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Family Head and Household Educational Expenditure in Three-generation Households: Evidence from China*

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Family head and household educational expenditure in three-generation households: Evidence from China

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Abstract

A substantial proportion of Chinese families comprises three generations living together. This study employed data extracted from the 2010 China Family Panel to examine the differences between grandparent- and parent-headed households in the allocation of family resources to children's education and investigate the causes of these differences. Additionally, we examined the role of children's educational stage in influencing the differences in educational expenditure when grandparents or parents served as family heads. Based on the Tobit regression, we found that parent-headed households spend more on education than grandparent-headed households. This difference may arise because parents' decision-making regarding educational expenditure is more altruistic than that of grandparents. We suggest that parents serving as both household heads and primary caregivers benefit children's education. This study fills an important literature gap because it highlights the family head's significance in three-generation households and also elucidates the differences between grandparents and parents in their motives for educational expenditures.

Keywords: three-generation; grandparents; education expenditure; altruism; exchange motive
JEL: D64; D91; D13; J13

1 Introduction

A considerable proportion of Chinese households comprises three generations. Based on the Sixth National Population Census of the People's Republic of China, the percentage of three-generation families in 2010 was 16.5%. By contrast, the percentage of households with three generations or more was 18.12%. Three-generation households constitute a significant proportion of all households and represent a highly stable family structure in China. According to China's census data from 1982, 1990, 2000, and 2010, the proportion of three-generation households remained consistently around 16–17% between 1982 and 2010. The percentage of households that have expanded to accommodate three or more generations is consistently between 18% and 19%, suggesting that the impact of three-generation families is significant and profound.

Numerous disparities exist in household educational expenditures between families—caused by various factors, such as income and urban-rural differences. In recent years, an increasing number of researchers have begun focusing on the differences in household education expenditures owing to differences in family structures, especially generational composition. Families with different generational compositions make different decisions regarding consumption, including educational investment. Regarding the literature on the impact of family generational composition on family behavior, numerous studies have considered the perspective of educational investment in children. Amorim (2019) utilized data from the United States to examine the disparity in decision-making regarding child-related expenses between two- and multi-generation households. The author discovered that, compared to two-generation homes, multi-generation households are associated with increased expenditures on schooling but decreased expenditures on childcare. Moreover, in China, adolescents in three-generation co-resident families exhibit significantly higher levels of emotional stability, conscientiousness, and academic performance compared to those in two-generation households. This may be because the participation of parents and the socioeconomic status of three-generation households positively influence adolescents' non-cognitive (Tang *et al.*, 2024; Zhang & Wu, 2020).

Additionally, when discussing three-generation households, grandparents' influence on children is unavoidable. The impact of grandparents on children differs between two- and three-generation households, as demonstrated by Zeng and Xie (2014). They utilized data from the Chinese Household Income Project to examine the impact of grandparents on children's schooling in two-(where they do not live together) and three-generation households (where they live together). Research has indicated that within households comprising three generations, the educational attainment of grandparents significantly impacts the schooling of their grandchildren. Moreover, Chen and Zhou (2022) investigated the impact of financial exchanges between grandparents and parents on educational expenditure. They found that parents who engaged in obligatory financial exchange patterns with grandparents spent less time on their children's education, suggesting that the needs of aging parents and young children may compete.

Furthermore, family decision-making on education differs not only between two- and three-generation households but may also vary within three-generation households owing to differences in the family head roles within the framework. The family head has the highest decision-making authority within the family. They play crucial roles in determining how family resources are allocated. The characteristics of the family heads of two-generation households have received significant attention in recent years. Some studies have found that the

characteristics of family heads substantially impact family resource allocation for education in two-generation households (Rizk & Afriyie, 2014; Salam *et al.*, 2021). Studies have revealed that in three-generation households, the role of family head—whether held by the grandparent or the parent— significantly impacts aspects such as children's development. Campbell *et al.* (2006) used data from the National Survey of Children's Health to compare how risk factors associated with re-offending differ between grandparent- and parent-headed households. They found that youths in grandparent-headed households face a higher risk of juvenile delinquency and are more likely to re-offend than those in parent-headed households. Additionally, Pang *et al.* (2020) found that children living in grandparent-headed households had lower creativity than those living in parent-headed households.

Thus, research on family structure and living arrangements, as well as on the financial exchanges between grandparents and parents and their impact on children's education, such as Amorim (2019), Zeng and Xie (2014), and Chen and Zhou (2022), has overlooked the important role played by the family head in family resource allocation within three-generation households. This has resulted in ambiguity in these studies regarding whether the family structure or the family head influences children's education. Existing research on three-generation families in China overlooks the family head's role, and studies on decision-making regarding resource allocation within three-generation households are limited. In this study, we focus on three-generation households, examining the role of the family head to elucidate the significance of grandparents in these households and the family head's role and influence in decision-making regarding resource allocation in Chinese households.

The remainder of this paper is organized as follows: Section 2 reviews previous studies and formulates the hypotheses. Section 3 describes the data and estimation methods used in the study. Section 4 presents estimation results and discussion. Finally, Section 5 concludes.

2 Literature and Hypothesis

2.1 Household educational expenditure: Grandparent vs. Parent

Parents as well as grandparents play a significant role in raising children (Chan & Boliver, 2013; Møllegaard & Jæger, 2015; Zeng & Xie, 2014). However, research has indicated that the impact of grandparents on children's development, particularly education, differs greatly from that of parents. Ao *et al.* (2022) found significant differences in the parenting styles and attitudes of grandparents compared to those of parents. Grandparents are less likely to take responsibility for their children's academic performance, less likely to take proactive measures to address it, and less concerned about their children's studies and daily life than parents. Xu *et al.* (2022) reported that custodial grandchildren tend to have poorer academic performance than parent-headed households. Irrespective of family socioeconomic status, custodial grandchildren are more susceptible to psychological, behavioral, and educational challenges than children in parent-headed households. One potential reason is that grandparents are less likely to participate in school activities compared to parents.

2.2 Family head in China

Numerous studies have explored the importance and significance of family heads within household dynamics. Yan *et al.* (2021) found that the family head's educational level positively affects the head's social class

identification, and as the subjective social class identification of household heads increases, educational expenditures tend to rise. Chen *et al.* (2023) demonstrated that the family head's age and educational level significantly impact household expenditure. However, studies on household heads in China have not provided a clear definition of what constitutes a household head. In studies of household heads in other countries, the family head is defined as the primary caregiver of the child or individual with the most decision-making and/or financial management capabilities in the family (Chakrabarti, 2021; Rapoport *et al.*, 2020).

In Chinese families, the designation of household heads is largely determined by cultural factors. According to Chen and Lewis (2015), Confucianism is significant in traditional Chinese culture. The concept of "filial piety" in Confucian thought describes the moral obligation to cherish and respect older adults. These traditional values contribute to a hierarchical grandparenting style in which grandparents hold the position of power and authority over younger generations within the family. Moreover, "filial piety" not only grants elders greater authority within the family but also places paternal relationships above maternal ones owing to its patriarchal nature. This empowers male elders with absolute authority over their families. Chen *et al*. (2011) showed that strong patriarchal norms still exist in Chinese society.

However, the modernization of Chinese society and the one-child policy have altered the traditional power structure within families. The 4-2-1 structure (four grandparents, two parents, and one child) increases parental indulgence, thereby fostering a more Westernized, child-centered parenting approach (Chen & Lewis, 2015). Under the one-child policy, young parents are allowed to have only one child, granting them invaluable status within the extended family (Liu, 2022). This has shifted the balance of power between generations, transferring family authority from grandparents to parents (Liu, 2024). Even though the modernization process and one-child policy have shifted family power from grandparents to parents, Li *et al.* (2020) found that regions in central and southern China, where dialects such as Hakka, Cantonese, Minnan, and Central Plains Mandarin are spoken, exhibit strong lineage family traditions. These regions have been slow in transitioning to modern family forms. Families living in areas with a stronger patriarchal culture are more likely to adopt a more conservative hereditary tradition.

Therefore, similar to Chakrabarty (2021), in this study, we define the family head as the person with the most authority or decision-making power in the family. In more modernized families, the shift of power from grandparents to parents has made parents the most authoritative household members. However, in families more deeply influenced by traditional patriarchy and filial piety culture, grandparents, especially grandfathers, remain the most authoritative figure and, thus, the family head.

Additionally, cultural and policy factors may significantly affect the determination of the family head. China's one-child policy has shifted the family's focus toward the child (Chen & Lewis, 2015), making the child the center of the household. In numerous three-generation families, grandparents primarily serve as caregivers, while parents take responsibility for their children's education and other related matters. In such cases, parents often act as primary decision-makers for the child and assume the role of the family head. Therefore, we hypothesize that in China, parent-headed households spend more on children's education than grandparent-headed households in three-generation households.

3 Data and Methods

3.1 Data

The China Family Panel Studies (CFPS) is a longitudinal study conducted by the Institute of Social Science Survey in 2010, 2012, 2014, 2016, 2018, and 2020. It surveyed a representative sample of 95% of the Chinese population across 25 provinces. Since the survey items related to family head are available only in the 2010 wave, we used data obtained from the foundational survey conducted in 2010. The CFPS gathers data at the individual, household, and community levels, using questionnaires on children, adults, household members, household economic positions, and community information. The CFPS dataset contains information in four categories: children, adults, household members, household economic status, and community statistics.

We used data on three-generation families, defined for this study as households that consist of at least one grandparent, at least one parent, and at least one child under the age of 16 "sharing a stove." Families comprising only grandparents and grandchildren, known as sandwich households, were not classified as three-generation families. The CFPS collects extensive information on the family, including data pertaining to the family head. This enables us to answer our primary question: How does decision-making regarding household education expenditures for children in three-generation households differ by who is the family head? Because only the 2010 data explicitly contains information about the family head, we used data only from the 2010 survey in this study. The CFPS used a self-reported method to determine who the family head was. The individual who had the most authority or decision-making power in the family was considered the family head. The aforementioned procedure yielded 1554 three-generation households containing at least one child under the age of 16, of which 827 households were headed by a parent, and 727 households were headed by a grandparent.

Chen and Zhou (2022) tested the impact of mandatory financial exchanges between grandparents and parents on children's educational expenditures, emphasizing that middle-generation parents "do not necessarily" have to live with their elderly parents. However, if they live and manage their finances jointly, it becomes difficult to determine whether a financial exchange occurs between them. However, Zeng and Xie (2014) focused solely on whether the grandparents or parents lived together. However, even if they lived together, they may have had separate finances, which can lead to inaccurate results or endogeneity problems. In this study, the definition of a three-generation household involves not only the physical co-residence of three generations but also the economic ties among them, specifically referred to as "sharing a stove" in the CFPS. Some studies have defined a three-generation family as a family where three generations live together. However, in some three-generation households in China, although the elderly live with their children, the two generations are economically independent and do not participate in decisions regarding the allocation of educational resources to the children. In this case, even though it is a three-generation household, the elderly do not participate in decision-making regarding family resources. Therefore, the decision-making for educational expenditures is the same as that in two-generation households. However, in three-generation households, defined by the CFPS as "sharing a stove," there are economic connections between different generations, and grandparents inevitably participate in decision-making regarding the allocation of family resources. In such cases, it becomes meaningful to distinguish between grandparents and parents with decision-making authority over educational expenditure.

3.2 Variables

In this study, we identified whether the family head is a parent or grandparent and used a dummy variable to measure the impact of the family head on educational expenditure. The dummy takes 1 if the family head is a parent and 0 if a grandparent. Additionally, we attempted to identify the factors that explain the differences in educational expenditure on children depending on whether a grandparent or parent heads the household. The independent variable in this study was household educational expenditure. However, because household educational expenditure has a right-skewed distribution, we use the natural logarithm of (household educational expenditure + 1) to reduce skewness and handle zero values (M = 5.32, SD = 3.38).

Emotional closeness. According to Korchmaros and Kenny (2001), emotional closeness is an important proximal cause of altruism. Moreover, Bar-Tur et al. (2018) found, using data from Israel and Germany, that emotional closeness between children and parents is strongly positively correlated with children's life satisfaction. Ong *et al.* (2013) used life satisfaction as a proxy for altruism. Antfolk *et al.* (2017) speculated on the relationship between parents and children and parents' willingness to invest in their children. A major factor that can indicate emotional closeness between parents and children, as well as between grandparents and children, is the frequency of contact with children (Ferguson & Ready, 2011). In this study, we used information on whether parents or grandparents were the primary caregivers of the children as a proxy for emotional closeness. In the CFPS data, the primary caregivers of children were mainly categorized into three groups: parents (M = 0.64), grandparents (M = 0.32), and childcare institutions (M = 0.04).

Exchange motive. As Wu (2019) argued, intergenerational support is akin to "altruism" if elderly people have sufficient retirement income or do not require financial support. Hence, whether parents or grandparents expect a return on their investment in their children's education depends largely on their economic situation. Therefore, we used variables that indicate the economic status of parents and grandparents to represent their motivations, which can be either exchange-driven or altruistic.

In the CFPS data, economic status was represented by variables such as household income (M = 10.24, SD = 0.92), whether grandparents were enrolled in the pension system (M = 0.14), whether parents were enrolled in the pension system (M = 0.1), the average age of co-residing grandparents (M = 62.36, SD = 8.82), and the average health condition of co-residing grandparents (M = 1.83, SD = 1.17). Owing to the right-skewed distribution of family income, we used the natural logarithm of (family income+1). The average health condition of the co-residing grandparents was controlled using a categorical variable that ranged from 1 to 5, where higher values indicated deteriorating health conditions. The average age of grandparents predicts not only their earnings capacity (younger grandparents presumably have greater earnings capacity) but also their remaining life expectancy (younger grandparents will presumably expect to live longer and have a greater expectation of receiving returns from children in the future).

Exchanges between parents and grandparents. Chen and Zhou (2022) investigated the impact of resource exchanges between Chinese parents and grandparents on children's educational spending. They found that a unilateral pattern of resource exchange from parents to grandparents reduced children's educational expenditure. Therefore, we also considered the resource exchanges between grandparents and parents. In this study, we used two dummy variables– whether co-residing grandparents receive money from parents (M = 0.13),

coded as 1 = co-residing grandparents receive money from parents (reference group = no co-residing grandparents receive money from parents); and whether co-residing grandparents receive care from parents (M = 0.17), coded as 1 = co-residing grandparents receive care from parents (reference group = no co-residing grandparents receive care from parents)–to represent the unilateral resource exchange pattern between grandparents and parents.

Cultural factors. The role of the head of household is largely determined by cultural factors. Therefore, culture may also be a significant reason for the differences in educational expenditure decision-making between grandparent- and parent-headed households. Li *et al.* (2020) found that culture plays an important role in the evolution of family structures in China and that the influence of culture on family forms varies significantly across different regions. Therefore, we divided the households in our sample into the following regions pursuant to the classification criteria of the CFPS: the North area (M = 0.12), the East area (M = 0.12), the South area (M = 0.12), the Central area (M = 0.15), the Northeast area (M = 0.14), the Northwest area (M = 0.18), and the Southwest (M = 0.18). We used these regional variables as a proxy for cultural influences, with the central area as the reference group. Additionally, there are cultural differences among the various ethnic groups in China, as well as connections between agrarian culture and modern civilization. Therefore, in addition to regional variables, we included variables indicating whether the household belonged to a minority ethnic group (M = 0.11), whether the grandparent engaged in agriculture (M = 0.24), and whether the parent engaged in agriculture (M = 0.32) to control for the impact of culture. These dummy variables were coded as follows: 1 = minority ethnic group (reference group = not a minority ethnic group), 1 = grandparent engaged in agriculture (reference group = grandparent does not engage in agriculture), and 1 = parent engaged in agriculture (reference group = parent does not engage in agriculture).

Control variables. We controlled for demographic and socioeconomic characteristics, including educational level, number of children, number of co-residing grandparents, gender of the family head, whether single parent, and urban area. The years of education of parents and co-residing grandparents were controlled for and generated in the same manner. The number of children and their educational levels were simultaneously controlled for and categorized into six categories: “Number of preschool-age children” (M = 0.69, SD = 0.65), “Number of children in primary school” (M = 0.5, SD = 0.63), “Number of children in middle school” (M = 0.16, SD = 0.4), “Number of children in high school” (M = 0.04, SD = 0.18), “Number of children above high school” (M = 0.01, SD = 0.09).

3.3 Descriptive statistics

Table 1 presents the characteristics of the total sample of three-generation households and subsamples of grandparent- and parent-headed families. A t-test showed that household educational expenditures were significantly higher for households headed by parents than for those headed by grandparents (t = -7.59, p .001). In the sample of three-generation families, families headed by grandparents accounted for 45.59%, while those headed by parents accounted for 54.41%. The family heads were predominantly male in all three-generation households. However, the proportion of family heads who were men was higher in parent-headed than in grandparent-headed households. In parent-headed households, the average years of education of parents is lower than that of grandparent-headed households, though most parents have attained education beyond primary

school. On the contrary, the average years of education for grandparents were generally lower, with grandparents in grandparent-headed households having more than twice the average number of years of education compared to those in parent-headed households. Regardless of whether a grandparent or a parent heads the household, the majority of primary caregivers of children are parents. The proportion of grandparents serving as primary caregivers is higher in grandparent-headed than in parent-headed households. In terms of income, the household income of grandparent- and parent-headed households exhibited no significant difference.

Figure 1 shows the logarithm of educational expenditure on children in parent- and grandparent-headed households. In grandparent-headed households, the average, upper quantile, lower quantile, maximum, and minimum values of educational expenditures were all lower than those in parent-headed households. In grandparent-headed households, the distribution of family education expenditure is more dispersed and skewed to the right. Figure 2 presents the relationship between the logarithm of family income and the logarithm of household education expenditure by family head. From Figure 2, across income levels, parent-headed households consistently spend more on education than grandparent-headed households. However, as income increases, the gap in education expenditure between parent- and grandparent-headed households gradually narrows.

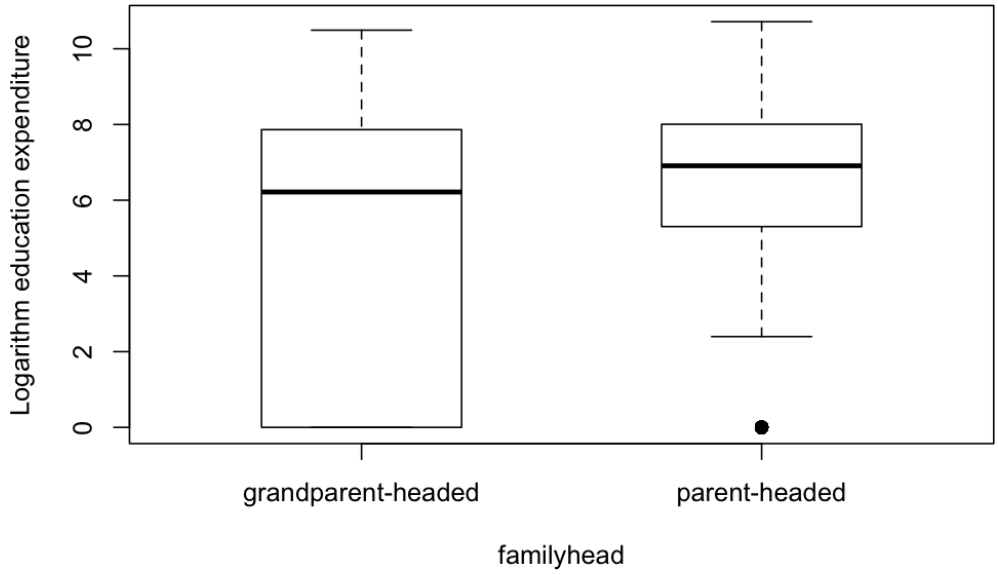

Fig. 1 Family head and logarithm household education expenditure

Table 1. Descriptive statistics

Sample	Total	Parent-headed	Grandparent-headed	Difference (t value)
Whether parent is the family head dummy (parent head = 1)	54.41%			
Logarithm household education expenditure	5.32 (3.38)	5.93 (2.92)	4.6 (3.73)	7.794***
Logarithm family income	10.24 (0.92)	10.14 (0.93)	10.37 (0.89)	-5.097***
Family head gender (man = 1)	82.95%	87.8%	77.15%	5.868***
Whether parent is children's primary caregiver dummy (parent care = 1)	63.44%	71.22%	54.15%	6.848***
Whether grandparent is children's primary caregiver dummy (grandparent care = 1)	32.38%	22.44%	44.25%	-8.972***
Whether the institute is children's primary caregiver dummy (institute care = 1)	4.18%	6.34%	1.6%	4.592***
Single parent dummy (single parent = 1)	3.58%	2.07%	5.39%	-3.296***
Number of under-school-age children	0.69 (0.65)	0.56 (0.65)	0.83 (0.62)	-8.326***
Number of children in primary school	0.5 (0.63)	0.65 (0.68)	0.33 (0.53)	10.128***
Number of children in middle school	0.16 (0.4)	0.23 (0.45)	0.08 (0.3)	7.345***
Number of children in high school	0.04 (0.18)	0.06 (0.23)	0.01 (0.09)	5.828***
Number of children above high school	0.01 (0.09)	0.01 (0.11)	0 (0.04)	2.625**
Urban area dummy (urban = 1)	40.81%	34.15%	48.76%	-5.929***
Average education year of co-residing grandparent(s)	3.26 (3.74)	1.77 (3.05)	5.05 (3.7)	-18.556***
Average education year of co-residing parent(s)	7.97 (3.69)	7.18 (3.89)	8.91 (3.19)	-9.540***
Average age of co-residing grandparent(s)	62.36 (8.82)	66.15 (8.46)	57.83 (6.91)	21.459***
Number of co-residing grandparent(s)	1.61 (0.5)	1.39 (0.51)	1.88 (0.32)	-22.521***
Whether parents provide care for co-residing grandparent(s) (provide = 1)	17.05%	20.37%	13.1%	3.901***
Whether parents provide money for co-residing grandparent(s) (provide = 1)	12.87%	16.1%	9.02%	4.269***
Whether co-residing grandparent(s) join pension system (join = 1)	14%	9.39%	19.51%	-5.469***
Whether parent(s) join a pension system (join = 1)	10.68%	9.02%	12.66%	-2.345**
Average health condition of co-residing grandparent(s)	1.83 (1.17)	1.7 (1.37)	1.98 (0.87)	-4.684***
North area dummy (north = 1)	11.94%	9.02%	15.43%	-3.687***
East area dummy (east = 1)	11.75%	8.54%	15.57%	-4.241***
South area dummy (south = 1)	10.88%	12.56%	8.88%	2.391**
Northeast area dummy (northeast = 1)	13.93%	11.46%	16.89%	-3.057***
Southwest area dummy (southwest = 1)	18.31%	22.56%	13.25%	4.728***
Northwest area dummy (northwest = 1)	17.92%	23.17%	11.64%	5.961***
Whether minority dummy (minority = 1)	11.02%	13.41%	8.15%	3.393***
Whether grandparent(s) engage in agriculture (engage = 1)	24.22%	15.98%	34.06%	-8.170***
Whether parent(s) engage in agriculture (engage = 1)	32.12%	40%	22.71%	7.405***
N	1507	820	687	

Note: ***p < 0.01; **p < 0.05; *p < 0.1.

Fig. 2 Logarithm family income and Logarithm household education expenditure

3.4 Empirical model

In this study, following Bayar and Yanik I˙lhan (2016), we employed a standard Tobit model (Tobin, 1958) to analyze the impact of the grandparent being the family head versus the parent being the family head on children's educational expenditure.

As a significant proportion of observations in the sample are zero, of the 1507 samples with zero educational expenditure, 393 faced sample censoring. According to Yee (2015), many refer to LogEduc exp∗ as a latent (i.e., unobserved) variable. Tobit modeling is synonymous with LogEduc exp as a limited dependent variable, meaning a variable constrained by a known upper and/or lower boundary. The Tobit model allows us to effectively address this problem.

$$LogEduc_i^* = \alpha + \beta G_{dummy,i} + \gamma Z_i + \varepsilon_i \quad (1)$$

$$\varepsilon_i \sim N(0, \sigma^2)\ independently, \quad (2)$$

coupled with

$$LogEduc_i = \begin{cases} LogEduc\ exp_i^*, & \text{if } LogEduc\ exp_i^* > 0; \\ 0, & \text{if } LogEduc\ exp_i^* \leq 0 \end{cases} \quad (3)$$

where $LogEduc\ exp^*_i$ is the logarithm of household educational expenditures on children, α is the intercept term, $G_{dummy,i}$ is the dummy variable of whether the grandparent is the family head, β is the coefficient of our special interest and whether the grandparent is the family head dummy, Z_i is the vector of other control variables, γ is the regression coefficient vector of other control variables. ε_i are the error terms.

To investigate whether the difference in educational expenditure between parent- and grandparent-headed households is influenced by their educational level, we included an interaction term between the household type (parent-headed) and the children's educational level into the subsequent Tobit model.

4.1 Blinder-Oaxaca Decomposition

To better understand the factors contributing to the differences in educational investment between grandparent- and parent-headed households, we employed the Blinder-Oaxaca decomposition method refined by Cotton (1988). This technique is widely used to decompose outcome differences between groups into two main components: differences attributable to endowments (i.e., characteristics such as income and educational background) and differences attributable to coefficients (i.e., how these characteristics are valued or rewarded in each group).

Table 4 presents the results of a Blinder-Oaxaca threefold decomposition analysis, which is used to examine the sources of differences in educational expenditures between grandparent- and parent-headed households. The model decomposes these differences into three components–endowments, coefficients, and interaction terms–each measuring the contributions of various factors to the overall disparity. The results indicate that a significant difference exists in educational expenditures between parent- and grandparent-headed households (coefficient of difference = 1.330, $p < 0.01$). The explainable portion (endowment) accounts for a larger proportion of this difference, approximately 1.291, suggesting that factors such as household characteristics, income, and region explain most of the differences in household educational expenditures. The unexplained portion (coefficients) accounted for approximately 0.494 of the difference, which may reflect the different attitudes and decision-making processes regarding educational investment between grandparents and parents. The interaction effect was negative, indicating that the interaction between certain variables across different groups reduced the overall difference.

In the endowments section, having grandparents as the primary caregivers (coefficient = -0.157, $p < 0.01$) negatively affects household education expenditure. In grandparent-headed households, the proportion of grandparents serving as primary caregivers for children is relatively high, widening the gap in educational expenditure between grandparent- and parent-headed households. However, when childcare institutions, such as daycare centers, act as primary caregivers (coefficient = 0.135, $p < 0.05$), there is a positive effect on education expenditure. As the proportion of childcare institutions serving as primary caregivers is higher in parent-headed households, this increases the gap in education expenditure between parent- and grandparent-headed households. Moreover, Northeastern (coefficient = -0.098, $p< 0.05$), Eastern (coefficient = -0.064, $p< 0.05$), and dummy variables (coefficient = -0.098, $p < 0.01$) show a significantly negative impact on household education expenditure, and the proportion of grandparent-headed households is higher in the northeast and east regions. This increases the gap in education expenditure between grandparent- and parent-headed households.

On the contrary, family income (the natural logarithm of (household income + 1), coefficient = 1.499) exhibits a strong positive coefficient, suggesting that income differences significantly influence educational expenditure across different households. Additionally, the institute serves as the children's primary caregiver.

Table 2. Tobit Model Estimation Results of Household Education Expenditures

Independent Variable: Logarithm household Education Expenditure											
Dependent variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**
Parent head dummy	0.554**	0.613***	0.601**	0.567**	0.407*	0.623***	0.609***	0.586**	0.670***	0.585**	0.791***
	(0.242)	(0.234)	(0.235)	(0.233)	(0.238)	(0.235)	(0.234)	(0.235)	(0.233)	(0.239)	(0.234)
Grandparent is primary caregiver dummy	0.207		0.271								
	(0.204)		(0.207)								
Daycare is primary caregiver dummy	0.912**		1.057**								
	(0.445)		(0.452)								
Logarithm family income	0.462***			0.529***							
	(0.114)			(0.112)							
Average grandparent age	0.062***				0.059***						
	(0.014)				(0.238)						
Average grandparent health condition	0.053					0.040					
	(0.079)					(0.078)					
Whether grandparent has a pension system	0.143						0.231				
	(0.278)						(0.278)				
Whether parent has a pension system	0.201						0.409				
	(0.327)						(0.329)				
Whether parent provides care to grandparent	-0.120							0.170			
	(0.260)							(0.251)			
Whether parent gives grandparent money	0.239							0.308			
	(0.278)							(0.280)			
Whether minority	-1.168***								-1.432***		
	0.325								(0.306)		
Whether grandparent engage in agriculture	0.094									-0.198	
	0.257									(0.255)	
Whether parent engage in agriculture	0.040									-0.024	
	(0.230)									(0.232)	
North	0.171										0.000
	(0.350)										(0.352)
South	-0.290										-0.284
	(0.358)										(0.361)
East	0.848**										0.908**
	(0.366)										(0.358)
Northeast	0.932***										0.696**
	(0.337)										(0.339)
Northwest	-0.326										-0.489
	(0.321)										(0.323)
Southwest	-0.416										-0.932***
	(0.332)										(0.320)
Sample size	1507	1507	1507	1507	1507	1507	1507	1507	1507	1507	1507

Note: ***p 0.01; **p 0.05; *p 0.1.

Robust standard errors are presented in parentheses. Other control variables included the family head's gender, single-parent dummy, number of underage children, number of children in primary school, number of children in middle school, number of children in high school, number of children above high school, urban dummy, average education year of co-residing grandparent(s), average education year of co-residing parents (s), and number of co-residing grandparents (s).

Table 3. Blinder-Oaxaca Decomposition Results

	Coefficient	Std. err.	z	P> |z|
Overall				
Parent head	5.929	0.103	57.35	0.000
Grandparent head	4.599	0.145	31.80	0.000
difference	1.330	0.178	7.48	0.000
endowments	1.283	0.320	4.01	0.000
coefficients	0.584	0.217	2.68	0.007
interaction	-0.537	0.342	-1.57	0.117
Endowment				
Grandparent is primary caregiver dummy	-0.157	0.061	-2.58	0.010
Daycare is primary caregiver dummy	0.135	0.055	2.45	0.014
Logarithm family income	-0.064	0.040	-1.59	0.112
Average grandparent age	0.309	0.210	1.47	0.142
Whether parent provides care to grandparent	-0.028	0.033	-0.85	0.396
Whether parent gives grandparent money	0.033	0.035	0.95	0.342
Whether grandparent joins pension system	-0.027	0.035	-0.77	0.440
Whether parent joins pension system	-0.007	0.016	-0.46	0.648
Average grandparent health condition	-0.018	0.042	-0.43	0.669
North dummy	-0.022	0.029	-0.75	0.452
East dummy	-0.098	0.041	-2.41	0.016
South dummy	-0.006	0.019	-0.33	0.742
Northeast dummy	-0.064	0.032	-2.03	0.042
Southwest dummy	0.035	0.044	0.78	0.434
Northwest dummy	0.013	0.054	0.24	0.810
Whether minority	-0.035	0.028	-1.25	0.211
Whether grandparent engage in agriculture	-0.048	0.060	-0.80	0.421
Whether parent engage in agriculture	0.016	0.062	0.26	0.796
Coefficients				
Grandparent is primary caregiver dummy	-0.518	0.154	-3.37	0.001
Daycare is primary caregiver dummy	-0.040	0.021	-1.91	0.057
Logarithm family income	1.671	2.06	0.81	0.418
Average grandparent age	0.128	1.632	0.08	0.937
Whether parent provides care to grandparent	0.034	0.065	0.52	0.607
Whether parent gives grandparent money	-0.040	0.049	-0.82	0.411
Whether grandparent joins pension system	-0.024	0.092	-0.26	0.794
Whether parent joins pension system	-0.005	0.070	-0.08	0.939
Average grandparent health condition	-0.045	0.324	-0.14	0.888
North dummy	-0.003	0.090	-0.03	0.974
East dummy	-0.186	0.098	-1.90	0.058
South dummy	0.007	0.055	0.12	0.905
Northeast dummy	-0.088	0.096	-0.92	0.358
Southwest dummy	-0.137	0.077	-1.77	0.077
Northwest dummy	-0.061	0.066	-0.91	0.363
Whether minority	-0.016	0.046	-0.35	0.729
Whether grandparent engage in agriculture	-0.131	0.148	-0.88	0.378
Whether parent engage in agriculture	-0.061	0.095	-0.64	0.521

In the coefficients section, the decomposition results primarily analyze the "unexplained part" of how explanatory variables, such as family income, household characteristics, and social support, affect the difference in educational expenditure between grandparent- and parent-headed households. The coefficient for grandparents as primary caregivers was -0.518 and is significant ($p < 0.01$). This indicates that even after controlling for other factors, having grandparents as primary caregivers significantly reduced the educational expenditure of parent-headed households. This likely reflects the differences in attitudes toward educational expenditure between grandparents and parents. In the case of the natural logarithm of (family income + 1), the coefficient is 1.671, and although not statistically significant ($p = 0.418$), it still suggests a positive impact on educational expenditures.

4.2 Effect of children's educational level

We also investigated whether the impact of grandparents as the household head on educational expenditure varied at different educational stages of the children. However, owing to the limited sample size, we were unable to conduct a subsample analysis. Therefore, we used an interaction term between the children's educational level and whether the grandparent was the household head to shed light on whether the children's educational level affected the impact of the grandparent being the household head on educational expenditure.

Table 5 summarizes the results based on models that include the interaction terms between children's educational level and whether a grandparent is the family head. Model 1 was used as the baseline. Models 2–5 include the interaction terms between the number of children at each educational level and whether the parent is the family head. As Model 1 shows, after controlling for other variables, households headed by parents spent 55.4% more on education than grandparent-headed households did. Moreover, for every additional child below school age, educational expenditure declined by 5.7%. This may be because having an additional preschool child requires reallocating part of the education expenditure to childcare expenses. However, this difference was not statistically significant. Moreover, the number of children at primary, middle, high school, and higher educational levels has a similar effect on educational expenditure. Specifically, each additional child at the primary educational level or above increases educational expenditure by approximately 20% to 23%.

We also examined whether the impact of parent-headed households on educational expenditure varied depending on the child's educational level. Model 2 explored the interaction between the role of the family head and the number of preschool children by adding an interaction term between the two variables. The results indicate that this interaction term does not significantly affect educational expenditures and that the positive impact of parent-headed households is somewhat diminished. This suggests that while parent-headed households generally tend to increase education spending, this effect may be partially offset when the number of preschool children is considered. Model 3 adds to Model 1 an interaction term between the number of primary school children in the household and whether the parent is the household head. After adding this interaction term, the coefficient for parent-headed households increases to 1.277 and remains significant. This indicates that, when considering the interaction between parental headship and the number of children in primary school, the positive impact of parent-headed households on educational expenditure is stronger. The coefficient of the interaction term is -1.427 and is significant. This means that as the number of primary school children increases, the difference in educational expenditures between parent- and grandparent-headed households decreases. Similar results are found in Model 4, in which an interaction effect was found between the number of middle school children in the household and whether the parent was the household head. In Model 4, the coefficient for parent-headed households increases to 0.676 relative to the results for Model 1 and remains significant; the coefficient of the interaction term is -0.891 and is statistically significant. As in Model 3, this indicates that as the number of middle school children increases, the difference in educational expenditures between parent- and grandparent-headed households decreases.

In Model 5, an interaction term between the number of high school children in the household and whether the parent was the head of the household was added. The results for Model 5 show that when this interaction term is added, the difference in educational expenditures between parent-headed households and grandparent-headed households is 56%, almost the same as in Model 1. Moreover, the number of high school

children positively affects household educational expenditure. The coefficient of the interaction term is -0.412, indicating that the difference in educational expenditure between parent- and grandparent-headed households decreased as the number of high school children increased, but this result was not statistically significant. Model 6 adds an interaction term between the number of children above high school age and whether the parent is the head of the household. The results for Model 6 show that the coefficient of whether a parent is the family head is 0.553, which is almost the same as that in Model 1. The coefficient of the interaction term between the number of children above high school and whether a parent is the household head is 0.492, indicating that an increase in the number of children above high school widens the gap in educational expenditure between parent- and grandparent-headed households. However, as in Model 5, this effect is not statistically significant.

Consequently, the results presented in Table 4 show that only children in the compulsory education stage impact how the identity of the family head—whether parent or grandparent—affects educational expenditures. As the number of children in the compulsory education stage within a household increases, the gap in educational expenditures between parent- and grandparent-headed households narrows. This may be because of the generally equal distribution of educational resources and lower costs during the compulsory education stage, making the differences in educational expenditures less pronounced than in the higher education stages. Relatively low expenditures during the compulsory education stage, along with diminishing marginal utility, led to a reduction in the gap in educational expenditures between parent- and grandparent-headed households at this stage.

Table 4. Tobit Model Estimation Results of Household Education Expenditures.

Independent Variable: Logarithm household Education Expenditure						
Dependent variables	(1)	(2)	(3)	(4)	(5)	(6)
Parent head dummy	0.554**	0.240	1.277***	0.676***	0.560**	0.553**
	(0.242)	(0.316)	(0.287)	(0.252)	(0.243)	(0.242)
Number of underage children	-0.057	-0.313	0.005	-0.040	-0.566	-0.057
	(0.187)	(0.249)	(0.186)	(0.187)	(0.187)	(0.187)
Number of children in primary school	2.094***	2.086***	3.084***	2.096***	2.092***	2.093***
	(0.184)	(0.184)	(0.282)	(0.184)	(0.184)	(0.184)
Number of children in middle school	2.186***	2.189***	2.193***	2.843***	2.182***	2.187***
	(0.260)	(0.260)	(0.258)	(0.451)	(0.260)	(0.260)
Number of children in high school	2.231***	2.280***	2.174***	2.237***	2.603*	2.231
	(0.486)	(0.487)	(0.483)	(0.485)	(1.518)	(0.486)
Number of children above high school	2.263**	2.319**	2.296**	2.302**	2.267**	1.816
	(1.022)	(1.021)	(1.016)	(1.021)	(1.021)	(3.351)
Parent head dummy × Number of underage children		0.442				
		(0.285)				
Parent head dummy × Number of children in primary school			-1.427***			
			(0.308)			
Parent head dummy × Number of children in middle school				-0.891*		
				(0.499)		
Parent head dummy × Number of children in high school					-0.412	
					(1.593)	
Parent head dummy × Number of children above high school						0.492
						(3.510)
Sample size	1507	1507	1507	1507	1507	1507

4.3 Family head and householder

In this study, we use the household head identified in the data as the family head; however, several studies have selected individuals with stronger bargaining power or the householder as the family head. According to previous studies, a householder is defined as the breadwinner of the household. Biddlecom and Kramarow (1998) show that married women, who are the main source of income for their families, are more likely to be family heads. Moreover, Mutchler and Velasco Rold´an (2023) showed that in three-generation households, grandparents who earn a significant portion of the household's total income or serve as homemakers are more likely to identify themselves as the primary caregivers of their grandchildren. We use information on whether the parents' income is higher than that of the grandparents instead of self-reported information on who the family head is to determine the family head. This is based on the assumption that a family member with a higher income has more bargaining power.

Table 5. Model Estimation Results of Householder and Family Head.

Independent Variable: Logarithm household Education Expenditure		
Dependent variables	Family head	Householder
Parent head dummy	0.554***	0.352
	(0.242)	(0.283)
(Intercept):1 (Intercept):2	-6.980***	-7.146***
	(1.737)	(1.750)
	1.306***	1.307***
	(0.020)	(0.020)
Sample size	1507	1507

Note: *** p<0.01; ** p<0.05; * p<0.1. Robust standard errors are indicated in the parentheses.

Other control variables include family head gender, single parent dummy, grandparent is primary caregiver dummy, daycare is primary caregiver dummy, logarithm family income, number of underage children, number of children in primary school, number of children in middle school, number of children in high school, number of children above school, average grandparent age, average grandparent health condition, whether grandparent join pension system, whether parent joins pension system, urban dummy, whether parent provides care to grandparent, whether parent provide money to grandparent, average education year of the co-residing grandparent(s), average education year of co-residing parent(s), number of the co-residing grandparent(s), whether minority, whether grandparent engages agriculture, whether the parent engages agriculture, north dummy, south dummy, east dummy, northeast dummy, northwest dummy, southwest dummy.

Table 5 shows the estimation results when the incomes of parents and grandparents are used to determine who the family head is. Educational expenditures in parent-headed households are approximately 55.4% more than those in grandparent-headed households, and this result is statistically significant. However, when we regard the householder as the family head, educational expenditure in parent-headed households is 35.2% higher than that in grandparent-headed households; however, this result is not statistically significant. Moreover, the coefficients of these two variables differ by nearly half, suggesting that a parent's family head position may not be determined by income. Consequently, some unobservable factors may exist, such as cultural factors that determine whether a grandparent or a parent heads a household.

5 Discussion

Regarding the core research question of this study, namely, whether parent-headed households spend more on children's education than grandparent-headed households in three-generation families in China, our

analysis indicates that in Chinese three-generation families, parent-headed households tend to allocate more family resources to children's education than grandparent-headed households. Additionally, we attempted to identify the factors contributing to differences in educational expenditure between parent- and grandparent-headed households. We considered four factors that could influence the difference in educational expenditure between parent- and grandparent-headed households: emotional closeness, financial factors (exchange motives), exchanges between parents and grandparents, and cultural factors. Our results show that only emotional closeness, measured by who is the children's primary caregiver, plays a significant role in explaining the difference in educational expenditures between parent-headed and grandparent-headed households in three-generation families.

The results of the Tobit model in Section 4.1 suggest that economic factors such as the natural logarithm of (household income + 1) and grandparents' age reduce the gap in educational expenditures between parent- and grandparent-headed households. Wu (2019) found that if elderly parents have sufficient income, intergenerational support resembles "altruism." In three-generation households, the middle generation—often parents—typically serves as the family's economic pillar. Therefore, an increase in household income is likely to be owing to an increase in parents' income. In this study, the observed reduction in the gap between educational expenditure in parent- and grandparent-headed households with rising incomes may be attributable to the possibility that parents invest in their children's education with the expectation of future returns. This suggests that richer parents or socially secure parents spend less on educational expenditures. However, because the impact of household income on narrowing the gap in educational expenditures between parent- and grandparent-headed households is not very strong, parents' educational expenditure on their children may be driven not only by the exchange motive but also by altruistic motives. The age of grandparents can partly reflect their earning capacity as younger grandparents are likely to be in better health and, therefore, have stronger earning potential. Additionally, it reflects their expectations of future returns from their grandchildren, with younger grandparents having higher expectations of receiving returns in the future. However, our results show that as grandparents age, the gap in educational expenditure between parent- and grandparent-headed households narrows significantly. Beach (2013) found that older grandparents tended to provide more financial support to their grandchildren. Therefore, the narrowing gap in education expenditure between parent- and grandparent-headed households may be attributable to the tendency of older grandparents, rather than parents, to allocate more family resources to children's education as they age. The grandparent was the head of the family. This contrasts with the explanation based on exchange motives, which suggests that inter vivos gifts may be driven by altruism. Therefore, the finding that parent-headed households exhibit significantly higher educational expenditure than grandparent-headed ones could be attributed to differences in core motivations. It is plausible that parents' decisions reflect both altruism and exchange motives, while grandparents' decisions are perhaps guided mainly by altruistic concerns. The combination of parental motives may be stronger than the purely altruistic motives of grandparents. However, this does not imply that parents are more altruistic or selfish than their grandparents.

This study also found that, in addition to economic factors, cultural factors such as ethnicity and region also significantly influence the disparity in educational expenditures between parent- and grandparent-headed households. The reduction in the gap between parent- and grandparent-headed households in educational expenditure after controlling for minority groups and regions may be attributable to cultural, economic, and

policy factors associated with minority backgrounds that act as a "buffer" in the original model. Once these variables were controlled for, these buffering effects were removed, revealing the true impact of family structure and highlighting the advantage of parent-headed households in educational expenditure. Li *et al.* (2020) found that variations in regional and ethnic cultural development in China led to differences in the family structure. Our findings align with Li *et al.* 's (2020) conclusion, as we also observed differences in educational expenditure between parent- and grandparent-headed households by region, which may be attributable to cultural differences. However, these findings are rejected by the results of our Blinder-Oaxaca decomposition, which revealed that in three-generation households in China, parent-headed households actually spend more on education than grandparent-headed households. In addition to the portion of the difference explained by the distribution of the sample, we observed that the key factors identified in Section 4.1, such as household income, the average age of grandparents, and regional culture, which significantly affect differences in educational expenditures between parent- and grandparent-headed households, do not adequately explain the educational expenditure gap between these two types of households in the Blinder-Oaxaca decomposition. By contrast, the Tobit model estimation results suggest that whether grandparents are the primary caregivers does not significantly impact the difference in educational expenditures between parent- and grandparent-headed households. However, in the Blinder-Oaxaca decomposition, grandparents play a significant role as primary caregivers in explaining the gap in educational expenditures between the two household types. This implies that the difference in educational expenditure between parent- and grandparent-headed households decreases when grandparents are primary caregivers. In other words, the influence of grandparents as primary caregivers in parent-headed households tends to reduce educational expenditures. This may be attributable to altruism associated with emotional closeness, whereby grandparents, as primary caregivers, tend to have closer relationships with their children. In contrast, the relationship between children and their parents may not be as close. According to Antfolk *et al.* (2017), lack of emotional closeness may reduce the willingness of parents to spend money on their children's educational expenditures.

However, ethnicity and region can only partially represent cultural differences, as there may also be economic disparities, differences in educational resources, and other factors between different ethnic groups and regions. Therefore, there may be unobservable cultural factors that lead to potential endogeneity. For example, in some traditional families, grandparents often serve as the head of the household, and the traditional preference for sons over daughters is more prevalent, leading to significantly lower educational expenditures for girls than for boys (Wang, 2005). Furthermore, China's one-child policy exacerbates the disparity in educational spending between households headed by grandparents and parents, which may have caused us to underestimate the gap in our conclusions. Moreover, under the one-child policy, grandparents in three-generation families may serve only as caregivers without participating in family decision-making. In such cases, parents typically act as the family head and play a decisive role in the allocation of educational expenditures to their children. This may have resulted in the overestimation of our findings.

6 Conclusion

Do households headed by grandparents spend more on their children's education than do households headed by parents in China's three-generation households? Our study shows that, in three-generation families,

households headed by a parent spend more on children's education than those headed by a grandparent. The underlying reason for this may be an altruistic motive for emotional closeness. We also found that the number of children in compulsory education had a significant impact on the difference in educational expenditure between parent- and grandparent-headed households, which may have important policy implications for compulsory education.

In China, many grandparents in three-generation households play the role of caregivers for children. However, we found that in three-generation households, it may be more beneficial for parents than grandparents to be responsible for matters concerning their children, as this could potentially lead to higher educational achievements for their children in the future.

In summary, our study focuses on the importance of family heads in three-generation households in relation to educational expenses for children. We used data from three-generation Chinese households to examine the importance of the family head and highlight differences in household resource allocation depending on which generation serves as the family head. Moreover, this study fills a gap in research on three-generation households. However, this study uses the 2010 cross-sectional data from the CFPS, which may lead to significant endogeneity concerns regarding the identification of the family head. As a limitation, this cross-sectional design may not fully address potential unobserved heterogeneity and reverse causality. In future research, we are working on extending the data to a panel structure, which will allow us to mitigate endogeneity issues and better capture within-family dynamics over time.

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