Sons or Daughters? Gender, Child Migration and Health of Parents Left Behind*

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September 2016

Abstract

We provide new empirical evidence on the impact of adult children's rural-urban migration on the health of elderly parents left behind in rural China, by distinguishing between the gender of the migrant child. To deal with migration endogeneity, we exploit a novel variation in children's exogenous characteristics and apply instrumental variables methods. Employing data from the China Health and Retirement Longitudinal Study (CHARLS), we find that migration of daughters increases parental health in various dimensions. In contrast, we find no evidence of such beneficial effects when sons migrate. We further explore the mechanism through which these gender-biased effects may arise. Our findings have important implications for would-be parents in China and for regions and countries that have high rates of female emigration.

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

Keywords: Internal Migration; Elderly Health; Gender; Chinese Zodiac.

*We would like to thank Thomas Gall, Corrado Giulietti, Hartmut Lehmann, Emmanouil Mentzakis, Hector Calvo Pardo, Christian Schluter, and Michael Vlassopoulos for helpful discussion and suggestions. We are also grateful to participants at the Economics PhD Annual Workshop in Southampton and the IAMO Forum 2016 in Halle (Saale) for feedback and comments. Chuhong Wang acknowledges financial support from the Economic and Social Research Council (ESRC). Any errors are ours alone.

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1 Introduction

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

Chinese Proverb

The question of how migration affects household members left behind has been and continues to be an important issue for researchers and policy makers. For elderly people, the enjoyment of good health is obviously crucial for their well-being in old age.[1] Nonetheless, the economic literature on the impact of adult children's migration on the health of elderly parents left behind provides mixed results, both in the context of international and internal migration. Several studies find that migration of adult children has a negative impact on the health of the left-behind parents (Antman, 2010, 2016; Ao, Jiang, and Zhao, 2015; Mosca and Barrett, 2016), whereas others find the opposite results that parents can benefit from children's migration when their health is concerned (Kuhn, Everett, and Silvey, 2011; Böhme, Persian, and Stöhr, 2015). Meanwhile, the underlying mechanism through which migration exerts such effects is still not fully understood. In particular, while it is useful to know *whether* a child's migration influences the health of the remaining parents, we believe that it is also of paramount importance to understand *who* contributes to the observed effects of migration on elderly health: migrant son or migrant daughter?

In this paper, we aim to bridge the existing gap by explicitly disentangling the migration effect of sons and daughters on the health of elderly parents left behind, an important distinction, which has largely been neglected thus far. It is intuitively obvious that migrant sons and migrant daughters may behave very differently in terms of their contributions (e.g., money, time, emotion) to elderly parents at home, depending on their expected roles in old-age support, their conditions in destination areas, and the strength of their ties to parents at home (Le Goff, 2016). For instance, the migration impact on health could be positive for elderly parents who have migrant sons particularly, if men are more likely to obtain a well-paid job in the city and to send remittances back home. Alternatively, it could be that migrant daughters stay stronger links to their older

[1] Health is a special form of human capital that depreciates with age.

parents at origin through remittances and more contacts, resulting in better health for their left-behind parents. Given that migrant sons and migrant daughters can contribute disproportionately towards the intergenerational transfers to their elderly parents, we extrapolate that the gender of the migrant child would affect differently the health outcomes for the left-behind elderly.

China provides a useful and interesting setting. Besides enormous ageing population and massive migration flows, China has a family-based care system in rural areas which especially favours sons over daughters, as reflected in a famous Chinese proverb: "Rear sons for help in old age and store up grains against famine." In Chinese rural society, sons are traditionally the primary caregivers for their aged parents. Until recently, however, a few studies have found that the increasing migration of rural females enhances the socioeconomic status of women, and daughters play an increasingly critical role in family support of elderly parents (see e.g., Song, Li, and Feldman, 2012). The Great Migration in China and the gain in female bargaining power that it entails can thus provide a fruitful opportunity to learn about the gender-specific migration effect on parental health. With the rise in the cost of providing care after migration, and the changes in jobs, earning capacity, and socioeconomic status of female migrants, one may want to know whether "more sons" still implies a "healthier and happier old age."

We seek to answer the following empirical questions. What is the causal impact of adult children's internal migration on the health of their elderly parents left behind in sending areas? Is the impact on the elderly parent dependent on the gender of the migrant child? What drives the gender-biased migration effect? As a result, we attempt to bring additional light to the relationship between child migration and elderly health, by rigorously distinguishing between the role of sons' and daughters' migration in parental health outcomes.

To explore the above questions, 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. Crucially for the analysis, the CHARLS survey encompasses a rich set of questions on respondents' health, which allows us to portray a rosy picture on how children's migration is associated with various dimensions of elderly health outcomes. The outcomes cover not only subjective measures but also more objective measures. In addition to the CHARLS, we make

use of another high-quality micro data set—the Rural-Urban Migration in China (RUMiC), as the RUMiC questionnaire contains *direct* measures of individual risk attitudes which we can exploit to support the rationale underlying our empirical strategy.

Establishing a causal link between child migration and elderly health is a challenging task in the presence of the endogeneity of migration. The identification of the migration effect is plagued by the fact that children make migration decisions according to the health status of their parents (reverse causality), or that children self-select into migration on the basis of unobservable characteristics (selection bias). For example, healthier children could have healthier parents, and also have a higher probability to migrate. Further biases are caused by unobservable third factors affecting simultaneously the migration decision of the child and the health of the elderly parent (omitted variable bias). For example, households recently experienced a crop failure might send children to the city as a shock-coping strategy, and might also cut down health-related expenditures (e.g., food), thus leading to a spurious negative correlation between children's migration and health outcomes of the left-behind parents.

To address these concerns, we propose a novel estimation strategy which exploits an unusual and credibly exogenous variation in children's characteristics: the Chinese zodiac sign determined by the year of birth.[2] To show the link between astrology and migration we combine the following two facts. First, research has shown that risk attitudes (e.g., Jaeger et al., 2010) and personality traits (e.g., Jokela, 2009) are important psychological determinants of the migration decision. Second, considerable evidence exists to suggest that sign of birth greatly influences a person's characters, behaviours, and real-life outcomes (e.g., Johnson and Nye, 2011). In Chinese astrology, different zodiac animals symbolise different characters and the Chinese people hold a strong belief that they share the similar qualities as their birth animal. For example, Tigers always think of themselves as risk-taking, ambitious, extrovert, and so on (which we will call *migration-prone* attributes), whereby Goats usually regard themselves as risk-averse, gentle, introvert, and so on (which we will call *migration-averse* attributes). An elderly

[2]Every Chinese, since the date of birth, has a unique zodiac animal accompanying him/her for life. In order, the twelve animals are Rat, Ox, Tiger, Rabbit, Dragon, Snake, Horse, Goat, Monkey, Rooster, Dog, or Pig.

parent who has more children born in the Year of Tiger is, therefore, more likely to see a child migrate, when compared to an elderly parent who has more Goat children. We therefore take advantage of the variation in children's Chinese zodiac as a source of exogenous variation in their propensity to migrate. We show that the Chinese zodiac sign is a strong predictor of a child's probability of migrating to the city. We subsequently use the RUMiC data to probe into the mechanism behind the predictive power of astrology. Interestingly, we find that a person's Chinese zodiac is significantly associated with his/her attitudes towards risk, and since migration is a risky choice, the effect of astrology may operate through this psychological channel.

Overall, the results reveal striking gendered pattern in the migration effect on parental health outcomes. Daughters' rural-urban migration results in an improvement in the health for the left-behind elderly, reflected in elderly parents' self-reported health, physical health (body mobility and functional capacity), cognitive ability and subjective well-being. In contrast, we find no similar beneficial effects on elderly health outcomes when sons migrate. This holds great promise for Chinese would-be parents, as our conclusion casts doubt on the conventional belief that only sons can be relied on in old age, whilst in China's rural areas the cost of raising a girl is actually much lower than a boy. Our findings will also be important to policy makers, as we suggest that policies and programmes targeting specifically at female migrants can effectively promote elderly health.

This paper contributes broadly 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-behinds. Distinguishing the migration effects based on child's gender also connects this paper with the literature on the economics of the family which investigates the intra-family or intra-household heterogeneity related to gender (e.g., Thomas, 1994; Duflo, 2003; Antman, 2012b, 2015).[3] The basic idea behind these studies is directly linked to the test of the unitary model of household decision-making. Still, there is very little evidence that the gender of the migrant affects the impact on health outcomes of the parents left behind, and

[3] Thomas (1994), Duflo (2003) and Antman (2015) find that more resources in the hands of women improve the outcomes for girls and not boys. Antman (2012b) presents similar evidence that a father's international migration enhances the education outcomes for girls and not boys.

our paper provides a first attempt at answering this question. In addition, the identification strategy we employ brings the paper into relation 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).[4] While some demographics such as gender mix are often explored, our instrumental variables rely on an unexploited and, which we argue, more exogenous source of variation in the astrological characteristics of children. To our best knowledge, this is the first paper to overcome the migration endogeneity by instrumenting using a person's sign of birth. Finally, we also contribute to the *Astronomics*,[5] a still narrow branch of literature that highlights the astrological influences on economics, by presenting fresh evidence that astrology predicts migration behaviour.

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 on the relationship between child migration and elderly health 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 typical developing country where rapidly ageing population, increasing labour migration and family-based social support network simultaneously exist. It is estimated that China's elderly population will increase from under 10 percent in 2000 to 30 percent in 2050 (Kinsella and He, 2009). The growth of elderly cohort has been happening concurrently with fast industrialisation and

[4] Chen, Jin, and Yue (2010) study peer migration in China and their IVs rely on whether a household has a girl firstborn. Antman (2016) counts on sex and married ratios of adult children as the IVs for children's Mexico-US migration.

[5] At the microeconomic level, Bennett and Barth (1973) investigate whether individuals with horoscope ruled by the planet Mars (i.e., Aries and Scorpio) are more likely to pursue military occupations; Wong and Yung (2005), Johnson and Nye (2011) and Sim (2015) focus on one of the auspicious Chinese zodiac signs, i.e., Dragon and show that timing of birth affects microeconomic outcomes such as education and earnings. No previous work has, however, tried to examine the impact of astrology on one's migration intention. See, for example, Chamberlain, Cheung, and Kwan (1991) and Lucey (2000), for evidence at the macroeconomic level.

urbanisation after the period of the economic reform in 1978. Higher agricultural productivity led to 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-to-urban migration flows. According to a recent survey (National Bureaus of Statistics of China, 2015), there are approximately 274 million rural-to-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 the internal migration flows. Migrant workers without local *hukou* are restricted in job opportunities and in access to social benefits and public services such as education, healthcare, unemployment insurance, housing subsidies, and pensions, 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 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 makes it both legal and moral responsibilities 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 support in old age (Figure 1). Notably, this number manifests salient rural-urban disparity (78.2% vs. 45.2%), reflecting the inadequate power of the institutional support mechanism in China's rural areas. As children's support is provided through geographical proximity, family separation that migration entails presents a potential disruption to the established patterns of the kin-based care for elderly parents. Yet, as economic opportunities are more promising in urban areas, migrant children are able to compensate the 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

[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.

health outcomes of the left-behind parents.

2.2 Conceptual Framework

To provide a simple conceptual framework, we start with the description of the health production function developed by Grossman (1972) and applied by McKenzie and Hildebrandt (2006) to a migration context.[7] The health status of an elderly parent i at a fixed point in time is determined as follows:

$$ParentHealth_i = f(X_i, \underbrace{M_i,}_{\text{monetary}} \underbrace{T_i, E_i, K_i,}_{\text{nonmonetary}} D_i, G_i, \varepsilon_i)$$

where X_i denotes observable parental attributes (such as age, gender, education, etc.). M_i, T_i and E_i stand for money (e.g., health services, nutrition), time (e.g., physical care), and emotional (e.g., contacts, visits) inputs invested into the parent's health. K_i indicates health knowledge and D_i indicates environmental factors (e.g., disease environment, health infrastructure). G_i is biological endowment (e.g., genetic factors), which is usually unobserved. ε_i denotes random health shock. Apparently, there are four main channels through which children's migration may influence the health of the elderly parent, consisting of the monetary channel (M_i) and the non-monetary channels (T_i, E_i, K_i). We next briefly explain the hypotheses with respect to each channel.

Firstly, the income effect of remittances (M_i) is likely to alter parental health in a positive way. More money allows the parents to buy more health-related inputs[8] (since health is a normal good) and to better mitigate the impact of negative health shocks. Note that there are other important considerations here, such as incentives to remit, situations in destination cities, and migrants' ties to the left-behinds. In such a context in which remittances are precarious, the gender of the migrant child becomes crucial. For example, it is possible that women are inherently more altruistic and thus migrant daughters are likely to send more remittances back home. Another possibility is that employment opportunities in the city are brighter for men and therefore migrant sons have a higher chance of

[7] In the paper, the authors study the impact of parental migration on the health outcomes of the children left behind in Mexico.

[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.

making financial transfers to parents left behind.

Secondly, an absent child obviously means fewer time inputs (T_i) into parental health function. Yet this channel is complicated by two important facts. First, children's time support may be close substitutes such that remaining siblings will care for the parents while migrants are away (Antman, 2012a). In China, when a child migrates, it is very common for the remaining household members (normally spouse of the migrant child or another child) to take care of the household. The second fact 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 lose the instrumental help from children.

Thirdly, there is evidence that migration of children causes psychological pains for elderly parents staying behind (Mosca and Barrett, 2016; Antman, 2016). In China, however, most of the migrants are circular or temporary in nature (due to the *hukoui* restrictions), and hence it is possible for them to visit parents several times per year or at least during the time of Chinese New Year. Even if a face-to-face visit is impossible, children can compensate the parents with frequent contacts. 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 positively their mental satisfaction. This is especially true in rural China where traditional notions advocate "bring honour to ancestors." Migration may also reduce trifles of family conflicts and helps to build more harmonious family relations.

Finally, there might be a transfer of health knowledge and attitudes (K_i) from migrant children to left-behind parents. Migrants may send back information about more advanced health practices, healthy lifestyle behaviours and new norms about diet (McKenzie and Hildebrandt, 2006), which will lead to greater awareness of health issues and more efficient use of health inputs among elderly parents. Again, if daughters tend to maintain stronger links to their parents at home, we can deduce that the positive effect of better health knowledge will be concentrated on parents who have migrant daughters in the city. Unfortunately, insufficient data on the health knowledge preclude us from exploring the possibility of this

channel.

In theory, it is hard to judge whether the migration effects are predominantly positive or negative, as this will depend on the relative importance of the four channels described above as well as local conditions of the country studied. Additionally, it is important to bear in mind that the potential effects within each channel are also likely to differ by the gender of the migrant child.

2.3 Related Literature

An important strand of the economic literature has attempted to identify the migration impact (of parents, children and spouses) on household members left behind (see Antman, 2013, for an overview). Nevertheless, most of the focus has been attached to analyse the effect of parental migration on the human capital development of children who stay behind in sending communities (Hanson and Woodruff, 2003; Cox-Edwards and Ureta, 2003; McKenzie and Hildebrandt, 2006; McKenzie and Rapoport, 2011; Antman, 2012b; Mu and De Brauw, 2015). The left-behind elderly, albeit equally vulnerable, remain an overlooked group.

With regards to the migration effect on elderly health outcomes, the rather small literature has come to ambiguous conclusions. In the only study using experimental data, Gibson, McKenzie, and Stillman (2011) find no significant impact of international migration on the health of the older adults left behind. Two papers by the same author—Antman (2010) and Antman (2016)—reveal 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 migration impact on elderly health is also observed by Ao, Jiang, and Zhao (2015) in the case of internal migration in China and Mosca and Barrett (2016) in the case of international migration in Ireland. Contrary to the preceding studies, Kuhn, Everett, and Silvey (2011) and Böhme, Persian, and Stöhr (2015) demonstrate optimistic evidence of positive migration effects on parental health outcomes. Using data from Indonesia, Kuhn, Everett, and Silvey (2011) report that children's internal migration results in health gains for their elder parents left behind, as measured by better self-reported health, reduced mobility limitations, and lower mortality. Similarly, Böhme, Persian, and Stöhr (2015) detect a positive impact of children's international migration on the self-rated health, body mass index (BMI) and body

mobility for the older parents left behind in Moldova. They attribute the positive migration effects to the income effect of remittances, which allows elderly parents to eat a more nutritious diet and to allocate more time to health-promoting activities (leisure and sleep).

Despite very interesting explorations, the aforementioned papers have all tended to estimate the *overall* migration effect on parental health and have rarely addressed this issue from a gender-based perspective (if any, have only looked at the gender of the elderly parent).[9] Not considering the potential gender differences in child migration impact might result in an incomplete understanding of migration effects on elderly health. In the present paper, we complement the existing literature by rigorously distinguishing between the role of sons' and daughters' migration in parental health outcomes. We show that sons' and daughters' migration has remarkably differential impacts on the health of the elderly parents left behind. This puts forward the importance of taking into account the gender of the migrant child, if the main research interest is to better understand the role of child migration in elderly health and to give more detailed policy recommendations.

3 Data

3.1 Data Sources and Sample

The data we use come from the China Health and Retirement Longitudinal Study (CHARLS), a collaborative research project carried out by the China Center for Economic Research at Peking University.[10,11] The CHARLS follows closely a range of influential ageing surveys in the world, including the Health and Retirement Survey (HRS), the Survey of Health, Ageing, and Retirement in Europe (SHARE), and the English Longitudinal Study of Ageing (ELSA) (see Zhao et al., 2012, for

[9] The only exception is Mosca and Barrett (2016). However, they focus exclusively on elderly parents' mental heath outcomes. Moreover, when exploring the effects by child's gender they utilise a small sample of older parents who have only one migrant child (and exclude those who have more than one child migrate), while their estimated negative effect of migration may be downwardly biased for this particular group of parents. Thus, their findings cannot be easily extrapolated to broader settings and general elderly population.

[10] It was jointly developed by a team of scholars from the Peking University, the University of Southern California, the Chinese Center for Disease Control and Prevention, the World Bank, the University of California (Los Angeles), the Hong Kong University of Science and Technology, and the University of Oxford.

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

more details). It is nationally representative and covers 450 villages/communities (i.e., primary sampling units) in 150 counties, located in almost all provinces of China.[12] The national baseline was conducted in 2011 (wave I) and a follow-up survey took place in 2013 (wave II). We limit our analysis to the recent wave of the survey in 2013 for two reasons. First, there appear to be problems in the 2011 survey with the measurement of child migration.[13] Second, unlike Antman (2016), very few CHARLS parents have experienced a change in their children's migration status over the two-year time window, which effectively rules out the possibility of applying fixed effects models to our study. 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 its availability of extensive measures of health status, 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 health (e.g., availability of medical facilities).[14]

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 economically active children (18 years and above). The reason 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 settling abroad (very few 50 cases).[15] Accordingly, we are left with 7,946 observations of elderly parents.

[12]The sampling frame covers 28 out of 31 provinces across China. Hainan and Ningxia are excluded due to small population size, and Tibet is excluded because it is beyond the survey's interest. In the Online Appendix we provide the geographical distribution of the sampled counties.

[13]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 usually produces 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, but is only asked to *non-coresident* children in 2011. It thus likely that such inconsistency introduces noises to the child migration variable.

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

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

The independent variables of interest relate to sons' and daughters' rural-urban migration. The CHARLS asks explicitly "where a child normally lives now" and the subsequent question asks about the type of location that the child lives (city, county, town, or village). Based on these two questions we define migrant children as those who are living out of the same village and residing in the urban areas (city, county, or town) at the time of the survey. This yields 53.4 percent of the elderly sample being parents with migrant children. Of this group, 40 percent of parents see their sons migrate, 30.1 percent of parents see their daughters migrate, and 29.9 percent of parents see both their sons and daughters migrate.

The outcome variables of interest pertain to health of elderly parents. To gain a comprehensive insight into the migration impact on parental health, we investigate a variety of dimensions of elderly health outcomes. The first outcome we examine is general self-reported health status (SRH), the one usually available in household surveys and widely adopted in the economic literature. Specifically, we use a dichotomous indicator equal to one if the elderly parent describes his/her health status as "excellent", "very good", or "good" (compared to "fair", "poor", or "very poor"). Despite the fact that the SRH is a useful composite measure of global health and an important predictor of other health problems, e.g., mortality (Idler and Benyamini, 1997), it might be subject to several sources of bias due to its inherent subjectivity, such as reporting heterogeneity, justification bias, and measurement error (Baker, Stabile, and Deri, 2004). Therefore, we will next explore more objective indicators of physical health and mental health.

In the physical dimension, we provide two measures related to mobility and functionality. First, mobility-related problems are essential to the elderly because restricted body movement can easily lead to physical inactivity, and even unexpected falls and injuries at old age. We construct a mobility index ranging from 9 (very poor body mobility) to 36 (very good body mobility) based on a set of activities: running, walking, getting up from a chair, climbing, stooping, kneeling, extending arms above the shoulder, carrying weights, and picking up a coin. The second measure evaluates the respondent's ability to perform activities of daily living (ADLs)[16] and instrumental activities of daily living (IADLs)[17] independently.

[16]The ADLs include bathing, dressing, eating alone, toileting, continence, and transferring (walking across a room).

[17]The IADLs include housekeeping, preparing meals, shopping, managing money, taking medicine, laundry, using the telephone, and transferring (driving or using public transport).

Based on answers to the twelve functional activities, we obtain a functional score between 0 (complete dependence) and 12 (complete independence). The elderly parent with a score of 8 or over is defined as having good functional capacity.[18]

To gauge the mental health of elderly parents, we firstly use an instrument available in the CHARLS, that is, the CESD-10 (10-item CHARLS version of the Center for Epidemiological Studies Depression Scale). This includes mood- and emotion-related questions asking whether the respondent has felt bothered by things, hard to concentrate, depressed, everything was an effort, hopeful, fearful, restless, happy, lonely, and could not get going (all refer to the week prior to the interview). We calculate a total depression score accordingly, which ranges from 0 (no depression) to 30 (very severe depression). A dichotomous indicator of poor mental health is then built using the cut-off of 8, which is set following Radloff (1977)'s 16 threshold for a 20-item case. In addition, cognition is known to be a crucial measure of mental health. According to a memory test conducted in the interview, in which the respondent was asked to repeat ten common words after hearing them, we construct a cognition index between 0 (very poor cognitive ability) and 10 (very good cognitive ability).

The final outcome we consider is subjective well-being (SWB), which has recently gained great prominence in economics and health economics in particular (Oswald and Powdthavee, 2008; Mentzakis et al., 2013). Following the standard approach, we use a dummy variable indicating whether the respondent is satisfied with life or has felt happy over the survey's reference week. It is worth noting that the SWB measure is not a health outcome in its own right but there is strong evidence that high subjective well-being (e.g., life satisfaction, happiness, optimism) contributes to better health and longevity (e.g., Diener and Chan, 2011). Owing to its clear and positive relation to health, the SWB acts as an effective input into parental health production function and may give us opportunity to explore some possible channels underlying the health benefits of migration.[19] In the Online Appendix we provide more details about the definition and construction of the parental health outcomes mentioned above (e.g., specific items of the CESD-10 and the answer categories).

[18] The average score for elderly parents in our sample is 10.79.

[19] For example, as noted in Section 2, one possible channel for increased elderly mental health lies in the fact that migrant children are often their parents' major pride. If this is indeed the case, it is most likely to be reflected in a high level of SWB among elderly parents who have children in the city.

In our sample, approximately 20 percent of elderly parents report good general health, 88 percent report good functional health, 45 percent report poor mental health, and 46 percent report good subjective well-being. The elderly parents score an average of 31.2 points for mobility and recall an average of 2.8 simple words in the memory test.

3.2 Descriptive Statistics

Table 1 presents descriptive statistics for the 7,946 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 7.6 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 (4,241 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.[20] As can be seen from the table, elderly parents with migrant children differ systematically from those without along a number of observable dimensions. For instance, the former group has more education, better Mandarin skills, more daughters and sons, and less grandchildren. They are also more likely to be *Han* Chinese, have health insurance, have more than one child and less likely to have access to tap water. In terms of remittances, parents with one or more children in the city are more likely to receive remittances, as compared to parents all of whose children are in the rural areas (86.4% vs. 71%). Parents of migrant children also report a higher amount of remittances on average, more than double the amount received by parents with no migrant children (4419 vs. 2081 RMB per year).

There appear to be important differences in health outcomes between elderly parents depending on the migration status of their children. In particular, the unconditional mean of four out of six parental health measures (i.e., body mobility, ADLs/IADLs, cognitive ability and SWB) is significantly higher among parents with migrant children in the city than those with no migrant children, suggesting

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

a positive correlation between child migration and elderly health.

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 zodiacs. 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 internal migration on the health of elderly parents left behind we therefore estimate the following regression model:

$$\begin{aligned} ParentHealth_{ihj} &= \beta_0 + \beta_d DauMig_{hj} + \beta_s SonMig_{hj} + \beta_1 X_{ihj} \\ &\quad + \beta_2 H_{hj} + \beta_3 V_j + \beta_4 ProvinceFE + \varepsilon_{ihj} \end{aligned} \tag{4.1}$$

where the dependent variable $ParentHealth_{ihj}$ represents the health outcome of elderly parent i in household h of village j. $DauMig_{hj}$ and $SonMig_{hj}$ are dummy variables indicating whether the elderly parent has at least one daughter and has at least one son in the city at the time of the survey, respectively. Hence, there are four groups of elderly parents: (1) parents with no migrant children; (2) parents with migrant daughters only; (3) parents with migrant sons only; and (4) parents with both migrant daughters and migrant sons. The first group naturally serves as the reference group in the analysis (i.e., $DauMig_{hj} = 0, SonMig_{hj} = 0$). X_{ihj} denotes a vector of parental characteristics: gender, age, age squared, *Han* ethnicity, a dummy for good Mandarin, marriage indicator, a set of education dummies (illiterate, can read or write, elementary school, middle school and above), and a dummy indicating whether the elderly parent has any health insurance. H_{hj} is a vector of household attributes: number of daughters, number of sons, average age of children, number of grandchildren, size of household, household assets,[21] and a dummy for whether the elderly parent has only one child. To account for omitted

[21] 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 (see the Online Appendix). This index is generally considered to contain less noise (e.g., recall bias, seasonality) than the traditional income- and expenditure-based measures, and has been increasingly seen in development economics (see e.g., McKenzie, 2005).

variable bias stemming from local conditions,[22] we add a vector of village-level characteristics (V_j): a dummy variable for whether the village has any medical facility (e.g., hospital, health clinic, medical post), a dummy variable for whether the village has access to tap water, number of rainy and snowy days, and distance from the village to the closest pollution site. $ProvinceFE$ effectively controls for the macroeconomic environment that differs by provinces.[23] Since both mothers and fathers of the same child are involved in the estimation sample, we cluster the error term ε_{ihj} at the level of the household 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 outcomes of the elderly parents left behind. 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 excess 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 (Riosmena, Wong, and Palloni, 2013). If health is positively correlated within a household (e.g., due to genetic links) such that healthy parents are more likely to have healthy children (Antman, 2016), 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

[22] The development level of a community and hence the availability and the quality of public health infrastructure have been shown to play an important role in determining the health of local residents, especially for elderly people who have been exposed to such environment for a long period of time. These factors might also exert an influence on a young kid's intention to move if his/her migration decision is based on health-related considerations.

[23] Controlling for city-level fixed effects renders very similar results. As the 2013 survey was fielded between July 2013 and January 2014, we also tried including a number of time dummies for the month of the interview in order to deal with potential biases related to seasonality. The full set of results controlling for the city-level fixed effects and the time effects are very robust and will be available from the authors upon request.

inherited diseases deprive adult children of migration opportunities and predispose their older parents in bad health. 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 data set. 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 zodiac, 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, 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. 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%.[24] 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 decision, fertility decision, making friends, and screening potential employees), we believe that the awareness of and the belief in astrology should be significantly higher in China, especially in rural areas (where superstition still prevails) and among older generations.

More importantly, "the substantive content of astrology is its predictive ability" (Gauquelin, 1969). Indeed, the Chinese have long believed that the animal

[24] 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."

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 has unique characters or qualities, some of which, as we will show below, might "predict" migration behaviour. It is therefore possible to exploit the astrological variation in children's Chinese zodiac to instrument for the endogenous migration decision. To be more concrete, we define two zodiac groups on the basis of migration-related attributes associated with each animal: *migration-prone* versus *migration-averse*. The former group comprises animals that are more extrovert, active, aggressive, curious, risk-loving, and so forth (Rat, Ox, Tiger, Rabbit, Dragon, Horse, Monkey and Dog), while animals in the latter group are more introvert, calm, gentle, conservative, risk-averse, and so forth (Snake, Goat, Rooster and Pig). The instrument for son (daughter) migration is the share of sons (daughters) who were born under the migration-prone Chinese zodiac signs among all sons (daughters) of elderly parents. Note that as there are two endogenous migration variables, we have two first-stage regressions, one for daughters' migration,

$$DauMig_{hj} = \gamma_0 + \gamma_1 Z_1 + \gamma_2 Z_2 + \gamma_3 X_{ihj} + \gamma_4 H_{hj} + \gamma_5 V_j + \gamma_6 ProvinceFE + \mu_{hj} \tag{4.2}$$

and one for sons' migration,

$$SonMig_{hj} = \lambda_0 + \lambda_1 Z_1 + \lambda_2 Z_2 + \lambda_3 X_{ihj} + \lambda_4 H_{hj} + \lambda_5 V_j + \lambda_6 ProvinceFE + \mu_{hj} \tag{4.3}$$

where the instruments in these equations are Z_1 and Z_2, indicating the respective share of daughters and sons born in the year of the migration-prone Chinese zodiac animals. 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 sign, 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 (Guiso and Paiella, 2004; Jaeger et al., 2010; Akgüc et al., 2015) and personality traits (Silventoinen et al., 2008; Jokela et al., 2008; Jokela, 2009) are crucial psychological determinants of migration, 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 in psychology (see e.g., Standen, 1975; Mayo et al., 1978) and restricting attention to the economic literature, Johnson and Nye (2011) cast some light on the underlying mechanism. Appealingly, they find that seemingly irrational superstitious beliefs (i.e., 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 person whose Chinese zodiac is Tiger 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 beliefs (e.g., Wong and Yung, 2005; Johnson and Nye, 2011).

The rationale underlies our identification strategy is thus the following: because the Chinese zodiac (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 in the city.

Our empirical strategy of using the Chinese zodiac as IVs rests on the key assumption that the Chinese zodiac is orthogonal to μ_{hj}, the so-called exclusion restriction. In words, the fraction of children born under the migration-prone zodiacs should affect parental health only through its effect on the likelihood that the elderly parent has migrant children in the city. As one's sign of birth is exogenously determined by the year s/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 the astrological variation as IV for migration,

we also discuss its potential limitations and perform relevant 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 under certain cohorts exhibit time trends in certain aspects which might also be correlated parental health. 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 towards 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 μ_{hj}. Since our zodiac IVs make use of information about the year of birth, the exclusion restriction may be violated. To illustrate, children with early life exposure to the *Great Famine* (1959-1961) may wish never to experience again the bitter of 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 the parents. To address this problem, we include a full set of 62 dummies indicating children's year of birth. These birth year dummies should remove any systematic effects on parental health that are related to time trends common to all children in a birth cohort. The results are reported in Table 7. 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 parents who have successfully achieved a "lucky" baby are a selected group of parents who have more advanced health knowledge, and since health knowledge affects health outcomes (see the health production function in Section 2), this would invalidate the spirit of 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 an expected child. Especially in rural China, the strong boy preferences make it even more likely that fertility timing adjustment is gender-driven instead of astrology-driven. Second, the astrology-based fertility

trends are observed in only 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. While Chinese have long believed 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 rest eleven Chinese zodiacs.

Combining the previous points, we do not think that the astrology-based fertility decision is likely to post 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 the twelve Chinese animal years. Encouragingly, we find no evidence of a fertility boom in the year of Dragon. We also address the Dragon preferences argument more directly by excluding from our estimation sample those elderly parents who have a Dragon child. 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 in ways independent of migration even if the Chinese zodiac can be argued to be purely exogenous. As discussed by Antman (2016), variations in children's sex and married mix can also be translated into differences in their contributions to the elderly parents. If, for example, 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 health besides its monetary contributions (Antman, 2016). 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 provide us with credibly exogenous variation in children's likelihood of 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.[25] 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, preferences over risk, and use the RUMiC data to assess the relationship between Chinese zodiac signs and individual risk attitudes. The second portion of the analysis centres on the estimation of the causal impact of daughters' and sons' rural-urban migration on parental health 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 of the elderly parents left behind (second-stage)?

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/her migration propensity. Ideally, we would need precise variation at the child level to study this relationship. 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. For this reason, we take advantage of the child level data, where the unit of observation becomes each different child of the elderly parent. Table 2

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

displays summary statistics for the sample of 14,142 CHARLS children, comparing between children with the migration-prone zodiac signs (N=9,594) and children with the migration-averse zodiac signs (N=4,548). Most crucially for our analysis, the probability of migrating to the urban areas demonstrates important differences between these two groups. Children who were born under the migration-loving creatures, as compared with children born under the migration-averse ones, have on average a greater chance of engaging in rural-urban migration (0.293 vs. 0.277). The t-statistic (2.000) implies that the difference between these two groups of children defined by their Chinese zodiac 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 are presented in Table 3 with the main coefficient of interest (δ_1) reported on the first line. Our preferred specification is the one that incorporates the most comprehensive set of controls (column (4)). We can see from the table that when no control is added (column (1)), having a migration-prone Chinese zodiac is linked with a 2.7 percentage point increase in the probability of migrating to the city (significant at the 1 percent level). Reassuringly this coefficient remains virtually unchanged in column (2) once we control for child characteristics and family background (2.6 percent effect, at the 1 percent significance level). We find that when village attributes (column (3)) and province dummies (column (4)) are added to the regressions, the point estimates on the child zodiac variable go down slightly but are still strictly positive (0.022 and 0.019) and statistically significant at the 5 percent level.[26] All these statistically significant estimates point to the predictive ability of astrology in a child's migration behaviour.

To summarise, we find 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

[26]There are also a number of other interesting correlations. For instance, being a female, more education, or being the eldest child is found to enhance migration probability, whereas the number of kids, the number of grandkids, or being the single child in the household significantly reduces the likelihood of migrating to the city. In line with the literature (Munshi, 2003; Giulietti, Wahba, and Zenou, 2014), the fraction of migrants from the same rural village predicts a considerable change in the probability of migration (14.6 percent increase, at the 1 percent significance level), suggesting the influential role of *weak ties* in individual migration decision.

migration likelihood for an average adult child after controlling for standard migration determinants. These results lend enormous support for 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, direct measures of individual risk preferences are not always available in survey data (including the CHARLS). In the second wave of the RUMiC Rural Household Survey (RHS, 2009),[27] there is a direct question on general risk attitudes. Importantly, 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., Dohmen et al., 2011; Jaeger et al., 2010). 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/her Western horoscope (i.e., Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricorn, Aquarius, and Pisces). This further advantage 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.[28] The expectation is that only the Chinese zodiac and not the Western zodiac can predict the risk

[27] The RUMiC database comprises three independent surveys: the Rural Household Survey (RHS), the Urban Household Survey (UHS), and the Migrant Household Survey (MHS).

[28] It is worthwhile to mention that although Western horoscope has gained some popularity in China nowadays, the traditional animal sign is deeply embedded in China's cultural heritage and 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 around 49 (refer to Table A.2.1 in the Online Appendix), it is plausible to expect that only the Chinese zodiac sign would matter here.

attitudes of the individuals in our sample. We will show later that this is indeed the case.

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 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 migration decision. Among these psychological factors, attitudes towards 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.

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, whereby the Western zodiac sign does not at all. This implies the big 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 be easily generalised to other aspects of 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 preferences over risk. 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: one's Chinese zodiac sign *causally* affects one's attitudes towards risk, and thus one's propensity to migrate to another place. In the Online Appendix 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 and itself because they may have profound implications for behavioural theories of migration. In other words, as we have demonstrated the ability of the Chinese zodiac signs 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 4 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 the migration-prone Chinese zodiac signs raises the probability of having a migrant daughter by 11 percentage points, whereas the share of sons with the 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 migration-loving zodiac animals has a positive (point estimate 0.100) 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 the 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 health outcomes.

One potential concern within the instrumental variable context is the bias resulting from weak instruments (Bound, Jaeger, and Baker, 1995). 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 4 the Kleibergen-Paap *rk* Wald *F* statistic has the value 17.25, well above the corresponding Stock-Yogo critical value at a very conservative threshold (10% maximal IV size), i.e., 7.03 (Stock and Yogo, 2005). According to the Staiger and Stock (1997)'s "larger than 10" rule of thumb, 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. Therefore, we conclude that children's Chinese zodiac sign is 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 Health Outcomes?

5.2.1 Main Results

Table 5 presents the OLS and IV results for elderly health outcomes: self-reported health (column (1)), two measures of physical health (column (2) and (3)), two measures of mental health (column (4) and (5)), and one welfare outcome(column (6)). The linear probability model (LPM) and IV-LPM are employed for the four outcomes which are measured as binary variables: SRH, ADLs/IADLs, depression 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.1 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 only. The estimates obtained with OLS, presented in the upper panel of Table 5, indicate that having a migrant daughter in the city is significantly positively correlated with the physical health (0.389 for mobility and 0.035 for functionality) and cognitive skills (0.104) of the elderly parents left behind. As for sons column (6) suggests that having a son currently in the city significantly improves the cognitive capacity of the remaining parents (0.157), while it is statistically insignificant in every other

parental health dimension.

We now turn to our 2SLS estimates, where daughters' migration and sons' migration are instrumented with the fraction of daughters and the fraction 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 sons' migration 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 migrate to the city is associated with a statistically significant 33.6 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 (9.3 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 the city are 3.645 points more mobile on the (9-36) 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 22.3 percentage points more likely to be able to perform the ADLs and IADLs independently (significant at the 5 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 ways are those that involve physical activity (e.g., provision of exercise facilities) and better diets (e.g., intake of micronutrients), which can obviously be easier to achieve 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 relevant coefficients from sons are close to zero (0.539 and 0.010) and statistically insignificant, suggesting that having a migrant son does not significantly affect the physical health outcomes of the rural parents left behind.

With regards to mental health, column (4) suggests that elderly parents with migrant children (either daughters or sons) appear to be not statistically different in their depressive symptoms as compared with parents with no migrant children. The estimated coefficients get larger in the IV specification relative to those obtained with the OLS (0.163 vs. 0.005 for daughters and 0.107 vs. 0.019 for

sons) but are still statistically insignificant. These results are consistent with the interpretation that rural parents do not necessarily suffer emotional stress when their children migrate to the urban—either they may receive more contacts from children thanks to modern telecommunication technology, or they may increase other forms of social contact (e.g., interact with friends or relatives) as well as participate in more social activities (e.g., play Mahjong). In column (5) we see that migration of daughters has a positive and strongly significant effect on the cognitive ability of their older parents staying behind, with a coefficient of 1.046 at the 5 percent significance level. This is indeed a sizable impact as the average parent in our sample can only recall 2.8 simple words in the memory test. Once again, we do not find any significant effect from sons. The coefficient of sons' migration is small (0.268) and insignificant. Interestingly, once migration endogeneity is taken into account, the estimated migration effect on subjective well-being becomes significant for daughters and shows that elderly parents who have emigrating daughters are 49 percentage points more likely to feel happy or satisfied with their life. The effect is significant at the 1 percent level. For sons we find a positive (0.058), but not significant effect of their migration on the subjective well-being of the elderly parents.

Overall, all of the statistically significant coefficient estimates point to an improvement in parental health outcomes as a result of their children's rural-urban migration. More appealingly, the gendered pattern of the migration impact are very striking: the estimated beneficial effects are entirely driven by having migrant daughters rather than migrant sons in the city. Specifically, the out-migration of rural daughters is found to significantly enhance various dimensions of elderly health outcomes, including the general self-reported health, body mobility, functional capacity, cognition, and subjective well-being. In contrast with daughters' results, Table 5 does not document any statistically significant changes in the health of the elderly parents in response to the migration of their sons, which is sharply against the traditional belief of "rear sons for help in old age" in the Chinese patrilineal rural society. One possible explanation relates to the increase in daughters' role in the family support resulting from their migration. We will return to this issue in Section 6.

5.2.2 Robustness Checks

In what follows, we intend to show that our results are very robust by performing a large number of checks. The relevant results are presented in Table 6-9. 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 rural-urban migration status. This placebo exercise follows the same spirit of Antman (2016). 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. In particular, we consider three alternative health outcomes of elderly parents. The first outcome pertains to the respondents' early life health status, namely their general self-reported health before the age of fifteen.[29] The second outcome is a dummy variable indicating the presence of any chronic diseases diagnosed by a doctor.[30] 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) than on migration episodes. The third outcome utilises the retrospective information on duration of disability. Namely, we create a dummy variable for whether the respondent became disabled before having the first child and thus under no circumstances could this placebo health measure have been caused by child migration since the child was not even born. The regression results of this test are listed in Table 6. As predicted, 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 (see Table 7), 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 children of elderly parents. In so doing, we take

[29]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", or "poor".

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

out any systematic differences in parental health that are associated with unobserved time trends, such as the historic events and the macroeconomic conditions commonly experienced by children in the same birth cohort. The specification including the birth year dummies yields very similar results (the only exception being the estimate for the migration effect of daughters in cognition), 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 parental health), we have greater confidence in the causal interpretation of our results.

In the third robustness check, we address potential endogeneity in elderly parents' fertility decision by providing both qualitative (see Figure 2) and quantitative (see Table 8) evidence. Figure 2 shows the distribution of birth rate based on our child-level sample. Each bar indicates the fraction of children being 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. Turn to the regression results, we do lose some predictive power in our instruments in the specification excluding the Dragons. The reason is that Dragon is a very migration-seeking creature and therefore our zodiac measures in this new specification (without Dragon) is much less precise. Yet, it is reassuring to find that the pattern of our main results remains the same.

In our fourth robustness check, we account for children's generosity to their elderly parents by controlling directly for children's remittances (see Table 9). 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 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.

We perform a final robustness check in order to lend further credence to the validity of our instrumental variable strategy (see Table 10). We re-estimate all

models by (1) excluding from the sample villages which are located in minority-concentrated provinces, i.e., Xinjiang, Inner Mongolia, Guangxi, Yunnan, Guizhou and Qinghai (Panel A); (2) limiting the sample to households in which both the elderly respondent and the spouse are *Han* Chinese (Panel B);[31] and (3) combining the restrictions in (1) and (2) (Panel C). This is because one might be concerned that ethnic minorities could have different zodiacal beliefs, although we think this is quite unlikely given their great assimilation into *Han* culture. We can see from the table that, in all instances, the estimated effects we obtain are very similar to those obtained from the full sample.

5.3 Heterogeneity

We now investigate heterogeneity in child migration effect according to parental characteristics and household characteristics. In particular, we split the data along the following dimensions: gender (mother and father), age ($\leq$65 and 65+), household income (above and below the mean), and living arrangement (live alone or with an elderly spouse and live with other household members).

Table 11 shows the regression results by subgroup. We report only the parameter estimates of the daughter migration variable because (as for the full sample) none of the coefficients on the son migration dummy is statistically significant. As is often the case, the strength of the instruments is relatively weaker due to smaller cells in the subsamples. A word of caution is thus appropriate regarding interpretation and comparison of the results. With that said, we can see that there seem no apparent gender-biased patterns in the results when distinguishing between the gender of the parent (panel A). The table documents a similar enhancement in self-rated health, functioning, and subjective well-being for mothers and fathers, but a statistically significant increase in body mobility only for mothers and a statistically significant rise in cognitive ability only for fathers. It thus appears that both mothers and fathers benefit from their daughters' internal migration.

Turning to panel B of Table 11 where we split the sample by age of the parent, the results are very interesting. We find remarkable differences in terms of age, with the positive migration impact from daughters concentrated on the older co-

[31] The CHARLS survey does not contain information on ethnicity for 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.

hort of the elderly parents. For the younger cohort, though, their health outcomes are not significantly affected by migration in any of the regressions performed. One potential explanation is that parents aged below 65 may still be physically and economically active and hence have a lower marginal utility of remittances relative to the older ones.

We focus next on panel C of Table 11, where we divide the sample into households whose income is above and below the mean. Interestingly, the positive effect of having migrant daughters is more pronounced among elderly parents from relatively poorer households (in terms of both magnitude and statistical significance). We see that parents from higher-income households respond stronger to daughters' migration only when it comes to the mobility outcome. It is conceivable that a rich household will invest in health (e.g., diet and fitness) as long as the benefits outweigh the costs. For poor households, however, they will not be able to afford a more nutritious diet or an exercise facility even if such investment promises a positive return. Importantly, our findings indicate that migration of daughters can be an effective way to relax the credit constraints which have been faced by these marginal parents.

Finally, we examine whether living arrangements of the elderly parents play a role (panel D). This is an instructive consideration for two reasons. First, since it is rather hard for the empty-nest elderly to find close substitutes for the absent child, they may represent one of the most vulnerable left-behind groups. Second, understanding how the effect varies by living arrangements would have significant policy implications. As a consequence of accelerated population ageing, the number of empty-nest households has been increasing quickly in China. In the absence of family support, elderly people who live alone may resort to social care which, as we discussed earlier, is generally under-provided in rural areas. Turning to the corresponding IV estimates, the results are strikingly different between elderly parents living by themselves and living with others. For parents who co-reside with other household members, daughters' internal migration is found to significantly improve their self-rated health, physical health, and subjective well-being. For parents who live on their own, however, having daughters in the city generates a positive, but insignificant impact on their health. It is thus important for the government to build up a well-established social security system to accommodate the care needs of this disadvantaged group.

6 How Is Parental Health Affected?

The results presented in the previous section indicate a causal and robust positive impact of children's migration, in particular, migration of daughters, on the health of the older parents remaining in rural villages. It would be interesting to deep further into the underlying channels through which such gender-biased impact may operate. We address this in the following two ways.

We start by checking specifically whether the intergenerational transfers, namely money, time and emotional inputs (as mentioned in the conceptual model described in Section 2), that elderly parents receive from children differ by children's migration status and by gender of the migrant children. For sake of simplicity, we compare three groups: parents with migrant daughters only, parents with migrant sons only, and parents with no migrant children (i.e., exclude the cases where the elderly parents have both daughters and sons migrate to the city). The descriptive results (listed in Table 12) show that migrant sons and migrant daughters both contribute financially in terms of remittances to their elderly parents. Although remittances from migrant daughters are smaller in the magnitude, daughters tend to have a higher likelihood of remitting once they migrate (85.2% vs. 83.4%). Therefore, although sons still have an advantage in economic support, as the socio-economic status of migrant daughters improve, the traditional gender difference in the economic support between sons and daughters is found to be weakened. We argue before that, besides financial transfers, migrant children are likely to compensate elderly parents also with frequent contacts via telephone or mails for their absence. In this aspect, migrant sons make significantly fewer contacts with their older parents when they are away from home, relative to migrant daughters. Focusing on a smaller sample of parents with functional limitations, we could observe that migrant daughters are more likely to provide care and also provide care for longer hours when parents need help.[32] Despite being purely qualitative, these results provide suggestive evidence that, after migration, daughters plays a more important role in their parents' old-age care.

We next replace the dependent variable in the benchmark IV regression with eighteen "channel variables" that are informative of the monetary and non-monetary

[32]Given the circular or repeat pattern of the rural-urban migration flows in China, physical care from migrants is also possible.

channels through which child migration may affect elderly health. Even though the CHARLS survey does not include information on time use, nutrition or health knowledge, we can still provide rich evidence here. The measures we consider within the monetary channel include health-related household expenditure (i.e., medical, fitness and food) and healthcare utilisation; within the non-monetary channel we explore measures including farm work, the probability of taking social activities, the number of social activities, hours of sleep, the number of meals, and care for the grandkid. We find suggestive evidence that elderly parents with migrant daughters are more likely to increase other forms of social contact and have more meals per day. The results also show that migrant households are significantly more likely to invest in health-related goods, namely food and fitness. We find no evidence that the positive migration impact is operating through increasing use of the health-care.

Summarising, we find that if the left-behind parents are able to maintain contact with the migrant children and benefit from remittances at the same time, their health would improve. The findings that beneficial effects are purely from the out-migration of rural daughters are in line with some sociology literature on intergenerational support and migration in China. Song, Li, and Feldman (2012), for example, documents that children's migration enhances the role and function of daughters in the family support for the elderly. Our findings point to the fact that migrant rural women are playing an increasingly important role in their parents' old-age support. Rural-urban migration in China might thus have altered and modernised the familial norms that favour sons as the main care providers.

7 Conclusion

In this paper we analyse the impact of adult children's internal migration on the health of their elderly parents left behind in rural China and compare its effect by gender of the migrant child. Our estimates reveal two main findings of novelty, which may deserve more attention.

Firstly, we draw on, for the first time in the economic literature, exogenous variations in children's astrological characteristics (i.e., their Chinese zodiac sign) to instrument for the endogenous migration choice. Our first stage results suggest that a one-unit increase in the fraction of daughters (sons) born under the

migration-prone Chinese zodiac animals raises the likelihood of having migrant daughters (sons) in the city 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 birth signs (the Western zodiac and the Chinese zodiac) do, in fact, influence individuals' migration decisions. Our results provide new evidence that confirms the ability of astrology to predict human behaviour and migration behaviour in particular. Future research can explore whether such astrological prediction is also found for the Western star sign for Western people, and for other risk- or personality-related microeconomic outcomes, for example, entrepreneurship decisions.

Secondly, our main results add to the current literature on the relationship between child migration and parental health by discovering a remarkable gendered pattern in the estimated migration effects. In particular, we find that left-behind parents could benefit from the ability to send their daughters to the city, which improves their self-reported health, physical health, mental health, and subjective well-being. Migration of sons, however, has no similar benefit effects, which is contrary to traditional expectations. The positive effects of daughters' migration are found to particularly prevalent among older parents (aged 65+), poorer parents (household income below the mean), and parents who live with other household members. Note that this does not rule out the possibility that other dimensions of old-age well-being that are not considered here could be positively affected by migration conducted by sons.

From a policy perspective, the potential benefits of daughters' migration on elderly health 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 sons and daughters and, second, broadening the benefits of female migration.

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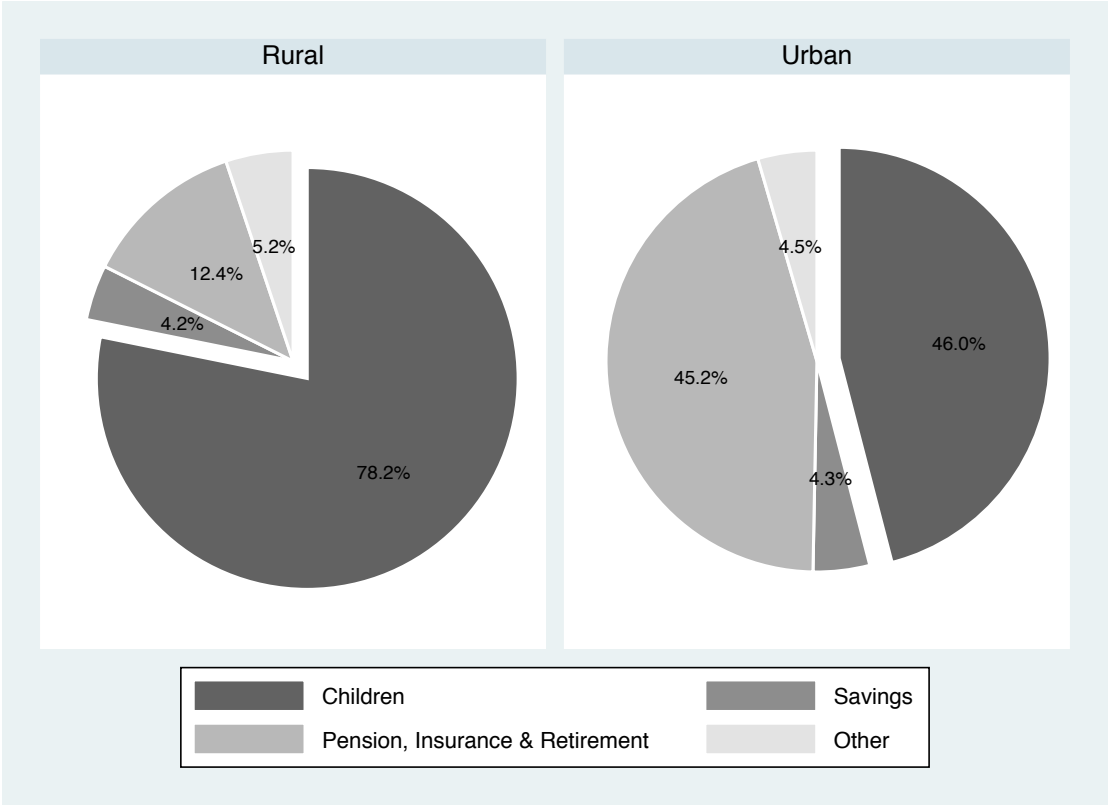
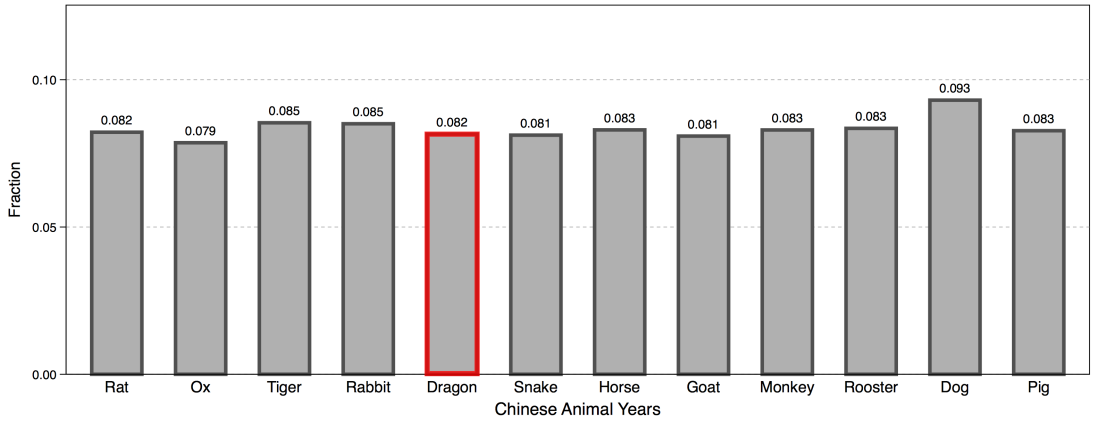
Figures and Tables

Figure 1: Main Sources of Old-Age Support by Rural/Urban Status (CHARLS 2011 & 2013).



Source: Authors' own calculations from the CHARLS national survey wave I (2011) and wave II (2013). The relevant question in the survey questionnaire asks elderly participants "who do you think you can rely on for old-age support?"

Figure 2: Distribution of Birth across the Twelve Chinese Animal Years.



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

Table 1: Descriptive Statistics (CHARLS 2013).

	Full Sample		**Has Migrant Child**		**No Migrant Child**		**Diff. in**
	Mean	SD	Mean	SD	Mean	SD	**Means**
Dependent Variables: Parental Health Outcomes							
Self-reported Health (0/1)	0.209	0.407	0.206	0.404	0.212	0.409	-0.007
Body mobility (9-36)	31.176	5.415	31.347	5.298	30.981	5.540	0.366***
ADLs/IADLs (0/1)	0.883	0.322	0.890	0.313	0.874	0.332	0.016**
Depressive symptoms (0/1)	0.446	0.497	0.440	0.497	0.453	0.498	-0.013
Cognitive ability (0-10)	2.847	1.821	2.951	1.851	2.728	1.778	0.223***
Subjective well-being (0/1)	0.459	0.498	0.469	0.499	0.446	0.497	0.023**
Demographic and Household Characteristics							
Female (0/1)	0.500	0.500	0.493	0.500	0.508	0.500	-0.015
Age	65.582	7.776	65.552	7.702	65.617	7.861	-0.065
Han ethnicity (0/1)	0.929	0.256	0.936	0.245	0.921	0.269	0.015**
Good Mandarin level (0/1)	0.111	0.314	0.120	0.325	0.101	0.301	0.019***
Married (0/1)	0.854	0.353	0.876	0.330	0.829	0.377	0.047***
Has health insurance (0/1)	0.968	0.175	0.973	0.162	0.963	0.188	0.010**
Illiterate (0/1) - reference group	0.371	0.483	0.347	0.476	0.398	0.490	-0.051***
Can read or write (0/1)	0.223	0.416	0.214	0.410	0.233	0.423	-0.019**
Elementary school (0/1)	0.217	0.412	0.219	0.414	0.214	0.410	0.005
Middle school and above (0/1)	0.190	0.392	0.220	0.414	0.155	0.362	0.065***
Household assets	0.022	2.271	0.016	2.178	0.029	2.373	-0.013
Household size	3.630	1.947	3.373	1.812	3.924	2.053	-0.551***
Number of daughters	1.473	1.139	1.564	1.163	1.368	1.101	0.196***
Number of sons	1.666	1.036	1.744	1.064	1.577	0.996	0.167***
Number of grandchildren	0.680	1.007	0.585	0.965	0.789	1.042	-0.204***
Mean age of children	37.974	7.359	37.963	7.146	37.986	7.598 86	-0.023
Has only one child (0/1)	0.076	0.264	0.042	0.200	0.114	0.318	-0.073***
Has migrant daughter	0.320	0.467	0.600	0.490	0.000	0.000	0.600***
Has migrant son	0.373	0.484	0.699	0.459	0.000	0.000	0.699***
Receive remittances from children (0/1)	0.792	0.406	0.864	0.343	0.710	0.454	0.154***
Remittances from children (/1000 RMB)	3.329	7.114	4.419	8.574	2.081	4.635	2.338***
Village Characteristics							
Presence of medical facility (0/1)	0.817	0.387	0.822	0.383	0.811	0.392	0.011
Has access to tap water (0/1)	0.439	0.496	0.412	0.492	0.470	0.499	-0.058***
Number of rainy days	52.897	39.717	53.580	40.229	52.114	39.113	1.466
Number of snowy days	7.254	14.201	6.962	12.096	7.589	16.275	-0.627**
Distance to closest pollution site (km)	97.052	267.730	98.788	270.360	95.064	264.710	3.724
Instruments							
Migration-prone zodiac daughter (%)	0.545	0.442	0.573	0.434	0.513	0.450	0.060***
Migration-prone zodiac son (%)	0.617	0.416	0.636	0.406	0.594	0.426	0.042***
Observations	7,946		4,241		3,705		

Source.—China Health and Retirement Longitudinal Study (CHARLS 2013). All variables refer to year 2013 (wave II) except village-level characteristics which refer to year 2011 (wave I).

Note.—Migration-prone zodiac refers to any of the eight signs of the Chinese zodiac animal: Rat, Ox, Tiger, Rabbit, Dragon, Horse, Monkey and Dog.

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

Table 2: Descriptive Statistics (CHARLS Child-Level Data 2013).

	Migration-Prone Zodiac		Migration-Averse Zodiac		Diff. in Means
	Mean	SD	Mean	SD	
Dependent Variable					
Migrate to urban (0/1)	0.293	0.455	0.277	0.447	0.016**
Demographic and Household Characteristics					
Female (0/1)	0.465	0.499	0.473	0.499	-0.008
Age	39.819	8.889	39.721	8.915	0.098
Married (0/1)	0.889	0.314	0.890	0.313	-0.001
Illiterate (0/1) - reference group	0.067	0.250	0.076	0.265	-0.09*
Can read or write (0/1)	0.123	0.329	0.134	0.341	-0.011*
Elementary school (0/1)	0.285	0.451	0.261	0.439	0.024***
Middle school and above (0/1)	0.525	0.499	0.529	0.499	-0.004
Eldest child (0/1)	0.314	0.464	0.330	0.470	-0.016*
Only child (0/1)	0.023	0.151	0.027	0.162	-0.004
Household assets	-0.198	2.202	-0.178	2.244	-0.019
Household size	3.524	2.030	3.589	2.084	-0.065*
Number of children	1.577	0.918	1.576	0.897	0.001
Number of grandchildren	0.235	0.763	0.232	0.741	0.002
Village Characteristics					
Paved road (0/1)	0.588	0.492	0.602	0.489	-0.014
Has road passing through (0/1)	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 (0/1)	0.441	0.497	0.445	0.497	-0.004
Number of rainy days	54.832	40.844	54.207	40.346	0.625
Number of snowy days	7.675	15.447	7.151	14.269	0.524*
Distance to train station (km)	60.488	122.837	58.172	121.550	2.316
Distance to bus stop (km)	4.304	10.972	4.350	11.357	-0.047
Located in non-mountainous areas (0/1)	0.671	0.470	0.693	0.461	-0.022***
Observations	9,594		4,548		

Source.—China Health and Retirement Longitudinal Study (CHARLS 2013). All variables refer to year 2013 (wave II) except village-level characteristics which refer to year 2011 (wave I).

Note.—Migration-prone zodiac refers to any of the eight signs of the Chinese zodiac animal: Rat, Ox, Tiger, Rabbit, Dragon, Horse, Monkey and Dog; Migration-averse zodiac refers to any of the four signs of the Chinese zodiac animal: Snake, Goat, Rooster and Pig.

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

Table 3: Probit Estimates of the Effects of Chinese Zodiac Signs on Children's Migration Propensity (CHARLS Child-Level Data 2013).

	Dependent Variable: **Migrate to Urban**			
	(1)	(2)	(3)	(4)
Migration-prone zodiac (δ_1)	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^2		–0.000**	–0.000	–0.000
		(0.000)	(0.000)	(0.000)
Married		–0.006	–0.004	–0.004
		(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***	0.122***
		(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***	0.034***
		(0.009)	(0.009)	(0.009)
Only child		–0.062***	–0.051**	–0.041*
		(0.023)	(0.024)	(0.025)
Household assets		0.003	0.007**	0.009***
		(0.003)	(0.003)	(0.003)
Household size		–0.032***	–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			–0.030***	–0.033***
			(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			–0.000	–0.000
			(0.000)	(0.000)
Distance to bus stop			–0.000	–0.000
			(0.001)	(0.001)
Located in non-mountainous areas			–0.032**	–0.042***
			(0.013)	(0.014)
Province fixed effects	No	No	No	Yes
Individual and household controls	No	Yes	Yes	Yes
Village controls	No	No	Yes	Yes
Observations	14,142	14,142	14,142	14,142
Predicted probability	0.277	0.279	0.284	0.284

Source.—China Health and Retirement Longitudinal Study (CHARLS 2013). All variables refer to year 2013 (wave II) except village-level characteristics which refer to year 2011 (wave I).

Note.—The dependent variable is a dummy variable indicating whether a child of elderly parents migrates to urban areas. Migration-prone zodiac refers to any of the eight signs of the Chinese zodiac animal: Rat, Ox, Tiger, Rabbit, Dragon, Horse, Monkey and Dog. Robust standard errors clustered at household level are reported in parentheses accounting for survey weights.

*Statistically significant at the 10 percent level.

**Statistically significant at the 5 percent level.

***Statistically significant at the 1 percent level.

Table 4: First Stage Regressions: Determinants of Having Migrant Daughters and Migrant Sons (CHARLS 2013).

	Dependent Variable	
	Has Migrant Daughter	**Has Migrant Son**
	(1)	(2)
Migration-prone zodiac daughter (%)	0.110***	–0.005
	(0.018)	(0.017)
Migration-prone zodiac son (%)	0.021	0.100***
	(0.018)	(0.017)
Province fixed effects	Yes	Yes
Other controls	Yes	Yes
Observations	7,946	7,946
R^2	0.160	0.171
F stat 1^{st} stage Equation1	19.95	
F stat 1^{st} stage Equation2		17.50
Kleibergen-Paap rk F stat	17.25	

Source.—China Health and Retirement Longitudinal Study (CHARLS 2013).

Note.—All models include the control variables listed in Table 1. Migration-prone zodiac refers to any of the eight signs of the Chinese zodiac animal: Rat, Ox, Tiger, Rabbit, Dragon, Horse, Monkey and Dog. Robust standard errors clustered at household level are reported in parentheses accounting for survey weights.

*Statistically significant at the 10 percent level.

**Statistically significant at the 5 percent level.

***Statistically significant at the 1 percent level.

Table 5: OLS and IV Estimates of Gender-Specific Migration Effects on Parental Health Outcomes (CHARLS 2013).

	Dependent Variable					
	Self-Reported Health	**Body Mobility**	**ADLs/ IADLs**	**Depressive Symptoms**	**Cognitive Ability**	**Subjective Well-Being**
	(1)	(2)	(3)	(4)	(5)	(6)
OLS						
Has migrant daughter (β_d)	0.003	0.389**	0.035***	–0.022	0.104*	0.022
	(0.012)	(0.161)	(0.009)	(0.016)	(0.056)	(0.016)
Has migrant son (β_s)	0.013	0.149	–0.001	–0.012	0.157***	0.023
	(0.012)	(0.145)	(0.009)	(0.014)	(0.048)	(0.015)
2SLS						
Has migrant daughter (β_d)	0.336***	3.645**	0.223**	–0.033	1.046**	0.490***
	(0.128)	(1.615)	(0.092)	(0.148)	(0.518)	(0.160)
Has migrant son (β_s)	0.093	0.539	0.010	0.200	0.268	0.058
	(0.145)	(1.806)	(0.103)	(0.162)	(0.580)	(0.181)
Outcome mean	0.21	31.2	0.88	0.45	0.46	2.8
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,946	7,946	7,946	7,946	7,946	7,946
Kleibergen-Paap rk F stat	17.25	17.25	17.25	17.25	17.25	17.25

Source.—China Health and Retirement Longitudinal Study (CHARLS 2013).

Note.—The dependent variables are (1) a dummy variable indicating self-reported health is excellent/very good/good/fair; (2) body mobility score ranges from 9 to 36; (3) a dummy variable equals to 1 when the functional score (0-12) derived from the 6-item KatzADLs and the 6-item LawtonIADLs is above 8; (4) a dummy variable equals to 1 when the CESD-10 depression scale (0-30) is above 8; (5) memory test score ranges from 0 to 10; (6) a dummy variable indicating an individual is happy or satisfied with life. All models include the control variables listed in Table 1. Instruments are the share of daughters with the migration-prone Chinese zodiacs and the share of sons with the migration-prone Chinese zodiacs. Robust standard errors clustered at household level are reported in parentheses accounting for survey weights.

*Statistically significant at the 10 percent level.

**Statistically significant at the 5 percent level.

***Statistically significant at the 1 percent level.

Table 6: Robustness: IV Estimates of Gender-Specific Migration Effects on Placebo Parental Health Outcomes (CHARLS 2013).

	Dependent Variable		
	Childhood Health	**Chronic Disease**	**Disability Before First Child**
	(1)	(2)	(3)
Has migrant daughter (β_d)	0.035	-0.175	0.001
	(0.131)	(0.127)	(0.051)
Has migrant son (β_s)	0.120	0.128	-0.003
	(0.137)	(0.147)	(0.057)
Outcome mean	0.73	0.74	0.04
Province fixed effects	Yes	Yes	Yes
Other controls	Yes	Yes	Yes
Observations	7,855	7,946	7,946
Kleibergen-Paap rk F stat	15.87	17.25	17.25

Source.—China Health and Retirement Longitudinal Study (CHARLS 2013).
Note.—The dependent variables are (1) a dummy variable indicating self-reported health before age 15 is excellent/very good/good/fair; (2) a dummy variable indicating presence of any chronic disease diagnosed by a doctor; (3) a dummy variable equals to 1 when onset of disability occurred before the first child was born. Instruments are the share of daughters with the migration-prone Chinese zodiacs and the share of sons with the migration-prone Chinese zodiacs. Robust standard errors clustered at household level are reported in parentheses accounting for survey weights.

Table 7: Robustness: IV Estimates of Gender-Specific Migration Effects on Parental Health Outcomes, Controlling for Business Cycles (CHARLS 2013).

	Dependent Variable					
	Self-Reported Health	**Body Mobility**	**ADLs/ IADLs**	**Depressive Symptoms**	**Cognitive Ability**	**Subjective Well-Being**
	(1)	(2)	(3)	(4)	(5)	(6)
Has migrant daughter (β_d)	0.262**	2.812**	0.182**	–0.079	0.587	0.343**
	(0.111)	(1.257)	(0.079)	(0.131)	(0.431)	(0.135)
Has migrant son (β_s)	0.036	–0.610	–0.026	0.240	–0.291	–0.089
	(0.128)	(1.475)	(0.091)	(0.148)	(0.486)	(0.157)
Year of birth dummies	Yes	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,946	7,946	7,946	7,946	7,946	7,946
Kleibergen-Paap rk F stat	21.73	21.73	21.73	21.73	21.73	21.73

Source.—China Health and Retirement Longitudinal Study (CHARLS 2013).

Note.—See notes for Table 5 for a detailed description of the dependent variables. All models include the control variables listed in Table 1 as well as a series of dummies for children's year of birth. Instruments are the share of daughters with the migration-prone Chinese zodiacs and the share of sons with the migration-prone Chinese zodiacs. Robust standard errors clustered at household level are reported in parentheses accounting for survey weights.

*Statistically significant at the 10 percent level.

**Statistically significant at the 5 percent level.

***Statistically significant at the 1 percent level.

Table 8: Robustness: IV Estimates of Gender-Specific Migration Effects on Parental Health Outcomes, Excluding Elderly Parents of Dragon Children (CHARLS 2013).

	Dependent Variable					
	Self-Reported Health	**Body Mobility**	**ADLs/ IADLs**	**Depressive Symptoms**	**Cognitive Ability**	**Subjective Well-Being**
	(1)	(2)	(3)	(4)	(5)	(6)
Has migrant daughter (β_d)	0.324**	4.073**	0.226**	–0.039	0.932*	0.305*
	(0.138)	(1.739)	(0.095)	(0.160)	(0.548)	(0.160)
Has migrant son (β_s)	0.081	–2.469	–0.098	0.288	0.265	0.099
	(0.210)	(2.571)	(0.145)	(0.237)	(0.805)	(0.244)
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,960	5,960	5,960	5,960	5,960	5,960
Kleibergen-Paap rk F stat	8.23	8.23	8.23	8.23	8.23	8.23

Source.—China Health and Retirement Longitudinal Study (CHARLS 2013).

Note.—See notes for Table 5 for a detailed description of the dependent variables. All models include the control variables listed in Table 1. Instruments are the share of daughters with the migration-prone Chinese zodiacs and the share of sons with the migration-prone Chinese zodiacs. Robust standard errors clustered at household level are reported in parentheses accounting for survey weights.

*Statistically significant at the 10 percent level.

**Statistically significant at the 5 percent level.

***Statistically significant at the 1 percent level.

Table 9: Robustness: IV Estimates of Gender-Specific Migration Effects on Parental Health Outcomes, Controlling for Children's Generosity to Elderly Parents (CHARLS 2013).

	Dependent Variable					
	Self-Reported Health	**Body Mobility**	**ADLs/ IADLs**	**Depressive Symptoms**	**Cognitive Ability**	**Subjective Well-Being**
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: Remittances are Exogenous					
Has migrant daughter (β_d)	0.345***	3.683**	0.227**	–0.025	1.050**	0.488***
	(0.130)	(1.664)	(0.094)	(0.151)	(0.530)	(0.162)
Has migrant son (β_s)	0.111	0.611	0.016	0.215	0.277	0.054
	(0.153)	(1.918)	(0.109)	(0.170)	(0.612)	(0.189)
Log (Remittances from children)	–0.008*	–0.032	–0.003	–0.007	–0.004	0.002
	(0.004)	(0.062)	(0.003)	(0.005)	(0.019)	(0.005)
Kleibergen-Paap rk F stat	15.27	15.27	15.27	15.27	15.27	15.27
	Panel B: Remittances are Endogenous (Second Stage)					
Has migrant daughter (β_d)	0.311**	3.154**	0.199**	0.014	0.935*	0.400**
	(0.127)	(1.563)	(0.090)	(0.150)	(0.516)	(0.172)
Has migrant son (β_s)	0.044	–0.415	–0.038	0.291*	0.053	–0.116
	(0.134)	(1.656)	(0.095)	(0.157)	(0.539)	(0.179)
Log (Remittances from children)	0.022	0.426**	0.021*	0.069***	0.096	0.078***
	(0.018)	(0.214)	(0.012)	(0.022)	(0.070)	(0.023)
	First Stage					
		Has Migrant Daughter	**Has Migrant Son**	**Remittances from Children**		
Migration-prone zodiac daughter (%)		0.111***	–0.003	0.090		
		(0.018)	(0.017)	(0.121)		
Migration-prone zodiac son (%)		0.021	0.099***	0.259**		
		(0.018)	(0.017)	(0.125)		
Married child (%)		–0.063**	–0.099***	1.477***		
		(0.030)	(0.033)	(0.241)		
F stat 1^{st} stage Equation1		14.79				
F stat 1^{st} stage Equation2			14.71			
F stat 1^{st} stage Equation3				14.11		
Kleibergen-Paap rk F stat		10.66	10.66	10.66		
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,946	7,946	7,946	7,946	7,946	7,946

Source.—China Health and Retirement Longitudinal Study (CHARLS 2013).

Note.—See notes for Table 5 for a detailed description of the dependent variables. In panel B, remittances from children are also considered as endogenous. In this case, instruments are the share of daughters with the migration-prone Chinese zodiacs, the share of sons with the migration-prone Chinese zodiacs, and the share of children who are married. 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.

*Statistically significant at the 10 percent level.

**Statistically significant at the 5 percent level.

***Statistically significant at the 1 percent level.

Table 10: Robustness: IV Estimates of Gender-Specific Migration Effects on Parental Health Outcomes, Excluding Ethnic Minorities (CHARLS 2013).

	Dependent Variable					
	Self-Reported Health	**Body Mobility**	**ADLs/ IADLs**	**Depressive Symptoms**	**Cognitive Ability**	**Subjective Well-Being**
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: Excluding Minority-Concentrated Provinces					
Has migrant daughter (β_d)	0.333**	3.165*	0.217**	0.228	0.946*	0.429**
	(0.138)	(1.685)	(0.096)	(0.163)	(0.550)	(0.171)
Has migrant son (β_s)	0.042	–0.727	–0.022	0.116	0.412	0.077
	(0.154)	(1.808)	(0.107)	(0.176)	(0.589)	(0.190)
Observations	6,684	6,684	6,684	6,684	6,684	6,684
Kleibergen-Paap rk F stat	14.97	14.97	14.97	14.97	14.97	14.97
	Panel B: Excluding Minority Elderly Parents					
Has migrant daughter (β_d)	0.408**	3.724*	0.231**	0.169	1.175*	0.548***
	(0.158)	(1.937)	(0.111)	(0.175)	(0.604)	(0.195)
Has migrant son (β_s)	0.210	1.497	0.137	0.261	0.516	0.204
	(0.180)	(2.164)	(0.126)	(0.195)	(0.673)	(0.221)
Observations	6,811	6,811	6,811	6,811	6,811	6,811
Kleibergen-Paap rk F stat	11.97	11.97	11.97	11.97	11.97	11.97
	Panel C: Excluding Minority Provinces and Minority Parents					
Has migrant daughter (β_d)	0.407**	3.604*	0.227**	0.245	0.974	0.465**
	(0.168)	(2.018)	(0.115)	(0.189)	(0.641)	(0.204)
Has migrant son (β_s)	0.142	0.320	0.084	0.190	0.525	0.213
	(0.174)	(1.988)	(0.117)	(0.191)	(0.632)	(0.211)
Observations	6,054	6,054	6,054	6,054	6,054	6,054
Kleibergen-Paap rk F stat	13.17	13.17	13.17	13.17	13.17	13.17
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes

Source.—China Health and Retirement Longitudinal Study (CHARLS 2013).

Note.—See notes for Table 5 for a detailed description of the dependent variables. All models include the control variables listed in Table 1. Instruments are the share of daughters with the migration-prone Chinese zodiacs and the share of sons with the migration-prone Chinese zodiacs. Robust standard errors clustered at household level are reported in parentheses accounting for survey weights.

*Statistically significant at the 10 percent level.

**Statistically significant at the 5 percent level.

***Statistically significant at the 1 percent level.

Table 11: Heterogeneous Effects of Daughters' Migration on Parental Health Outcomes (CHARLS 2013).

	Dependent Variable					
	Self-Reported Health	**Body Mobility**	**ADLs/ IADLs**	**Depressive Symptoms**	**Cognitive Ability**	**Subjective Well-Being**
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: Gender					
Mother						
Has migrant daughter (β_d)	0.445**	6.606**	0.273*	–0.083	0.851	0.563**
	(0.199)	(2.788)	(0.148)	(0.221)	(0.755)	(0.241)
Observations	3,974	3,974	3,974	3,974	3,974	3,974
KP rk F stat	8.95	8.95	8.95	8.95	8.95	8.95
Father						
Has migrant daughter (β_d)	0.272*	2.118	0.215**	–0.065	1.124*	0.431**
	(0.149)	(1.716)	(0.104)	(0.178)	(0.607)	(0.181)
Observations	3,972	3,972	3,972	3,972	3,972	3,972
KP rk F stat	17.67	17.67	17.67	17.67	17.67	17.67
	Panel B: Age					
Aged≤65						
Has migrant daughter (β_d)	0.236	0.047	–0.013	–0.207	0.750	0.119
	(0.167)	(1.570)	(0.087)	(0.193)	(0.645)	(0.188)
Observations	4,589	4,589	4,589	4,589	4,589	4,589
KP rk F stat	11.51	11.51	11.51	11.51	11.51	11.51
Aged 65+						
Has migrant daughter (β_d)	0.651**	10.679**	0.627**	0.240	1.423	1.063**
	(0.297)	(4.520)	(0.271)	(0.348)	(1.132)	(0.420)
Observations	3,357	3,357	3,357	3,357	3,357	3,357
KP rk F stat	3.3	3.3	3.3	3.3	3.3	3.3
	Panel C: Household Income					
Low						
Has migrant daughter (β_d)	0.301*	3.313	0.239**	–0.044	1.071**	0.594***
	(0.161)	(2.074)	(0.122)	(0.189)	(0.650)	(0.211)
Observations	5,594	5,594	5,594	5,594	5,594	5,594
KP rk F stat	12.23	12.23	12.23	12.23	12.23	12.23
High						
Has migrant daughter (β_d)	0.239	3.576*	0.144	0.022	0.552	0.211
	(0.211)	(2.100)	(0.110)	(0.226)	(0.864)	(0.223)
Observations	2,352	2,352	2,352	2,352	2,352	2,352
KP rk F stat	3.2	3.2	3.2	3.2	3.2	3.2
	Panel D: Living Arrangement					
Live with Others						
Has migrant daughter (β_d)	0.297**	3.480*	0.219**	–0.059	0.946	0.458**
	(0.149)	(1.872)	(0.109)	(0.175)	(0.605)	(0.187)
Observations	5,049	5,049	5,049	5,049	5,049	5,049
KP rk F stat	6.8	6.8	6.8	6.8	6.8	6.8
Empty-Nest						
Has migrant daughter (β_d)	0.396	4.429	0.217	0.025	0.886	0.414
	(0.246)	(2.793)	(0.162)	(0.265)	(0.863)	(0.287)
Observations	2,897	2,897	2,897	2,897	2,897	2,897
KP rk F stat	5.77	5.77	5.77	5.77	5.77	5.77
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes

Source.—China Health and Retirement Longitudinal Study (CHARLS 2013).
Note.—See notes for Table 5 for a detailed description of the dependent variables. All models include the control variables listed in Table 1. Instruments are the share of daughters with the migration-prone Chinese zodiacs and the share of sons with the migration-prone Chinese zodiacs. Robust standard errors clustered at household level are reported in parentheses accounting for survey weights.
*Statistically significant at the 10 percent level.
**Statistically significant at the 5 percent level.
***Statistically significant at the 1 percent level.

Table 12: Pathways: Monetary, Emotional and Time Inputs to Elderly Parents by Children's Migration Status and Gender (CHARLS 2013).

	Migrant Daughter Only	**Migrant Son Only**	**No Migrant Child**	**Diff. in Means**	**Std. Error**
Monetary Support: M_i					
Receive remittances	0.852	0.834	0.710	0.018	(0.014)
Remittances in total (RMB)	3552.146	4326.238	2081.094	-774.092**	(329.541)
Remittances in money (RMB)	2333.353	3282.267	1432.668	-948.914***	(251.660)
Remittances in in-kind (RMB)	1218.793	1043.971	648.426	174.823	(116.605)
Emotional Support: E_i					
Avg. # of meets	85.830	62.648	107.544	23.182***	(3.253)
Meet at least once a year	0.987	0.969	0.890	0.019***	(0.006)
Meet at least once a month	0.766	0.636	0.703	0.130***	(0.017)
Meet at least once a week	0.567	0.475	0.555	0.092***	(0.018)
Meet almost everyday	0.413	0.315	0.415	0.098***	(0.018)
Avg. # of contacts	63.009	47.566	31.927	15.443***	(2.887)
Contact at least once a year	0.824	0.874	0.591	-0.050***	(0.013)
Contact at least once a month	0.752	0.802	0.516	-0.050***	(0.015)
Contact at least once a week	0.496	0.464	0.274	0.032*	(0.019)
Contact almost everyday	0.105	0.058	0.037	0.047***	(0.010)
Observations	1,276	1,696	3,705		
Time Support: T_i ***(Subsample)***					
Receive any help	0.209	0.150	0.215	0.059**	(0.023)
Hours of help per day	17.656	11.873	17.918	5.783	(4.311)
Days of help in past month	3.842	2.281	3.972	1.561***	(0.584)
Help with ADLs	0.113	0.099	0.124	0.013	(0.024)
Help with IADLs	0.240	0.174	0.238	0.065**	(0.027)
Observations	487	638	1,598		

Source.—China Health and Retirement Longitudinal Study (CHARLS 2013).

Note.—*/**/*** indicate difference in means between the first two groups (parents who only see their daughters migrate and who only see their sons migrate) is statistically significant at the 0.1/0.05/0.01 level. Time support from children is reported by a subsample of parents who experienced any difficulty with one or more ADLs or IADLs (i.e. functionally limited parents).

Table 13: Causal Pathways: IV Estimates of Gender-Specific Migration Effects on "Channel Outcomes" (CHARLS 2013).

	Dependent Variable					
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: Lifestyle					
	Farming^{+}	**Social Activities**$^{+}$	**Social Activities**$^{\#}$	**Sleep**$^{\#}$	**Meals**$^{+}$	**Grandchild Care**$^{+}$
Has migrant daughter (β_d)	0.133	0.483***	0.864***	0.162	0.274**	–0.082
	(0.142)	(0.161)	(0.278)	(0.535)	(0.137)	(0.160)
Has migrant son (β_s)	0.043	0.073	0.051	–0.517	0.120	0.063
	(0.156)	(0.180)	(0.311)	(0.568)	(0.150)	(0.178)
Outcome mean	0.59	0.48	0.69	6.18	0.79	0.42
Kleibergen-Paap rk F stat	17.25	17.25	17.25	17.25	17.25	17.25
	Panel B: Health-Related Expenditure					
	Incurring Medical Exp.$^{+}$	**Log p.c. Medical Exp.**$^{\#}$	**Incurring Fitness Exp.**$^{+}$	**Log p.c. Fitness Exp.**$^{\#}$	**Log p.c. Food Exp.**$^{\#}$	**Food/Total Exp. (%)**
Has migrant daughter (β_d)	0.279*	1.428	0.212***	0.981**	1.155**	–0.002
	(0.153)	(1.043)	(0.080)	(0.393)	(0.522)	(0.119)
Has migrant son (β_s)	0.123	1.254	0.024	0.365	0.205	–0.304**
	(0.173)	(1.192)	(0.091)	(0.441)	(0.587)	(0.136)
Outcome mean	0.80	4.94	0.04	0.21	3.61	0.70
Kleibergen-Paap rk F stat	17.25	17.25	17.25	17.25	17.25	17.25
	Panel C: Healthcare Utilisation					
	Outpatient^{+}	**Outpatient**$^{\#}$	**Inpatient**$^{+}$	**Inpatient**$^{\#}$	**Forgone Healthcare**$^{+}$	**Treat Chronics**$^{+}$
Has migrant daughter (β_d)	0.012	–0.760	–0.048	–0.007	0.027	0.141
	(0.072)	(0.524)	(0.096)	(0.179)	(0.085)	(0.114)
Has migrant son (β_s)	0.018	0.080	0.028	–0.001	0.034	0.073
	(0.078)	(0.507)	(0.102)	(0.204)	(0.094)	(0.126)
Outcome mean	0.23	0.56	0.14	0.22	0.14	0.56
Kleibergen-Paap rk F stat	17.06	17.06	17.06	17.06	17.06	17.33
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,946	7,946	7,946	7,946	7,946	7,946

Source.—China Health and Retirement Longitudinal Study (CHARLS 2013).

Note.—(+) refers to dichotomous variables. (#) refers to continuous variables. The dependent variables in panel B are at the household level. All models include the control variables listed in Table 1. Panel C includes an additional dummy for whether an individual had any illness (column 1-5) and a set of dummies for presence of any chronic disease diagnosed by a doctor (column 6). Instruments are the share of daughters with the migration-prone Chinese zodiacs and the share of sons with the migration-prone Chinese zodiacs. Robust standard errors clustered at household level are reported in parentheses accounting for survey weights.

*Statistically significant at the 10 percent level.

**Statistically significant at the 5 percent level.

***Statistically significant at the 1 percent level.

Appendix to the Paper

Table A.1: Full Set of IV Estimates of Gender-Specific Migration Effects on Parental Health Outcomes (CHARLS 2013).

	Dependent Variable					
	Self-Reported Health	**Body Mobility**	**ADLs/ IADLs**	**Depressive Symptoms**	**Cognitive Ability**	**Subjective Well-Being**
	(1)	(2)	(3)	(4)	(5)	(6)
Has migrant daughter (β_d)	0.336***	3.645**	0.223**	0.163	1.046**	0.490***
	(0.128)	(1.615)	(0.092)	(0.148)	(0.518)	(0.160)
Has migrant son (β_s)	0.093	0.539	0.010	0.107	0.268	0.058
	(0.145)	(1.806)	(0.103)	(0.165)	(0.580)	(0.181)
Female	–0.061***	–1.818***	–0.034***	–0.127***	0.054	–0.033**
	(0.012)	(0.159)	(0.010)	(0.014)	(0.050)	(0.015)
Age	–0.017	0.426**	0.048***	0.009	0.096**	0.052***
	(0.011)	(0.172)	(0.010)	(0.012)	(0.038)	(0.012)
Age^2	0.000	–0.005***	–0.000***	–0.000	–0.001***	–0.000***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Han ethnicity	–0.027	–0.270	–0.035*	–0.086**	–0.277**	–0.070**
	(0.026)	(0.309)	(0.020)	(0.034)	(0.113)	(0.034)
Good Mandarin level	0.002	–0.188	–0.010	–0.032	0.061	–0.052**
	(0.022)	(0.254)	(0.014)	(0.024)	(0.084)	(0.026)
Married	–0.038	–0.454	–0.020	0.055*	0.025	–0.026
	(0.025)	(0.316)	(0.019)	(0.029)	(0.094)	(0.032)
Has health insurance	–0.087**	0.010	–0.024	0.046	0.235*	0.030
	(0.036)	(0.529)	(0.025)	(0.040)	(0.123)	(0.040)
Can read or write	–0.025*	0.185	0.018	–0.018	0.600***	–0.032*
	(0.015)	(0.195)	(0.011)	(0.017)	(0.060)	(0.018)
Elementary school	–0.019	0.449*	0.009	0.016	0.856***	–0.090***
	(0.018)	(0.243)	(0.014)	(0.021)	(0.073)	(0.021)
Middle school and above	–0.042*	0.786*	0.025	–0.020	1.106***	–0.140***
	(0.024)	(0.458)	(0.022)	(0.032)	(0.134)	(0.030)
Household assets	0.010***	0.223***	0.004	0.032***	0.073***	0.022***
	(0.004)	(0.044)	(0.003)	(0.004)	(0.014)	(0.005)
Household size	0.010	–0.106	–0.006	–0.002	–0.005	0.017
	(0.012)	(0.164)	(0.009)	(0.014)	(0.051)	(0.015)
Number of daughters	–0.040**	–0.554***	–0.033***	–0.016	–0.110*	–0.038*
	(0.017)	(0.209)	(0.013)	(0.019)	(0.066)	(0.021)
Number of sons	0.002	0.062	0.004	0.000	0.065	0.043**
	(0.016)	(0.189)	(0.012)	(0.019)	(0.061)	(0.021)
Number of grandchildren	–0.005	0.282	0.019*	–0.004	–0.017	–0.024
	(0.013)	(0.175)	(0.010)	(0.015)	(0.051)	(0.016)
Mean age of children	0.005***	0.041*	0.001	0.003*	0.005	0.004*
	(0.002)	(0.024)	(0.001)	(0.002)	(0.007)	(0.002)
Has only one child	0.116***	0.573	0.013	0.041	0.179	0.133***
	(0.035)	(0.464)	(0.025)	(0.040)	(0.149)	(0.043)
Presence of medical facility	0.006	0.535**	0.002	–0.008	–0.096	–0.016
	(0.016)	(0.208)	(0.012)	(0.019)	(0.063)	(0.020)
Has access to tap water	0.026*	0.314	0.008	0.020	–0.019	0.019
	(0.016)	(0.202)	(0.012)	(0.018)	(0.063)	(0.020)
Number of rainy days	–0.001***	–0.003	–0.000*	–0.000	0.000	–0.001**
	(0.000)	(0.003)	(0.000)	(0.000)	(0.001)	(0.000)
Number of snowy days	0.000	–0.020***	0.000	–0.000	0.004	0.000
	(0.000)	(0.007)	(0.000)	(0.001)	(0.002)	(0.001)
Distance to closest pollution site	–0.000	0.001	0.000	–0.000**	–0.000	–0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,946	7,946	7,946	7,946	7,946	7,946
Kleibergen-Paap rk F stat	17.25	17.25	17.25	17.25	17.25	17.25

Source.—China Health and Retirement Longitudinal Study (CHARLS 2013). All variables refer to year 2013 (wave II) except village-level characteristics which refer to year 2011 (wave I).

Note.—See notes for Table 5 for a detailed description of the dependent variables. All models include the control variables listed in Table 1. Instruments are the share of daughters with the migration-prone Chinese zodiacs and the share of sons with the migration-prone Chinese zodiacs. Robust standard errors clustered at household level are reported in parentheses accounting for survey weights.

*Statistically significant at the 10 percent level.

**Statistically significant at the 5 percent level.

***Statistically significant at the 1 percent level.

Online Appendix (not for publication) for: "Sons or Daughters? Gender, Child Migration and Health of Parents Left Behind"

by Jackline Wahba and Chuhong Wang

This online appendix contains additional evidence and robustness checks to supplement the findings in the main text of the paper. In Appendix A, we provide more details about how we construct our elderly health outcomes. In Appendix B, we provide evidence that the Chinese zodiac sign predicts individual risk attitudes for the Chinese people, based on the Rural-Urban Migration in China (RUMiC) data. Finally, in addition to the appendix tables referred to in Appendix B, this online appendix also contains some other figures and tables referred to in the main text.

Appendix A. Construction of Health Variables

a. Self-Reported Health (SRH)

The CHARLS follows the HRS frame and asks respondents to assess their general health on the basis of two different scales: (1) excellent, very good, good, fair, poor, and (2) very good, good, fair, poor, very poor. The respondents were randomly assigned to the two scales. Following the standard approach, we transform the five-point categorical variable into a dichotomous outcome indicating "good general health". So the binary variable is set to =1 if the 1st-scale respondent reports excellent/very good/good or if the 2nd-scale respondent reports very good/good, and =0 if fair/poor is answered by the 1st-scale respondent or if fair/poor/very poor is answered by the 2nd-scale respondent.

b. Physical Health

In this dimension, we provide two specific measures to capture the physical health condition of the elderly: body mobility index and overall functional score. We construct a mobility score based on a set of mobility questions asked in the survey: running or jogging about 1km, walking 1km, walking 100km, getting up from a chair after sitting for a long period, climbing several flights of stairs, stooping,

kneeling or crouching, reaching or extending arms above shoulder level, lifting or carrying weights over 10 jin, picking up a small coin from a table. Each question was given four options: "No, I don't have any difficulty" (4 points), "I have difficulty but can still do it" (3 points), "Yes, I have difficulty and need help" (2 points), and "I can not do it" (1 point). The mobility score aggregates answers in these nine questions and ranges from 9 (very poor mobility) to 36 (very good mobility).

In addition, we construct an overall functional indicator based on the Katz Index of Independence in Activities of Daily Living (KatzADLs) and the Lawton Instrumental Activities of Daily Living Scale (LawtonIADLs). The KatzADLs is the most appropriate instrument commonly used to assess the functional status of an individual as measured by the individual's ability to perform the six basic activities of daily living independently: bathing, dressing, feeding, transferring/moving about, toileting and continence. The LawtonIADLs measures the ability to perform the activities necessary to live independently: housekeeping, food preparation, shopping, finance, medication, transportation, laundry and telephone. One point is given for each activity in case of independence. Therefore, the aggregate score ranges from 0 (complete dependence) to 12 (complete independence). We adopt the cut-off of 8 and create a dichotomous indicator to capture the functioning of the elderly parents. We adopt the cut-off of 8 and create a dichotomous indicator to capture the functioning of the elderly parents. An individual is defined as having good function health if the reported score is above 8.

c. Mental Health

We utilise two measures to gauge the psychological well-being of elderly parents. The first is based on one of the most widely used depression scales originally developed by Radloff (1977), called the Center for Epidemiological Studies Depression Scale (CES-D). Similarly, CHARLS encompasses a 10-item Chinese version of screening test in the survey, the CESD-10, consisting of ten questions on a variety of depressive symptoms. Respondents were asked whether they had the following feelings during the last week: (1) "I was bothered by things that don't usually bother me"; (2) "I had trouble keeping my mind on what I was doing"; (3) "I felt depressed"; (4) "I felt everything was an effort"; (5) "I felt hopeful about the future"; (6) "I felt fearful"; (7) "My sleep was restless"; (8) "I was happy"; (9) "I felt lonely"; (10) "I could not get "going"". The possible options are:

"Rarely or none of the time", "Some or a little of the time", "Occasionally or a moderate amount of the time" and "Most or all of the time". Each of the items evaluates the severity of a particular symptom of psychological distress using a 4-point Likert-type scale from 0 (rarely or none of the time) to 3 (most or all of the time). Two positive items were recoded such that "rarely or none of the time" is scored 3 points and "most or all of the time" is scored 0 points. The total score is derived by summing the responses. This final score delivers an aggregate depression index ranging from 0 to 30, with higher point indicating a more frequent occurrence of depressive symptoms, thus worse mental health. We create a dichotomous indicator using the threshold score of 8, which was set according to the 16 threshold suggested by Radloff (1977) for a 20-item case. Cognition is an important measure of mental health. Although CHARLS questionnaire contains a five-point question on self-rated memory, just as the SRH described above, this subjective measure of cognition may suffer from similar concerns. To quantify the cognitive capacity of elderly in a more reliable way, we instead construct an objective measure based on the score from a short memory test. In the interview, participants were asked to memorise a list of ten common words[33] and recall as many words as possible in any order, both immediately after hearing them and later (after finishing depression and numeracy questions as well as drawing tasks). The immediate and delayed recall tasks gauge the elderly respondents' short-term memory and episodic memory respectively. We average the number of correct recalls at the immediate recall phase and delayed recall phase as our dependent variable in terms of cognitive ability, which ranges from 0 (poor cognitive skill) to 10 (good cognitive skill). On average, respondents remember 2.8 simple words over the immediate and delayed recall phases.

d. Subjective Well-being

In this paper, we focus on two subjective well-being questions that have been shown to be the most crucial ingredient and well reflect a person's subjective well-being, that is, life satisfaction and happiness. Life satisfaction question asks interviewees "Please think about your life as a whole. How satisfied are you with it?" and again, the answers take a scale representation from "Completely satis-

[33]The ten words used to ask the respondent were randomly selected from one of the four wordlists: A. rice, river, doctor, clothes, egg, bowl, child, hand, book; B. stool, foot, sky, money, pillow, dog, house, wood, school, tea; C. mountain, stone, blood, mother, shoes, eye, girl, house, road, sun; D. water, hospital, tree, father, fire, tooth, moon, village, boy, table.

fied" to "Not at all satisfied". Similarly, happiness is asked directly in the survey as one positive item of the CESD-10 test. We create a discrete indicator that equals to 1 if respondents claim they are completely satisfied/very satisfied with their life or felt happy during the last week.

Appendix B. Chinese Zodiac Signs and Risk Attitudes: RUMiC Data

To investigate the extent to which the Chinese zodiac can influence individual risk attitudes, we obtain data from the second wave of the RUMiC-Urban Migration in China (RUMiC RHS, 2009). 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)."*

Based on this question we create two measures to capture an individual's underlying attitudes towards 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 9 provinces of China.[34] 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 is a total of 11,965 observations (7,570 households) in our final sample. Table A.2.1 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

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

sign's migration type (migration-prone or migration-averse).[35] In our representative sample, roughly 67% of individuals were born under the migration-loving Chinese zodiac signs, while a smaller fraction of respondents (about 52%) were born with the migration-loving Western zodiac signs. This is not surprising as the migration-prone group defined using the Chinese animals incorporates two more zodiac signs than the same group characterised by horoscope.

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 the migration-seeking animal signs, relative to those born under the 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 the 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 huge 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 sign. Therefore, simply a raw comparison of unconditional means reveals that the Chinese zodiac sign is a relevant determinant of Chinese people's risk attitudes, whilst the Western zodiac sign does not appear to reflect risk preferences of the Chinese.

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

[35] 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 with a *positive* or *odd-numbered* sun sign (Aries, Gemini, Leo, Libra, Sagittarius, Aquarius) are relatively more extroverted, adventurous, active and aggressive as opposed to those born with a *negative* or *even-numbered* sun sign (Taurus, Cancer, Virgo, Scorpio, Capricorn, Pisces) who are more introverted, gentle, conservative and risk-averse (see, for example, Mayo, White, and Eysenck, 1978; Van Rooij, 1994). We thus postulate that persons born under the odd numbered star signs are more *prone* to migration and persons born under the even numbered star signs are more *averse* to migration.

dren, household size, and province of residence)[36]. The dependent variable is an individual's willingness to take risks—we examine both probability of taking risks (*risk indicator*, estimated by a probit model) and 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 animals. 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 A.2.2. 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 carry 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), one's sign of birth 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 to take 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% of the gender effects on risk attitudes. In terms of risk level, column (3) suggests that being born under 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 the re-

[36]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.

sults, despite being statistically weaker at the 5 percent significance level (column (4)). In column (5)-(8) of Table A.2.2 we perform a placebo test, where we estimate the impact of the Western zodiac sign on a Chinese person's risk attitudes. In neither of the regressions performed does the Western horoscope appear to exert an influence on 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) to 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 be easily generalised to other traits associated with migration (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 one's birth sign (determined by year of birth) is exogenous with respect to his/her attitudes towards 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 sign can lead to differences in migration behaviour.

Table A.2.1: Descriptive Statistics (RUMiC 2009).

	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
Demographic and Household Characteristics				
Female (0/1)	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 (0/1)	0.913	0.920	0.913	0.917
Years of education	7.311	7.296	7.292	7.322
Monthly earnings (/100 RMB)	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).

Note.—In Chinese astrology, migration-prone zodiac refers to any of the eight signs of the Chinese zodiac animal: Rat, Ox, Tiger, Rabbit, Dragon, Horse, Monkey and Dog; Migration-averse zodiac refers to any of the four signs of the Chinese zodiac animal: Snake, Goat, Rooster and Pig. In Western astrology, migration-prone zodiac refers to any of the odd-numbered Western horoscope: Aries, Gemini, Leo, Libra, Sagittarius and Aquarius; Migration-averse zodiac refers to any of the even-numbered Western horoscope: Taurus, Cancer, Virgo, Scorpio, Capricorn and Pisces.

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

Table A.2.2: Probit and OLS Estimates of the Effects of Zodiac Signs on Risk Attitudes: Chinese Animal *v.s.* Western Horoscope (RUMiC 2009).

	Dependent Variable							
	Chinese Zodiac Sign				**Western Zodiac Sign *(Placebo Test)***			
	Risk Indicator		**Risk Index**		**Risk Indicator**		**Risk Index**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Migration-prone zodiac	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^2	–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	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	–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		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)
Province fixed effects	No	Yes	No	Yes	No	Yes	No	Yes
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)

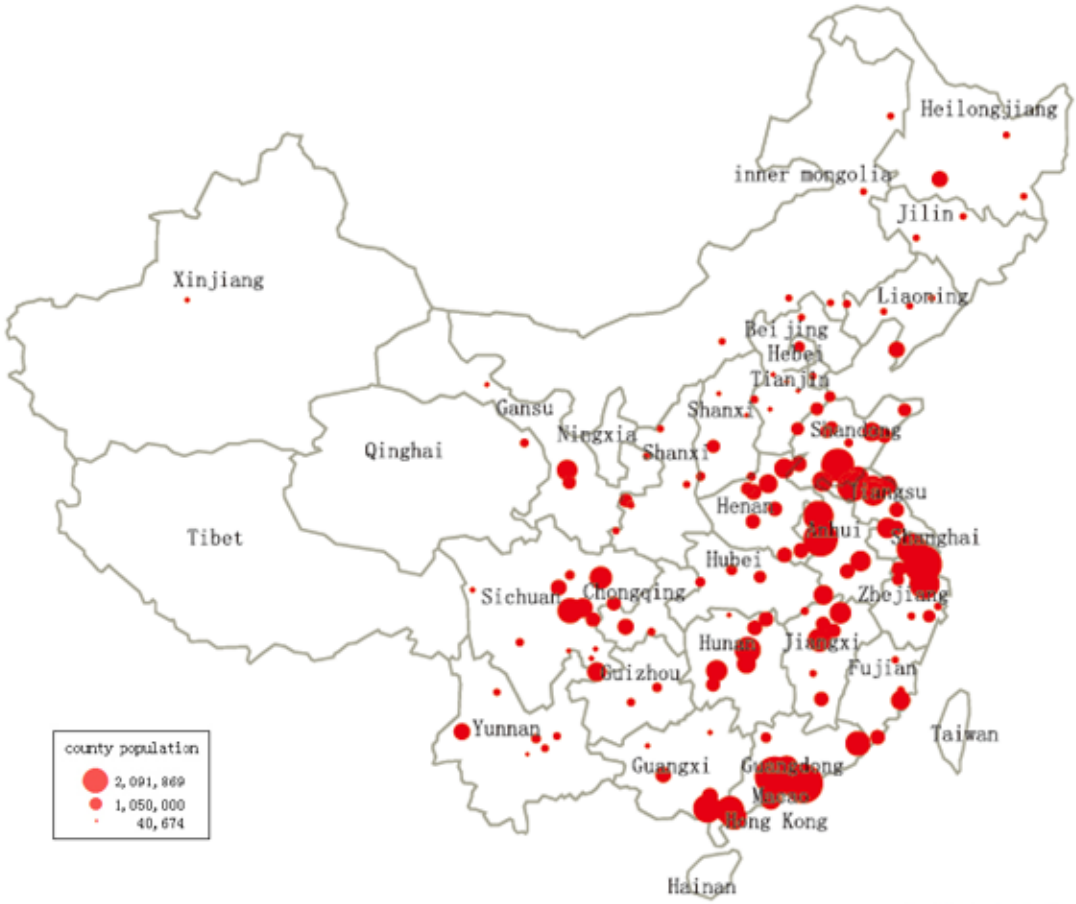
Note.—The dependent variable risk index is the risk tolerance level reported by respondents on a scale from 0 (never take risk) to 10 (most likely to take risk). Risk indicator is a dummy variable that equals to 1 when the risk index is above 0. Migration-prone zodiac refers to any of the eight signs 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. Robust standard errors are reported in parentheses.

*Statistically significant at the 10 percent level.

**Statistically significant at the 5 percent level.

***Statistically significant at the 1 percent level.

Figure A.2.1: 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.2.3: Principle Components of the Asset Index (CHARLS 2013).

	Scoring Factor	**Mean**	**SD**
Ownership of automobile	0.165	0.063	0.243
Ownership of electric bicycle	0.165	0.311	0.463
Ownership of motorcycle	0.180	0.361	0.480
Ownership of refrigerator	0.262	0.637	0.481
Ownership of washing machine	0.241	0.609	0.488
Ownership of television	0.137	0.934	0.249
Ownership of computer	0.279	0.147	0.354
Ownership of air conditioner	0.268	0.193	0.395
Number of durable goods	0.378	4.286	2.246
Flush toilet	0.225	0.327	0.469
Pit toilet/latrine	-0.151	0.885	0.319
No toilet	-0.150	0.288	0.453
Tap water	0.139	0.635	0.481
Bath facility	0.277	0.386	0.487
Main heating energy gas/electricity	0.192	0.390	0.488
Main cooking energy biomass (coal/crop residue/wood)	-0.195	0.593	0.491
Telephone connection	0.134	0.395	0.489
Broad-band internet	0.250	0.115	0.319
Number of rooms	0.216	6.471	3.589
Housing area (m^2)	0.165	124.860	79.386
Building high-quality material	0.185	0.265	0.441
Building low-quality material	-0.142	0.134	0.340
First eigenvalue	5.22		
% of covariance explained	23.7%		

Source.—Authors' calculation from the China Health and Retirement Longitudinal Study (CHARLS 2013).

Note.—The 22 asset variables used to construct the asset index are binary indicators with two exceptions: number of durable good owned by the household and number of rooms in the dwelling. This makes interpretation of the results easier: a change from 0 to 1 alters the asset index by scoring factor/standard deviation. For instance, asset index goes up by 0.262 units for households that own a refrigerator.