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RURAL SOCIOLOGY

Intergenerational financial transfers and physical health of old people in rural China: evidence from CHARLS data

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ABSTRACT: *With the reduction of intergenerational temporal transfers, financial transfers from adult offspring to their elderly parents are prevailing in rural China. Although much has been done, little is known about the association between the expansion of intergenerational transfers and rural old people's physical health in China. The purpose of this paper was to examine the effect of intergenerational financial transfers on the elders' physical health in rural China. Using data collected from China Health and Retirement Longitudinal Study (CHARLS), panel data fixed effect model and threshold model are employed to estimate the impact of intergenerational financial transfers on the old people's physical health in rural areas. Results showed that; although, the intergenerational financial transfers have a positive effect on the old people's physical health, no linear relationship exists between them. Intergenerational financial transfers are clearly less effective for low-income old people's physical health than those of middle-income, while the effect on high-income old people's health is the most insignificant. Studies concerning the effect of intergenerational financial transfers on the elders' health in developing countries remain limited. Findings of this paper provided great insights into how intergenerational transfers, such as intergenerational financial transfers, may affect the well-beings of old residents in rural areas. Additionally, this study can offer inspiration to policy makers regarding what measures they should take to enhance rural old residents' well-beings.*
Key words: *intergenerational financial transfers, old people, ADL, income, rural China.*

Transferências financeiras intergeracionais e saúde física de idosos na China rural: evidências de dados CHARLS

RESUMO: *Com a redução de transferências temporais intergeracionais, as transferências financeiras da prole adulta a seus pais idosos estão prevalecendo em China rural. Embora muito tenha sido feito, pouco se sabe sobre a associação entre a expansão das transferências intergeracionais e a saúde física dos idosos rurais na China. O objetivo deste artigo é examinar o efeito das transferências financeiras intergeracionais sobre a saúde física dos anciãos na China rural. Usando dados coletados do estudo longitudinal de saúde e aposentadoria da China (CHARLS), o modelo de efeito fixo de dados do painel e o modelo de limiar são empregados para estimar o impacto das transferências financeiras intergeracionais na saúde física dos idosos em áreas rurais. Os resultados mostram que, embora as transferências financeiras intergeracionais tenham um efeito positivo na saúde física dos idosos, não existe relação linear entre eles. As transferências financeiras intergeracionais são claramente menos eficazes para a saúde física de idosos de baixa renda do que as de renda média, enquanto o efeito sobre a saúde de idosos de alta renda é o mais insignificante. Os estudos sobre o efeito das transferências financeiras intergeracionais sobre a saúde dos anciãos nos países em desenvolvimento permanecem limitados. Os achados deste artigo fornecem grandes insights sobre como as transferências intergeracionais, e as transferências financeiras intergeracionais podem afetar o bem-estar de idosos residentes em áreas rurais. Além disso, este estudo pode oferecer inspiração para os decisores políticos sobre as medidas que devem tomar para melhorar o bem-estar dos residentes rurais.*
Palavras-chave: *transferências financeiras intergeracionais, pessoas idosas, ADL, renda, China rural.*

INTRODUCTION

Rapid economic development and its accompanying social reforms in China have already aroused substantial scholarly interest in the well-beings of the elders (LOGAN & BIAN, 2003; SUN, 2002). Although, many researchers have extensively studied this topic, most of them focus solely on the urban area and its formal pension system. Little attention has been paid to living conditions of the elders and the informal family mutual insurance system in rural areas, where nearly one half of the Chinese residents, and a largest amount of the elders live. Contrast to old residents in urban areas, most old residents in rural areas have to depend exclusively on their family members, especially their adult offspring, to provide informal assistance for their lives (WANG & LI, 2011). This phenomenon is enforced by cultural enthusiasm about filial piety (JOSEPH et al., 1999; ZIMMER & KWONG, 2003) and has lasted for thousands of years as part of China's traditional systems. However, a decline

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in the prevalence of multigenerational co-residence and the migration of working adult offspring from countryside to cities have geographically separated them from their elderly parents, altering the patterns of traditional family support for old people in rural areas (SILVERSTEIN et al., 2006). While a small number of adult offspring still live with their parents, they might have to cut down on the time spent with the elders for better livelihoods. Adults tend to give more financial support to their aged parents, which can make up for the lack of old-age care in their subconscious mind. However, can more financial transfers definitely bring about an increase in the well-beings of the elderly in their lives? Controversy still exists among existing literature.

From the existing literature, we can conclude a positive correlation between intergenerational financial transfers and well-beings of the old people. A positive correlation may be assumed because support from others can satisfy old people' basic needs related to sanitation, nutrition and housing, and can enhance their ability to consume goods and services that serve physical and mental purposes, as it is related to opportunities for social participation, self-fulfillment and control over their life circumstances (MARMOT, 2002; MARMOT & WILKINSON, 2001). Hence, upstream financial transfers can improve the elders' well-beings.

Meanwhile, we can also find support for a negative correlation between upstream monetary transfers and the old people's well-beings. Occasionally, when old people expect more support than they actually receive or when the adult offspring reduce financial transfers to them, the elders may suffer from well-being loss. Some existing studies support the negative correlation. For instance, DAVEY & EGGEBEEN (1998) reported that parents who gave more than they received felt more depressed. Li et al. (2009) showed that receiving financial transfers from adult children, was negatively associated with old people' subjective health. Moreover, research by WATSON & KIVETT (1976) revealed that more adult offspring often meant more intergenerational conflicts and economic contradictions, which finally led to a decline in the quality of the elders' lives.

In addition, there are also few studies revealing little relation between intergenerational financial support and well-beings of the elders. SONG (2014) denoted that receiving financial support provided by the migrating adult offspring had no significant impact on the health of the left-behind elderly. However, the elders' health was very sensitive to the emotional transfers from their working adult offspring. As one way of social transfers, XIANG & YAO (2016) reported that the role of upstream financial transfers in the elders' health and life satisfaction was very limited, but mental support could greatly promote the health and life satisfaction of the elders.

Extant studies merely deal with one aspect of the transfer phenomenon - the exchange of financial transfers. Two additional aspects of the phenomenon and their relation to elders' well-beings still require attention - the extent of receiving and the conditions of receiving. The published literature hardly deals with the extent of financial receiving and its conditions. However, people's intuitive feelings are that financial support in different quantities has different effects on the elders' well-beings in different conditions. Actually, some scholars believe that upstream financial transfers may bring more benefits to old people at the low-income level than those at the high-income level. Unfortunately, up to now, they have not verified this relationship and its economic principle through empirical analysis. What's more, most of the existing research ignores the endogeneity caused by the mutual causality between intergenerational financial transfers and old people's health, which may finally lead to significant estimate bias.

Based on the existing studies, this paper aimed to examine the implications of various intergenerational financial transfers for the physical well-beings of old residents in rural China. This paper adds to the extant research in the following three ways. Firstly, it analysed the relationship between parental physical health and the intergenerational financial transfers under different economic conditions in rural China. Secondly, this paper solved the endogenous problem by using the key variable lag method. Thirdly, since this analysis was conducted on the basis of national survey data, it can fill the gap created by insufficient sample representation in the field of rural household-based research.

The rest of this paper is organized as follows. Section 2 provides a theoretical framework. Section 3 displays data source and the statistical models. Section 4 presents sample description and main empirical results. Section 5 makes discussions over potential implications.

THEORETICAL FRAMEWORK

The theoretical analysis framework of this paper is based on the health demand model proposed by GROSSMAN (1972). In Grossman's

health demand model, healthy human capital is an investment product. By consuming such investment products, it will bring two benefits to the individuals. One benefit is that healthy capital increases the income of workers by increasing the labor duration of consumers (rather than labor productivity). The other one is that healthy capital can be directly put into the consumer's utility function and can bring benefits to consumers, whereas other investment products can merely create monetary benefits. Suppose the utility function of the consumer for each period of his life is as follows:

$$U = U(\varphi_t H_t, Z_t), t = 0,1, \dots, n \quad (1)$$

where H_t denotes the stock of healthy human capital in period t. $\varphi_t H_t$ and Z_t indicate the consumed health and the general consumed commodity in period *t*. The consumer's initial healthy human capital is H_0 and it is exogenous, and the H_t in subsequent periods is the result of consumer's choice. As an investment product, the healthy human capital consisted of two parts, which can be increased through investment, and will also be depreciated in the process of consumption. That is, the net investment in the stock of healthy human capital equals gross investment minus healthy depreciation by definition:

$$H_t - H_{t-1} = I_t - \delta_t H_t \quad (2)$$

Where I_t is the gross investment in healthy human capital, and δ_t is the rate of healthy depreciation in period *t*, which will change with the increase of age. The health investment I_t and other consumed commodities Z_t are determined by the family production function. The functional form is:

$$I_t = (M_t, TH_t; E_t) \quad (3)$$

and

$$Z_t = Z_t(X_t, T_t; E_t) \quad (4)$$

In these equations, M_t is a purchasable product that can increase healthy capital. TH_t is the time needed to produce health. X_t represents other goods that can be purchased. T_t is the time to produce Z_t. And E_t is human capital.

The budget constraints for consumers are as follows:

$$\sum_{t=0}^{n} \frac{P_t M_t + Q_t X_t}{(1+r)^t} = \sum_{t=0}^{n} \frac{W_t \times TW_t}{(1+r)^t} + A_0 \quad (5)$$

Where P_t and Q_t are the prices of healthy and non-healthy goods. W_t is the wage rate. TW_t is the working duration and A_0 is the initial wealth. In addition to budget constraints, consumers are also faced with time constraints. The total length of each period is Ω_t. And the current period must be used up. That is:

$$\Omega_t = TW_t + TH_t + TL_t + T_t \quad (6)$$

In Eqs. (6), TL_t is the time loss caused by poor health, which is the result of health depreciation. An important purpose of healthy human capital investment is to reduce the above loss.

Based on the above model, there are two ways to empirically study health needs: pure investment model and pure consumption model. Grossman emphasized the use of pure investment model rather than pure consumption model in empirical research because the former's assumptions are weak and can produce strong predictions from simple analysis. Therefore, the research in this paper is also based on the pure investment model, and the equilibrium condition is:

$$\frac{G_t W_t}{\pi_t - 1} + \frac{G_t\left[\frac{U_{ht}}{m}(1+r)^t\right]}{\pi_t - 1} = r + \delta_t \quad (7)$$

Where $G_t = \partial TL_t / \partial H_t$, which is the marginal output of health. $U_{ht} = \partial U / \partial H_t$, which is the marginal utility of health. *m* is the marginal utility of monetary income. π_t-1 is the healthy shadow price, which is determined by many factors such as the price of health services and the wage level of consumers. The equilibrium condition (7) indicated that the consumer achieves maximum utility when the marginal benefit and marginal costs of health are equal. The benefits of health come from two aspects: One is the direct monetary gain; i.e. $G_t W_t / \pi_{t-1}$, the second is the direct effect of health, which is expressed as $G_t[(U_{ht}/m)(1+r)^t]/\pi_{t-1}$. And the cost component included the interest rate and the depreciation rate.

Equation (7) provides a series of theoretical predictions that can be tested. As shown in Figure 1, the optimal health demand H_t^* is determined by the intersection of the marginal yield curve and the marginal cost curve. If the cost of investing in health increases, it will lead to a decline in health demand.

In the literature, people are concerned about the change of the depreciation rate δ_t. It is generally believed that the depreciation rate will gradually increase with age. If the depreciation rate changes from δ_t to δ^*_t, the health requirement will be reduced from H_t^* to $H_t^{*\alpha}$. Education is another variable that everyone cares about. The two human capitals of education and health are complementary. The improvement of education level will lead to the improvement of the efficiency of production of human capital, thus reducing the shadow price of health, causing the health demand curve to shift outwards, and increasing the demand for health from H_t^* to H_t^{*b}.

As a key variable we care most about, intergenerational financial transfers and other income together constitute the income budget for the health

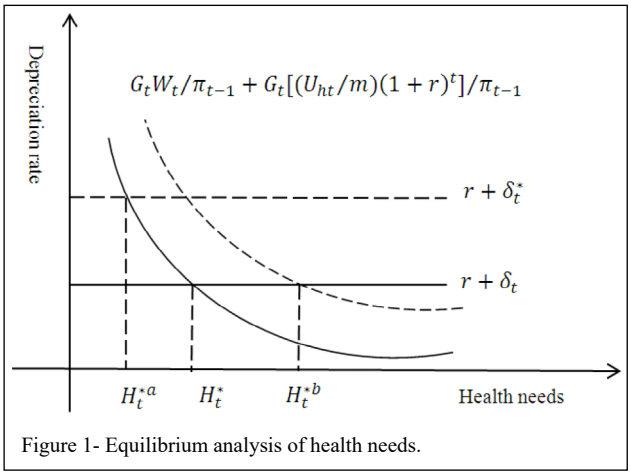

Figure 1- Equilibrium analysis of health needs.

needs of the elderly. With other conditions unchanged, an increase in intergenerational financial support will cause the health demand curve to move outward and ultimately prompt health demand from H_t^* to H_t^{*b}.

Moreover, many studies have shown that the gender of the aged (WU et al., 2018), the marital status (RICHMOND & ROEHNER, 2017), the living arrangement (TEERWICHITCHAINAN et al., 2015), the frequency of intergenerational communication (WATSON & KIVETT, 1976), and the number of places for recreational activities are important factors affecting healthy human capital. On this basis, this study will estimate the effect of the above factors on old rural residents' health condition.

Through the above analysis, this study establishes a theoretical analytical model for the health of rural elderly:

$$H_t = H(S_t, Y_t, \delta_t, K_{1t}, \dots, K_{nt}) \quad (8)$$

Where S_t is the intergenerational financial transfers received from adult children. Y_t is the elders' income which does not include intergenerational financial transfers. And $K_{1t}, \dots, K_{nt}$ are other variables that can affect healthy human capital, such as education level, marital status and the living arrangement.

MATERIALS AND METHODS

Data source

Data for this paper is obtained from China Health and Retirement Longitudinal Study (CHARLS), a panel study of 28 Chinese provinces. CHARLS was conducted by the Institute of Social Science Survey of Peking University, using a multi-stage stratified probability proportion to size (PPS) sampling method to choose the sample investigated in each of the counties from 28 provinces. CHARLS is comprised of a set of survey questions concerning demographics, socio-economic status, public resources and health of old people and their family members. In addition, detailed community information was collected including infrastructure and public facilities, migration, production, income, price and social policy at the community level. The CHARLS baseline survey was conducted in 2011 and its follow-up surveys were conducted every two years. One year after the survey was completed, the data would be freely available to the academic community. CHARLS has conducted surveys in the year of 2011, 2013, 2014 (China's middle-aged and old-aged life history survey) and 2015 in 450 communities (villages) of 150 counties of 28 provinces. By 2015, the sample has covered 23,000 respondents from 12,400 households.

Sample selection

The selected sample for our study included people aged from 55 through 92, who have been living in rural areas with a household register of agriculture and have at least one adult offspring alive. The reason why we set the age of 55 as the dividing line of the old-aged and middle-aged people is that people are considered to be old at the age of 55 and above in most of China's rural areas (SHU & TONG, 2017). When removing individuals with missing values and outliers, the study sample consisted of 5036 observations from two surveys made respectively in 2013 and 2015 (2518 individuals in each survey).

Dependent variables

We assessed old people' physical health by using the six-item version of activities of daily living (ADL) developed by KATZ et al. (1963). The ADL index measures difficulties in performing tasks required for personal self-care and independent

living in every-day life (OHRNBERGER et al., 2017), which can reflect present quality of life and is a good predictor of future morbidity and mortality, under adjustment of indicators such as demographic indicators and socioeconomic indicators. In CHARLS data survey, the functional assessment was based on respondents' responses (1 represents that the respondents don't have any difficulty; 2 represents having difficulty but can still do it; 3 represents having difficulty and needing help; 4 represents that the respondents can't do it) at each wave to the six item questions asking them for difficulties in (a) dressing, (b) bathing or showering , (c) eating, such as cutting up food, (d) getting into or out of bed, (e) using the toilet, (f) controlling urination and defecation. The overall score (ADL) for each respondent is calculated by summing the item-specific responses (ZANINOTTO & FALASCHETTI, 2011). Thus, the ADL index ranges from 0 (least difficulty and best physical health) to 24 (most difficulty and worst physical health).

Independent variables

We classified predictor variables into three categories: intergenerational financial transfers (IFT), socio-demographic characteristics and regional features. When parents are divorced or widowed, we measure intergenerational financial transfers based on the total amount, including total money transfers and total in-kind transfers that old people have obtained from adult offspring in the past 12 months. When parents are married, as the intergenerational financial transfers provided by adult children to their fathers and to their mothers is generally summed up in the end and shared by both of them, we used half of the total money transfers and total in-kind transfers that old people have obtained from adult offspring in the past 12 months to measure the intergenerational financial transfers.

Demographic and socio-economic control variables included the respondents' age, gender, educational level, marital status, income, living arrangement, frequency of intergenerational communication (FIC) and medical insurance status. We took the survey year minus the elders' birth year as the age of the elderly, representing the healthy human capital depreciation. We measured the respondents' educational level through their highest level of education achieved. The options for the educational level are as follows: 1 represents receiving no formal education (illiterate); 2 represents not completing primary school education; 3 represents home school education; 4 represents elementary school education; 5 represents middle school education; 6 represents high school education; 7 represents vocational school education; 8 represents associate degree; 9 represents bachelor's degree; 10 represents master's degree and 11 represents Ph.D. degree. We used old people's disposable income (including the measurable personal income and the per capita income which can't be separated in the household, but not including intergenerational financial transfers) to represent their income level, as disposable income can be freely used for the consumption. Unlike previous studies which only divided the living status into living alone and living together, we classified living arrangement into four types: (a) Living with at least one adult offspring; (b) Not living with adult offspring in one house, but at least one adult offspring lives in the adjacent neighborhood; (c) Not living with adult offspring in one house, but at least one adult offspring lives in the same village or another village/ neighborhood that is at least 3 kilometers far; (d) All adult offspring live far away from the old people. We divided the contacting frequency with adult offspring into 9 types, with 1 representing contacting every day, 2 representing contacting 2-3 times a week, 3 representing contacting once a week, 4 representing contacting every two weeks, 5 representing contacting once a month, 6 representing contacting every three months, 7 representing contacting every six months, 8 representing contacting once a year and 9 representing having no contact. And then we used the weighted average values to represent the frequency of intergenerational communication. we used the number of medical insurances that the respondents have been involved in as a proxy variable for their medical insurance status. Additionally, we took the remaining variables as dummy variables, including gender (1=male, 2=female) and marital status (1=yes, 0=no).

Regional features primarily included the number of recreational places (NRP) and the province. We used the administrative code to represent each province.

Statistical models

Firstly, the sample was characterized using descriptive statistics. Subsequently, We conducted Hausman tests (HAUSMAN, 1978) to verify whether the structure of our data is suitable for the fixed effects models or random effects models. However, both panels' tests are significant as p=0.0003 (Table 1). Therefore, we analyzed the data by using fixed-effects (FE) models (ALLISON, 2009; OSHIO, 2016). The main advantage of FE models is that they control heterogeneity caused by any unobserved

Table 1 - Results of the fixed effects estimation.

Variables	Coef.	Std. Err.	t
lnIFT	-0.0448***	0.0168	-2.67
age	0.2206***	0.0396	5.57
gender	_	_	_
education level	_	_	_
Marital status	-0.5310*	0.2913	-1.82
lnincome	-0.0599***	0.0191	-3.14
living arrangement	-0.0779	0.0536	-1.45
FIC	0.1805***	0.0302	5.98
Medical insurance status	-0.0348	0.1284	-0.27
NRP	_	_	_
province	_	_	_
Constant	-9.1285***	2.7482	-3.32
Obs	5036	Hausman test	chi2(8)=28.83 p=0.0003
R^2	0.0812	F test	F(7,2511) =15.54 p=0.0000

Note: *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

time-constant variables (GORMLEY & MATSA, 2014). Concentrating on variation within individuals over time, FE regression allowed to treat respondents as their own controls (ALLISON, 2009).

Since there may be a bidirectional causation between intergenerational financial transfers and the elders' health, direct estimation may lead to deviations. Based on the study of LIU (2016), we examined the influence of intergenerational financial transfers received from the t^{th} to the $t+1^{th}$ on the health of the old people in $t+1^{th}$. As well, in order to avoid the possible collinearity and heteroscedasticity of the panel data, we processed the upstream financial support and income variables in a logarithm. The foundational FE regression model adopted here is written as

$$H_{i,t+1} = \alpha_0 + \alpha_1 LNX_{i,t} + \sum \beta_j \times z_{i,t+1} + \mu_{i,t+1} \quad (9)$$

where $H_{i,t+1}$ denotes physical health of the rural old people at time t+1, $X_{i,t}$ denotes the intergenerational financial transfers received from adult offspring at time t, and $Z_{i,t+1}$ indicates a series of control variables that affect the health of the elderly at time t+1. α_0 is the time-invariant individual effect, capturing any individual-specific unobservable factors that are constant over time. α_1 and β_j are the coefficients. μ_{t+1} is the residual. And LN represents the logarithm form of variables.

To further explore whether various upstream financial support has different effects on the health of old people in different economic situations, we introduced the panel threshold regression model. The specific measurement model is as follows:

$$H_{i,t+1} = \alpha_0 + \alpha_2 LNX_{i,t} \times I(q_{it} \le \gamma) + \alpha_3 LNX_{i,t} \times I(q_{it} > \gamma) + \sum \beta_j \times Z_{i,t+1} + \mu_{i,t+1} \quad (10)$$

Where I(·) is an explicit function, and its value is 1 when the expression in parentheses is established, otherwise the value is 0; q_{it} is the threshold variable, and disposable income of the elderly is employed to represent the threshold variable in this paper; γ is the specific threshold value; α_2 and α_3 respectively represents the marginal influence of intergenerational financial transfers on the old people's health when $q_{it} \le \gamma$ and $q_{it} > \gamma$. Other variables and coefficients are the same as fixed effect models in equation (9).

For any threshold value Y, the estimated value of each parameter can be obtained by adding up the squares of the residuals. The specific formula of the sum of squared residuals can be expressed as $S_n(\gamma)=\hat{e}(\gamma)'\hat{e}(\gamma)$. The optimal threshold $\hat{\gamma}$ is the value that minimizes the sum of all residuals $\hat{\gamma} = ar\ gmin S_n(\gamma)$. HANSEN (1999) used every observation in the threshold variable as a possible threshold value, and finally took the satisfying observation value of equation $\hat{\gamma} = ar\ gmin S_n(\gamma)$.

The threshold regression model can be used to determine whether the model estimation

parameters of the two sets of samples are identical by the threshold value. The basic assumption is H_0:α_2=α_3, H_0:α_2≠α_3,. We perform statistical tests on null hypotheses by constructing LM statistics. LM statistics is as follows

$$F = n\frac{S_0 - S_n(\hat{\gamma})}{S_n(\hat{\gamma})} \quad (11)$$

Where S_0 represents the sum of squared residuals under the null hypothesis, and S_n represents the sum of squared residuals with threshold values. Since $\hat{\gamma}$ cannot be identified in the null hypothesis, the large sample distribution of traditional test statistics no longer follows the "chi-square distribution". HANSEN (2000) used the large sample distribution function of the statistic itself to convert the bootstrap P value of the large sample by using the bootstrap method. When the p value obtained is smaller than 0.1, the null hypothesis will be rejected at the 1% significance level. When the hypothesis H_0:α_2=α_3 holds, the equations degenerate into a single linear regression equation, i.e. there is no threshold effect. Otherwise, there is a threshold effect. Meanwhile, α_2 and α_3 have different effects in different intervals.

After determining a threshold, two or more threshold tests can be performed to determine whether there are other thresholds. When the LM test is rejected, it indicated that there is one threshold value. Based on the estimated threshold value, it is necessary to explore the existence of the second threshold γ_2, the third threshold γ_2, and other thresholds, until the null hypothesis cannot be rejected.

RESULTS

This section presents the sample description and the main empirical results concerning the impact of intergenerational financial transfers on old people's physical health in rural China. Firstly, sample descriptive results are presented in table 2. Secondly, the net impact of upstream financial transfers on the elders' physical health is shown in table 1. Thirdly, the non-net impact of intergenerational financial transfers on rural old people's health under their specific economic conditions is displayed in table 3.

Descriptive statistical analysis

Table 2 presents the descriptive results of health status, intergenerational financial transfers, demographic and socioeconomic characteristics of the respondents. The sample size of this study is 5036. In terms of physical health, the mean value of ADL is 5.7212 (Std.= 3.3083). Since this study reflected physical health status through the assignment of dysfunction problems, it indicated that there are relatively few old people with large dysfunction among the interviewed elders. This showed to a certain extent that most of the elders have relatively good health. The mean value of upstream financial support is 2035.6500 yuan (Std.= 4176.4530). In terms of control variables, the average age is 68.2435 years old (Std.=8.2093). Females account for approximately half of the sample (49.1660%). Most of the respondents do not complete primary school education, 39.7538% of whom have never attended school. More than half of the respondents are married and presently live with spouse (54.1104%). The mean value of income is 4933.7920 yuan (Std.= 9109.7670), which is very close to the per capita disposable income of China's low- and middle-income rural residents in the year of 2013. Although, the proportion of respondents living with their adult offspring is less than half (46.7633%), there are still one third of respondents living close to their adult offspring (6.9897%+24.7021%=31.6918%). The mean value of the frequency of intergenerational communication between old people and their adult offspring is 4.8519 (Std.=2.4262), indicating that adult offspring have less communication with their parents. A majority of respondents have medical insurance (mean value=0.8948, Std.=0.3896). However, most of them are merely involved in the New Cooperative Medical Scheme (NCMS). There are few people involved in higher-level medical insurance in rural China. Table 2 also showed that the mean value of recreational places was 1.5548 (Std.=1.8647), indicating that respondents are lacking in recreational places.

Regression analysis

In order to investigate the relationship between intergenerational financial transfers and old people's physical health, panel fixed effect model is performed. The tests and estimation results are shown in table 1. In column (2), the estimated coefficient for intergenerational financial transfers was -0.0448 and passes the 1% significance test (P<0.01), suggesting that receiving financial transfers from adult offspring has a positive effect on old residents' physical health in rural China, by controlling other variables, such as demographic factors, socioeconomic factors and regional factors. Our finding is consistent with the findings of WU et al. (2018). WU et al. (2018) denoted that intergenerational financial support from adult offspring is conducive to the health of the elders.

The demographic characteristics, socioeconomic characteristics and regional features of

Table 2 - Descriptive statistics of the study sample.

Variables		Mean	Unit	Std. Dev.
Dependent variable	ADL	5.7212		3.3083
Independent variable	Intergenerational financial transfers (IFT)	2035.6500	yuan	4176.4530
Demographic factors:	Age	68.2435	year	8.2093
	Gender			
	Male	50.8340	%	
	Female	49.1660	%	
	educational level			
	Receiving no formal education	39.7538	%	
	not completing primary school education	21.9619	%	
	Home school education	0.8737	%	
	Elementary school education	23.2724	%	
	Middle school education	11.5965	%	
	High school education	2.3828	%	
	Vocational school education	0.1191	%	
	Associate degree	0.0397	%	
	Bachelor's degree	0.0000	%	
	Master's degree	0.0000	%	
	Ph.D. degree	0.0000	%	
	Marital status			
	Yes	54.1104	%	
	No	45.8896	%	
Socioeconomic factors:	Income	4933.7920	yuan	9109.7670
	Living arrangement			
	Living with at least one adult offspring	46.7633	%	
	at least one adult offspring lives the same or adjacent dwelling/courtyard	6.9897	%	
	at least one child lives in the same village or another near village	24.7021	%	
	all adult offspring live far away the old people	21.5449	%	
	Frequency of intergenerational communication (FIC)	4.8519		2.4262
	Medical insurance status	0.8948		0.3896
Regional features	The number of recreational places (NRP)	1.5548		1.8647

old people are important determinants of their health status. Different studies on the effect of upstream financial transfers on old people's health showed that the elders' age can negatively affect their own health (DING & YAN, 2017; YU et al., 2016). This paper also found that the younger the elders are, the better health condition they are in. Meanwhile, this study showed that old people with higher level of income are healthier than those who are not, which is consistent with the findings of most researchers as higher income can contribute to more leisure opportunities, better nourishment and medical service (MARMOT, 2002; MARMOT & WILKINSON, 2001). Subsequently, the findings revealed that respondents who are married reported better health conditions. Extant studies have explained this phenomenon in

Table 3 - Results of the double threshold model regression.

Variable	Coef	Std	t
age	0.2171***	0.0397	5.4634
gender	_	_	_
Education level	_	_	_
Marital status	-0.5065*	0.2911	-1.7396
lnincome	-0.0639***	0.0195	-3.2826
Living arrangement	-0.0781	0.0536	-1.4561
FIC	0.1801***	0.0302	5.9706
Medical insurance status	-0.0309	0.1283	-0.2411
NRP	_	_	_
province	_	_	_
lnIFT (income<20928.5454)	-0.0479***	0.0170	-2.8165
lnIFT (20928.5454≤income<28352.3636)	-0.1407***	0.0535	-2.6310
lnIFT (income≥28352.3636)	0.0664	0.0453	1.4654

Notes: The critical values are simulated by using the bootstrap method with 500 replications. *, ** and *** denote significance at the 10%, 5% and 1% levels respectively.

two aspects. On the one hand, marriage can lead to healthy lifestyles (SCHONE & WEINICK, 1998; HORWITZ& WHITE, 1991). On the other hand, spouse's emotional support and their related social support are beneficial to their health (UMBERSON, 1992; WAITE, 1995; ALLEN, 1994). In addition, this study indicated that contacting adult children more frequently can promote the physical health of old people, which was widely supported by extant research (GIERVELD et al., 2012). Surprisingly, our study demonstrated that living together with adult offspring has a negative and insignificant impact on the health of the elders, which was inconsistent with the most extant research (GIERVELD et al., 2012). The reason may be partly explained by the continued preference for male offspring in rural China. In rural China, most of the elders live with male offspring. However, in comparison with females, males are poorer at caregiving. Another explanation is that inharmoniousness exists between daughters-in-law and old people in rural society (YANG & CHANDLER, 1992), which may have a negative impact on the health of the elders. Finally, we ascertained that medical insurance has a positive but insignificant effect on old people's health, possibly because most of old people in rural China are merely involved in the New Cooperative Medical Scheme (NCMS), which places many restrictions on medical services for the participants (WANG et al., 2010; YIP & HANSON, 2009).

Results of the threshold estimation

To further explore whether various upstream financial supports have different effects on the elders' health in different economic situations, this paper introduced the panel threshold regression model and reported the results in table 4, table 5, and table 3. Estimated results of two threshold values are shown in table 4. Single and double threshold effects are reported at the significant level of 1% and 10% respectively, while the triple threshold effect is not significant. Threshold values of the elders' income are derived from bootstrap estimation. According to those two threshold values, old people's income can be divided into three groups composed of low income (less than 20928.5454 yuan), medium income (more than 20928.5454 yuan and less than 28352.3636 yuan) and high income (more than 28352.3636 yuan) (Table 5).

Table 3 shows results of the double threshold effect regression. From table 3, we knew that relevant control variables' parameter estimates are consistent with the fixed effects, which indicated that our estimation results are robust. In contrast to the net impact caused by the upstream financial transfers, this paper found that various intergenerational financial supports from adult offspring have different effects on the elders' physical health when old people's income is taken into account. Actually, according to three income intervals divided by the thresholds, we found that intergenerational financial

Table 4 - Bootstrapping results of threshold effects.

Threshold variable	Hypothetical test	Bootstrap LM value	----------Different significant horizontal threshold----------		
			90%	95%	99%
Income	H_0: No threshold	7.6598***	2.7760	3.7639	6.4073
	H_1: Single threshold				
	H_0: Single threshold	3.1551*	2.6377	3.6383	6.7461
	H_1: Double threshold				
	H_0: Double threshold	2.5617	2.9320	4.4742	7.6653
	H_1: Triple threshold				

Note: *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

support and the health of old people present a similar inverse "U" shaped relationship with the increase of the elders' income. That is, when the elders' income is less than 20928.5454 yuan, intergenerational financial transfers showed a significant promoting effect (i.e. -0.0479, P<0.01) on their physical health with slight marginal effect. Empirical data showed that if the elders' income reaches 20928.5454 yuan, the promoting effect will be greatly enhanced and a significant incentive effect of upstream financial transfers (i.e. -0.1407, P<0.01) on old people's health will be created until their income exceeds 28352.3636 yuan. At this moment, previous marginal effect reaches maximum value. However, when the elders' income exceeded 28352.3636 yuan, the intergenerational financial support demonstrates a negative effect on old people's health and does not pass the 10% level of significance test. In a word, our findings revealed that intergenerational financial transfer is obviously less effective for low-income old people's physical health than those of medium income, while the effect on the high-income old people's health is the least significant.

These findings can be explained by the elders' average annual expenditure and the corresponding structure. Taking data collected in 2014 as an instance, the average expenditure of old people is 18812.88 yuan, which is very close to the first threshold value and is mainly comprised of non-healthy consumptions expenditure. Namely, when the income of old people is below the first threshold value, the intergenerational financial transfers from adult offspring may be partially used for non-health expenditure to offset their payment imbalance. Therefore, the impact of upstream financial support on the elders' health is relatively smaller. When the income of old people is above the first threshold value, the normal expenditure of them will be basically balanced. Offspring's financial support will be more likely to be used to cover the health expenditures and finally plays an important role in old people's health. However, in the case that the income of the elders is above the second threshold value, their income level must be high. Under this circumstance, they may need other types of support from their adult offspring because they have no financial barriers. According to the theory of diminishing marginal utility, receiving financial support from adult offspring at this time may have little positive effect on old people's health, and it may bring about negative effect.

Table 5 - Estimation results of threshold values.

Threshold value	Estimation value	95% confidence interval
First one	20928.5454	(13900.0000,38900.0000)
Second one	28352.3636	(22900.0000,30700.0000)

Notes: The critical values are simulated by using the bootstrap method with 500 replications. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

DISCUSSION AND CONCLUSION

The findings of this paper demonstrate a nonlinear relationship between the upstream financial transfers and the physical health of old people, with considering their economic characteristics. That is, although those who receive financial transfers from their adult offspring report better health conditions, it does not mean that more intergenerational economic support will contribute to a greater effect on their health, which is because intergenerational financial support may not work for those in good economic conditions, and it may even have negative impact on the elders' health. Namely, the findings indicate a positive correlation between financial transfers and the physical health of old people on condition that old people' income is at a reasonable level.

Actually, most of findings from extant research support the notion that intergenerational financial transfers are indeed correlated with better physical health of old people, as manifested by better activities of daily living (ADL) status or fewer chronic diseases (LIU, 2016; MAO & ZHU, 2017). Whereas, this is not the case when the elders' economic status is taken into account. Our study reveals that old people who are in a better income status may be less significantly affected by the upstream financial support.

This study makes several contributions, from both practical and theoretical perspectives. Firstly, on the basis of national survey data, we examined the effect of upstream financial transfers on the elders' well-beings and found that intergenerational financial support had a significant promoting influence on old people's physical health. Secondly, we employed the theory of diminishing marginal utility and the bootstrap method to examine how the influence of intergenerational financial transfers on old people's well-beings varied in accordance with their income levels. The effect of upstream financial transfers on the elders' health demonstrates an inverted-U relationship.

It must be kept in mind, however, that data used in this study only revealed the source structure of intergenerational financial support without showing how financial transfers were used, hence our estimates may be biased. For instance, if transfers received by the elders are mainly used for the consumption of their grandchildren instead of themselves, the effect of intergenerational financial transfers on old people's health will be smaller. Meanwhile, the situation that a lot of upstream financial transfers originally given to the elders are consumed by grandchildren will also lead to a high estimate of the threshold value. Therefore, future research should address this topic.

Most importantly, some policy implications can be derived from the empirical analysis. In the period of rapid social change, adult offspring may tend to give more financial transfers to their parents to make up for the insufficient upstream temporal transfers. For old people at a low income level, financial support from their adult offspring may play an important role. Nonetheless, for those who have a high level of income, intergenerational financial transfers may not have any positive impact on their well-beings, and it can even have negative effect. This phenomenon reveals that the intergenerational financial support is not 'the more the better'. What should be done is to optimize the intergenerational support structure and to improve the efficiency of intergenerational support for old people's well-beings with reasonable consideration of old people's socioeconomic characteristics and adult offspring's burden.

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The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

AUTHORS' CONTRIBUTIONS

Guangyan Chen was fully engaged in writing the manuscript and was also fully involved in paper revision. Lingling Qiu performed data analysis and was involved in paper revision. Wei Si provided supervision and support for the completion of the paper.

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