**The London School of Economics and Political Science**

# *Essays on Public and Private Welfare Provisions in China*

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# Abstract

This thesis consists of three self-contained essays that are aimed towards contributing to the understanding of the emerging of the public and private welfare states in developing economies. Three chapters, specifically, focus on how the public policies affect individuals labour market participation and what affects the private provision of the social safety-net in the context of China.

The first chapter provides novel empirical evidence for a question: how is the norm of providing old-age support transmitted inter-generationally in China? Intergenerational old-age support within families is an important norm in developing countries, which typically lack comprehensive pension coverage. The transmission mechanism for this norm is potentially influenced by socioeconomic factors internal and external to the family, which the norm may in turn influence. This chapter studies the intergenerational transmission of this social norm in China, focusing on the role of gender. The suggested mechanism behind this transmission is that parents, by their provision of support to their own parents, shape their same-gender children's preference for old-age support. Given that the gender ratio of Chinese children is not random, I develop an instrumental variable strategy using an interaction term of the timing of the ban on sex-selective abortions in China and the gender of the first-born child as the instrumental variable for the gender of the children to alleviate the possible endogeneity. The empirical results, using two Chinese datasets, show that parents with more same-gender children provide more support to their ageing parents than parents with cross-gender ones, controlling for their household size. The father effect is more significant in rural subsamples, and the mother effect mainly exists in urban areas. The urban-rural difference in the results may indicate a normative shift accompanying economic and demographic changes.

The second chapter presents a theoretical framework for understanding the empirical evidence in Chapter 1. Based on the model of the "demonstration effect" by Cox and Stark (1996), I construct a model describing the intergenerational transmission of social norms in old-age support. The model combines the "demonstration effect" and the same-gender transmission channel. The parents are more likely to influence their same-gender children in terms of providing old-age support, thus they provide more old-age support if there are more same-gender children in the household. The key parameter distinguishing my model from the existing literature is the gender of the future generation. The baseline model concludes that fathers with more sons in their households provide more old-age support to their parents than fathers with more daughters, assuming the number of children are exogenous. Mothers provide more support to their parents with more daughters in their household. The conclusions from the baseline model are shown to be valid under models with generalised assumptions.

The last chapter studies how misallocation in labour markets in China can be caused by the provision of public welfare programmes. Providing health insurance with certain geographical restrictions may lead to possible misallocations in the labour market by hindering migration. This chapter tests whether the new rural health insurance introduced in 2003, the New Cooperative Medical Scheme (NCMS), had unintended and negative effects on rural-to-urban migration mobility in China. The NCMS only offers health insurance to people with rural household registration, and rural residents can only benefit from the NCMS if they visit the hospitals near their registered location in the household registration system. Utilising a new dataset collected from provincial yearbooks in China, the results of the event-study approach show that the NCMS does not reduce the percentage of rural residents who are rural-to-urban migrants and working outside their home counties at the county level but does have negative effects on its growth rate. Using the China Health and Nutrition Survey (CHNS), my instrumental variable results find that being enrolled in the NCMS decreases the probability of being a migrant at the individual level. The IV is a time-variant dummy indicating the counties that has relative early NCMS implementations. I also used the CHNS to construct a county-level dataset and replicate the county-level results. Together, the results suggest that the NCMS gradually locks the rural labour force into rural areas and further hinders geographical job mobility in China.

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# Chapter 1

# The Role of Social Norms in Old-age Support: Evidence from China

Intergenerational old-age support within families is an important norm in developing countries, which typically lack comprehensive pension coverage. The transmission mechanism for this norm is potentially influenced by socioeconomic factors internal and external to the family, which the norm may in turn influence. This chapter studies the inter-generational transmission of this social norm in China, focusing on the role of gender. The mechanism behind this transmission is that parents, by their provision of support to their own parents, shape their same-gender children's preference for old-age support. Given that the gender ratio of Chinese children is not random, I use an interaction term of the timing of the ban on sex-selective abortions in China and the gender of the first-born child as the instrumental variable for the gender of the children to alleviate the possible endogeneity. The empirical results, using two Chinese datasets, show that parents with more same-gender children provide more support to their ageing parents than parents with cross-gender ones, controlling for their household size. The father effect is more significant in rural subsamples, and the mother effect is seen mainly in the urban ones. The urban-rural difference in the results may indicate a normative shift accompanying economic and demographic changes.

## 1.1 Introduction

Family support provided by adult children acts as a major income source for ageing parents in developing countries. This social norm of providing support to the elderly is traditional and common, especially in China.[1] Usually, the norm is gender-specific: sons provide more support than daughters (Lee et al., 1993). It helps to offset possible risks and expected income drops for the elderly in countries with underdeveloped public pension systems and incomplete financial markets. As a large developing country with an estimated share of the elderly population due to reach 25% in 2030, China is feeling the weight on its public finances of sustaining, improving, and complementing its current pension schemes.[2] Family old-age support has served as the complement for the incomplete public pension system in sustaining the welfare of the elderly in China. A major topic of debate here, with possibly unsustainable pay-as-you-go pension schemes in the future, has been how the norm of providing old-age support can be transmitted to future generations. Given the decline in population growth and the potential problem of ageing in other developing countries, a study of the transmission of social norms of support for the elderly in China may help many developing countries understand better how to encourage such support in the future.

This chapter studies the inter-generational transmission of the social norm of old-age support provision in China, focusing on the same-gender channel. Parents convey the social norm of old-age support provision to their same-gender children, in the way that they provide support to their own parents. The hypothesised mechanism behind this norm transmission is the same-gender "demonstration effect". It is based on the demonstration effect established by Cox and Stark (1996). The demonstration effect means that parents treat their parents well if they have "their own children to whom to demonstrate the appropriate behaviour" (Cox and Stark, 2005). This inter-generational demonstration meets the anthropologists' description of an upward and positive indirect reciprocity (Arrondel and Massaon, 2006). Anthropologists believe the indirect reciprocity is an important channel of cultural norm transmission (Mauss, 1950, 1968). I improve Cox and Stark's demonstration effect by adding the same-gender transmission channel for two reasons. First, there is good evidence in sociology and psychology that children are largely influenced by their same-sex parent in their learning of gender norms in society (Lytton and Romney, 1991; Bussey and Bandura, 1999; McHale et al., 1999). Economists have recently found empirical evidence for same-gender intergener-

[1] In the Chinese Household Finance Survey, 74% of the respondents believed that their children should be fully or at least partly responsible for their care in old age.

[2] United Nations (2015) estimated that, in 2030, the share of the population in China aged 60 and older will be 25%. The current share of the population aged 60 and older in the U.K. is 23.9% and in China is 16.2% (United Nations, 2017). The total number of people aged 60 or above is 222 million, which is around 4 times the current population of the United Kingdom. WSJ coverage: https://blogs.wsj.com/chinarealtime/2015/03/10/china-sets-timeline-for-first-change-to-retirement-agesince-1950s/. In 2017 China raised the retirement age, set in the 1950s, to alleviate pressures on its public finances.

ational transmissions in individual preferences and social norms (Alesina et al., 2013; Kleven et al., 2018). The second reason is that the gender difference is prominent in the norm of old-age support provision in China and other developing cultures (Gupta et al., 2003). Traditionally, sons are responsible for supporting their elderly parents in China (Lee et al., 1993; Chan et al., 2002).

In my proposed mechanism, parents provide old-age support to their parents, and they expect to be recompensed by their same-gender children. A key assumption in this mechanism is that parents internalise the fact that their behaviours regarding old-age support provision may affect their same-gender children (Eccles et al., 1990; Bussey and Bandura, 1999). Under this mechanism, a parent should provide more old-age support when the household includes more same-gender children than a parent with more cross-gender children. This channel of inter-generational transmission of the norm does not only exist in the theoretical framework created by academic researchers, but there are also real-world examples for it. Public service announcement posters in China in Figure 1.1 show the same-gender demonstration effect described. These posters also show the government's efforts to promote the norm of providing family support in old age, which indicates the importance of this norm in Chinese society. By studying the same-gender inter-generational transmission of the norm in old-age support provision, this chapter seeks to demonstrate how changes in economic and demographic conditions affect the norm and its transmission in China, both financially and non-financially.

I provide novel evidence for the same-gender transmission of this social norm of support in old age and show that the decision-making regarding old-age support provision involves three generations. Most of the family old-age support studies assume by default that the children will provide old-age support when their parents retire because of altruism or direct reciprocity (Becker and Lewis, 1973; Guttman, 2001). These channels limit the effect of old-age support to two generations, the parents and the children.[3] However, there is a gap in the literature: only a few researchers focus on the way in which the social norm of providing old-age support is transmitted to the next generation. Cox and Stark (1996, 2005) provide a theoretical framework for the inter-generational transmission of the norm of providing support in old age. The only empirical evidence for this inter-generational transmission has been collected by Wolff (2001) and Mitrut and Wolff (2009). The present chapter helps to fill this gap by providing empirical evidence for the gender-specific effect demonstrated in support for the elderly in China. The empirical results show the importance of the future generation in the process of transmitting the social norm of old-age support. The chapter also contributes to the literature by first documenting a normative shift with economic and demographic changes during China's transformation into a modern nation, thanks to the wide urban-rural differences.

When studying the effects of the gender of children on the support for the elderly

[3] Some of the relevant literature evaluates the "manipulation" of children by their parents to ensure more old-age support in the future (Becker et al., 2016).

provided by their parents in China, an empirical difficulty is that the gender of the children is endogenous. The increasing gender ratio of newborns in China corresponds to the imbalance in the gender ratio of the children in the datasets. The gender ratio of new-borns has been increasing since 1990 (China Population and Employment Statistics Yearbooks, Figure 2). For this, sex-selective abortion is one of the main reasons (Chen et al., 2014). The non-random gender ratio of the children could positively or negatively affect the support for the elderly provided by parents.[4] To address this problem, I utilise two facts: the gender of the first child in households and the timing of a policy ban on sex-selective abortions.

I use the interaction term of the gender of the first child in a household and whether or not a household is affected by the policy ban as the instrumental variable (IV) for the gender ratio of the children. This IV exploits two facts. First, the gender of the first child is closer to the natural rate than the gender ratio for all new-borns in China (Ebenstein, 2010; Wei and Zhang, 2011). Scholars usually regard the gender of the first child as random (Jayachandran and Pande, 2017; Heath and Tan, 2018). However, given the highly skewed gender ratio of newborns in China, it is difficult to concede that the gender of first-born children is fully exogenous. Second, a policy was introduced to reduce the gender ratio to its natural level, so the gender of first-born children who were born in or after the year of the policy ban is approximately close to the natural rate. The policy banned the use of ultrasound for prenatal sex determination and imposed fines on those who conduct sex-selective abortions. It was initiated by the National Family Planning Commission (NFPC) in 2003 affecting all households that have at least one child born in or after 2003.

The timing of the policy change is plausibly exogenous at household-level.[5] I find that the policy, as intended, negatively affects the household-level gender ratio of children. The compliers are those who have not conducted sex-selective abortions since the policy ban. Usually, they prefer sons to daughters. There are two different types of complier: affected and unaffected. The affected compliers are those who have children of the opposite sex to their wishes. They capture the time variation of the policy. For example, after 2003, the affected compliers who would have been willing, had no ban existed, to conduct sex-selective abortions, have daughters, and this decreases the gender ratio of their children. Unaffected compliers who have sons after 2003 by natural chance provide no variation. The gender ratio of the children of people who would not conduct a sex-selective abortion in any circumstances cannot be affected by this policy, and the gender ratio in their households should be close to the natural rate. The IV thus captures the differences for the affected compliers before and after the policy ban.

The main empirical findings indicate that parents increase probabilities of providing financial and non-financial support in old age with more same-gender children, con-

[4]This will be further elaborated in the empirical results section.

[5]The law-making processes of most Chinese policies are quite exogenous, as far as members of the public are concerned (Hu, 1998; Shen, 2008).

trolling for the household size. I only compare the difference within parents' gender for the old-age support provided by them. In the datasets, the father and the mother both show gender-specific demonstration behaviours. The results from the robustness check and the heterogeneity analysis are mostly consistent with the expected results under the demonstration effect channel. The 'father' demonstration effect is generally more significant in low-income and rural subsamples, and also in households with more than one child. The 'mother' effect is most significant for the outcome variables in low-income and urban subsamples. The empirical evidence implies that support for the elderly is closely linked to the composition of the gender of parents and their children, which suits the assumption that the norm of providing support for the elderly is likely to be transmitted to offspring of the same gender.

However, the two datasets exhibit different gender-dominated demonstration behaviours. The CHARLS (the China Health and Retirement Longitudinal Study) mainly presents the father demonstration effect. The mother effect has a more substantial role in the urban subsample and also in the whole sample of the CHFS (the China Household Finance Survey). One explanation for this difference is because the CHARLS contains more rural samples than the CHFS. It is consistent with results from the urban-rural heterogeneity analysis and subsample check. The discrepancy between the urban and rural subsample results has implications for the norm-shift of providing support for the elderly together with the development of China. Urban areas in China are more developed than rural areas: they have higher pension/insurance coverage, better public infrastructure, and, in particular, fewer gender inequalities and higher female bargaining powers (Fong, 2002; Lee, 2012). The results may suggest that higher female household bargaining power may lead to more significant mother demonstration effects. The mechanism checks also show that the existence of other possible mechanisms, such as altruism and direct reciprocity, is not likely to affect the demonstration effect mechanism in the results. I also calculate the correlation between the "missing girls" and the demand for support for the elderly in a patrilineal society, using a method from Oster's 2005 paper. Using this method, I calculate the adjusted sex-ratio based only on the correlation between the unbalanced gender ratio and the demand for support for the elderly from sons. The demand for old-age support accounts for 12-18% of the unbalanced gender ratio in the data.

The chapter proceeds as follows. More background information on support for the elderly from children in China is in Section 1.2. Section 1.3 provides the theoretical background for the same-gender social norm transmission and the model. This is followed by Section 1.3, which provides the identification strategy and the empirical findings. Section 1.4 also provides the robustness check for the key empirical findings. Section 1.6 offers some concluding thoughts.

## 1.2 Background

### 1.2.1 Old-age support in China

The provision of financial and non-financial support to ageing parents is a pro-social norm in China and other countries that are influenced by Confucianism. This family support for the elderly has been acting as an alternative way of sustaining the welfare of elderly to the incomplete public pension system. Table 1.1 shows that in 2005 less than 50% of the urban elderly viewed public pensions as their major source of income. In rural areas, the percentage was only around 5%. More than 50% of the rural elderly and around 40% of their urban counterparts believed their major source of income to be family support. Even with the development of the public pension in both urban and rural areas in China, the percentage of rural elderly choosing pensions as their main income source in 2010 was unchanged, although the percentage of those who chose family support declined to 47%. The pension schemes in urban areas have been improved since 2005: around 70% of the urban elderly in 2010 relied on a public pension while only around 20% of them lived mainly on family support. Inferring from the statistics, the public pension coverage shows a wide urban-rural difference. Rural areas in China do not seem to have had an effective pension scheme before 2011, so the elderly there were still depending on the norm of private support for the elderly.

A large proportion of the elderly in China live on support from their family members, especially from their adult children. The social norm of providing support for the elderly is then important to those who try to secure their income after their retirement. First, they have to know which characteristics affect the amount of support that they can depend on in old age. The number and the gender of the adult children are two major aspects studied in the relevant literature on China. In the standard old-age support literature, such as Becker and Lewis (1973), people believe that more children in a household will lead to more support for the elderly in the future. Cai et al. (2006) and Oliveira (2016) both verify this common belief among Chinese people. As regards the gender of the children, traditionally, males are responsible for providing support to their parents in their old age. Hence the early literature assumed that males provide more than females due to cultural and labour market restrictions (Lee et al., 1993; Chan et al., 2002). The value of male offspring in providing support for the elderly is one of the reasons behind the persistent preference for sons in China and other developing countries (Gupta et al., 2003). It was common in China for households to have at least one son, right up to the implementation of the "One-Child" Policy (OCP) (Milwertz, 1997; Ebenstein and Leung, 2010). However, in the recent literature, Xie and Zhu (2009) find that females were providing more support to elderly parents in urban areas, and Oliveira (2016) finds no gender differences in the provision of support in old age. But given the rising gender ratio for newborns in China, especially in rural areas, it is reasonable to assume that this gender difference still exists, though it may vary between rural and urban areas.

Once those who rely on family support for income in old age know the factors affecting their future income, it is highly likely that they will try to manipulate these characteristics. For most families in China, the number of children is difficult to manipulate. With the strict implementation and high fines of the OCP, Ebenstein (2010) has found that the policy reduced fertility. Gender, however, was a characteristic that was easier for people to manipulate, with the help of advanced technologies. Chen et al. (2013) have inferred that the increasing gender ratio could be attributed to increased gender selection before birth, thanks to gender-selection technology. For example, B-mode ultrasound allowed people to know the sex of a foetus and was in common use all over the world after 1980 (White, 2001). Qian (2008) has discovered that an increased future income for females also improved the female survival rate. In addition, Ebenstein and Leung (2010) have studied the effects of having a public pension system on the sex ratio at birth in China. They find that when a region is covered by a public pension scheme, its gender ratio is more balanced than it is in regions without such coverage. From the literature, it seems that in China, gender is a key factor in the norm of family support in old age. Support for the elderly is also, important enough to affect fertility decisions, such as the number and gender of people's future children. Parents internalise future support that they will receive from their children when they are old and try to alter the characteristics that might affect their own future support.

### 1.2.2 Indirect reciprocity

It is important to learn how to best support the elderly, given their situation. First, we should understand the possible mechanisms for doing so. Altruism and exchange are the two main motives in the standard theoretical models analysing intergenerational transfer. Altruism, in the context of, support for the elderly means that people are generally willing to support their ageing and retired parents. The theoretical framework for altruistic individuals is developed by Barro (1974) and Becker (1976, 1981). The exchange mechanism is also referred to as (direct) reciprocity. It describes support for the elderly as reciprocal payments for the financial and/or non-financial investment made in the donors' childhood (Cox, 1987). However, the existing empirical results are not robust enough to support these two motives in theoretical models (Arrondel and Masson, 2006). The theory of indirect reciprocity may serve to reconcile the motives of altruism and exchange. Indirect reciprocity is also the theoretical support for the inter-generational transmission of the norm of giving support to the elderly.

The concept of indirect reciprocity is usually attributed to Mauss (1950, 1968), a French anthropologist. He expands the common "gift-return" reciprocity relationship between two parties, the giver and the beneficiary, to three parties. He states that indirect reciprocities involving three successive generations will lead to infinite chains of transfers. He observes that the givers do not get direct payback from the beneficiary but receive it from a third person (Arrondel and Masson, 2001). The channel works for any type of transfer: upward, downward, positive or negative. Cox and Stark (1996) provide a model to describe similar behaviours in the provision of support in old age, which coincides with the upward and positive indirect reciprocity channel. In the context of support for the elderly, the interaction between three parties is that parents educate their children by providing support for the elderly to their parents so that the parents when elderly will receive support from their children. It is usually referred to as the "demonstration effect". The model predicts that transfers from individuals to their parents are positively affected by the presence of their children. Cox and Stark (2005) test the prediction using U.S. data. Wolff (2001) and Mitrut and Wolff (2009) also find that the existence of granddaughters increases the visits paid to the grandparents; Becker et al. (2016) believe that parents can "manipulate" the preferences of children, an assumption underlying the demonstration effect.

Bau (2019) studies the connection between the cultural norm and support for the elderly in Ghana and suggests that support for the elderly is a product of cultural norms. Except for Mitrut and Wolff (2009), the relevant literature considers only the role of the children in the transmission of the norm of old-age support, without any consideration of the role of gender. Given the gender difference regarding support for the elderly and preference in China for sons, the demonstration effect may also be linked with the gender of the third generation. Godelier (1982) describes indirect reciprocity as gender-specific when it functions as a channel for the transmission of cultural traits and norms. If there is a gender-specific social norm, then it is also a channel for passing on gender norms in society. Mitrut and Wolff (2009) find that parents' visits to their own parents are largely affected by the presence of daughters rather than sons in their households. This empirical finding is consistent with common beliefs about the role of gender: parents of girls are the more likely ones to pay visits and care for the elderly (Lee et al., 1993).

If providing support for the elderly links with gender norms, one vital assumption is that parents should be able to influence their same-gender children more effectively than cross-gender children. Children would also mimic the behaviour of the same-gender parent in the future, a phenomenon which is known in psychology and sociology as "gender socialisation/specification". Many sociologists and psychologists believe that the same-sex parent is the main source for ensuring that children to learn the corresponding gender role that fits social expectations and that the children will perform gender-related behaviours when they become adults (Lytton and Romney, 1991; Bussey and Bandura, 1999; McHale et al., 1999). In the recent economics literature, several papers focus on same-gender intergenerational transmission. Jayachandran and her colleagues show that the effects of the same-sex parent on gender attitudes are greater than the peer effects (Dhar et al., 2018). Kleven et al. (2018) reveal that in Denmark preferences over family and career for females are largely influenced by the mother's preference observed during childhood. Alesina et al. (2013) also find that paternal ancestors affect the perspectives of males on the gender role and the female labour market participation.

Parents should also internalise the fact their children's future behaviours will be affected by theirs. This internalisation means that parents will begin to influence their offspring in order to form their children's preferences. Becker (1996), Bisin and Verdier (2000), Guttman (2001), Bronnenberg et al., (2012), and Becker et al. (2016) study whether parents show certain behaviours to or spend more resources on their children in order to formalise their children's preferences. After listing the relevant evidence supporting the demonstration effect and same-gender intergenerational norm transmission, it is reasonable to assume that the demonstration effect works in a more gender-specific way when there is a wide gender difference in the planned support for the elderly. People will demonstrate the norm of support in old age to their same-gender offspring by providing support for the elderly to their own parents. Figure 1.1 provides examples in China for the same-gender demonstration effect.

## 1.3 Data and empirical results

### 1.3.1 Data

Two datasets are used to assess the gender effects of children on the norm transmission of old-age support, more specifically, how the gender of children affects the support for the elderly provided by their parents. The first dataset is the China Health and Retirement Longitudinal Study (the CHARLS). The CHARLS is a longitudinal survey of 28 out of the 34 provinces of the country for three waves in the years 2011, 2013 and 2015 up to the present day.[6] It collects a representative sample of residents aged 45 or above. The main wave used in this chapter is the 2011 wave. The data set contains information on each respondent's family, work, retirement, wealth, health and income. The main demographic group in the survey is people aged 45 or above. In the 2011 sample, this covered about 17,708 individuals in 10,257 households from 28 provinces. The sample was randomly selected from four samplings at different levels: county-level, neighbourhood-level, household-level and respondent-level.[7]

The CHARLS provides detailed information on inter-generational and inter-household transfers. One advantage of this dataset is that it clearly distinguishes between the transfers from each child of the respondents. The survey also identifies different types of support, whether regular or non-regular. The regular support acts as income received from the children of the respondents at fixed times. Regular support is similar to the support for the elderly as defined: a certain amount of income paid repetitively

[6] The detailed distribution in provinces and counties is presented in Figure A.1.

[7] The detailed sampling method at each level can be accessed at: http://charls.pku.edu.cn/en/page/about-sample-2011.

to the elderly at a fixed time. Non-regular support is the support provided at different times of the year and is not necessarily repetitive, whereas the regular one is.[8] Given the high average age of the respondents, the sample size for the available observations in terms of the transfer provided by the respondents to their parents is small. But many of the respondents have children of working age, so most of them receive support from their children. I regard the support for the respondents provided by their children as the support from parents to their elderly parents discussed in the previous section. The respondents in the survey are the passive recipients of old-age support. Namely, they are the elderly the main regressions in the CHARLS. The grandchildren of the survey's respondents are the children of the respondents' children.

To fit the original dataset into my setting, I construct a new sample that covers the adult children of the survey respondents, namely, the parents.[9] In the newly constructed sample, the sample size decreases to about 14,000 observations. In the reconstructed 2011 wave, around 65% of people come from rural areas, and more than 75% of them have rural *hukou* ("household registration"). However, due to the questionnaire design of the CHARLS, the demographic information on the parents and their children is not as detailed as the information on their elderly parents in my regression. The available demographic variables in the 2011 wave about the children are only the gender and the number of them. In the 2013 and 2015 wave, the only available demographic variable is the number of the children. This is the reason why I can conduct only cross-sectional analyses when using the CHARLS.

I used a second dataset to verify the generalisation of the results from the CHARLS and also to provide supplementary evidence for the demonstration effect. The dataset is the China Household Finance Survey (the CHFS). The CHFS is a panel dataset covering 25 provinces in China, by Southwestern University's Department of Finance and Economics and Research Institute of Economics and Management. This survey focuses on household-level financial behaviours. It currently has three waves: for the years 2011, 2013, and 2015. The survey does not have the same age limitation on the survey respondents as the CHARLS does; hence, there is no need to reconstruct the dataset. In the CHARLS, I treated the main respondents of the survey as the parents. The sample in the 2011 wave includes only 8,438 households, and its questionnaire includes only the gender of the children who are living together with the respondents. In the 2013 wave, the number of observations increased significantly: 28,142 households and 97,916 individuals. Accordingly, I used the 2013 wave in the CHFS for more observations and more precise information on the gender ratio of the children and old-age support provided.

I include only the main respondent for each household in my CHFS sample for regression. The main respondents know the household financial situation best (Li et

[8]In the CHARLS, non-regular support is defined as "support at Spring Festival or/and Mid-Autumn Festival or/and birthday or/and wedding or/and funerals or/and others".

[9]A detailed discussion of the dataset reconstruction is in Appendix A.3.

al., 2015). They are responsible for answering the household-level financial questions, which includes the questions regarding inter-household transfers. If I included only the main respondents, there would be a selection bias. In this sample, the parents are in charge of household finances. So, one possible effect would from females who were in charge of the household finances, who may have a higher power in their household than is held by females who are not in charge. A possible result of this selection would be that the females in my CHFS sample transferred more to their parents, which makes my CHFS results an upper bound of the female demonstration effect. However, regarding the households' support for the elderly, the main respondents may know only the exact amount of their own transfers, and not that of their partner. Their partner may hide the information from them (Ashraf, 2009). Moreover, only the main respondents have information about their own parents. The 2013 wave also includes the gender of all the children of the respondents. One limitation of the CHFS is that the information about the intergenerational and inter-household transfer collected in the survey is not as detailed as the information available in the CHARLS. Each dataset has its advantages and disadvantages. A comprehensive interpretation of the results from both datasets is necessary.

### 1.3.2 Main regression

The chapter sets out to examine the gender effects of the children on the support for the elderly provided by their same-sex parent. The main regression includes the gender of the parents, the gender ratio of their children in their household, and their interaction term. The main regression is:

$$y_i = \alpha + \beta sex\_ratioK_i + \gamma maleP_i + \delta(maleP_i \times sex\_ratioK_i) + \mathbf{X_i'}\boldsymbol{\theta} + \phi_c + \varepsilon_i. \quad (1.1)$$

In the equations, $i$ stands for a parent $i$. $y_i$ represents the outcome variables testing various aspects of old-age support. The error term is $\varepsilon_i$ is clustered at the prefecture city-level for the CHARLS and the province-level for the CHFS.[10] The different cluster-levels for the CHARLS and the CHFS is because the CHFS does not provide any information on prefecture cities. $\phi_c$ is the province fixed effects. For the main regressors, I use the three-generation setting: $P$ is the parents, $K$ represents the children of $P$, and $O$ is the parents of $P$. $maleP_i$ is the gender of a parent $i$ in the $P$ generation. It equals 1 if the parent is male and 0 otherwise. The regressor $sex\_ratioK_i$ is the actual male-to-female gender ratio of the children in parent $i$'s household. The gender ratio of $K$ equals the number of sons for a parent $i$ divided by the total number of $K$ in the household if $i$ has more than one child. For $i$ with one child, if the only

[10]The results are similar when the error terms clustered at the individual-level and also the province-level. The choice of the cluster level is discussed in the following section discussing the instrumental variable.

child is a boy, then $sex\_ratioK_i = 1$. If the only child is a girl, then $sex\_ratioK_i = 0$. $sex\_ratioK_i \times maleP_i$ is the interaction term, and $\mathbf{X_i}$ is the set of demographic variables for $P$ and $O$ to be controlled for in the regression.[11] I run separated regressions for the CHARLS and the CHFS, since the difference between the two datasets is quite large. Using this regression equation, I manage to calculate the within-parent gender differences in terms of providing support for the elderly caused by the gender ratio of their children, while controlling for the $P$'s own gender and household-size.

There are three consistent main outcome variables in both two data sets. They are the dummy indicating whether $P$ provide any financial transfer to $O$ (*any-transfer*), the amount of any transfer provided (*amount*), and the number of days spent on $P$'s visits paid to $O$ per year (*visit days*). The transfers provided to $P$'s parents are the pecuniary old-age support provided. For the amount of the transfer, I unify it to the annual amount and the amounts are capped.[12] The summary statistics for the outcome variables, key regressors, and control variables in different datasets are shown in Table 1.2.[13] In the CHARLS questionnaire, transfers are classified into two different types: regular transfer and non-regular transfer. The regular transfer is the fixed-amount transfer that parents make to their elderly parents at fixed times. The non-regular transfer represents transfers provided by the parents at non-regular but important social events or circumstances. These two types of transfers are not used in the main analysis, but in the check parts only. The amount of any transfer provided in the CHARLS is the sum of the regular and the non-regular transfer.

The OLS results from Equation (1.1) for the CHARLS and the CHFS are shown in Table 1.3. Before analysing the gender effects of children, I first want to verify whether there are gender differences in the provision of support for the elderly by the parents in the CHARLS and the CHFS. In the recent literature, it seems that males no longer provide more old-age support than females (Xie and Zhu, 2009; Oliveira, 2016).[14] I want to use the simple OLS regressions with $maleP$ as the only key regressor to check whether the male $P$ provide more in the datasets used. The corresponding results in Table A.3 might imply that there are certain gender differences of $P$ in old-age support. The coefficients of $maleP$ are similar to the corresponding coefficients in Table 1.3. The detailed discussion about the gender differences of $P$ in old-age support is in Appendix Section A.1.

For the main results in Table 1.3, they suggest that most of the effects of the gender of $K$ on old-age support are insignificant. From now on, I refer to females in

[11] The controls are different in the CHARLS and the CHFS. I try to make the controls consistent between the two datasets. The control variables for $O$ are more in the CHARLS than in the CHFS, but information on $P$ and $K$ is more precise in the CHFS.

[12] The amount of transfers are capped at 100,000 per year in the CHARLS and 10,000 in the CHFS.

[13] The full summary statistics for all the controls and the summary statistics by gender of the adult children are in the Appendix, Tables A.1 and A.2.

[14] Oliveira (2016) shows that there is no gender difference in the support for the elderly provided by parents. Xie and Zhu (2009) show that females in urban areas provide more to their parents than males do.

the $P$ generation as mothers, and their male counterparts as fathers. I only focus on the gender effects of $K$ within a certain gender of $P$. In Equation 1.1, $-\beta$ indicates, for mothers, the change of old-age support provision corresponding to decreases in the gender of $K$ in their households. The decrease in the gender of $K$ means there are more daughters in one's household, controlling for the total household size. So I name $-\beta$ as the mother demonstration effect. $\beta+\delta$ shows the same change for fathers corresponding to increases in the gender of $K$ in their households, which is the father demonstration effect. If the same-gender channel works, the expected coefficients of $\beta$ should be negative and significant for the mother demonstration effect. The coefficients of $\beta + \delta$ should be positive and significant to show the father effect. For outcome variables in the CHARLS, the coefficients of $sex\_ratioK$, which is $\beta$, for *visit days* is negative and significant. The mother and father demonstration effect on the probability of providing any transfer are insignificant. The father demonstration effects are significant for visits paid and the amount of transfer. The coefficients for $\beta$ and $\beta + \delta$ are all insignificant, yet the signs mostly fit the prediction of the same-gender effects in the CHFS results.

I also include the coefficients for the $P$ household size in the results in Table 1.3. A large household size implies more children in one's household. For a mother, an increase in household size has possible negative effects on her provision of old-age support, financially or non-financially. But these effects are only significant for the visits paid to her parents in both datasets. A father, on the other hand, an increase in his household size have positive effects on the amount of his support provided and the visits paid to his parents. These positive effects are significant for the visits paid to his parents in both datasets and for the amount of old-age support in the CHARLS. The impacts of household-size on fathers are consistent with the demonstration effect by Cox and Stark (1996): people provide more old-age support if they have more children in their households. The household size is another important factor that might affect the decision of gender selections, which is a problem that I would discuss more in the subsample check section, so controlling the household size and its interaction term with $maleP$ might help to alleviate the possible selections.[15]

### 1.3.3 Identification strategy

The OLS results in both datasets do not appear to support the proposed demonstration effect. It may be that the results under the OLS model suffer from biases caused by various possible endogenous problems. One main endogeneity problem comes from the gender selection issue affecting the gender ratio of the children, $sex\_ratioK$. According to the China Population and Employment Statistics Yearbooks, the yearly national-level gender ratio of new-borns has been increasing since the late 1980s.[16] The national

[15]It would be more desirable if I can use calculate a counter-factual household size without its correlation with the household gender ratio using Qian's method in her paper "Quantity-Quality and the One-Child Policy: the Only-Child Disadvantage in School Enrolment in Rural China".

[16]The yearly national-level gender ratio of new-borns is shown in Figure 1.2.

gender in 2011 shows the ratio of boys to girls to be as high as 1.25 to 1, revealing the gender selection problem as quite severe. Households with son preference would be likely to conduct selective abortions, and these are usually the households holding the traditional stereotypes of daughters. Households with modern views on gender equality are less likely to select their children's gender. In my sample, the gender ratio of the parents is almost free from this problem. In the CHARLS the average age of the parents in the sample is 40 and in the CHFS, it is 48. It is around 0.51 in both datasets. When they were born, gender selection technology was not yet available in China (Chen et al., 2013). The endogeneity problem of $sex\_ratioK$ is a larger one, and it may affect the OLS outcomes in two opposite ways as illustrated by males with a preference for sons. First, if a male is eager to have a boy only to secure his own future support, then gender-selection will lead to an upward bias for the father demonstration effect. Second, if, alternatively, a father wants to have a boy to enhance the household's prosperity, he will invest more family resources in a son's upbringing. So the father effect is downwardly biased. The effect of the endogeneity is ambiguous in this setting.

To alleviate the bias, I use the timing of a regulation announced in late 2002 by the Ministry of Health, State Food and Drug Administration (SFDA) together with the National Family Planning Commission (NFPC). The regulation bans the use of B-scan ultrasonography and other technologies for determining foetal sex from January 1st 2003.[17] It states that all methods of gender selection should be banned and imposes fines for different levels of violation of the regulation. Fines are imposed on individuals who choose the sex of a foetus allowed to survive and on the hospitals that conduct scans and abortions. The policy was intended to make the gender of the children born in or after 2003 closer to the natural birth rate relatively random, which is lower than the gender ratio of the children born before. The policy was designed to reduce the gender ratio of new-born males to females, so it would be relevant to the average gender ratio of children in households, which is the variable $sex\_ratioK$ in the main regression equation. Figure 1.3 shows the estimated yearly gender ratios of new-borns using the 2011 wave in the CHARLS and the estimated yearly gender ratios of the first-born children using the 2013 wave in the CHFS. This graph shows that both gender ratios fall after the year 2003.

I use mainly the timing of the policy change to construct the first part of the instrumental variable employed in the chapter. The policy covers most of the provinces, and the provincial congresses passed the policy at much the same time,[18] with no great time difference between them. I assign the value of the policy timing variable to 1 for $P$ with at least one child born in or after 2003, and 0 otherwise. The increasing gender ratio of male to female new-borns is a heated social issue that usually attracts public

[17]Website: http://www.gov.cn/banshi/2005-10/24/content_82759.htm. Last accessed: September 2018.

[18] The provincial congresses all passed the policy at some time between November 2002 and January 2003. The information was collected from the provincial government websites.

attention. So public discussion may accompany the agenda-setting process of the policy. However, Hu (1998) and Shen (2008) declare that detailed information and plans are rarely revealed to the Chinese public in the policy planning stage. Thus, the timing of the policy implementation is exogenous to the general public. Regarding this policy, in particular, most of the news about it on Baidu.com or Google.com appears after the provincial governments or the central government passed the associated regulation. Also, the policy ban on gender-selective abortions is designed mainly for adjusting the high male-to-female gender ratio for the newborns in China.[19] The exclusion restriction of using the policy variation is satisfied policy-wise because the policy design does not include the concern of the old-age provision. However, people might still violate this policy ban and pay high fines to conduct gender-selective abortions. This could, in turn, affect that total expenditure of the households, and affect old-age support provision due to household budget limitations. To conclude, the exogeneity assumption of the policy timing is reasonable in my setting.

Although Figure 1.3 shows the gender ratio in the CHARLS and the CHFS decreased after 2003, the situation is not quite the same as in Figure 1.2. The national gender ratio has been stagnating at a high level since 2003, although it has not increased since then. Figure 1.2 implies a slight chance that the policy does not ban sex-selective abortions outright.[20] To address this concern, I combined the dummy indicating the timing of the policy implementation together with the gender of the first-born child in the households surveyed. The gender ratio of the oldest child in a family is relatively balanced in China. The One-Child Policy (OCP) does not strictly require all households to have only "one child", especially in rural areas, so the first child's gender is relatively close to the natural ratio of new-borns (Ebenstein, 2010). In Figure 1.4, the graphs show the ratio of new-born boys who are not the eldest to their girl counterparts are all larger than the gender ratio among first-born babies. For the relevance condition for this variable, the gender of the oldest child is usually correlated with the gender ratio of children in households (Angrist and Evans, 1998; Heath and Tan, 2018). But the male-to-female ratio for the first-born child is still higher than the natural rate. Together with the timing of the plausible exogenous policy, my instrumental variable can plausibly satisfy the exclusion condition. The IV is an interaction term of two dummies: one dummy equals 1 for households with at least one child born in or after 2003 and one dummy equals 1 if the oldest child in a household is a son.

This instrumental variable borrows the concept of the instrumented difference-in-differences design (DDIV) (Dulfo, 2001; Hudson et al., 2017).[21] The key variation

[19] http://www.gov.cn/banshi/2005-10/24/content_82759.htm

[20] Because the policy did not make the gender ratio of new-borns completely random, I cannot use the subsample of households with new babies in or after 2003 to test the demonstration effect.

[21] Using of the interaction term of the gender of the first child and whether a household is affected by the policy as IV is necessary. I cannot use only the subsample of households that are affected by the policy ban when using the gender of the first children as IV. This is because, even with the policy ban, the gender ratios in some provinces are still higher than the natural rate. A more detailed explanation in Appendix A.3 and the sub-sample regression results are shown in Table A.22.

comes from the policy compliers: those who were not allowed to conduct sex-selective abortions after the policy implementation and had young children of the undesired gender. Take, for example, people with only one child and a preference for sons; assume they want to have a son but cannot conduct sex-selective abortions due to the policy ban. If they happen to have a son by natural chance, they are not the compliers that I expect under this policy. The compliers are people of the same type who have a daughter eventually. The gender ratio of the first child in the compliers' households will decrease after the policy implementation beyond the gender ratio of the first child before the policy change. The constructed instrumental variable is used for two datasets. As noted above, the CHARLS gives limited information on the children of the parents that it surveys. Hence, constructing the gender of the first child in a household using the CHARLS entails a few assumptions, which are included in Appendix A.3.

One additional assumption that should be stated is that the support for the elderly provided by the parents does not change over time after controlling for the demographic variables, because the DDIV outcome variables are usually time-variant. Due to the data limitation, I manage to get only cross-sectional datasets, so I use the CHFS dataset to compute the average probability of providing old-age support for the elderly for groups of $P$ who have their last child in the same year. If there is no increasing trend in these averages in the different years of the last childbirth, the DDIV assumption is likely to be satisfied in the datasets. The graphs for plotting the "time-trend" are shown in Figure A.2 in the Appendix. They show that for the $P$ generation, there is no significant decrease in the trend in the year of birth of the last child in households until the last two years before 2013.

I also construct another instrumental variable to proxy for the household-level gender ratio for the CHARLS only. It is the prefecture-level compliance index of the policy implementation/enforcement. Ebenstein (2010) uses different enforcement levels of the OCP in China and shows that the regional variation in fines levied for unauthorized births is associated with the gender ratio. Bo (2018) exploits geographical variations in the policy ban on gender-selective abortions and use it as an IV of the children's gender ratio. Only the CHARLS has detailed information on the different prefecture-level cities. One of the components included in the index is the time when the provinces included the policy change in their provincial-level Regulation on Population and Family Planning. The policy change was announced in late 2002, and the actual implementation date was in early 2003. The time when the policy was introduced in the provincial regulation may indicate the level of compliance in different provinces.

Another component included in the index concerns a campaign in early 2005 initiated by the Ministry of Health with the NFPC targeting illegal clinics and underqualified doctors in prefecture-level cities.[22] The illegal clinics are usually the ones which illegal conduct sex-selective abortions. The policy acts to complement the pol-

[22]Website: http://www.gov.cn/zwgk/2006-08/02/content_352694.htm. The regulation date was in 2006, but in the content, it states that the campaign started early in 2005.

icy ban of 2003. Both the central and the provincial governments decide to use this top-down approach because the local governments may have better control of the actual implementation of the campaign. Different prefecture-level cities have different enforcement-level of this campaign. Some cities have mounted this campaign every year since the campaign started. Others may have implemented the campaign in 2005 for only one year or may even have started the campaign later than the NFPC requirement. The number of years that a city has enforced the campaign and also the year each city started to do so are indicators of the strictness with which the regulation was implemented at the prefecture-level. I take the relevant information from various prefectural government websites and also from newspapers and generate an index showing the various compliance levels of the listed prefectural cities regarding this policy and this campaign. The constructed compliance index varies from 0 to 2, where 2 is the highest level of allegiance to the aims of the campaign.

The policy implementation levels at the prefectural city-level also link to the choice of the cluster level in the main regression for the CHARLS. As the policy compliance level varies in different prefectural cities, it is likely that the residuals for the regressions for the CHARLS are correlated at the prefecture-level. So, it is reasonable to cluster the stander error at the prefecture-level for the regression results in the CHARLS. For the CHFS, because the data does not offer any information on prefectural cities, I cluster the standard errors at the province-level. The similar argument applies when using the province-level cluster in the CHFS. The policy enforcement of policies also varies between different provinces, similar to the OCP enforcement level (Ebenstein, 2010). There is another argument that the error terms should be clustered at the household-level in generation $O$ in the CHARLS. Under the data reconstruction, some $P$ and their sibling $P$ are from the same family in $O$. Also, given the provision of the old-age support is a household-level decision, the stander errors in the CHFS should be clustered at the household level. The main results for the CHARLS and the CHFS are similar to the results in Table A.4 when clustering at different levels. I use the prefecture-level cluster for the CHARLS and the province-level cluster for the CHFS for conservative clustered standard errors.

To summarise, the instrumental variables used in the chapter are the gender of the first child for households having at least one child in or after 2003 and the prefecture-level compliance index. The IV method exploits three facts: first, that the gender of the first child is closer to the natural rate than the total gender ratio for all new-borns; second, that amongst the first-born children, the gender of those who were born in or after the year of the policy ban is more random; third, that the prefecture-level policy compliance level is higher when the gender ratio of the children, in general, is lower. The results from the IV regressions are shown in Tables 1.4. The first stage results are in Table A.5 in the Appendix.

### 1.3.4 Main results

The first three columns of Table 1.4 shows the results for the CHARLS. For *any-transfer*, the coefficients of *maleP* and *maleP* $\times$ *hh-size* have opposite signs compared to the corresponding coefficients in OLS results, but all four coefficients are insignificant. The coefficients of *maleP* and *maleP* $\times$ *hh-size* for the amount of any transfers and *maleP* $\times$ *hh-size* for the visits paid are consistent with the OLS results. The *maleP* coefficient for *visit days* is negative and significant in the IV results. The CHARLS IV results show that the father demonstration effects are positive for all three outcomes, and significant for the probability of providing any transfer and the visits paid. One unit increase in the actual gender ratio of $K$ in fathers' households increases the fathers' probability of providing old-age support to their parents by 7.9%. A simple interpretation is that, compared to fathers with only daughters, fathers with only sons are 7.9% more likely to provide support of any support to their own parents. They also pay 72 days of annual visits more to their own parents. For the mother demonstration effect, the coefficients of *sex_ratioK* are negative yet insignificant for three outcomes. These results indicate there might be some potential mother demonstration effects, but the effects are less significant compared to the father demonstration effects. It implies that mothers may also try to demonstrate filial piety to their daughters, as the fathers in the CHARLS do.

The demonstration effect in the CHFS is different from the father demonstration effect in the CHARLS. The mother demonstration effect is stronger and more significant than the father counterpart.[23] The coefficients for *sex_ratioK* are negative and significant for the probability of providing any support and visits paid to their own parents, and negative for the amount of transfer. Similar interpretations, mothers with only daughters are 7.3% more likely to provide any support to their own parents than mothers with only sons. They will also devote 46.9 more days per year visiting their own parents. In the CHFS, it is difficult to draw any conclusion about the father effect. The coefficients for *sex_ratioK* + *maleP* $\times$ *sex_ratioK* are insignificant for all outcomes, and the signs of these coefficients are also inconsistent.

The gender ratio of the third generation is the actual gender ratio of children in $P$'s households. Using the actual gender ratio, I impose a linear assumption on the gender ratio when interpreting the results. It is possible that the linear interpretation would be violated when the gender ratio changes from values below 0.5 to values above 0.5. So I create a variable, *more_sons*, which is a dummy variable equals 1 if the gender ratio is greater or equal to 0.5, and 0 otherwise. The results are presented in Table A.6 in the Appendix. The coefficients are very similar to and consistent with the ones in Table 1.4. So I continue to use the actual gender ratio *sex_ratioK* as my main regressor in the later analyses. It is also possible the definition of the outcome variables, especially

[23] The difference between the mother demonstration effects and the father demonstration effect is $-2 \times \beta - \theta$, which are significant for the outcomes *any-transfer* and *visit days* in the CHFS results.

for financial old-age support, could affect the results. In Section A.2 in Appendix A, I discuss detail about different ways to present the financial old-age support and show the demonstration effect under the different representations. The signs of the father or mother demonstration effects in Table A.7 are also mostly consistent with the main results in Table 1.4, yet the significance-level varies.

The IV results from the CHARLS and the CHFS, they show a very interesting phenomenon. The fathers in the CHARLS and the mothers in the CHFS both demonstrate to their same-gender children. One possible explanation may be that the CHARLS and the CHFS focus on different samples. As shown in the summary statistics, one major difference between the CHARLS and the CHFS is the proportion of urban samples in each dataset. The CHFS has a sample of which 65.2% live in an urban area, while the sample in the CHARLS contains 33.2% urban dwellers. In the CHARLS OLS results, fathers, in general, support their own parents more than mothers do. This result is consistent with the hypothesis that sons in rural areas are still preferred for their propensity to provide old-age support. In China's rural areas, a higher proportion of people accept traditional gender discrimination/stereotype, and females have less bargaining power in their households than males (Wang and Zhang, 2018). Urban areas contain more households with a single child than rural areas do as a result of the "1.5" Child Policy implemented in China (Rosenzweig and Zhang, 2009; Wang and Zhang, 2018).[24] If a household only has a daughter, mothers are more likely to demonstrate to this daughter so that they can look forward to receiving support when they grow old. Urban areas in China also have more opportunities for female labour market participants and more gender equality compared to rural areas. My predictions for the discrepancies between the CHARLS and the CHFS are an urban-rural difference and/or a single-$K$/nonsingle-$K$ household difference. The significant female or male demonstration effect might be driven by the corresponding subsamples with more observations. The results of a subsample check and heterogeneity analysis provide more empirical findings on these two conjectures in the following subsections.

There is a possible channel that could also explain the demonstration effects that I found. Fathers with only or more sons might anticipate receiving more old-age support in future, thus they are able to provide more old-age support to their own parents because they do not need to save for their old age. Analogously, it could also happen to mothers, especially in the urban areas, with daughters as the possible future old-age support. They could have more money to provide support to their own households. This channel works in the same directions with the demonstration effect. It is likely that they co-exist in the real world scenario and also in the empirical results. The key component that distinguishes the demonstration effect from this possible channel is that the demonstration behaviours from fathers and mothers need to be observed by their same-gender children. In the CHARLS, there are two different types of transfer:

[24] The gender preference in the CHFS is in Table A.8 in the Appendix.

regular transfer and non-regular transfer. The regular transfer is the fixed-amount transfers that parents make to their elderly parents at fixed times, which suits the definition of old-age support but less visible to their children. The non-regular transfer represents transfers provided by the parents at festivals, birthdays, weddings, funerals, and for medical treatments, and also for other non-regular but important social events. In these family-gathering situations, the provisions of transfer are more visible to their children. If the channel described and the demonstration effect co-exist, then I would expect both coefficients representing the father or mother demonstration effects are significant when using the regular and non-regular transfer as outcome variables. Also, the magnitudes of these demonstration effects should be larger for the more visible transfer compared to the less visible one.

Table 1.5 show the corresponding results for four different outcomes: the probability of providing regular and non-regular transfer, and the amount of regular and non-regular transfer. Focusing on the IV results in Panel B, the father demonstration effect is 5.6% for the probability of providing non-regular support and 3.2% for the corresponding probability for the regular transfer. In terms of the amount of the regular and non-regular transfer, both father demonstration effects are insignificant. The magnitude of the effect for the regular support is larger than the one for the non-regular. This can be interpreted as a substitution effect between the regular and the non-regular support due to household budget constraint. Males are responsible for the regular old-age support provision, according to the traditional gender norm of the old-age support. One interesting result from Table 1.5 is the significant mother demonstration effect for the amount of non-regular transfer. The results suit the traditional norm of old-age support as provided by adult daughters in rural areas: they are not mainly responsible for the living expense of their parents. Also, the mother demonstration effects for the probability of providing non-regular support is positive and insignificant. The results from Table 1.5 shows that the possible channel discussed could be one of the possible channels that drives the results, but the larger effects for the probability of providing more visible old-age support might indicate the demonstration effects also exist.

In the main results, I notice the demonstration effects of visits paid to the parents are larger than other outcome variables when compared to their corresponding mean. Cohabitation with the elderly parent would be one of the possible explanations for the large effect in visits paid to $O$. Living together with the elderly parent is one important way to take care of them. Although this may count as mutual care of the family members, it seems that the $P$ generation is more likely to take care of their elderly parents with respect to income-earning. In the literature, cohabitation with one's ageing parents is generally used as an outcome variable. In my specification, the probability of providing monetary support and the outcome variable *visit days* partially capture the cohabitations. I use cohabitations with $O$ as a dummy outcome variable for both datasets. The prediction of the results would be similar: the same-gender demonstration effects of cohabitation. The results are shown in Table 1.6. Both mothers and fathers are more likely to cohabit with their own parents to demonstrate filial piety to their same-gender children, except for the father demonstration effect in the CHFS results. The father demonstration effects of cohabitation are significantly larger than the mother effects in the CHARLS. The same-gender demonstration effect has a higher significant level for this outcome variable than the main CAHRLS results.

Apart from running the main regression on the cohabitation dummy, I also check the subsample of those who are not living together with their own parents for their old-age support provision. The results are in Table A.9. The results imply that the father demonstration effect in the CHARLS might be fully driven by $P$ who are living together with their own parents. But in the CHFS, the mother demonstration effect shows up in the subsample results as well. The living pattern in urban and rural areas could explain why two subsamples are showing the demonstration effect results for the CHARLS and the CHFS. Nuclear families are more common in urban areas; while in rural areas, people are more likely to live with extended family members, especially with males' ageing parents and sometimes their male siblings.

### 1.3.5 Subsample analysis and heterogeneity check

To verify the effect of the gender composition of $K$ working mostly through the demonstration mechanism, I use results from the subsample analysis and the heterogeneity check to show whether, in different circumstances, the results are still consistent with the predicted results from this mechanism. The analyses are conducted for both or only one of the datasets, depending on the available information. I mainly describe the subsample analysis results and then mention the consistency of the results with the corresponding heterogeneity checks. Since the CHARLS data exhibits the father demonstration effect and the CHFS shows the mother effect, I focus only on the father effect in different groups from the CHARLS and the mother effect in different groups from the CHFS. Six categories are used for the analysis: high or low income-level, singleton or non-singleton households regarding the children, urban or rural residence, parents with or without older brothers, the pension coverage of the parents, and membership of the *Han*/non-*Han* ethnic group. The category for the singleton or non-singleton households and the urban-rural residence are the two categories that may provide possible explanations for the discrepancies between the results from the CHARLS and the CHFS.

#### Income-level difference

As the future support for the elderly received from the offspring acts as an economic incentive to have children (Banerjee and Duflo, 2011; Alfano, 2017), households at different income levels will have different patterns for the demonstration effect. People in the high-income group will have enough savings, investments, and pension income to support their consumption after retirement. So, their incentive to demonstrate to their children by pecuniary support for the elderly is not as large as those who in the low-income group. For the financial old-age support, if the demonstration effect is to obtain secure private old-age support in future, the subsample results would show larger or more significant demonstration effects for people in the lower-income group than those with higher income. Regarding the non-pecuniary support, the high-income group may demand it as much as or even more than the other group, so larger or more significant father and mother demonstration effects are also expected for *visit days* in the high-income group. The reason for the possible higher demand for non-pecuniary support for the high-income group is that the time and monetary support are substitutes.

The subsample IV regression results for the CHARLS and the CHFS are shown in Table 1.7. The CHARLS only have one categorical variable of the household income level of the parents. To get a balanced subsample in the CHARLS, I classify those whose household income level above the 20,000 $RMB$ per year category as the high-income group. The father effects in the low-income group are significant for the two pecuniary outcomes; while for the high-income, the father demonstration effects are not significant for these outcomes. For the non-pecuniary outcome, the father demonstration effect is also significant in both high and low-income group, but the magnitude of the effect is greater in the high-income group. The mother demonstration effects for visits paid in the high-income group are positive, yet they are negative in households with a low income. But both of the mother effects are insignificant. The coefficients seem to be consistent with the prediction. The evidence for the mother demonstration effect of pecuniary outcomes is that mother insignificantly signal the old-age support behaviours to their daughters.

With the detailed income information in the CHFS data, I classify those who have above the average income in the high-income group and the rest of the sample in the low-income group. The last three columns of Table 1.7 show that in the low-income group, mothers increase their visits paid to their own parents with more daughters, which implies a mother demonstration effect in the non-pecuniary old-age support. While in the high-income group, the mother demonstration effects are insignificant for all outcomes. The mother demonstration effect for *amount* is even positive. For the insignificant mother effects for *visit days*, it could be the reason that people in urban areas with busier lifestyles than rural areas, so people with high income might hire others to take care of their own parents.

The heterogeneity check provides similar results to those of the subsample analysis. It can also check whether there are significant differences in the demonstration effect between the high and low-income groups. The results of the heterogeneity check for the income-level are shown in Tables A.10 in the Appendix. The CHARLS results show that the father demonstration effects for pecuniary outcomes are positive and significant in the low-income group, while they are negative and significant in the high-income group. The differences in the father demonstration effect between these two subgroups are significant for the two pecuniary outcomes, which indicates the low-income group has a larger father demonstration effect than the high-income group. Both groups show positive and significant father effects for the visits paid, yet the difference is insignificant.

In CHFS heterogeneity results, an important coefficient is the coefficient for *sex_ratioK* $\times$*high income*. It is the difference between the mother demonstration effects for $P$ with high-level income and the mother demonstration effects for $P$ with low-level income, which should be negative and significant if the mother demonstration effects for $P$ with high-level income are larger than the mother demonstration effects for $P$ with low-level income. The absolute value of the coefficient of *sex_ratioK* is now the mother demonstration effect for $P$ with low-level income. The mother demonstration effect in the high-income group is insignificant for the pecuniary outcomes and positive and significant for the visits paid. The coefficient for *sex_ratioK* $\times$ *high income* is positive and significant for the amount of transfer and the visits paid, which implies the mother demonstration effect for $P$ with low-level income is larger than the effect for $P$ with high-level income. The CHARLS heterogeneity results are mostly consistent with the subsample analysis, yet the CHFS heterogeneity fit the prediction better than the subsample results. Both results show the low-income group has larger father demonstration effects.

**The number of the children**

This chapter mainly focuses on how the gender of the children affects the support for the elderly provided by their parents. While the chapter does not, on the whole, discuss other characteristics of the children, I can use the number of members of the third generation to conduct a subsample analysis and heterogeneity check. Most of the households with only one child ('singleton households') are the households that strictly comply with the OCP, even when they have an only daughter. These households may hold modern views of gender roles; hence, females in these households may be able to enjoy higher bargaining powers. A preference for sons is a good indicator of whether a household has more traditional views on gender roles. Such households are more likely to violate the OCP (or be allowed by "1.5" Child Policy) to have a second child if their first child is a girl. If the existence of the father and mother demonstration effects depend on the types of views of gender roles, then I expect larger and more significant mother demonstration effects in singleton households and father effects in non-singleton households. Tables 1.8 displays the results for the CHARLS and the CHFS. The number of children may also correlate with the gender of the first child in the households, which may lead to biased results in my IV regressions even with the household size controlled. The subsample analysis of the number of household children also helps to get rid of the possible bias arising from selections in the number of children for the singleton households sub-group.

The first three columns of Table 1.8 show male $P$ in both types of households increase the visits paid with more sons. $P$ with non-single child family show significant and positive father demonstration effect in terms of the probability of providing any transfer to their own parents, while the corresponding father effect is insignificant in the households with a single child. As discussed in the previous section, given the OCP, households with more than one child are usually rural households or urban households with relatively strong son preference. In rural areas, the OCP allows households in which the first child is a daughter to have a second child, and the law and the enforcement of fines in rural areas are not as strict as they are in urban areas (Ebenstein, 2010). According to Ebenstein (2010), if the OCP is violated in an urban area, the fine is quite high. Non-singleton households in urban areas usually possess a stronger preference for sons than singleton ones do; hence, females may have less bargaining power in non-singleton households. The singleton households in the CHARLS is trying to show up a mother demonstration effect in the pecuniary old-age support, when the magnitude of the coefficient of $sex\_ratioK$ is larger in this subsample than the magnitude in the non-single child households, although both of them are insignificant.

The CHFS results in Table 1.8 show significant mother demonstration effects in singleton households in terms of the probability of providing any transfers and the visits paid. But in terms of the amount of provision and the visits paid, the non-singleton households also show significant mother demonstration effects. The father demonstration effects are insignificant for both subsamples. The results of the heterogeneity check for the singleton and non-singleton households are shown in Tables A.11 in the Appendix. The CHARLS results show that the father demonstration effect in terms of the visits paid is on average greater in non-singleton households than in singleton households, yet the difference is insignificant. Table A.11 also shows that in the CHFS the mother demonstration both exists in the singleton and the non-singleton households. But, for the amount of transfer provided, the non-singleton group has a larger and significant mother demonstration effect compared to the singleton group. The heterogeneity analysis results are in general consistent with the subsample analysis. Higher bargaining power for mothers in singleton households is one of my conjectures for explaining the difference between the CHARLS and the CHFS results. But the CHFS results do not support this conjecture completely. I need to explain the discrepancy of the results between the CHARLS and the CHFS by the urban-rural difference.

#### Urban-rural differences

Another conjecture in explaining the discrepancies between the CHARLS and the CHFS results is the urban-rural difference. Residences in urban areas in China enjoy more developed public pension systems, more opportunities for females to be employed and more gender equality. As the argument in the previous subsample check, with the shift in gender norm of providing old-age support in urban areas, the mother demonstration effect should show up more in urban areas, and the father effect should appear in the rural subsample. Table 1.9 presents the regression results for the urban and rural subsamples in the CHARLS and the CHFS using the IV regressions. In the urban and rural areas in the CHARLS, the gender effects of the children are insignificant for pecuniary and non-pecuniary outcomes of the mother demonstration effect. While in the rural subsamples, the father demonstration effects are significant for *any-transfer* and *visit days* for the CHARLS. In urban areas, the CHARLS results only show up a significant father demonstration effect for the visits paid. The heterogeneity analysis in Table A.12 shows the father demonstration effect for the amount of transfer and the visits paid is significantly larger in the rural areas. The heterogeneous analysis findings may indicate that the gender norms as regards support for the elderly are not strong in urban areas compared to rural areas.

The difference in the gender effects of the children between rural and urban areas in the CHFS partially corresponds to my prediction. The last three columns of Table 1.9 show that the mother demonstration effect is significant except for *amount* in the urban subsample. In the rural subsample, there is no significant demonstration effect for mothers to their daughters nor fathers to their sons in terms of the pecuniary outcomes. But the differences between the rural and urban mother demonstration effects are insignificant. The father demonstration effect for *visit days* in the rural subsample is significantly larger than the corresponding coefficients in the urban subsample with the supporting evidence from Table A.12. This indicates that the gender norm of providing support for the elderly may still be different between rural and urban areas. Although the coefficients for the father demonstration effects of the pecuniary outcomes are insignificant in rural areas in Table 1.9, there may still be gender-role differences concerning the demonstration effects. The heterogeneity check results in Table A.12 support and are mostly consistent with the subsample analysis results.

The urban-rural subsample analysis partially supports my prediction of more mother demonstration effects and fewer father effects in urban areas. Scholars believe that females have higher bargaining power in urban areas in China (Fong, 2002). However, certain urban households where the first-born is a girl would pay the high fine to have a son (Ebenstein, 2010). Lee (2012) and Hu and Shi (2018) find that the human capital investment for boys and girls is not significantly different in singleton households, but the gap is still wide in multiple-child households. Fong (2002) also limits the rising female empowerment in urban China only to daughters in singleton households. I run a simple urban-singleton and other types of household subsample in CHARLS.

I find only significant father demonstration effect in the urban-singleton subsample is the non-pecuniary outcome. In the non-urban-singleton households in the CHARLS, the father demonstration effects are again significant for *any-transfer* and *visit days*. The signs of the mother effects are inconsistent between different outcome variables for the urban-single-$K$ subsample, but all negative and insignificant for the non-urban-singleton subsample in the CHARLS. The CHFS subsample results show significant mother demonstration effects in the urban-singleton group for *any-transfer* and *visit days*. The results for this simple subsample are shown in Tables A.13 in the Appendix and are mostly consistent with Table 1.9. The similar results between urban-rural and urban-singleton subsample results show that the urban-rural difference is a possible explanation for the discrepancies between the CHARLS and the CHFS results, not only driven by the urban-singleton households. But both subsample results only provide a partial explanation for the CHARLS and the CHFS discrepancies, especially for the outcome *any-transfer*.

### Siblings of the parents

Supporting ageing parents is crucial for most males in China owing to the enduring cultural impact of Confucianism. Some people have to support their own parents, regardless of the gender of their children. This is especially true for many males who provide regular support to their own parents. It may also be the case for some females in the second generation if they are the oldest child in their own family or have no older brothers. If people are not fully responsible for the support of their elderly parents and only want to demonstrate the norm of providing support for the elderly to their children, the results may show greater effects from the gender ratio of the children. I use the same regression equations and the identification methods to obtain the separate results for those who with and without older brothers. The results are shown in Table 1.10. The CHFS provides only the number of siblings for the main respondents in households, but no information on his or her rank in the siblings. So this subsample analysis is conducted in the CHARLS dataset only.

The results indicate that, for the probability of providing any support and also the visits paid, the father demonstration effects are all significant for those with older brothers and for those without. The magnitude of all father demonstration effects are larger in the subgroup for people with older brothers, yet the differences are mostly insignificant according to the heterogeneity results in Table A.14. Most of the heterogeneity results are consistent with the subsample effect, except the father effect is significantly larger for $P$ without old brother than those who with. The subsample results suit the predicted results under the demonstration effect channel than the heterogeneity analysis results. But I still cannot draw any conclusions on the subsample check results in this part.

### Pension coverage

In the introduction, I treat family support for the elderly as a complement of the public pension scheme. As Table 1.1 shows, in rural areas where the public pension coverage is low family-provided support for the elderly is the primary source of support of China's elderly according to 48% of the NBS survey respondents. Under the demonstration channel, if parents want to secure future old-age support because they do not have public pension coverage, then parents without proper pension coverage of their own are expected to be more likely to provide more support to their own elderly parents if they have more same-gender children. The demonstration effect will be larger or more significant for parents without any pension coverage, especially for the pecuniary old-age support.

To check this hypothesis, I run heterogeneity-analysis regressions on parents with and without a pension scheme. In the CHARLS, due to the data reconstruction, I have no information on $P$'s pension coverage. However, I can use the occupation of the parents as a proxy for their pension status. The CHARLS provides six categories of occupation for the parents, namely, managers; professionals and technicians; clerks, commercial and service workers; agricultural, forestry, husbandry, and fishery producers; and production and transportation workers. Of these six categories, the agricultural, forestry, husbandry, and fishery producers are less likely to be covered by a pension scheme. I create a dummy, $pensionP$, that equals 0 if a parent is classified as an agricultural, forestry, husbandry, or fishery producer, and 1 otherwise. The results from this heterogeneity analysis are shown in Table 1.11 and they show that the father demonstration effect is larger for parents if they are less likely to be covered by a pension system for the visits paid. But for *amount*, it is the group are more likely to be covered by a pension showing up the father demonstration effect. Yet the difference between the father demonstration effects in the group with pension coverage and without is insignificant for the probability of providing any transfer. The empirical results from the CHARLS only fit part of the description of the relationship between a public pension scheme and family old-age support. It may due to the pension information is not detailed enough in the dataset.

In the CHFS, the information is available for defining the exact pension status of the parents. I create a dummy which equals 1 if a parent is covered by at least one pension scheme, and 0 otherwise. The heterogeneity check results are shown in the last three columns of Table 1.11. Yet mothers both with and without any pension coverage have two out of three negative coefficients corresponding to the mother demonstration effect. The differences between them show that the mother demonstration effects for $P$ without any pension coverage are larger the effects in the other sub-group, although only the difference for *amount* is significant. The CHFS results in Tables 1.11 might provide a piece of suggestive evidence on the relationship between public pension schemes and family support for the elderly suggested previously in the chapter. The conclusion is difficult to draw from the CHARLS results.

### *Han* culture and norm

As discussed in the background section, the norm of providing support for the elderly is closely linked with Confucianism and filial piety. This raises a possible concern: because the culture of Confucianism is well-known in Chinese society, not only do parents teach their children to provide support for the elderly in the future through the demonstration effect, but also the surrounding community, in schools, the neighbourhood, or the media, could shape young children's predilection to provide support to their parents in their old age. *Han* ethnic group is the majority ethnic group in China and filial piety is the key value in the *Han* group. If other channels apart from the parents affect children's preferences regarding old-age support, the demonstration effect from the parents will be smaller or less significant in a *Han*-ethnic dominated community or an exclusively *Han*-ethnic group.

In the community survey questionnaire in the CHARLS, there is information on whether minority ethnic groups are living in the same community that the parents live in. I generate a dummy that equals 1 if there are minority ethnic groups living in the community, and 0 otherwise. From the results in Table A.15 in the Appendix, the father demonstration effect for *any-transfer* and *visit days* in communities with people from minority ethnic groups are significant, yet the differences are insignificant for the fathers in two types of community.

There is no information on the community ethnic composition in the CHFS, but there is detailed information on $P$'s own ethnic groups. So I use this information to check whether *Han* ethnic group are more likely to demonstrate the filial piety to their children than other ethnic groups. I create a *Han* dummy that equals 1 for members of the *Han* ethnic group, and 0 otherwise. In the heterogeneity analysis results in Table A.16 shown in the Appendix, the mother demonstration effects are significant for *Han* ethnic groups in terms of *any-transfer* and *visit days*. The effects are insignificant for non-*Han* group. Yet, the differences are again insignificant. Combining the heterogeneity check results from the CHARLS and the CHFS, it seems that there still are possible mother and father demonstration effects in *Han* ethnic families and communities with other ethnic groups, but these effects cannot significantly distinguish themselves from the corresponding results from the opposite sub-groups.

### Migrants and old-age support

The visibility of old-age support is discussed using different types of transfers. The results seem to show that the demonstration effects are larger when the demonstrative behaviours are easier for $K$ to observe the demonstration behaviours. When discussing the visibility of the old-age support, it is also common to focus on the migrants, especially the rural-to-urban migrants, in China. A lot of migrants work far from their home town, and a large proportion of them are not living together with their young children. Given these circumstances, it is difficult for the migrants to signal the norm of providing old-age support to their children. Thus, if the demonstration effects are the channel driving the results, I would expect the migrant subsample does not show large and/or significant father and mother demonstration effects.

Neither of the data sets provides very clear information on whether an individual is a migrant or not. I use a general definition of migrants for both datasets. An individual is defined as a migrant is one's *hukou* status does not match one's current resident areas. This means a migrant in this part is people with rural (urban) *hukou* status living in urban (rural) areas. I only run the main regressions for the migrant subsample for the CHARLS and the CHFS. Table A.17 shows the subsample results. The results show that the migrants in the CHARLS do not show significant father demonstration effect as the main results in Table 1.3. It implies the visible demonstration effect could be the right channel explaining the main results for the CHARLS. However, the results for the CHFS in Table A.17 imply the opposite interpretation. The migrants in the CHFS show large and significant mother demonstration effects for all three main outcomes. Female migrants increase the probability of proving any transfer, the amount of transfers and also visits paid to their own-parents with more daughter in their own households. The results from CHFS do not seem to support the argument that the demonstration effect is the channel behind the main results from the CHFS.

Different types of migrants in the CHFS and the CHARLS are one of the possible explanations for the different results generated from the migrant subsample. 75% of the migrants in the CHFS have *hukou* that belongs to the county where their current residence place. This means that most of them are intra-county migrants, so they can easily commute between their hometowns and their workplaces. It is relatively easy for them to demonstrate the norm of old-age support to their children compared to inter-county or even inter-province migrants. On the contrary, the statistics in the CHARLS show that 67% of migrants are working in another county or province. The commuting costs are high for these inter-county or inter-province migrants, so it is less likely for them to go back to their home town frequently and signal the old-age support behaviours to their children.

The CHFS also provides information on whether a migrant $P$ lives together with one's children and/or own parents. Thus, I further separate the migrant subsample into two different samples: migrants living with their children but without their parents, and migrants living without their children and parents. The main regressions run on these two samples, and the results are in Table A.18. The results imply that females increase the visits paid to their own-parent with more daughters in their own household for migrants living with their children but without their parents. But this effect is not significant for migrants living without their children and their parents. This could suggest that at least part of the mother demonstration effects are significant in the migrant sample may due to female migrants take their children to visit their own parents, which makes the provision of non-pecuniary old-age support more visible to their children. Other mother demonstration effects for the financial support are similar in these two different migrant subsamples, which, again, the intra-county migrant behaviour is one of the possible explanation for the significant effects.

## 1.4 Robustness check

### 1.4.1 Mechanism check

There are other different channels that may explain the effects of children on the support for the elderly provided by their parents. Testing the subsamples may show what are the main drivers behind the effects of children's gender on the parents' support for the elderly provision. In this section, I also check other mechanisms discussed in the literature review section and try to disentangle the demonstration effects from other possible mechanisms. I first discuss the channels of altruism and direct reciprocity that may affect my empirical results and go on to discuss the effectiveness of the demonstration effect.

**Education investment in $K$**

The difference in the education investment in the children could be one of the possible explanations for the mother demonstration effect. The significant mother demonstration effect in the CHFS may result from the fact that mothers with daughters are less likely to invest in their daughters' human-capital such that they can provide more for their parents. However, this argument does not work for the father demonstration effects because human capital investments in sons in China are on average higher than the investments in daughters, except for urban singleton households (Fong, 2002). In addition, I run the main regressions on three new outcome variables that indicate the education investment for $K$.

Only the CHFS offers information on the education investments in $K$. The evidence from the CHFS is shown in Table A.19. It shows that, at least in the CHFS, mothers with more daughters increase the amount of education investment and the percentage of education investment in the household expenditure, and decrease the probability of investing in $K$'s education, controlling for the household size. For fathers with the household size fixed, with more sons, they increase the probability of investing in $K$'s education and decrease the amount of education investment and the percentage of education investment in the household expenditure. From the results, the gender of $K$ affects the total amount of education investment and the probability of providing education investment in different ways, so I cannot draw the conclusion on whether mothers and fathers invest more on their daughters or their sons. So the possibility of the different education costs in sons and daughters of $P$ might not be the main channel working for the mother demonstration effect found in the CHFS results.

**Altruism and Direct reciprocity channel**

The first possible mechanism is altruism. If the main mechanism is pure altruism, the only reason behind the parents providing support to their own elderly parents is that these parents are poor and in need of help. There should not be any significant coefficients for the gender of the adult children, the gender ratio of the children or their interaction term after controlling for the income of the elderly parents in the regression. I run heterogeneity checks on the elderly parents' income-level as included in the CHARLS. In the sample, most of the elderly parents observed have no income, so I create a dummy $income\ of\ O$ which equals 1 if the elderly parents have some income, and 0 otherwise. The results are shown in Table 1.12. They reveal that, for *any-transfer* and *visit days*, the father effect is significant for elderly parents without any income, whereas for the high-income group, the effects are positive but insignificant except for the father effect for *visit days*. However, the key is that the difference between these two groups is also insignificant. I may draw the conclusion that there is a certain degree of altruism among the motives of providing support to one's elderly parents, but it is not the main channel working behind the empirical results in this chapter.

Another mechanism discussed in the previous section is direct reciprocity. One kind of direct reciprocities in the context of old-age support is the parents' desire to support ageing parents to repay the investment in their childhood. I name this kind of direct reciprocity as sequential direct reciprocity. It may also explain why females provide less support to the elderly to their parents because, according to the CHARLS, they did not get enough financial or non-financial investment from their parents during their childhood. Only the CHARLS includes this type of information, so I use only this dataset to check this mechanism.

If sequential direct reciprocity is the only channel for old-age support to flow along, then controlling in the regression for the same financial and non-financial investment received by the parents in their childhood should confirm that males and females in the $P$ generation should provide the same amount of old-age support. Moreover, the gender of the children should not have different effects on the transfers provided by the parents. I control for different variables that indicate the financial investment and non-financial investment the $P$ received during their childhood in the regression. The results are shown in Table 1.13. There are two variables represent the time investment (non-financial support) during the parents' childhood. *awaytime* is the variable representing how long a $P$ has been away from his or her parents in childhood, and *awayage* indicates the age when the parent left her/his parents.

The *log edu expense* indicates the financial investment in education that $P$ received in their childhood. I also show the coefficients for *edu level* in the table, which is the education level controlled in the main regression. It is another indicator of the size of the financial investment. Table 1.13 shows that, after controlling for the non-financial, financial investment, and their interaction terms with *maleP*, the coefficients that represent the demonstration effect are still similar to the results in Table 1.4. With most of the coefficients representing the father demonstration effect being still significant, it also suggests that the same-gender demonstration effect also works as one of the potential channels. Most of the coefficients including *awaytime*, *awayage*, *log edu expense*, *edu level*, and their interaction terms with *maleP* are insignificant as well. In addition to the results in Table 1.13, the CHFS main results may also demonstrate that this sequential direct reciprocity channel is not the main mechanism. In general, mothers provide more to their own parents in the CHFS than fathers, given the fact that females on average have a lower education level than males.

Another direct reciprocity channel works through the transfers from the elderly parents to the parents in the same period. This is a type of non-sequential direct reciprocity. In the previous regressions in the CHARLS and the CHFS, I control the transfer from the elderly parents to the parents. This variable would, in theory, have positive effects on the outcome variable, and vice versa. I also control for the time that the elderly parents spend on taking care of the children of the parents and also the transfer to the children in the regressions in the CHARLS. For the robustness check, I show the regression results without these controls in Table A.20, also their corresponding coefficients in Table A.21. The key results are similar to the main results, except for the mother demonstration effect for *any-transfer* in the CHFS. The coefficients for these transfers exhibit positive father and mother demonstration effects on the transfers provided.

The rationale behind the non-sequential direct reciprocity is that if the parents with more same-gender children receive more from their elderly parents than those receiving less, then they also provide more old-age support. However, when I run the same regression on the transfer received by the parents from their elderly parents, the CHARLS results appearing in the second column of Table 1.14 show that people who provide more to their elderly parents, namely fathers with more sons, receive less. Also, for the CHFS in the fourth and the fifth column of Table 1.14 show the fathers, who are more likely to receive transfers from their parents with more sons, are not more likely to provide transfer to their parents. Also, in the CHFS, mothers increase the probability of old-age support provision with more daughters but are less likely to receive transfers from $O$. The results may fit the explanation by Li et al. (2010): the elderly parents may show more altruism toward their adult children, which are $P$, who do not provide more transfer than others, rather than expecting commensurate paybacks from the parents who receive their support. To conclude, the non-sequential direct reciprocity may exist, but there is still room for the proposed mechanism: the demonstration effect.

The CHARLS results in Table A.21 show that the coefficients for both time and financial transfer from elderly parents to their grandchildren are positive for most of the outcome variables. This may suggest another form of indirect reciprocity. The elderly can transfer to their favourite grandchildren. If the favourite grandchildren receive more, their parents (the parent generation) are more likely to provide support to the ageing parents, $O$, in return. This type of indirect reciprocity has no time lag for the payback, unlike the demonstration effect studied in the present paper. Usually, the preferred grandchildren are grandsons. This could be one of the explanations of the father demonstration effect in the CHARLS. If the indirect reciprocity works in this way, male parents with more sons should have more transfers from their elderly parents to their sons. However, the third column of Table 1.14 shows that, statistically, male $P$'s sons do not receive more than daughters of males with more daughters. These grandchildren gender effects are not significant for transfers from elderly parents. Thus, it is less likely to be the main channel driving the main results observed.

### Effectiveness of the demonstration effect

Apart from verifying the possible channels, I also have to test for the effectiveness of the demonstration effect in the datasets. The parents expect their children to provide support to them in the future. The previous results imply only that the parents demonstrate filial piety to their children, but they do not show whether the children actually go on to provide old-age support to their parents in the future. Using the CHARLS dataset only, I obtain the information on support in old age that is provided by the elderly generation to their own parents, who are the grandparents of the parent generation. I run a simple OLS regression to regress the upward-transfers of males and females among the elderly parents to their own parents on the outcome variables used for the CHARLS results. I run the regression separately for male and female parents. The types of transfer provided by the elderly parents to their own parents on the left-hand side of the equation also match the corresponding dependent variables. Take, for example, the regressions for $log(regular)$, two key regressors, *father's transfer* and *mother's transfer*, these are the logarithm amount of the regular transfer provided by the father and mother of the present parents' generation to their own parents in an earlier sequence. The outcome variables are the probability of providing any, regular, and non-regular transfer, and the logarithm of the amount of regular and non-regular transfer. The control variables are the same as the controls in Table 1.2. One extra control that I have for the particular regressions is the average self-reported health of the grandparents of the parents. The health problems of $P$'s grandparents may affect the support provided.

To simplify the description of the results, I continue to use the $O$, $P$, and $K$ setting in this part. The results are combined in Table 1.15. The key regressors for male and female $P$ panels are *father's transfer* and *mother's transfer*. For male and female $P$, the demonstration effects seem to take into account the effects from the same gender channel: females are more affected by the support for the elderly provided by their mothers than their fathers'. The converse is partially true for males. The same-gender demonstration effect is more significant for female members of $P$ than the cross-gender demonstration effect. The magnitude and also the significance level for *father's transfer* are much smaller than the *mother's transfer* for female $P$; while for males $P$, the difference is not large. The results show that if the members of $O$ provide more to their parents, they are more likely to receive more from $P$.

### 1.4.2 Panel results: Event study

The main regression results mainly show the cross-sectional empirical evidence of the demonstration effect. The conclusion will be more convincing if there is empirical evidence from a panel dataset. Both the CHARLS and the CHFS are longitudinal datasets, but CHARLS does not provide information on the gender composition of the children for the whole sample in the 2013 and 2015 wave. The CHFS contains this necessary information in the 2011, 2013, and 2015 wave. The reason for using this three-wave dataset is to gain more yearly data before and after the event. The drawback of using the CHFS is that I can only test the demonstration effect on one consistent outcome variable - the probability of providing old-age support - for three different waves. Together with the limited number of waves in the CHFS, I use only the panel result as a robustness check for the main results.

To examine the yearly effect of having a son or a daughter on old-age support, I use the event study approach. The event is the birth of the first child. The event usually causes sharp changes in several outcomes for the parents, especially labour market outcomes (Kleven et al., 2018). I apply a similar event study approach to that used by Kleven et al. (2018) and aim to show even possible causal results in the event study approach. In the three-wave panel dataset, the sample is still limited to household respondents. Given the event study approach setting and the limited number of waves for the data, the panel sample includes only those respondents whose first child was born between 2011 and 2015. For each household respondent, I set the event time $e = 0$ for the year in which the respondent has his or her first child. The value of other years is set relative to the $e = 0$ year. Using the specification in Kleven et al. (2018), the regression is:

$$y_{ite} = \sum_j \alpha_j \times \mathbf{I}[j = e] + \sum_k \beta_k \times \mathbf{I}[k = age_{it}] + \sum_l \gamma_l \times \mathbf{I}[l = t] + \varepsilon_{ite}, \tag{1.2}$$

where $i$ stands for individual $i$, $t$ for wave $t$, and $e$ for the event time $e$. $y_{ite}$ is the probability of providing support to elderly parents. $\mathbf{I}[j = e]$ represents the event time dummies, $\mathbf{I}[k = age_{it}]$ is for the age dummies, and $\mathbf{I}[l = t]$ is the wave fixed effects. By controlling the age dummies, I can control the non-parametrical underlying life-cycle trend (Kleven et al., 2018). I run this regression separately for four different groups: fathers with a first son (father-son), fathers with a first daughter (father-daughter), mothers with a first son (mother-son), and mothers with a first daughter (mother-daughter). Then I compare the results for the parents within a certain gender and observe that the effect of having a first son/daughter on the father/the mother. The reason why the results may be causal is that I examine the variation in the results caused by the gender of the first child. As noted in the previous section, the gender of the first child is almost exogenous. In addition, the timing of the birth for the first child is after 2003, which is after the ban on the use of ultrasonography techniques for sex-detective abortions. The regression results are shown in Table 1.16. The sample size for each group is around 800 observations, which also indicates that the gender of the first child in the event study sample is satisfactorily balanced.

The graph for the plot of the event time dummies coefficients is shown in Figure 1.5. The graph on the left shows the difference between fathers with a first son and fathers with a first daughter. The right graph is the difference between mothers. After the birth of a first child, the mothers with a first daughter provide more than those with sons, whereas the differences between fathers are relatively small. For the pre-trend of the event study, I can only observe one period before the birth of the first child in the panel dataset due to the limitations of the data. But from this one-period pre-trend result, it seems that for mothers and father, the pre-trend differences are insignificant. Lack of the pre-trend time period will affect the validity of the inference and the causality of the event study results. But the results may provide some insights into the effects of the gender of the children on the old-age support provided by their same-gender parents.

There is a concern that the mother demonstration effect from the event study takes off from the birth year of the child. For the demonstration effect, $K$ have to observe the corresponding behaviour of their same-gender $P$. More likely to provide old-age support during the very early stage of $K$'s life (age 0-2) would not help with the interpretation of the demonstration effect. However, the birth of a new child is a big change in household composition. According to Heath and Tan (2018), “a daughter raises her mother's participation in household decisions”, and the mothers with daughters would seek more female autonomy in their households. With a newborn girl in the family, it is likely that the mother realises that she needs to start to participate more in the decisions on the household resources allocation and to provide more old-age support to her own parents, so she could affect her daughters' norm formation later and receive more old-age support in her old age.

It is also possible that a mother with a newborn daughter will receive more support from her own parents. However, the transfers from the elderly are not included in the construction of the outcome variables used in the main regressions. I change the transfer outcome variables to net transfer variables. If $any\text{-}transfer$, *regular* or *nonregular* equals 1 and the parents receive the transfers from or are living together with their elderly parents, I change the corresponding value to 0. For the amount of transfer, I use the net transfer provided by the parents, which is the amount of transfer provided to the parents minus the amount of the transfer received by them from their elderly parents. The change is made for both datasets. The results for the net transfers are shown in Table A.7. They are consistent with the main results, except for the negative father demonstration effect for $any\text{-}transfer$ in the CHFS. The magnitudes of the demonstration effect also increase beyond the main results.

## 1.5 Welfare analysis

### 1.5.1 "Missing women" and the old-age support

As pointed out by Qian (2008), the future income of children will affect their gender ratio, and parents expect in their old age to receive support from their children . My empirical results show the causality of the support for the elderly provided by the parents and the gender of their children. It may be possible to draw some inferences on the correlations between the support for the elderly and the gender of children from the literature and my results. The results in the chapter show that, in rural areas, males provide more in general, and the effects are more persistent for households with consistent male heirs over several generations. I may be able to argue that support for the elderly is at least correlated with the gender ratio, or the "missing women" in China may be correlated with the demand for support in old age. I follow Oster's method in 2005. She calculates the number of "missing women" in China due to hepatitis B infection. She estimates the effect of prevalent hepatitis B on the male-female gender ratio and calculates the hepatitis B-adjusted gender ratio using the percentage of the population infected with hepatitis B. She draws the conclusion that hepatitis B accounts for 75% of the "missing women" in China. Her results are not entirely accurate due to the data that she collected, but her method provides a reasonable estimation strategy to evaluate how much the unbalanced gender ratio can be correlated with hepatitis B infection. I use her method of estimation to measure the possible correlation between the "missing women" and the need for support in old age.

I use the CHFS to conduct the estimation.[25] One of the advantages of using the CHFS is that the dataset provides people's attitudes on family, children and support for the elderly. There are two relevant questions in the survey: "Do you prefer daughters or sons?" and "Who do you think is responsible for your care in old age?". I created a dummy that equals 1 if people prefer sons and believe that their children should be responsible for supporting their elderly parents and 0 otherwise. I obtain the mean of this dummy in the full sample in the main regressions, the urban subsample and rural subsample. Running the dummy on the gender ratio of the children, the coefficient for the dummy, which is the prevalence of old-age support, is shown in the second

[25]The CHARLS does not contain many questions on people's ideology, so I cannot distinguish those who have a preference for sons from whose who do not.

column of Table 1.17. Then I calculate the estimated gender ratio on the sole basis of the prevalence of support for the elderly shown in the third column. Given that the natural male-to-female gender ratio (1.049) and the percentage of people who prefer sons and who believe that their children should be responsible for their old-age support, I calculate the adjusted gender ratio in Column 5.[26] The equation for the adjusted gender ratio is $GR_{adjust} = GR_{old-age} \times percentage_{old-age} + GR_{nonold-age} \times (1 - percentage_{old-age})$ (Oster, 2005). The percentage of the gender ratio correlated with the needs of the future support for the elderly is listed in the last column. From the estimations, around 12%-18% of the unbalanced gender ratio is correlated with the needs for support in old age. 17.23 million Chinese babies were born in 2017, and the medium gender ratio for 2015-2017 is 1.150 according to the world population prospects in 2017.[27] If people conduct gender selections to secure future support in their old age, the number of "missing girls" due to this would have been around 93,000 in 2017.

## 1.6 Conclusions

The existence of a younger generation plays an essential role in parents' decisions on the support that they provide for the elderly. This chapter finds that the gender of the children in China affects the support for the elderly provided by their parents. The parents are more likely to provide more financial and non-financial support to their ageing parents when they themselves have more same-gender offspring, which is the demonstration effect. However, the demonstration effects by mothers and fathers are exhibited in different areas in China. Rural areas show the father demonstration effects while mother demonstration effects appear in urban areas. The urban-rural difference may be due to female empowerment in urban areas, but this needs to be verified by future studies. The demonstration effect is a way for the norm of providing support in old age to be conveyed to future generations. The intergenerational transmission of norms is also gender-specific.

This chapter predicts that support for the elderly provided by a father increases when more sons in his family and when he has greater bargaining power than his wife, fixing his household size constant. The support for the elderly provided by mothers increases with the advent of more daughters and when mothers earn more income. The empirical results of the gender ratio for the household's children match the predictions of the model in the next chapter. In China, urban females have more bargaining power in their households than females in rural areas have. The findings indicate that the mother demonstration effect mainly shows up in the dataset with more urban

[26]The percentage of people who prefer daughters or who have no preference, and who believe that their children should be responsible for their support in old age is 34.38% for the full sample, 47.48% for the rural subsample and 18.39% for the urban subsample.

[27]The source for these data can be accessed through the following websites: https://www.statista.com/statistics/250650/numberof-births-in-china and http://data.un.org/Data.aspx?d=PopDiv& f=variableID%3A52.

samples. The heterogeneity analysis for the urban households further suggests that the assumption of intra-household bargaining is valid. The theoretical model that support the empirical results is in Chapter 2.

The empirical evidence shows that the gender of the parents and their children in China jointly affect the likelihood and the amount of old-age support, both financial and non-financial, that they provide. The story behind this is more complicated than any pure gender effect from the children. The proposed mechanism, with the same-gender intergenerational transmission, is indirect reciprocity, or the demonstration effect. It carries the social norm of providing private support for the elderly across the generations. Given the heavy financial burden of the public pension system facing the central government in China, the government has realised that private support for the elderly is a crucial complement to the public pension. In 2017, the central government started a pilot implementation of "homebased old-age care services". One of the expected goals of this pilot implementation is to collect information on the demographics of all households with ageing parents and use the information to set future policies or incentives for completing the home-based system of care services for old people.[28] The empirical results in the present paper can offer some insights into the demographics of those who provide or do not provide support to their ageing parents: policy-makers could introduce diverse incentives in order to target different groups. The rural-urban discrepancies in the results will also help the government to set targeted policies in rural and urban areas.

Although the Chinese government has become aware of the importance of private support for the elderly and has started to promote "filial piety", there may be a hidden hazard behind this action. As this chapter shows, sons in rural areas in China provide more support for the elderly than daughters do. The previous literature also states that economic incentives, especially old-age support, provide one reason for sex selection before birth (Qian, 2008; Ebenstein and Leung, 2010). The gender ratio might stagnate at a high level, to create a damaging equilibrium. The government needs to promote gender equality by legislating to protect the right of females to inherit, own property and compete in the labour market, especially in rural areas. In urban areas, there is already a healthier balance in the gender ratio of new-borns. Mother demonstration effects showing in urban areas alone may also be due to female empowerment and higher bargaining powers in the household for females. More research is needed to confirm this possible mechanism.

[28]Website: http://xinhuanet.com/gongyi/yanglao/2017-04/17/c_129543350.htm

## 1.7 Figures and Tables

Figure 1.1: Public service announcement posters in China

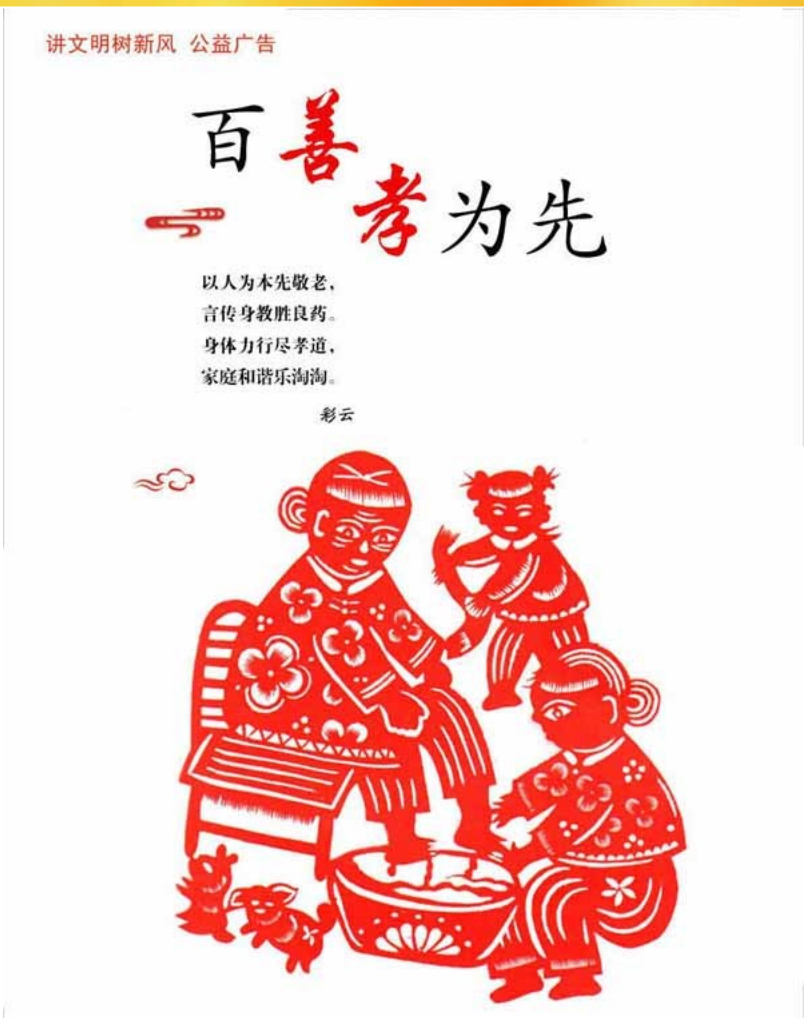
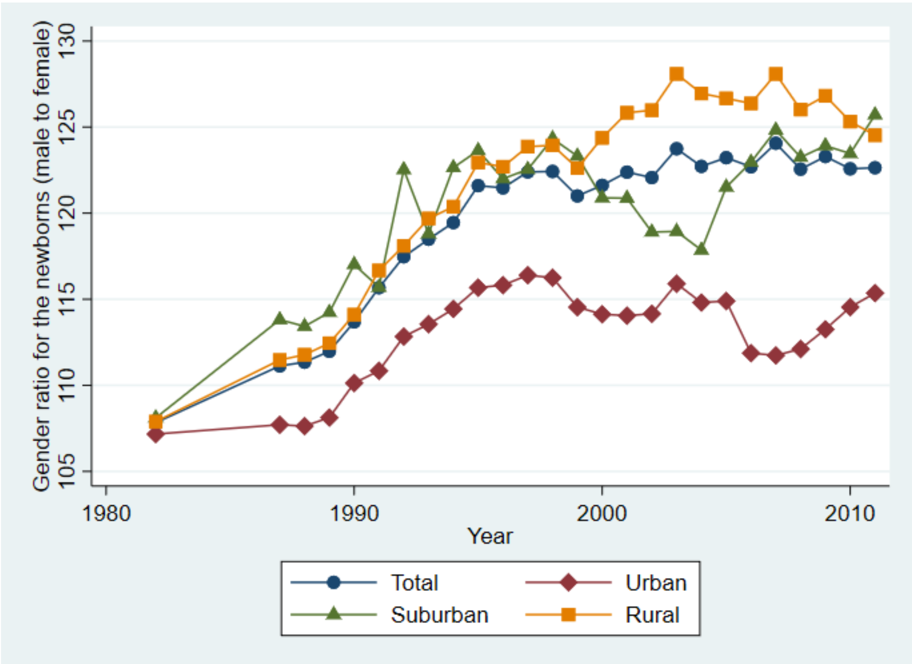
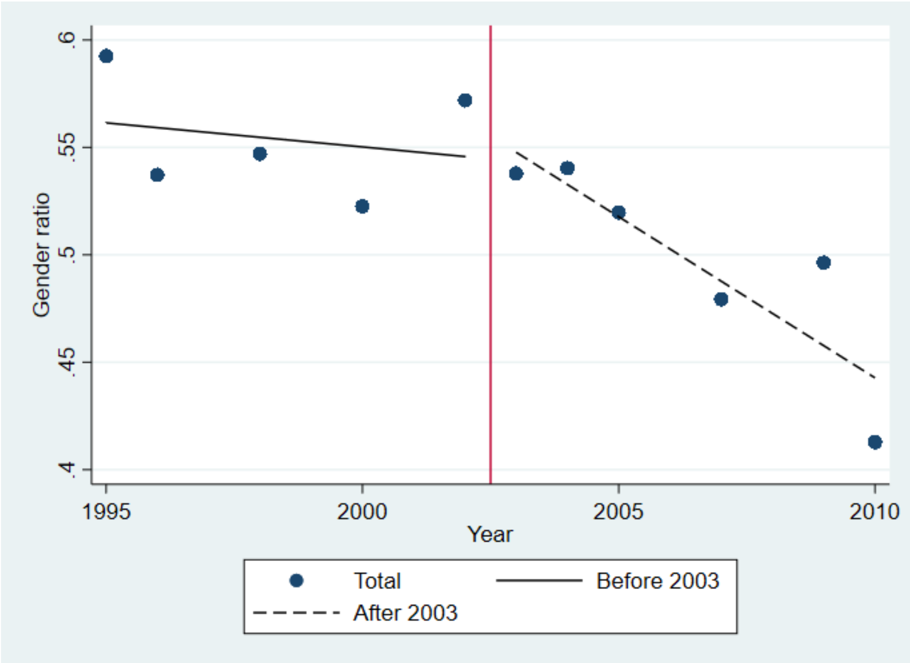



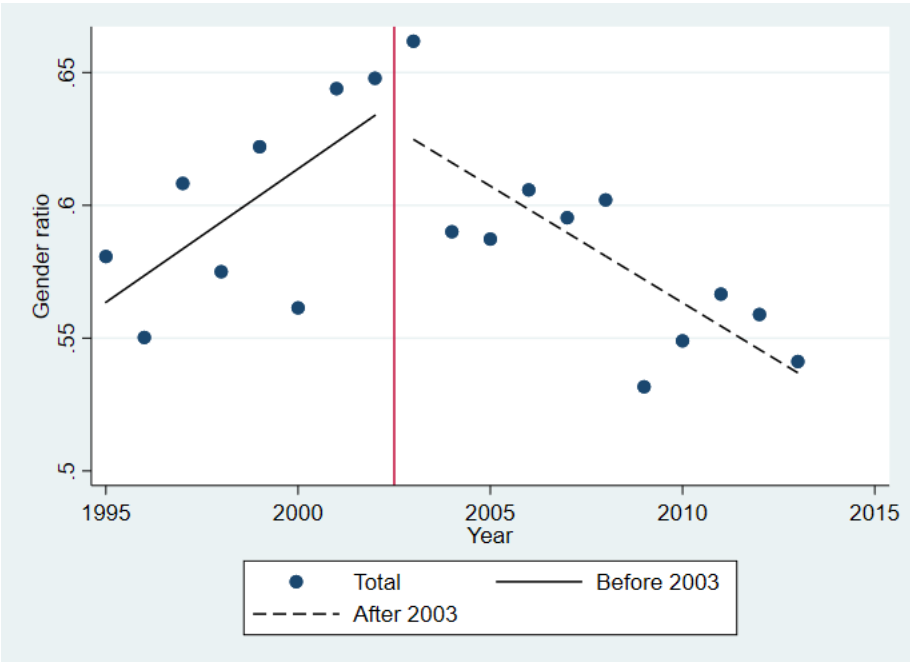
Figure 1.2: Actual gender ratios for the newborns in China: the yearly trend




Note: The information is obtained from the China Population and Employment Statistics Yearbook. 1982-2011. $y$-axis is the male to female gender ratio for the newborns (female=100). $x$-axis is the year 1982 to 2011. The yearly trend started in 1987. The circle dot is the national male to female gender ratio. The diamond dot represents the male to female gender ratio in urban areas only. The triangle and square dots are for the male to female gender ratio in township (suburban) areas and rural areas respectively.

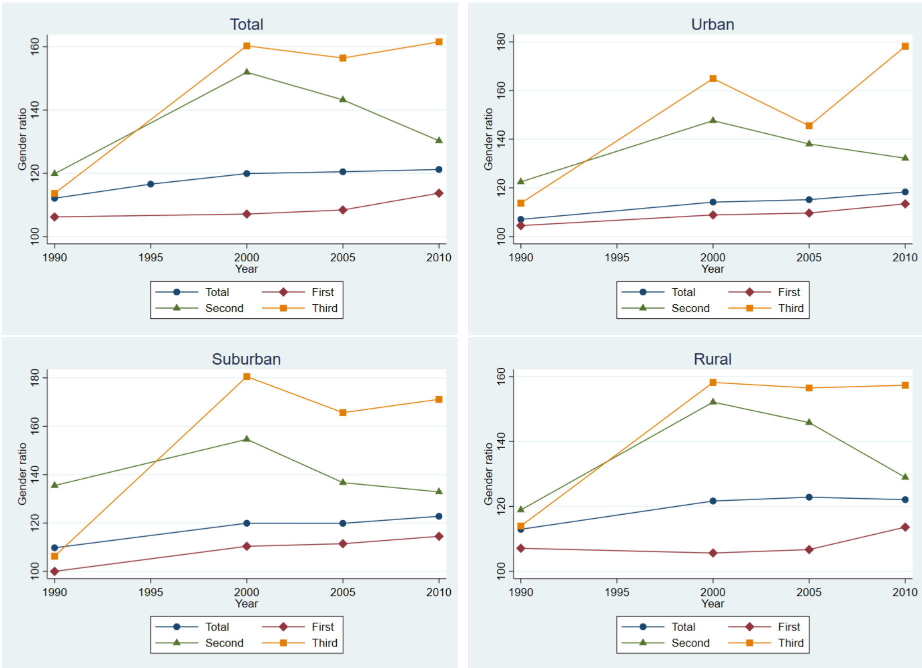
Figure 1.3: Estimated gender ratios for the newborns in China: the yearly trend



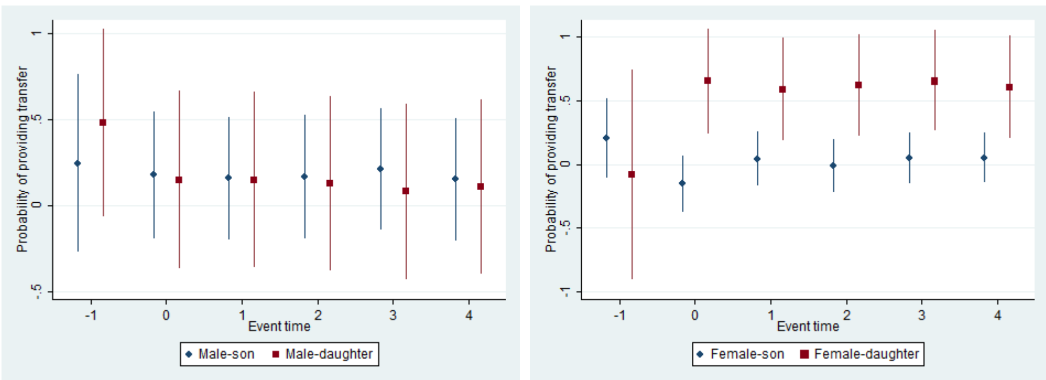

Note The graphs are the estimated male-to-female gender ratio for the newborns in China using the 2011 CHARLS wave (above), and the estimated male-to-female gender ratio for the first-born child in the 2013 CHFS wave (below). $y$-axis is the male-to-female gender ratio (male newborns divided by the total number of newborns). $x$-axis is the year from 1995 to 2011 for the CHARLS and from 1995 to 2013 for the CHFS. The dots represent the estimated gender ratio for each year. The red vertical line represents the implementation of the policy ban on gender-selective abortion. The solid line is the linear estimation of the gender ratio trend before 2003, and the dashed line is the estimated linear trend after 2003.

Figure 1.4: Actual gender ratios for the newborns in China: by birth order




Note: The information is obtained from the National Population Census. 1990, 1995, 2000, 2005 and 2010. The figure shows four graphs on the male-to-female gender ratio (female=100) of the new-borns by different birth orders. From left to right, the graphs show the gender ratios in China, urban areas, township (suburban) areas, and rural areas. The circle dot is the overall gender ratio. The diamond dot represents the ratio for the first-born children. The triangle and square dots are for the male to female gender for the second-born and the third-born children respectively.

Figure 1.5: Impact of the gender of the first child on the probability of providing any old-age support




Note: The graphs are the plot of the coefficients in Table 1.16. $y$-axis is the probability of providing any transfer to $O$, and $x$-axis is the event time. The event is the birth of the first child in households. The graph on the left is the coefficients for males and the right graph is the results for females. The diamond dot coefficients represent people with first child as a son. The square dot coefficients are for people with first child as a daughter. Due to data limitation, I can only get one period before the event in the panel dataset.

Table 1.1: Primary source of support of China's elderly, 2005 and 2010

2005

| | *Urban* | | | *Rural* | | |
|---|---|---|---|---|---|---|
| *Source of support* | Average | Male | Female | Average | Male | Female |
| Labour income | 13.0 | 18.4 | 7.9 | 37.9 | 48.5 | 27.5 |
| Pensions | 45.4 | 56.9 | 34.6 | 4.60 | 8.1 | 1.3 |
| *Dibao* | 2.4 | 1.8 | 2.9 | 1.3 | 1.8 | 0.9 |
| Insurnace and subsidy | 0.3 | 0.3 | 0.2 | 0.1 | 0.2 | 0.0 |
| Property income | 0.5 | 0.5 | 0.5 | 0.2 | 0.2 | 0.1 |
| Family support | 37.0 | 20.7 | 52.3 | 54.1 | 39.3 | 68.5 |
| Other | 1.5 | 1.4 | 1.6 | 1.8 | 2.0 | 1.7 |

Source: NBS, 2006. Most significant share of support reported.

2010

| | *Urban* | | | *Rural* | | |
|---|---|---|---|---|---|---|
| *Source of support* | Average | Male | Female | Average | Male | Female |
| Labour income | 6.16 | 9.72 | 3.75 | 41.18 | 50.53 | 32.14 |
| Pensions | 66.30 | 74.21 | 58.99 | 4.60 | 7.19 | 2.09 |
| *Dibao* | 2.33 | 1.76 | 2.87 | 4.48 | 5.14 | 3.85 |
| Insurnace and subsidy | - | - | - | - | - | - |
| Property income | 0.68 | 0.75 | 0.62 | 0.19 | 0.21 | 0.16 |
| Family support | 22.43 | 12.13 | 31.95 | 47.74 | 35.13 | 59.93 |
| Other | 1.64 | 1.44 | 1.83 | 1.81 | 1.79 | 1.83 |

Source: NBS, 2011. Most significant share of support reported.

Table 1.2: Summary statistics: Key variables

| | CHARLS | | | | CHFS | | | |
|---|---|---|---|---|---|---|---|---|
| VARIABLES | Mean | Std. Dev. | Min | Max | Mean | Std. Dev. | Min | Max |
| whether $P$ provides | | | | | | | | |
| any transfers | 0.284 | 0.306 | 0 | 1 | 0.265 | 0.441 | 0 | 1 |
| regular transfer | 0.105 | 0.272 | 0 | 1 | - | - | - | - |
| non-regular transfer | 0.243 | 0.308 | 0 | 1 | - | - | - | - |
| amount of | | | | | | | | |
| total transfer | 831.2 | 4598.6 | 0 | 100000 | 599.2 | 1649.8 | 0 | 10,000 |
| regular transfer | 354.6 | 3873.1 | 0 | 100,000 | - | - | - | - |
| non-regular transfer | 476.6 | 3065.6 | 0 | 100,000 | - | - | - | - |
| visit days | 118.7 | 2.374 | 0 | 365 | 91.66 | 145.4 | 0 | 365 |
| gender of $P$ | 0.513 | 0.500 | 0 | 1 | 0.499 | 0.500 | 0 | 1 |
| gender ratio of $K$ | 0.562 | 0.405 | 0 | 1 | 0.567 | 0.416 | 0 | 1 |
| household size of $P$ | 3.643 | 0.774 | 2 | 10 | 3.662 | 0.889 | 2 | 11 |
| age of $P$ | 39.73 | 9.287 | 21 | 65 | 48.17 | 10.71 | 21 | 65 |
| income level of $P$ | 5.078 | 1.420 | 1 | 11 | - | - | - | - |
| income of $P$ | - | - | - | - | 21779 | 43639 | 0 | 1649439 |
| education of $P$ | 0.892 | 0.496 | 0 | 2 | 0.832 | 0.646 | 0 | 2 |
| whether $P$ has a rural *hukou* | 0.680 | 0.466 | 0 | 1 | 0.546 | 0.498 | 0 | 1 |
| $P$ living in rural areas | 0.652 | 0.476 | 0 | 1 | 0.332 | 0.471 | 0 | 1 |
| No. of siblings of $P$ | 3.758 | 1.612 | 1 | 10 | 3.218 | 1.856 | 0 | 16 |
| marital status of $P$ | 0.998 | 0.040 | 0 | 1 | 0.763 | 0.425 | 0 | 1 |
| professional title/occupation of $P$ | 0.105 | 0.547 | 0 | 4 | 0.902 | 1.717 | 0 | 8 |
| any transfers from $O$ | 0.037 | 0.190 | 0 | 1 | 0.144 | 0.351 | 0 | 1 |
| average education level of $O$ | 2.898 | 1.665 | 1 | 9.5 | 1.894 | 1.104 | 0 | 7 |
| $P$'s ranking in siblings | 2.391 | 1.396 | 1 | 10 | - | - | - | - |
| working status of $P$ | - | - | - | - | 0.688 | 0.463 | 0 | 1 |
| distance from $O$ | 3.265 | 1.837 | 0 | 7 | - | - | - | - |
| gender of household head of $O$ | 0.439 | 0.496 | 0 | 1 | - | - | - | - |
| average age of $O$ | 63.94 | 10.441 | 42 | 101 | - | - | - | |
| No. of $O$ alive | - | - | - | - | 1.230 | 0.929 | 0 | 2 |
| average working status of $O$ | 0.568 | 0.453 | 0 | 1 | - | - | - | - |
| average pension of $O$ | 0.185 | 0.388 | 0 | 1 | - | - | - | - |
| who should support $O$ | 1.626 | 1.042 | 1 | 5 | - | - | - | - |
| have $O$ retired | 1.875 | 0.301 | 1 | 2 | - | - | - | - |
| whether $O$ are party members | - | - | - | - | 2.086 | 0.9291 | 0 | 3 |
| whether $O$ have deposit | 0.137 | 0.347 | 0 | 1 | - | - | - | - |
| *hukou* status of $O$ | - | - | - | - | 2.086 | 0.9291 | 0 | 3 |
| household income of $O$ | 157661 | 4336359 | 0 | 2.00e+8 | - | - | - | - |
| hours of $O$ taking care of $K$ | 530.901 | 1816.5 | 0 | 17136 | - | - | - | - |

Table 1.3: The demonstration effect on the provision of old-age support: OLS

| | OLS: CHARLS (mostly rural) | | | OLS: CHFS(mostly urban) | | |
|---|---|---|---|---|---|---|
| VARIABLES | *any-transfer* | *amount* | *visit days* | *any-transfer* | *amount* | *visit days* |
| *maleP* | 0.0104 | -95.90 | 14.51*** | -0.0325** | -99.75 | 23.70*** |
| | (0.0281) | (233.8) | (5.201) | (0.0153) | (63.95) | (6.275) |
| *sex_ratioK* | 0.00471 | -7.627 | -4.680** | -0.0119 | -38.61 | -1.326 |
| | (0.0172) | (136.6) | (2.352) | (0.00968) | (51.97) | (3.441) |
| $maleP \times sex\_ratioK$ | -0.0108 | 271.2 | 10.39*** | 0.00977 | 41.14 | 6.089 |
| | (0.0215) | (175.7) | (3.853) | (0.0116) | (62.96) | (5.324) |
| *hh-size* | -0.00910 | -12.69 | -4.398** | -0.00527 | -20.49 | -7.979*** |
| | (0.0129) | (89.94) | (1.829) | (0.00527) | (18.53) | (1.263) |
| $maleP \times$ *hh-size* | -0.000565 | 327.5** | 12.22*** | -0.00299 | 30.36 | 14.73*** |
| | (0.0120) | (152.5) | (2.837) | (0.00675) | (24.30) | (2.843) |
| $sex\_ratioK +$ | -0.006 | 263.6* | 5.713* | -0.002 | 2.535 | 4.762 |
| $maleP \times sex\_ratioK$ | (0.013) | (142.8) | (3.251) | (0.009) | (38.86) | (4.208) |
| $P$ demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| $O$ demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 12,232 | 12,232 | 12,232 | 19,509 | 19,509 | 19,509 |
| R-squared | 0.205 | 0.050 | 0.628 | 0.282 | 0.203 | 0.168 |
| Mean | 0.401 | 831.2 | 118.7 | 0.303 | 489.1 | 91.66 |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. *maleP* is the gender of $P$. *sex_ratioK* is the gender ratio of $K$ in the household of $P$ and represents the mother demonstration effect. $sex\_ratioK + maleP \times sex\_ratioK$ shows the father demonstration effect. The three outcome variables are the dummy indicating whether parents provide any financial transfer to their elderly parents (*any-transfer*), the amount of any transfer provided (*amount*), and the number of days spent on visits paid to their elderly parents per year (*visit days*). The key controls are $P$'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from $O$, and $O$'s transfer to $P$, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of $O$ taking care of $P$'s $K$, depending on the availability of the information in the CHARLS and the CHFS. The standard error is clustered at the prefectural city level for the CHARLS and the cluster-level is the province-level in the CHFS.

Table 1.4: The demonstration effect on the provision of old-age support: IV

| | IV: CHARLS (mostly rural) | | | IV: CHFS(mostly urban) | | |
|---|---|---|---|---|---|---|
| VARIABLES | *any-transfer* | *amount* | *visit days* | *any-transfer* | *amount* | *visit days* |
| *maleP* | -0.0802 | -230.5 | -29.89*** | -0.0518 | -237.7 | -3.363 |
| | (0.0499) | (316.5) | (11.24) | (0.0448) | (173.5) | (16.57) |
| *sex_ratioK* | -0.0450 | -273.3 | -4.315 | -0.0733** | -96.20 | -46.92*** |
| | (0.0437) | (399.4) | (7.493) | (0.0343) | (135.4) | (10.82) |
| *maleP* × *sex_ratioK* | 0.125** | 472.9 | 76.49*** | 0.0412 | 259.2 | 49.37** |
| | (0.0579) | (442.2) | (14.13) | (0.0645) | (291.9) | (24.53) |
| *hh-size* | -0.0116 | -35.25 | -3.153 | -0.00878 | -21.63 | -10.35*** |
| | (0.0139) | (73.55) | (2.005) | (0.00599) | (18.06) | (1.259) |
| *maleP*× *hh-size* | 0.0085 | 340.3** | 16.66*** | -0.00180 | 39.99 | 16.52*** |
| | (0.0132) | (147.0) | (2.910) | (0.00789) | (26.58) | (3.048) |
| *sex_ratioK*+ | 0.079*** | 200.0 | 72.17*** | -0.032 | 163.0 | 2.455 |
| *maleP* × *sex_ratioK* | (0.026) | (190.6) | (11.72) | (0.045) | (203.9) | (17.92) |
| *P* demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| *O* demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 12,232 | 12,232 | 12,232 | 19,509 | 19,509 | 19,509 |
| R-squared | 0.201 | 0.050 | 0.610 | 0.280 | 0.203 | 0.159 |
| Mean | 0.401 | 831.2 | 118.7 | 0.303 | 489.1 | 91.66 |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. *maleP* is the gender of *P*. *sex_ratioK* is the gender ratio of *K* in the household of *P* and represents the mother demonstration effect. $sex\_ratioK + maleP \times sex\_ratioK$ shows the father demonstration effect. The three outcome variables are the dummy indicating whether parents provide any financial transfer to their elderly parents (*any-transfer*), the amount of any transfer provided (*amount*), and the number of days spent on visits paid to their elderly parents per year (*visit days*). The key controls are *P*'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from *O*, and *O*'s transfer to *P*, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of *O* taking care of *P*'s *K*, depending on the availability of the information in the CHARLS and the CHFS. The standard error is clustered at the prefectural city level for the CHARLS and the cluster-level is the province-level in the CHFS. The IVs are the gender of the first child born in or after 2003 and the prefectural compliance index for the CHARLS and the gender of the first child born in or after 2003 for the CHFS.

Table 1.5: Visibility of the provision of financial old-age support

| **Panel A** | OLS: CHARLS (mostly rural) | | | |
|---|---|---|---|---|
| VARIABLES | *regular* | *nonregular* | *amount reg* | *amount nonreg* |
| *maleP* | 0.00117 | 0.000998 | -161.2 | 65.27 |
| | (0.0138) | (0.0267) | (205.9) | (110.0) |
| *sex_ratioK* | -0.00141 | 0.00227 | -39.45 | 31.82 |
| | (0.00744) | (0.0177) | (110.0) | (70.37) |
| *maleP* × *sex_ratioK* | -0.00503 | -0.00224 | 110.2 | 161.1* |
| | (0.00976) | (0.0215) | (139.5) | (93.03) |
| *hh-size* | -0.0147** | 0.000577 | -55.72 | 43.03 |
| | (0.00636) | (0.0133) | (63.71) | (52.53) |
| *maleP*× *hh-size* | 0.0211*** | -0.0166 | 222.6 | 104.9* |
| | (0.00670) | (0.0114) | (137.3) | (60.95) |
| *sex_ratioK*+ | -0.006 | 0.000 | 70.71 | 192.9** |
| *maleP* × *sex_ratioK* | (0.007) | (0.134) | (105.4) | (81.46) |
| Observations | 12,232 | 12,232 | 12,232 | 12,232 |
| R-squared | 0.077 | 0.141 | 0.043 | 0.025 |
| **Panel B** | IV: CHARLS (mostly rural) | | | |
| VARIABLES | *regular* | *nonregular* | *amount reg* | *amount nonreg* |
| *maleP* | -0.0149 | -0.0848* | -165.8 | -64.68 |
| | (0.0241) | (0.0480) | (254.7) | (235.5) |
| *sex_ratioK* | 0.0126 | -0.0697 | 79.85 | -353.1** |
| | (0.0218) | (0.0447) | (337.7) | (166.9) |
| *maleP* × *sex_ratioK* | 0.0190 | 0.126** | 116.9 | 356.1 |
| | (0.0248) | (0.0561) | (355.6) | (230.1) |
| *hh-size* | -0.0129* | -0.00421 | -43.84 | 8.588 |
| | (0.00671) | (0.0145) | (49.49) | (46.01) |
| *maleP*× *hh-size* | 0.0228*** | -0.00816 | 223.5* | 116.8* |
| | (0.00738) | (0.0126) | (132.9) | (68.68) |
| *sex_ratioK*+ | 0.032*** | 0.056** | 196.7 | 2.929 |
| *maleP* × *sex_ratioK* | (0.012) | (0.024) | (165.0) | (101.9) |
| Observations | 12,232 | 12,232 | 12,232 | 12,232 |
| R-squared | 0.075 | 0.139 | 0.043 | 0.023 |
| *P* demographics | Yes | Yes | Yes | Yes |
| *O* demographics | Yes | Yes | Yes | Yes |
| Mean | 0.105 | 0.243 | 354.6 | 476.6 |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. *maleP* is the gender of $P$. *sex_ratioK* is the gender ratio of $K$ in the household of $P$ and represents the mother demonstration effect. $sex\_ratioK + maleP \times sex\_ratioK$ shows the father demonstration effect. The four outcome variables are the dummy indicating whether parents provide any regular and non-regular financial transfer to their elderly parents (*regular* and *nonregular*) and the amount of any regular and non-regular transfer provided (*amount reg* and (*amount nonreg*). The key controls are $P$'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from $O$, and $O$'s transfer to $P$, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of $O$ taking care of $P$'s $K$. The standard error is clustered at the prefectural city level for the CHARLS. The IVs are the gender of the first child born in or after 2003 and the prefectural compliance index for the CHARLS.

Table 1.6: The demonstration effect on cohabitation

| | IV: CHARLS (mostly rural) | IV: CHFS (mostly urban) |
|---|---|---|
| VARIABLES | Ageing parents cohabitation | |
| $maleP$ | -0.564*** | 0.003 |
| | (0.047) | (0.031) |
| $sex\_ratioK$ | -0.039** | -0.059** |
| | (0.018) | (0.023) |
| $maleP \times sex\_ratioK$ | 0.883*** | 0.109** |
| | (0.064) | (0.048) |
| $maleP \times sex\_ratioK$ | 0.843*** | 0.049 |
| $+sex\_ratioK$ | (0.061) | (0.034) |
| $P$ demographics | Yes | Yes |
| $O$ demographics | Yes | Yes |
| Observations | 12,232 | 19,509 |
| R-squared | 0.183 | 0.141 |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. $maleP$ is the gender of $P$. $sex\_ratioK$ is the gender ratio of $K$ in the household of $P$ and represents the mother demonstration effect. $sex\_ratioK + maleP \times sex\_ratioK$ shows the father demonstration effect. The outcome variable is a dummy that equals 1 if $P$ is living together with their own parents. The key controls are $P$'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from $O$, and $O$'s transfer to $P$, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of $O$ taking care of $P$'s $K$, depending on the availability of the information in the CHARLS and the CHFS. The standard error is clustered at the prefectural city level for the CHARLS and the cluster-level is the province-level in the CHFS. The IVs are the gender of the first child born in or after 2003 and the prefectural compliance index for the CHARLS and the gender of the first child born in or after 2003 for the CHFS.

Table 1.7: Subsample analysis: Income-level

| | IV: CHARLS (mostly rural) | | | IV: CHFS (mostly urban) | | |
|---|---|---|---|---|---|---|
| VARIABLES | *any-transfer* | *amount* | *visit days* | *any-transfer* | *amount* | *visit days* |
| **Low income group** | | | | | | |
| *maleP* | -0.0982 | -533.8* | -5.406 | -0.0375 | -339.8* | -18.91 |
| | (0.0694) | (299.2) | (13.90) | (0.0599) | (205.2) | (19.64) |
| *sex_ratioK* | -0.0680 | -226.6 | 5.073 | -0.0757 | -285.5 | -86.57*** |
| | (0.0623) | (151.2) | (10.75) | (0.0481) | (192.7) | (14.78) |
| *maleP* × *sex_ratioK* | 0.131** | 0.0166 | 0.122** | 247.4 | 125.1 | 47.07*** |
| | (0.0614) | (0.0296) | (0.0581) | (297.2) | (158.3) | (11.61) |
| *sex_ratioK*+ | 0.080** | 376.4*** | 56.12*** | -0.057 | 140.5 | 16.57 |
| *maleP* × *sex_ratioK* | (0.031) | (196.7) | (11.67) | (0.062) | (249.3) | (22.45) |
| | | | | | | |
| Observations | 7,048 | 7,048 | 7,048 | 12,663 | 12,663 | 12,663 |
| R-squared | 0.177 | 0.021 | 0.626 | 0.288 | 0.168 | 0.177 |
| **High income group** | | | | | | |
| *maleP* | -0.0636 | -107.4 | -55.53*** | -0.0538 | -57.27 | -7.504 |
| | (0.0651) | (691.3) | (15.59) | (0.0568) | (236.4) | (25.08) |
| *sex_ratioK* | -0.0168 | -320.0 | -12.74 | -0.0631 | 113.6 | -3.169 |
| | (0.0534) | (796.2) | (10.61) | (0.0432) | (204.0) | (11.90) |
| *maleP* × *sex_ratioK* | 0.0935 | 569.3 | 114.2*** | 0.0457 | -75.62 | -1.974 |
| | (0.0749) | (975.3) | (21.93) | (0.0875) | (411.6) | (33.00) |
| *sex_ratioK*+ | 0.077 | 249.3 | 101.5*** | -0.017 | 37.94 | -5.143 |
| *maleP* × *sex_ratioK* | (0.046) | (507.0) | (19.06) | (0.059) | (290.6) | (25.97) |
| | | | | | | |
| Observations | 5,184 | 5,184 | 5,184 | 6,846 | 6,846 | 6,846 |
| R-squared | 0.238 | 0.080 | 0.160 | 0.259 | 0.220 | 0.126 |
| *P* demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| *O* demographics | Yes | Yes | Yes | Yes | Yes | Yes |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. *maleP* is the gender of *P*. *sex_ratioK* is the gender ratio of *K* in the household of *P* and represents the mother demonstration effect. $sex\_ratioK + maleP \times sex\_ratioK$ shows the father demonstration effect. The three outcome variables are the dummy indicating whether parents provide any financial transfer to their elderly parents (*any-transfer*), the amount of any transfer provided (*amount*), and the number of days spent on visits paid to their elderly parents per year (*visit days*). The key controls are *P*'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from *O*, and *O*'s transfer to *P*, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of *O* taking care of *P*'s *K*, depending on the availability of the information in the CHARLS and the CHFS. The standard error is clustered at the prefectural city level for the CHARLS and the cluster-level is the province-level in the CHFS. The IVs are the gender of the first child born in or after 2003 and the prefectural compliance index for the CHARLS and the gender of the first child born in or after 2003 for the CHFS. The sample is split based on the income-level of *P*.

Table 1.8: Subsample analysis:: Single-$K$ family

| | IV: CHARLS (mostly rural) | | | IV: CHFS (mostly urban) | | |
|---|---|---|---|---|---|---|
| VARIABLES | *any-transfer* | *amount* | *visit days* | *any-transfer* | *amount* | *visit days* |
| **Single child family** | | | | | | |
| *maleP* | -0.0437 | 26.27 | 0.900 | -0.0751** | -121.7 | 31.15** |
| | (0.0379) | (299.0) | (8.138) | (0.0355) | (133.6) | (12.90) |
| *sex_ratioK* | -0.0540 | -323.9 | -0.0551 | -0.0891** | 50.33 | -18.69* |
| | (0.0402) | (395.0) | (8.140) | (0.0348) | (155.5) | (10.46) |
| *maleP* × *sex_ratioK* | 0.0852 | 431.4 | 51.12*** | 0.0737 | 94.86 | 12.40 |
| | (0.0518) | (444.6) | (11.76) | (0.0588) | (252.6) | (21.59) |
| *sex_ratioK*+ | 0.031 | 107.4 | 51.07*** | -0.015 | 145.2 | -6.285 |
| *maleP* × *sex_ratioK* | (0.025) | (255.3) | (8.782) | (0.038) | (265.5) | (15.85) |
| | | | | | | |
| Observations | 5,909 | 5,909 | 5,909 | 12,144 | 12,144 | 12,144 |
| R-squared | 0.209 | 0.064 | 0.650 | 0.270 | 0.210 | 0.148 |
| **Non-single child family** | | | | | | |
| *maleP* | -0.175* | 19.53 | -64.56** | 0.0280 | -405.2 | -43.86 |
| | (0.106) | (701.5) | (26.02) | (0.0934) | (383.3) | (47.88) |
| *sex_ratioK* | -0.0175 | 0.151 | -13.72 | -0.0266 | -534.2** | -146.9*** |
| | (0.111) | (674.3) | (17.47) | (0.0669) | (236.6) | (39.24) |
| *maleP* × *sex_ratioK* | 0.184 | 29.52 | 145.0*** | -0.110 | 766.6 | 167.0** |
| | (0.140) | (919.2) | (32.91) | (0.151) | (650.6) | (73.58) |
| *sex_ratioK*+ | 0.167*** | 29.67 | 131.3*** | -0.137 | 232.4 | 20.09 |
| *maleP* × *sex_ratioK* | (0.060) | (416.4) | (26.24) | (0.110) | (525.8) | (56.69) |
| | | | | | | |
| Observations | 6,323 | 6,323 | 6,323 | 7,365 | 7,365 | 7,365 |
| R-squared | 0.198 | 0.046 | 0.566 | 0.293 | 0.149 | 0.175 |
| $P$ demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| $O$ demographics | Yes | Yes | Yes | Yes | Yes | Yes |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. *maleP* is the gender of $P$. *sex_ratioK* is the gender ratio of $K$ in the household of $P$ and represents the mother demonstration effect. *sex_ratioK* + *maleP* × *sex_ratioK* shows the father demonstration effect. The three outcome variables are the dummy indicating whether parents provide any financial transfer to their elderly parents (*any-transfer*), the amount of any transfer provided (*amount*), and the number of days spent on visits paid to their elderly parents per year (*visit days*). The key controls are $P$'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from $O$, and $O$'s transfer to $P$, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of $O$ taking care of $P$'s $K$, depending on the availability of the information in the CHARLS and the CHFS. The standard error is clustered at the prefectural city level for the CHARLS and the cluster-level is the province-level in the CHFS. The IVs are the gender of the first child born in or after 2003 and the prefectural compliance index for the CHARLS and the gender of the first child born in or after 2003 for the CHFS. The sample is split based on whether $P$ have only one child in the household or not.

Table 1.9: Subsample analysis: Urban-rural differences

| | IV: CHARLS (mostly rural) | | | IV: CHFS (mostly urban) | | |
|---|---|---|---|---|---|---|
| VARIABLES | *any-transfer* | *amount* | *visit days* | *any-transfer* | *amount* | *visit days* |
| **Urban** | | | | | | |
| *maleP* | -0.0306 | -973.8 | -16.20 | -0.0658* | -318.9* | -9.214 |
| | (0.0621) | (758.0) | (16.74) | (0.0391) | (188.2) | (16.84) |
| *sex_ratioK* | 0.00798 | -475.3 | 1.422 | -0.0846** | -193.8 | -30.11*** |
| | (0.0614) | (931.6) | (16.47) | (0.0386) | (154.7) | (9.295) |
| *maleP* × *sex_ratioK* | 0.0471 | 657.9 | 34.88* | 0.0681 | 357.3 | 25.96 |
| | (0.0779) | (1,074) | (20.65) | (0.0613) | (319.1) | (24.20) |
| *sex_ratioK*+ | 0.055 | 182.7 | 36.31** | -0.016 | 163.5 | -4.149 |
| *maleP* × *sex_ratioK* | (0.048) | (504.4) | (15.61) | (0.042) | (236.4) | ( 19.56) |
| Observations | 3,869 | 3,869 | 3,869 | 12,979 | 12,979 | 12,979 |
| R-squared | 0.231 | 0.067 | 0.587 | 0.260 | 0.200 | 0.132 |
| **Rural** | | | | | | |
| *maleP* | -0.125** | 105.4 | -30.25* | 0.115 | 286.8 | -79.63 |
| | (0.0620) | (377.7) | (15.61) | (0.130) | (288.7) | (49.30) |
| *sex_ratioK* | -0.0677 | -141.7 | -3.406 | 0.0443 | 287.3 | -155.2*** |
| | (0.0550) | (321.2) | (8.393) | (0.0944) | (216.2) | (37.84) |
| *maleP* × *sex_ratioK* | 0.179*** | 226.9 | 91.59*** | -0.226 | -445.5 | 240.9*** |
| | (0.0688) | (391.1) | (18.96) | (0.172) | (410.6) | (67.97) |
| *sex_ratioK*+ | 0.111*** | 85.27 | 88.18*** | -0.181 | -158.1 | 85.71* |
| *maleP* × *sex_ratioK* | (0.030) | (209.3) | (15.21) | (0.113) | (306.1) | (46.12) |
| Observations | 8,363 | 8,363 | 8,363 | 6,530 | 6,530 | 6,530 |
| R-squared | 0.195 | 0.046 | 0.622 | 0.312 | 0.076 | 0.217 |
| *P* demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| *O* demographics | Yes | Yes | Yes | Yes | Yes | Yes |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. *maleP* is the gender of *P*. *sex_ratioK* is the gender ratio of *K* in the household of *P* and represents the mother demonstration effect. $sex\_ratioK + maleP \times sex\_ratioK$ shows the father demonstration effect. The three outcome variables are the dummy indicating whether parents provide any financial transfer to their elderly parents (*any-transfer*), the amount of any transfer provided (*amount*), and the number of days spent on visits paid to their elderly parents per year (*visit days*). The key controls are *P*'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from *O*, and *O*'s transfer to *P*, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of *O* taking care of *P*'s *K*, depending on the availability of the information in the CHARLS and the CHFS. The standard error is clustered at the prefectural city level for the CHARLS and the cluster-level is the province-level in the CHFS. The IVs are the gender of the first child born in or after 2003 and the prefectural compliance index for the CHARLS and the gender of the first child born in or after 2003 for the CHFS. The sample is split based on whether *P* lives in urban areas or rural areas.

Table 1.10: Subsample analysis: $P$ with or without brothers (CHARLS)

| | IV: CHARLS (mostly rural) | | |
|---|---|---|---|
| VARIABLES | *any-transfer* | *amount* | *visit days* |
| **With older brothers** | | | |
| *maleP* | -0.0795 | -594.8 | -49.85*** |
| | (0.0742) | (616.8) | (16.75) |
| *sex_ratioK* | -0.0425 | 210.5 | -7.118 |
| | (0.0681) | (669.6) | (14.63) |
| *maleP* × *sex_ratioK* | 0.132 | 595.4 | 96.13*** |
| | (0.0806) | (829.5) | (20.22) |
| *hh-size* | -0.0176 | -103.2 | -2.210 |
| | (0.0210) | (91.64) | (3.102) |
| *maleP* × *hh-size* | 0.0195 | 557.4** | 20.80*** |
| | (0.0209) | (245.8) | (3.993) |
| *sex_ratioK*+ | 0.090** | 805.8 | 89.01*** |
| *maleP* × *sex_ratioK* | (0.045) | (555.0) | (16.16) |
| Observations | 5,283 | 5,283 | 5,283 |
| R-squared | 0.202 | 0.040 | 0.566 |
| **Without older brothers** | | | |
| *maleP* | -0.0788 | -63.51 | -7.773 |
| | (0.0558) | (479.5) | (11.14) |
| *sex_ratioK* | -0.0417 | -588.3 | 1.403 |
| | (0.0498) | (466.3) | (8.813) |
| *maleP* × *sex_ratioK* | 0.121* | 451.5 | 49.05*** |
| | (0.0654) | (542.4) | (14.51) |
| *hh-size* | -0.00345 | 38.00 | -4.284* |
| | (0.0138) | (93.56) | (2.585) |
| *maleP* × *hh-size* | -0.00234 | 196.5 | 14.03*** |
| | (0.0153) | (137.0) | (3.548) |
| *sex_ratioK*+ | 0.078** | -136.7 | 50.45*** |
| *maleP* × *sex_ratioK* | (0.031) | (198.3) | (10.43) |
| Observations | 6,912 | 6,912 | 6,912 |
| R-squared | 0.207 | 0.065 | 0.647 |
| $P$ demographics | Yes | Yes | Yes |
| $O$ demographics | Yes | Yes | Yes |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. *maleP* is the gender of $P$. *sex_ratioK* is the gender ratio of $K$ in the household of $P$ and represents the mother demonstration effect. *sex_ratioK* + *maleP* × *sex_ratioK* shows the father demonstration effect. The three outcome variables are the dummy indicating whether parents provide any financial transfer to their elderly parents (*any-transfer*), the amount of any transfer provided (*amount*), and the number of days spent on visits paid to their elderly parents per year (*visit days*). The key controls are $P$'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from $O$, and $O$'s transfer to $P$, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of $O$ taking care of $P$'s $K$. The standard error is clustered at the prefectural city level for the CHARLS. The IVs are the gender of the first child born in or after 2003 and the prefectural compliance index for the CHARLS. The sample is split based on whether $P$ have any older brothers.

Table 1.11: Heterogeneity Check: Parents' pension coverage

| | IV: CHARLS (mostly rural) | | | IV: CHFS (mostly urban) | | |
|---|---|---|---|---|---|---|
| VARIABLES | *any-transfer* | *amount* | *visit days* | *any-transfer* | *amount* | *visit days* |
| *maleP* | -0.120* | 35.20 | -59.80*** | 0.0243 | 4.783 | 5.230 |
| | (0.0626) | (514.2) | (12.73) | (0.0625) | (174.3) | (30.80) |
| *sex_ratioK* | -0.0808 | -362.6 | 6.448 | -0.0912 | -375.5** | -59.71*** |
| *(Without pension mother demonstration effects)* | (0.0565) | (585.4) | (10.15) | (0.0647) | (166.5) | (20.62) |
| *pensionP* | -0.0894 | -300.8 | 8.126 | 0.0131 | -152.5 | -6.875 |
| | (0.0580) | (341.1) | (8.636) | (0.0351) | (151.5) | (14.70) |
| *maleP* × *sex_ratioK* | 0.183* | -171.5 | 106.1*** | -0.0497 | 0.968 | 45.57 |
| | (0.101) | (860.9) | (19.01) | (0.0981) | (309.3) | (47.91) |
| *maleP* × *pensionP* | 0.0907 | -498.3 | 39.13** | -0.0872 | -249.2 | -7.197 |
| | (0.104) | (587.3) | (15.93) | (0.0592) | (235.1) | (32.88) |
| *sex_ratioK* × *pensionP* | 0.0692 | 192.3 | -17.39 | 0.0366 | 470.0* | 22.06 |
| *(Difference in mother demonstration effects)* | (0.0961) | (517.2) | (13.85) | (0.0594) | (272.1) | (25.15) |
| *sex_ratioK* × *maleP* | -0.109 | 1,172 | -26.08 | 0.104 | 238.5 | -0.917 |
| ×*pensionP* | (0.169) | (960.7) | (23.87) | (0.104) | (426.6) | (56.75) |
| *With pension father demonstration effects* | 0.063 | 829.7** | 69.07*** | -0.000 | 334.0 | 7.002 |
| | (0.058) | (392.2) | (17.35) | (0.057) | (259.1) | (22.69) |
| *Without pension father demonstration effects* | 0.103 | -534.1 | 112.5*** | -0.140** | -374.4 | -14.14 |
| | (0.072) | (509.5) | (15.74) | (0.067) | (231.8) | (42.81) |
| *Difference in father demonstration effects* | -0.040 | 1363* | -43.47** | 0.141 | 708.4** | 21.14 |
| | (0.118) | (803.7) | (17.60) | (0.088) | (329.4) | (52.64) |
| *With pension mother demonstration effects* | -0.012 | -170.2 | -10.94 | -0.054** | 94.55 | -37.65*** |
| | (0.072) | (342.8) | (10.30) | (0.027) | (203.8) | (13.28) |
| $P$ demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| $O$ demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 12,232 | 12,232 | 12,232 | 19,509 | 19,509 | 19,509 |
| R-squared | 0.202 | 0.049 | 0.600 | 0.281 | 0.201 | 0.160 |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. The three outcome variables are the dummy indicating whether parents provide any financial transfer to their elderly parents (*any-transfer*), the amount of any transfer provided (*amount*), and the number of days spent on visits paid to their elderly parents per year (*visit days*). The key controls are $P$'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from $O$, and $O$'s transfer to $P$, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of $O$ taking care of $P$'s $K$, depending on the availability of the information in the CHARLS and the CHFS. The standard error is clustered at the prefectural city level for the CHARLS and the cluster-level is the province-level in the CHFS. The IVs are the gender of the first child born in or after 2003 and the prefectural compliance index for the CHARLS and the gender of the first child born in or after 2003 for the CHFS. *pensionP* is a dummy representing whether $P$ have any types of pension, and it interacts with key regressors. *maleP* is the gender of $P$. *sex_ratioK* is the gender ratio of $K$ in the household of $P$ and is the mother demonstration effect for $P$ without pension. *sex_ratioK* × *pensionP* represents the difference between the mother demonstration effects for $P$ with pension and the mother demonstration effects for $P$ without pension coverage, which should be negative and significant if the mother demonstration effects for $P$ with pension coverage is larger than the mother demonstration effects for $P$ without pension coverage.

Table 1.12: Heterogeneity Check: Income of generation $O$

| | IV: CHARLS (mostly rural) | | |
|---|---|---|---|
| VARIABLES | *any-transfer* | *amount* | *visit days* |
| *maleP* | -0.0877 | -249.4 | -30.60* |
| | (0.0624) | (372.4) | (17.26) |
| *sex_ratioK* | -0.0520 | -572.3 | 5.128 |
| *(Low-income O's mother demonstrate effect)* | (0.0664) | (445.7) | (11.20) |
| *income of O* | -0.0141 | -529.4 | 16.14 |
| | (0.0592) | (418.1) | (10.13) |
| *sex_ratioK* × *income of O* | 0.00973 | 804.0 | -15.20 |
| *(Differences in mother demonstrate effects)* | (0.0938) | (688.9) | (17.02) |
| *maleP* × *sex_ratioK* | 0.141* | 646.0 | 80.50*** |
| | (0.0840) | (590.1) | (22.24) |
| *maleP* × *income of O* | 0.0169 | 91.57 | -14.40 |
| | (0.0831) | (672.2) | (15.66) |
| *maleP* × *sex_ratioK* × *income of O* | -0.0384 | -469.8 | 12.06 |
| | (0.146) | (1,153) | (23.06) |
| *High-income O's father demonstrate effect* | 0.060 | 407.9 | 82.49*** |
| | (0.072) | (577.5) | (12.36) |
| *Low-income O's father demonstrate effect* | 0.089** | 73.66 | 85.63*** |
| | (0.043) | (340.5) | (17.35) |
| *Differences in father demonstrate effects* | -0.029 | 334.2 | -3.143 |
| | (0.100) | (825.1) | (15.14) |
| *High-income O's mother demonstrate effect* | -0.042 | 231.7 | -10.07 |
| | (0.059) | (608.5) | (11.48) |
| $P$ demographics | Yes | Yes | Yes |
| $O$ demographics | Yes | Yes | Yes |
| Observations | 12,232 | 12,232 | 12,233 |
| R-squared | 0.202 | 0.050 | 0.601 |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. The three outcome variables are the dummy indicating whether parents provide any financial transfer to their elderly parents (*any-transfer*), the amount of any transfer provided (*amount*), and the number of days spent on visits paid to their elderly parents per year (*visit days*). The key controls are $P$'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from $O$, and $O$'s transfer to $P$, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of $O$ taking care of $P$'s $K$. The standard error is clustered at the prefectural city level for the CHARLS. The IVs are the gender of the first child born in or after 2003 and the prefectural compliance index for the CHARLS. *income of O* is a dummy representing whether $O$ have any income sources, and it interacts with key regressors. *maleP* is the gender of $P$. *sex_ratioK* is the gender ratio of $K$ in the household of $P$ and is the mother demonstration effect for $P$ whose $O$ have income. *sex_ratioK*× *income of O* represents the difference between the mother demonstration effects for $P$ whose $O$ have income and the mother demonstration effects for $P$ whose $O$ do not have income, which should be negative and significant if the mother demonstration effects for $P$ whose $O$ have income is larger than the mother demonstration effects for $P$ whose $O$ do not have income.

Table 1.13: Effects of education and time investment on the provision of old-age support

| | IV: CHARLS (mostly rural) | | |
|---|---|---|---|
| VARIABLES | *any-transfer* | *amount* | *visit days* |
| *maleP* | -0.0996* | -417.1 | -22.01 |
| | (0.0562) | (337.8) | (15.09) |
| *sex_ratioK* | -0.0459 | -244.3 | -2.669 |
| | (0.0438) | (388.1) | (7.441) |
| *maleP* × *sex_ratioK* | 0.126** | 424.7 | 88.30*** |
| | (0.0582) | (429.2) | (15.88) |
| awayage | 0.0675** | -13.89 | -0.0725 |
| | (0.0291) | (140.0) | (4.325) |
| awaytime | -0.0110 | 35.12 | 0.200 |
| | (0.00903) | (82.48) | (1.040) |
| *ln*(*edu_expense*) | 0.00175 | 125.0* | 0.0899 |
| | (0.00421) | (72.07) | (0.586) |
| *edu level* | -0.00137 | 24.90 | 9.006*** |
| | (0.0194) | (128.2) | (3.137) |
| *maleP* × *awayage* | -0.0824*** | 202.5 | -7.187 |
| | (0.0319) | (274.8) | (5.885) |
| *maleP* × *awaytime* | 0.00531 | -116.7 | 0.0528 |
| | (0.0110) | (95.28) | (2.161) |
| *maleP* × *ln*(*edu_expense*) | -0.00768 | -99.08 | -1.089 |
| | (0.00471) | (93.84) | (0.775) |
| *maleP* × *edu-level* | 0.0283 | 292.3 | -13.92*** |
| | (0.0223) | (211.8) | (5.011) |
| *sex_ratioK*+ | 0.080*** | 180.4 | 85.63*** |
| *maleP* × *sex_ratioK* | (0.027) | (191.9) | (13.83) |
| *P* demographics | Yes | Yes | Yes |
| *O* demographics | Yes | Yes | Yes |
| Observations | 12,232 | 12,232 | 12,232 |
| R-squared | 0.202 | 0.051 | 0.642 |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. *maleP* is the gender of *P*. *sex_ratioK* is the gender ratio of *K* in the household of *P* and represents the mother demonstration effect. $sex\_ratioK + maleP \times sex\_ratioK$ shows the father demonstration effect. The three outcome variables are the dummy indicating whether parents provide any financial transfer to their elderly parents (*any-transfer*), the amount of any transfer provided (*amount*), and the number of days spent on visits paid to their elderly parents per year (*visit days*). The key controls are *P*'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from *O*, and *O*'s transfer to *P*, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of *O* taking care of *P*'s *K*. The standard error is clustered at the prefectural city level for the CHARLS. The IVs are the gender of the first child born in or after 2003 and the prefectural compliance index for the CHARLS. *awayage* is the age that *P* were away from their parents during *P*'s childhood. *awaytime* is the length of time that *P* were away from their parents during *P*'s childhood. $edu - level$ is the education-level of *P* and *ln*(*edu_expense*) is the log of the education investment that *P* received from their parents during *P*'s childhood.

Table 1.14: The demonstration effect on upward and downward transfer

| | IV: CHARLS (mostly rural) | | | IV: CHFS (mostly urban) | |
|---|---|---|---|---|---|
| VARIABLES | *any transfer* | *any receipt by P* | *any receipt by K* | *any transfer* | *any receipt by P* |
| *maleP* | -0.0802 | 0.0368** | 0.101** | -0.0518 | 0.00864 |
| | (0.0499) | (0.0164) | (0.0450) | (0.0448) | (0.0363) |
| *sex_ratioK* | -0.0450 | -0.0397*** | 0.0353 | -0.0733** | 0.173*** |
| | (0.0437) | (0.0144) | (0.0288) | (0.0343) | (0.0278) |
| $maleP \times sex\_ratioK$ | 0.125** | 0.00392 | -0.0912 | 0.0412 | -0.00716 |
| | (0.0579) | (0.0168) | (0.0577) | (0.0645) | (0.0607) |
| *any receipt by P* | -0.0200 | - | 0.170*** | 0.357*** | - |
| | (0.0331) | - | (0.0261) | (0.0151) | - |
| *any transfer* | - | -0.00442 | 0.0901*** | - | 0.242*** |
| | - | (0.00653) | (0.0113) | - | (0.0108) |
| $sex\_ratioK+$ | 0.080*** | -0.036*** | -0.056 | -0.032 | 0.166*** |
| $maleP \times sex\_ratioK$ | (0.027) | (0.009) | (0.047) | (0.045) | (0.047) |
| *P* demographics | Yes | Yes | Yes | Yes | Yes |
| *O* demographics | Yes | Yes | Yes | Yes | Yes |
| Observations | 12,232 | 12,232 | 12,232 | 19,509 | 19,509 |
| R-squared | 0.201 | 0.040 | 0.086 | 0.280 | 0.229 |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. *maleP* is the gender of *P*. *sex_ratioK* is the gender ratio of *K* in the household of *P* and represents the mother demonstration effect. *sex_ratioK* $+maleP \times sex\_ratioK$ shows the male dominated demonstration effect. *any-transfer* is the probability of *P* providing any transfer to *O*, and *anyreceiptbyP* and *anyreceiptbyK* are the transfer from *O* to *P*'s household and *P*'s children *K*. The key controls are *P*'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from *O*, and *O*s transfer to *P*, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of *O* taking care of *P*'s *K*, depending on the availability of the information in the CHARLS and the CHFS. The standard error is clustered at the prefectural city level for the CHARLS and the cluster-level is the province-level in the CHFS. The IVs are the gender of the first child born in or after 2003 and the prefectural compliance index for the CHARLS and the gender of the first child born in or after 2003 for the CHFS.

Table 1.15: The demonstration effect by generation $O$

| | OLS: CHARLS (mostly rural) | | | | |
|---|---|---|---|---|---|
| VARIABLES | *any-transfer* | *regular* | *nonregular* | *log(regular)* | *log(nonregular)* |
| **Male** $P$ | | | | | |
| $father's\ transfer$ | 0.064** | 0.103*** | 0.102*** | 0.114*** | 0.102*** |
| | (0.027) | (0.030) | (0.029) | (0.037) | (0.035) |
| $mother's\ transfer$ | 0.048** | 0.067** | 0.109*** | 0.111** | 0.116*** |
| | (0.021) | (0.028) | (0.023) | (0.045) | (0.027) |
| Observations | 6,688 | 6,688 | 6,688 | 6,688 | 6,688 |
| **Female** $P$ | | | | | |
| $father's\ transfer$ | 0.056 | 0.031 | 0.112*** | 0.058* | 0.113** |
| | (0.035) | (0.025) | (0.039) | (0.030) | (0.045) |
| $mother's\ transfer$ | 0.108*** | 0.075** | 0.185*** | 0.171*** | 0.206*** |
| | (0.048) | (0.031) | (0.030) | (0.054) | (0.034) |
| Observations | 5,540 | 5,540 | 5,540 | 5,540 | 5,540 |
| $P$ demographics | Yes | Yes | Yes | Yes | Yes |
| $O$ demographics | Yes | Yes | Yes | Yes | Yes |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. The $father's\ transfer$ and $mother's\ transfer$ are the transfer provided by $O$ to $P$'s paternal and maternal grandparents. The outcome variables are the probability of providing any, regular, and non-regular transfer to $O$ (*any-transfer*, *regular*, and *nonregular*), and the log of the amount of regular and non-regular transfer (*log(regular)* and *log(nonregular)*). The controlling variables for $P$ are age, marital status, rural *hukou*, provinces, education, professional title, income level, whether $P$ lives with parents and the distant to parents place, visit frequency to $O$, the number and rank of siblings and the number of children. And also $O$'s transfer to $P$, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of $O$ taking care of $P$'s $K$. The standard error is clustered at the prefectural city level.

Table 1.16: Impact of the gender of the first child on the probability of providing any old-age support

| VARIABLES | *any-transfer* in CHFS (mostly urban) | | | |
|---|---|---|---|---|
| | father-son | father-daughter | mother-son | mother-daughter |
| *Event time* | | | | |
| -1 | 0.244 | 0.479* | 0.207 | -0.0824 |
| | (0.264) | (0.278) | (0.160) | (0.418) |
| 0 | 0.175 | 0.148 | -0.155 | 0.655*** |
| | (0.186) | (0.262) | (0.114) | (0.211) |
| 1 | 0.157 | 0.148 | 0.0436 | 0.588*** |
| | (0.181) | (0.258) | (0.108) | (0.206) |
| 2 | 0.163 | 0.125 | -0.0116 | 0.618*** |
| | (0.183) | (0.258) | (0.105) | (0.204) |
| 3 | 0.208 | 0.0787 | 0.0499 | 0.660*** |
| | (0.180) | (0.259) | (0.102) | (0.201) |
| 4 | 0.150 | 0.105 | 0.0507 | 0.607*** |
| | (0.182) | (0.258) | (0.0991) | (0.204) |
| Age fixed-effect | Yes | Yes | Yes | Yes |
| Wave fixed-effect | Yes | Yes | Yes | Yes |
| Observations | 809 | 771 | 811 | 765 |
| R-squared | 0.140 | 0.142 | 0.093 | 0.064 |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. *any-transfer* is the probability of providing any transfer to $O$. The event is the birth of the first child in the respondents' household. The event time equals 0 in the year of the birth of the first child. All the other event times are adjusted accordingly. male-son is the male group with the first child as a son, male-daughter is the male group with the first daughter. female-son and female-daughter are the corresponding female groups. The outcome variable is the probability of providing any transfer to elderly parents. The results are for the CHFS only and use 2011, 2013 and 2015 wave. The error term is clustered at household-level.

Table 1.17: The “missing girls” and the needs of future old-age support

| Sample | (1)<br>Estimated Old-age support prevalence | (2)<br>Predicted sex ratio under old-age support prevalence | (3)<br>Sample percentage value old-age support and sons | (4)<br>Old-age support prevalence adjusted sex ratio | (5)<br>Acutal sex ratio | (6)<br>Percentage explained by old-age support |
|---|---|---|---|---|---|---|
| Full sample | 0.0317*** | 1.1913 | 34.38% | 1.0958 | 1.3070 | 18.13% |
| Urban | 0.0376*** | 1.2200 | 18.39% | 1.0784 | 1.2127 | 17.96% |
| Rural | 0.0210*** | 1.1412 | 47.48% | 1.0918 | 1.3912 | 12.57% |

*Notes*: The estimations are fully based on Oster's method (2005). Column (1) shows the coefficients of the old-age support dummy on the gender ratio of the third generation. This is the prevalence of the needs of future old-age support on the gender ratio. The natural male-to-female gender ratio is 1.049. Column (2) is the estimated gender ratio for people only care about future old-age support from the next generation. Column (3) is the percentage of the sample who value both sons in the household and old-age support provided by their children. Column (4) is the weighted gender ratio of the whole population using Column (2), Column (3), and the natural gender ratio. The equation for the adjusted gender ratio is $GR_{adjust} = GR_{old-age} \times percentage_{old-age} + GR_{nonold-age} \times (1 - percentage_{old-age})$ (Oster, 2005). The actual gender ratio in the data is in Column (5) and Column (6) is the percentage of the unbalanced gender ratio correlates with the needs of old-age support.

# Chapter 2

# The Role of Social Norms in Old-age Support: a Theoretical Approach

This chapter presents an economic model of the intergenerational transmission of social norms in old-age support. The analysis is based on the same-gender intergenerational transmission channel of the social norm. Research in sociology and psychology suggests that young children are more likely to inherit their same-gender parents' social traits and norms (Lytton and Romney, 1991; Bussey and Bandura, 1999). Because of the same-gender transmission, the old-age support provided by individuals to their parents depends on the gender of their children. Based on existing intergenerational transfer models, I include the gender ratio of children in the model and examine the effect of the gender ratio on old-age support provided by their parents to their grandparents. The model concludes that fathers with more sons in their households provide more old-age support than fathers with more daughters. For mothers, they provide more support to their parents with more daughters in their household.

## 2.1 Introduction

The topic of intergenerational transfers within the family is of general interest to economists, especially upward intergenerational transfers: the support that adults provide to their elderly parents. However, in the literature, most models of motives for people to provide old-age support to their parents, especially the standard models, do not seem to match the empirical findings (Arrondel and Masson, 2006). Moreover, the existing models usually focus only on interactions between two generations, adult children and their parents. One of the possible reasons for the mismatch between the empirical evidence and the theoretical models may be that researchers sometimes ignore the fact that the norm of people providing old-age support, whether financial or otherwise, to their parents exists in nearly every generation. Usually, the norm of providing old-age support is gender-specific in developing countries, and most commonly in China. The element of norm transmission combined with gender should be included in the model for explaining old-age support provision with families.

This chapter presents a model of the intergenerational transmission of the social norm of old-age support provision in China, which focuses on the same-gender channel. The way that parents provide support to their own parents conveys the social norm of old-age support provision to their children of the same-gender. The model is based on the demonstration effect model established by Cox and Stark (1996). The demonstration effect means that parents treat their parents well if they have "their own children to whom to demonstrate the appropriate behaviour" (Cox and Stark, 2005). I modify Cox and Stark's demonstration effect by adding the same-gender transmission channel for the old-age support provision and find that this produces two major improvements in the model's ability to match the empirical findings. First, the model fills the gap of the same-gender transmission channel in the theoretical framework in economics, while a lot of empirical evidence exists. Sociologists and psychologists believe that children are largely influenced by their same-sex parent in their learning of gender norms in society (Lytton and Romney, 1991; Bussey and Bandura, 1999; McHale et al., 1999). Economists have also recently found empirical evidence for same-gender inter-generational transmission in individual preferences and social norms (Alesina et al., 2013; Keleven et al., 2018). Second, the gender element in the model makes it more suitable for the real-world scenario. The gender difference is prominent in the norm of old-age support provision in China and other developing cultures (Das Gupta et al., 2003). Traditionally, it is sons who are responsible for supporting their elderly parents in China (Lee et al., 1994; Chan et al., 2002).

To illustrate the same-gender demonstration effect, I set up a simple two-period consumption model describing the three-generation interactions in providing old-age support. The model includes inter-household transfers (Banerjee et al., 2014) and a same-gender demonstration effect. The same-gender demonstration effect in the model is expressed as the total amount of the childrens future transfer to their parents that will be more likely and positively affected by the transfer from their same-gender parent to their paternal or maternal grandparents that they observe when they are young. The same-gender demonstration effect is similar to the demonstration effect by Cox and Stark (1996) but adds gender-specific parental influences to the demonstration effect. It also contains a simple intra-household bargaining component. The model concludes that the parent who holds the higher bargaining power in a household is more likely to demonstrate the norm of old-age support to offspring of the same gender. By reflecting the empirical results in Chapter 1, the model in this chapter provides a possible explanation for providing old-age support. It also makes the gender of the children a key component in the interaction between three generations in terms of old-age support, given that the key channel of the model is gender-specific.

The chapter proceeds as follows. Section 2.2 provides a literature review of the current standard models and the theoretical background for same-gender social norm transmission and establishes the connections between my model assumptions and the literature. This is followed by Section 2.3, which presents a baseline unitary household model with simple assumptions. Section 2.4 adds a simple intra-household bargaining component to the baseline model. Section 2.5 offers a more complicated model with relaxed assumptions based on the model in Section 2.4. Section 2.6 concludes.

## 2.2 Literature review

The discussion of the literature review in Chapter 1 Section 1.2 implies that altruism and exchange are the two main motives in the standard theoretical models explaining intergenerational transfer. However, the existing empirical results are not robust enough to support these two motives in theoretical models (Arrondel and Masson, 2006). My model in this chapter, together with the empirical evidence in Chapter 1, reconcile the theoretical framework with the empirical evidence and add to the literature, showing the intergenerational transmission of social norms as one possible explanation of the personal support given to the elderly. In this section, I also focus on how the assumptions in my model are matched with the existing empirical and theoretical literature. Altruism, as discussed by Barro (1974) and Becker (1976, 1981), is one of the generally accepted reasons for people providing old-age support. Thus, I include an altruism parameter into my model, assuming people generate utility by providing old-age support to their own parents. Yet this utility generated from people's altruism is smaller than the utility generated directly from the consumption.

The norm transmission proposed in the model is similar to the concept of indirect reciprocity, which is attributed to Mauss (1950, 1968). He states that indirect reciprocities involving three successive generations will lead to infinite chains of transfers. He observes that the givers do not get direct payback from the beneficiary but receive it from a third person (Arrondel and Masson, 2001). Similar concepts are also discussed in Cox and Stark's 1996 model, which specify the upward and positive indirect reciprocity channel in the context of the provision of old-age support. Cox and Stark (1996) called this channel the "demonstration effect". The norm transmission and the indirect reciprocity both rely on the assumption that parents can affect their children's behaviours in the future. Becker et al. (2016) support this assumption and believe that parents can "manipulate" the preferences of their children. The interpretation of this transmission of the norm is that people educate their children by providing old-age support to their own parents. Their children are affected by this behaviour their parents, who in turn receive old-age support when the time comes. In my model, the norm transmission is represented by an assumption that the old-age support people received from their children in future should be positively affected by the old-age support people provided to their own parents.

The norm of providing old-age support is usually gender-specific, thus the norm transmission process should also be based on the gender of the future generation. Godelier (1982) describes indirect reciprocity as gender-specific when it functions in the anthropology literature as a channel for the transmission of cultural traits and norms. If there is a gender-specific social norm, then it also should be the channel for passing on gender norms in a society. Mitrut and Wolff (2009) find that parents' visits to their own parents are largely affected by the presence of daughters rather than sons in their households. This empirical finding is consistent with common beliefs about the role of gender: girls are the more likely ones to pay visits and care for the elderly (Lee et al., 1993). However, except for Mitrut and Wolff (2009), there is no other paper in the related literature that takes note of the gender of children and the role of children in the transmission of the norm of old-age support.

For the transmission of gender-specific norms to be valid, one important factor is that parents can influence their same-gender children more effectively than cross-gender children. Many sociologists and psychologists believe that the same-sex parent is the main channel for ensuring that children learn the corresponding gender role in a way that fits social expectations and that the children will behave in gender-related ways when they become adults (Lytton and Romney, 1991; Bussey and Bandura, 1999; McHale et al., 1999). In the recent economics literature, several papers focus on same-gender intergenerational transmission. Jayachandran and her colleagues show that the effects of one's same-sex parent on gender attitudes are greater than the effects of one's peers (Dhar et al., 2015). Kleven et al. (2018) reveal that in Denmark preferences in matters of family and career for females are largely influenced by the mother's preferences observed during childhood. Alesina et al. (2013) also find that paternal ancestors affect the perspectives of males on the roles of the genders and the participation of females in the labour market. The same-gender influence from the parents is represented by the following assumptions in my model. Old-age support provided by females to their parents affects old-age support for the females will receive from their daughters more than from their sons. Males' old-age support provisions affect the support that they will receive from their sons more than from their daughters.

Another key assumption in determining whether the gender of the children affects their parents' decision to providing old-age support is that parents also internalise the fact that their childrens future behaviours will be affected by theirs. This internalisation means that parents understand their influence on their children and they will try to shape their childrens preferences according to their own. Becker (1996), Bisin and Verdier (2000), Guttman (2001), Bronnenberg et al., (2012), and Becker et al. (2016) study whether parents show certain behaviours to or spend more resources on their children in order to formalise their children's preferences. In my model, this internalisation means that the parents know the function of their children's future transfers.

All the literature mentioned above acts as supporting evidence for the same-gender demonstration effect assumption that I included in my model. Under the same-gender demonstration effect, the model should predict a father with more sons in his family provides more old-age support than a father with more daughters, fixing the number of children. For mothers, they provide more with more daughters in their households. Figure 2.1 provides a simple graphic illustration of the same-gender demonstration effect in China. In a simple situation with only one child in the household, when the only child is a son, then the father provides more old-age support and has a greater influence on the son than the mother does. When the only child is a daughter, then the mother provides more and has a greater influence on the daughter.

## 2.3 Baseline model

The model describing the same-gender demonstration effect in the following section is based on the demonstration effect model by Cox and Stark (1996, 2005), combined with a definition of intergenerational transfers taken from a model by Banerjee et al. (2014). It is a simple inter-temporal two-period consumption model. Cox and Stark (1996, 2005) maintain that "... childhood experience affects behaviour in adulthood". Parents who value support for the elderly will demonstrate the norm of providing support for the elderly to their children by providing support to their own elderly parents. Based on the demonstration effect, the model assumes that parents know that their support to their own elderly parents will affect the future support behaviour of their same-gender children. Another assumption noted above is that children will be affected by the behaviour of their same-gender parents. Given differences in anticipation of the future and same-gender intergenerational transmission, the model predicts that parents will provide support to their own parents, according to the gender of their children. This explains the relationship between parents' support for the elderly and the gender ratio of their children.

There are three generations in the model: the mid-age generation ($P$), the parents;

the older generation ($O$), parents of $P$, and the younger generation ($K$), children of $P$. They correspond to the second generation, the first generation and the third generation respectively, but only in this chapter. There are two periods in the model: the first period, $t = 1$, and the second period, $t = 2$. The baseline model uses the notation in Banerjee et al. (2014) and requires a few additional assumptions:

- (i) each household in $P$ has a father and a mother;
- (ii) the father transfers a fraction $\tau_1^F$ of his income and the mother transfers a fraction $\tau_1^M$ of hers to their own parents. Both of them have income $Y_1$. $Y_1$ is exogenous;
- (iii) the number of $K$ in each household, $n$, is exogenous. The male-to-female gender ratio of children in a household is $\phi$;
- (iv) people value their parents' welfare as well as their own consumption, so they derive utilities from providing transfers to their parents. However, there is also a discount factor, $0 < \delta < 1$, for the utility derived from the provision of old-age support, since the transfer to $O$ is not direct consumption for the individuals;
- (v) $\tau_t^F$ and $\tau_t^M$ are endogenous and different when $t = 1$ and when $t = 2$. The transfer from the children of the father and mother in the second period will be affected by their same-gender parents' transfer in the first period.[1] In the equations, this assumption is expressed as

$$\tau_2^F = \mathcal{T}^F(\tau_1^F) \quad \text{and} \quad \tau_2^M = \mathcal{T}^M(\tau_1^M). \tag{2.1}$$

  Both functions are strictly concave and increasing in $\tau_1^F$ and $\tau_1^M$, and

$$\tau_2^F = 0 \quad \text{if} \quad \tau_1^F = 0 \quad \text{and} \quad \tau_2^M = 0 \quad \text{if} \quad \tau_1^M = 0;$$

- (vi) the father and the mother in a household make unitary household-level decisions. The household consumption is $c_t$ in each time period;
- (vii) for simplicity, I assume the transfer from $P$ to their parents-in-law would only make their children provide transfers to their parents-in-law in the second period. So providing transfers to $P$'s parents-in-law is not in line with the interest of the $P$'s household. So I do not consider the transfer to $P$'s parents-in-law in Chapter 2;[2]
- (viii) for simplicity, I assume that there is no saving in the baseline model;[3]

[1] This same-gender demonstration assumption is later relaxed (See Section 2.3.1).
[2] This assumption is a bit restrictive. I should consider incorporating the relaxed version of this assumption in future.
[3] Saving is included in the basic model in Section B.1.

- (ix) $u(\cdot)$ is a strictly concave function.

In this model, $P$ is the generation solving the optimisation problem in the first period. $O$ passively receives support from $P$ in the first period and dies in the second period. Members of $K$ observe their parents' $\tau_1$ in the first period and provide their parents with $\tau_2$ in the second period. With the assumptions above, a typical household in generation $P$ solves the following problem:

$$\max_{\tau_1^F,\tau_1^M} \quad U = u(c_1) + \delta u(e_1) + \beta u(c_2)$$
$$s.t.$$
$$c_1 + c_2 \leq Y_1(2 - \tau_1^F - \tau_1^M) + Y_2(\mathcal{T}^F(\tau_1^F)\phi n + \mathcal{T}^M(\tau_1^M)(1-\phi)n);$$
$$e_1 = Y_1(\tau_1^F + \tau_1^M).$$

The father and the mother in generation $P$ make unitary household-level decisions, and there is no saving, thus that the expressions for the household consumption for the two periods are as follows:

$$c_1 = Y_1(2 - \tau_1^F - \tau_1^M); \quad c_2 = Y_2[\mathcal{T}^F(\tau_1^F)\phi n + \mathcal{T}^M(\tau_1^M)(1-\phi)n].$$

$e_1$ is the old-age support provided by the whole household. $\delta$ is the discount factor for the utility generated from altruism, and $\beta$ is the time discount factor. If $u(c)$ is specified as a log or a CRRA function, and $\tau_2$ is a concave function of $\tau_1$, the FOCs with respect to $\tau_1^F$ and $\tau_1^M$ are:

$$U^1 = \frac{\mathrm{d}U}{\mathrm{d}\tau_1^F} = u'(c_1)(-Y_1) + \delta u'(Y_1(\tau_1^F + \tau_1^M))Y_1 + \beta u'(c_2)Y_2\tau_2^{F'}\phi n = 0; \tag{2.2}$$

$$U^2 = \frac{\mathrm{d}U}{\mathrm{d}\tau_1^M} = u'(c_1)(-Y_1) + \delta u'(Y_1(\tau_1^F + \tau_1^M))Y_1 + \beta u'(c_2)Y_2\tau_2^{M'}(1-\phi)n = 0. \tag{2.3}$$

Given Equations (2.2) and (2.3), I obtain the following condition to derive the optimal $\tau_1^F$ and $\tau_1^M$, which are $\tau_1^{F*}$ and $\tau_1^{M*}$ respectively:

$$\frac{\tau_2^{F'}}{\tau_2^{M'}} = \frac{1-\phi}{\phi}. \tag{2.4}$$

From the FOCs, I can derive the SOCs corresponding to $\tau_1^F$, $\tau_1^M$, and $\phi$. Recall that $c_1 = Y_1(2 - \tau_1^F - \tau_1^M)$ and $c_2 = Y_2(\tau_2^F\phi n + \tau_2^M(1-\phi)n)$. From Equation (2.2), the SOCs with respect to $\tau_1^F$ and $\phi$ are:

$$\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{F2}} = u''(c_1)(Y_1^2) + \delta u''(Y_1(\tau_1^F + \tau_1^M))Y_1^2$$
$$+ \beta u'(c_2)Y_2\tau_2^{F''}\phi n + \beta u''(c_2)(Y_2\tau_2^{F'}\phi n)^2; \tag{2.5}$$
$$\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^F\mathrm{d}\phi} = \beta u''(c_2)(Y_2^2\phi n^2)\tau_2^{F'}(\tau_2^F - \tau_2^M) + \beta u'(c_2)Y_2\tau_2^{F'}n.$$

I assign:

$$U^{11} = \frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{F*2}}; \qquad U^{13} = \frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{F*}\mathrm{d}\phi},$$

which are the SOCs at the optimal value of $\tau_1^F$ and $\tau_1^M$. Recall that function $u$ is strictly concave in $c_1$ and $c_2$. $\mathcal{T}^F$ and $\mathcal{T}^M$ are both strictly concave functions. $U^{11}$ is always smaller than 0 under these assumptions. For the sign of $U^{13}$, when the function $u(\cdot)$ is specified as a log or a CRRA function, I obtain

$$|u''(c_2)(Y_2^2\tau_2^{F'}\phi n)(n\tau_2^F - n\tau_2^M)| < |u'(c_2)Y_2\tau_2^{F'}n| \quad \Rightarrow \quad U^{13} > 0.$$

From Equation (2.3), the corresponding SOCs are:

$$\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{M2}} = u''(c_1)(Y_1^2) + \delta u''(Y_1(\tau_1^F + \tau_1^M))Y_1^2$$
$$+ \beta u'(c_2)Y_2\tau_2^{M''}(1-\phi)n + \beta u''(c_2)(Y_2\tau_2^{M'}(1-\phi)n)^2; \tag{2.6}$$
$$\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^M\mathrm{d}\phi} = \beta u''(c_2)(Y_2^2(1-\phi)n^2)\tau_2^{M'}(\tau_2^F - \tau_2^M) - \beta u'(c_2)Y_2\tau_2^{M'}n.$$

The SOC for $\tau_1^F$ and $\tau_1^M$ is:

$$\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^F\mathrm{d}\tau_1^M} = u''(c_1)(Y_1^2) + \delta u''(Y_1(\tau_1^F + \tau_1^M))Y_1^2 + \beta u''(c_2)Y_2^2\tau_2^{F'}\tau_2^{M'}\phi(1-\phi)n^2. \tag{2.7}$$

Here again I specify

$$U^{22} = \frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{M*2}}; \qquad U^{23} = \frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{M*}\mathrm{d}\phi}; \qquad U^{12/21} = \frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{F*}\mathrm{d}\tau_1^{M*}};$$

which are the SOCs at the optimal value of $\tau_1^F$ and $\tau_1^M$. Because of the concave assumptions for $u(\cdot)$, $\mathcal{T}^F$, and $\mathcal{T}^M$, I infer the signs of $U^{22}$, $U^{23}$, and $U^{12/21}$ are negative, and do not depend on the specification of the utility function $u(c)$, as long as $u(c)$ is concave. If Equation (2.4) is substituted for Equations (2.5), (2.6) and (2.7), then the comparison between the absolute values of $U^{11}$, $U^{22}$, and $U^{12}$ is

$$|U^{11}| > |U^{12}|; \qquad |U^{22}| > |U^{12}|.$$

According to the assumption of the demonstration effect, I would expect the optimal value of the transfer from the father, $\tau_1^{F*}$, to be positively affected by his children's gender ratio, $\phi$, and the optimal value of the transfer from the mother, $\tau_1^{M*}$, would be negatively affected by $\phi$. In other words, the expected comparative statics from the optimisation problem are:

$$\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi} > 0; \qquad \frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi} < 0.$$

To obtain these two comparative statics, I need to totally differentiate Equations (2.2) and (2.3), which are:

$$\begin{aligned} U^{11}\mathrm{d}\tau_1^{F*} + U^{12}\mathrm{d}\tau_1^{M*} + U^{13}\mathrm{d}\phi = 0; \\ U^{21}\mathrm{d}\tau_1^{F*} + U^{22}\mathrm{d}\tau_1^{M*} + U^{23}\mathrm{d}\phi = 0, \end{aligned} \tag{2.8}$$

where again

$$U^{11} = \frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{F*2}}; \quad U^{13} = \frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{F*}\mathrm{d}\phi}; \quad U^{22} = \frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{M*2}}; \quad U^{23} = \frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{M*}\mathrm{d}\phi}; \quad U^{12/21} = \frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{F*}\mathrm{d}\tau_1^{M*}}.$$

The asterisks denote optimal values. The $U^{ij}$s are the SOCs when $\tau_1^F = \tau_1^{F*}$ and $\tau_1^M = \tau_1^{M*}$, $i \in \{1,2\}$ and $j \in \{1,2,3\}$. Hence, the comparative statics from the conditions in Equation (2.8) are:

$$\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi} = \frac{U^{12}U^{23} - U^{13}U^{22}}{U^{11}U^{22} - U^{12}U^{21}}; \quad \frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi} = \frac{U^{11}U^{23} - U^{13}U^{21}}{U^{12}U^{21} - U^{11}U^{22}}.$$

The signs for SOCs when $\tau_1^F = \tau_1^{F*}$ and $\tau_1^M = \tau_1^{M*}$ are:

$$U^{11} < 0; \quad U^{13} > 0; \quad U^{22} < 0;$$ [4]

$$U^{23} < 0; \quad U^{12} = U^{21} < 0.$$

From the equations for SOCs, I can obtain the sign of the numerators and denominators in the comparative statics:

$$\begin{aligned} U^{12}U^{23} - U^{13}U^{22} > 0; \\ U^{11}U^{23} - U^{13}U^{21} > 0; \\ U^{11}U^{22} - U^{12}U^{21} > 0, \end{aligned}$$

and thus the signs of the comparative statics are:

$$\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi} = \frac{U^{12}U^{23} - U^{13}U^{22}}{U^{11}U^{22} - U^{12}U^{21}} > 0; \quad \frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi} = \frac{U^{11}U^{23} - U^{13}U^{21}}{U^{12}U^{21} - U^{11}U^{22}} < 0. \tag{2.9}$$

[4] Note that $U^{13} > 0$ when the utility function is specified as a log or a CRRA function. For example, if $u(c) = log(c)$, then $U^{13} = \frac{\beta Y_2^2 n^2 \tau_2^{F'} \tau_2^M}{C_2^2} > 0$.

The comparative statics can be summarised in the following proposition:

***Proposition 1:*** *In the model in this section, when the utility function is specified as a log or a CRRA function, then $\tau_1^{F*}$ is increasing in $\phi$ and $\tau_1^{M*}$ is decreasing in the gender ratio of $K$, $\phi$. The model shows:*

$$\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi} > 0; \qquad \frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi} < 0.$$

The first interpretation of the comparative statics in *Proposition 1* is that the fraction of the father's income transferred to his parents increases with the male-to-female gender ratio of his children. It also means that he will provide more old-age support to his parents the more sons he has in his household, fixing the number of $K$. The mother will transfer more to her own parents if she has more daughters, regardless of whether $\tau_1^F$ is greater or smaller than $\tau_1^M$. As noted above, it is more usual in China for males to support their parents than for females. $\tau_1^F > \tau_1^M$ indicates that the father transfers more than the mother does, as a general social norm. However, the condition $\tau_1^F > \tau_1^M$ does not affect the conclusion of the baseline model.

One key assumption for the interpretations is that $\phi$ should be exogenous. To make sure that $\phi$, the gender ratio of the generation $K$, is exogenous at the household-level in the empirical part of the first chapter, I use the policy change which started in 2003. From this date, the selection of unborn children by sex was banned in China. I give a more detailed explanation in the empirical section in Chapter 1. The regulation brought the gender ratio of newborns after 2003 closer to the natural rate than the gender ratio was before the policy changed.

### 2.3.1 The demonstration effect from different-gender parents

In the basic model, I assume generation $P$'s transfer would affect only the future transfer that they received from the same-gender members in the next generation. The formulas for these assumptions are:

$$\tau_2^F = \mathcal{T}^F(\tau_1^F); \qquad \tau_2^M = \mathcal{T}^M(\tau_1^M),$$

and they are both strictly concave and increasing functions in $\tau_1^F$ and $\tau_1^M$. I relax this assumption to a more general one: both parents would affect the future transfer of the next generation, but each parent would have a greater influence on the same-sex children of the next generation than on the the hetero-sex ones. The equations for $\tau_2^F$ and $\tau_2^M$ under the relaxed assumptions are:

$$\tau_2^F = \mathcal{T}^F(\tau_1^F, \tau_1^M); \qquad \tau_2^M = \mathcal{T}^M(\tau_1^F, \tau_1^M).$$

The functions are still concave in both $\tau_1^F$ and $\tau_1^M$, and I impose new assumptions on the new equations as well:

- (i) assumptions on the FOCs for $\tau_2^F$ and $\tau_2^M$

$$\frac{\mathrm{d}\tau_2^F}{\mathrm{d}\tau_1^F} > \frac{\mathrm{d}\tau_2^F}{\mathrm{d}\tau_1^M}; \quad \frac{\mathrm{d}\tau_2^M}{\mathrm{d}\tau_1^M} > \frac{\mathrm{d}\tau_2^M}{\mathrm{d}\tau_1^F}; \quad \frac{\mathrm{d}\tau_2^M}{\mathrm{d}\tau_1^M} > \frac{\mathrm{d}\tau_2^F}{\mathrm{d}\tau_1^M}; \quad \frac{\mathrm{d}\tau_2^F}{\mathrm{d}\tau_1^F} > \frac{\mathrm{d}\tau_2^M}{\mathrm{d}\tau_1^F};$$

- (ii) assumptions on the SOCs

$$\frac{\mathrm{d}^2\tau_2^F}{\mathrm{d}\tau_1^F\mathrm{d}\tau_1^M} = 0; \quad \frac{\mathrm{d}^2\tau_2^M}{\mathrm{d}\tau_1^F\mathrm{d}\tau_1^M} = 0.$$

The interpretation of the assumptions on the FOCs of $\tau_2^F$ and $\tau_2^M$ with respect to $\tau_1^F$ and $\tau_1^M$ is that the marginal effects of old-age support in the first period from $P$ on the old-age support in the second period provided the same-gender $K$ are greater than the opposite-gender effects. For the SOCs, I assume in this section that the cross partial derivatives equal 0, which means that $\mathcal{T}^F(\tau_1^F, \tau_1^M)$ and $\mathcal{T}^M(\tau_1^F, \tau_1^M)$ are linear combinations of $\tau_1^F$ and $\tau_1^M$.

Under these new assumptions, I re-consider the basic model. The maximisation problem is still the same except for the equations of $\tau_2^F$ and $\tau_2^M$. I would want the counterpart to *Proposition 1* to hold given the SOCs and FOCs derived from the optimisation problem in this subsection, even under certain limitations on the value of optimal $\tau_1^F$ and $\tau_1^M$. The new maximisation problem is:

$$\max_{\tau_1^F, \tau_1^M} \quad U = u(c_1) + \delta u(e_1) + \beta u(c_2)$$
$$s.t.$$
$$c_1 + c_2 \leq Y_1(2 - \tau_1^F - \tau_1^M) + Y_2(\tau_2^F \phi n + \tau_2^M(1-\phi)n);$$
$$e_1 = Y_1(\tau_1^F + \tau_1^M).$$

According to *Proposition 1*, the key comparative statics from this model should be:

$$\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi} > 0; \qquad \frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi} < 0.$$

In this model, for $\tau_1^F$ and $\tau_1^M$, the FOCs:

$$\begin{aligned} U^1 =& \frac{\mathrm{d}U}{\mathrm{d}\tau_1^F} = u'(Y_1(2 - \tau_1^F - \tau_1^M))(-Y_1) + \delta u'(Y_1(\tau_1^F + \tau_1^M))Y_1 \\ &+ \beta u'(c_2)Y_2 n(\tau_{2,\tau_1^F}^{F'}\phi + \tau_{2,\tau_1^F}^{M'}(1-\phi)) = 0; \\ U^2 =& \frac{\mathrm{d}U}{\mathrm{d}\tau_1^M} = u'(Y_1(2 - \tau_1^F - \tau_1^M))(-Y_1) + \delta u'(Y_1(\tau_1^F + \tau_1^M))Y_1 \\ &+ \beta u'(c_2)Y_2 n(\tau_{2,\tau_1^M}^{F'}\phi + \tau_{2,\tau_1^M}^{M'}(1-\phi)) = 0. \end{aligned} \tag{2.10}$$

The expressions for $c_2$ is $Y_2(\tau_2^F\phi n + \tau_2^M(1-\phi)n)$. Given Equation (2.10), I obtain the following condition to derive the optimal $\tau_1^F$ and $\tau_1^M$:

$$\frac{\tau^{F'}_{2,\tau_1^F} - \tau^{F'}_{2,\tau_1^M}}{\tau^{M'}_{2,\tau_1^M} - \tau^{M'}_{2,\tau_1^F}} = \frac{1-\phi}{\phi}. \tag{2.11}$$

$\tau_1^{F*}$ and $\tau_1^{M*}$ are the optimal solution for $\tau_1^F$ and $\tau_1^M$ derived from Equation (2.11). From Equation (2.10), I can also obtain the corresponding SOCs. The SOCs are:

$$\begin{aligned}
\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{F2}} &= u''(Y_1(2-\tau_1^F-\tau_1^M))Y_1^2 + \delta u''(Y_1(\tau_1^F+\tau_1^M))Y_1^2 \\
&\quad + \beta u'(c_2)Y_2 n(\tau^{F''}_{2,\tau_1^F}\phi + \tau^{M''}_{2,\tau_1^F}(1-\phi)) + \beta u''(c_2)(Y_2 n(\tau^{F'}_{2,\tau_1^F}\phi + \tau^{M'}_{2,\tau_1^F}(1-\phi)))^2 < 0; \\
\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{M2}} &= u''(Y_1(2-\tau_1^F-\tau_1^M))Y_1^2 + \delta u''(Y_1(\tau_1^F+\tau_1^M))Y_1^2 \\
&\quad + \beta u'(c_2)Y_2 n(\tau^{F''}_{2,\tau_1^M}\phi + \tau^{M''}_{2,\tau_1^M}(1-\phi)) + \beta u''(c_2)(Y_2 n(\tau^{F'}_{2,\tau_1^M}\phi + \tau^{M'}_{2,\tau_1^M}(1-\phi)))^2 < 0; \\
\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^F \mathrm{d}\tau_1^M} &= u''(Y_1(2-\tau_1^F-\tau_1^M))Y_1^2 + \delta u''(Y_1(\tau_1^F+\tau_1^M))Y_1^2 \\
&\quad + \beta u''(c_2)Y_2^2 n^2(\tau^{F'}_{2,\tau_1^M}\phi + \tau^{M'}_{2,\tau_1^M}(1-\phi))(\tau^{F'}_{2,\tau_1^F}\phi + \tau^{M'}_{2,\tau_1^F}(1-\phi)) \\
&\quad + \beta u'(c_2)Y_2 n(\tau^{F''}_{2,\tau_1^F,\tau_1^M}\phi + \tau^{M''}_{2,\tau_1^F,\tau_1^M}(1-\phi)) < 0; \\
\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^F \mathrm{d}\phi} &= \beta u''(c_2)Y_2^2 n^2(\tau^{F'}_{2,\tau_1^F}\phi + \tau^{M'}_{2,\tau_1^F}(1-\phi))(\tau_2^F-\tau_2^M) + \beta u'(c_2)Y_2 n(\tau^{F'}_{2,\tau_1^F} - \tau^{M'}_{2,\tau_1^F}); \\
\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^M \mathrm{d}\phi} &= \beta u''(c_2)Y_2^2 n^2(\tau^{F'}_{2,\tau_1^M}\phi + \tau^{M'}_{2,\tau_1^M}(1-\phi))(\tau_2^F-\tau_2^M) + \beta u'(c_2)Y_2 n(\tau^{F'}_{2,\tau_1^M} - \tau^{M'}_{2,\tau_1^M}).
\end{aligned} \tag{2.12}$$

While the sign for the first three SOCs in Equation (2.12) is known, the signs for $\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^F\mathrm{d}\phi}$ and $\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^M\mathrm{d}\phi}$ are uncertain. Depending on the value of $\tau_1^F$, $\tau_1^M$, $\tau^{F'}_{2,\tau_1^M}$, and $\tau^{M'}_{2,\tau_1^F}$, the signs for $\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^F\mathrm{d}\phi}$ and $\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^M\mathrm{d}\phi}$ vary. There are two sets of conditions to set the signs of $\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^F\mathrm{d}\phi}$ and $\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^M\mathrm{d}\phi}$:

1. If the function $u(\cdot)$ is specified as a log or a CRRA function and $\tau_2^F > \tau_2^M$:
   (a) $\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^M\mathrm{d}\phi} < 0$;
   (b) if $\tau^{M'}_{2,\tau_1^F}$ is small enough or $\tau^{M'}_{2,\tau_1^F} \to 0$
      - $\tau^{F'}_{2,\tau_1^F}\tau_2^M - \tau_2^F\tau^{M'}_{2,\tau_1^F} > 0$
      - then $\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^F\mathrm{d}\phi} > 0$.
2. If the function $u(\cdot)$ is specified as a log or a CRRA function and $\tau_2^F < \tau_2^M$:
   (a) $\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^F\mathrm{d}\phi} > 0$;
   (b) if $\tau^{F'}_{2,\tau_1^M}$ is small enough or $\tau^{F'}_{2,\tau_1^M} \to 0$:
      - $\tau^{F'}_{2,\tau_1^M}\tau_2^M - \tau_2^F\tau^{M'}_{2,\tau_1^M} < 0$

- then $\frac{\mathrm{d}^2 U}{\mathrm{d}\tau_1^M \mathrm{d}\phi} < 0$.

Recall that the comparative statics are:

$$\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi} = \frac{U^{12}U^{23} - U^{13}U^{22}}{U^{11}U^{22} - U^{12}U^{21}}; \quad \frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi} = \frac{U^{11}U^{23} - U^{13}U^{21}}{U^{12}U^{21} - U^{11}U^{22}}.$$

$\tau_1^{F*}$ and $\tau_1^{M*}$ is the optimal solution of $\tau_1^F$ and $\tau_1^M$ from Equation (2.11). The $U^{ij}$s are the SOCs listed above when $\tau_1^F$ and $\tau_1^M$ at their optimal values.[5] I need the signs of the $U^{ij}$ to determine the sign of the comparative statics. For $U^{11}$, $U^{22}$ and $U^{12}/U^{21}$, the signs are all negative as showed in Equation (2.12).

For the sign of $U^{13}$ and $U^{23}$, $U^{13} > 0$ and $U^{23} < 0$, if under with two sets of conditions:

1. $\tau_2^{F*} > \tau_2^{M*}$ and $\tau_{2,\tau_1^{F*}}^{F*'}\tau_2^{M*} > \tau_2^{F*}\tau_{2,\tau_1^{F*}}^{M*'}$; or
2. $\tau_2^{F*} < \tau_2^{M*}$ and $\tau_{2,\tau_1^{M*}}^{F*'}\tau_2^{M*} < \tau_2^{F*}\tau_{2,\tau_1^{M*}*}^{M*'}$,

so the signs of the numerators in the comparative statics are:

$$U^{12}U^{23} - U^{13}U^{22} > 0;$$
$$U^{11}U^{23} - U^{13}U^{21} > 0.$$

For the sign of the denominator, under the assumption $\frac{\mathrm{d}^2\tau_2^F}{\mathrm{d}\tau_1^F \mathrm{d}\tau_1^M} = 0$ and $\frac{\mathrm{d}^2\tau_2^M}{\mathrm{d}\tau_1^F \mathrm{d}\tau_1^M} = 0$, I obtain:

$$|U^{11}| > |U^{12}| \quad \text{and} \quad |U^{22}| > |U^{12}| \quad \Rightarrow \quad U^{11}U^{22} - U^{12}U^{21} > 0.$$

Combining the signs of the denominator and numerator, the signs of the comparative statics are:

$$\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi} > 0; \qquad \frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi} < 0.$$

The signs for $\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi}$ and $\frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi}$ are consistent with the baseline model. The counterpart to *Proposition 1* for this model holds under two sets of conditions:

1. $\tau_2^{F*} > \tau_2^{M*}$ and $\tau_{2,\tau_1^{F*}}^{F*'}\tau_2^{M*} > \tau_2^{F*}\tau_{2,\tau_1^{F*}}^{M*'}$; or
2. $\tau_2^{F*} < \tau_2^{M*}$ and $\tau_{2,\tau_1^{M*}}^{F*'}\tau_2^{M*} < \tau_2^{F*}\tau_{2,\tau_1^{M*}*}^{M*'}$.

The interpretations of the counterpart to *Proposition 1* are similar to the interpretations in Section 2.3, although it should be borne in mind that these two sets of conditions may be difficult to realise in the real world scenario.

[5] $i \in \{1,2\}$ and $j \in \{1,2,3\}$. $U^{11} = \frac{\mathrm{d}^2 U}{\mathrm{d}\tau_1^{F*2}}$, $U^{13} = \frac{\mathrm{d}^2 U}{\mathrm{d}\tau_1^{F*}\mathrm{d}\phi}$, $U^{22} = \frac{\mathrm{d}^2 U}{\mathrm{d}\tau_1^{M*2}}$, $U^{23} = \frac{\mathrm{d}^2 U}{\mathrm{d}\tau_1^{M*}\mathrm{d}\phi}$, and $U^{12} = U^{21} = \frac{\mathrm{d}^2 U}{\mathrm{d}\tau_1^{F*}\mathrm{d}\tau_1^{M*}}$, which are the SOCs at the optimal value of $\tau^F$ and $\tau^M$.

## 2.4 Collective household model: the intra-household bargaining

One of the assumptions in the baseline model is that households in generation $P$ make unitary household-level decisions, and the utility generated by providing the old-age transfer counts as a utility of the household. To relax this assumption, I assume a collective model for the household-level decisions, which involves intra-household resource allocation. According to Browning and Chiappori (1998), the genders hold different bargaining powers or "distributions of powers" in households. This can be translated into different weights attached to the father's and mother's utility in the household-level utility function. The additional assumptions on intra-household bargaining are as follows:

- (i) The father earns $Y_t^F$ and the mother earns $Y_t^M$. The weight for the father's utility function is $\rho_t$ when $t \in \{1, 2\}$, and

$$\rho_t = \mathcal{P}(\frac{Y_t^F}{Y_t^M}) \quad \forall \quad t \in \{1, 2\}.$$

  The weight for the mother is $1 - \rho_t$. $\rho_t$ is increasing in $\frac{Y_t^F}{Y_t^M}$ and $0 \leq \rho_t \leq 1$. When $Y_t^F = Y_t^M$, $\rho_t = 0.5$.

- (ii) The father and the mother each have 5 own individual-level consumption, $c_1^F$ and $c_1^M$ respectively, when $t = 1$.

- (iii) $\eta_t$ is a result from the intra-household resource allocation between $Y_t^F$ and $Y_t^M$.

$$\eta_t = \mathcal{H}(\frac{Y_t^F}{Y_t^M}) \quad \forall \quad t \in \{1, 2\}.$$

  It is increasing in $\frac{Y_t^F}{Y_t^M}$ and $0 \leq \eta_t \leq 2$. When $Y_t^F \geq Y_t^M$, $1 \leq \eta_t \leq 2$, and when $Y_t^F < Y_t^M$, $0 \leq \eta_t < 1$.

- (iv) The results of the intra-household resource allocation are represented in both periods. The father in each period provides a proportion, $\eta_t$, of his original fraction of provision, $\tau_t^F$, while the mother provides $2 - \eta_t$ of her original fraction of provision, $\tau_t^M$ for $t \in \{1, 2\}$.

- (v) In the second period, when neither the father nor the mother earns income, the previous intra household bargaining parameters are not applicable. Thus, I assume that they share the transfer that they received from their next generation when $t = 2$. The consumption in the second period ($c_2$) is also at the household level.

- (vi) The second period transfer $\tau_2^F$ and $\tau_2^M$ depends not only on $\tau_1^F$ and $\tau_1^M$, but also on $\eta_1$. $\tau_2^F = \mathcal{T}^F(\eta_1 \tau_1^F)$ and $\tau_2^M = \mathcal{T}^M((2 - \eta_1)\tau_1^M)$.

Other assumptions are the same as the assumptions in the baseline model in Section 2.3. These additional assumptions describe that the incomes from the father and the mother, $Y_t^F$ and $Y_t^M$, affect the allocation of household resources, such as providing old-age support to the father's ageing parents ($\tau_t^F$) and those of the mother ($\tau_t^M$). For example, in the first period, the father provides $\eta_1 Y_1^F \tau_1^F$ and the mother provides $(2-\eta_1)Y_1^M\tau_1^M$ to their respective own parents. The optimisation problem becomes:

$$\begin{aligned}\max_{\tau_1^F,\tau_1^M} \quad U &= \rho_1 u(c_1^F) + (1-\rho_1)u(c_1^M) + \delta\rho_1 u(e_1^F) \\ &+ \delta(1-\rho_1)u(e_1^M) + \beta u(c_2);\end{aligned}$$

$$s.t.$$

$$\begin{aligned}c_1^F + c_1^M + c_2 \leq Y_1^F(1-\eta_1\tau_1^F) + Y_1^M(1-(2-\eta_1)\tau_1^M) \\ + Y_2^F\eta_2\mathcal{T}^F(\eta_1\tau_1^F)\phi n + Y_2^M(2-\eta_2)\mathcal{T}^M((2-\eta_1)\tau_1^M)(1-\phi)n; \\ e_1^F = \eta_1 Y_1^F\tau_1^F; \\ e_1^M = (2-\eta_1)Y_1^M\tau_1^M.\end{aligned}$$

In this section, I discuss only two extreme cases of the model:

1. when $Y_t^F \geq Y_t^M \quad \forall \quad t$, then $\eta_t = 2$,
2. when $Y_t^F < Y_t^M \quad \forall \quad t$, then $\eta_t = 0$.

When $Y_t^F \geq Y_t^M$ and $\eta_t = 2$, the father provides $\eta_t Y_t^F \tau_t^F$ to his parents and the mother accordingly provides no support to her parents. When $Y_t^F < Y_t^M$ and $\eta_t = 0$, the reverse occurs and the mother provides $(2-\eta_t)Y_t^M\tau_t^M$.[6] When $\eta_t = 2$ or $\eta_t = 0 \quad \forall \quad t$, the $\frac{\mathrm{d}^2 U}{\mathrm{d}\tau_1^F \mathrm{d}\tau_1^M} = 0$. The consumption for $t \in \{1, 2\}$ is respectively:

$$c_1^F + c_1^M = Y_1^F(1-2\tau_1^F) + Y_1^M \quad \text{or} \quad c_1^F + c_1^M = Y_1^F + Y_1^M(1-2\tau_1^M),$$

and

$$c_2 = 2Y_2^F\mathcal{T}^F(2\tau_1^F)\phi n \quad \text{or} \quad c_2 = 2Y_2^M\mathcal{T}^M(2\tau_1^M)(1-\phi)n,$$

depending on the value of $\eta_t$.

In this model, the FOCs and SOCs are different under different circumstances. In the extreme cases, I need to assume $u(c)$ is as a CRRA function form if $c > 0$ and $u(0) = 0$.[7] The detailed equations and signs for the FOCs and the SOCs under all the assumptions in two extreme cases in terms of the economic circumstances in the house are:

[6] The generalised case for this assumption is discussed in Section 2.4.1.

[7] The specification of the utility function can be relaxed to the log or the CRRA function in the next section.

1. When $Y_t^F \geq Y_t^M \quad \forall \quad t$, then $\eta_t = 2 \quad \forall \quad t$, while $c_1^F = Y_1^F(1-2\tau_1^F) + Y_1^M - c_1^M$ and $c_2 = 2Y_2^F\tau_2^F\phi n$, then the FOC and the SOCs are:

$$\begin{aligned}
\frac{\mathrm{d}U}{\mathrm{d}\tau_1^F} &= -(\rho_1)u'(c_1^F)2Y_1^F + \delta\rho_1 u'(e_1^F)2Y_1^F \\
&\quad + \beta u'(c_2)2Y_2^F\tau^{F'}\phi n = 0; \\
\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{F2}} &= \rho_1 u''(Y_1^F(1-2\tau_1^F))4Y_1^{F2} + \rho_1\delta 4Y_1^{F2}u''(Y_1^F\tau_1^F) \\
&\quad + \beta u'(c_2)2Y_2^F\tau_2^{F''}\phi n + \beta u''(c_2)(2Y_2^F\tau_2^{F'}\phi n)^2 < 0; \\
\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^F\mathrm{d}\phi} &= \beta u'(c_2)2Y_2^F\tau_2^{F'}n + \beta u''(c_2)(2Y_2^F n)^2\tau_2^{F'}\tau_2^F\phi > 0.
\end{aligned}$$

2. When $Y_t^F < Y_t^M \quad \forall \quad t$, then $\eta_t = 0 \quad \forall \quad t$, while $c_1^M = Y_1^F + Y_1^M(1-2\tau_1^M) - c_1^F$ and $c_2 = 2Y_2^M\tau_2^M(1-\phi)n$, then the FOC and the SOCs are:

$$\begin{aligned}
\frac{\mathrm{d}U}{\mathrm{d}\tau_1^M} &= -(1-\rho_1)u'(c_1^M)2Y_1^M + \delta(1-\rho_1)u'(e_1^M)2Y_1^M \\
&\quad + \beta u'(c_2)2Y_2^M\tau^{M'}(1-\phi)n = 0; \\
\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{M2}} &= (1-\rho_1)u''(Y_1^M(1-2\tau_1^M))4Y_1^{M2} + (1-\rho_1)\delta 4Y_1^{M2}u''(Y_1^M\tau_1^M) \\
&\quad + \beta u'(c_2)2Y_2^M\tau_2^{M''}(1-\phi)n + \beta u''(c_2)(2Y_2^M\tau_2^{M'}(1-\phi)n)^2 < 0; \\
\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^M\mathrm{d}\phi} &= -\beta u'(c_2)2Y_2^M\tau_2^{M'}n - \beta u''(c_2)(2Y_2^M n)^2\tau_2^{M'}\tau_2^M(1-\phi) < 0.
\end{aligned}$$

Again $U^{11} = \frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{F*2}}$, $U^{13} = \frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{F*}\mathrm{d}\phi}$, $U^{22} = \frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{M*2}}$, and $U^{23} = \frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{M*}\mathrm{d}\phi}$, which are the SOCs when $\tau^F$ and $\tau^M$ equal their optimal value derived from the FOCs. The key comparative statics I want to prove in this setting are different depending on the value of $\eta_t$. Again, there are two different cases:

1. When $Y^F \geq Y^M$ and $\eta_t = 2$ for all $t$, then the father in the household provides old-age support to his parents and the mother does not. I would expect

$$\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi} > 0; \qquad \frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi} = 0.$$

2. When $Y^F < Y^M$ and $\eta_t = 0$ for all $t$, then the mother in the household provides old-age support to her parents and the father does not. Then the comparative statics are

$$\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi} = 0; \qquad \frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi} < 0.$$

The derivation of these comparative statics in the different economic circumstances of the household are shown as follows, based on all the previous assumptions, and also on the assumption $u(0) = 0$:

1. If $Y_t^F \geq Y_t^M$ and $\eta_t = 2$. $\tau_1^{F*}$ is the optimal solution of $\tau_1^F$ from $U^1 = 0$. The total differentiation of $U^1 = 0$ is

$$U^{11}\mathrm{d}\tau_1^{F*} + U^{13}\mathrm{d}\phi = 0.$$

Given the conditions $U^{11} < 0$ and $U^{13} > 0$, the conclusion from these conditions is:

$$\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi} = -\frac{U^{13}}{U^{11}} > 0.$$

In this case, the gender ratio of the generation $K$, $\phi$, does not affect the mother's transfers to her parents, so

$$\frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi} = 0.$$

2. If $Y_t^F < Y_t^M$ and $\eta_t = 0$ for all $t$, $\tau_1^{M*}$ is the optimal solution of $\tau_1^M$ from $U^2 = 0$. The total differentiation of $U^2 = 0$ is:

$$U^{22}\mathrm{d}\tau_1^{M*} + U^{23}\mathrm{d}\phi = 0;$$

so,

$$\frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi} = -\frac{U^{23}}{U^{22}}.$$

Given the conditions $U^{22} < 0$ and $U^{23} < 0$, as in the case when $Y_t^F < Y_t^M$ and $\eta_t = 0$ for all $t$, the comparative statics from these conditions are:

$$\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi} = 0; \quad \frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi} < 0.$$

From the derivations from these two cases, *Proposition 2* can be established as follows:

***Proposition 2:*** *In the model with CRRA utility functions, with all the assumptions stated,*

1. *when* $Y_t^F \geq Y_t^M$ *and* $\eta_t = 2$ *for all* $t$, $\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi} > 0$ *and* $\frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi} = 0$,
2. *when* $Y_t^F < Y_t^M$ *and* $\eta_t = 0$ *for all* $t$, $\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi} = 0$ *and* $\frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi} < 0$.

The two simple parameters representing the collective-household assumption in this model are: $\rho_t$ and $\eta_t$. As stated in the results, the parameter $\rho_t$ does not affect the results during the process of deriving the signs of $\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi}$ and $\frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi}$. This parameter does not represent the process of bargaining in terms of old-age support provided by the father or the mother. It simply represents the different weightings attached to different members of the households as a result of household bargaining. $\eta_t$ is the key component that is linked to the old-age support provided by $P$ and the income of $P$, which affect the signs of the key comparative statics.

The interpretation of *Proposition 2* from the intra-household bargaining model is as follows: when the father in a household has a higher bargaining power than the mother, he provides more old-age support to his own parents if he has more sons. When the mother has a higher bargaining power than the father, she provides more with more daughters in her family. Different bargaining powers possessed by fathers and mothers lead to different demonstration effects from these fathers and mothers. Again, the key assumption is that $\phi$ is exogenous.

### 2.4.1 Relaxed intra-household resource allocation condition

In the basic intra-household bargaining model, I analyse only the extreme cases when $\eta_t = 2$ or $\eta_t = 0$, depending on the value of $Y_t^F$ and $Y_t^M$. $\eta_t$ is the parameter that indicates the results of the intra-household resource allocation. The father provides $Y_t^F(\eta_t\tau_t^F)$ to his parents after the intra-household bargaining, and the mother provides $Y_t^M((2-\eta_t)\tau_t^M)$. When $\eta_t = 2$ or $\eta_t = 0$, the extreme cases are that either the father or the mother with lower income does not provide any transfer to his or her own parents. I relax this assumption in this section, and assume that the party with the lower income in a household provides a smaller proportion of his/her income to his/her own parents. The party with a higher income provides a larger proportion. The proportion can be again represented by $\eta_t$ defined in this intra-household bargaining model.

$$\eta_t = \mathcal{H}(\frac{Y_t^F}{Y_t^M}) \quad \text{for} \quad t \in \{1, 2\}.$$

$\mathcal{H}(\frac{Y_t^F}{Y_t^M})$ is an increasing function in $\frac{Y_t^F}{Y_t^M}$, and $0 \leq \eta_t \leq 2$. When $Y_t^F = Y_t^M$, then $\eta_t = 1$. For simplicity, in this subsection, I assume again the same-gender demonstration effect, which means that $\tau_2^F = \mathcal{T}^F(\eta_1\tau_1^F)$ and $\tau_2^M = \mathcal{T}^M((2-\eta_1)\tau_1^M)$. The new maximisation problem for a household in generation $P$ is:

$$\begin{aligned} \max_{\tau_1^F, \tau_1^M} \quad & U = \rho_1 u(c_1^F) + (1-\rho_1)u(c_1^M) + \delta\rho_1 u(e_1^F) \\ & + \delta(1-\rho_1)u(e_1^M) + \beta u(c_2); \end{aligned} \tag{2.13}$$

$$s.t.$$

$$\begin{aligned} c_1^F + c_1^M + c_2 \leq Y_1^F(1-\eta_1\tau_1^F) + Y_1^M(1-(2-\eta_1)\tau_1^M) \\ + Y_2^F\eta_2\mathcal{T}^F(\eta_1\tau_1^F)\phi n + Y_2^M(2-\eta_2)\mathcal{T}^M((2-\eta_1)\tau_1^M)(1-\phi)n; \\ e_1^F = \eta_1 Y_1^F\tau_1^F; \\ e_1^M = (2-\eta_1)Y_1^M\tau_1^M. \end{aligned}$$

For this optimisation problem, it would be interesting to have a counterpart to *Proposition 1* in Section 2.3 to hold. I may conjecture that such a counterpart would again show that the percentage of the father's income for old-age support transfer ($\tau_1^{F*}$) increases, and the corresponding percentage for the mother's transfer ($\tau_1^{M*}$) decreases with the increasing male-to-female gender ratio of the children ($\phi$) in the household. In addition, under the intra-household allocation assumption, it might seem reasonable to find that the effect of the gender ratio in the household is greater on $\tau_1^{F*}$ than $\tau_1^{M*}$ if the father's earning is greater than the mother's. Likewise, if the father earns less than the mother, I might expect to find that the effect of the gender ratio is greater on $\tau_1^{M*}$ than $\tau_1^{F*}$. These thoughts can be summarised in the following conjecture:

***Conjecture 1:*** *$u(\cdot)$ is specified as a log or a CRRA function.*

1. *When $Y_1^F \geq Y_1^M$ for all t, $|\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi}| > |\frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi}|$.*
2. *When $Y_1^F < Y_1^M$ for all t, $|\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi}| < |\frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi}|$.*

First let me examine the counterpart to *Proposition 1*, which would mean that the comparative statics in this model with the relaxed intra-household resources allocation assumption needs to be:

$$\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi} > 0; \qquad \frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi} < 0.$$

From the optimisation problem in Equation (2.13), the FOCs for $\tau_1^F$ and $\tau_1^M$ are:

$$\begin{aligned}
U^1 =& \frac{\mathrm{d}U}{\mathrm{d}\tau_1^F} = \rho_1\eta_1 u'(c_1^F)(-Y_1^F) + \rho_1\eta_1\delta Y_1^F u'(e_1^F) + \beta u'(c_2)\eta_2 Y_2^F \tau_2^{F'}\phi n = 0,\\
U^2 =& \frac{\mathrm{d}U}{\mathrm{d}\tau_1^M} = (1-\rho_1)(2-\eta_1)u'(c_1^M)(-Y_1^M) + (1-\rho_1)(2-\eta_1)\times\\
& \delta Y_1^M u'(e_1^M) + \beta u'(c_2)(2-\eta_2)(1-\phi)Y_2^M\tau_2^{M'} n = 0;
\end{aligned} \tag{2.14}$$

and

$$c_2 = \eta_2 Y_2^F \tau_2^F \phi n + (2-\eta_2)Y_2^M\tau_2^M(1-\phi)n.$$

Again, $\tau_1^{F*}$ and $\tau_1^{M*}$ is the optimal solution of $\tau_1^F$ and $\tau_1^M$ from Equation (2.14). The corresponding SOCs are:[8]

$$\begin{aligned}
\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{F2}} =& \rho_1\eta_1^2 u''(c_1^F)Y_1^{F2} + \rho_1\eta_1^2\delta Y_1^{F2}u''(e_1^F)\\
& + \beta u'(c_2)\eta_2 Y_2^F\tau_2^{F''}\phi n + \beta u''(c_2)(\eta_2 Y_2^F\tau_2^{F'}\phi n)^2 < 0;\\
\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{M2}} =& (1-\rho_1)(2-\eta_1)^2u''(c_1^M)Y_1^{M2} + (1-\rho_1)(2-\eta_1)_1^2\delta Y_1^{M2}u''(e_1^M)\\
& + \beta u'(c_2)(2-\eta_2)Y_2^M\tau_2^{M''}(1-\phi)n + \beta u''(c_2)((2-\eta_2)Y_2^M\tau_2^{M'}(1-\phi)n)^2 < 0;\\
\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^F\mathrm{d}\tau_1^M} =& \beta u''(c_2)\eta_2(2-\eta_2)\phi(1-\phi)Y_2^M\tau_2^{M'}Y_2^F\tau_2^{F'}n^2 < 0;
\end{aligned}$$

[8]The function for $\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^F\mathrm{d}\tau_1^M}$ is valid only when $c_1^F = Y_1^F(1-\eta_1\tau_1^F)$ and $c_1^M = Y_1^M(1-(2-\eta_1)\tau_1^F)$.

$$\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^M \mathrm{d}\phi} = -\beta u'(c_2)(2-\eta_2)Y_2^M \tau_2^{M'} n$$
$$+ \beta u''(c_2)(2-\eta_2)Y_2^M \tau_2^{M'}(1-\phi)n^2(\eta_2 Y_2^F \tau_2^F - (2-\eta_2)Y_2^M \tau_2^M) < 0; \quad (2.15)$$
$$\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^F \mathrm{d}\phi} = \beta u'(c_2)\eta_2 Y_2^F \tau_2^{F'} n + \beta u''(c_2)\eta_2 Y_2^F \tau_2^{F'} \phi n^2(\eta_2 Y_2^F \tau_2^F - (1-\eta_2)Y_2^M \tau_2^M).$$

Again, the $U^{ij}$s are the SOCs listed above when $\tau_1^F$ and $\tau_1^M$ at their optimal values,[9] where

$$U^{11} = \frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{F*2}}; \quad U^{13} = \frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{F*}\mathrm{d}\phi}; \quad U^{22} = \frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{M*2}}; \quad U^{23} = \frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{M*}\mathrm{d}\phi}; \quad U^{12/21} = \frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{F*}\mathrm{d}\tau_1^{M*}}.$$

For $U^{11}$, $U^{12}$, $U^{22}$, and $U^{23}$, the signs are always negative according to the SOCs in Equation (2.15). But the sign of $U^{13}$ is not determined. If $u(\cdot)$ is specified as a log or a CRRA function, then $U^{13} > 0$. The comparative statics from the total differentiation equations of FOCs in Equation (2.14) are:

$$\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi} = \frac{U^{12}U^{23} - U^{13}U^{22}}{U^{11}U^{22} - U^{12}U^{21}}; \qquad \frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi} = \frac{U^{11}U^{23} - U^{13}U^{21}}{U^{12}U^{21} - U^{11}U^{22}}. \quad (2.16)$$

From the SOCs in Equation (2.15), I can infer

$$|U^{11}| > |U^{12}| \qquad \text{and} \qquad |U^{22}| > |U^{12}|,$$

if $u(\cdot)$ is specified as a log or a CRRA function. So the signs for the denominators and numerators in Equation (2.16) are as follows:

$$U^{12}U^{23} - U^{13}U^{22} > 0;$$
$$U^{11}U^{23} - U^{13}U^{21} > 0;$$
$$U^{11}U^{22} - U^{12}U^{21} > 0.$$

Under these conditions, the key comparative statics are

$$\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi} > 0; \qquad \frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi} < 0,$$

thus the counterpart to *Proposition 1* holds in the model with the relaxed intra-household resource allocation condition.

To examine the validity of *Conjecture 1*, I need to consider two cases corresponding to different economic circumstances in the family. The first case, as stated in *Conjecture 1*, is that when $Y_t^F > Y_t^M$ for $t \in \{1, 2\}$

$$\left|\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi}\right| > \left|\frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi}\right|.$$

[9] $i \in \{1, 2\}$ and $j \in \{1, 2, 3\}$.

From Equation (2.16), I infer

$$|\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi}|>|\frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi}| \quad \text{if} \quad U^{12}U^{23}-U^{13}U^{22}>U^{11}U^{23}-U^{13}U^{21},$$

and

$$U^{12}U^{23}-U^{13}U^{22}>U^{11}U^{23}-U^{13}U^{21}$$
$$\text{if} \quad U^{23}(U^{12}-U^{11})+U^{13}(U^{21}-U^{22})>0;$$

When $Y_t^F > Y_t^M$ for $t \in \{1,2\}$, then from the function of SOCs in Equation (2.15), I infer:

$$U^{12}-U^{11}>U^{21}-U^{22}>0.$$

Given the function of $U^{13}$ and $U^{23}$ in Equation (2.15), the absolute value of $U^{13}$ and $U^{23}$ have to be analysed under different conditions.

1. When $\tau_2^{M*}\tau_2^{F*'} < \tau_2^{F*}\tau_2^{M*'}$, then $|U^{23}|>|U^{13}|$. Under this condition, together with $U^{12}-U^{11}>U^{21}-U^{22}>0$, I conclude

$$U^{12}U^{23}-U^{13}U^{22}<U^{11}U^{23}-U^{13}U^{21} \Rightarrow |\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi}|<|\frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi}|$$

2. When $\tau_2^{M*}\tau_2^{F*'} > \tau_2^{F*}\tau_2^{M*'}$, then $|U^{13}|>|U^{23}|$. But $0<U^{21}-U^{22}<U^{12}-U^{11}$ when $Y_t^F > Y_t^M$ for $t \in \{1,2\}$. It is difficult to draw any conclusion about whether the inequation $U^{12}U^{23}-U^{13}U^{22}>U^{11}U^{23}-U^{13}U^{21}$ is valid. In another word, I cannot draw any conclusion on the relationship between $|\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi}|$ and $|\frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi}|$.

To conclude, when $Y_t^F > Y_t^M$ for $t \in \{1,2\}$, I cannot prove the first case in *Conjecture 1* is true.

The second case stated in *Conjecture 1* is that when $Y_t^F < Y_t^M$ for $t \in \{1,2\}$,

$$|\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi}|<|\frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi}|.$$

From Equation (2.16), I infer

$$|\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi}|<|\frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi}| \quad \text{if} \qquad U^{23}(U^{12}-U^{11})+U^{13}(U^{21}-U^{22})<0.$$

When $Y_t^F < Y_t^M$ for $t \in \{1,2\}$ and analysing the function of SOCs in Equation (2.15),

$$U^{21}-U^{22}>U^{12}-U^{11}>0.$$

Given the function of $U^{13}$ and $U^{23}$ in Equation (2.15), the absolute value of $U^{13}$ and $U^{23}$ have to be analysed under different conditions.

1. When $\tau_2^{M*}\tau_2^{F*'} > \tau_2^{F*}\tau_2^{M*'}$, then $|U^{13}| > |U^{23}|$. Under this condition, together with $U^{21} - U^{22} > U^{12} - U^{11} > 0$, I conclude

$$U^{12}U^{23} - U^{13}U^{22} > U^{11}U^{23} - U^{13}U^{21} \Rightarrow |\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi}| > |\frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi}|.$$

2. When $\tau_2^{M*}\tau_2^{F*'} < \tau_2^{F*}\tau_2^{M*'}$, then $|U^{13}| < |U^{23}|$. But $U^{21} - U^{22} > U^{12} - U^{11} > 0$ when $Y_t^F < Y_t^M$ for $t \in \{1, 2\}$. It is difficult to draw any conclusion about whether the inequation $U^{12}U^{23} - U^{13}U^{22} < U^{11}U^{23} - U^{13}U^{21}$ is valid. In another word, I cannot draw any conclusion on the relationship between $|\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi}|$ and $|\frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi}|$.

When $Y_t^F < Y_t^M$ for $t \in \{1, 2\}$, I cannot prove that the second case in *Conjecture 1* holds.

One possible explanation why neither case in *Conjecture 1* hold lies in the property of diminishing marginal utility. Take the scenario under $Y_t^F > Y_t^M$ when $t \in \{1, 2\}$ for example. The fathers earn more and the mothers earn less. For this reason, the magnitude of the same-gender demonstration effect can be smaller for the fraction of the fathers' income provided ($\tau_1^{F*}$) and greater for the mothers' ($\tau_1^{M*}$) to obtain the same amount of transfers from the next generation. So rather than trying to prove whether the effects of $\phi$ on the fraction of the income used for providing old-age support ($\tau_1^{F*}$ or $\tau_1^{M*}$) is greater for the individual who earns more in his or her household, it is more reasonable to show the effects of $\phi$ on the actual amount of old-age support ($\eta_1 Y_1^F \tau_1^{F*}$ or $(2-\eta_1)Y_1^M\tau_1^{M*}$) is larger for the individual who earns more in his or her household. As explained in the analysis for *Conjecture 1*,

1. When $Y_t^F > Y_t^M$ for $t \in \{1, 2\}$ and $\tau_2^{M*}\tau_2^{F*'} > \tau_2^{F*}\tau_2^{M*'}$, then $|U^{13}| > |U^{23}|$ and $U^{12} - U^{11} > U^{21} - U^{22} > 0$. It is difficult to draw any conclusion about whether the inequation $U^{12}U^{23} - U^{13}U^{22} > U^{11}U^{23} - U^{13}U^{21}$ is valid. But if $Y_t^F \gg Y_t^M$, then

$$\eta_1 Y_1^{F*}(U^{12}U^{23} - U^{13}U^{22}) > (2-\eta_1)Y_1^{M*}(U^{11}U^{23} - U^{13}U^{21}),$$
$$\text{so} \qquad |\frac{\mathrm{d}\eta_1 Y_1^{F*}\tau_1^{F*}}{\mathrm{d}\phi}| > |\frac{\mathrm{d}(2-\eta_1)Y_1^{M*}\tau_1^{M*}}{\mathrm{d}\phi}|.$$

2. When $Y_t^F < Y_t^M$ for $t \in \{1, 2\}$ and $\tau_2^{M*}\tau_2^{F*'} < \tau_2^{F*}\tau_2^{M*'}$, then $|U^{13}| < |U^{23}|$ and $U^{21} - U^{22} > U^{12} - U^{11} > 0$. It is difficult to draw any conclusion about whether the inequation $U^{12}U^{23} - U^{13}U^{22} < U^{11}U^{23} - U^{13}U^{21}$ is valid. But if $Y_t^M \gg Y_t^F$, then

$$\eta_1 Y_1^{F*}(U^{12}U^{23} - U^{13}U^{22}) < (2-\eta_1)Y_1^{M*}(U^{11}U^{23} - U^{13}U^{21}),$$
$$\text{so} \qquad |\frac{\mathrm{d}\eta_1 Y_1^{F*}\tau_1^{F*}}{\mathrm{d}\phi}| < |\frac{\mathrm{d}(2-\eta_1)Y_1^{M*}\tau_1^{M*}}{\mathrm{d}\phi}|.$$

Summarising the analyses above, I obtain another proposition for the optimisation problem in Equation (2.13):

***Proposition 3:*** *$u(\cdot)$ is specified as a log or a CRRA function.*

1. *When $Y_t^F > Y_t^M$ for all $t$, $\tau_2^{M*}\tau_2^{F*'} > \tau_2^{F*}\tau_2^{M*'}$ and the difference between $Y_1^F$ and $Y_1^M$ is large enough, then*

$$|\frac{\mathrm{d}\eta_1 Y_1^F \tau_1^{F*}}{\mathrm{d}\phi}| > |\frac{\mathrm{d}(2-\eta_1)Y_1^M\tau_1^{M*}}{\mathrm{d}\phi}|.$$

2. *When $Y_t^F < Y_t^M$ for all $t$, $\tau_2^{M*}\tau_2^{F*'} < \tau_2^{F*}\tau_2^{M*'}$ and the difference between $Y_1^F$ and $Y_1^M$ is large enough,*

$$|\frac{\mathrm{d}\eta_1 Y_1^F \tau_1^{F*}}{\mathrm{d}\phi}| < |\frac{\mathrm{d}(2-\eta_1)Y_1^M\tau_1^{M*}}{\mathrm{d}\phi}|.$$

When fitting the model to the data, the difference between $Y_t^F$ and $Y_t^M$ is quite large, especially in rural areas in China. $\eta_1$ and $(2-\eta_1)$ always amplify the difference between $Y_t^F$ and $Y_t^M$ accordingly. The conditions in *Proposition 3* are not extreme in situations in China, especially those for the first case in *Proposition 3*. It shows that the effects of $\phi$ on the total amount of old-age support by the father are greater than the old-age support provided by the mother if the father earns more in his household. When the mother earns more than the father, the effect of the gender ratio of the children on the amount of old-age support provided by her in the household is considerable. It also means that the mother demonstrates more to her children if she earns more and the male-to-female gender ratio is low in her household. The father demonstrates more if he earns more and the gender ratio is high. The implications from *Proposition 3* fit the empirical results in Chapter 1.

## 2.5 Combined model

In the previous setting, I show for different models under various relaxed assumptions that the individuals in generation $P$ provide more old-age support if there are more same-gender children in their household. In this section, I combine all the relaxed assumptions in the model and try to reach a similar conclusion. The first relaxed assumption is that the transfer from generation $K$ is affected by both parents. The second relaxed assumption is that the party that earns less in the household provides a smaller proportion of her/his income to her/his parents. Under these two relaxed assumptions and the basic bargaining model, the new optimisation problem is:

$$\max_{\tau_1^F,\tau_1^M} \quad U = \rho_1 u(c_1^F) + (1-\rho_1)u(c_1^M) + \delta\rho_1 u(e_1^F) + \delta(1-\rho_1)u(e_1^M) + \beta u(c_2);$$

$$s.t.$$

$$c_1^F + c_1^M + c_2 \leq Y_1^F(1-\eta_1\tau_1^F) + Y_1^M(1-(2-\eta_1)\tau_1^M)$$
$$+ Y_2^F\eta_2\mathcal{T}^F(\tau_1^F,\tau_1^M)\phi n + Y_2^M(2-\eta_2)\mathcal{T}^M(\tau_1^F,\tau_1^M)(1-\phi)n;$$
$$e_1^F = \eta_1 Y_1^F\tau_1^F;$$
$$e_1^M = (2-\eta_1)Y_1^M\tau_1^M.$$

In this combined model, I want to show that the counterparts to *Proposition 1* and *Proposition 3* hold. The counterpart to *Proposition 1* would show that $\tau_1^{F*}$ increases and $\tau_1^{M*}$ decreases with the increasing male-to-female gender ratio of the children, $\phi$, in the households. The counterpart to *Proposition 3* is that, depending on different household-level economic circumstances, the effect of $\phi$ is larger on the amount of old-age support provided by the individual who earns more in the household to his or her parents. In this section, I first examine the counterpart to *Proposition 1* and then check the validity of the *Proposition 3* counterpart.

Both proofs for the counterparts to *Proposition 1* and *Proposition 3* needs the functions of FOCs for $\tau_1^F$ and $\tau_1^M$. The FOCs from the optimisation problem are:

$$\begin{aligned}
U^1 =& \frac{\mathrm{d}U}{\mathrm{d}\tau_1^F} = \rho_1\eta_1 u'(c_1^F)(-Y_1^F) + \rho_1\eta_1\delta Y_1^F u'(e_1^F)\\
&+ \beta u'(c_2)(\eta_2 Y_2^F\tau'^{F}_{2,\tau_1^F}\phi n + (2-\eta_2)Y_2^M\tau'^{M}_{2,\tau_1^F}(1-\phi)n) = 0;\\
U^2 =& \frac{\mathrm{d}U}{\mathrm{d}\tau_1^M} = (1-\rho_1)(2-\eta_1)u'(c_1^M)(-Y_1^M) + (1-\rho_1)(2-\eta_1)\\
&\delta Y_1^M u'(e_1^M) + \beta u'(c_2)(\eta_2 Y_2^F\tau'^{F}_{2,\tau_1^M}\phi n + (2-\eta_2)Y_2^M\tau'^{M}_{2,\tau_1^M}(1-\phi)n) = 0.
\end{aligned} \tag{2.17}$$

and

$$c_2 = \eta_2 Y_2^F\tau_2^F\phi n + (2-\eta_2)Y_2^M\tau_2^M(1-\phi)n).$$

The corresponding SOCs are:[10]

$$\begin{aligned}
\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{F2}} =& \rho_1\eta_1^2 u''(c_1^F)Y_1^{F2} + \rho_1\eta_1^2\delta Y_1^{F2}u''(e_1^F)\\
&+ \beta u'(c_2)(\eta_2 Y_2^F\tau''^{F}_{2,\tau_1^F}\phi n + (2-\eta_2)Y_2^M\tau''^{M}_{2,\tau_1^F}(1-\phi)n)\\
&+ \beta u''(c_2)(\eta_2 Y_2^F\tau'^{F}_{2,\tau_1^F}\phi n + (2-\eta_2)Y_2^M\tau'^{M}_{2,\tau_1^F}(1-\phi)n)^2 < 0;\\
\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{M2}} =& (1-\rho_1)(2-\eta_1)^2 u''(c_1^M)Y_1^{M2} + (1-\rho_1)(2-\eta_1)_1^2\delta Y_1^{M2}u''(e_1^M)\\
&+ \beta u'((c_2)(\eta_2 Y_2^F\tau''^{F}_{2,\tau_1^M}\phi n + (2-\eta_2)Y_2^M\tau''^{M}_{2,\tau_1^M}(1-\phi)n)\\
&+ \beta u''(c_2)(\eta_2 Y_2^F\tau'^{F}_{2,\tau_1^M}\phi n + (2-\eta_2)Y_2^M\tau'^{M}_{2,\tau_1^M}(1-\phi)n)^2 < 0;
\end{aligned}$$

[10]The equation for $\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^F\mathrm{d}\tau_1^M}$ is valid only when $c_1^F = Y_1^F(1-\eta_1\tau_1^F)$ and $c_1^M = Y_1^M(1-(2-\eta_1)\tau_1^F.)$

$$
\begin{aligned}
\frac{\mathrm{d}^2 U}{\mathrm{d}\tau_1^F \mathrm{d}\tau_1^M} &= \beta u''(c_2)(\eta_2 Y_2^F \tau_{2,\tau_1^F}^{F'} \phi n + (2-\eta_2) Y_2^M \tau_{2,\tau_1^F}^{M'} (1-\phi) n) \\
&\quad \times (\eta_2 Y_2^F \tau_{2,\tau_1^M}^{F'} \phi n + (2-\eta_2) Y_2^M \tau_{2,\tau_1^M}^{M'} (1-\phi) n) \\
&\quad + \beta u'(c_2(\eta_2 Y_2^F \tau_{2,\tau_1^F,\tau_1^M}^{F''} \phi n + (2-\eta_2) Y_2^M \tau_{2,\tau_1^F,\tau_1^M}^{M''} (1-\phi) n) < 0; \\
\frac{\mathrm{d}^2 U}{\mathrm{d}\tau_1^F \mathrm{d}\phi} &= \beta u'(c_2)(\eta_2 Y_2^F \tau_{2,\tau_1^F}^{F'} n - (2-\eta_2) Y_2^M \tau_{2,\tau_1^F}^{M'} n) \\
&\quad + \beta u''(c_2)(\eta_2 Y_2^F \tau_2^F n - (2-\eta_2) Y_2^M \tau_2^M n) \\
&\quad \times (\eta_2 Y_2^F \tau_{2,\tau_1^F}^{F'} \phi n + (2-\eta_2) Y_2^M \tau_{2,\tau_1^F}^{M'} (1-\phi) n); \\
\frac{\mathrm{d}^2 U}{\mathrm{d}\tau_1^M \mathrm{d}\phi} &= \beta u'(c_2)(\eta_2 Y_2^F \tau_{2,\tau_1^M}^{F'} n - (2-\eta_2) Y_2^M \tau_{2,\tau_1^M}^{M'} n) \\
&\quad + \beta u''(c_2)(\eta_2 Y_2^F \tau_2^F n - (2-\eta_2) Y_2^M \tau_2^M n) \\
&\quad \times (\eta_2 Y_2^F \tau_{2,\tau_1^M}^{F'} \phi n + (2-\eta_2) Y_2^M \tau_{2,\tau_1^M}^{M'} (1-\phi) n);
\end{aligned}
\tag{2.18}
$$

Similar to the proof in the Section 2.3.1, $\tau_1^{F*}$ and $\tau_1^{M*}$ is the optimal solution of $\tau_1^F$ and $\tau_1^M$ from Equation (2.17). The $U^{ij}$s are the SOCs listed above when $\tau_1^F$ and $\tau_1^M$ at their optimal values,[11] where

$$
U^{11} = \frac{\mathrm{d}^2 U}{\mathrm{d}\tau_1^{F*2}}; \quad U^{13} = \frac{\mathrm{d}^2 U}{\mathrm{d}\tau_1^{F*} \mathrm{d}\phi}; \quad U^{22} = \frac{\mathrm{d}^2 U}{\mathrm{d}\tau_1^{M*2}}; \quad U^{23} = \frac{\mathrm{d}^2 U}{\mathrm{d}\tau_1^{M*} \mathrm{d}\phi}; \quad U^{12/21} = \frac{\mathrm{d}^2 U}{\mathrm{d}\tau_1^{F*} \mathrm{d}\tau_1^{M*}}.
$$

For $U^{11}$, $U^{12}$, and $U^{12/21}$, the signs are always negative according to the SOCs in Equation (2.18). But the sign of $U^{13}$ and $U^{23}$ are not determined. From the functions of SOCs in Equation (2.18), if $u(\cdot)$ is specified as a log or a CRRA function, then under two different sets of conditions:

1. $\tau_2^{F*} < \tau_2^{M*}$ and $\tau_{2,\tau_1^{M*}}^{F*'} \tau_2^{M*} < \tau_2^{F*} \tau_{2,\tau_1^{M*}*}^{M*'}$; or,
2. $\tau_2^{F*} > \tau_2^{M*}$ and $\tau_{2,\tau_1^{F*}}^{F*'} \tau_2^{M*} > \tau_2^{F*} \tau_{2,\tau_1^{F*}}^{M*'}$.

I obtain $U^{13} > 0$ and $U^{23} < 0$. The summary of the signs for $U^{ij}$ is:

$$
U^{11} < 0; \quad U^{22} < 0; \quad U^{12/21} < 0; \quad U^{13} > 0; \quad U^{23} < 0.
$$

The comparative statics from the total differentiation equations of the FOCs in Equation (2.17) are:

$$
\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi} = \frac{U^{12}U^{23} - U^{13}U^{22}}{U^{11}U^{22} - U^{12}U^{21}}; \quad \frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi} = \frac{U^{11}U^{23} - U^{13}U^{21}}{U^{12}U^{21} - U^{11}U^{22}}. \tag{2.19}
$$

From the SOCs in Equation (2.18), I can infer that $|U^{11}| > |U^{12}|$ and $|U^{22}| > |U^{12}|$, so:

[11] $i = \{1, 2\}$ and $j = \{1, 2, 3\}$.

$$U^{12}U^{23} - U^{13}U^{22} > 0;$$
$$U^{11}U^{23} - U^{13}U^{21} > 0;$$
$$U^{11}U^{22} - U^{12}U^{21} > 0.$$

Under these conditions, the counterpart to *Proposition 1* is proved in the combined model, which means that the signs for the key comparative statics from this model are:

$$\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi} > 0; \qquad \frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi} < 0.$$

For the examination for the counterpart to *Proposition 3*, I would like to show that the effect of $\phi$ on the total amount of old-age support by the father ($|\frac{\mathrm{d}\eta_1 Y_t^F \tau_1^{F*}}{\mathrm{d}\phi}|$) are larger than the effect on the old-age support provided by the mother ($|\frac{\mathrm{d}(2-\eta_1) Y_t^M \tau_1^{M*}}{\mathrm{d}\phi}|$) if the father earns more in his household. When the mother earns more than the father, the effect of the gender ratio of the children on the amount of old-age support provided by her in the households is more considerable than the old-age support provision by the father. There are two cases corresponding to the different economic circumstances in the household, as discussed in Section 2.4.1.

The first case is when $Y_t^F > Y_t^M$ for $t \in \{1, 2\}$. In this case, I want to show

$$|\frac{\mathrm{d}\eta_1 Y_t^F \tau_1^{F*}}{\mathrm{d}\phi}| > |\frac{\mathrm{d}(2-\eta_1) Y_t^M \tau_1^{M*}}{\mathrm{d}\phi}|.$$

From Equation (2.19), I infer that

$$|\frac{\mathrm{d}\eta_1 Y_t^F \tau_1^{F*}}{\mathrm{d}\phi}| > |\frac{\mathrm{d}(2-\eta_1) Y_t^M \tau_1^{M*}}{\mathrm{d}\phi}| \quad \text{if} \quad \eta_1 Y_1^F (U^{12}U^{23} - U^{13}U^{22}) > (2-\eta_1) Y_1^M (U^{11}U^{23} - U^{13}U^{21}).$$

If I rearrange this condition, then the condition is:

$$U^{23}U^{12}(\eta_1 Y_1^F - (2-\eta_1) Y_1^M \frac{U^{11}}{U^{12}}) + U^{13}U^{12}((2-\eta_1) Y_1^M - \eta_1 Y_1^F \frac{U^{22}}{U^{12}}) > 0,$$

if $U^{13} > 0$ and $U^{23} < 0$,[12] then this condition holds if

$$\frac{Y_1^F}{Y_1^M} > \frac{(2-\eta_1)U^{11}}{\eta_1 U^{12}} \quad \text{and} \quad \frac{Y_1^F}{Y_1^M} > \frac{(2-\eta_1)U^{12}}{\eta_1 U^{22}}.$$

[12] The sign for $U^{13}$ and $U^{23}$ when $u(\cdot)$ is specified as a log or a CRRA function, and under two different sets of conditions, are:

1. $\tau_2^{F*} > \tau_2^{M*}$ and $\tau^{F*'}_{2,\tau_1^{F*}} \tau_2^{M*} > \tau_2^{F*} \tau^{M*'}_{2,\tau_1^{F*}}$ or,
2. $\tau_2^{F*} < \tau_2^{M*}$ and $\tau^{F*'}_{2,\tau_1^{M*}} \tau_2^{M*} < \tau_2^{F*} \tau^{M*'}_{2,\tau_1^{M*}*}$.

From the functions in Equation (2.18), I get $0 < \frac{U^{12}}{U^{22}} < 1$ and $\frac{U^{11}}{U^{12}} > 1$, so when $Y_1^F > Y_1^M$ for $t \in \{1, 2\}$,

$$|\frac{\mathrm{d}\eta_1 Y_1^F \tau_1^{F*}}{\mathrm{d}\phi}| > |\frac{\mathrm{d}(2-\eta_1) Y_1^M \tau_1^{M*}}{\mathrm{d}\phi}| \quad \text{if} \quad \frac{Y_1^F}{Y_1^M} > \frac{(2-\eta_1)U^{11}}{\eta_1 U^{12}}.$$

The second case is when $Y_t^F < Y_t^M$ for $t \in \{1, 2\}$. In this case, I expect

$$|\frac{\mathrm{d}\eta_1 Y_1^F \tau_1^{F*}}{\mathrm{d}\phi}| < |\frac{\mathrm{d}(2-\eta_1) Y_1^M \tau_1^{M*}}{\mathrm{d}\phi}|.$$

From Equation (2.19), I infer that

$$|\frac{\mathrm{d}\eta_1 Y_1^F \tau_1^{F*}}{\mathrm{d}\phi}| < |\frac{\mathrm{d}(2-\eta_1) Y_1^M \tau_1^{M*}}{\mathrm{d}\phi}| \quad \text{if} \quad \eta_1 Y_1^F (U^{12}U^{23} - U^{13}U^{22}) < (2-\eta_1) Y_1^M (U^{11}U^{23} - U^{13}U^{21}).$$

Keeping $U^{13} > 0$ and $U^{23} < 0$, I rephrase this condition as

$$|\frac{\mathrm{d}\eta_1 Y_1^F \tau_1^{F*}}{\mathrm{d}\phi}| < |\frac{\mathrm{d}(2-\eta_1) Y_1^M \tau_1^{M*}}{\mathrm{d}\phi}| \quad \text{if} \quad \frac{Y_1^M}{Y_1^F} > \frac{\eta_1 U^{22}}{(2-\eta_1)U^{12}}.$$

The conditions required under different cases for $|\frac{\mathrm{d}Y_1^F \tau_1^{F*}}{\mathrm{d}\phi}| > |\frac{\mathrm{d}Y_1^M \tau_1^{M*}}{\mathrm{d}\phi}|$ or $|\frac{\mathrm{d}Y_1^F \tau_1^{F*}}{\mathrm{d}\phi}| < |\frac{\mathrm{d}Y_1^M \tau_1^{M*}}{\mathrm{d}\phi}|$ to hold are different and more specific in the combined model than the conditions in *Proposition 3*. The new proposition for the combined model is:

***Proposition 4:*** *When $u(\cdot)$ is specified as a log or a CRRA function, and under two different sets of conditions:*

1. $\tau_2^{F*} > \tau_2^{M*}$ *and* $\tau^{F*\prime}_{2,\tau_1^{F*}} \tau_2^{M*} > \tau_2^{F*} \tau^{M*\prime}_{2,\tau_1^{F*}}$*; or,*
2. $\tau_2^{F*} < \tau_2^{M*}$ *and* $\tau^{F*\prime}_{2,\tau_1^{M*}} \tau_2^{M*} < \tau_2^{F*} \tau^{M*\prime}_{2,\tau_1^{M*}*}$*,*

*then I obtain the following statements:*

$$\textit{When} \quad Y_t^F > Y_t^M \quad \textit{for} \quad t \in \{1,2\} \quad \textit{and} \quad \frac{Y_1^F}{Y_1^M} > \frac{(2-\eta_1)U^{11}}{\eta_1 U^{12}}$$
$$\Rightarrow \quad |\frac{\mathrm{d}\eta_1 Y_1^F \tau_1^{F*}}{\mathrm{d}\phi}| > |\frac{\mathrm{d}(2-\eta_1) Y_1^M \tau_1^{M*}}{\mathrm{d}\phi}|.$$

$$\textit{When} \quad Y_t^F < Y_t^M \quad \textit{for} \quad t \in \{1,2\} \quad \textit{and} \quad \frac{Y_1^F}{Y_1^M} > \frac{(2-\eta_1)U^{12}}{\eta_1 U^{22}}$$
$$\Rightarrow \quad |\frac{\mathrm{d}\eta_1 Y_1^F \tau_1^{F*}}{\mathrm{d}\phi}| < |\frac{\mathrm{d}(2-\eta_1) Y_1^M \tau_1^{M*}}{\mathrm{d}\phi}|.$$

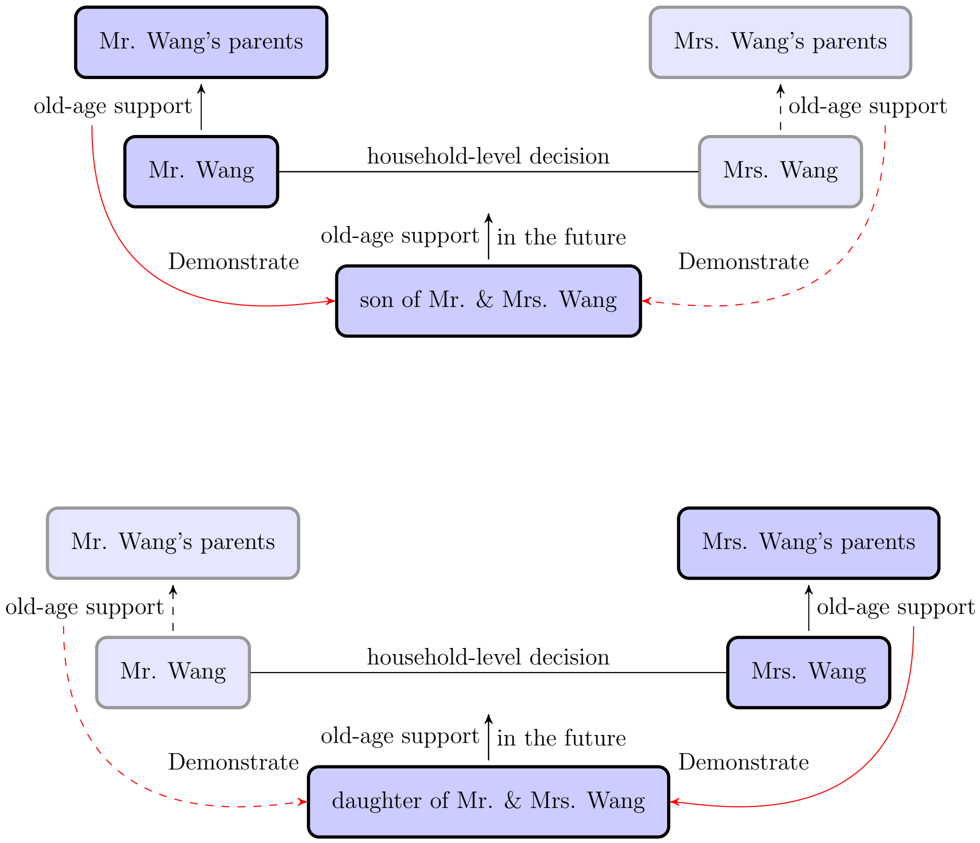
The interpretations of *Proposition 4* are still similar to the ones in *Proposition 3*. The mother demonstrates more to her children or provide more old-age support if she earns more and the male-to-female gender ratio is low in her household. The father demonstrates more if he earns more and the male-to-female gender ratio is high. The implications from *Proposition 4* fit the empirical results in Chapter 1.

## 2.6 Conclusions

This chapter discusses a simple model of old-age support provision based on the same-gender social norm transmission. I include the male-female gender ratio of the third generation, K, in the model and test the effect of the gender ratio of K on the old-age support provided by their parents. The key assumption in the model is that parents are more likely to influence their same-gender children in terms of old-age support provision behaviours. The model shows that the father in a household increases the old-age support that he provides to his own parents if the male-to-female gender ratio of his children increases, fixing the number of children. For mothers, their provision of old-age support decreases with the gender ratio of their children. In general, the conclusion holds in the model of relaxed assumptions under certain conditions. The model regards the motive for receiving more old-age support from the next generation as a possible explanation for the provision of old-age support by individuals. Passing on the norm of providing old-age support is a way of ensuring that the people who provide old-age support can receive more support from their children when the time comes.

However, the models in this chapter do not include all the aspects related to interactions within families. My analysis does not include the social enforcement of forming the norm of providing old-age support and does not include different cost when raising sons or daughters in households. These factors would also have the possibility of affecting people's old-age support provision behaviours. Moreover, no dynamic setting is included in the model. If we want to understand the transmission of the social norm through different generations, a dynamic setting or an OLG model would be a more suitable setting. Yet, the comparative statics and the propositions from the model generally reflect the empirical evidence provided in Chapter 1. Also, in the model, I assume $Y_t^F > Y_t^M$ or $Y_t^M > Y_t^F$ for all $t$. It would be interesting to show in the model how the norm changes if the relationship between $Y_t^F$ and $Y_t^M$ varies over time, like what I presented empirically in the later sections in Chapter 1.

Figure 2.1: Simple graphical illustration of the basic model




Note: This graphic illustration is for a simple scenario of the baseline model. I assume in this graph that each household has one child only. Mr. and Mrs. Wang have different degrees of influence on their child depending on its gender. The solid curve line represents a larger influence compared to the dashed curve line. Also, the dashed lines from Mr.or Mrs. Wang to their respective parents indicate Mr.or Mrs. Wang provide less old-age support than their partner in the household.

## 2.7 Figures

# Chapter 3

# Locked out? China's New Cooperative Medical Scheme and Rural Labour Migration

Providing health insurance with certain geographical restrictions may lead to possible misallocations in the labour market by hindering migration. This chapter tests whether the new rural health insurance introduced in 2003, the New Cooperative Medical Scheme (NCMS), had unintended and negative effects on rural-to-urban migration mobility in China. The NCMS only offers health insurance to people with rural household registration, and rural residents can only benefit from the NCMS if they visit the hospitals near their registered location in the household registration system. Utilising a new dataset collected from provincial yearbooks in China, the results of the event-study approach show that the NCMS does not reduce the percentage of rural residents who are rural-to-urban migrants and working outside their home counties at the county level but does have negative effects on its growth rate. Using the China Health and Nutrition Survey (CHNS), my instrumental variable results find that being enrolled in the NCMS decreases the probability of being a migrant at the individual level. The IV is a time-variant dummy indicating the counties that have relative early NCMS implementations. In addition, I use the CHNS to construct a county-level dataset and replicate the county-level results. Together, the results suggest that the NCMS gradually locks the rural labour force into rural areas and further hinders geographical job mobility in China.

## 3.1 Introduction

Providing basic health care services to every citizen is one of the important responsibilities of the central government in China (Wang, 2009). In 2003, the central government initiated a new rural health insurance scheme to replace the old policy, which was largely ineffective, to cover the health needs of the rural population. This scheme, the New Co-operative Medical Scheme (NCMS), provides coverage for catastrophic illnesses among those within the rural population and aims to prevent "poverty caused by illness".[1] However, the policy has a major geographical restriction on the reimbursement rate for medical expenses. The reimbursement rates for medical expenses vary depending on the administrative regions of the hospitals visited. Rural residents are eligible for high reimbursement rates only when they visit hospitals in the same administrative regions as their residence place registered in the household registration system in China.[2]

How might this policy restriction on health insurance distort the migrant labour market in China? This chapter finds that the implementation of the NCMS has a negative effect on the number of rural residents who are rural-to-urban migrants and work in urban areas away from their hometowns. However, from a first glance at the general statistics, the trend seems to be the opposite. During the implementation period of the NCMS from 2003 to 2008, the number of migrants increased dramatically due to China's rapid urbanisation process and increasing income differences between rural and urban areas. The great temptation to work in urban areas might alleviate the proposed negative effects of the NCMS. Despite the rapid economic development of urban areas in China before 2008, the social security system for rural-to-urban migrants is greatly underdeveloped. More than 70% of migrants were still not enrolled in health or work injury insurance within employment-based health insurance in the urban areas in 2012 (NBS, 2012; Giles et al., 2013). Rural-to-urban migrants are particularly vulnerable to health problems that might hinder their earning ability (Barber and Yao, 2010). Providing health insurance in rural areas fulfils rural-to-urban migrants' need for the social safety net. But the geographical restriction brought by the health insurance might potentially encourage these migrants to stay close to their hometown, which is usually their residence place in the household registration system, to benefit from high reimbursement rates.

This chapter studies the unintended consequences of the implementation of the NCMS on the rural-to-urban migrant labour market in China. Similar effects of health insurance schemes on labour market distortions have been noted in the U.S. context at the individual level. Gruber and Madrian (1993) discuss the "job-lock" effect of employer-sponsored health insurance portability; other papers examine the effects of

[1]Source for NCMS information: http://www.gov.cn/gongbao/content/2002/content_61818.htm (Content in Chinese), the State Council of the P.R.C.

[2]The system of household registration includes information such as whether the person is a rural or urban resident, birthplace, age, gender and other basic personal information (Chan, 2009).

health insurance, especially Medicare, on retirement decisions (Gruber and Madrian 1995; Fairlie et al., 2016). Results from the U.S. show that health insurance affects job-related decisions at the individual level. However, none of the studies in the U.S. investigates the effect of health insurance on geographical job mobility. This chapter also contributes to the literature on welfare-induced migration. Borjas (1999) found that immigrant welfare recipients are more likely to end up in high-benefit states in the U.S. Others have also contributed to the literature by providing empirical evidence for similar conclusions (Blank, 1988; Gelbach, 2004; McKinnish, 2005; McKinnish, 2007; Giorgi and Pellizzari, 2009), but mostly in developed countries. Munshi and Rosenzweig (2016) conducted a study on migration in India; their structural model estimates whether the improvement of formal insurance on migrations, such as government safety nets and private credit will double the migration rate. However, whether health insurance schemes have similar effects on the labour markets in developing countries, especially in China, is still an under-studied topic in the literature. To date, there has been almost no discussion of possible labour-market distortions caused by the NCMS in China. Qin and Zheng (2011) mentioned this issue, but the results are limited to an individual-level dataset with a restricted period and an identification strategy that not fully identify possible individual endogeneities. My chapter provides both robust individual and county-level evidence with clearer identification strategies and longer time-span to fill the missing empirical evidence in the literature, with the new datasets collected from various statistical yearbooks and newspapers.

I provide new county-level evidence of the effects of the implementation of the NCMS on the rural-to-urban migration labour market. By collecting raw data of the rural-to-urban migrants for each county for 13 years from five provincial statistical yearbooks and the county implementation date of the NCMS from the newspapers, I use an event-study approach to test whether the gradual roll-out of the NCMS decreases the percentage of rural-to-urban migrants from different counties. Rural-to-urban migrants from a county are a county's rural residents who are working in urban areas outside their home county. I call this percentage of rural-to-urban migrants at county-level the 'migration propensity'. The results show that, although the NCMS implementation does not decrease the migration propensity at the county-level, it has a lagged effect on the corresponding growth rate of the migration propensity, usually taking effect after the first year of the NCMS implementation.

As the results from the county-level data with limited geographical coverage might suffer from misreporting, I also use a survey dataset, the China Nutrition and Health Survey (CHNS), to conduct an individual-level analysis. In this analysis, I examine the effects of individual NCMS enrolment on the probability of one being a rural-to-urban migrant. The instrumental variable method is my identification strategy to tackle the possible endogeneities between individual-level health insurance enrolment and migration decision. I use the difference in time of counties becoming the "pilot" county as an IV for the individual level enrolment. The results show that individual enrolment in the health scheme decreases the probability of one being a rural-to-urban migrant. I also utilise the CHNS to construct a county-level data, and the results from the constructed county dataset provide supporting evidence for the results from the self-collected county dataset.

The chapter seeks to fill the gaps in the current literature by studying the distortionary effect of the NCMS on rural-to-urban migration in China. This is important because the studied migrant group with potential distorted migration behaviour is one of the main labour forces contributing to China's recent development. The first contribution of this chapter is that the new health insurance scheme in China might affect people's choices in the labour market on a larger scale compared to the effects of health insurance in the U.S (Gruber and Madrian 1995; Fairlie et al., 2016). The results imply that the unintended consequences of health insurance policies for labour markets in developing countries might be greater than what has been discussed in the literature on developed countries. Secondly, the chapter contributes to the existing literature by documenting the aggregated change in migration behaviour caused by health insurance, while most of the papers studying the effects of health insurance focus on individual-level evidence. Another contribution is the new county-level dataset that I collected from provincial statistical yearbooks and used for the county-level analysis.

The remainder is organised as follows. Section 3.2 provides background on different types of health insurance, especially the NCMS, and rural-to-urban migrants in China. Section 3.3 mainly focuses on the county-level data, and Section 3.4 discusses the individual-level evidence. Policy implication and conclusions are in Section 3.5.

## 3.2 Background

To understand why the rural-to-urban migration labour market could possibly be distorted by the geographical restriction of the NCMS, I first need to provide some background on the NCMS, other health insurance policies implemented in China, and also rural-to-urban migrants.

### 3.2.1 New Cooperative Medical Scheme and other health insurance schemes

The Cooperative Medical Scheme (CMS) was the health insurance before the implementation of the New Cooperative Medical Scheme (NCMS) since the 1950s, and its coverage was considerably low just before 2003 (Wagstaff et al., 2009). According to Wagstaff and his colleagues, there were many efforts, from local areas to the central government, to improve or even to resuscitate the CMS, yet the improvement on individual health nor the decrease in out-of-pocket medical expenses in rural areas in China was quite insignificant.

The NCMS was designed to cover the health expenditure on the illnesses of rural residents and aimed to avoid possible "poverty caused by catastrophic illness" in rural areas (Yi et al., 2009). The scheme was launched in some counties first in 2003, then gradually rolled out until all counties in China had implemented the NCMS by 2008. For each year from 2003, each provincial government chose different counties within the province as "pilot areas".[3] Once a county became a pilot area, the local government would continuously provide the NCMS to rural residents in the county from then on. I regard the pilot counties as treated counties on and after their first year of this policy implementation throughout this chapter. The treated counties increased year by year from 2003.[4] Figure 3.1 presents the number of counties that first become pilot counties in different years.

It is called a "cooperative" medical scheme because there are different administrative level parties involved in the financing of the NCMS. Governments at every administrative level, the central government, provincial government, county-level government, and local (village/township-level) government, are all involved in the implementation of the NCMS in rural areas, and so are the individual participants. The county-level governments are the main operators and designers of the NCMS, and the local government has "some discretion over the level of financing of the program, and the associated benefit package" (Wagstaff et al., 2009). Individual participants pay a relatively small fixed part of the contribution, and the central or provincial government provides subsidies for the NCMS. The scheme only provides higher reimbursements for medical expenses for a person seeking medical services in his or her township health centres and county-level hospitals (Wagstaff et al., 2009). This geographical restriction on the level of reimbursement rate across different administrative regions is mainly due to the financial structure of the NCMS. Because county-level and local governments are the main operators in the financing of the NCMS, the reimbursement rate is higher if rural residents visit their local hospitals than higher administrative-level hospitals (i.e. county-level or provincial level hospitals) and/or hospitals in places where are administratively different from the rural residents' household registration location.

The NCMS provides not only reimbursements for catastrophic and chronic diseases, but also for inpatient and outpatient services, making the NCMS important for the young rural generation as well as the elderly. The NCMS offers reimbursement services for different types of service utilised. For any inpatient services, it provides reimbursements for each inpatient treatment within-county, but there is a cap on the amount that can be reimbursed per year. The highest rate is around 80% to 90%, but the rate varies across counties and locations of hospitals. Some provinces allow a fixed subsidy to each person per year for all outpatient services that this person consumes in a year, and others provide different reimbursement rates depending on the hospitals visited.

[3]The selection of "pilot areas" is discussed in Section 3.3.

[4]Figure C.1 shows the gradual expansion of the "pilot" counties from 2003 to 2008 in the five provinces used in the county-level dataset.

These subsidies are in addition to the coverage for outpatient services for chronic diseases. For outpatient services and medicines for chronic diseases, the NCMS provides reimbursements depending on the type of disease. The inpatient or outpatient services reimbursement level decreases to around 30-40% if the patients attend hospitals outside their county but within the same provinces.[5] The health expenditure coverage for the NCMS varies slightly across counties but is mostly based on the provincial standard. The reimbursement level has been increasing since its early implementation. According to Wagstaff et al. (2009), hospitals above the county level only consist of 26% of the number of reimbursement episodes per NCMS member. There was no reimbursement for inter-province out/inpatient visits until 2013. The information implies rural residents are more likely to visit their local hospitals to benefit from the NCMS.

Apart from the NCMS, there are two other main health schemes in China, Urban Resident Health Care Insurance and Urban Employee Health Care Insurance, up to the final period of the NCMS implementation (Yu, 2015). Each of these three schemes provides health insurance coverage for different groups of residents in China. The NCMS mainly benefits rural residents and a small percentage of rural migrants that work close to their home address according to their household registration. Urban Resident Health Care Insurance covers residents with urban *hukou* but only those who are not employed, such as young students and senior residents. Urban Employee Health Care Insurance covers people who are employed in companies that offer this insurance in urban areas, regardless of their household registration status. The summary of the coverage is in Table 3.1.

Combining all three insurance schemes, it shows that most of the rural-to-urban migrants are theoretically covered by the NCMS, yet it is difficult for them to directly benefit from the scheme.[6] Given their low-income level, it is not likely that they will buy commercial health insurance.[7] If rural-to-urban migrants want to enrol in the scheme and benefit from the NCMS, they have to go back to the residence place in their household registration, so this scheme might count as an incentive for them to return to or to stay in rural areas, rather than working in urban areas and cannot commute frequently between their workplaces and hometowns. This is one of the main reasons why there might be potential negative effects of the NCMS on the rural-to-urban migration labour market. There is some health insurance coverage for rural-to-

[5] Different counties have their own regulations on the NCMS, but there are usually some common settings in these different regulations. Patients have the highest reimbursement rate when visiting village-level NCMS-designated hospitals (above 90%), and get a relatively high reimbursement rate of around (70-80%) when visiting county-level designated hospitals. If patients want to visit provincial-level designated hospitals, they usually get around 40% for the reimbursement rate. The process of getting reimbursements is also troublesome after visiting designated hospitals at their province-level. Some counties require an official transfer document from the county or village-level hospitals if patients want to visit the provincial level hospital. The regulation from Qidong (a county in Jiangsu) is in http://www.qidongnews.com/html/2015-11/20151104063042.htm.

[6] Thorough discussion in Section 3.2.2.

[7] The market for commercial health insurance was very limited during the implementation period of the NCMS.

urban migrants in big cities such as Beijing, Shanghai, Guangdong, and Shenzhen, but these schemes are not compulsory for the employers hiring the migrants and were not well implemented before 2010 (Barber and Yao, 2010).

### 3.2.2 Rural migrants and the *hukou* system

The different coverages of the different insurance schemes in China imply that rural-to-urban migrants are difficult to directly benefit from any of these schemes. One of the possible reasons that inferred from the previous descriptions is the household registration system (*hukou*) in China. *Hukou* is the individual level record in the system of household registration. It includes information such as whether a person is a rural or urban resident, birthplace, age, gender and other basic personal information (Chan, 2009). The classification of rural or urban residency is very difficult for rural residents to change. This geographical mismatch between where one's hukou is registered and where one is working and living potentially prevents a sizeable number of people in rural areas from benefiting from other urban health insurance schemes and also the NCMS, which most of the inter-province or even inter-county rural-to-urban migrants should be able to utilise.

Rural-to-urban migrants consist of three types. The first type (Type 1) is intra-county rural-to-urban migrants. They work in urban areas of the county in which they reside and comprise some 20% of the total migrants (NBS report, 2012).[8] It is easy for the intra-county rural migrants to commute between their *hukou* residence and their workplace, so they can still benefit from local welfare schemes such as the NCMS. The second type (Type 2) consists of the rural-to-urban migrants who are the focus of this chapter. They have rural *hukou*, but they work and live in urban areas far from their hometowns.[9] They are usually enrolled in low-skilled labour sectors such as construction and manufacturing in urban areas. In these sectors, employers are usually less likely to provide insurance coverage during the roll-out period of the NCMS. Working in big cities makes it difficult for them to participate in local welfare schemes, and their rural *hukou*s prevent them from enrolling in welfare schemes in urban areas that are designed for urban *hukou* residents. The third type (Type 3) of rural-to-urban migrants are similar to Type 2, but Type 3 migrants have higher education levels and are mostly employed by companies that provide welfare benefits in urban areas. The NCMS implementations in rural areas do not affect Type 3 migrants because these migrants' social insurance is already provided by their employers in urban areas. Type 3 migrants are more likely to be classified as rural-to-urban employees rather than rural-to-urban migrants.

According to the Report of Chinese Migrants in 2012, there are 208 million rural-

[8]All information about migrants in Section 2.1 are from this report and similar reports from other years.

[9]This category of migrants is non-seasonal because of the long distance between their workplace and their hometown. It is expensive and difficult for them to go back in the harvest season.

to-urban migrants working outside their hometown, and 83% of them still cannot benefit directly from any health insurance scheme (NBS report, 2012). 94% of rural migrants do not have a college degree, and 80% of them do not even have a high school diploma. Moreover, around 75% of them are not employed by companies providing welfare benefits in urban areas (NBS, 2012). Giles et al. (2013) found that no more than 20% of rural-to-urban migrants are covered by employment-based insurance. The rural-to-urban migrants have much less health insurance coverage compared to urban residents, rural residents who are not working outside their hometowns, and rural-to-urban employees. Despite the group's young average age (around 30), this group of migrants is vulnerable to serious health problems including lower immunization rates, higher rates of infectious diseases, and maternal mortality (Barber and Yao, 2010). The occupational health risks that migrants face are higher than for those with higher socioeconomic status and/or "white collar" jobs (Herd et al., 2010). Rural-to-urban migrants usually have relatively poor health because their workloads are higher while their incomes are comparatively lower than others (Chen et al., 2014). They can easily be dragged back below the poverty line if they fall ill and cannot afford health expenditures for illness because of the difficulty of enrolling in most of the health insurance schemes available in urban areas.

There was a decrease in the number of rural-to-urban migrants and also in the growth of rural-to-urban migration in 2009 due to the 2008 financial crisis; however, the number of migrants returning to their hometowns (return migrants) was relatively low compared to the total migration population. According to Xiwen Chen, one of the officials in the Rural Working Leading Group from the central government, there were about 20 million return migrants in 2009 due to the financial crisis.[10] The total number of inter-county rural migrants was 145.33 million, and the total number of rural migrants was 229.78 million (NBS, 2009). These return migrants account for less than 10% of the total migrants and 14% of the inter-county migrants. The total number of migrants actually increased by 1.9% in 2009, and the total number of inter-county migrants increased by 3.5% (NBS, 2009). From the different growth rates for total migrants and inter-county migrants, it seems that the financial crisis affected more intra-county migrants compared to the inter-county group. The corresponding growth rates for the total migrants and the inter-county migrants were 6% and 5.4% in 2010, 3.4% and 4.4% in 2011, and 3.0% and 3.9% in 2012 (NBS, 2009-2012). The different growth rates of the total migrants and the inter-county migrants indicates that the financial crisis might only have had one-year negative effects on the increase of rural migrants, especially the inter-county ones. The return migrants represent a relatively small percentage in terms of the total number of rural-to-urban migrants. These growth rates also indicate the trend of increasing rural-to-urban migrants might not be concave, which helps the later interpretation of my empirical results.

[10]Website: http://theory.people.com.cn/GB/49154/49369/8738602.html, contents in Chinese.

The county-level data in the government report does not identify the new migrants and the return migrants. According to a longitudinal survey on Rural-Urban Migration in China (RUMiC),[11] there were 522 new migrants who had just migrated to cities in 2008, compared to 407 new migrants in 2007.[12] The trend of an increasing number of new migrants is evident in Figure 3.2. I might not be able to eliminate all impacts of the 2008 financial crisis on the number of migrants, but as the evidence from the RUMiC shows, the effects might not be large enough to affect my main results in an extensive way, at least in 2008 and 2009. However, given that the RUMiC is limited to the 2008 and 2009 sample, I cannot say more about what might have happened for the rural-to-urban migrants after 2009. The financial crisis might have had lagged effects on rural-to-urban migrants, but interpreting this information together with the figures of the growth rates from the NBS migration report, it seems that 2009 should be the year that the financial crisis had the largest effect on rural-to-urban migrants.[13]

## 3.3 Evidence from the county-level data

The theoretical mechanism behind the negative effects of the NCMS is a simple compensating differential model by Gruber (2000) based on Rosen's model (1986). A modified form of the Gruber model applied to the rural-to-urban migration context is in Appendix C.1. The migration decision under the compensating differential model is very simple. For those who have already migrated, if the NCMS were to narrow the urban-rural income gap after decreasing the medical expenses in rural areas, then the number of migrants who want to move back to their hometown would increase. For these people in rural areas, the number of people who want to become rural-to-urban migrants would also decrease. So if the NCMS were more generous, then there would be fewer rural residents who are rural-to-urban migrants. The important condition for these changes is that the implementation of the NCMS does not affect the probability of people getting sick, which is likely to be true. I provide two sets of empirical evidence for the effects of the NCMS implementation on the number of rural residents who are rural-to-urban migrants in two different perspectives: the county-level results and the individual level results. I focus on the county-level results in this section first, using the county-level data collected from the statistical yearbook. The results provide

[11]The Longitudinal Survey on Rural-Urban Migration in China (RUMiC) consists of three parts: the Urban Household Survey, the Rural Household Survey and the Migrant Household Survey. It was initiated by a group of researchers at the Australian National University, the University of Queensland and Beijing Normal University and was supported by the Institute for the Study of Labor (IZA), which provided the Scientific Use Files. The financial support for RUMiC was obtained from the Australian Research Council, the Australian Agency for International Development (AusAID), the Ford Foundation, IZA and the Chinese Foundation of Social Sciences.

[12]RUMiC only contains two waves, one in 2008 and one in 2009. In the 2009 data, it cannot capture all the new migrants who migrated in 2009 in the sample, so I use the number of new migrants up to the year 2008 in the 2009 dataset.

[13]The effect of the financial crisis on the counties with the NCMS implementation close to 2008 is discussed in Appendix C.4.2.

insight into the extent to which rural-to-urban migrants respond at an aggregate-level to a policy change that should not affect the labour market in China.

### 3.3.1 County-level dataset and main variables

To examine the effects of the NCMS on the percentage of rural residents who are rural-to-urban migrants working outside their county at the county level, I obtained the corresponding data from different provincial statistical yearbooks and compiled a novel self-collected dataset. The dataset consists of county-level data collected from yearbooks from different provinces from 1998 to 2011. Only five provinces, Jiangsu, Gansu, Ningxia, Hubei and Shanxi, provide data on the number of rural-to-urban migrants at the county-level in their provincial yearbooks or provincial rural yearbooks. These provinces are important for economic and also migration-related activities in China. Gansu, Hubei and Shanxi are in the top-ten list of migrant-exporting provinces (Chan, 2013),[14] and Jiangsu is the province with the second largest GDP in China.[15]

The main variables collected are the total number of the rural population and the total number of the rural labour force who are rural-to-urban migrants and working outside their county at the county level. I call the percentage of rural residents who are rural-to-urban migrants in urban areas the migration propensity, and the percentage is the number of rural residents who are rural-to-urban migrants divided by the total rural population. Because the data collected is at the county-level, this sample only consists of inter-county rural-to-urban migrants, and 85% of the migrants are aged between 16-45 (NBS, 2009). The intra-county rural-to-urban migrants are counted as being in the labour force in other sectors (manufacturing or service etc.) within the total county labour force. For all provincial yearbooks, in most years, I also collected GDP, disposable income per capita for rural residents, total irrigated farmland, and the total number of the rural labour force at the county-level. The format of the provincial statistical yearbooks is not completely consistent over a long period, thus in certain years, for one or two provinces, the total number of migrants in rural areas is missing. Some imputations based on the dataset are needed in order to fill in the missing values.[16]

Another important variable is the exact starting year of the implementation of the NCMS for different counties. To get the exact date of the initial implementation of the NCMS for each county, I extracted these dates from the official county government websites and government-owned newspapers. I collected the information from various county/prefecture/province-level newspapers and government documents and formed a dataset for 6 years and 178 counties. Suburban areas that belong to prefecture-level

[14]In the list, Chongqing needs to be included in Sichuan province because it is more a city than a province in terms of the land area.

[15]Source: http://www.economist.com/content/chinese_equivalents

[16]The detailed information about imputation methods is in Appendix C.2. The estimations depend on different provincial statistical yearbooks.

cities were excluded from the regressions. Each suburban area is classified administratively as a county, but in practice, they are more similar to the urban areas in prefecture-level cities rather than counties that are far from prefecture-level cities. Rural-to-urban migrants from these suburban areas usually work in the prefecture city close to their *hukou* residence place, so it is easier for them to benefit from the NCMS than migrants from other counties. The migrants in rural areas in this county-level dataset are inter-county or inter-province migrants. As they cannot easily benefit from the NCMS due to the commuting difficulties, this is the group on which the NCMS might exert a negative effect.

### 3.3.2 Empirical methods and results

The implementation of the NCMS was gradually rolled-out in different counties in different years from 2003 to 2008. I first use a simple difference-in-differences method to empirically test the effects of the implementation of the NCMS on the county-level migration propensity. The treatment group and control group are time-variant. The treatment group includes those counties with the NCMS, and the control group comprises those counties without the NCMS. The counties in these two groups vary every year until all counties are in the treatment group.

To observe the basic results of the NCMS's impacts on the migration propensity for different counties, the regression equation using the simple DID method is:

$$\begin{aligned} prop(migrants)_{i,t} =& \alpha + \beta NCMS_{i,t} + X'_{i,t}\theta + \sum_k \gamma_k \times \mathbf{I}[k=t] \times \sum_l \rho_l \times \mathbf{I}[l=p] \\ & + year_t + \mu_i \times year_t + \upsilon_t + \varepsilon_{i,t}, \end{aligned} \tag{3.1}$$

where $i$ is the index for county and $t$ stands for time. $prop(migrants)_{i,t}$ is the propensity of rural residents in county $i$ working outside their home county (county $i$) at year $t$, which is the migration propensity. It is used to analyse the aggregate level of rural-to-urban migration from a county. The definition for this variable is the number of rural-to-urban migrants from a county divided by the total rural population in the county. $NCMS_{i,t}$ is an indicator set to 1 when county $i$ provides the NCMS in year $t$.[17] $\upsilon_t$ is the year fixed effect. $year_t$ is the linear year trend and $\mu_i \times year_t$ is the county fixed effect times the linear year trend. $\mathbf{I}[k=t]$ represents the year dummies from 1998-2011, and $\mathbf{I}[l=p]$ indicates the province ($p$) dummies for five provinces in total. The fixed-effect error term $\varepsilon_{i,t}$ is clustered at the county level. The choice of the cluster-level in the regressions is based on the discussion of the cluster-level by Abadie et al. (2017). They suggest that when using fixed-effects regressions, the cluster-level

[17] For example, if a county was chosen to be the pilot area for the NCMS from 2005, then the $NCMS_{i,t}$ for this county will be 0 before 2005 and 1 for 2005 and the years afterwards.

should be adjusted to the level of corresponding policy treatments. The NCMS policy is implemented at the county level. It would be suitable to use the cluster at the county-level in all fixed-effects regressions in this chapter. $X_{i,t}$ are the control variables, which include GDP per capita, disposable income per capita for rural residents, irrigated farmland per capita, and total rural labour force for each county at each year.[18] The result of this regression is in Table 3.2, and it shows an insignificant coefficient for the implementation of the NCMS on migration propensity.

The NCMS might take years to come into effect, but the variable $NCMS_{i,t}$ only represents the aggregate average effect from the year of implementation onwards. For the difference-in-differences, one of the key assumptions for the results to be valid is the parallel-trend assumption, which means before the implementation of the NCMS, the trend of outcome variables for the treatment and control groups should be similar. It is difficult to assess this pre-trend using $NCMS_{i,t}$ in the regression equation, given the fact the NCMS implementation is time-varying. To test the yearly effects of the NCMS after its implementation and to verify the parallel pre-trend assumption, I use the event study approach. The event is the initial implementation of the NCMS at the county level, which is different in different counties. The new regression equation for the event study is:

$$\begin{aligned} prop(migrants)_{i,t} =&\alpha + \sum_{n=-4}^{4} \beta_n \mathbf{I}[FirstNCMS_{i,t} = n] + X'_{i,t}\theta + \sum_{k} \gamma_k \times \mathbf{I}[k = t] \\ &\times \sum_{l} \rho_l \times \mathbf{I}[l = p] + year_t + \mu_i \times year_t + \upsilon_t + \varepsilon_{i,t}, \end{aligned} \tag{3.2}$$

while the definition of other variables remains the same. $\mathbf{I}[FirstNCMS_{i,t} = n]$ is a dummy variable and equals 1 for the $n^{th}$ years before or after the initial implementation of the NCMS for each county $i$ at year $t$. The choice of the cluster-level is still at the county-level for the event study approach. The argument for the choice of the cluster-level is similar to the one for Equation (3.1).

The results are shown in the first and the second column of Table 3.3, and the plot for the coefficients is presented in the left graph in Figure 3.3. The regression results are similar with or without controls. After controlling for county fixed-effects, year fixed-effects, year times province fixed-effects, and other county-level control variables, each of the coefficients $\beta_n$ represents the yearly effects of $n^{th}$ year before or after implementing the NCMS. The trend before the implementation of the NCMS is not violated since in Table 3.3 and Figure 3.3, the coefficients representing the years before implementation are insignificant and close to zero. The coefficients representing the

[18] Results for the correlation between controls and the implementation dates of the NCMS are in Appendix C.4.3 Table C.7. The detailed explanations are also in Appendix C.4.3.

years after the implementation of the NCMS are still insignificant but the magnitudes are larger than those before implementation. However, it is still difficult to draw any conclusion about the effects of the new insurance policy here. The effects of the first and the second year of the initial NCMS implementation are even positive. I find no strong evidence of the NCMS having negative effects on the migration propensity at the county-level.

One explanation for not finding the expected negative effects of the NCMS implementation on the $prop(migrants)_{i,t}$ could be the economic background during the examined time period in the data. The dataset is from 1998 to 2011. During this period, China experienced rapid development and urbanisation. The urban-to-rural income ratio from 1998 increased from 2.5 to 3 and has been stagnating at a high level since 2007 (Sicular, 2013). Due to the income differences, there was a large increase in rural-urban migration during this time (Shi, 2008). It is reasonable to believe that the NCMS might not have strong effects on the propensity of rural migrants for each county directly, but it might be able to slow its growing trend. To test this effect, I change the dependent variables from $prop(migrants)_{i,t}$ to the growth rate of the migration propensity in a county, so the two regressions become:

$$\begin{aligned} growthrate_{i,t} =& \alpha + \beta NCMS_{i,t} + X'_{i,t}\theta + \sum_k \gamma_k \times \mathbf{I}[k=t] \times \sum_l \rho_l \times \mathbf{I}[l=p] \\ &+ year_t + \mu_i \times year_t + \upsilon_t + \varepsilon_{i,t}, \end{aligned} \tag{3.3}$$

and

$$\begin{aligned} growthrate_{i,t} =& \alpha + \sum_{n=-4}^{4} \beta_n \mathbf{I}[FirstNCMS_{i,t}=n] + X'_{i,t}\theta + \sum_k \gamma_k \times \mathbf{I}[k=t] \\ &\times \sum_l \rho_l \times \mathbf{I}[l=p] + year_t + \mu_i \times year_t + \upsilon_t + \varepsilon_{i,t}, \end{aligned} \tag{3.4}$$

The results are again presented in the second column of Table 3.2 and the third and fourth columns of Table 3.3. The regression results are similar with or without controls. The graph on the right in Figure 3.3 plots the coefficients from Equation (3.4).

Table 3.2 shows that the aggregate effect of the NCMS on the growth rate is still insignificant, whereas there are significant negative effects of the NCMS for the 1st, 3rd and 4th year after its initial implementation, shown in Table 3.3. These results indicate that the NCMS slows down the growing trend of rural-urban migration in most of the years following implementation. The insignificant aggregate effect in Table 3.2 might be due to the fact that the NCMS takes time to come into effect. The rural residents who are working in urban areas may require time to quit their jobs and settle in their hometowns if they want to benefit from the NCMS. The implementation of the NCMS could unintentionally decrease the growth rate of migrants by as much as 1.43% on average in the first year after the initial implementation. The effect counts around 40% of the growth rate for the number of inter-county migrants, which was 3.5% in 2009, and also the corresponding growth rate of the rural-to-urban migrants in 2004, which was also 3.5%.[19] The third-year effect of the NCMS is the largest amongst the yearly effects. It decreases the growth rate of the migration propensity by 1.65%.

One possible explanation for the growth rate of the migration propensity is the possible diminishing growth rate of the rural-to-urban migrants. To address this concern, I control for the county fixed effect times a linear year trend in all the regressions in this chapter. Apart from the empirical method, the statistical figures about the growth rate from 2009-2011 stated in Section 3.2.2 shows that the growth rate is around 3%. There is no general decreasing trend for the growth rate of the migrant. A report from Asian Development Bank also shows the increasing trend of the migration share of the total population is not diminishing.[20] These numbers might also help to alleviate the concern of the possible diminishing growth rate of the rural-to-urban migrants that might be driven the results.

Generalising the results to the whole country, and, given the actual number of inter-county migrants in 2008 was 140.41 million (NBS, 2012), if the NCMS decreased the growth rate in 2009 by 1.65%, this would mean that 2.31 million rural residents were affected by the NCMS.[21] This number is calculated based on the number of rural residents who are already rural-to-urban migrants, which does not include potential rural-to-urban migrants, so the actual size of the affected population could be larger. The decrement in the migrants in just one year would be more than two-thirds of the total labour force of Singapore, Hong Kong or Massachusetts.[22] The large absolute numbers arise from the large population base, not to mention the migrants-to-be who might be affected. However, there are many restrictive assumptions that need to be born in mind when interpreting the generalised effect.

The results under different cluster-levels are presented in Table C.1. When the error term is just robust but not clustered, the results are similar to the results in Table 3.3. When the error term is clustered at the prefecture-level, the significance level dropped and only the effect of the NCMS implementation on $growthrate_{i,t}$ after the fourth year of its implementation is significant at 90%. The results are insignificant when the error term is clustered at the province-level. However, since I am only able to collect 5 provinces for the county-level dataset, it might be too few clusters used when choosing

[19] https://clb.org.hk/schi/content/%E4%B8%AD%E5%9B%BD%E5%86%9C%E6%B0%91%E5%B7%A5%E9%97%AE%E9%A2%98%E7%A0%94%E7%A9%B6%E6%80%BB%E6%8A%A5%E5%91%8A. Content in Chinese

[20] Lu and Xia (2016). Migration in the Peoples Republic of China. https://www.adb.org/sites/default/files/publication/191876/adbi-wp593.pdf

[21] Assume all counties implemented the NCMS in 2006.

[22] Sources: http://www.censtatd.gov.hk/hkstat/sub/so30.jsp (HKG), http://stats.mom.gov.sg/Pages/Labour-Force-In-Singapore-2013.aspx (SGP) and http://www.bls.gov/news.release/laus.t03.htm (USA).

the province as the cluster-level. Also, within a province or even a prefecture city, the differences between different counties are quite large in terms of GDP, population, and especially the NCMS implementation. It is reasonable to use the county level as the cluster-level of my stander errors in the regressions, together with the argument by Abadie et al. (2017).

The takeaway from the results is that the implementation of the NCMS has a negative second-order effect on the number of the rural-to-urban migrants. The robustness checks for different numbers of years before and/or after the implementation of the NCMS are presented in Appendix C.4.1. The results from these checks show significant negative effects for different numbers of leads and lags on the growth rate of the migration propensity. These results also suggest that the NCMS has a long-term lagged effect on migration rather than an immediate effect. When interpreting the results, I need to consider the increasing generosity of the NCMS since the early years of its implementation. The increase in the NCMS generosity level would amplify the negative effects of the implementation. However, the county-level governments set the reimbursement rates based on the guidelines provided by the provincial governments. The year times province fixed effects that I controlled for in the regression would help to address this concern. Apart from this, the interpretation of the results and the conclusions also rely on a set of identification assumptions for the event study approach.

## Checking the identification assumptions

The first and most important assumption in the event study approach is that the NCMS implementation is not determined by the outcome variable. The NCMS was emphasised mainly as a welfare benefit for rural residents rather than the central government targeting the rural migrants (Yi et al., 2009). From a policy point of view, implementing the NCMS and the rural-to-urban migrants from different counties should be exogenous. In addition, the plots of coefficients in Figure 3.3 both support this assumption: the migration propensity and its growth rate do not vary much before the implementation of the NCMS. To further confirm this assumption, I conduct a placebo-test on the implementation of the NCMS. If the NCMS is not implemented, the migration propensity and the corresponding growth rate should not decrease. Data from Guangdong province is a good fit to test this scenario. This province implemented an early version of the NCMS in 1999 (Zheng, 2011). The implementation of the NCMS in 2003 in Guangdong province was merely a name change from the previous health insurance system. So if there were no actual NCMS implementation in Guangdong, then the advertising of the NCMS would be unlikely to have affected the migration propensity. The results from the placebo test show that the advertising of the NCMS might not affect the migration trend negatively. The details of this placebo test are in Appendix C.3, and the results are in the first two columns of Table C.2. The large coefficients and stander errors might be due to the sample size limitation for the placebo province.

One province results might not be a convincing piece of evidence for the assumption. So I also conduct a traditional placebo test. I assume hypothetically that the NCMS initial implementation starts two years early than the actual starting date for each county. I run Equations (3.2) and (3.4) with the same specification and the hypothetical early NCMS implementation date, and the results are in the third and fourth column of Table C.2. The results show that, for the migration propensity and its growth rate, the hypothetical early NCMS implementation does have effects at least until the third year of the implementation, which are consistent with the results when running the actual NCMS implementation timing in Table 3.3. The results from this placebo test make the assumption of the migration propensity and its growth rate do not vary much before the implementation of the NCMS as a valid one.

Another key assumption for the results to hold is that the timing of the NCMS implementation also needs to be exogenously assigned to each county in theory. However, the detailed official requirements for the timing of the implementation of the NCMS in each county were not publicly revealed. Some news reports discussed the requirements for being a "pilot" county, yet the requirements were quite vague, and there is no detailed information on the timing of the implementation.[23] The main concern arising from the vague requirements is that the timing of the first implementation of the NCMS was related to GDP per capita or other characteristics that are controlled at the county level. For example, counties with higher GDP per capita might have implemented the NCMS earlier than counties with lower GDP per capita. Also, GDP per capita and other controls might lower the migration propensity and/or its growth, which might affect the interpretation of the results.

To check whether GDP per capita and other controls correlate with the timing of the counties' initial NCMS implementation. I first classify counties into two groups based on the date of the NCMS implementation: an early-treated group and a late-treated group. The early-treated group includes counties that implemented the NCMS in 2003, 2004 and 2005, and the late-treated group includes those counties that implemented it after 2005. I test the correlations between GDP per capita, rural residents' income per capita, the number of the total rural labour force, and whether a county is in the early treated group. The results are in Table C.7 in the Appendix, and the correlations between whether a county is in the early-treated group and different controls at the county level are insignificant. However, there are other unobservables that might affect the interpretation of the result in the same way as the GDP per capita and other controls. It would have been desirable to have the information related to medical and health services provided in the rural areas at county-level. I could have used the

[23]Website: http://www.jxsrwsj.gov.cn/Article/ShowArticle.asp?ArticleID=174 (The content is in Chinese). The requirements are such that the county has sufficient ability to manage health care resources or the county needs to have sufficient subsidies to help the implementation of the NCMS, but they did not define what "sufficient" is in their requirements.

information as an instrument for the timing of the NCMS implementation. However, not all statistical yearbooks offer this information from five provinces. This possible selection bias should be borne in mind when interpreting the results.

In the event study approach, I show that the coefficients for the years before the NCMS implementation are insignificant and have smaller magnitudes than the yearly effects after the implementation. However, it would be reassuring if the difference between the average of the $prop(migrant)$ and $growthrate$ for the early-treated counties and late-treated counties are small or insignificant. In Figure 3.4, I show the average of the $prop(migrant)$ and $growthrate$ for early-treated and late-treated counties for three periods: before the NCMS implementation (1998-2003), during the roll-out of the NCMS (2003-2008), after roll-out of the NCMS (2009-2011). The early-treated counties are counties with the NCMS implemented from 2003 to 2005, and the late-treated counties are those implemented the NCMS on or after 2006. The figure shows the $prop(migrant)$ for early and late-treated counties are similar before and even during the NCMS implementation. For the growth rate of $prop(migrant)$, it seems like the late-treated group has a higher average for the period before and during the NCMS implementation. However, the differences seem not large enough given the 95% confidence intervals for the early-treated and late-treated groups. The figure shows for the growth rate of $prop(migrant)$ after roll-out of the NCMS, the early-treated counties have a higher average than the late-treated counties, which could explain the results of early-treated counties with insignificant NCMS impacts in Table C.6. The statistics for pre-NCMS implementation period and the period during the NCMS roll-out seems to be consistent with the pre-event results from the main regressions.

Apart from testing the validity of the identifying assumptions, during the time period examined in this section, there might have been other reforms in China that might also have affected the percentage of rural-to-urban migrants from counties. Large-scale agricultural reforms could be one of these. For example, the central government officially abolished the agricultural tax on January 1st, 2006.[24] This reform was nationwide, so the abolition of agricultural taxation was implemented provincially from 2004 to 2006 (Chen, 2017). Another change that might have affected the results could be the change in provincial leaders. From 1998 to 2011, the provincial leaders changed at least five times. Different provincial leaders also affected policy implementations in their provinces differently, depending on the closeness of their relationship with the central government (Chung, 1995). The year-times-province fixed effect controlled in the regressions could capture the tax reform effect and hopefully captures other provincial-level changes.

However, there are two other flaws in the county-level dataset that might have weakened the credibility of the results: under-reporting on the number of migrants at the county level and limited provincial coverage of the dataset. Regarding the

[24] Website: http://news.xinhuanet.com/politics/2009-10/13/content_12220598.htm

first weakness, a county's government has an incentive to under-report the number of migrants in order to "look good" in comparison to other counties in provincial statistical yearbooks (Cai, 2014). According to Koch-Weser (2013), the under-reporting might also be due to unregistered migrants. The second problem is that the dataset only covers 5 out of 32 provinces in China. The results represent an upper-bound of the actual effects of the NCMS on the internal migration labour market if the counties start to under-report after the NCMS implementation. I have to bear these two main flaws of the county-level dataset, as well as the possible selection bias, in mind when interpreting the results. Using individual-level datasets collected by non-governmental research organisations helps avoid the under-reporting problem. Therefore, I use the individual-level data to verify the county-level results and also try to analyse the question from a micro/individual perspective.

## 3.4 Evidence from the China Health and Nutrition Survey

Because the interpretation of the county-level data results might suffer from the misreporting problem and the geographical limitation, I use an individual dataset, the China Health and Nutrition Survey (CHNS), to verify the effect of the NCMS implementation on rural-to-urban migrants at the individual level. The CHNS is a comprehensive survey panel dataset covering information regarding income, healthcare, medical expenditure, health insurance and other aspects. This unbalanced longitudinal dataset contains comprehensive information about households from nine different provinces from 1989-2011.[25] Hence, the CHNS can be treated as a comprehensive representation of national data compared to the county-level data. Data are collected through questionnaires filled out by households, and one household representative answers the questionnaire for all the household members.[26] The data are at the individual level. I utilise the dataset in two ways. First, I use the individual-level data originally provided by the CHNS to examine the effect of being enrolled in the NCMS on the probability of an individual being a migrant, providing supporting evidence for the effect of the NCMS on rural-urban migrants at the individual level. The second method of utilising the CHNS is to construct a county-level CHNS dataset. The results from this method provide new county-level results which are comparable to the analysis in Section 3.3. This helps to verify the county-level results in Section 3.3.[27]

[25] Liaoning, Heilongjiang, Jiangsu, Shandong, Henan, Hubei, Hunan, Guangxi, and Guizhou. Guangdong is not included in this dataset. There are nine waves: 1989, 1991, 1993, 1997, 2000, 2004, 2006, 2009, 2011 and, recently 2015. The coverage map for CHNS is shown in Figure C.4.

[26] In survey wave on or before 2000 and for some questions on and after the wave 2004.

[27] In the CHNS, I still cannot distinguish the return migrants in the rural population; however, as discussed in Section 3.2.2, the return migrants only accounts for around 10% of the total migrants. Also, all the individual information is answered by the household respondents in the CHNS.

### 3.4.1 Individual level evidence

When generating the individual-level evidence, what I want to test in the results was whether being enrolled in the NCMS makes individuals less likely to be inter-county rural-to-urban migrants. The outcome variable that indicates whether an individual is seeking jobs somewhere else and has not been home for a certain period (labelled here as *migrant*), and the key independent variable that shows whether an individual is covered by the NCMS (labelled here as *haveNCMS*). I use a sample that contains individuals with rural *hukou* only, for it to be consistent with the results in Section 3.3. The CHNS does not show whether an individual is an inter-county migrant. It only provides information on whether an individual is now a migrant and how long this individual has been away from home. To identify the inter-county rural-to-urban migrant, I set the variable migrant equal to 1 if individuals are seeking jobs somewhere else and have been away from their hometown for more than six months. In the wave 1989, 1991, and 1993, there was no information about the migration behaviour in the data, so I only use 6 waves of the CHNS from 1997 to 2011 (1997, 2000, 2004, 2006, 2009, and 2011) to match the time period covered by the county-level results. It is still difficult to identify whether a person is a return migrant in the CHNS, just like the county-level data.

Using the difference-in-differences method with panel data, the possible unobservable time-invariant individual effects were eliminated from the individual-fixed effect. For the time-variant variables, the wave (corresponding to year) times province fixed-effect also helps to control for the trends partially. The regression for the individual-level result is:

$$\begin{aligned} migrant_{d,t} =& \alpha + \beta haveNCMS_{d,t} + X'_{d,t}\theta + \sum_k \gamma_k \times \mathbf{I}[k=t] \\ &\times \sum_l \rho_l \times \mathbf{I}[l=p] + \mu_d + \upsilon_t + \varepsilon_{d,t}, \end{aligned} \tag{3.5}$$

where $d$ is the index for individuals and $t$ stands for time. $\mu_d$ is the individual fixed effect and $\upsilon_t$ is the wave fixed effect. $\mathbf{I}[k=t]$ represents the six wave dummies from 1998-2011, and $\mathbf{I}[l=p]$ is the province ($p$) dummies for 9 provinces in total. $migrant_{d,t}$ equals 1 if an individual has a rural *hukou*, is aged between 16 and 45,[28] is seeking a job somewhere else, and has been away from home for more than half a year in wave $t$. $X_{d,t}$ is an array of the demographic variables including deflated household income per capita, age, marital status, occupation, and highest education level, and also county-level average household income. All individuals in the sample have rural *hukou*. The error term $\varepsilon_{d,t}$ is robust. $haveNCMS_{d,t}$ equals 1 if an individual $d$ covered by the NCMS in wave $t$. The OLS results are presented in Panel A in Table 3.4.

[28] which is the main age range for rural-to-urban migrants (NBS, 2012)

At the individual level, enrolment of the NCMS is voluntary (Wagstaff et al., 2009). So, there are endogeneities between $haveNCMS_{d,t}$, $migrant_{d,t}$, the controls, and possible unobservable variables, even after controlling for the individual fixed effects. For example, individual health affects decisions on both whether or not to become a rural-to-urban migrant and the NCMS enrolment. In addition to the difference-in-differences method, I adopt Lei and Lin's (2009) method and use a variable related to the county-level NCMS enrolment as the instrumental variable for the individual-level enrolment. Lei and Lin argue that it is difficult for the individual-level factors to affect the county-level implementation of the NCMS, which indicates the county-level policies are plausibly exogenous to individual-level controls and unobservable demographic variables. Also, the county-level NCMS implementation is strongly correlated with the individual-level NCMS enrolment. Most of the counties implemented the NCMS cover for more than 50% of the population even during the first year of the NCMS implementation (Wagstaff et al., 2009).

However, the county-level NCMS implementation might still affect the individual decision to be a rural-to-urban migrant. Hence, I modify the county-level NCMS implementation variable to a variable indicating whether the county is an early pilot county for the NCMS. Whether the county is an early pilot county affects the residents' decision to be a rural-to-urban migrant in a relatively smaller way. The average county-level NCMS implementation's effects on the individual level decisions are alleviated by using the differences between the early-treated and the late-treated counties as the IV. Also, in Section 3.3, I show that, before the implementation of the NCMS, the early-treated counties and the late-treated counties had a similar pre-trend in terms of the percentage of rural-urban migrants at the county level. The early-treated counties usually have higher NCMS coverage for their population than the late-treated counties given their early implementation dates and advertising.

To identify which counties are the early-treated counties, I need the percentage of NCMS coverage for different counties. An ideal scenario would be if I knew the exact start date of the first implementation of the NCMS with the detailed county names. However, the CHNS does not provide the exact name of counties that were surveyed in the data, so I cannot use the information collected in the county-level dataset and also could not search for the corresponding implementation date for these counties. Each county is classified as belonging to one of two groups, the early-treated group or the late-treated group. Those counties where there are sudden increases in the number of people enrolled in the NCMS in the 2004 or 2006 wave are classified as the early-treated group.[29] This is because only the 2004 and 2006 waves of the CHNS are close to the starting date of the initial implementation of the NCMS. In 2004, only a few counties

[29] In rare cases, if a county had less than 10 people in 2000/2004 and had at least a 50% increase in 2004/2006, then I counted this as a sudden increase and treated this county as an early-treatment county. The detailed number of counties that had a sudden increase in NCMS coverage for each year are presented in Appendix Table C.8.

were included in the first and the second round pilot, so it is likely that only a small number of counties included in the CHNS 2004 wave started to implement the NCMS. The year 2006 can be regarded as a suitable date to ensure that at least some of these counties in the CHNS are included in the early-treated group.

I create a dummy variable *earlycounty* which sets to 1 all individuals from early-treated counties for the waves on and after 2006, and 0 for other individuals and waves. The time-variant feature of the IV makes it similar to the idea of the difference-in-differences IV, which further alleviates the concern of the county-level implementation affecting the individual migration decisions. Also, the results from Section 3.3 shows that the trends exist before the NCMS implementation for both the early and the late-treated county, which helps the validity assumption of my resembling difference-in-differences IV. The insignificant effect of the NCMS implementation on the migration propensity in Section 3.3 might imply the early-treated county implementation do not directly affect the probability of one being a rural-to-urban migrant. Yet, there might be some second-order effects that I need to bear in mind when interpreting the results.

Using this new instrumental variable in the regression, I test whether individual enrolment in the NCMS affects individuals' choice to be a rural-urban migrant. The IV results are reported in Panel B in Table 3.4, after controlling for individual demographics, and the wave times province fixed effects. The result is negative and significant for $haveNCMS_{d,t}$. The effects of the NCMS on individual choices test the stock of migrants. This means that, on average, being enrolled in the NCMS reduces the probability of one being a migrant by 5.9%. The first-stage results for $earlycounty_{d,t}$ are reported in Table 3.5, and the coefficients are positive and significant with large $F$-statistics. The IV results show that being enrolled in the NCMS has negative effects on the probability of one being a rural-urban migrant.

If I generalise this individual-level effect to a county-level effect, it corresponds to the negative effects of the NCMS implementation on the percentage of rural-urban migrants at the county-level. The individual-level results show that the effects of the NCMS implementation are larger than the county-level evidence, which only shows that the NCMS implementations have second-order negative effects on the migration propensity. One of the possible explanations for the difference between the individual-level and county-level results is the misreporting problem. The under-reporting problems in the county-level dataset would give me the lower-bound of the effect of the NCMS implementation on the migration propensity. The possible endogeneity from the timing of the county-level implementation can be another possible reason that drives the larger effect of the NCMS implementation found in the individual-level results than in the county-level results. Although the difference-in-differences IV alleviates the effects of the county-level NCMS implementation on the individual-level migration decisions, there are still possibilities that these effects are difficult to be ruled out completely. I should bear this in mind when interpreting the results in this section.

The different effects of individual NCMS enrolment by gender are also presented in the second and the third column of Table 3.4 for the OLS and the IV results. The different effects of the NCMS enrolment on the choice to be rural-to-urban migrants at the individual level could be driven by a specific gender group. The gender of the rural-to-urban migrants could have two different impacts on insurance enrolment. First, according to the literature, women are more risk-averse than men (Borghan et al., 2009), so the strong insurance preference of female migrants might camouflage the fact that healthy male migrants do not want to be enrolled in the insurance scheme. Second, male rural-to-urban migrants are more likely to join the workforce in poorly regulated sectors, such as private mining, construction, and manufacturing firms (NBS, 2009). The actual accident injury rate and the occupational injuries of males are higher than that of the female migrants. So female migrants are more under-insured than male migrants because of their lower occupational risk (Mou et al., 2013), and this makes male migrants more likely to respond to the new health insurance in rural areas. The results for different gender in Table 3.4 show that the effects of the NCMS on males and females are both negative and insignificant, which implies the effects of the NCMS enrolment are not driven by one specific gender group, yet the male group does have lager coefficients compared to the female group.

There is also an age differences in terms of the enrolment of the NCMS. Theoretically, young migrants are less likely to be enrolled in health insurance than old migrants. I divide the total sample into two different age groups: young migrants aged between 16 to 29, and old migrants aged between 30 to 45. I run Equation (3.5) on two different subgroups, and the results are in the last two columns of Table 3.4. The results show that the effects of the NCMS implementation are larger on young migrants than old migrants, yet both effects are insignificant. The results can be possibly interpreted as young migrants might on average have less saving than old migrants. They also understand the idea and the function of the insurance, especially health insurance, better than the old migrants. So, the results do not support the argument that the effect of the NCMS enrolment is driven by the old-migrant group.

In the description of the mechanism, the reason why the NCMS decreases the migration propensity or its growth rate is that the NCMS reduces medical expenditure. It is also necessary to test whether the NCMS actually reduces healthcare expenditure in the individual-level dataset. However, the quality of the information on medical expenditures is not very good in the CHNS. Hence, I provide the evidence proving the mechanism by quoting the results of the impact of the NCMS implementation on out-of-pocket expenditures from previous literature. There are many papers in the literature on the reduction in out-of-pocket expenditures by the NCMS. Sun et al. (2009) find that the NCMS decreases the out-of-pocket payments and significantly decreases the number of households below the poverty line after catastrophic illnesses, and they draw a similar conclusion in their paper in 2010 (Sun et al., 2010). In their review of the NCMS, Wagstaff et al. (2009) show that the NCMS increases the outpatient and inpatient utilisation and reduces the cost of deliveries.

#### Attrition bias

The difference-in-differences method tracks individual behaviours over time, so the attrition of the sample in the CHNS might affect the results. The argument is as follows. The sample attrition could be partly driven by the people who became rural-to-urban migrants and moved to urban areas with their whole family members during the period of the survey. With people leaving the sample and the data's focus on people remaining in the sample, the attrition bias amplifies the negative effects of the NCMS implementation. I test the attrition bias by regressing the probability of one not being present for the next wave $t+1$ on the implementation of the NCMS, with the same demographic variables controlled as in Equation (3.5) in the current wave $t$ (Zhang, 2012). If people enrol in the NCMS, they are then less likely to become rural-to-urban migrants and have a lower possibility of leaving their place of residence. The probability of people leaving the sample should decrease through the implementation of the NCMS if there is an attrition bias affecting the results. The results are in Panel A in Table 3.6. From the insignificant coefficients and quite low $R^2$, the results indicate the effects of the attrition bias might be small in the CHNS, and in the context of rural-to-urban migration and the NCMS implementation.

I also simply examine the effect of the NCMS on those individuals who remained in the dataset from 1997 to 2011. The number of individuals drops from 5,769 to 2,539, so less than half of the sample remained. I apply the same regressions in this reduced sample, and the results are in Panel B in Table 3.6. A comparison of the results in Panel B in Table 3.4 and Table 3.6 shows the two results are similar. For other attrition biases, the fixed effect approach helps to alleviate potential biases associated with demographic factors (Ziliak and Kniesner, 1998). These two methods are naive ways of dealing with the attrition bias problem; I cannot eliminate other possible attrition biases.

### 3.4.2 County-level evidence

In addition to the individual-level evidence provided by the CHNS, I construct a county-level CHNS dataset and provide supporting county-level evidence from this data source other than the yearbook dataset. The county-level CHNS dataset has a limited sample with 36 counties only. Using the individual-level variable migrant, I created a variable measuring the total number of eligible rural-to-urban migrants working in other places in different counties.[30] Dividing the total number of eligible rural-urban migrants by the total sample population for different counties, I obtain the migration propensity for each

[30] Eligible migrants mean those migrants included in the sample for regression 3.5 who are aged between 16-45 and are away from their households for more than 6 months.

county, and again I use $prop(migrants)_{i,t}$ to indicate the migration propensity, as in Section 3.3. I also generate corresponding growth rate, $growthrate_{i,t}$. The constructed average income per capita, irrigated farmland per capita, total rural-labour force, and average education level for each county similarly matched the control variables included in Equation (3.2) in Section 3.3.

Due to the data limitation, the CHNS county-level data only include 36 counties for the years 1997, 2000, 2004, 2006, 2009, and 2011. A difference-in-differences county-level regression is used to conduct the county-level CHNS analysis. The detailed information of the name for the counties is not available in the CHNS, so I cannot obtain specific NCMS implementation dates for the counties. I continue to use $earlycounty_i$ used as the IV for the individual-level results, which equals 1 if a county $i$ is in the early-treated group and is covered by the NCMS at wave $t$, and 0 otherwise. I use a simple fixed-effect difference-in-differences regression to conduct the analysis. The regression for examining the impact of the NCMS implementation on the migrant propensity at the county-level is:

$$\begin{aligned} prop(migrants)_{i,t} =& \alpha + \beta earlycounty_{i,t} + X'_{i,t}\theta + \sum_k \gamma_k \times \mathbf{I}[k=t] \\ & \times \sum_l \rho_l \times \mathbf{I}[l=p] + year_t + \mu_i \times year_t + \upsilon_t + \varepsilon_{i,t}, \end{aligned} \tag{3.6}$$

where $i$ is the index for county and $t$ stands for wave. $prop(migrants)_{i,t}$ is the propensity of rural residents in county $i$ working outside their home county (county $i$) at wave $t$. $year_t$ is the linear wave trend and $\mu_i \times year_t$ is the county-fixed effect times the linear wave trend. $\upsilon_t$ is the wave fixed effect. $\mathbf{I}[k=t]$ represents the six wave dummies from 1997-2011, and $\mathbf{I}[k=p]$ is the province ($p$) dummies (nice provinces in total). The fixed-effect error term $\varepsilon_{i,t}$ is clustered at the county level. $X_{i,t}$ are the control variables: the constructed average income per capita, irrigated farmland per capita, total rural-labour force, and the average education level at the county-level. To examine the impact of the NCMS on the growth rate of the migration propensity for each county, the regression is:

$$\begin{aligned} growthrate_{i,t} =& \alpha + \beta earlycounty_{i,t} + X'_{i,t}\theta + \sum_k \gamma_k \times \mathbf{I}[k=t] \\ & \times \sum_l \rho_l \times \mathbf{I}[l=p] + year_t + \mu_i \times year_t + \upsilon_t + \varepsilon_{i,t}. \end{aligned} \tag{3.7}$$

All other variables have the same meaning as in Equation (3.6). Again, the identifying assumption for the difference-in-differences method is that the migration propensity and its growth rate for the early-treated counties and the late-treated counties show similar trends before the NCMS implementation. The assumption is likely to be valid as discussed in the previous sections, and the results in Section 3.3 also show a parallel trend using a county-level dataset with larger sample size.

The results of the two regressions are reported in Table 3.7. It shows that the NCMS implementation does not have a significant negative effect on the migration propensity but has a marginally significant negative impact on its growth rate. The negative effect on the growth rate could enhance the hypothesis that the NCMS implementation has negative effects on the number of rural residents who are rural-to-urban migrants at the county level, although through a second-order effect. This aggregate-level result from CHNS also implies that it is reasonable to believe that the county-level results from the dataset collected from the yearbooks are more likely to be valid. However, the magnitude of the coefficient for $earlycounty_{i,t}$ is around 0.9%, which is smaller than most of the yearly effects of the NCMS initial implementation in Table 3.3. It is also smaller than the average effect of the NCMS implementation in Table 3.2. I cannot conclude the exact effects of the NCMS implementation on the growth rate of the migration propensity, but it is plausible that there is a negative effect on the growth rate of the migration propensity.

## 3.5 Conclusions

Providing health insurance coverage for residents improves social welfare states, yet the restrictions imposed by health insurance schemes might create unintended misallocations in the labour market. This chapter finds that implementing a new health insurance scheme with geographical limitations on the entitled reimbursement rates has negative effects on the rural-to-urban migration labour market from both the county-level analysis and the individual-level analysis. The county-level results show that the NCMS implementation has negative and lagged effects on the growth rate of the migration propensity at the county level, while the individual-level results find a larger effect for NCMS: it decreases the migration propensity directly. It is difficult to draw a precise conclusion on the exact effect of the NCMS on the rural-to-urban migration labour market from the individual and the county-level results, but both results suggest that the NCMS implementation is likely to hinder the job mobility of rural-to-urban migrants in China. The mechanism is that the NCMS helps reduce individual medical expenditure through a simple compensating differential model. Rural residents are more likely to stay in their hometown so that they can benefit from NCMS, according to the model.

There are a few limitations of the analysis that affect the interpretation of the results. First, both of the datasets used are not comprehensive. Only twelve of China's 23 provinces are covered, and there are missing entries in the CHNS. Also, data from some years are missing in the county-level dataset collected from yearbooks due to the long-time span covered. Second, the measurement error problems in both datasets are almost unavoidable when using survey data and yearbook data. Third, there are potential problems with the empirical methods used in the chapter due to the data limitation. Both the county-level and the individual-level results support possible negative effects of the NCMS on rural-to-urban migration. This makes the misreporting and the low-coverage less of a problem to some extent, although the magnitude of the NCMS effects does not match these results from the two datasets. The problems caused by the limitations have not been completely eliminated, and this still needs to be borne in mind when interpreting the results. If there were a more complete and larger dataset for migrant information in China, this would permit a structural analysis of individual willingness to pay for the NCMS in rural areas and also the propensity-score matching method to better identify the empirical results.

Given the large population in China, even a small change in the growth rate of the migration propensity can affect millions of people's labour market behaviours. The NCMS was implemented with the aim of meeting the welfare needs of residents in rural areas and providing universal health insurance coverage for all residents in China. But, its restriction on the reimbursement rate due to the method of financing the NCMS creates unexpected adverse effects on rural residents who are rural-to-urban migrants. Even after 2008, when all the counties in China implemented the NCMS, this cheap manual labour is still in high demand in urban areas, but the pool of workers is shrinking. If the NCMS continues to tether migrants and potential migrants to their birthplace, it might hinder any further urbanisation process.[31] It would be optimal if the government provided a specific health insurance scheme for rural-to-urban migrants who work in urban areas. From 2010 onwards, the government has made the enrolment of rural-to-urban migrants in Urban Resident Health Care Insurance easier for rural-to-urban migrants.[32] This is a useful step forward, but the ultimate goal of this policy might be difficult to achieve. It is likely that there will continue to be unregistered migrants working in urban areas, especially in middle-sized or small cities. It is also difficult to enforce the policy in small cities because, for these cities, local financial support might not be enough for the policy implementation.[33] The government merged the NCMS and the Urban Resident Insurance Scheme from 2016 onwards, making it easier for rural residents to claim their expenses and get a higher reimbursement rate if they visit hospitals outside their own town or village (Pan et al., 2016). This is a practical policy for the government to enhance the health insurance provision for rural-to-urban migrants and should be encouraged in order to improve the consolidation of these two health insurance schemes. But it still requires collaborations between different administrative-level governments, and it might be challenging in practice due to the way that the NCMS is financed.

[31] There are news articles reporting the difficulties of hiring rural-to-urban migrants in 2012. http://jingji.cntv.cn/20120206/116278.shtml

[32] Source: http://www.sz.gov.cn/sbjjblj/zcfggfxwj/sbzy/201311/t20131130_2258714.htm (in Chinese).

[33] Source: http://news.cb.com.cn/html/economy_9_26010_1.html (in Chinese).

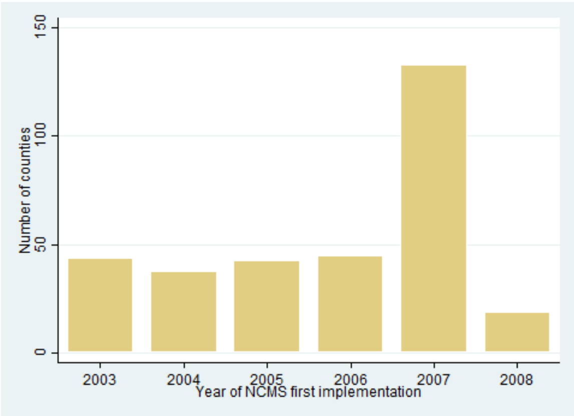
From the above description of the constraints on the NCMS, it is clear that the *hukou* system is one of the main factors preventing rural-to-urban migrants from participating in the health insurance programme provided in urban areas. If the *hukou* system were abolished, and urban and rural people had an identical household registration type, the geographical limitations of the NCSM would have smaller negative effects on individual migration decisions. Without the *hukou*, migrants could be enrolled in any type of health insurance schemes in China. The central government in China is trying to abolish, or at least relax, the restrictions of *hukou*.[34] However, it is difficult for the government to do this quickly because the design of many existing policies is based on the *hukou* system, and the urban-rural differences in China are quite large. It is easier for the central government to introduce a health insurance scheme only for rural-to-urban migrants and to use the new scheme to address the immediate health care needs of this large group of migrants. Apart from the health insurance policy, it would also be more relevant if the government in future could set policies that were not based on the *hukou* system given the large migrant population in China.

The low geographical mobility of the rural-to-urban migrants might hinder the urbanisation process and economic developments in China. But it might not be inefficient given other restrictions in other markets, especially in the public pension market. According to Chapter 1, the public pension provision is not sufficient for the old-age care in China even with its expansion. So, if people stay in their hometown and stay close to their elderly parents, it is likely that they would spend more time taking care of their parents and provide more non-financial old-age support. This would help alleviate the public old-age care provision burden.

[34]Source: https://www.scmp.com/news/china/politics/article/2187689/could-be-end-chinas-notorious-household-registration-system

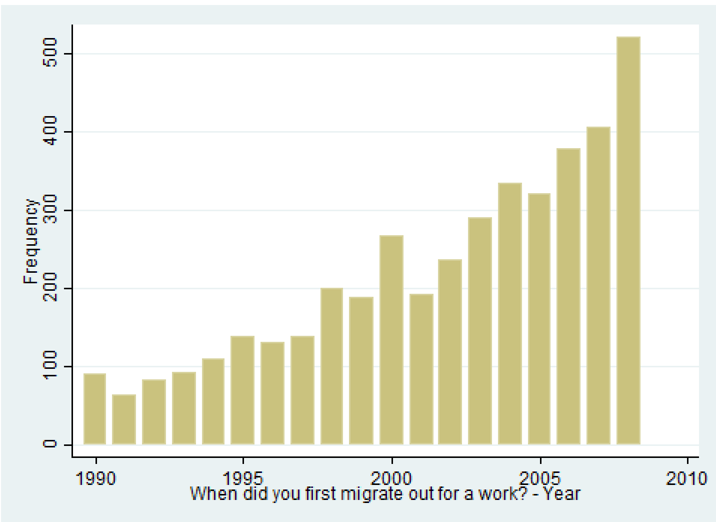
## 3.6 Figures and Tables

Figure 3.1: The distribution of "pilot" counties: 2003-2008



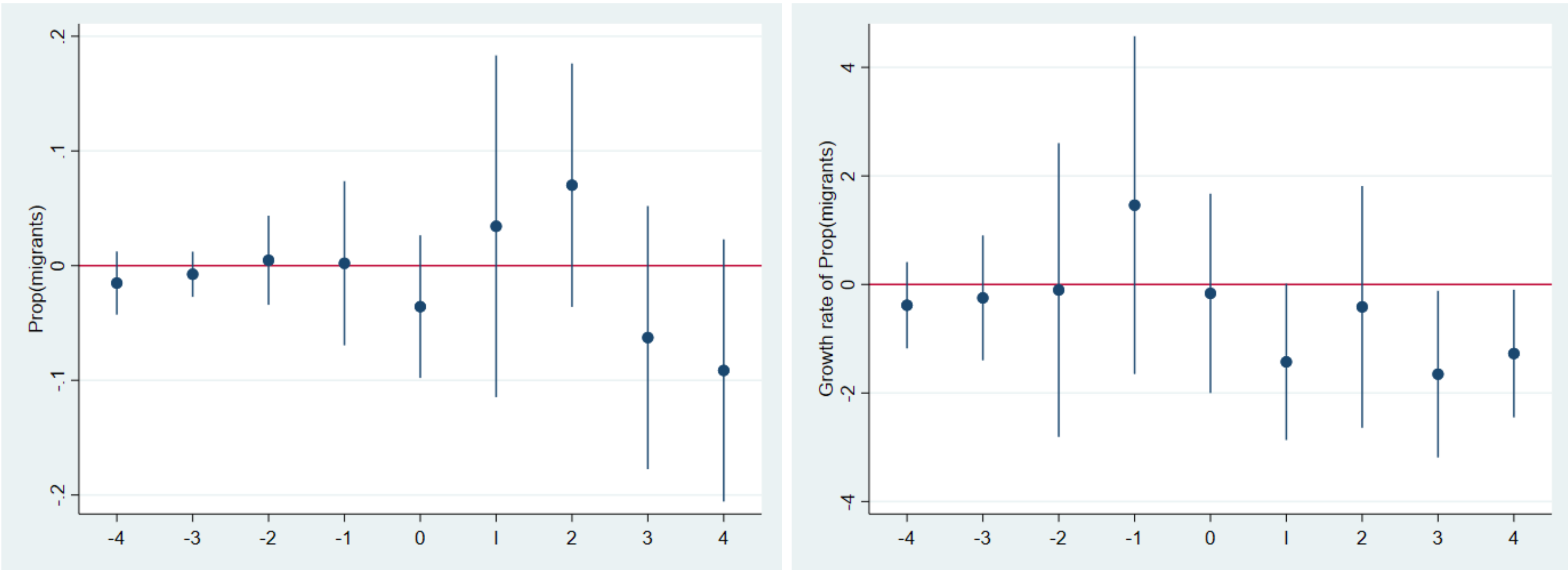

Note: This distribution is based only on data collected from provincial statistical yearbooks. $y$-axis is the number of new "pilot" counties for each year. $x$-axis is the year of the NCMS initial implementation. The figure only includes counties from the five provinces covered in this chapter. There is also one county starting in 2002 and one county starting in 2009.

Figure 3.2: The number of new migrants (1990 to 2008, RUMiC)



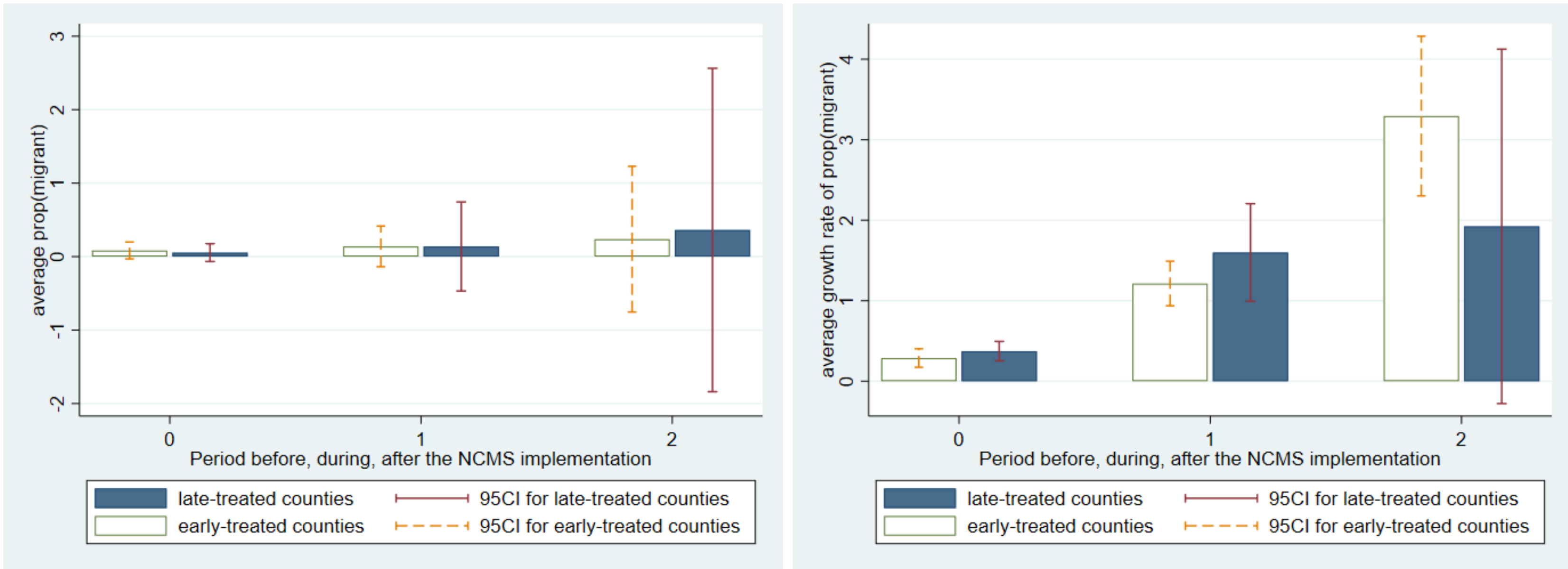

Note: The number of new migrants is the number of people who first migrates out as a rural-to-urban migrant. $y$-axis is the number of new migrants. $x$-axis is the year that respondents answered for the question "When did you first migrate out for work". The time span similar to the datasets used in this chapter, I only show the number of new migrants from 1990 to 2008.

Figure 3.3: The yearly effects of $FirstNCMS$ on $prop(migrants)_{i,t}$ and $growthrate_{i,t}$




Note: The graph is a coefficient plot for Table 3.3. The confidence intervals are 95% confidence interval. $y$-axis is the effect of NCMS initial implementation on the migration propensity (left graph) and its growth rate (right). $x$-axis indicates the event time $t$. $t = 0$ means the year that a county first starts to implement the NCMS.

Figure 3.4: Overview of the average migration propensity and its growth rate




Note: The left one is the graph for the migration propensity and the right one is the graph for its growth rate. $y$-axis is the average migration propensity and its growth rate respectively. $x$-axis is the different time frame before, during and after the NCMS implementation. 0 represents years before the NCMS implementation, 1 is the period during the NCMS roll-out, and 2 is the years after roll-out of the NCMS implementation. The navy bar represents the late-treated group and the white bar is the early-treated group.

Table 3.1: Different health insurance schemes and their coverage in China

| Group | Heath insurance coverage |
|---|---|
| Urban residents | URHI |
| Urban employees | UEHI |
| Rural-to-urban employees | UEHI |
| Rural residents | NCMS |
| Intra-county migrants | NCMS |
| **Rural-to-urban migrants** | **NCSM, difficult to benefit** |

Table 3.2: The average effects of NCMS on $prop(migrants)_{i,t}$ and $growthrate_{i,t}$

| VARIABLES | $prop(migrants)_{i,t}$ | $growthrate_{i,t}$ |
|---|---|---|
| *NCMS* | 0.000 | -0.685 |
| | (0.041) | (1.172) |
| year × province FE | Yes | Yes |
| year trend | Yes | Yes |
| county FE × year trend | Yes | Yes |
| controls | Yes | Yes |
| Observations | 1,814 | 1,813 |
| Number of counties | 178 | 178 |
| R-squared | 0.229 | 0.154 |

Note: Robust standard errors in parentheses.* significant at 10%; ** significant at 5%;*** significant at 1%. The stand errors are clustered at county-level. $prop(migrants)_{i,t}$ is the migration propensity for each county $i$ at time $t$ and $growthrate_{i,t}$ is the corresponding growth rate. Key regressor *NCMS* is the treatment and time interaction term in the difference-in-differences method. The control variables include GDP per capita, disposable income per capita for rural residents, irrigated farmland per capita, and total rural labour force for each county at each year. Three counties were merged with other counties and hence the growth rate data are missing.

Table 3.3: The event study results on $prop(migrants)_{i,t}$ and $growthrate_{i,t}$

| VARIABLES | $prop(migrants)_{i,t}$ | | $growthrate_{i,t}$ | |
|---|---|---|---|---|
| *Event time* | | | | |
| -4 | -0.0161 | -0.0152 | -0.400 | -0.383 |
| | (0.0138) | (0.0139) | (0.400) | (0.403) |
| -3 | -0.00747 | -0.00752 | -0.230 | -0.247 |
| | (0.00945) | (0.00998) | (0.592) | (0.584) |
| -2 | 0.00517 | 0.00465 | -0.0829 | -0.102 |
| | (0.0196) | (0.0197) | (1.375) | (1.371) |
| -1 | 0.00162 | 0.00203 | 1.474 | 1.461 |
| | (0.0361) | (0.0363) | (1.574) | (1.577) |
| 0 | -0.0356 | -0.0358 | -0.156 | -0.164 |
| | (0.0315) | (0.0315) | (0.932) | (0.931) |
| 1 | 0.0331 | 0.0343 | -1.453** | -1.426* |
| | (0.0757) | (0.0755) | (0.729) | (0.730) |
| 2 | 0.0696 | 0.0701 | -0.464 | -0.413 |
| | (0.0544) | (0.0538) | (1.119) | (1.129) |
| 3 | -0.0615 | -0.0627 | -1.724** | -1.653** |
| | (0.0554) | (0.0581) | (0.777) | (0.778) |
| 4 | -0.0900 | -0.0914 | -1.282** | -1.272** |
| | (0.0578) | (0.0579) | (0.591) | (0.596) |
| year × province FE | Yes | Yes | Yes | Yes |
| year trend | Yes | Yes | Yes | Yes |
| county FE × year trend | Yes | Yes | Yes | Yes |
| controls | No | Yes | No | Yes |
| Observations | 1,813 | 1,813 | 1,812 | 1,812 |
| R-squared | 0.236 | 0.237 | 0.158 | 0.158 |
| Number of county | 178 | 178 | 178 | 178 |
| Autocorrelation test | 0.0183 | 0.0183 | 0.5583 | 0.5583 |

Note: Robust standard errors in parentheses.* significant at 10%; ** significant at 5%; *** significant at 1%. The stand errors are clustered at county-level. $prop(migrants)_{i,t}$ is the migration propensity for each county $i$ at time $t$ and $growthrate_{i,t}$ is the corresponding growth rate. Key regressor *Event time* equals 0 indicates the first year a county starting to implement NCMS. The control variables include GDP per capita, disposable income per capita for rural residents, irrigated farmland per capita, and total rural labour force for each county at each year.

Table 3.4: The effect of the NCMS enrolment on one's decision to be a migrant

| VARIABLES | $migrant_{d,t}$ | | | | |
|---|---|---|---|---|---|
| *Panel A: OLS* | | | | | |
| | Total | Male | Female | Young | Old |
| *haveNCMS* | 0.001 | -0.003 | 0.006 | -0.0131 | 0.005 |
| | (0.005) | (0.008) | (0.006) | (0.0238) | (0.004) |
| Observations | 12,092 | 6,255 | 5,837 | 4,151 | 7,941 |
| Number of individuals | 5,769 | 2,844 | 2,925 | 2,895 | 3,750 |
| R-squared | 0.052 | 0.017 | 0.008 | 0.042 | 0.004 |

| *Panel B: IV* | | | | | |
|---|---|---|---|---|---|
| | Total | Male | Female | Young | Old |
| *haveNCMS* | -0.060** | -0.077 | -0.035 | -0.101 | -0.0125 |
| | (0.027) | (0.047) | (0.027) | (0.106) | (0.025) |
| Observations | 12,092 | 6,255 | 5,837 | 4,151 | 7,941 |
| Number of individuals | 5,769 | 2,844 | 2,925 | 2,895 | 3,750 |
| R-squared | 0.068 | 0.013 | 0.005 | 0.047 | 0.004 |
| individual FE | Yes | Yes | Yes | Yes | Yes |
| county control | Yes | Yes | Yes | Yes | Yes |
| year FE | Yes | Yes | Yes | Yes | Yes |
| year × province FE | Yes | Yes | Yes | Yes | Yes |
| controls | Yes | Yes | Yes | Yes | Yes |

Note: Robust standard errors in parentheses.* significant at 10%; ** significant at 5%; *** significant at 1%. The stand errors are clustered at county-level. $migrant_{d,t}$ is a dummy variable equals 1 if individual $d$ is a migrant and 0 otherwise. Key regressor $haveNCMS$ is the individual decision variable of NCMS participation. This table also shows the effect of $haveNCMS$ by gender and age. Males and females are nearly equally sampled in the dataset. Young migrants age from 16 to 29 and old migrants age from 30 to 45. The instrumental variable for $haveNCMS$ is $earlycounty$, which sets to 1 for all individuals from early-treated counties for the waves 2006, 2009 and 2011 and 0 for other individuals and waves. The control variables are deflated household income per capita, age, marital status, occupation, and highest education level, and also county-level average household income.

Table 3.5: The first stage for the early county NCMS implementation IV

| VARIABLES | $haveNCMS_{d,t}$ | | | | |
|---|---|---|---|---|---|
| | Total | Male | Female | Young | Old |
| *earlycounty* | 0.278*** | 0.237*** | 0.336*** | 0.350*** | 0.291*** |
| | (0.020) | (0.027) | (0.029) | (0.060) | (0.026) |
| individual FE | Yes | Yes | Yes | Yes | Yes |
| county control | Yes | Yes | Yes | Yes | Yes |
| year FE | Yes | Yes | Yes | Yes | Yes |
| year × province FE | Yes | Yes | Yes | Yes | Yes |
| controls | Yes | Yes | Yes | Yes | Yes |
| Observations | 12,092 | 6,255 | 5,837 | 4,151 | 7,941 |
| Number of individuals | 5,769 | 2,844 | 2,925 | 2,895 | 3,750 |
| R-squared | 0.002 | 0.003 | 0.115 | 0.283 | 0.027 |
| $F$-statistic | 226.09 | 141.63 | 104.12 | 21.76 | 141.53 |

Note: Robust standard errors in parentheses.* significant at 10%; ** significant at 5%; *** significant at 1%. The stand errors are clustered at county-level. Key regressor *haveNCMS* in the main regression is the individual decision variable of NCMS participation is the main outcome variable here. This table also shows the effect of *haveNCMS* by gender and age. Males and females are nearly equally sampled in the dataset. Young migrants age from 16 to 29 and old migrants age from 30 to 45. The instrumental variable *earlycounty* is the key regressor, which sets to 1 for all individuals from early-treated counties for the waves 2006, 2009 and 2011 and 0 for other individuals and waves. The control variables are deflated household income per capita, age, marital status, occupation, and highest education level, and also county-level average household income. $F$-statistic is larger than 10.

Table 3.6: Attrition bias check and attrition-bias-free CHNS data

*Panel A: attrition bias check*

| | $pr(attrition)_{d,t}$ | | | | |
|---|---|---|---|---|---|
| VARIABLES | Total | Male | Female | Young | Old |
| *haveNCMS* | -0.030 | -0.020 | -0.042 | -0.040 | 0.002 |
| | (0.050) | (0.080) | (0.061) | (0.096) | (0.062) |
| Observations | 12,092 | 6,255 | 5,837 | 4,151 | 7,941 |
| Number of individuals | 5,769 | 2,844 | 2,925 | 2,895 | 3,750 |
| R-squared | 0.0004 | 0.0002 | 0.0000 | 0.0000 | 0.0000 |

*Panel B: attrition-bias-free sample*

| | $migrant_{d,t}$: IV | | | | |
|---|---|---|---|---|---|
| VARIABLES | Total | Male | Female | Young | Old |
| *haveNCMS* | -0.064** | -0.080 | -0.040 | -0.111 | -0.009 |
| | (0.017) | (0.050) | (0.035) | (0.133) | (0.026) |
| Observations | 6,419 | 3,644 | 2,775 | 2,099 | 4,320 |
| Number of individuals | 2,539 | 1,132 | 1,494 | 1,272 | 1,755 |
| R-squared | 0.101 | 0.006 | 0.035 | 0.003 | 0.005 |
| individual FE | Yes | Yes | Yes | Yes | Yes |
| county FE | Yes | Yes | Yes | Yes | Yes |
| year × province FE | Yes | Yes | Yes | Yes | Yes |
| controls | Yes | Yes | Yes | Yes | Yes |

Note: Robust standard errors in parentheses.* significant at 10%; ** significant at 5%; *** significant at 1%. The stand errors are clustered at county-level. Key variable *haveNCMS* is the individual decision variable of NCMS participation. In Panel A, outcome variable $pr(attrition)_{d,t}$ is the probability of respondents leaving the sample in year $t+1$. In Panel B, outcome variable $migrant_{d,t}$ is a dummy variable equals 1 if individual $d$ is a migrant and 0 otherwise. This table also shows the effect of *haveNCMS* by gender and age. Males and females are nearly equally sampled in the dataset. Young migrants age from 16 to 29 and old migrants age from 30 to 45. The control variables are deflated household income per capita, age, marital status, occupation, and highest education level, and county-level average household income. The instrumental variable for *haveNCMS* is *earlycounty*, which sets to 1 for all individuals from early-treated counties for the waves 2006, 2009 and 2011 and 0 for other individuals and waves. In this attrition-bias-free CHNS dataset, the sample size drops from around 5,769 to 2,539 observations.

Table 3.7: Results from the county-level CHNS data

| VARIABLES | $prop(migrants)_{i,t}$ | $growthrate_{i,t}$ |
|---|---|---|
| $earlycounty_{i,t}$ | -0.009 | -0.902* |
| | (0.011) | (0.446) |
| county FE × year trend | Yes | Yes |
| year trend | Yes | Yes |
| year × province FE | Yes | Yes |
| control | Yes | Yes |
| Observations | 212 | 172 |
| Number of counties | 36 | 36 |
| R-squared | 0.026 | 0.0512 |

Note: Robust standard errors in parentheses.* significant at 10%; ** significant at 5%; *** significant at 1%. The stand errors are clustered at county-level. $prop(migrants)_{i,t}$ is the county-level migration propensity and $growthrate_{i,t}$ is the growth rate of the migration propensity. The control variable is the average household income per capita adjusted by CPI for each county. *earlycounty* is the county-level decision variable of NCMS participation. There are only 36 counties in this sample because of CHNS data limitations. The number of observations drops in the third column because for the growth rate of the migration propensity, it loses one-year of data due to the calculation.

# Appendix A

# Appendix of "The Role of Social Norms in Old-age Support: Evidence from China"

## A.1 Gender differences of $P$ in old-age support

The OLS results from in the first three columns in Table A.3 show that, in the CHARLS, there is no significant gender difference between the parents in the probability of providing any kinds of transfer and the total amount of the transfer provided. But males visit their parents more. Also for male $P$, with the increase in their household size, they provide more old-age support and visit their parents more. To sum up, males still provide more support than females, especially when it comes to transfers and visits paid to elderly parents recorded in the CHARLS. However, the OLS results from the CHFS in Table A.3 seem to show fewer gender differences. The coefficients of $maleP$ for the probability of providing any kind of transfer and for the total amount of any transfer are both negative, although the coefficient for the total amount of any transfer is insignificant. The only positive and significant coefficient for $maleP$ is the one for the days spent visiting their ageing parents. From the CHFS results, it seems that at least regarding the probability of providing pecuniary transfer, female $P$ are more likely to provide than males. The greatest difference between the two datasets arise from the composition of samples living in urban and rural areas, as shown in the summary statistics (see Table 1.2) and discussed in the subsample section. The discrepancy between the OLS results from the CHARLS and the CHFS for $maleP$ may suggest that there is a difference in the gender norm for providing support for the elderly in urban and rural areas in China. Combining the results in the CHARLS and the CHFS, it is reasonable to assume that males still provide more in the rural areas and urban females may have more important roles in terms of providing old-age support, supported by the empirical finding in Xie and Zhu (2009).

## A.2 Different representations of outcome variables

In the previous regression equations, the outcome variable regarding the amount of the transfer is the actual amount of the transfer. The results when using the actual amount of the transfer might be affected by the outliers in the sample, so I capped the amount of the transfer used, and this might create bias in the results. Using the logarithms of the amount of transfer and also the corresponding income or expenditure percentage help to reduce the sensitivity of the results caused by the outliers, which are common in survey datasets. For both datasets, I run Equation (1.1) on the new outcome variables for the amount of the transfer: the logarithms of the amount of the transfer and the amount of the transfer as a percentage of total income. The results are shown in Table A.7 in the Appendix. For the CHARLS results, the father demonstration effect for the outcome variable, the percentage of income, appears to be consistent with the results in Table 1.4, although with an 88% significance level. The log amount of the transfer has a marginally significant father demonstration effect that is consistent with the main results using the CHARLS dataset. The father demonstration effects for the transfer percentage in the CHARLS are both positive and insignificant. With the CHFS, the results show the insignificant but negative mother demonstration effect for the percentage outcome and the log amount of any transfer provided by the parents.

Furthermore, the transfers from the elderly are not included in the construction of the outcome variables used in the main regressions. I change the transfer outcome variables to net transfer variables. If $any\ transfer$ equals 1 and the parents receive the transfers from or are living together with their elderly parents, I change the corresponding value to 0. For the amount of the monetary transfer, I use the net transfer provided by the parents, which is the amount of transfer provided to the parents minus the amount of the transfer received by them from their elderly parents. The change is made for both datasets. The results for the net transfers are also included in Table A.7. They are consistent with the main results, except for the negative father demonstration effect for $any\ transfer$ in the CHFS. The magnitudes of the demonstration effect for the probability of providing any transfer also increase beyond the main results.

## A.3 Additional Notes

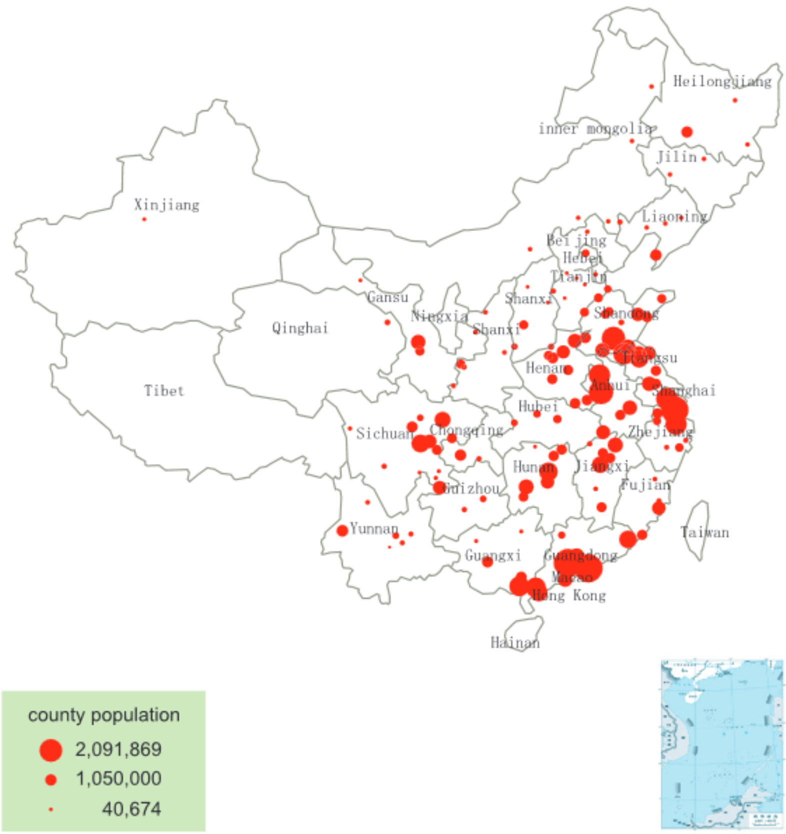
**Data and IV construction in CHARLS:** I have had to make certain assumptions when constructing the gender of the first child IV in CHARLS. As discussed above, I have restructured the original dataset from a dataset where the main respondents are the $O$ generation in my setting to a dataset in which the main observations are the children of the main respondents. In the regression setting, the children of the respondents are the $P$ generation. The original dataset gives no information on the birth year but gives the gender composition and number of the $K$ generation. The year of birth is available only if grandchildren are living with the first generation.

Moreover, many observations are missing for $P$ and $K$ that are not living together with $O$. Apart from this information, the dataset does provide information on the gender composition and number of the third generation if she or he is above the age of 16. For most households, I can use this information to work out the gender of the first child. But some estimations are still needed in this process; they are based on the parents' age, especially the average age of female parents when their children are born, in order of birth, in both urban and rural areas.

**For households affected by the policy ban after 2003** As discussed, using a subsample includes only households affected by the policy ban after 2003 might not provide well-identified results when the gender of the first child is kept as the instrumental variable. This is because, even with the policy ban, the gender ratio in some provinces is still high. I use a subsample check to provide relevant evidence. I divide the sample that includes only households affected by the policy ban after 2003 into two subsamples, one showing a high gender-ratio and the other showing a low gender-ratio. A province is classified as a high gender-ratio province 1 if in the 2010 Population Census gender ratio there is above the national gender ratio, and 0 otherwise. Table A.22 shows the results of this simple subsample check. The father demonstration effects are positive for the amount of the transfer and the visits paid for the high gender-ratio provinces. The father effect is only significant for the visits paid in the low gender-ratio province subsample. The results from the CHFS are also in Table A.22, which shows that the only significant mother demonstration effect is the effect on the amount of the transfer provided in low gender-ratio provinces. The results from this simple sample check add a piece of suggestive evidence that depending on the gender ratio level, different provinces might lead to the demonstration effect differently.

## A.4 Figures and Tables

Figure A.1: Distribution of CHARLS sample counties and districts




Data source: Official report by CCER. Website: http://charls.pku.edu.cn/uploads/document/public_documents/application/Challenges-of-Population-Aging-in-China-final.pdf

Table A.1: Summary statistics for CHARLS: Females and males subsamples

| | CHARLS (mostly rural) | | | |
|---|---|---|---|---|
| | Females | | Males | |
| VARIABLES | Mean | Std. Dev. | Mean | Std. Dev. |
| whether $P$ provides | | | | |
| any transfers | 0.254 | 0.264 | 0.314 | 0.341 |
| regular transfer | 0.045 | 0.166 | 0.164 | 0.336 |
| non-regular transfer | 0.222 | 0.262 | 0.265 | 0.346 |
| amount of | | | | |
| regular transfer | 209.9 | 3036.5 | 475.4 | 4450.2 |
| non-regular transfer | 412.1 | 2330.1 | 531.7 | 3564.7 |
| visit days | 61.67 | 104.6 | 166.4 | 157.6 |
| more sons in $K$ | 0.679 | 0.467 | 0.688 | 0.464 |
| No. of $Y$ | 1.648 | 0.781 | 1.637 | 0.766 |
| age of $P$ | 38.11 | 8.956 | 38.81 | 8.737 |
| income level of $P$ | 5.085 | 1.417 | 5.076 | 1.419 |
| education of $P$ | 0.814 | 0.531 | 0.960 | 0.444 |
| whether $P$ has a rural *hukou* | 0.766 | 0.423 | 0.767 | 0.423 |
| whether $P$ is married | 0.999 | 0.031 | 0.998 | 0.0462 |
| $P$ living in rural areas | 0.351 | 0.477 | 0.345 | 0.476 |
| No. of siblings of $P$ | 3.875 | 1.598 | 3.645 | 1.617 |
| $P$'s ranking in siblings | 2.827 | 1.445 | 1.978 | 1.210 |
| professional title of $P$ | 0.077 | 0.481 | 0.130 | 0.600 |
| distance from $O$ | 3.874 | 1.332 | 2.703 | 2.048 |
| household head of $O$ | 0.433 | 0.496 | 0.431 | 0.495 |
| average age of $O$ | 65.25 | 9.622 | 66.04 | 9.552 |
| average working status of $O$ | 0.550 | 0.455 | 0.536 | 0.456 |
| average pension of $O$ | 0.180 | 0.384 | 0.182 | 0.385 |
| average education level of $O$ | 2.735 | 1.564 | 2.690 | 1.556 |
| who should support $O$ | 1.592 | 1.024 | 1.567 | 1.003 |
| have $O$ retired | 1.874 | 0.302 | 1.870 | 0.305 |
| whether $O$ have deposit | 0.124 | 0.330 | 0.129 | 0.336 |
| household income of $O$ | 103669 | 3454041 | 129728 | 3796947 |
| hours of $O$ taking care of grandchildren | 217.61 | 1124 | 827.9 | 2248 |
| any transfers from $O$ | 0.034 | 0.182 | 0.041 | 0.197 |

Table A.2: Summary statistics for CHFS: Females and males subsamples

| | CHFS (mostly urban) | | | |
|---|---|---|---|---|
| | Females | | Males | |
| VARIABLES | Mean | Std. Dev. | Mean | Std. Dev. |
| whether $P$ provides any transfers | 0.301 | 0.459 | 0.228 | 0.420 |
| amount of total transfer | 650.0 | 1670.0 | 548.4 | 1627.8 |
| visit days | 69.05 | 126.2 | 114.4 | 159.2 |
| gender ratio of $K$ | 0.559 | 0.426 | 0.575 | 0.407 |
| No. of $K$ | 1.585 | 0.833 | 1.740 | 0.936 |
| age of $P$ | 46.91 | 10.35 | 49.44 | 9.822 |
| income of $P$ | 22510 | 43919 | 21049 | 43347 |
| education of $P$ | 0.801 | 0.652 | 0.864 | 0.638 |
| whether $P$ has a rural *hukou* | 0.493 | 0.500 | 0.597 | 0.491 |
| marital status of $P$ | 0.763 | 0.425 | 0 | 1 |
| $P$ living in rural areas | 0.268 | 0.443 | 0.395 | 489 |
| No. of siblings of $P$ | 3.189 | 1.821 | 3.248 | 1.890 |
| whether $P$ is working | 0.576 | 0.494 | 0.801 | 0.400 |
| occupation of $P$ | 0.789 | 1.597 | 1.014 | 1.822 |
| whether $P$ has loan | 0.096 | 0.295 | 0.934 | 0.291 |
| No. of $O$ alive | 1.279 | 0.948 | 1.181 | 0.904 |
| average education level of $O$ | 1.974 | 1.137 | 1.813 | 1.064 |
| whether $O$ are party members | 2.722 | 0.546 | 2.736 | 0.555 |
| *hukou* status of $O$ | 1.372 | 0.504 | 1.283 | 0.904 |
| any transfers from $O$ | 0.144 | 0.351 | 0.118 | 0.323 |

Table A.3: The gender of the adult child on the provision of old-age support

| | OLS: CHARLS (mostly rural) | | | OLS: CHFS(mostly urban) | | |
|---|---|---|---|---|---|---|
| VARIABLES | *any-transfer* | *amount* | *visit days* | *any-transfer* | *amount* | *visit days* |
| *maleP* | 0.00313 | 85.61 | 21.48*** | -0.0264** | -73.99 | 27.56*** |
| | (0.0223) | (223.1) | (4.754) | (0.0124) | (56.59) | (5.792) |
| *hh-size* | -0.00937 | -16.81 | -4.125** | -0.00463 | -18.53 | -7.966*** |
| | (0.0126) | (87.83) | (1.835) | (0.00531) | (18.48) | (1.296) |
| *maleP*× *hh-size* | 0.000158 | 309.0** | 11.54*** | -0.00339 | 28.64 | 14.46*** |
| | (0.0117) | (151.0) | (2.858) | (0.00667) | (24.01) | (2.876) |
| $P$ demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| $O$ demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 12,232 | 12,232 | 12,232 | 19,509 | 19,509 | 19,509 |
| R-squared | 0.205 | 0.050 | 0.628 | 0.282 | 0.203 | 0.168 |
| Mean | 0.401 | 831.2 | 118.7 | 0.303 | 489.1 | 91.66 |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. *maleP* is the gender of $P$. The three outcome variables are the dummy indicating whether parents provide any financial transfer to their elderly parents (*any-transfer*), the amount of any transfer provided (*amount*), and the number of days spent on visits paid to their elderly parents per year (*visit days*). The key controls are $P$'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from $O$, and $O$'s transfer to $P$, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of $O$ taking care of $P$'s $K$, depending on the availability of the information in the CHARLS and the CHFS. The standard error is clustered at the prefectural city level for the CHARLS and the cluster-level is the province-level in the CHFS.

Table A.4: The demonstration effect on the provision of old-age support: different cluster levels

| | IV: CHARLS (mostly rural) | | | | | | IV: CHFS(mostly urban) | | |
|---|---|---|---|---|---|---|---|---|---|
| cluster-level | *O* household | | | province | | | *P* household | | |
| VARIABLES | *any-transfer* | *amount* | *visit days* | *any-transfer* | *amount* | *visit days* | *any-transfer* | *amount* | *visit days* |
| *maleP* | -0.0802** | -230.5 | -29.89*** | -0.0802* | -230.5 | -29.89*** | -0.0518 | -237.7 | -3.363 |
| | (0.0391) | (392.6) | (8.057) | (0.0467) | (327.1) | (11.26) | (0.0393) | (159.4) | (13.13) |
| *sex_ratioK* | -0.0450 | -273.3 | -4.315 | -0.0450 | -273.3 | -4.315 | -0.0733** | -96.20 | -46.92*** |
| | (0.0411) | (356.7) | (7.011) | (0.0428) | (398.9) | (6.859) | (0.0362) | (151.3) | (10.86) |
| $maleP \times sex\_ratioK$ | 0.125*** | 472.9 | 76.49*** | 0.125** | 472.9 | 76.49*** | 0.0412 | 259.2 | 49.37** |
| | (0.0482) | (444.9) | (9.592) | (0.0523) | (372.5) | (14.47) | (0.0601) | (255.6) | (19.88) |
| *sex_ratioK*+ | 0.079*** | 200.0 | 72.17*** | 0.079*** | 200.0 | 72.17*** | -0.032 | 163.0 | 2.455 |
| $maleP \times sex\_ratioK$ | (0.022) | (247.3) | (6.221) | (0.022) | (231.9) | (12.89) | (0.042) | (181.5) | (14.77) |
| *P* demographics | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| *O* demographics | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 12,232 | 12,232 | 12,232 | 12,232 | 12,232 | 12,232 | 19,509 | 19,509 | 19,509 |
| R-squared | 0.201 | 0.050 | 0.610 | 0.201 | 0.050 | 0.610 | 0.280 | 0.203 | 0.159 |
| Mean | 0.401 | 831.2 | 118.7 | 0.401 | 831.2 | 118.7 | 0.303 | 489.1 | 91.66 |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. *maleP* is the gender of *P*. *sex_ratioK* is the gender ratio of *K* in the household of *P* and represents the mother demonstration effect. $sex\_ratioK + maleP \times sex\_ratioK$ shows the father demonstration effect. The three outcome variables are the dummy indicating whether parents provide any financial transfer to their elderly parents (*any-transfer*), the amount of any transfer provided (*amount*), and the number of days spent on visits paid to their elderly parents per year (*visit days*). The key controls are *P*'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from *O*, and *O*'s transfer to *P*, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of *O* taking care of *P*'s *K*, depending on the availability of the information in the CHARLS and the CHFS. The standard error is clustered at the *O*'s household-level and the province level for the CHARLS and the cluster-level is the *P*'s household-level in the CHFS. The IVs are the gender of the first child born on or after 2003 and the prefectural compliance index for the CHARLS and the gender of the first child born on or after 2003 for the CHFS.

Table A.5: First stage for two constructed instrumental variables

| VARIABLES | *sex_ratioK* | |
|---|---|---|
| | CHARLS | CHFS |
| *sex_ratioK_1_2003* | 0.263*** | 0.430*** |
| | (0.007) | (0.007) |
| *prefectural_index* | -0.039** | - |
| | (0.009) | - |
| $P$ demographics | Yes | Yes |
| $O$ demographics | Yes | Yes |
| Observations | 12,232 | 19,509 |
| $F$-test | 199.88 | 512.63 |
| **Under-identification test** | | |
| Kleibergen-Paap rk LM statistic | 65.17 | 25.715 |
| **Weak identification test** | | |
| Cragg-Donald Wald $F$-stat. | 678.83 | 2100.56 |
| Kleibergen-Paap Wald rk $F$ test | 199.88 | 512.63 |
| **Over-identification test** | | |
| Hansen J statistic | 0.858 | - |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. The coefficient presented here for first stage coefficients for the IV regression. *sex_ratioK* is the gender ratio of $K$ in the household of $P$. *sex_ratioK_1_2003* is the gender of the first-born child in the family after 2003 together and *prefectural _index* is the index that indicating how strict the cities on the gender selection behaviours at prefecture-level. The key controls are $P$'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from $O$, and $O$'s transfer to $P$, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of $O$ taking care of $P$'s $K$, depending on the availability of the information in the CHARLS and the CHFS.

Table A.6: The demonstration effect on the provision of old-age support: Dummy gender ratio

| | IV: CHARLS (mostly rural) | | | IV: CHFS (mostly urban) | | |
|---|---|---|---|---|---|---|
| VARIABLES | *any-transfer* | *amount* | *visit days* | *any-transfer* | *amount* | *visit days* |
| *maleP* | -0.0774 | -230.3 | -31.03** | -0.0497 | -230.8 | -1.524 |
| | (0.0491) | (308.0) | (12.27) | (0.0432) | (165.2) | (16.01) |
| *more_sons* | -0.0387 | -254.6 | -3.464 | -0.0695** | -89.49 | -44.25*** |
| | (0.0406) | (368.1) | (7.092) | (0.0321) | (126.1) | (10.14) |
| $maleP \times more\_sons$ | 0.120** | 467.7 | 78.72*** | 0.0397 | 242.9 | 46.80** |
| | (0.0566) | (419.3) | (14.75) | (0.0606) | (271.0) | (22.87) |
| *hh-size* | -0.00835 | -18.43 | -2.253 | -0.00467 | -14.67 | -7.549*** |
| | (0.0131) | (81.63) | (1.865) | (0.00498) | (18.17) | (1.227) |
| $maleP \times$ *hh-size* | -0.000595 | 307.2** | 10.72*** | -0.00509 | 26.01 | 13.32*** |
| | (0.0119) | (149.2) | (2.888) | (0.00624) | (23.66) | (2.734) |
| $more\_sons +$ | 0.081*** | 213.1 | 75.25*** | -0.030 | 153.4 | 2.551 |
| $maleP \times more\_sons$ | (0.029) | (207.1) | (12.36) | (0.043) | (190.1) | (16.83) |
| *P* demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| *O* demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 12,232 | 12,232 | 12,232 | 19,509 | 19,509 | 19,509 |
| R-squared | 0.200 | 0.049 | 0.602 | 0.280 | 0.202 | 0.158 |

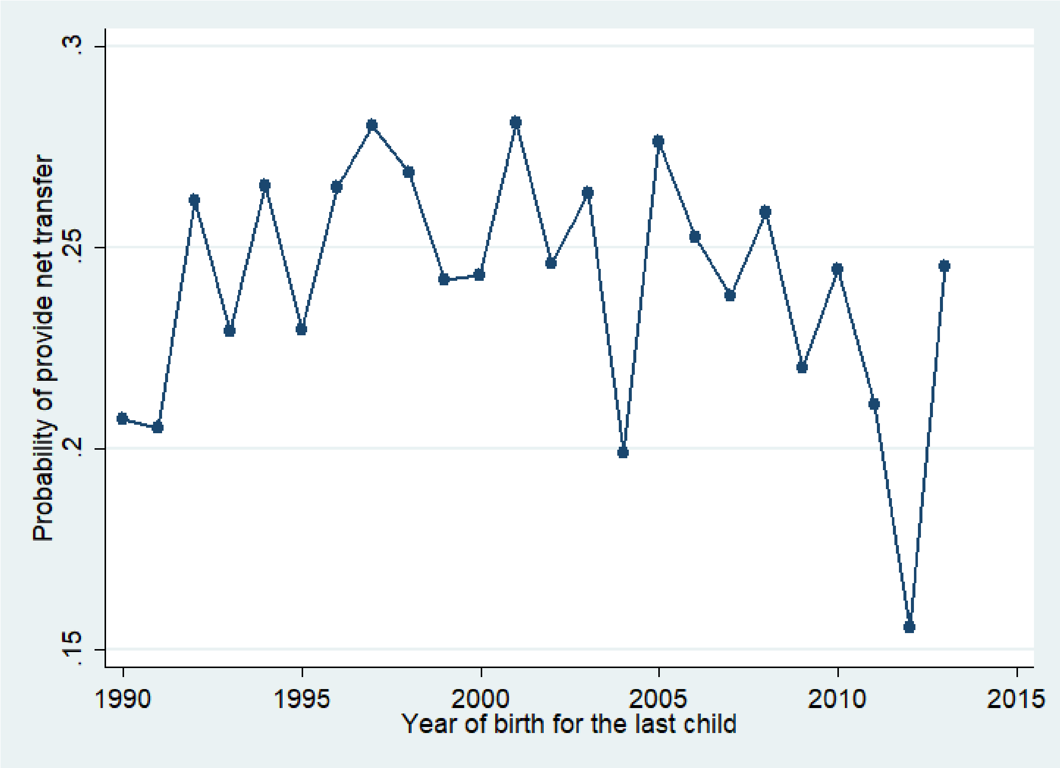
*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. *maleP* is the gender of *P*. *more_sonsK* is a dummy representing whether the gender ratio of *K* in the household of *P* is larger or equal to 0.5, and it is the mother demonstration effect. $more\_sons + maleP \times sex\_ratioK$ shows the father demonstration effect. The three outcome variables are the dummy indicating whether parents provide any financial transfer to their elderly parents (*any-transfer*), the amount of any transfer provided (*amount*), and the number of days spent on visits paid to their elderly parents per year (*visit days*). The key controls are *P*'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from *O*, and *O*'s transfer to *P*, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of *O* taking care of *P*'s *K*, depending on the availability of the information in the CHARLS and the CHFS. The standard error is clustered at the prefectural city level for the CHARLS and the cluster-level is the province-level in the CHFS. The IVs are the gender of the first child born on or after 2003 and the prefectural compliance index for the CHARLS and the gender of the first child born on or after 2003 for the CHFS.

Table A.7: Different representations of the probability and the amount of transfers

| | IV: CHARLS (mostly rural) | | | | IV: CHFS (mostly urban) | | | |
|---|---|---|---|---|---|---|---|---|
| VARIABLES | any net transfer | net total *amount* | *log* amount of transfer | percentage of income | any net transfer | net total *amount* | *log* amount of transfer | percentage of income |
| $maleP$ | -0.0969* | -35,144 | -0.315 | -0.0468** | -0.00450 | 382.3 | -0.527* | -0.00497 |
| | (0.0514) | (37,300) | (0.363) | (0.0226) | (0.0359) | (851.0) | (0.307) | (0.00649) |
| $sex\_ratioK$ | -0.0354 | 3,950 | -0.141 | -0.0178* | -0.0977*** | -104.9 | -0.361$^{\dagger}$ | -0.00205 |
| | (0.0439) | (4,241) | (0.290) | (0.0105) | (0.0264) | (925.4) | (0.224) | (0.00616) |
| $maleP \times sex\_ratioK$ | 0.129** | -1,141 | 0.719 | 0.0593* | -0.0375 | -507.8 | 0.0676 | -0.000853 |
| | (0.0582) | (14,263) | (0.481) | (0.0335) | (0.0521) | (1,523) | (0.448) | (0.0104) |
| *hh-size* | -0.012 | -8,070 | -0.117 | -0.00530*** | -0.010** | -8.107 | -0.0912** | -0.00125 |
| | (0.014) | (7,373) | (0.0878) | (0.00148) | (0.005) | (30.94) | (0.0421) | (0.000819) |
| $maleP\times$ *hh-size* | 0.011 | 10,244 | 0.0754 | 0.0137*** | -0.006 | -61.41 | 0.0601 | 0.00137 |
| | (0.014) | (8,902) | (0.0871) | (0.00325) | (0.006) | (54.87) | (0.0486) | (0.00112) |
| $sex\_ratioK+$ | 0.094*** | 2,809 | 0.578* | 0.041 | -0.135*** | -612.7 | -0.293 | -0.002 |
| $maleP \times sex\_ratioK$ | (0.026) | (15,917) | (0.346) | (0.030) | (0.036) | (788.7) | (0.309) | (0.007) |
| $P$ demographics | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| $P$ income level | Yes | Yes | Yes | No | Yes | Yes | Yes | No |
| $O$ demographics | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 12,232 | 12,232 | 12,232 | 12,232 | 19,509 | 19,509 | 19,509 | 19,509 |
| R-squared | 0.198 | 0.006 | 0.120 | 0.507 | 0.056 | 0.009 | 0.202 | 0.040 |

*Notes*:Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. $maleP$ is the gender of $P$. $sex\_ratioK$ is the gender ratio of $K$ in the household of $P$ and represents the mother demonstration effect. $sex\_ratioK + maleP \times sex\_ratioK$ shows the father demonstration effect. The outcome variables from left to right are the probability of providing any net transfers, the net amount of the transfer provided, the log amount of the total transfer provided, and the percentage of the amount of the total transfer in the total household income of $P$. The key controls are $P$'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from $O$, and $O$'s transfer to $P$, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of $O$ taking care of $P$'s $K$, depending on the availability of the information in the CHARLS and the CHFS. The standard error is clustered at the prefectural city level for the CHARLS and the cluster-level is the province-level in the CHFS. The IVs are the gender of the first child born on or after 2003 and the prefectural compliance index for the CHARLS and the gender of the first child born on or after 2003 for the CHFS.

Figure A.2: Trend assumption for the instrumental variable (DDIV)




Note: $x$-axis is the year of birth for the last child in households and $y$-axis shows the average probability of providing net old-age support for people who have their last child born in the same year. The graph is generated from the CHFS only.

Table A.8: Son preference in China

| | Urban areas | | Rural areas | |
|---|---|---|---|---|
| CHFS | No. | Percentage | No. | Percentage |
| Prefer sons | 1,159 | 8.43% | 621 | 9.25% |
| Prefer daughters | 2,904 | 21.12% | 672 | 10.01% |
| Indifferent | 9,685 | 70.45% | 5,423 | 80.75% |

*Notes*: The question asked in the 2013 CHFS wave is "Do you think it is better to have a son or it is better to have a daughter?". I separate the sample into people who live in urban areas and those who live in rural areas.

Table A.9: The demonstration effect: no cohabitation sample only

| | IV: CHARLS (mostly rural) | | | IV: CHFS (mostly urban) | | |
|---|---|---|---|---|---|---|
| VARIABLES | *any-transfer* | *amount* | *visit days* | *any-transfer* | *amount* | *visit days* |
| *maleP* | -6.097 | -1,452 | -1,229 | -0.0966** | -354.1* | -15.63 |
| | (16.87) | (25,990) | (2,917) | (0.0486) | (195.1) | (13.24) |
| *sex_ratioK* | -0.114 | -246.0 | -21.28 | -0.0816** | -190.7 | -41.03*** |
| | (0.341) | (687.8) | (65.42) | (0.0338) | (140.1) | (9.957) |
| $maleP \times sex\_ratioK$ | 8.995 | 2,098 | 1,837 | 0.0827 | 514.2 | 41.74** |
| | (24.97) | (38,537) | (4,311) | (0.0692) | (323.9) | (21.24) |
| $sex_{r}atioK+$ | 8.881 | 1,851 | 1,815 | 0.001 | 323.5 | 0.715 |
| $maleP \times sex\_ratioK$ | (24.65) | (37,960) | (4,249) | (0.050) | (247.0) | (16.16) |
| *P* demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| *O* demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 10,488 | 10,488 | 10,489 | 17,786 | 17,786 | 17,786 |
| R-squared | -24.100 | 0.048 | -18.517 | 0.230 | 0.220 | 0.072 |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. *maleP* is the gender of *P*. *sex_ratioK* is the gender ratio of *K* in the household of *P* and represents the mother demonstration effect. $sex\_ratioK + maleP \times sex\_ratioK$ shows the father demonstration effect. The three outcome variables are the dummy indicating whether parents provide any financial transfer to their elderly parents (*any-transfer*), the amount of any transfer provided (*amount*), and the number of days spent on visits paid to their elderly parents per year (*visit days*). The key controls are *P*'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from *O*, and *O*'s transfer to *P*, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of *O* taking care of *P*'s *K*, depending on the availability of the information in the CHARLS and the CHFS. The standard error is clustered at the prefectural city level for the CHARLS and the cluster-level is the province-level in the CHFS. The IVs are the gender of the first child born on or after 2003 and the prefectural compliance index for the CHARLS and the gender of the first child born on or after 2003 for the CHFS.

Table A.10: Heterogeneity Check: Household income level

| | IV: CHARLS (mostly rural) | | | IV: CHFS(mostly urban) | | |
|---|---|---|---|---|---|---|
| VARIABLES | *any-transfer* | *amount* | *visit days* | *any-transfer* | *amount* | *visit days* |
| *maleP* | -0.104 | -780.7** | -17.08 | -0.0448 | -354.0* | -29.87 |
| | (0.0654) | (369.9) | (14.29) | (0.0592) | (199.6) | (18.96) |
| *sex_ratioK* | -0.0214 | -153.4 | 8.847 | -0.0789 | -470.0** | -67.30*** |
| *(Low income mother demonstrate effects)* | (0.0628) | (339.8) | (10.93) | (0.0514) | (212.2) | (14.98) |
| *high income* | 0.0553 | -600.1 | 24.80*** | 0.00333 | -587.2*** | -19.90* |
| | (0.0567) | (426.7) | (9.306) | (0.0400) | (186.2) | (11.44) |
| *maleP* × *sex_ratioK* | 0.198** | 1,136** | 69.74*** | 0.0326 | 500.9 | 105.2*** |
| | (0.0870) | (484.7) | (19.72) | (0.0904) | (335.2) | (29.20) |
| *sex_ratioK*× *high income* | -0.0451 | -256.4 | -22.31 | 0.0121 | 778.4** | 41.26** |
| *(Differences in mother demonstrate effects)* | (0.0930) | (625.2) | (16.06) | (0.0728) | (361.8) | (19.03) |
| *maleP*× *high income* | 0.130 | 1,202** | -42.42*** | -0.0141 | 229.5 | 50.48** |
| | (0.0856) | (593.2) | (14.58) | (0.0721) | (254.8) | (22.78) |
| *maleP* × *sex_ratioK* | -0.276* | -1,676* | 39.33* | 0.0183 | -513.5 | -112.3*** |
| ×*high income* | (0.142) | (857.1) | (23.61) | (0.130) | (466.6) | (38.19) |
| *High income father demonstrate effects* | -0.145** | -949.1* | 95.61*** | -0.016 | 295.8 | -33.14 |
| | (0.068) | (502.8) | (16.47) | (0.062) | (289.8) | (26.55) |
| *Low income father demonstrate effects* | 0.176*** | 983.0*** | 78.58*** | -0.046 | 30.91 | 37.92* |
| | (0.043) | (311.8) | (15.94) | (0.063) | (265.1) | (22.25) |
| *Differences in father demonstrate effects* | -0.321*** | -1932.2*** | 17.02 | 0.030 | 264.9 | -71.06** |
| | (0.093) | (702.0) | (16.95) | (0.088) | (382.1) | (32.02) |
| *High income mother demonstrate effects* | -0.066*** | -409.7 | -13.46 | -0.067 | 308.4 | -26.03* |
| | (0.065) | (635.4) | (11.10) | (0.048) | (239.7) | (13.29) |
| *P* demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| *O* demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 12,232 | 12,232 | 12,232 | 19,509 | 19,509 | 19,509 |
| R-squared | 0.195 | 0.047 | 0.600 | 0.280 | 0.199 | 0.154 |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. The three outcome variables are the dummy indicating whether parents provide any financial transfer to their elderly parents (*any-transfer*), the amount of any transfer provided (*amount*), and the number of days spent on visits paid to their elderly parents per year (*visit days*). The key controls are *P*'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from *O*, and *O*'s transfer to *P*, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of *O* taking care of *P*'s *K*, depending on the availability of the information in the CHARLS and the CHFS. The standard error is clustered at the prefectural city level for the CHARLS and the cluster-level is the province-level in the CHFS. The IVs are the gender of the first child born on or after 2003 and the prefectural compliance index for the CHARLS and the gender of the first child born on or after 2003 for the CHFS. *maleP* is the gender of *P*. *high income* is a dummy representing *P*'s income-level, and it interacts with key regressors. *sex_ratioK* is the gender ratio of *K* in the household of *P* and the mother demonstration effect for *P* with high-level income. *sex_ratioK*× *high income* represents the difference between the mother demonstration effects for *P* with high-level income and the mother demonstration effects for *P* with low-level income, which should be negative and significant if the mother demonstration effects for *P* with high-level income are larger than the mother demonstration effects for *P* with low-level income.

Table A.11: Heterogeneity Check: Single child family

| | IV: CHARLS (mostly rural) | | | IV: CHFS(mostly urban) | | |
|---|---|---|---|---|---|---|
| VARIABLES | *any-transfer* | *amount* | *visit days* | *any-transfer* | *amount* | *visit days* |
| *maleP* | -0.0623 | 1,069 | -15.65 | 0.00656 | -394.9 | -28.71 |
| | (0.104) | (998.0) | (20.78) | (0.0829) | (317.8) | (37.09) |
| *sex_ratioK* | 0.0160 | -209.2 | -4.973 | 0.0329 | -854.0*** | -100.4*** |
| *(non-singleK HH mother demonstrate effects)* | (0.115) | (777.9) | (17.51) | (0.0835) | (264.2) | (38.34) |
| *singleK* | 0.0346 | 16.06 | 0.577 | 0.0822* | -472.6*** | -23.44 |
| | (0.0635) | (456.5) | (10.84) | (0.0441) | (160.4) | (22.81) |
| *maleP* × *sex_ratioK* | 0.112 | -605.5 | 118.8*** | -0.0838 | 769.1 | 177.9** |
| | (0.198) | (1,706) | (38.17) | (0.161) | (634.6) | (70.41) |
| *sex_ratioK*× *singleK* | -0.0830 | 50.71 | 5.181 | -0.141 | 1,020*** | 68.50 |
| *(Differences in mother demonstrate effects)* | (0.125) | (766.7) | (19.55) | (0.0872) | (305.3) | (43.22) |
| *maleP*× *singleK* | -0.00938 | -1,004 | 1.102 | -0.0794 | 286.8 | 61.52* |
| | (0.128) | (1,170) | (20.48) | (0.0780) | (279.8) | (37.03) |
| *maleP* × *sex_ratioK* | 0.0281 | 1,192 | -44.64 | 0.162 | -684.1 | -166.7** |
| ×*singleK* | (0.232) | (1,991) | (36.89) | (0.154) | (543.5) | (69.94) |
| *singleK HH father* | 0.073 | 428.5 | 74.32*** | -0.031 | 250.7* | -20.66 |
| *demonstrate effects* | (0.049) | (409.4) | (11.42) | (0.036) | (146.2) | (15.62) |
| *Non-singleK HH father* | 0.128 | -814.6 | 113.7*** | -0.051 | -84.88 | 77.49 |
| *demonstrate effects* | (0.129) | (1,053) | (30.72) | (0.119) | (567.3) | (63.71) |
| *Differences in father* | -0.055 | 1,243 | -39.46 | 0.020 | 335.6 | -98.16 |
| *demonstrate effects* | (0.167) | (1,399) | (28.09) | (0.108) | (507.1) | (64.70) |
| *singleK HH mother* | 0.029 | -554.7 | 123.9** | -0.108*** | 165.7 | -31.86*** |
| *demonstrate effects* | (0.300) | (2,371) | (51.88) | (0.034) | (158.6) | (11.10) |
| $P$ demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| $O$ demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 12,232 | 12,232 | 12,232 | 19,509 | 19,509 | 19,509 |
| R-squared | 0.200 | 0.047 | 0.597 | 0.278 | 0.198 | 0.151 |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. The three outcome variables are the dummy indicating whether parents provide any financial transfer to their elderly parents (*any-transfer*), the amount of any transfer provided (*amount*), and the number of days spent on visits paid to their elderly parents per year (*visit days*). The key controls are $P$'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from $O$, and $O$'s transfer to $P$, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of $O$ taking care of $P$'s $K$, depending on the availability of the information in the CHARLS and the CHFS. The standard error is clustered at the prefectural city level for the CHARLS and the cluster-level is the province-level in the CHFS. The IVs are the gender of the first child born on or after 2003 and the prefectural compliance index for the CHARLS and the gender of the first child born on or after 2003 for the CHFS. *maleP* is the gender of $P$. *singleK* is a dummy representing whether $P$ have only one child, and it interacts with key regressors. *sex_ratioK* is the gender ratio of $K$ in the household of $P$ and the mother demonstration effect for $P$ with only one child. *sex_ratioK* × *singleK* represents the difference between the mother demonstration effects for $P$ with only one child and the mother demonstration effects for $P$ with more than one child, which should be negative and significant if the mother demonstration effects for $P$ with only one child are larger than the mother demonstration effects for $P$ with more than one child.

Table A.12: Heterogeneity Check: Urban-rural differences

| | IV: CHARLS (mostly rural) | | | IV: CHFS(mostly urban) | | |
|---|---|---|---|---|---|---|
| VARIABLES | *any-transfer* | *amount* | *visit days* | *any-transfer* | *amount* | *visit days* |
| *maleP* | -0.108* | -773.6* | -39.24** | 0.0675 | 118.6 | -95.96* |
| | (0.0618) | (406.0) | (15.80) | (0.131) | (314.6) | (51.21) |
| *sex_ratioK* | -0.0640 | -495.6 | -4.914 | 0.00835 | -522.6* | -16.54 |
| *(Rural mother demonstrate effects)* | (0.0605) | (423.5) | (8.866) | (0.127) | (275.8) | (39.53) |
| *urban* | -0.0904 | -320.3 | 12.19 | 0.0987 | -131.6 | 23.86 |
| | (0.0615) | (494.2) | (11.21) | (0.0852) | (178.5) | (24.47) |
| *maleP* × *sex_ratioK* | 0.133 | 1,234** | 99.33*** | -0.154 | -251.1 | 259.7*** |
| | (0.0828) | (622.2) | (20.21) | (0.196) | (482.3) | (75.87) |
| *sex_ratioK* × *urban* | 0.0489 | 674.6 | 17.13 | -0.0905 | 526.2 | -46.43 |
| *(Differences in mother demonstrate effects)* | (0.103) | (858.2) | (18.51) | (0.150) | (336.5) | (40.78) |
| *maleP* × *urban* | 0.0511 | 1,358* | 15.15 | -0.125 | -391.4 | 92.35* |
| | (0.0751) | (765.2) | (13.60) | (0.116) | (336.2) | (48.16) |
| *maleP* × *sex_ratioK* | -0.0125 | -2,108* | -50.96** | 0.219 | 604.9 | -233.3*** |
| ×*urban* | (0.131) | (1,219) | (21.06) | (0.196) | (580.7) | (77.24) |
| *Urban father demonstrate effects* | 0.104* | -694.7 | 60.59*** | -0.017 | 357.3 | -36.54* |
| | (0.062) | (519.9) | (14.63) | (0.042) | (251.1) | (21.54) |
| *Rural father demonstrate effects* | 0.068* | 738.5** | 94.41*** | -0.145 | -773.7* | 243.1*** |
| | (0.041) | (308.1) | (17.54) | (0.133) | (408.0) | (66.24) |
| *Differences in father demonstrate effects* | 0.036 | -1,433** | -33.82* | 0.128 | 1,131** | -279.7*** |
| | (0.088) | (703.3) | (18.08) | (0.132) | (533.4) | (73.37) |
| *Urban mother demonstrate effects* | 0.181 | 1,908 | 116.5*** | -0.082* | 3.561 | -62.98*** |
| | (0.163) | (1,199) | (28.88) | (0.044) | (154.7) | (11.19) |
| *P* demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| *O* demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 12,232 | 12,232 | 12,232 | 19,509 | 19,509 | 19,509 |
| R-squared | 0.201 | 0.047 | 0.601 | 0.279 | 0.194 | 0.094 |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. The three outcome variables are the dummy indicating whether parents provide any financial transfer to their elderly parents (*any-transfer*), the amount of any transfer provided (*amount*), and the number of days spent on visits paid to their elderly parents per year (*visit days*). The key controls are *P*'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from *O*, and *O*'s transfer to *P*, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of *O* taking care of *P*'s *K*. The standard error is clustered at the prefectural city level for the CHARLS. The IVs are the gender of the first child born on or after 2003 and the prefectural compliance index for the CHARLS. *maleP* is the gender of *P*. *urban* is a dummy representing whether *P* live in urban areas, and it interacts with key regressors. *sex_ratioK* is the gender ratio of *K* in the household of *P* and the mother demonstration effect for *P* with any older brothers. *sex_ratioK* × *urban* represents the difference between the mother demonstration effects for *P* live in urban areas and the mother demonstration effects for *P* live in rural areas, which should be negative and significant if the mother demonstration effects for *P* live in urban areas are larger than the mother demonstration effects for *P* live in rural areas.

Table A.13: Subsample analysis: Urban-singleton households

| | IV: CHARLS (mostly rural) | | | IV: CHFS (mostly urban) | | |
|---|---|---|---|---|---|---|
| VARIABLES | *any-transfer* | *amount* | *visit days* | *any-transfer* | *amount* | *visit days* |
| **Urban-singleton** | | | | | | |
| *maleP* | -0.00299 | -592.9 | 8.020 | -0.0816** | -180.6 | 8.082 |
| | (0.0568) | (722.7) | (12.85) | (0.0328) | (131.2) | (13.64) |
| *sex_ratioK* | -0.0157 | -244.4 | 7.033 | -0.0896*** | -13.23 | -24.11** |
| | (0.0670) | (911.7) | (15.49) | (0.0343) | (158.8) | (10.14) |
| $maleP \times sex\_ratioK$ | 0.00379 | 877.1 | 19.02 | 0.0921 | 173.6 | 26.14 |
| | (0.0830) | (1,215) | (18.31) | (0.0580) | (255.3) | (22.34) |
| $sex\_ratioK+$ | -0.012 | 632.7 | 26.04** | 0.002 | 160.3 | 2.028 |
| $maleP \times sex\_ratioK$ | (0.045) | (622.6) | (12.56) | (0.039) | (157.7) | (17.27) |
| | | | | | | |
| Observations | 2,466 | 2,466 | 2,466 | 9,364 | 9,364 | 9,364 |
| R-squared | 0.230 | 0.085 | 0.612 | 0.254 | 0.206 | 0.128 |
| **Others** | | | | | | |
| *maleP* | -0.142** | 55.45 | -29.65** | 0.0655 | -301.6 | -6.517 |
| | (0.0593) | (346.3) | (14.86) | (0.103) | (369.0) | (38.15) |
| *sex_ratioK* | -0.0634 | -279.4 | -3.850 | -0.0101 | -258.5 | -122.7*** |
| | (0.0526) | (430.1) | (8.439) | (0.0650) | (181.0) | (29.26) |
| $maleP \times sex\_ratioK$ | 0.184*** | 391.7 | 92.12*** | -0.149 | 477.7 | 127.6** |
| | (0.0681) | (504.5) | (17.89) | (0.140) | (538.1) | (53.40) |
| $sex\_ratioK+$ | 0.121*** | 112.2 | 88.26*** | -0.158 | 219.1 | 4.876 |
| $maleP \times sex\_ratioK$ | (0.030) | (179.7) | (14.27) | (0.099) | (436.5) | (40.35) |
| | | | | | | |
| Observations | 9,766 | 9,766 | 9,766 | 10,145 | 10,145 | 10,145 |
| R-squared | 0.195 | 0.043 | 0.610 | 0.293 | 0.136 | 0.196 |
| $P$ demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| $O$ demographics | Yes | Yes | Yes | Yes | Yes | Yes |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. *maleP* is the gender of $P$. *sex_ratioK* is the gender ratio of $K$ in the household of $P$ and represents the mother demonstration effect. $sex\_ratioK + maleP \times sex\_ratioK$ shows the father demonstration effect. The three outcome variables are the dummy indicating whether parents provide any financial transfer to their elderly parents (*any-transfer*), the amount of any transfer provided (*amount*), and the number of days spent on visits paid to their elderly parents per year (*visit days*). The key controls are $P$'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from $O$, and $O$'s transfer to $P$, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of $O$ taking care of $P$'s $K$, depending on the availability of the information in the CHARLS and the CHFS. The standard error is clustered at the prefectural city level for the CHARLS and the cluster-level is the province-level in the CHFS. The IVs are the gender of the first child born on or after 2003 and the prefectural compliance index for the CHARLS and the gender of the first child born on or after 2003 for the CHFS. The sample is split based on whether $P$ live in urban areas and have only one child.

Table A.14: Heterogeneity Check: Family compositions of $P$

| | IV: CHARLS (mostly rural) | | |
|---|---|---|---|
| VARIABLES | *any-transfer* | *amount* | *visit days* |
| *maleP* | -0.138** | -483.6 | -30.12** |
| | (0.0549) | (421.6) | (13.41) |
| *sex_ratioK* | -0.0851 | -662.8 | 4.674 |
| *(Without older brothers mother demonstrate)* | (0.0578) | (473.8) | (9.214) |
| *older bro* | -0.0370 | -559.4 | 17.30 |
| | (0.0564) | (437.7) | (10.88) |
| *maleP* × *sex_ratioK* | 0.239*** | 851.1 | 73.15*** |
| | (0.0729) | (604.3) | (18.52) |
| *sex_ratioK*× *older bro* | 0.104 | 1,013 | -17.87 |
| *(Differences in mother demonstrate effects)* | (0.0980) | (718.1) | (17.44) |
| *maleP*× *older bro* | 0.212*** | 519.7 | -24.12 |
| | (0.0736) | (725.1) | (15.26) |
| *maleP* × *sex_ratioK* ×*older bro* | -0.358*** | -721.7 | 97.87*** |
| | (0.125) | (1,183) | (16.26) |
| *With older brothers father demonstrate* | -0.101 | 479.5 | 97.87*** |
| | (0.063) | (754.3) | (16.26) |
| *Without older brothers father demonstrate* | 0.154*** | 188.3 | 77.82*** |
| | (0.035) | (256.5) | (14.61) |
| *Differences in father demonstrate effects* | -0.255*** | 291.2 | 20.05 |
| | (0.078) | (909.5) | (14.35) |
| *With older brothers mother demonstrate* | 0.343** | 1,864 | 55.27* |
| | (0.151) | (1,142) | (30.70) |
| $P$ demographics | Yes | Yes | Yes |
| $O$ demographics | Yes | Yes | Yes |
| Observations | 12,232 | 12,232 | 12,232 |
| R-squared | 0.196 | 0.049 | 0.599 |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. The three outcome variables are the dummy indicating whether parents provide any financial transfer to their elderly parents (*any-transfer*), the amount of any transfer provided (*amount*), and the number of days spent on visits paid to their elderly parents per year (*visit days*). The key controls are $P$'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from $O$, and $O$'s transfer to $P$, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of $O$ taking care of $P$'s $K$. The standard error is clustered at the prefectural city level for the CHARLS. The IVs are the gender of the first child born on or after 2003 and the prefectural compliance index for the CHARLS. *maleP* is the gender of $P$. *older bro* is a dummy representing whether $P$ have any older brothers, and it interacts with key regressors. *sex_ratioK* is the gender ratio of $K$ in the household of $P$ and the mother demonstration effect for $P$ with any older brothers. *sex_ratioK* × *old bro* represents the difference between the mother demonstration effects for $P$ with any older brothers and the mother demonstration effects for $P$ without any older brothers, which should be negative and significant if the mother demonstration effects for $P$ with any older brothers are larger than the mother demonstration effects for $P$ without any older brothers.

Table A.15: Heterogeneity Check: Living in a community with minority ethnic groups

| | IV: CHARLS (mostly rural) | | |
|---|---|---|---|
| VARIABLES | *any-transfer* | *amount* | *visit days* |
| *maleP* | -0.0591 | -174.0 | -49.90*** |
| | (0.0725) | (494.5) | (17.56) |
| *sex_ratioK* | -0.0141 | -559.5 | -5.602 |
| *(Non-Mino. mother demonstration effects)* | (0.0780) | (535.2) | (10.25) |
| *minority* | -0.0300 | -412.2 | -0.749 |
| | (0.0677) | (411.8) | (9.165) |
| *maleP* × *sex_ratioK* | 0.0469 | 540.2 | 104.3*** |
| | (0.114) | (585.2) | (22.49) |
| *sex_ratioK* × *Minority* | -0.0760 | 695.4 | 6.357 |
| *(Difference in mother demonstration effects)* | (0.114) | (699.5) | (13.90) |
| *maleP* × *Minority* | -0.0624 | -1.668 | 20.78 |
| | (0.0920) | (575.3) | (15.57) |
| *sex_ratioK* × *Minority* | 0.183 | -239.6 | -35.77 |
| ×*maleP* | (0.163) | (864.3) | (22.90) |
| *Mino. father* | 0.140*** | 436.4 | 69.29*** |
| *demonstration effects* | (0.050) | (361.1) | (13.63) |
| *Non-Mino. father* | 0.033 | -19.33 | 98.70*** |
| *demonstration effects* | (0.065) | (453.5) | (18.73) |
| *Difference in father* | 0.107 | 455.8 | -29.40 |
| *demonstration effects* | (0.102) | (720.7) | (18.36) |
| *Mino. mother* | -0.029 | 1,235 | 110.6*** |
| *demonstration effects* | (0.208) | (1,121) | (31.12) |
| *P* demographics | Yes | Yes | Yes |
| *O* demographics | Yes | Yes | Yes |
| Observations | 12,232 | 12,232 | 12,232 |
| R-squared | 0.201 | 0.050 | 0.601 |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. The three outcome variables are the dummy indicating whether parents provide any financial transfer to their elderly parents (*any-transfer*), the amount of any transfer provided (*amount*), and the number of days spent on visits paid to their elderly parents per year (*visit days*). The key controls are *P*'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from *O*, and *O*'s transfer to *P*, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of *O* taking care of *P*'s *K*. The standard error is clustered at the prefectural city level for the CHARLS. The IVs are the gender of the first child born on or after 2003 and the prefectural compliance index for the CHARLS. *maleP* is the gender of *P*. *minority* is a dummy representing whether *P* live in communities with any minority ethnic groups, and it interacts with key regressors. *sex_ratioK* is the gender ratio of *K* in the household of *P* and the mother demonstration effect for *P* living in communities with any minority ethnic groups. *sex_ratioK* × *minority* represents the difference between the mother demonstration effects for *P* living in communities with any minority ethnic groups and the mother demonstration effects for *P* living in *Han*-only communities, which should be negative and significant if the mother demonstration effects for *P* living in communities with any minority ethnic groups are larger than the mother demonstration effects for *P* living in *Han*-only communities.

Table A.16: Heterogeneity Check: Ethnic groups

| | IV: CHFS (mostly urban) | | |
|---|---|---|---|
| VARIABLES | *any-transfer* | *amount* | *visit days* |
| *maleP* | -0.0558 | -212.6 | 15.15 |
| | (0.135) | (537.3) | (36.25) |
| *sex_ratioK* | -0.184 | -93.91 | -5.164 |
| *(Non-Han mother demonstration effects)* | (0.161) | (558.5) | (45.56) |
| *Han* | -0.0462 | -23.79 | 30.46 |
| | (0.0677) | (411.8) | (9.165) |
| $maleP \times sex\_ratioK$ | 0.0618 | 253.8 | 16.61 |
| | (0.226) | (935.7) | (66.02) |
| $sex\_ratioK \times Han$ | 0.126 | 7.621 | -47.45 |
| *(Difference in mother demonstration effects)* | (0.166) | (556.6) | (46.18) |
| $maleP \times Han$ | 0.0133 | -10.09 | -24.61 |
| | (0.136) | (506.5) | (38.11) |
| $sex\_ratioK \times Han$ $\times maleP$ | -0.0355 | -20.43 | 42.04 |
| | (0.241) | (889.5) | (72.12) |
| *Han father demonstration effects* | -0.031 | 147.0 | 6.036 |
| | (0.047) | (189.5) | (20.19) |
| *Non-Han father demonstration effects* | -0.122 | 159.8 | 11.44 |
| | (0.191) | (690.2) | (46.56) |
| *Difference in father demonstration effects* | 0.091 | -12.81 | -5.408 |
| | (0.199) | (650.6) | (56.40) |
| *Han mother demonstration effects* | -0.058* | -86.28 | -52.61*** |
| | (0.034) | (130.7) | (11.19) |
| $P$ demographics | Yes | Yes | Yes |
| $O$ demographics | Yes | Yes | Yes |
| Observations | 19,509 | 19,509 | 19,509 |
| R-squared | 0.280 | 0.203 | 0.160 |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. The three outcome variables are the dummy indicating whether parents provide any financial transfer to their elderly parents (*any-transfer*), the amount of any transfer provided (*amount*), and the number of days spent on visits paid to their elderly parents per year (*visit days*). The key controls are $P$'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from $O$, and $O$'s transfer to $P$, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of $O$ taking care of $P$'s $K$. The standard error is clustered at the province level for the CHFS. The IV is the gender of the first child born on or after 2003 for the CHFS. *maleP* is the gender of $P$. *Han* is a dummy representing whether $P$'s ethnicity is *Han*, and it interacts with key regressors. *sex_ratioK* is the gender ratio of $K$ in the household of $P$ and the mother demonstration effect for $P$ as *Han*. $sex\_ratioK \times Han$ represents the difference between the mother demonstration effects for $P$ as *Han* and the mother demonstration effects for $P$ as other minority ethnic groups, which should be negative and significant if the mother demonstration effects for $P$ as *Han* are larger than the mother demonstration effects for $P$ as other minority ethnic groups.

Table A.17: The demonstration effect: migrants only

| VARIABLES | IV: CHARLS (mostly rural) *any-transfer* | *amount* | *visit days* | IV: CHFS (mostly urban) *any-transfer* | *amount* | *visit days* |
|---|---|---|---|---|---|---|
| $maleP$ | 0.126 | -22,246 | -32.62 | -0.164* | -717.8*** | 11.31 |
| | (1.017) | (31,166) | (107.4) | (0.0876) | (261.5) | (32.29) |
| $sex\_ratioK$ | 0.116 | -712.8 | -4.559 | -0.185*** | -791.9*** | -41.70*** |
| | (0.123) | (2,849) | (9.792) | (0.0717) | (180.8) | (15.18) |
| $maleP \times sex\_ratioK$ | -0.184 | 30,706 | 50.17 | 0.266** | 1,117*** | 22.89 |
| | (1.460) | (45,032) | (153.2) | (0.125) | (389.9) | (40.71) |
| $sex_r atioK+$ | -0.068 | 29,993 | 45.61 | 0.080 | 325.4 | -18.81 |
| $maleP \times sex\_ratioK$ | (1.401) | (42,530) | (146.7) | (0.080) | (358.8) | (34.91) |
| $P$ demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| $O$ demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 1,581 | 1,581 | 1,581 | 4,471 | 4,471 | 4,471 |
| R-squared | 0.177 | -1.644 | 0.076 | 0.240 | 0.135 | 0.144 |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. $maleP$ is the gender of $P$. $sex\_ratioK$ is the gender ratio of $K$ in the household of $P$ and represents the mother demonstration effect. $sex\_ratioK + maleP \times sex\_ratioK$ shows the father demonstration effect. The three outcome variables are the dummy indicating whether parents provide any financial transfer to their elderly parents (*any-transfer*), the amount of any transfer provided (*amount*), and the number of days spent on visits paid to their elderly parents per year (*visit days*). The key controls are $P$'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from $O$, and $O$'s transfer to $P$, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of $O$ taking care of $P$'s $K$, depending on the availability of the information in the CHARLS and the CHFS. The standard error is clustered at the prefectural city level for the CHARLS and the cluster-level is the province-level in the CHFS. The IVs are the gender of the first child born on or after 2003 and the prefectural compliance index for the CHARLS and the gender of the first child born on or after 2003 for the CHFS. The sample contains only migrants.

Table A.18: The demonstration effect: migrants living with/out $K$ and $O$

| | IV: CHFS (mostly urban) | | | | | |
|---|---|---|---|---|---|---|
| *subsample* | live together with $K$, without $O$ | | | live together without $K$ and $O$ | | |
| VARIABLES | *any-transfer* | *amount* | *visit days* | *any-transfer* | *amount* | *visit days* |
| *maleP* | -0.190** | -571.1** | 12.49 | -0.164* | -717.8*** | 48.58358 |
| | (0.0908) | (275.9) | (29.25) | (0.0876) | (261.5) | (52.61) |
| *sex_ratioK* | -0.174*** | -663.9*** | -48.76*** | -0.185*** | -791.9*** | -13.725 |
| | (0.0676) | (174.2) | (15.24) | (0.0717) | (180.8) | (58.52) |
| $maleP \times sex\_ratioK$ | 0.267** | 836.5** | -4.591 | 0.266** | 1,117*** | -50.84252 |
| | (0.125) | (404.5) | (42.95) | (0.125) | (389.9) | (74.11) |
| $sex_ratioK+$ | 0.093 | 172.5 | -53.35 | 0.260 | 1,810 | -64.56 |
| $maleP \times sex\_ratioK$ | (0.084) | (401.4) | (37.96) | (0.310) | (1,306) | (47.70) |
| $P$ demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| $O$ demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 2,820 | 2,820 | 2,820 | 1,305 | 1,305 | 1,305 |
| R-squared | 0.190 | 0.171 | 0.069 | 0.016 | 0.120 | 0.0845 |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. *maleP* is the gender of $P$. *sex_ratioK* is the gender ratio of $K$ in the household of $P$ and represents the mother demonstration effect. $sex\_ratioK + maleP \times sex\_ratioK$ shows the father demonstration effect. The three outcome variables are the dummy indicating whether parents provide any financial transfer to their elderly parents (*any-transfer*), the amount of any transfer provided (*amount*), and the number of days spent on visits paid to their elderly parents per year (*visit days*). The key controls are $P$'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from $O$, and $O$'s transfer to $P$, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of $O$ taking care of $P$'s $K$. The standard error is clustered at the prefectural city level for the CHARLS. The IVs are the gender of the first child born on or after 2003 and the prefectural compliance index for the CHARLS. Two migrant subsamples: $P$ live together with $K$ but without $O$, and $P$ live without $K$ and $O$.

Table A.19: The demonstration effect and the education investment in generation $K$

| | IV: CHFS (mostly urban) | | |
|---|---|---|---|
| VARIABLES | the amount of the education investment | any education investment in $K$ | percentage of edu. investment in total expense |
| *maleP* | -29.39 | -0.0879** | -0.0342** |
| | (1,071) | (0.0422) | (0.0169) |
| *sex_ratioK* | -3,360*** | 0.0914** | -0.0838*** |
| | (959.8) | (0.0416) | (0.0190) |
| *maleP* × *sex_ratioK* | 791.2 | 0.143** | 0.0437* |
| | (1,275) | (0.0669) | (0.0254) |
| *maleP*× *hh-size* | -323.0* | -0.00354 | -0.00103 |
| | (185.8) | (0.00952) | (0.00412) |
| *hh-size* | 491.8*** | 0.0280*** | 0.00443 |
| | (144.5) | (0.00688) | (0.00382) |
| *amount of old-age support* | -0.539 | - | - |
| | (0.483) | - | - |
| *any old-age support provided* | - | 0.0452*** | -0.0299*** |
| | - | (0.00997) | (0.00443) |
| *sex_ratioK* + | -2,568** | 0.235*** | -0.040* |
| *maleP* × *sex_ratioK* | (1,024) | (0.066) | (0.023) |
| (Male with sons-males with daughters) | | | |
| *maleP* + | 761.7 | 0.055* | 0.010 |
| *maleP* × *sex_ratioK* | (478.2) | (0.031) | (0.011) |
| (Male with sons-females with sons) | | | |
| $P$ demographics | Yes | Yes | Yes |
| $O$ demographics | Yes | Yes | Yes |
| Observations | 19,509 | 19,509 | 19,509 |
| R-squared | 0.308 | 0.144 | 0.051 |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. *maleP* is the gender of $P$. *sex_ratioK* is the gender ratio of $K$ in the household of $P$ and represents the mother demonstration effect. *sex_ratioK* + *maleP* × *sex_ratioK* shows the father demonstration effect. The three outcome variables are the amount of the education investment on $K$ from$P$, the probability of $P$ providing any education investment for $K$, and the percentage of the education expenditure on $K$ in the total household expenses. The key controls are $P$'s household-size, whether provide any old-age support to $O$ and the corresponding amount, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from $O$, and $O$'s transfer to $P$, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of $O$ taking care of $P$'s $K$. The standard error is clustered at the province level for the CHFS. The IV is the gender of the first child born on or after 2003 for the CHFS.

Table A.20: The demonstration effect without controlling for the transfers from generation $O$

| | IV: CHARLS (mostly rural) | | | IV: CHFS(mostly urban) | | |
|---|---|---|---|---|---|---|
| VARIABLES | *any-transfer* | *amount* | *visit days* | *any-transfer* | *amount* | *visit days* |
| *maleP* | -0.121** | -325.3 | -10.26 | -0.0533 | -240.2 | -3.723 |
| | (0.0595) | (312.8) | (9.130) | (0.0521) | (185.3) | (16.79) |
| *sex_ratioK* | -0.116** | -302.3 | -2.654 | -0.0127 | 5.500 | -37.15*** |
| | (0.0494) | (403.7) | (7.169) | (0.0374) | (135.3) | (10.36) |
| *maleP* × *sex_ratioK* | 0.224*** | 649.7 | 47.79*** | 0.0422 | 261.0 | 50.83** |
| | (0.0772) | (448.7) | (11.04) | (0.0747) | (309.2) | (24.52) |
| *hh-size* | -0.00751 | -26.42 | -3.820* | -0.00589 | -16.78 | -10.09*** |
| | (0.0136) | (74.95) | (2.000) | (0.00685) | (19.78) | (1.273) |
| *maleP*× *hh-size* | 0.00385 | 355.5** | 14.50*** | -0.000755 | 41.74 | 17.12*** |
| | (0.0136) | (145.8) | (2.750) | (0.00860) | (27.53) | (3.122) |
| *sex_ratioK*+ | 0.108*** | 347.4* | 45.13*** | 0.030 | 266.4 | 13.67 |
| *maleP* × *sex_ratioK* | (0.050) | (181.4) | (7.853) | (0.055) | (219.6) | (18.58) |
| Transfer from $O$ | No | No | No | No | No | No |
| $O$ taking care for $K$ | No | No | No | No | No | No |
| $P$ demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| $O$ demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 12,232 | 12,232 | 12,232 | 12,232 | 12,232 | 12,232 |
| R-squared | 0.084 | 0.049 | 0.670 | 0.214 | 0.186 | 0.140 |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. *maleP* is the gender of $P$. *sex_ratioK* is the gender ratio of $K$ in the household of $P$ and represents the mother demonstration effect. *sex_ratioK* + *maleP* × *sex_ratioK* shows the father demonstration effect. The three outcome variables are the dummy indicating whether parents provide any financial transfer to their elderly parents (*any-transfer*), the amount of any transfer provided (*amount*), and the number of days spent on visits paid to their elderly parents per year (*visit days*). The key controls are $P$'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from $O$, and $O$'s age, education, working status, retirement status, any deposit, *hukou* status, and household income, depending on the availability of the information in the CHARLS and the CHFS. The standard error is clustered at the prefectural city level for the CHARLS and the cluster-level is the province-level in the CHFS. The IVs are the gender of the first child born on or after 2003 and the prefectural compliance index for the CHARLS and the gender of the first child born on or after 2003 for the CHFS.

Table A.21: The direct downward transfer from generation $O$

| | IV: CHARLS (mostly rural) | | | IV: CHFS(mostly urban) | | |
|---|---|---|---|---|---|---|
| VARIABLES | *any-transfer* | *amount* | *visit days* | *any-transfer* | *amount* | *visit days* |
| *maleP* | -0.0962* | -283.6 | -29.82*** | -0.0518 | -237.7 | -3.363 |
| | (0.0505) | (320.7) | (11.18) | (0.0448) | (173.5) | (16.57) |
| *sex_ratioK* | -0.0503 | -291.0 | -4.282 | -0.0733** | -96.20 | -46.92*** |
| | (0.0434) | (403.1) | (7.485) | (0.0343) | (135.4) | (10.82) |
| *maleP* × *sex_ratioK* | 0.138** | 518.3 | 76.39*** | 0.0412 | 259.2 | 49.37** |
| | (0.0577) | (450.1) | (14.08) | (0.0645) | (291.9) | (24.53) |
| *hh-size* | -0.0115 | -34.99 | -3.152 | -0.00878 | -21.63 | -10.35*** |
| | (0.0135) | (73.16) | (2.005) | (0.00599) | (18.06) | (1.259) |
| *maleP*× *hh-size* | 0.00947 | 343.5** | 16.65*** | -0.00180 | 39.99 | 16.52*** |
| | (0.0133) | (147.5) | (2.907) | (0.00789) | (26.58) | (3.048) |
| *sex_ratioK*+ | 0.088*** | 227.3 | 72.11*** | -0.032 | 163.0 | 2.455 |
| *maleP* × *sex_ratioK* | (0.028) | (190.6) | (11.70) | (0.045) | (203.9) | (17.92) |
| transfer from $O$ to $P$ | -0.0491 | -401.3 | -3.679 | 0.357*** | 598.4*** | 62.91*** |
| | (0.0322) | (267.9) | (5.636) | (0.0151) | (49.66) | (4.418) |
| $O$ taking care for $K$ | 7.61e-06*** | 0.0627*** | 0.000929 | - | - | - |
| | (2.40e-06) | (0.0240) | (0.000614) | - | - | - |
| transfer from $O$ to $K$ | 0.173*** | 568.7*** | -0.273 | - | - | - |
| | (0.0178) | (214.0) | (2.715) | - | - | - |
| $P$ demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| $O$ demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 12,232 | 12,232 | 12,232 | 19,509 | 19,509 | 19,509 |
| R-squared | 0.201 | 0.050 | 0.610 | 0.280 | 0.203 | 0.159 |
| Mean | 0.401 | 831.2 | 118.7 | 0.303 | 489.1 | 91.66 |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. *maleP* is the gender of $P$. *sex_ratioK* is the gender ratio of $K$ in the household of $P$ and represents the mother demonstration effect. $sex\_ratioK + maleP \times sex\_ratioK$ shows the father demonstration effect. The three outcome variables are the dummy indicating whether parents provide any financial transfer to their elderly parents (*any-transfer*), the amount of any transfer provided (*amount*), and the number of days spent on visits paid to their elderly parents per year (*visit days*). The key controls are $P$'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from $O$, and $O$'s transfer to $P$, transfer to $P$'s $K$, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of $O$ taking care of $P$'s $K$, depending on the availability of the information in the CHARLS and the CHFS. The standard error is clustered at the prefectural city level for the CHARLS and the cluster-level is the province-level in the CHFS. The IVs are the gender of the first child born on or after 2003 and the prefectural compliance index for the CHARLS and the gender of the first child born on or after 2003 for the CHFS.

Table A.22: Subsample check: High and low gender-ratio provinces (after 2003 samples only)

| | IV: CHARLS (mostly rural) | | | IV: CHFS(mostly urban) | | |
|---|---|---|---|---|---|---|
| VARIABLES | *any-transfer* | *amount* | *visit days* | *any-transfer* | *amount* | *visit days* |
| ***Low gender-ratio provinces*** | | | | | | |
| *maleP* | 0.0418 | -30.36 | -10.22 | -0.00266 | -421.3* | 10.49 |
| | (0.0591) | (385.4) | (12.11) | (0.0458) | (231.0) | (17.75) |
| *sex_ratioK* | -0.00135 | -254.9 | 7.162 | -0.0331 | -228.8* | -4.708 |
| | (0.0392) | (220.0) | (6.782) | (0.0300) | (138.7) | (9.741) |
| $maleP \times sex\_ratioK$ | 0.0292 | 228.6 | 36.96*** | 0.0274 | 249.2 | -15.74 |
| | (0.0507) | (358.5) | (13.74) | (0.0477) | (182.5) | (13.99) |
| *sex_ratioK+* | 0.028 | -26.33 | 44.12*** | -0.006 | 20.40 | -20.45** |
| $maleP \times sex\_ratioK$ | (0.025) | (243.4) | (11.26) | (0.032) | (151.6) | (9.702) |
| Observations | 3,373 | 3,373 | 3,373 | 2,672 | 2,672 | 2,672 |
| R-squared | 0.199 | 0.090 | 0.690 | 0.185 | 0.230 | 0.145 |
| ***High gender-ratio provinces*** | | | | | | |
| *maleP* | 0.0959* | 109.4 | -15.82 | -0.0270 | -52.15 | 24.94 |
| | (0.0499) | (758.5) | (19.98) | (0.0453) | (256.2) | (30.53) |
| *sex_ratioK* | -0.0326 | -103.9 | -19.32** | 0.00924 | -114.6 | -16.13 |
| | (0.0423) | (674.4) | (8.086) | (0.0485) | (178.1) | (12.19) |
| $maleP \times sex\_ratioK$ | 0.00560 | 630.6 | 83.06*** | 0.0430 | 147.1 | 13.21 |
| | (0.0529) | (852.2) | (21.12) | (0.0484) | (280.7) | (35.44) |
| *sex_ratioK+* | -0.027 | 526.6* | 63.74*** | 0.052 | 32.46 | -2.917 |
| $maleP \times sex\_ratioK$ | (0.027) | (318.2) | (16.47) | (0.056) | (170.3) | (35.67) |
| Observations | 2,489 | 2,489 | 2,490 | 1,454 | 1,454 | 1,454 |
| R-squared | 0.265 | 0.065 | 0.717 | 0.255 | 0.316 | 0.199 |
| *P* demographics | Yes | Yes | Yes | Yes | Yes | Yes |
| *O* demographics | Yes | Yes | Yes | Yes | Yes | Yes |

*Notes*: Robust standard errors in parentheses. Stars indicate statistical significance. *** p<0.01, ** p<0.05, * p<0.1. *maleP* is the gender of *P*. *sex_ratioK* is the gender ratio of *K* in the household of *P* and represents the mother demonstration effect. $sex\_ratioK + maleP \times sex\_ratioK$ shows the father demonstration effect. The three outcome variables are the dummy indicating whether parents provide any financial transfer to their elderly parents (*any-transfer*), the amount of any transfer provided (*amount*), and the number of days spent on visits paid to their elderly parents per year (*visit days*). The key controls are *P*'s household-size, gender, age, income education, *hukou* status, whether live in urban areas, siblings, marital status, occupation, distance from *O*, and *O*'s transfer to *P*, age, education, working status, retirement status, any deposit, *hukou* status, household income and hours of *O* taking care of *P*'s *K*, depending on the availability of the information in the CHARLS and the CHFS. The standard error is clustered at the prefectural city level for the CHARLS and the cluster-level is the province-level in the CHFS. The IVs are the gender of the first child born on or after 2003 and the prefectural compliance index for the CHARLS and the gender of the first child born on or after 2003 for the CHFS. The sample only contains *P* who have their first child on or after 2003. This sample is split based on the province-level of gender-ratios.

# Appendix B

# Appendix of "The Role of Social Norms in Old-age Support: a Theoretical Approach"

## B.1 The baseline model with saving

In this section, I illustrate only the model with saving in the baseline model and do not include the intra-household bargaining assumption. The optimisation problem with saving is:

$$\max_{\tau_1^F, \tau_1^M, s_1} \quad U = u(c_1) + \delta u(e_1) + \beta u(c_2)$$
$$s.t.$$
$$c_1 + \frac{c_2}{1+r_2} \leq Y_1(2 - \tau_1^F - \tau_1^M) + \frac{Y_2}{1+r_2}(\tau_2^F \phi n + \tau_2^M (1-\phi) n);$$
$$e_1 = Y_1(\tau_1^F + \tau_1^M).$$

Again, the father and the mother in generation $P$ make unitary household-level decisions. $e_1$ is the old-age support provided by the whole household. $\delta$ is the discount factor for the utility generated from altruism. If the function $u(\cdot)$ is specified as a log or a CRRA function, and $\tau_2^F$ and $\tau_2^M$ are concave function of $\tau_1^F$ and $\tau_1^M$ for the fathers and mothers as stated in Equation (2.1), the FOCs regarding to $\tau_1^F$, $\tau_1^M$, and $s_1$ are:

$$\begin{aligned} U^1 =& \frac{\mathrm{d}U}{\mathrm{d}\tau_1^F} = 0; \\ U^2 =& \frac{\mathrm{d}U}{\mathrm{d}\tau_1^M} = 0; \\ U_4 =& \frac{\mathrm{d}U}{\mathrm{d}s_1} = -u'(c_1) + \beta u''(c_2)(1+r_2) = 0, \end{aligned} \tag{B.1}$$

where $c_1 = Y_1(2 - \tau_1^F - \tau_1^M) - s_1$ and $c_2 = Y_2(\tau_2^F \phi n + \tau_2^M (1-\phi) n) + (1+r_2) s_1$. The expressions for $U^{11}$, $U^{12}$, $U^{13}$, $U^{21}/U^{12}$, $U^{22}$, and $U^{23}$ similar to the SOCs listed in Equations (2.5), (2.6), and (2.7) the previous model without savings (Section 2.3). With savings, the signs of these SOCs will not change with savings included in the model. The expressions for $U^{14}/U^{14}$, $U^{24}/U^{42}$, $U^{44}$, and $U^{34}$ are:

$$\begin{aligned}
\frac{\mathrm{d}^2U}{\mathrm{d}s_1^2} &= u''(Y_1(2-\tau_1^F-\tau_1^M)-s_1)+\beta u''(c_2)(1+r_2)^2<0;\\
\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^F\mathrm{d}s_1} &= u''(Y_1(2-\tau_1^F-\tau_1^M)-s_1)(Y_1)+\beta u''(c_2)Y_2\tau_2^{F'}\phi n(1+r_2)<0;\\
\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^M\mathrm{d}s_1} &= u''(Y_1(2-\tau_1^F-\tau_1^M)-s_1)(Y_1)+\beta u''(c_2)Y_2\tau_2^{M'}(1-\phi)n(1+r_2)<0;\\
\frac{\mathrm{d}^2U}{\mathrm{d}s_1\mathrm{d}\phi} &= \beta u''(c_2)Y_2(n\tau_2^F-n\tau_2^M).
\end{aligned} \tag{B.2}$$

Again, I define

$$U^{11}=\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{F*2}};\quad U^{13}=\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{F*}\mathrm{d}\phi},\quad U^{22}=\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{M*2}};\quad U^{23}=\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{M*}\mathrm{d}\phi};\quad U^{12/21}=\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{F*}\mathrm{d}\tau_1^{M*}}$$

$$U^{44}=\frac{\mathrm{d}^2U}{\mathrm{d}s_1^{*2}};\quad U^{14}=U^{41}=\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{F*}\mathrm{d}s_1^*};\quad U^{24}=U^{42}=\frac{\mathrm{d}^2U}{\mathrm{d}\tau_1^{M*}\mathrm{d}s_1^*};\quad U^{34/43}=\frac{\mathrm{d}^2U}{\mathrm{d}s_1^*\mathrm{d}\phi}.$$

$\tau_1^{F*}$, $\tau_1^{M*}$, and $s^*$ are the optimal solution from the corresponding FOCs. The $U^{ij}$s are the SOCs listed above when $\tau_1^F$ and $\tau_1^M$ at their optimal values.[1] A summary for the signs of the SOCs is:

$$\begin{gathered}
U^{11}<0;\qquad U^{13}>0;\qquad U^{22}<0;\qquad U^{23}<0;\qquad U^{12}=U^{21}<0;\\
U^{44}<0;\quad U^{14}=U^{41}<0;\quad U^{24}=U^{42}=<0;\\
\text{and}\\
U^{34}=U^{43}>0\quad\text{if}\quad \tau_2^F-\tau_2^M<0;\quad U^{34}=U^{43}<0\quad\text{if}\quad \tau_2^F-\tau_2^M>0.
\end{gathered}$$

The total differentiation equations of the FOCs in Equation (B.1) with respect to $\tau_1^{F*}$, $\tau_1^{M*}$, and $s^*$ are:

$$\begin{aligned}
U^{11}\mathrm{d}\tau_1^{F*}+U^{12}\mathrm{d}\tau_1^{M*}+U^{13}\mathrm{d}\phi+U^{14}\mathrm{d}s_1^*&=0;\\
U^{21}\mathrm{d}\tau_1^{F*}+U^{22}\mathrm{d}\tau_1^{M*}+U^{23}\mathrm{d}\phi+U^{24}\mathrm{d}s_1^*&=0;\\
U^{41}\mathrm{d}\tau_1^{F*}+U^{42}\mathrm{d}\tau_1^{M*}+U^{34}\mathrm{d}\phi+U^{44}\mathrm{d}s_1^*&=0,
\end{aligned} \tag{B.3}$$

and from Equation (B.3), I get the expressions

[1] $i \in \{1,2,3,4\}$ and $j \in \{1,2,3,4\}$.

$$\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi} = \frac{bq - dp}{bc - ad};$$
$$\frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi} = \frac{aq - cp}{ad - bc}.$$

The signs for these two comparative statics depends on the sign of $U^{34}$. In the first scenario, when $\tau_2^{F*} - \tau_2^{M*} > 0$, which means that $U^{34} < 0$, I obtain:

$$\begin{aligned} a &= U^{11} - \frac{U^{14}U^{41}}{U^{44}} < 0; & b &= U^{12} - \frac{U^{24}U^{14}}{U^{44}} < 0; \\ c &= U^{21} - \frac{U^{14}U^{42}}{U^{44}} < 0; & d &= U^{22} - \frac{U^{24}U^{42}}{U^{44}} < 0; \\ p &= \frac{U^{14}U^{43}}{U^{44}} - U^{13} < 0; & q &= \frac{U^{24}U^{43}}{U^{44}} - U^{23}. \end{aligned} \tag{B.4}$$

From Equation B.4, I infer $b = c$ because $U^{12} = U^{21}$ and $U^{24} = U^{42}$. Given the SOCs, if $\tau_2^{F*'} \approx \tau_2^{M*'}$,

$$|d| > |b| \quad \text{and} \quad |a| > |c| \quad \Rightarrow \quad bc - ad < 0.$$

However the sign of the $q$ is undetermined. If $bq - dp < 0$ and $aq - cp < 0$, so

$$q > 0.$$

Then

$$\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi} > 0; \qquad \frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi} < 0.$$

Recall that from Equation (B.4), $q = \frac{U^{24}U^{43} - U^{23}U^{44}}{U^{44}}$. From the SOCs function for $U^{23}$, $U^{24}$, $U^{43}$, and $U^{44}$ from Equations (2.6) and (B.2), I conclude

$$\text{if} \quad Y_1(1 + r_2) - Y_2\tau_2^{M*'}(1 - \phi)n < 0 \quad \Rightarrow \quad q > 0.$$

If not, $q$ is also highly likely to be positive, especially when $c_2$ is large enough.

The second case is when $\tau_2^{F*} - \tau_2^{M*} < 0$, which means $U^{34} > 0$. The signs for $a$, $b$, $c$, and $d$ do not change, and in this scenario, $q$ is always larger than 0. However, I need to show $p < 0$. If $bq - dp < 0$ and $aq - cp < 0$, then $p < 0$. The following statement shows

$$\text{if} \quad Y_1(1 + r_2) - Y_2\tau_2^{F*'}\phi n < 0 \quad \Rightarrow \quad U^{14}U^{34} - U^{13}U^{44} > 0 \quad \Rightarrow \quad p < 0.$$

Then I get the same conclusion:

$$\frac{\mathrm{d}\tau_1^{F*}}{\mathrm{d}\phi} > 0; \qquad \frac{\mathrm{d}\tau_1^{M*}}{\mathrm{d}\phi} < 0.$$

This is consistent with the previous comparative statics in the baseline model in Section 2.3 under the assumption ${\tau_2^{F*}}' \approx {\tau_2^{M*}}'$.

# Appendix C

# Appendix of "Locked out? China's New Cooperative Medical Scheme and Rural Labour Migration"

## C.1 NCMS coverage and the compensating differential model

Todaros (1969) and Harris and Todaros (1971) migration models focus on market equilibria in rural and urban labour markets. Most general equilibrium models place more emphasis on the importance of the unemployment rate in the urban labour market. However, my analysis focuses on partial equilibrium: whether these rural migrants want to come back to, or stay in, their hometown because of the NCMS, given the fact that they can find a job in urban areas. The migrants are usually guaranteed at least one job option in rural areas, which is farming. Gruber (2000) uses a model of compensating differential based on Rosen (1986) when analysing health insurance coverage and job mobility. A modified form of the Gruber model is applied to the rural-to-urban migration context.

Focusing on individuals in rural areas, an individual $i$ has preferences over the net income in urban areas $M_{iu}$, or in rural areas $M_{ir}$, and the consumption-related job indicator, $D_i$. So the utility function for a rural-to-urban migrant in urban areas is

$$U_{iu} = U(M_{iu}, D_i),$$

and in rural areas is

$$U_{ir} = U(M_{ir}, D_i);$$

$M_{ir}$ and $M_{iu}$ can take positive or negative values. $D_i$ is a binary indicator for the individual's job type, $D_i = 1$ (jobs in urban areas), and $D_i = 0$ (jobs in rural areas). The utility function is quasi-concave in $M_i$.

The net income earned in urban or rural areas equals wages for the job in urban or rural areas respectively, $W_{iu}$ or $W_{ir}$, minus health care expenditure, $C_i$:

$$M_{iu} = W_{iu} - C_{iu},$$

and

$$M_{ir} = W_{ir} - C_{ir}.$$

For simplicity, we assume for now that health care expenses are the same in both urban and rural areas. So $C_i = C_{iu} = C_{ir}$. This assumption will be changed after introducing the NCMS into the model.

Wages in urban areas are usually higher than rural wages. The compensating variation ($Z$) is the difference between $M_{iu}$ and $M_{ir}$ when the individual is indifferent between working in rural or urban areas, $U(M^*_{iu}, 1) = U(M^*_{ir}, 0)$, and

$$Z = M^*_{iu} - M^*_{ir}.$$

The wage difference for an individual, $\triangle W_i$, in urban and rural areas is $W_{iu} - W_{ir}$ assuming identical urban and rural health care expenses, then

$$\triangle M_i = M_{iu} - M_{ir} = \triangle W_i,$$

where $\triangle M_i$ is the urban-rural income difference for individual $i$. The choice to work in urban areas can be summarised as

$$D_i = 0 \quad \text{if} \quad Z > \triangle M_i; \qquad D_i = 1 \quad \text{if} \quad Z \leq \triangle M.$$

I use $F(Z)$ for the cumulative distribution function of $Z$ and $f(Z)$ for the associated probability density function. Aggregating from the individual level to the county level, the fraction of the rural population who work in urban areas is

$$N_{D=1} = \int_0^{\triangle M} f(z)dz = F(\triangle M) = P(Z \leq \triangle M), \tag{C.1}$$

and the fraction of the rural population who remain in rural areas is

$$N_{D=0} = \int_{\triangle M}^{\infty} f(z)dz = 1 - F(\triangle M) = 1 - P(Z \leq \triangle M), \tag{C.2}$$

assuming that demand in both urban and rural labour markets is exogenous. The demand for rural migrant workers in urban areas, especially during the period of NCMS implementation, grew fast (Shi, 2008). It is reasonable to assume that the labour markets in cities were large enough that the changes in numbers of migrants in each county did not affect the urban labour market. From Equation (C.1), if $\triangle W$ decreases, the fraction of the rural population who work in urban areas decreases.

If a rural migrant joins the NCMS, he/she can get reimbursements, $B_i$, from health care expenses generated when visiting hospitals or clinics in his/her own county. The rural-urban income difference for this migrant after joining the NCMS becomes:

$$\triangle M_i^{'} = \triangle W_i + B_i = M_{iu} - M_{ir} + B_i.$$

As the income difference decreases, the NCMS implementation should lead to a decrease in the fraction of rural residents who work in urban areas according to Equation (C.1).

At the beginning of this section, I assumed $C_i = C_{iu} = C_{ir}$. However, in reality, urban health care expenses are usually higher than rural expenses (Chen et al., 2014). This further reduces the income difference:

$$\triangle M_i^{''} = W_{iu} - C_{iu} - W_{ir} + C_{ir} + B_i < \triangle M_i^{'},$$

where $C_{iu} > C_{ir}$. It decreases the fraction of rural-urban migrants in the total rural population compared to the case where health care expenses are the same in both rural and urban areas. The simple model here shows how health insurance affects migration behaviours through changes in income differences.

## C.2 Data imputation

**Missing data for a specific year** During the long time span of the data collected from provincial yearbooks or provincial rural yearbooks, there are missing entries for the key variables for different years and different provinces. I needed to impute the missing entries based on the information available. For example, if, for the year 2000, the total number of migrants in rural areas was missing, but I had data for this variable and the total labour force and other sectors' labour force for 1999 and 2001, I would use the 1999 to 2001 data's growth rate of the total labour force and other sectors' labour force to calculate 2000's data. These imputed missing years are the year 2007 for Hubei, the year 2011 for Ningxia and the years 2005, 2007, 2011 for Shanxi.

**Missing data on the exact number of migrants** If, in the yearbooks, there was no data for the total number of migrants in rural areas, but they provided all other sectors' labour force data, I approximated the total number of migrants in rural areas using the total number of labour force in rural areas minus the total number of all other labour forces. The imputed province is Jiangsu. Other provinces all have the rural-to-urban migrant data from provincial yearbooks or provincial rural yearbooks.

## C.3 Placebo test

Guangdong province has had an early version of the NCMS since 1999 (Zheng, 2011). The early version in Guangdong operated in a similar way to the NCMS before 2003. In 2003 and 2004, the province redistributed documents in its counties about the implementation of the NCMS, and the NCMS replaced its early version in 2003 and 2004. Compared to other provinces, Guangdong was a highly-treated group around 2003. The NCMS implementation should not have effects on the county level migration propensity trend showing up just right after 2003, nor on its growth rate. Although Guangdong province is one of the provinces that receive a lot of migrants from other provinces and has a lot of intra-province migrants, the inter-province migrants also account for around 40% of the total migrants in Guangdong. After factoring out the suburban or urban areas in Guangdong, other under-developed rural areas in counties should behave similarly to other counties in other provinces in terms of rural-to-urban migrants if they experienced the same NCMS implementation timeline.

The same regression equations (3.2) and (3.4) for $prop(migrants)_{i,t}$ and $growthrate_{i,t}$ are applied to the Guangdong data. The date of NCMS implementation is the time that the NCMS replaced its early version. All variables have the same definitions as before. The results are in Table C.2. The regression results for $prop(migrants)_{i,t}$ and $growthrate_{i,t}$ show that there is no negative and significant effect of NCMS on migration trends on or after 2003. For $growthrate_{i,t}$, the effects for the third and fourth year after the NCMS implementation are even positive.

The increasing trends in rural-to-urban migration might be due to the fact that Guangdong province allows rural-to-urban migrants and rural residents to visit hospitals in Guangzhou and get their reimbursements in their hometown.[1] Therefore, many inter-county but intra-province migrants in Guangdong province are no longer "locked" by the NCMS. Hence, intra-province rural-to-urban migration in Guangdong might be positively affected after the implementation of the NCMS. Also, Guangdong is one of the provinces that receive a large number of rural-to-urban migrants. The provincial government has more incentives to implement policies that are beneficial for migrants to maintain social stability in urban areas in Guangdong.

## C.4 Robustness Checks

### C.4.1 Different lengths of leads and lags

The regression results in Table 3.3 can be valid only for four years before and after the first implementation of the NCMS. In this section, I tried different numbers of years before and after the NCMS first implementation. The results for three, five, and seven years before and after the implementation are shown in Table C.3 and C.4. I also

[1] Website: http://www.gd.gov.cn/gdgk/gdyw/200711/t20071128_35482.htm (In Chinese)

present the results with four lags only and four leads only in Table C.5. The results are consistent with the main regression with four leads and lags: NCMS implementations have lagged negative effects on the growth rate of migration in a county. These results show that the main results are robust in terms of the number of years before and after the implementation used.

### C.4.2 Comparison between the early-treated group and the late-treated groups

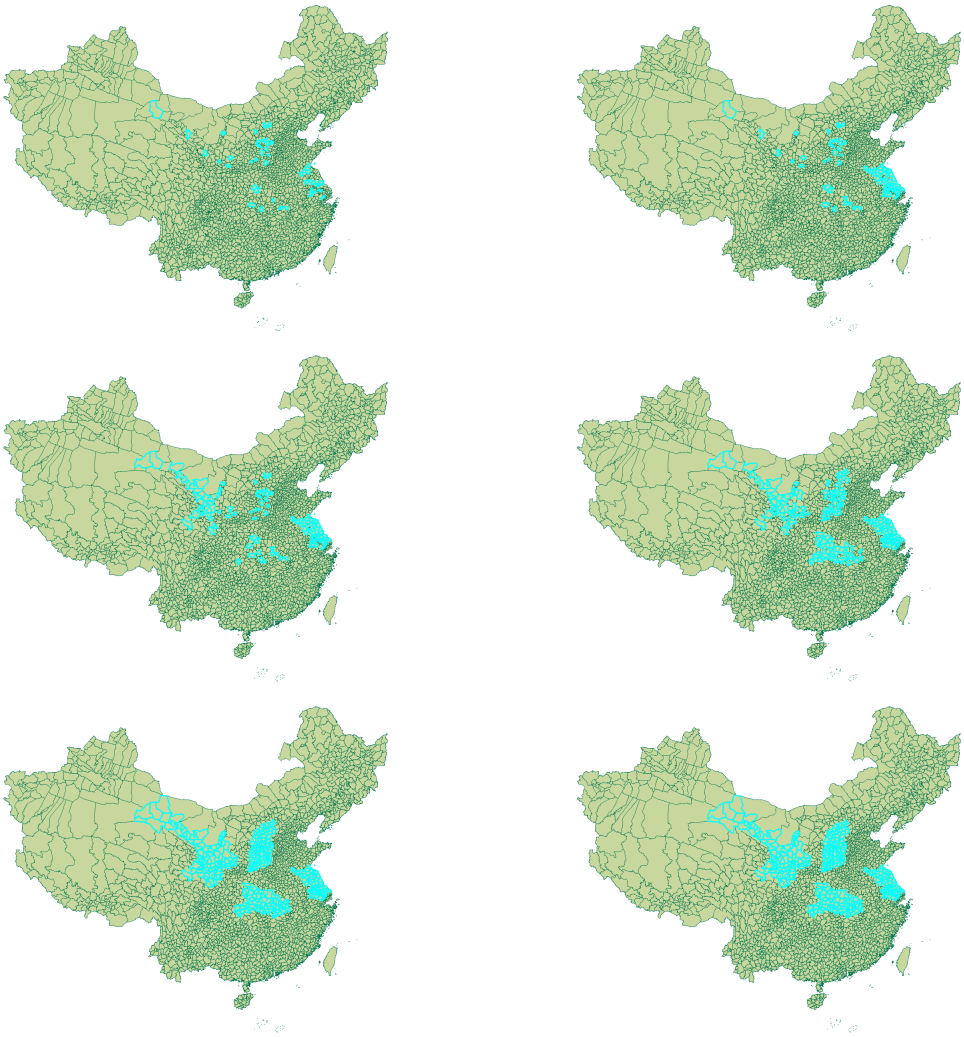
To further check whether all of the negative effects of the NCMS were fully driven by the early-treated group, I run the same regressions separately on the early-treated group and the late-treated group and compared the results. Table C.6 shows the results for these two groups. The main dependent variable is the migration propensity and its growth rate at the county level.

The results surprisingly show that the late-treated group contributes more to the significant negative effects in the whole sample. This implies that the NCMS has more effects on the late-treated group after controlling for year trends, county fixed effects, and their interactions. However, this might lead to another possibility, which is that the financial crisis in 2008 caused the decrease in rural-to-urban migrations rather than the implementation of the NCMS. After controlling for the year and the year times province fixed effects, the concern might be less worrying in the context. Also, the financial crisis had effects on both the early-treated and late-treated groups, yet the results do not reflect this for the 4th-year lag after the NCMS implementation for the early-treated group. I also ran regressions with 7 years before and after the NCMS implementation for both groups, which show the negative effects of the NCMS still show up after the fifth and seventh year of the initial NCMS implementation.

### C.4.3 Possible determiners of the NCMS implementation date

The results for the regression analysing the correlations between county GDP per capita, the migration propensity, rural income per capita, total rural labour force, and the NCMS implementation dates are presented in Table C.7. The results show that none of the controls or the migration propensity is significantly correlated with whether counties are selected as early "pilot" counties. The results might help to relieve worries about the selection of the "pilot counties" depending on the outcome and the controls.

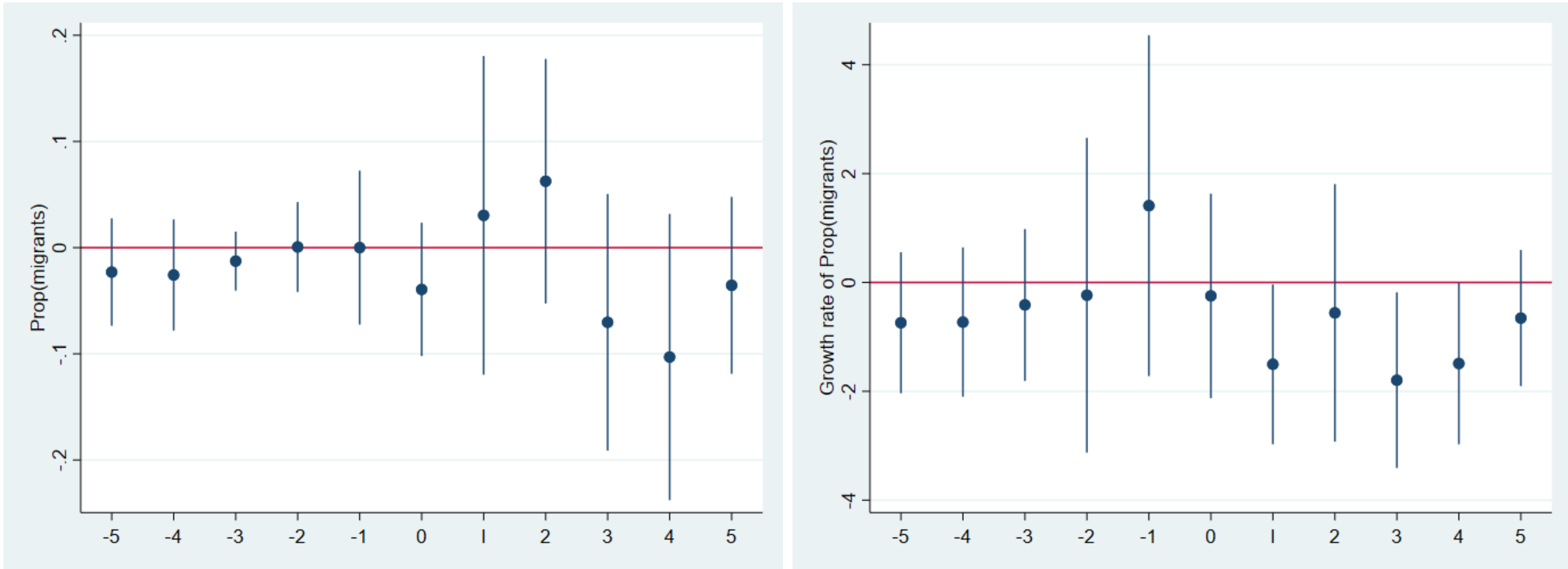
Figure C.1: NCMS coverage from 2003 to 2008



Note: The distribution of counties for different implementation years. Only five provinces are shown in this figure and it indicates the gradual expansion of NCMS in the five provinces from 2003 to 2008.

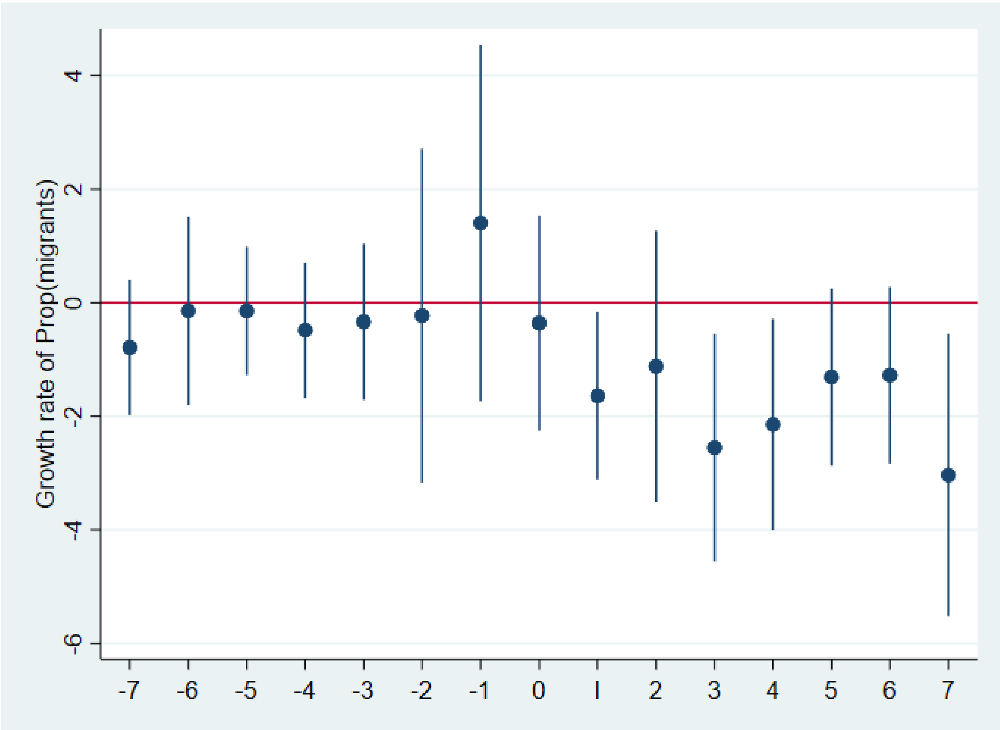
## C.5 Figures and Tables

Figure C.2: Coefficients plot for the effects of $FirstNCMS$ on $prop(migrants)_{i,t}$ and $growthrate_{i,t}$: Five leads and lags




Note: The graph is a coefficient plot for the third and fourth column of Table C.3. The confidence intervals are 95% confidence interval. $y$-axis is the effect of the NCMS implementation on the migration propensity (left graph) and its growth rate (right). $x$-axis indicates the event time $t$. $t = 0$ means the year that a county first starts to implement the NCMS.

Figure C.3: Coefficients plot for the effects of $FirstNCMS$ on $growthrate_{i,t}$: Seven leads and lags




Note: The graph is a coefficient plot for $growthrate_{i,t}$ coefficients in Table C.4. The confidence intervals are 95% confidence interval. $y$-axis is the effect of the NCMS implementation on the growth rate of the the migration propensity. $x$-axis indicates the event time $t$. $t = 0$ means the year that a county first starts to implement the NCMS.

Figure C.4: Map of survey regions in the CHARLS


Note: The map is taken from the CHNS website. It shows the geographical coverage of CHNS. Website: https://www.cpc.unc.edu/projects/china.

Table C.1: The event study results with different s.e. clusters

| cluster | robust s.e. | | prefecture-level | | province-level | |
|---|---|---|---|---|---|---|
| VARIABLES | $prop(migrants)_{i,t}$ | $growthrate_{i,t}$ | $prop(migrants)_{i,t}$ | $growthrate_{i,t}$ | $prop(migrants)_{i,t}$ | $growthrate_{i,t}$ |
| *Event time* | | | | | | |
| -4 | -0.0152 | -0.383 | -0.0152 | -0.383 | -0.0152 | -0.383** |
| | (0.0271) | (0.541) | (0.0141) | (0.447) | (0.0144) | (0.0744) |
| -3 | -0.00752 | -0.247 | -0.00752 | -0.247 | -0.00752 | -0.247 |
| | (0.0252) | (0.632) | (0.00717) | (0.561) | (0.0113) | (0.117) |
| -2 | 0.00465 | -0.102 | 0.00465 | -0.102 | 0.00465 | -0.102 |
| | (0.0255) | (1.278) | (0.0105) | (1.514) | (0.00585) | (0.551) |
| -1 | 0.00203 | 1.461 | 0.00203 | 1.461 | 0.00203 | 1.461 |
| | (0.0328) | (1.428) | (0.0353) | (1.531) | (0.00291) | (0.543) |
| 0 | -0.0358 | -0.164 | -0.0358 | -0.164 | -0.0358 | -0.164 |
| | (0.0317) | (0.857) | (0.0521) | (0.729) | (0.0520) | (0.200) |
| 1 | 0.0343 | -1.426* | 0.0343 | -1.426 | 0.0343 | -1.426 |
| | (0.0724) | (0.758) | (0.0415) | (0.898) | (0.0281) | (1.681) |
| 2 | 0.0701 | -0.413 | 0.0701 | -0.413 | 0.0701 | -0.413 |
| | (0.0524) | (1.084) | (0.0865) | (0.622) | (0.0760) | (0.430) |
| 3 | -0.0627 | -1.653** | -0.0627 | -1.653 | -0.0627 | -1.653 |
| | (0.0551) | (0.781) | (0.0404) | (1.158) | (0.0652) | (1.445) |
| 4 | -0.0914* | -1.272** | -0.0914 | -1.272* | -0.0914 | -1.272 |
| | (0.0547) | (0.632) | (0.0864) | (0.688) | (0.104) | (1.212) |
| year × province FE | Yes | Yes | Yes | Yes | Yes | Yes |
| year trend | Yes | Yes | Yes | Yes | Yes | Yes |
| county FE × year trend | Yes | Yes | Yes | Yes | Yes | Yes |
| controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 1,813 | 1,812 | 1,813 | 1,812 | 1,813 | 1,812 |
| R-squared | 0.237 | 0.158 | 0.237 | 0.158 | 0.237 | 0.158 |
| Number of county | 178 | 178 | 178 | 178 | 178 | 178 |

Note: Robust standard errors in parentheses.* significant at 10%; ** significant at 5%; *** significant at 1%. The stand errors are clustered at robust, clustered at prefecture city-level, and clustered at province-level perspectively. $prop(migrants)_{i,t}$ is the migration propensity for each county $i$ at time $t$ and $growthrate_{i,t}$ is the corresponding growth rate. Key regressor *Event time* equals 0 indicates the first year a county starting to implement NCMS. The control variables include GDP per capita, disposable income per capita for rural residents, irrigated farmland per capita, and total rural labour force for each county at each year.

Table C.2: The placebo tests for the effects of the NCMS

| | Guangdong province only | | simulated early NCMS implementation | |
|---|---|---|---|---|
| VARIABLES | $prop(migrants)_{i,t}$ | $growthrate_{i,t}$ | $prop(migrants)_{i,t}$ | $growthrate_{i,t}$ |
| *Event time* | | | | |
| -4 | 1.821 | 1.379 | 0.0230 | -0.295 |
| | (3.144) | (4.658) | (0.0478) | (0.819) |
| -3 | 2.925 | 5.604 | -0.0158 | -0.795 |
| | (4.671) | (6.617) | (0.0358) | (0.817) |
| -2 | 3.730 | 8.063 | -0.0276 | -0.600 |
| | (5.826) | (8.336) | (0.0219) | (0.594) |
| -1 | 4.482 | 10.06 | -0.00914 | -0.302 |
| | (6.864) | (10.02) | (0.0139) | (0.678) |
| 0 | 5.520 | 12.36 | 0.00673 | -0.107 |
| | (8.111) | (12.18) | (0.0230) | (1.450) |
| 1 | 6.704 | 9.943 | 0.0111 | 1.638 |
| | (9.943) | (15.27) | (0.0362) | (1.590) |
| 2 | 9.104 | 11.06 | -0.0189 | 0.185 |
| | (12.19) | (17.72) | (0.0269) | (0.937) |
| 3 | 27.35 | 46.98** | 0.0473 | -1.171* |
| | (17.40) | (22.47) | (0.0766) | (0.701) |
| 4 | 13.40*** | 21.93** | 0.0945 | 0.159 |
| | (5.060) | (9.103) | (0.0593) | (1.162) |
| county FE × year trend | Yes | Yes | Yes | Yes |
| year × province FE | - | - | Yes | Yes |
| year trend | Yes | Yes | Yes | Yes |
| controls | Yes | Yes | Yes | Yes |
| Observations | 475 | 474 | 1,813 | 1,812 |
| R-squared | 0.269 | 0.180 | 0.234 | 0.157 |
| Number of counties | 47 | 48 | 178 | 178 |

Note: Robust standard errors in parentheses.* significant at 10%; ** significant at 5%; *** significant at 1%. The stand errors are clustered at county-level. $prop(migrants)_{i,t}$ is the migration propensity for each county $i$ at time $t$ and $growthrate_{i,t}$ is the corresponding growth rate. Key regressor *Event time* equals 0 indicates the first year a county starting to implement NCMS. The control variables include GDP per capita, disposable income per capita for rural residents, irrigated farmland per capita, and total rural labour force for each county at each year. The first and the second column table is only run on counties in Guangdong. The third and fourth column are the results for the placebo test for hypothetical early NCMS implementation.

Table C.3: The effects of $FirstNCMS$ on $prop(migrants)_{i,t}$ and $growthrate_{i,t}$: with different lengths of leads and lags

| VARIABLES | $prop(migrants)_{i,t}$ | $growthrate_{i,t}$ | $prop(migrants)_{i,t}$ | $growthrate_{i,t}$ |
|---|---|---|---|---|
| *Event time* | | | | |
| -5 | - | - | -0.0230 | -0.740 |
| | - | - | (0.0256) | (0.656) |
| -4 | - | - | -0.0257 | -0.730 |
| | - | - | (0.0266) | (0.695) |
| -3 | -6.57e-05 | -0.0853 | -0.0126 | -0.413 |
| | (0.00739) | (0.460) | (0.0141) | (0.707) |
| -2 | 0.0103 | -0.00235 | 0.000620 | -0.234 |
| | (0.0189) | (1.318) | (0.0214) | (1.465) |
| -1 | 0.0101 | 1.582 | 3.06e-05 | 1.410 |
| | (0.0349) | (1.556) | (0.0367) | (1.587) |
| 0 | -0.0214 | 0.0492 | -0.0394 | -0.247 |
| | (0.0288) | (0.886) | (0.0318) | (0.952) |
| 1 | 0.0453 | -1.266* | 0.0304 | -1.504** |
| | (0.0775) | (0.722) | (0.0760) | (0.744) |
| 2 | 0.0860 | -0.188 | 0.0626 | -0.560 |
| | (0.0529) | (1.091) | (0.0583) | (1.199) |
| 3 | -0.0299 | -1.192* | -0.0703 | -1.797** |
| | (0.0514) | (0.693) | (0.0612) | (0.818) |
| 4 | - | - | -0.103 | -1.489** |
| | - | - | (0.0683) | (0.752) |
| 5 | - | - | -0.0355 | -0.656 |
| | - | - | (0.0422) | (0.633) |
| year × province FE | Yes | Yes | Yes | Yes |
| year trend | Yes | Yes | Yes | Yes |
| county FE × year trend | Yes | Yes | Yes | Yes |
| controls | Yes | Yes | Yes | Yes |
| Observations | 1,813 | 1,812 | 1,813 | 1,812 |
| R-squared | 0.234 | 0.157 | 0.237 | 0.159 |
| Number of county | 178 | 178 | 178 | 178 |

Note: Robust standard errors in parentheses.* significant at 10%; ** significant at 5%; *** significant at 1%. The stand errors are clustered at county-level. $prop(migrants)_{i,t}$ is the migration propensity for each county $i$ at time $t$ and $growthrate_{i,t}$ is the corresponding growth rate. Key regressor *Event time* equals 0 indicates the first year a county starting to implement NCMS. The control variables include GDP per capita, disposable income per capita for rural residents, irrigated farmland per capita, and total rural labour force for each county at each year.

Table C.4: The effects of $FirstNCMS$ on $prop(migrants)_{i,t}$ and $growthrate_{i,t}$: Seven leads and lags

| VARIABLES | $prop(migrants)_{i,t}$ | $growthrate_{i,t}$ | | $prop(migrants)_{i,t}$ | $growthrate_{i,t}$ |
|---|---|---|---|---|---|
| *Event time* | | | *Event time* | | |
| -7 | 0.022 | -0.789 | 1 | 0.0222 | -1.640** |
| | (0.0357) | (0.572) | | (0.0771) | (0.746) |
| -6 | 0.0319 | -0.145 | 2 | 0.0297 | -1.122 |
| | (0.0502) | (0.841) | | (0.0634) | (1.210) |
| -5 | -0.0147 | -0.146 | 3 | -0.114 | -2.553*** |
| | (0.0328) | (0.572) | | (0.0812) | (1.012) |
| -4 | -0.0207 | -0.485 | 4 | -0.141* | -2.146** |
| | (0.0243) | (0.604) | | (0.0849) | (0.941) |
| -3 | -0.00970 | -0.337 | 5 | -0.0746 | -1.309* |
| | (0.0140) | (0.694) | | (0.0591) | (0.790) |
| -2 | 0.00464 | -0.228 | 6 | -0.0779 | -1.277 |
| | (0.0226) | (1.490) | | (0.0589) | (0.788) |
| -1 | 9.74e-05 | 1.402 | 7 | -0.173* | -3.035** |
| | (0.0368) | (1.589) | | (0.0901) | (1.259) |
| 0 | -0.0462 | -0.360 | | | |
| | (0.0330) | (0.961) | | | |
| year × province FE | Yes | Yes | | Yes | Yes |
| year trend | Yes | Yes | | Yes | Yes |
| county FE × year trend | Yes | Yes | | Yes | Yes |
| controls | Yes | Yes | | Yes | Yes |
| constant | 0.499 | 4.528 | | 0.499 | 4.528 |
| R-squared | 0.241 | 0.161 | | 0.241 | 0.161 |
| Observations | 1,813 | 1,812 | | 1,813 | 1,812 |
| Number of counties | 178 | 178 | | 178 | 178 |

Note: Robust standard errors in parentheses.* significant at 10%; ** significant at 5%; *** significant at 1%. The stand errors are clustered at county-level. $prop(migrants)_{i,t}$ is the migration propensity for each county $i$ at time $t$ and $growthrate_{i,t}$ is the corresponding growth rate. Key regressor *Event time* equals 0 indicates the first year a county starting to implement NCMS. The control variables include GDP per capita, disposable income per capita for rural residents, irrigated farmland per capita, and total rural labour force for each county at each year.

Table C.5: The effects of $FirstNCMS$ on $prop(migrants)_{i,t}$ and $growthrate_{i,t}$: Four leads only and four lags only

| | 4 years before | | | 4 years after | |
|---|---|---|---|---|---|
| VARIABLES | $prop(migrants)_{i,t}$ | $growthrate_{i,t}$ | | $prop(migrants)_{i,t}$ | $growthrate_{i,t}$ |
| *Event time* | | | *Event time* | | |
| -4 | -0.0180 | -0.257 | 0 | -0.0350 | -0.300 |
| | (0.0167) | (0.388) | | (0.0303) | (0.723) |
| -3 | -0.0104 | -0.105 | 1 | 0.0343 | -1.552* |
| | (0.0119) | (0.556) | | (0.0773) | (0.836) |
| -2 | -0.00215 | 0.0679 | 2 | 0.0698 | -0.506 |
| | (0.0199) | (1.316) | | (0.0531) | (1.070) |
| -1 | 0.00255 | 1.761 | 3 | -0.0629 | -1.778** |
| | (0.0386) | (1.612) | | (0.0581) | (0.801) |
| 0 | -0.0310 | 0.382 | 4 | -0.0916 | -1.378** |
| | (0.0311) | (0.985) | | (0.0570) | (0.569) |
| year × province FE | Yes | Yes | | Yes | Yes |
| year trend | Yes | Yes | | Yes | Yes |
| county FE × year trend | Yes | Yes | | Yes | Yes |
| controls | Yes | Yes | | Yes | Yes |
| R-squared | 0.230 | 0.155 | | 0.237 | 0.157 |
| Observations | 1,813 | 1,812 | | 1,813 | 1,812 |
| Number of counties | 178 | 178 | | 178 | 178 |

Note: Robust standard errors in parentheses.* significant at 10%; ** significant at 5%; *** significant at 1%. The stand errors are clustered at county-level. $prop(migrants)_{i,t}$ is the migration propensity for each county $i$ at time $t$ and $growthrate_{i,t}$ is the corresponding growth rate. Key regressor *Event time* equals 0 indicates the first year a county starting to implement NCMS. The control variables include GDP per capita, disposable income per capita for rural residents, irrigated farmland per capita, and total rural labour force for each county at each year.

Table C.6: The effects of the NCMS on the early-treated and late-treated group

| | early-treated | | late-treated | |
|---|---|---|---|---|
| VARIABLES | $prop(migrant)_{i,t}$ | $growthrate_{i,t}$ | $prop(migrant)_{i,t}$ | $growthrate_{i,t}$ |
| *Event time* | | | | |
| -4 | -0.00187 | -0.303 | -0.00318 | -0.0750 |
| | (0.00667) | (0.234) | (0.0294) | (1.500) |
| 3 | -0.00253 | -0.235 | -0.0110 | -0.136 |
| | (0.00740) | (0.152) | (0.0466) | (2.541) |
| 2 | -0.00444 | -0.137 | -0.0213 | -1.028 |
| | (0.00694) | (0.0843) | (0.0618) | (3.982) |
| 1 | 0.0722* | 0.360 | -0.0367 | 1.967 |
| | (0.0420) | (0.365) | (0.0589) | (2.688) |
| 0 | 0.00426 | -0.0376 | -0.0789 | -0.374 |
| | (0.0125) | (0.0848) | (0.0533) | (1.480) |
| 1 | 0.0151 | -0.177 | 0.0516 | -1.850* |
| | (0.0200) | (0.274) | (0.125) | (0.951) |
| 2 | 0.00829 | -0.0411 | 0.137* | 0.0446 |
| | (0.00737) | (0.0817) | (0.0809) | (1.219) |
| 3 | 0.00988 | -0.0379 | -0.0687 | -2.894* |
| | (0.00789) | (0.0846) | (0.121) | (1.664) |
| 4 | 0.00884 | -0.0416 | -0.0563 | -1.707** |
| | (0.00744) | (0.116) | (0.0688) | (0.854) |
| year × province FE | Yes | Yes | Yes | Yes |
| year trend | Yes | Yes | Yes | Yes |
| county FE × year trend | Yes | Yes | Yes | Yes |
| controls | Yes | Yes | Yes | Yes |
| Observations | 848 | 848 | 965 | 964 |
| R-squared | 0.289 | 0.272 | 0.244 | 0.161 |
| Number of county | 69 | 69 | 109 | 109 |

Note: Robust standard errors in parentheses.* significant at 10%; ** significant at 5%; *** significant at 1%. The stand errors are clustered at county-level. $prop(migrants)_{i,t}$ is the migration propensity for each county $i$ at time $t$ and $growthrate_{i,t}$ is the corresponding growth rate. Key regressor *Event time* equals 0 indicates the first year a county starting to implement NCMS. The control variables include GDP per capita, disposable income per capita for rural residents, irrigated farmland per capita, and total rural labour force for each county at each year. The early-treated group includes counties that implemented the NCMS in 2003, 2004 and 2005, and the late-treated group includes those counties with the implementation after 2005.

Table C.7: The correlations between NCMS implementation and possible determiners

| VARIABLES | prop(migrants) | GDP per capita | $ln$(rural income) | rural labour |
|---|---|---|---|---|
| *early-treated* | 2.555 | -0.400 | 3.571 | 204,148 |
| | (28.88) | (0.0.427) | (3.950) | (655,553) |
| year × province FE | Yes | Yes | Yes | Yes |
| year trend | Yes | Yes | Yes | Yes |
| county FE × year trend | Yes | Yes | Yes | Yes |
| controls | Yes | Yes | Yes | Yes |
| Observations | 1,813 | 1,813 | 1,813 | 1,813 |
| Number of counties | 178 | 178 | 178 | 178 |
| R-squared | 0.229 | 0.761 | 0.869 | 0.893 |

Note: Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. The stand errors are clustered at county-level. *earlycounty* indicates if a county is in the early-treated group. The early-treated group includes counties that had NCMS implementation in 2003, 2004 and 2005 and the late-treated group includes those counties with the implementation after 2005. The four outcome variables are the migration propensity, GDP per capita, *log* of the rural income per capita, and the total number of the rural labour force.

Table C.8: Number of counties implimented the NCMS in the CHNS dataset overtime

| | CHNS wave | | | |
|---|---|---|---|---|
| | 2000 | 2004 | 2006 | 2009 |
| Number of pilot counties | 0 | 7 | 24 | 36 |
| New pilot counties | 0 | 7 | 17 | 12 |
| Total number of counties | 36 | 36 | 36 | 36 |

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