An inverted "U-shaped" pattern: the residence distance of adult children and the mental health of elderly in rural China

Journal:	*Applied Economics*
Manuscript ID	AEL-2021-1240
Journal Selection:	Applied Economics Letters incorporating Applied Financial Economics Letters
Date Submitted by the Author:	21-Dec-2021
Complete List of Authors:	Cai, Chaohua; South China Agricultural University, College of Economics and Management He, Qinying; South China Agricultural University, College of Economics and Management Alwang, Jeffrey; Virginia Tech, Department of Agricultural and Applied Economics
JEL Code:	I12 - Health Production: Nutrition, Mortality, Morbidity, Disability, etc. < I1 - Health < I - Health, Education, and Welfare, J14 - Economics of the Elderly < J1 - Demographic Economics < J - Labor and Demographic Economics, R23 - Regional Migration|Regional Labor Markets|Population < R2 - Household Analysis < R - Urban, Rural, and Regional Economics
Keywords:	Aging, Rural-urban Migration, Residence Distance, Mental Health, Rural China

An inverted "U-shaped" pattern: the residence distance of adult children and the mental health of elderly in rural China*

Chaohua Cai[a] Qinying He[a] Jeffrey Alwang[b]

[a]College of Economics and Management, South China Agricultural University, Guangzhou, 510642, China.
[b]Department of Agricultural and Applied Economics, Virginia Tech, Blacksburg, Virginia, 24061, United States.
*Corresponding author:Jeffrey Alwang, Email: alwangj@vt.edu (J.A)

ABSTRACT

Using data from the three waves of the China Health and Retirement Longitudinal Study, this study identifies a causal effect of the distance adult children reside from their parents on the mental health of the rural elderly. We use panel correlated random effect methods with instrumental variables to address the confounding effects of reverse causality and unobserved omitted variables. We find that the impact of the distance adult children live from their parents on mental health of the rural elderly shows an inverted "U-shaped" pattern that first increases and then slowly decreases. Further analysis finds that the effect of the residence distance on the mental health of rural elderly has statistically significant differences by gender of the elderly.

KEYWORDS

Aging;Rural-urban Migration; Residence Distance; Mental Health;Rural China.

JEL CLASSIFICATION

I12; J14; R23

*The authors acknowledge support from the Abroad Joint Training Project for doctoral students of South China Agricultural University (2019LHPY006).

I. Introduction

Labor migration from rural areas has been promoted to support rapid industrialization and urbanization in China (Huang et al., 2015; Rozelle et al., 1999). The consequence of adult migration on the health of the left-behind population in rural China is an important topic (Li et al., 2015; Huang et al., 2016; Yi et al., 2019). As the ageing population has become a critical policy focus, scholars have been increasingly attentive to the mental health of those left behind by this migration (He et al., 2016). Migration of adult children has been shown to impair the psychological well-being of the left-behind parent (Antman, 2010; Huang et al., 2016; Yi et al., 2019). However, most empirical studies use a dummy variable indicating whether the child migrated or not or a count of migrated children and ignore the effect of distance migrated. This might be appropriate in studies of international migration such as from Mexico to the U.S. (Antman, 2011; 2012). In internal migration, the distance migrated may matter due to the time and costs associated with travel. These costs can affect the decision to substitute financial resources for time spent with elderly parents (Cai et al., 2021).

This paper analyzes the causal effect of the residence distance of adult children from their parents on the mental health of left behind parents. It offers new evidence of the impact of long-distance migration on the mental health of the left-behind elderly. The contribution to the literature is two-fold. First, we use two variables to reflect distance: the residence distance and the square of residence distance. Second, estimates of the effect of residence distance of adult children on the mental health of the rural elderly can be confounded by effects of reverse causality and unobserved omitted variables. We apply a panel correlated random effect (CRE)[1] model with instrumental variables (IV) to address this potential source of bias.

II. Data

Data come from China Health and Retirement Longitudinal Study (CHARLS) collected in three waves and conducted every two years since 2011 in 28 provinces. We restrict the sample to elderly parents who have an agricultural hukou and at least one child (men above 60 years and women above 55 years old). The resulting sample includes 15364 observations (Appendix Table 1). The average residence distance for different living arrangements between the adult child and her elderly parents is 0.11, 17.77 and 883.68 kilometers, respectively. And the corresponding percentages of the rural elderly parent whose mental health is "good" are 58.44, 59.14 and 56.68, respectively, indicating a potential nonlinear relationship.

[Insert Table 1]

III. Methods

To estimate the effect of the distance on the mental health of the rural elderly, we use the following model:

$$Y_{ijt} = \alpha_0 + \alpha_1 Dis\hat{tan}ce_{ijt} + \alpha_2 X_{ijt} + \alpha_3 F_{jt} + \alpha_4 V_t + \kappa G_t + \vartheta Z_{ij} + C_{ij} + \varepsilon_{ijt} \quad (1)$$

Where i is the individual subscript and j denotes the household. Y_{ijt} is the self-reported mental health status[2] of the elderly parents of migrants. The core independent variable $Dis\hat{tan}ce_{ijt}$ indicates the maximum residence distance and the square of maximum residence

[1]Correlated random effects (CRE) approaches be viewed as complementary to fixed effects/bias adjustment approaches, with CRE applying in situations with short panels, arbitrary time heterogeneity, and arbitrary time dependence (Wooldridge, 2019).
[2]A 10-question version of the Center for Epidemiologic Studies-Depression (CES-D) is used in CHARLS which reflect subjective perceptions of feelings and behavior over the past week. The negative emotion options given were " < 1 day (0 point)," "1–2 days (1 point)," 3–4 days (2 points)," and "5–7 days (3 points)." And assign values to the positive emotion options from opposite directions, the aggregate point for these questions, named CES-D score, is used for the mental health variable. A high CES-D score implies worse mental health.

distance in kilometers between the adult child and the left-behind rural elderly[3]. X_{ijt} and F_{jt} are a vectors of individual and family characteristic variables of the rural elderly[4]. V_t includes village and city characteristics[5]. G_t is a vector of year dummies. Z_{ij} is a set of time-constant observed variables of the elderly and village and province fixed effects. C_{ij} denote the unobserved heterogeneity of individual and household of rural elderly, and ε_{ijt} is an error term.

Estimates of the effect of the residential distance on parental mental health might be contaminated by reverse causality between the two and confounding effects of unobserved omitted variables such as birth order, child ability, family values, and filial piety. Ignoring such factors could produce biased estimates.

We minimize these potential confounders in three ways. First, we include a set of covariates that may affect the distance adult children decide to reside from their parents. Factors such as parental age, the number of children, etc., may affect the residence decision and the mental health of the elderly. Second, correlated random effects (CRE) approaches can estimate the impacts of time-invariant variables that may affect the mental health of elderly parents and be viewed as complementary to fixed effects/bias adjustment approaches in a panel data model (Wooldridge, 2019). Third, we use instrumental variables (IV) to address the possible reverse causality issue.

---

[3]The variable of adult child's maximum residence distance was constructed using the following question: 'Where does CHILDn's NAME normally live now?'. Available responses were:(1) This household, but economically independent; (2) The same or adjacent dwelling/courtyard; (3)Another household in this village/neighborhood; (4) Another village/neighborhood in this county/city; distance from here (km); (5) Another county/city in this province; distance from here (km); (6) Another province; distance from here (km); and(7) Abroad. There was a small change in potential responses to this question in 2013 and 2015.One option was added (1) This household, and economically dependent, and (5)-(6) were merged into a single option (6) Other,province_city_county/city/district _village/neighborhood. We delete the observations "abroad" because the sample size is very small and domestic migration is different from international migration.

[4]Individual characteristic variables include the gender, age, years of schooling, widowhood status, self-rated health status of the elderly parent; family characteristic variables include household per capita income, the number of children, average age of children, average years of schooling of children in a household, whether adult child live with parents in the same village/house, etc.

[5]These variables reflect economic status, activity center of elderly of the village, the situation of high-speed rail in the place where the parents reside.

A valid IV should be correlated with the residence distance while not directly affecting the mental health of the elderly. We include the proportion of migrant workers in the parental village and the distance from elderly parent's city to the nearest coastal port and the square of both variables as IV's. The rationale is as follows. It is well known that there is a demonstration/peer effect in rural social networks; that migration is affected by migration history and experience of peers. Coastal cities have magnet effects in the labour market, and families located closer to the coast are more likely to have children who migrate. These four variables do not affect the mental health of the rural elderly directly but are correlated with the residence distance of adult children.

IV. Results

Here, we summarize our main findings. First, we estimate the effect of the residence distance on the CES-D score and ten depression symptoms in Table 2, respectively. We find a "U-shaped" pattern, with parental CES-D score decreasing and then slowly increasing with the location distance of their adult child. The exception is for three depression symptoms of feeling hopeful, happy and not getting going, which are not significantly affected by distance migrated (Appendix Figure 1). In other words, according to the definition of mental health (higher CES-D score implies worse mental health), the effect of adult child's residence distance on the probability of rural elderly suffering from depression is primarily determined by an inverted "U-shaped" pattern.

Specifically, when the residence distance between adult children and elderly parents is less than 80 kilometers, a 1% increase in distance leads to a 5.7% decrease in the CES-D score of elderly parents. Short distances tend to reduce intergenerational conflict and ambivalence

(Willson et al., 2003). In addition, it is convenient for elderly parents whose children live near to maintain a beneficial social network(Löckenhoff and Carstensen, 2004). In contrast, when the residence distance between adult children and elderly parents is more than 80 kilometers, a 1% increase in residence distance leads to a 0.6% increase in the CES-D score of their left-behind parents. It is recognized in the literature that a long-distance residence harms the mental health of rural elderly (Antman, 2010; Yi et al., 2019; Miltiades, 2002). This relationship applies to the other seven depression symptoms.

The instrumental variables are acceptable as they pass conventional tests. The weak identification test shows that all to be significant at the 1% level, well above the rule-of-thumb cutoff (greater than 10) for weak instruments. They also pass the over-identification test (greater than 0.1) for exogeneity. Robustness checks using OLS with IVs and replacing different variables for independent variables are reported in Appendix Table 2.

We explore the effect of the residence distance-mental health relationship by distance and gender differences in Table 3. Firstly, we find the effect of long distances on the mental health of the elderly is statistically significant while a short distance is not. This finding indirectly indicates a non-linear relationship of the impact of the residence distance is not due to the choice of the function form. Secondly, we find strong evidence to show that the impact of the residence distance of adult children on the probability of depression in the rural male elderly is stronger than that of the female elderly.

[Insert table 2]

[Insert table 3]

V. Conclusions

This paper examines a causal effect of the residence distance of adult children on the mental health of rural elderly. Results indicate an inverted "U-shaped" effect of the residence distance. 80 kilometers is a threshold of residence distance for the mental health of the rural elderly; beyond this point, the mental health of the left-behind parent deteriorates with added distance. The effect has statistically gender differences.

Our findings reveal that the residence distance of adult children directly affects the rural elderly parent's mental health, which may underpin interventions in developing countries to respond to the ageing population. As the Chinese proverb says, parents are here, don't travel far away. To avoid the potential negative impact of the increasing long-distance migration of adult children, preventive policy may be employed. Specifically, the government should pay more attention to revitalization of township enterprises to improve employment opportunities for adult children near their rural parents. Multifunctional activity communities for the elderly in villages and towns to strengthen the spiritual support might also be tried. Although our study is limited to China, these results may produce reference information that may help developing countries in the policy of an ageing population.

References

Antman, F. M. (2010). Adult child migration and the health of elderly parents left behind in Mexico. *American Economic Review*, 100(2), 205-08.

Antman, F. M. (2011). The intergenerational effects of paternal migration on schooling and work: What can we learn from children's time allocations?. *Journal of Development Economics*, 96(2), 200-208.

Cai, C., He, Q., & Alwang, J. (2021). Money is time: geographical distance and intergenerational support to aging parents in rural China. *Economic Research Ekonomska Istraivanja*, online, https://doi.org/10.1080/1331677X.2021.2013273.

Huang, B., Lian, Y., & Li, W. (2016). How far is Chinese left-behind parents' health left behind?. *China Economic Review*, 37, 15-26.

He, G., Xie, J. F., Zhou, J. D., Zhong, Z. Q., Qin, C. X., & Ding, S. Q. (2016). Depression in left-behind elderly in rural China: Prevalence and associated factors. *Geriatrics & Gerontology International*, 16(5), 638-643.

Löckenhoff, C. E., & Carstensen, L. L. (2004). Socioemotional selectivity theory, aging, and health: The increasingly delicate balance between regulating emotions and making tough choices. *Journal of personality*, 72(6), 1395-1424.

Lei, X., Sun, X., Strauss, J., Zhang, P., & Zhao, Y. (2014). Depressive symptoms and SES among the mid-aged and elderly in China: Evidence from the China Health and Retirement Longitudinal Study national baseline. *Social Science & Medicine*, 120, 224-232.

Li, Q. , Liu, G. , & Zang, W. . (2015). The health of left-behind children in rural china. *China Economic Review*, S1043951X15000577.

Miltiades, H. B. (2002). The social and psychological effect of an adult child's emigration on non-immigrant Asian Indian elderly parents. *Journal of Cross-Cultural Gerontology*, 17(1), 33-55.

Rozelle, S., Taylor, J. E., & DeBrauw, A. (1999). Migration, remittances, and agricultural productivity in China. *American Economic Review*, 89(2), 287-291.

Willson, A. E. , Elder, S. G. H. , & Jr. (2003). Ambivalence in the relationship of adult children to aging parents and in-laws. *Journal of Marriage & Family*, 65(4), 1055-1072.

Wooldridge, J. M. . (2019). Correlated random effects models with unbalanced panels. *Journal of Econometrics*, 211(1), 137-150.

Yi, F., Liu, C., & Xu, Z. (2019). Identifying the effects of migration on parental health: Evidence from left-behind elders in China. *China Economic Review*, 54, 218-236.

Table 1 Distribution of relationship between residential distance of adult children and the mental health of rural elderly

The living arrangement between adult child and elderly parent	The average residential distance between adult child and parent(km)	The mental health of rural elderly Poor (%)	Good (%)
Reside in the same village (45.951%)	0.109	41.560	58.440
Different villages in the same counties (29.465%)	17.765	40.862	59.138
Different counties in the same or different province	883.676	43.317	56.683

Table 3 Heterogeneity analysis

VARIABLES	Panel CRE+IV			
	Distance(ln)		Gender	
	(1) <=4	(2) >4	(3)Male	(4)Female
The max distance of the adult child with their parent in kilometres (km)	-18.011	-39.187***	-8.227***	-3.807
	(33.678)	(10.867)	(2.832)	(2.450)
The square of max distance of the adult child with their parent in kilometers (km)	3.907	3.235***	0.909***	0.493*
	(8.869)	(0.864)	(0.327)	(0.283)
Control of demographic variables	YES	YES	YES	YES
Control of province dummies	YES	YES	YES	YES
Control of wave dummies	YES	YES	YES	YES
Constant	15.804	140.578***	18.462	23.324***
	(27.306)	(37.600)	(12.988)	(7.982)
Observations	8,638	6,726	6,288	9,076

Note:Standard errors are reported in parentheses. *, ** and *** represent a 10%, 5% and 1% significance level, respectively. The control variables in the model are consistent with Table 2.

Table 2 The impact of the adult child's residence distance on the mental health of rural elderly

	Panel CRE+IV										
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Depression score	Bothered	Trouble keeping mind	Depressed	Effortless	Hopeful	Fearful	Restless	Happy	Lonely	Not get "going"
The max distance of the adult child with	-5.628***	-0.625***	-0.414*	-0.906***	-0.959***	0.045	-0.419**	-1.325***	0.148	-1.194***	-0.371*
their parent in kilometers (km)	(1.542)	(0.232)	(0.234)	(0.253)	(0.264)	(0.249)	(0.201)	(0.429)	(0.237)	(0.279)	(0.217)
The square of max distance of the adult	0.643***	0.079***	0.054**	0.108***	0.114***	0.001	0.045*	0.150***	-0.014	0.141***	0.035
child with their parent in kilometers (km)	(0.177)	(0.027)	(0.027)	(0.029)	(0.030)	(0.029)	(0.023)	(0.050)	(0.027)	(0.032)	(0.025)
Control of demographic variables	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Control of province dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Control of wave dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	15,364	16,621	16,376	16,585	16,615	16,172	16,804	16,821	16,745	16,693	16,635
Weak identification test (F statistic)	10.132	12.447	15.122	15.244	16.06	16.213	13.072	13.213	15.938	21.574	12.454
Over-identification test (Sargan statistic)	0.1326	0.2438	0.1654	0.4772	0.4711	0.2101	0.4852	-	0.66	-	0.3739
Average marginal effects of distance(ln)	-0.982***	-0.055***	-0.024**	-0.127***	-0.136***	-	-0.094**	-0.242***	-	-0.175***	-
Optimal distance for parent's mental health	80km	51.5km	455km	65km	66km	-	105km	82km	-	68km	-

Note: Standard errors are reported in parentheses. *, ** and *** represent a 10%, 5% and 1% significance level, respectively. The maximum distance in kilometers between adult child and elderly are taken in a logarithmic form, such as lnX=ln(X+1).

Appendix

A 10-question version of the Center for Epidemiologic Studies-Depression (CES-D) is used in CHARLS as follows:

(1) I was bothered by things that don't usually bother me. (2) I had trouble keeping my mind on what I was doing. (3) I felt depressed. (4) I felt everything I did was an effort. (5) I felt hopeful about the future. (6) I felt fearful. (7) My sleep was restless. (8) I was happy. (9) I felt lonely. (10) I could not get "going." .

Table A1 Descriptive Statistics of Key Variables

Variable	Obs.	Mean	Std. Dev.
Mental health of the elderly (depression index, 0-30)	15364	9.365	6.526
The max residence distance of the adult child with their parent(km)	15364	447.940	980.157
Whether adult child live with parents in the same village (1=yes, 0=no)	15364	0.761	0.426
Whether adult child live with parent in the same house(1=yes, 0=no)	15364	0.471	0.499
Gender(years)	15364	0.409	0.492
Age(years)	15364	65.907	6.899
Marital status (1=with spouse; 0=without spouse)	15364	0.833	0.373
Years of schooling (years)	15364	3.311	3.439
Chronic(1=yes, 0=no)	15364	0.732	0.443
The activities of daily living(0-18)	15364	15.027	2.745
Self-rated health status(1-5)	15364	2.887	0.927
Pension (1=yes, 0=no)	15364	0.559	0.497
Medical insurance (1=yes, 0=no)	15364	0.951	0.216
Worked (1=yes, 0=no)	15364	0.644	0.479
Per-capita income (thousand yuan)	15364	3.715	18.382
Computer or phone (1=yes, 0=no)	15364	0.740	0.439
Number of children	15364	3.499	1.569
Average age of children	15364	8.207	2.953
Average years of schooling of children	15364	38.130	7.045
Economic status (1-7)	15364	3.544	1.328
Activity center of elderly (1=yes)	15364	0.251	0.434
Whether operate high-speed rail of the city (1=yes)	15364	0.314	0.464
Proportion of migrant workers in the village	15364	0.278	0.253
Distance to the nearest coast port from parent's city	15364	484.565	403.727

Note: (1)Self-rated health status:1.Very poor; 2. Poor; 3. Fair; 4. Good; 5. Very good. (4)Economic status:1-7, poor to rich.

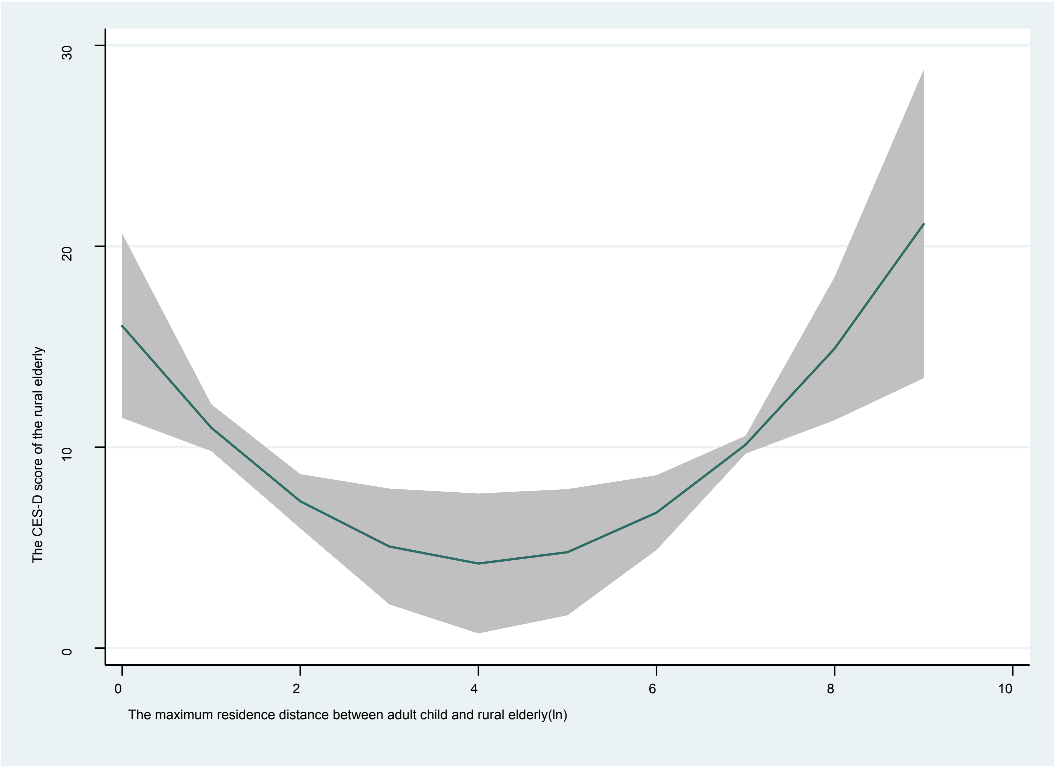

Figure A1 "U-shaped" pattern: residence distance of adult children and the CES-D score of rural elderly

Table A2 Robustness check

VARIABLES	The Mental Health of Rural Elderly		
	Depression score		
	OLS+IV	Panel CRE+IV	
The max distance of the adult child with their parent in kilometers (km)	-5.492***		
	(1.459)		
The square of max distance of the adult child with their parent in kilometers (km)	0.639***		
	(0.170)		
The min distance of the adult child with their parent in kilometers (km)		-9.708***	
		(2.806)	
The square of min distance of the adult child with their parent in kilometers (km)		1.558***	
		(0.477)	
The distance of the eldest adult child with their parent in kilometers (km)			-8.505***
			(3.048)
The square of the eldest adult child's distance with their parent in kilometers (km)			1.242***
			(0.468)
Control of wave dummies	YES	YES	YES
Control of province dummies	YES	YES	YES
Constant	11.708**	28.507***	38.612***
	(4.924)	(6.875)	(10.146)
Observations	15,364	15,364	14,917

Note:Standard errors are reported in parentheses. *, ** and *** represent a 10%, 5% and 1% significance level, respectively. The control variables in the model are consistent with Table 3.