus, Cancer, Virgo, Scorpio, Capricorn and Pisces.
*/**/*** indicate difference in means between the two groups is statistically significant at the 0.1/0.05/0.01 level.

Table B.2: Probit and OLS Estimates of the Effects of Zodiac Signs on Risk Attitudes: Chinese Animals *v.s.* Western Horoscopes.

	Chinese Zodiac Sign				***Western Zodiac Sign (Placebo Test)***			
Dependent Variable	Risk Indicator		Risk Index		Risk Indicator		Risk Index	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Migration-prone zodiac sign	0.034***	0.032***	0.120***	0.108**	–0.005	–0.002	–0.063	–0.049
	(0.009)	(0.009)	(0.044)	(0.043)	(0.008)	(0.008)	(0.041)	(0.041)
Female	–0.055***	–0.051***	–0.529***	–0.447***	–0.055***	–0.051***	–0.529***	–0.447***
	(0.011)	(0.011)	(0.051)	(0.052)	(0.011)	(0.011)	(0.051)	(0.052)
Age	0.002	0.002	–0.030**	–0.025*	0.002	0.002	–0.031**	–0.025*
	(0.002)	(0.003)	(0.012)	(0.013)	(0.002)	(0.003)	(0.012)	(0.013)
Age squared	–0.000**	–0.000**	–0.000	–0.000	–0.000**	–0.000**	–0.000	–0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Height (cm)	0.002***	0.004***	0.009**	0.018***	0.002***	0.004***	0.009**	0.018***
	(0.001)	(0.001)	(0.004)	(0.004)	(0.001)	(0.001)	(0.004)	(0.004)
Weight (kg)	–0.000	–0.001	0.008**	0.007**	–0.000	–0.001	0.008**	0.008**
	(0.001)	(0.001)	(0.003)	(0.003)	(0.001)	(0.001)	(0.003)	(0.003)
Eldest child	0.011	0.008	0.016	–0.003	0.012	0.009	0.018	–0.002
	(0.009)	(0.009)	(0.043)	(0.043)	(0.009)	(0.009)	(0.043)	(0.043)
Married		0.042**		0.111		0.042**		0.110
		(0.018)		(0.087)		(0.018)		(0.087)
Years of education		0.002		–0.001		0.002		–0.002
		(0.002)		(0.009)		(0.002)		(0.009)
Monthly earnings (RMB/100)		0.001***		0.014***		0.001***		0.014***
		(0.000)		(0.002)		(0.000)		(0.002)
Number of children		0.003		0.022		0.003		0.022
		(0.005)		(0.024)		(0.005)		(0.024)
Household size		–0.010***		–0.022		–0.010***		–0.022
		(0.004)		(0.018)		(0.004)		(0.018)
Jiangsu		0.046**		0.434***		0.003		0.438***
		(0.021)		(0.109)		(0.022)		(0.109)
Zhejiang		0.077***		0.324***		0.035*		0.324***
		(0.019)		(0.103)		(0.020)		(0.103)
Anhui		0.010		0.192*		–0.035		0.196*
		(0.022)		(0.113)		(0.023)		(0.113)
Henan		0.019		0.200*		–0.026		0.203*
		(0.022)		(0.110)		(0.023)		(0.110)
Hubei		–0.057**		–0.169		–0.105***		–0.167
		(0.023)		(0.105)		(0.023)		(0.105)
Guangdong		–0.041*		0.034		–0.090***		0.034
		(0.024)		(0.110)		(0.024)		(0.111)
Chongqing		0.044*		1.141***				1.142***
		(0.024)		(0.128)				(0.128)
Sichuan		0.162***		0.917***		0.125***		0.920***
		(0.017)		(0.100)		(0.017)		(0.101)
Observations	11,965	11,965	11,965	11,965	11,965	11,965	11,965	11,965

Source.—Rural-Urban Migration in China (RUMiC), RHS 2009.

Notes.—Risk Index is the risk tolerance level reported by the respondent on a scale from 0 (never take risk) to 10 (most likely to take risk). Risk Indicator is a dummy variable for the willingness to take risks, 1 if the risk index is above 0. Marginal effects are reported when using Probit models. Migration-prone zodiac signs refer to any of the eight signs of the Chinese zodiac animal: Rat, Ox, Tiger, Rabbit, Dragon, Horse, Monkey and Dog, or any of the six signs of the Western horoscope: Aries, Gemini, Leo, Libra, Sagittarius and Aquarius. All models include the control variables listed in Table B.1.

Robust standard errors are reported in parentheses.

* $p<0.1$, ** $p<0.05$, *** $p<0.01$.