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DOES INTERGENERATIONAL ECONOMIC SUPPORT REDUCE THE PERCEPTION OF PENSION RISK AMONG ECOLOGICAL MIGRANTS? – EVIDENCE FROM CHINA

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Abstract. Understanding the influence of intergenerational economic support on ecological migrants' perceived pension risks is essential. It provides a basis for designing targeted pension security systems and promoting sustainable livelihoods. Based on survey data from 1,915 ecological migrants in the upper reaches of the Yangtze River, this study employs empirical methods to examine the mechanisms and impacts of intergenerational economic support on their perceived pension risks. The main findings are as follows: (1) Intergenerational economic support significantly reduces ecological migrants' perceived pension risks. This conclusion remains robust after a series of sensitivity and endogeneity tests, highlighting the crucial role of economic support from children in alleviating elderly migrants' concerns about future pension security. (2) Individual, family, and community-level characteristics all exert significant effects on perceived pension risks. (3) Mechanism analysis reveals that intergenerational economic support alleviates perceived pension risks primarily through enhanced life satisfaction. Based on these findings, this study provides policy recommendations aimed at mitigating pension risks among ecological migrants in China.

Keywords: ecological migrants, intergenerational economic support, pension risk perception, propensity score matching, life satisfaction, individual characteristics, family characteristics.

JEL Classification: J14, Q56, H55.

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1. Introduction

As global ageing accelerates, pension risk has emerged as a critical challenge for countries worldwide. As one of the most affected countries, China faces immense pressure in this regard. To address the dual challenges of population ageing and environmental degradation, China has implemented an ecological migration policy since the 1980s, relocating large populations from ecologically fragile areas to more secure regions. This policy not only alleviates the tensions between the population growth, resource scarcity, and environmental degradation but also offers a strategic approach to mitigating pension risks among elderly migrants.

Ecological migrants are people who are relocated by the government from ecologically fragile areas to safer locations due to environmental degradation or frequent natural disasters. These relocated populations are called ecological migrants. According to official statistics, by 2020, the number of ecological migrants in China had reached 16.28 million (Liu, 2023), of

whom those aged 60 and above accounted for more than 12%, surpassing the international threshold for "ageing societies". This phenomenon is closely linked to the economic underdevelopment of resettlement areas. Due to limited employment opportunities, many younger individuals migrate to urban centers or seek jobs elsewhere, whereas elderly residents, constrained by health issues and livelihood challenges, tend to remain in the resettlement areas – thereby intensifying population ageing in these regions.

Although ecological relocation promotes environmental protection, it also generates various social issues, particularly the pension risks faced by elderly ecological migrants. After relocation, elderly ecological migrants often encounter problems such as an unstable income, inadequate social support, and inadequate pension coverage. For instance, prior to relocation, most elderly migrants primarily depended on agricultural activities; however, after relocation, many lost their stable income sources, thereby intensifying pension risks (Zhang, 2021). These issues indicate that, after relocation, ecological migrants face significant pension risks, which are not only closely related to factors such as poverty and social integration but also intertwined with external risks such as social unrest. Tackling the pension risks faced by China's ecological migrant population has emerged as a pressing social concern. Research on the pension risks of ecological migrants in China is not only highly important for the reform of the domestic pension system but also offers valuable insights for developing countries facing similar challenges. In particular, this study offers valuable international lessons on balancing environmental protection with population resettlement while mitigating the pension risks among elderly migrants.

Previous studies have demonstrated that intergenerational economic support can effectively reduce elderly individuals' perception of pension risks. However, the current literature primarily focuses on traditional elderly populations, offering limited insight into the distinctive circumstances of ecological migrant groups. The effectiveness of intergenerational economic support is influenced by multiple factors, including the family structure (Baurin & Hindriks, 2023), socioeconomic status (Cottle & Caliendo, 2023), policy support (Floridi, 2020; Sabol et al., 2021), and individual characteristics (Ko & Möhring, 2021), resulting in heterogeneous impacts across population subgroups. Specifically, for ecological migrant populations, factors such as social and cultural adaptation, resource access, and economic pressures resulting from relocation may alter the mechanism through which intergenerational economic support operates. Therefore, this study focuses on ecological migrants and examines how intergenerational economic support influences their perception of pension risks, with particular attention to the underlying mechanisms. This paper offers a novel perspective for advancing future research in this field.

The marginal contributions of this paper are as follows: **(1)** Existing research has focused primarily on the general elderly population, with insufficient attention given to the pension risks faced by ecological migrants. By employing ecological migrants as an empirical case, this paper explores the complex relationship between intergenerational economic support and pension risk, thereby broadening the analytical perspective on this vulnerable group. **(2)** This study systematically analyses the impact of intergenerational economic support on ecological migrants' perception of pension risks. By employing the Propensity Score Matching (*PSM*) method and instrumental variable techniques, this study overcomes endogeneity issues, ensuring the scientific validity and effectiveness of the findings. **(3)** The mediating role of life

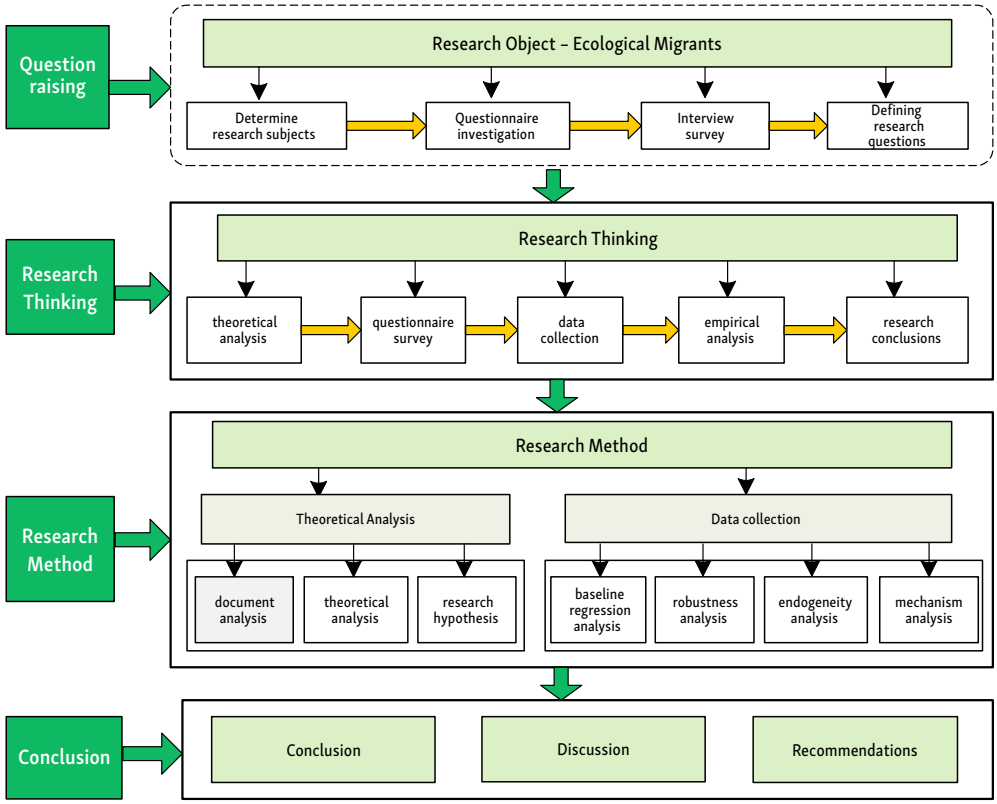

Figure 1. Research framework of this study

satisfaction in the relationship between intergenerational economic support and ecological migrants' perception of pension risks is empirically verified, offering a novel perspective for future research on this issue.

The research framework of this paper integrates theoretical analysis, survey analysis, empirical investigation, and research conclusions, employing both theoretical and empirical methodologies (see Figure 1). The remainder of the paper is organized as follows: Section 2 presents the literature review and research hypotheses; Section 3 outlines the research materials and methods, including the study area, the data sources, variable selection, and model construction; Section 4 reports the empirical analysis results; Section 5 discusses the research findings and their limitations; and Section 6 concludes the paper by summarizing the main findings and providing policy implications.

2. Literature review and research hypothesis

2.1. Literature review

With the advancement of ecological migration policies, pension-related risks have emerged as a critical focus in academic research. Ecological migration refers to the relocation of individuals

driven by ecological degradation or the need for ecological protection. While such relocation alleviates ecological pressures, it also introduces numerous pension risks for the relocated population. For ecological migrants, pensions risks primarily refer to the vulnerability of their pension security and quality of life to external shocks, such as changes in living environments, social adaptation, and economic security, during the relocation process (Chen & Sui, 2013). Pension risk perception refers to an individual's subjective evaluation of potential risks related to economic security, healthcare services, social support, and other aspects during retirement or old age. For ecological migrants, pension risk perception includes not only the perception of economic security risks, care risks, and emotional support risks but also the uncertainties associated with the relocation process and expectations for future quality of life.

Early research focused predominantly on the perception of pension risks among the general elderly population. However, with the expansion of the ecological migrant population, scholars have increasingly recognized that ecological migrants face pension risks that are significantly different from those faced by traditional groups. For instance, during the relocation process, ecological migrants often encounter challenges such as adapting to new social and cultural environments, insufficient policy support, and changes in their family structure. These factors contribute to the distinct characteristics of pension risk perception among ecological migrants (Bielawska & Kozłowski, 2024; Han et al., 2022; J. Li et al., 2020; Institute of Medicine, 2012; Miglino et al., 2023). In particular, regarding intergenerational economic support, although prior studies suggest that such support can alleviate pension risk perception among the general elderly, it remains unclear whether this mechanism functions similarly for ecological migrants and what specific pathways are involved. Systematic empirical investigations on this topic remain limited.

Existing research has primarily examined the mechanisms of intergenerational economic support within traditional family structures, particularly its role in mitigating pension risks (Olesen et al., 2012; Oswald & Rowles, 2017; Wang, 2017; Sun, 2023). However, studies on how intergenerational economic support influences the pension risks of ecological migrants remain relatively limited. In particular, insufficient attention has been paid to optimizing intergenerational support structures within ecological migrant populations. To address this gap, this paper systematically reviews the literature, summarizes the key findings regarding intergenerational economic support across different studies, identifies existing research gaps, and examines the complexities of pension risks among ecological migrants. Table 1 presents a summary of major empirical studies, emphasizing the impact of intergenerational economic support on pension risk perception, and critically evaluates their key findings and identified research gaps. This summary provides a reference point for future research on the relationship between intergenerational economic support and the pension risks of ecological migrants.

A review of the literature, along with the summary presented in Table 1, demonstrates that existing research on intergenerational economic support and pension risk perception has achieved some progress. However, significant gaps remain, particularly in relation to the unique context of ecological migrants, who constitute a distinct and underexamined population. These gaps can be classified into the following categories:

Current research on intergenerational economic support and the perception of pension risks has made notable progress, but there are still several gaps in regard to the specific case of ecological migrant population. Specifically, **(1)** existing studies tend to overlook economic vulnerability, individual heterogeneity, and the mediating role of life satisfaction in the relationship between intergenerational economic support and pension risk perception in ecological migrants. Ecological migrants face challenges such as income changes and social isolation during migration, which may reduce their life satisfaction and, in turn, exacerbate their perception of pension risks. **(2)** Existing research offers limited attention to the challenges related to family support and social integration within the context of ecological migration.

Table 1. Overview of existing literature

Research topic	Research findings and summary evaluation	Research gaps and critical analysis
The impact mechanism of economic factors and individual factors on pension risk perception	❶ Economic factors, such as income, savings, and pension benefits, are widely acknowledged as key determinants of perceived pension risk. Higher income levels and greater asset accumulation are associated with substantially lower perceived pension risks (Albertini et al., 2007; Bielawska & Kozłowski, 2024; Cameron et al., 2008; Han et al., 2022; J. Li et al., 2020; Institute of Medicine, 2012). ❷ Individual characteristics, such as mental health, education level, and gender, have also been highlighted for their influence on pension risk perception. Elderly individuals with higher education levels are more likely to plan their retirement resources effectively, while those with poorer mental health are more prone to perceiving higher pension risks (Coimbra et al., 2013; Olesen et al., 2012; Oswald & Rowles, 2017; Wang, 2017; Sun, 2023).	❶ Existing research focuses on the general elderly population, overlooking the economic instability of ecological migrants and the changes in income sources caused by relocation. ❷ The interaction between mental health and social support has been underestimated. The increased sense of isolation experienced by ecological migrants after relocation may exacerbate their pension risk perception, requiring further in-depth investigation into the combined effects of these factors.
The impact mechanism of family factors and social factors on pension risk perception	❶ Family size and intergenerational support play a significant role in alleviating pension risks. Larger family sizes provide elderly individuals with more caregivers; however, an increased family dependency ratio may, in turn, exacerbate pension risks (Akin & Leukhina, 2015; Antman, 2010; Clark Spengler, 1980; Zanker & Altrogge, 2017). ❷ Social integration, community governance, and public policy, such as pension systems and medical insurance, have been identified as critical factors in mitigating pension risks. In particular, social integration enhances older adults' psychological well-being and life satisfaction by expanding opportunities for social engagement and strengthening their sense of community belonging (Du, 2023; Gruber & Wise, 2007; Cremer et al., 2008).	❶ Existing research is based on the assumption of traditional family models and has not thoroughly explored the weakening of social support networks in ecological migrant families caused by geographic separation. ❷ The regional disparities and effectiveness of policy support have not been adequately considered. Current studies overlook the social and cultural adaptation challenges of ecological migrants and the accessibility of policies to this population.

End of Table 1

Research topic	Research findings and summary evaluation	Research gaps and critical analysis
Intergenerational economic support significantly reduces pension risk perception	The first category of representative viewpoints suggests that intergenerational economic support can significantly reduce pension risk perception, which can be further divided into two subcategories of perspectives, as follows: ❶ One perspective argues that intergenerational economic support, through financial assistance and emotional support provided by children, significantly reduces pension risk perception. The direct effect of intergenerational economic support is reflected in addressing daily expenses and medical costs, while emotional support indirectly alleviates pension risks by reducing feelings of loneliness (Huang et al., 2024; Manyeli & Thabane, 2023; Yuanfeng & Xu, 2024). ❷ Another perspective suggests that while intergenerational economic support can play a role, its effects are limited and uncertain. For instance, in economically disadvantaged families, the role of intergenerational economic support tends to be more prominent; however, its effectiveness may be constrained by children's limited financial resources and evolving family structures (Aboderin, 2017; Tur-Sinai & Lewin-Epstein, 2020).	❶ Current research on the role of intergenerational support in ecological migrant families is relatively limited and has not sufficiently addressed the changes in intergenerational support patterns caused by family relocation and their long-term impacts. ❷ Existing studies primarily focus on economic support, while the importance of emotional support in the context of ecological migration has not been thoroughly explored. In particular, the increased sense of social isolation during the relocation process may make emotional support especially critical in alleviating pension risks.
The complexity and variability of intergenerational economic support	The second category of representative viewpoints suggests that the impact of intergenerational economic support on elderly pension risk perception is characterized by complexity and variability. This can be further divided into different perspectives: ❶ One perspective argues that the effectiveness of intergenerational economic support is significantly influenced by multiple factors, such as family structure (e.g., nuclear families vs. extended families), cultural background, and socioeconomic status (Carvalho, 2012; Isengard et al., 2020; Preoteasa et al., 2018). ❷ Another perspective highlights the importance of examining how policy interventions and institutional design can optimize the structure and functioning of intergenerational economic support, thereby more effectively mitigating perceived pension risks among older adults (Abruquah et al., 2019; Björklund & Jäntti et al., 2020).	❶ Existing research has not systematically explored the interaction between cultural adaptation and intergenerational support mechanisms within ecological migrant groups, thereby neglecting the regional heterogeneity in the effectiveness of such support under relocation conditions. ❷ Current policy recommendations often adopt a one-size-fits-all approach, which fails to adequately reflect the diverse needs for intergenerational support among ecological migrant families and overlooks issues related to policy adaptability. Moving forward, more targeted and customized policy measures should be formulated, taking into account the specific socio-economic backgrounds and support dynamics of different ecological migrants.

Migration may alter the familial support structures of ecological migrants and disrupt their social ties with origin communities, thereby influencing their perception and coping abilities regarding pension risks. **(3)** The complexity and long-term dynamics of intergenerational economic support have not been adequately explored. In particular, as economic pressures on ecological migrants increase post-migration, the sustainability of intergenerational economic support and its impact on pension risks warrant more systematic examination. **(4)** Existing policy frameworks are often overly generalized and fail to respond effectively to the specific needs and cultural contexts of ecological migrants.

In summary, existing research provides important references for this study. However, relatively few studies have directly examined the relationship between intergenerational economic support and perceived pension risks of ecological migrants, and existing findings remain inconclusive. Most existing studies focus on the perceived pension risks of the general elderly population, with relatively limited research on the pension risks of ecological migrants. Additionally, existing research often emphasizes the economic and social factors influencing pension risks while insufficiently exploring the specific mechanisms and impacts of intergenerational economic support. Studies have not fully considered the complex interactions between the familial and societal levels and their comprehensive impact on perceived pension risks. In particular, further research is warranted to investigate how intergenerational economic support can be more effectively leveraged to mitigate pension risks of ecological migrants, taking into account China's distinctive socio-cultural context and economic realities.

To further examine the relationship between intergenerational economic support and perceived pension risks of ecological migrants, this study systematically investigates the underlying mechanisms through which such support influences pension risk perception, drawing on insights from the existing literature. In addition, it examines how the effects of intergenerational economic support vary across different familial and social contexts. Based on the findings of this study, specific policy recommendations are proposed to effectively mitigate the perceived pension risks of ecological migrants, providing strategies and solutions for better pension security.

2.2. Research hypotheses

2.2.1. Hypothesis on the relationship between intergenerational economic support and the pension risk perception of ecological migrants

Most scholars believe that intergenerational economic support helps reduce pension risk. Through empirical analysis, Abruquah et al. (2019) found that urban retired elderly individuals in China rely primarily on economic support and emotional comfort from their adult children to navigate their later years. Through empirical analysis, S. Li and Zhang (2022) discovered that the more economic support, caregiving help, and emotional care that elderly people receive from their children, the more pension resources they have, the greater their confidence in pension security, and thus, the lower their perception of pension risk. This finding also holds true for ecological migrants. Intergenerational economic support from children is a vital safeguard for meeting the basic living and medical needs of elderly ecological migrants, significantly enhancing their living standards and health, and thus ensuring their quality of life in old age and reducing their pension risk. On the basis of the analysis above, the following hypothesis is proposed:

H1: *The greater the intergenerational economic support received by ecological migrants is, the lower their perception of pension risk; conversely, the lesser the intergenerational economic support is, the greater their perception of pension risk.*

2.2.2. Hypothesis on the relationship between family environment factors and the pension risk perception of ecological migrants

The family environment is crucial for elderly care, serving as the core source of caregiving services and an important micro-system for individual eldercare. It plays a key role in mitigating pension risks (Fujisaki, 2013; Shu et al., 2021). Elderly ecological migrants mainly obtain resources to counteract pension risk through their families, thus increasing their pension security. Many scholars believe that internal family relationships, family income, and family savings significantly impact pension risk perception, although their studies are typically based on traditional single-level empirical analyses. For instance, Yu (2018) reported that family relationships, family size, and family savings significantly affect pension risk. Xiong and Yu (2019) argued that family size, family income, and family savings significantly affect the perception of pension risk. Specifically, the more savings a family has, the higher the income level, and the larger the family size, the lower the perceived pension risk of elderly individuals.

The same applies to ecological migrants. Family income, family savings, family size, and family relationships significantly affect the pension risk of ecological migrants. Specifically, ecological migrants with a higher family income, more savings, better family relationships, and larger family sizes tend to have a lower perception of pension risk. Hence, the following hypothesis is proposed:

H2: *Family environment factors have a significant effect on the perceived pension risks of ecological migrants. Specifically, ecological migrants with a higher family income, more savings, larger family sizes, and better family relationships perceive lower pension risks. Conversely, those with a lower family income, less savings, smaller family sizes, and poorer family relationships perceive higher pension risks.*

2.2.3. Hypothesis on the relationship between community environment factors and the pension risk perception of ecological migrants

Community environment resources, which serve as the external environment for elderly care, can be viewed as the supply of pension resources and services (Tomioka et al., 2017). For ecological migrants, whether their community provides necessary services for pension care is closely related to their pension risk, with factors such as community economic development, transportation convenience, and neighbourhood relationships potentially impacting pension risk. For example, through a logistic regression model, Yue (2006) discovered that the better the economic conditions of the community are, the less worried farmers are about pension risks. Conversely, the poorer the community's neighbourhood relationships are, the higher the perceived level of pension risks. Through ordinal logistic regression analysis, Xiong and Yu (2019) discovered that the community environment, transportation, and social relations are significant factors affecting pension risk.

The same applies to ecological migrants. Community identity, transportation convenience, neighbourhood relationships, and the economic status of the community have significant impacts on the pension risks of ecological migrants. Ecological migrants who hold leadership

positions (e.g., village cadres or community managers), maintain stronger neighborhood ties, experience better transportation access, and reside in economically developed communities tend to report lower levels of perceived pension risk. Conversely, those with poorer community conditions perceive higher pension risks. Based on the analysis above, the following hypothesis is proposed:

H3: *Community characteristics significantly influence the pension risk perception of ecological migrants; Specifically, those with leadership roles in the community, better transportation, stronger neighbourhood relationships, and better economic conditions perceive lower pension risk; conversely, those without have a higher pension risk perception.*

2.2.4. Hypothesis on the relationship between individual characteristic factors and the pension risk perception of ecological migrants

Most scholars agree that factors such as gender, age, marital status, education level, and health status significantly influence pension risk perception (Bhan et al., 2017). For example, Yu (2018) noted that factors such as gender, age, marital status, health status, ethnicity, and education level significantly influence the perception of pension risks among elderly people. Specifically, elderly individuals with better health and higher education levels tend to have lower pension risks. In contrast, unmarried, Han, and male elderly individuals generally exhibit lower perceptions of pension risks (Yu, 2018). Using empirical analysis, S. Li and Zhang (2022) found that age, annual income, and self-assessed health are significant variables influencing the perception of pension risks. There is a negative correlation between age and the perception of pension risks, and the better the level of self-assessed health is, the lower the perceived risks among rural elderly people (J. Li et al., 2022). This conclusion also applies to ecological migrant groups. These findings also extend to ecological migrant populations. Studies have shown that ecological migrants with higher levels of education, older age, better health, urban household registration, marital status, Han ethnicity, and male gender tend to report lower levels of perceived pension risk. Conversely, the absence of these characteristics is associated with elevated perceptions of pension risk. Based on the above theoretical analysis, the following hypothesis is proposed:

H4: *Individual characteristics significantly influence the perceived pension risks of ecological migrants. Specifically, ecological migrants with higher levels of education, better health status, and older age tend to report lower levels of perceived pension risk. Similarly, those who are Han, possess urban household registration, are unmarried, or are male also tend to perceive lower pension risks. Conversely, ecological migrants who lack these characteristics are more likely to perceive higher levels of pension risk.*

2.2.5. Hypothesis on the mediating role of life satisfaction in the relationship between intergenerational economic support and the pension risk perception of ecological migrants

From the previous hypotheses, it is evident that ecological migrants' perceptions of pension risk are shaped not only by their available pension resources but also by the intergenerational economic support that they receive. Intergenerational economic support serves not only as a critical means of meeting the basic living and healthcare needs of elderly ecological

migrants, but also enhances their living standards, improves health outcomes, and increases life satisfaction, thereby reducing perceived pension risks (Ciobanu et al., 2017; Gorry et al., 2018). Therefore, this paper posits that the impact of intergenerational economic support on the perceived pension risks of ecological migrants is mediated by life satisfaction. In other words, intergenerational economic support influences the perceived pension risks of ecological migrants through life satisfaction as an intermediary variable. On this basis, the following hypothesis is proposed:

H5: *Intergenerational economic support has a positive effect on the pension risk perception of ecological migrants through life satisfaction as a mediating variable.*

In this study, intergenerational economic support is the core explanatory variable; family environment factors, community environment factors, and individual characteristic factors are control variables; perceived pension risks are the dependent variable; and life satisfaction is the mediating variable. The research model is constructed to explore the relationships among these variables: intergenerational economic support; family environment factors, community environment factors, and individual characteristic factors as explanatory variables; perceived pension risks as the dependent variable; and life satisfaction as the mediating variable. The specific model is illustrated in Figure 2.

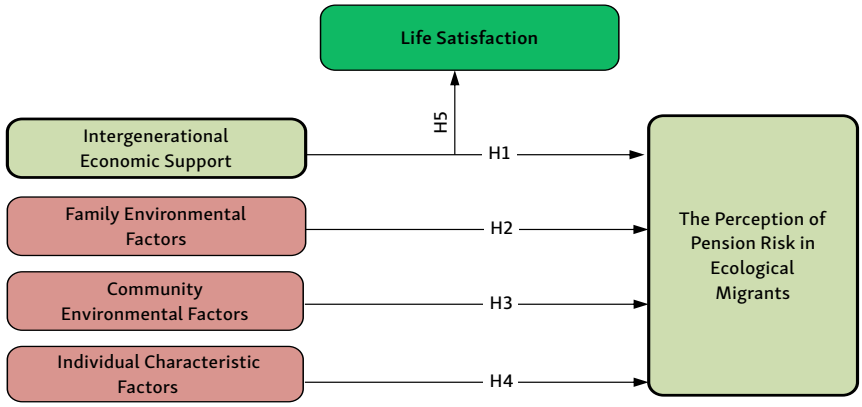

Figure 2. Research model

3. Materials and methods

3.1. Study area

Our study area is located in the Upper Yangtze River region of China, which encompasses 60% of the area of the Yangtze River Basin. It mainly includes Chongqing, Yunnan Province, Guizhou Province, and Sichuan Province (see Figure 3). The Upper Yangtze River region is a core area for ecological environmental protection in China, serving a crucial role as an ecological barrier. To alleviate the pressure of the population on the ecological environment, the region has implemented large-scale ecological resettlement programmes aimed at reducing environmental stress in ecologically fragile areas through population relocation, thus effectively protecting the ecosystem of the Yangtze River Basin.

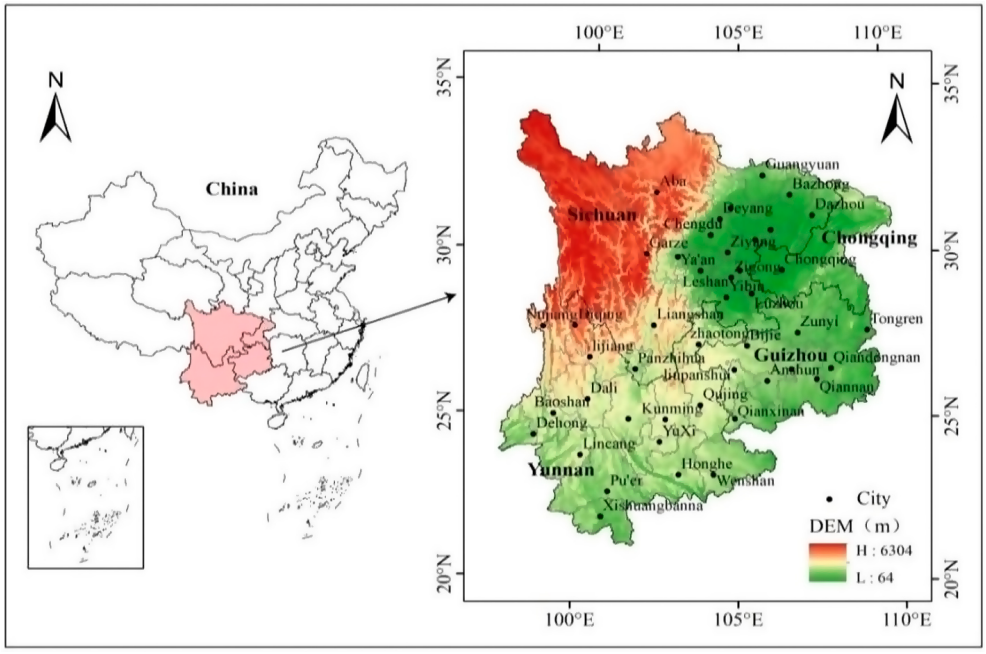

Figure 3. Study area location

At present, the ecological migrant population in the Upper Yangtze River region exceeds 5 million, and it is primarily concentrated in the mountainous areas of Sichuan, Chongqing, Yunnan, and Guizhou, particularly in regions with vulnerable ecological environments. Among these relocated ecological migrants, individuals aged 60 and above account for more than 12%, which is significantly higher than the internationally recognized threshold for an "ageing society". This Figure 3 highlights the ageing trend within the ecological migrant population in this region (specific causes have been described in the introduction). From this analysis, it is evident that the Upper Yangtze River region is not only a focal area for ecological migration but also a representative and typical site for studying the pension risks of ecological migrants, holding unique academic research value. As a significant example of ecological migration in China, the experiences of the Upper Yangtze River region not only are highly relevant domestically but also provide valuable insights for addressing global challenges related to ecological protection, population migration, and ageing.

3.2. Data source

To comprehensively assess the pension status of ecological migrants in China, the author led a research team to conduct field surveys between July 2021 and November 2024 in provinces and municipalities along the upper Yangtze River-specifically Sichuan, Guizhou, Yunnan, and Chongqing-where ecological migrants are highly concentrated. Initially, the team conducted a preliminary survey with 200 ecological migrants; then, on the basis of the preliminary survey results and consultations with relevant experts, the survey questionnaire was revised

and finalized after multiple adjustments. The researchers subsequently received intensive training. To ensure representativeness, 8 to 10 typical towns were randomly selected based on variations in local economic development. A total of 1,970 ecological migrants were randomly sampled from these locations. A mixed-methods approach combining structured questionnaires and semi-structured interviews was employed to investigate pension status, perceived risks, coping strategies, individual characteristics, and security conditions of ecological migrants. The data collection for the questionnaire survey was primarily conducted through field surveys, with a small portion of the questionnaires administered electronically. A total of 1,970 questionnaires were distributed, and after invalid questionnaires were excluded, 1,915 valid questionnaires were confirmed, resulting in a response rate of 97.21%.

3.3. Variable selection

Referencing the studies of scholars such as Yu (2017), Xiong and Yu (2019), Hu and Wen (2020), and on the basis of the current pension status of ecological migrants and consultations with relevant experts, the dependent variable selected was pension risk perception, which includes three dimensions: economic security risk perception, caregiving risk perception, and emotional comfort risk perception. The core explanatory variable is intergenerational economic support, and the control variables include individual characteristics, family characteristics, and community characteristics, all of which are detailed as follows:

3.3.1. Dependent variable

The dependent variable is the perception of pension risks. Following the research of S. Li and Zhang (2022), pension risks are divided into three dimensions: economic security risk perception, caregiving risk perception, and emotional comfort risk perception. Each dimension includes three measurement items, with the following scoring: very worried = 5, quite worried = 4, neutral = 3, slightly worried = 2, and not worried at all = 1 (see Table 2, See Table A2 in Appendix for more details). The specific scores for the dimensions of economic security risk perception, caregiving risk perception, and emotional comfort risk perception are calculated by summing the scores of the individual items within each dimension. The score ranges from 3 to 15 for each dimension, and the higher the score is, the higher the level of pension risk perception among ecological migrants.

3.3.2. Core explanatory variable

The core explanatory variable in this paper is intergenerational economic support. Following studies such as Preoteasa et al. (2018) and Marquez (2019), intergenerational economic support is measured by whether children have provided their elderly ecological migrant parents with monetary support. The specific measurement item is as follows: In the past year, have your children/grandchildren given you money? The specific assignment is as follows: yes = 1, no = 0.

3.3.3. Control variables

Based on existing literature (Olesen et al., 2012; Oswald & Rowles, 2017; Wang, 2017; Sun, 2023), the control variables in this paper are categorized into three levels: (1) Individual

Table 2. Measurement items for pension risk perception variables

Variable	Item	Value assignment
Economic security risk perception	**1.** I am very worried about not having an economic source in old age.	very worried = 5, quite worried = 4, neutral = 3, slightly worried = 2, and not worried at all = 1
	2. I am very worried about not having money to go to the hospital when I am old.	very worried = 5, quite worried = 4, neutral = 3, slightly worried = 2, and not worried at all = 1
	3. I am very worried that my children will not provide me with living expenses when I am old.	very worried = 5, quite worried = 4, neutral = 3, slightly worried = 2, and not worried at all = 1
Caregiving risk perception	**4.** I am very worried that no one will take care of me when I get sick in old age.	very worried = 5, quite worried = 4, neutral = 3, slightly worried = 2, and not worried at all = 1
	5. I am very worried that no one will help me with household chores in old age.	very worried = 5, quite worried = 4, neutral = 3, slightly worried = 2, and not worried at all = 1
	6. I am very worried that no one will take care of my affairs after I pass away.	very worried = 5, quite worried = 4, neutral = 3, slightly worried = 2, and not worried at all = 1
Emotional comfort risk perception	**7**. I am worried that my children will not be willing to listen to my heartfelt words in old age.	very worried = 5, quite worried = 4, neutral = 3, slightly worried = 2, and not worried at all = 1
	8. I am very worried that no one will accompany me to chat and relieve boredom in old age.	very worried = 5, quite worried = 4, neutral = 3, slightly worried = 2, and not worried at all = 1
	9. I am worried that I will become increasingly estranged from others in old age.	very worried = 5, quite worried = 4, neutral = 3, slightly worried = 2, and not worried at all = 1

characteristics, including age, gender, ethnicity, household registration status, marital status, health status, and educational level; (2) family characteristics, including family income, family savings, family size, and family relationships; (3) community characteristics, including community status, the community economy, community transportation, neighbourhood relationship, and community elderly care facilities.

These three types of control variables are selected in this study with the purpose of comprehensively examining the multidimensional factors that influence the pension risk perception of ecological migrants. The specific reasons are as follows: individual-level variables (e.g., age, gender, and health status) directly reflect the personal living conditions of ecological migrants and their perceptions of pension risks; family environment-level variables (e.g., household income, family savings, and family relationships) reveal the role of family support systems in mitigating pension risks; and community environment-level variables (e.g., community identity, community economic conditions, and transportation convenience) reflect the influence of community resources and social support on ecological migrants' pension risk perceptions. By controlling for these variables, it is possible to effectively reduce biases caused by omitted variables, thus ensuring an accurate evaluation of the impact of intergenerational economic support on the pension risk perception of ecological migrants.

3.3.4. Instrumental variable

Previous analyses suggest that ecological migrants may prefer to rely on intergenerational economic support from their children, which could reduce their pension risk perception or potentially lead to intergenerational conflicts, adversely affecting the reduction in pension risk perception among ecological migrants. This could result in biased estimates in ordinary regression models. Therefore, this paper introduces an instrumental variable in the ordinary regression model to overcome the potential endogeneity problems caused by intergenerational economic support. The selection of the instrumental variable should meet two criteria: first, the instrumental variable should be highly correlated with the endogenous variable; second, the instrumental variable must be uncorrelated with the disturbance term (error term), meaning that it should not be affected by unobserved variables in the model. Following Oliveira (2016) and Zheng and Zheng (2017), this study chooses the number of children as the instrumental variable. The reason is that, influenced by the traditional concepts of " more children bring more happiness" and "raising children for security in old age," the pension issues of elderly ecological migrants are closely linked to the number of children. Families with more children have a higher probability and greater amount of support, suggesting a positive correlation between the number of children and intergenerational economic support.

3.3.5. Mediating variable

Following prior studies such as Qu (2016), Tur-Sinai and Spivak (2021) and Wu (2022), life satisfaction is selected as the mediating variable. The measurement item is as follows: Overall, are you satisfied with your current life? The assignment is as follows: very dissatisfied = 1, somewhat dissatisfied = 2, neutral = 3, somewhat satisfied = 4, and very satisfied = 5. The variables involved in this study are detailed in Table 3 (See Appendix for the detailed items of this scale).

Table 3. Descriptive statistical analysis of variables

Variable type	Variable	Definition and value assignment
Core explanatory variable	Intergenerational economic support	In the past year, have your children/grandchildren given you any money? Yes = 1, No = 0.
Individual characteristic variables	Age	Measured by the actual age of the respondent.
	Gender	Female = 0, Male = 1.
	Ethnicity	Ethnic minority = 0, Han ethnicity = 1.
	Household Registration status	Rural household registration = 0, Urban household registration = 1.
	Marital status	Married = 1, Unmarried (including single, divorced, widowed) = 0.
	Health condition	Rated from 1 to 5, where 1 = very poor and 5 = very good. The higher the score, the better the health condition. Values are: Very poor = 1, Quite poor = 2, Average = 3, Quite good = 4, Very good = 5.
	Education level	Primary school and below = 1, Junior high school = 2, High school or vocational school = 3, Junior college = 4, Bachelor degree and above = 5.

End of Table 3

Variable type	Variable	Definition and value assignment
Family environment variables	Family income	Measured by the actual income of the respondent's family.
	Family savings	Measured by the actual savings of the respondent's family.
	Family size	Measured by the actual size of the respondent's family.
	Family relationship	Rated from 1 to 5, where 1 = very poor and 5 = very good. The higher the score, the better the family relationship. Values are: Very poor = 1, Quite poor = 2, Average = 3, Quite good = 4, Very good = 5.
Community environment variables	Community identity	Village cadres, doctors, teachers, managers, etc. = 1, General public = 0.
	Community economy	Rated from 1 to 5, where 1 = very poor and 5 = very good. The higher the score, the better the family relationship. Values are: Very poor = 1, Quite poor = 2, Average = 3, Quite good = 4, Very good = 5.
	Community transportation	Rated from 1 to 5, where 1 = very inconvenient and 5 = very convenient. The higher the score, the more convenient the community transportation. Values are: Very inconvenient = 1, Not very convenient = 2, Average = 3, Quite convenient = 4, Very convenient = 5.
	Neighbourhood relationship	Rated from 1 to 5, where 1 = very poor and 5 = very good. The higher the score, the better the neighbourhood relationship. The values are as follows: Very poor = 1, Quite poor = 2, Average = 3, Quite good = 4, Very good = 5.
	Community elderly care institution	Does your community/village have an elderly care institution? Yes = 1, No = 0.
Instrumental variable	Number of children	Measured by the number of children the respondent has.
Mediating variable	Life satisfaction	Rated from 1 to 5, where 1 = very dissatisfied and 5 = very satisfied. The higher the score, the greater the life satisfaction. Values are: Very dissatisfied = 1, Quite dissatisfied = 2, Average = 3, Quite satisfied = 4, Very satisfied = 5
Robustness variable	Medical service condition	Rated from 1 to 5, where 1 = very dissatisfied and 5 = very satisfied. The higher the score, the better the medical service level. Values are: Very dissatisfied = 1, Quite dissatisfied = 2, Neural = 3, Quite satisfied = 4, Very satisfied = 5.
	Community nursing service	Does your area have community nursing services? Yes = 1, No = 0.
	Community elderly care service	Does your area have community elderly care services? Yes = 1, No = 0.

3.4. Model construction

3.4.1. Construction of the baseline model

Drawing on prior literature (e.g., Wei & Yu, 2019), the dependent variable in this paper is pension risk perception, which includes three dimensions: economic security risk perception, caregiving risk perception, and emotional comfort risk perception. This paper employs a multiple linear regression model. The empirical model examining the factors influencing perceived pension risk among ecological migrants is specified as follows:

$$esrisk_i = \alpha_0 + \alpha_1 ies_i + \alpha_2 icv_i + \alpha_3 fev_i + \alpha_4 cev_i + \alpha_i; \quad (1)$$

$$lcrisk_i = \beta_0 + \beta_1 ies_i + \beta_2 icv_i + \beta_3 fev_i + \beta_4 cev_i + \beta_i; \quad (2)$$

$$scrisk_i = u_0 + u_1 ies_i + u_2 icv_i + u_3 fev_i + u_4 cev_i + \theta_i. \quad (3)$$

In Equations (1)–(3), $esrisk_i$, $lcrisk_i$, and $scrisk_i$ represent the ecological migrant's perception of economic security risk perception, caregiving risk perception, and emotional comfort risk perception, respectively. The core explanatory variable is ies_i, which represents intergenerational economic support. The control variables icv_i, cev_i, and fev_i represent individual characteristic factors, community environment factors and family environment factors, respectively. α_1–α_4, β_1–β_4, and u_1–u_4 represent the estimated coefficients of the explanatory variables, while α_1, β_i, and θ_i are the random error terms.

To mitigate the impact of sample selection bias and potential endogeneity issues in the model on the empirical results, referring to the research methods of Ma et al. (2022) and Tiatité (2023), this paper employs the Propensity Score Matching (PSM) method to construct a counterfactual framework for the impact of children's intergenerational economic support on the pension risk perception of ecological migrants. This method is used to perform a robustness check and correction of the benchmark regression results. The core idea of the propensity score matching method is to establish experimental and control groups. Through a diversified matching of the variables between the two groups, the average treatment effect on the samples is obtained, and the robustness of the regression results is examined. The specific Equation is as follows:

$$\begin{aligned} &ATT = E\left[\left(Y_{1k} - Y_{0k}\right) | D_k = 1\right] = \\ &E\left\{\left[\left(Y_{1k} - Y_{0k}\right) | D_k = 1\right], P\left(X_k\right)\right\} = \\ &E\left\{E\left[Y_{1k} | D_k = 1, P\left(X_k\right)\right] - E\left[Y_{0k} | D_k = 0, P\left(X_k\right)\right] D_k\right\} = 1 = \\ &\frac{1}{N_k} \sum k : D_k \left(Y_k - \hat{Y}_{0k}\right). \end{aligned} \quad (4)$$

3.4.2. Construction of the mediation model

The construction of the mediation model is as follows: the independent variable (*X*) influences the dependent variable (*Y*). If independent variable *X* influences dependent variable *Y* through variable M, then M is a mediating variable. In other words, the impact of independent variable *X* on dependent variable *Y* is realized through mediating variable *M*. The process of using statistical analysis methods to study whether the impact of independent variable *X* on dependent variable *Y* can be explained by mediating variable *M* and to what extent is called mediating effect analysis. In recent years, the method of mediating effect analysis has been applied in various disciplines, such as economics and management, promoting the development of research in these fields (Caselli et al., 2021; He et al., 2022; Le et al., 2024). This study employs the regression testing method to examine the mediating effect of life satisfaction

on the relationship between intergenerational economic support and the perceived pension risks of ecological migrants. The following three regression equations were established to verify the mediating effect of life satisfaction:

$$esrisk_i = c_0 + c_1 ies_i + c_2 icv_i + c_3 fev_i + c_4 cev_i + e_i; \quad (5)$$

$$M_i = a_0 + a_1 ies_i + a_2 icv_i + a_3 fev_i + a_4 cev_i + e_i; \quad (6)$$

$$esrisk_i = c_0' + c_1' ies_i + bM_i + c_2' icv_i + c_3' fev_i + c_4' cev_i + e_i. \quad (7)$$

In Eq. (5), the dependent variable is $esrisk_i$, the core explanatory variable is ies_i, and c_1 is the regression coefficient for the core explanatory variable ies_i. The control variables are icv_i, fev_i, and cev_i, with c_2, c_3, and c_4 being the regression coefficients, respectively. e_i is the regression residual for Equation (4). In Eq. (6), the mediating variable is M_i, the core explanatory variable is ies_i, and the control variables are ies_i, icv_i, cev_i, and fev_i, where a_1 is the regression coefficient for the core explanatory variable ies_i and a_2, a_3, and a_4 are the regression coefficients for the control variables, respectively. e_i is the regression residual for Eq. (5). In Eq. (7), icv_i, cev_i, and fev_i are the control variables, c_1' is the regression coefficient for the core explanatory variable ies_i, b is the regression coefficient for the mediating variable M_i, and c_2', c_3', and c_4' are the regression coefficients for the control variables, with e_i being the regression residual for the regression Equation.

4. Results and analysis

The primary objective of this study is to examine the mechanism by which intergenerational economic support influences the pension risk perception of ecological migrants. The empirical strategy employed in this study comprises the following steps. First, the results of the benchmark regression model were estimated. Second, a robustness analysis was conducted using both Propensity Score Matching (PSM) and an omitted variable bias test. Third, the number of children was used as an instrumental variable to address potential endogeneity concerns. Finally, a mechanism analysis was conducted to examine the mediating role of life satisfaction (see Figure 4).

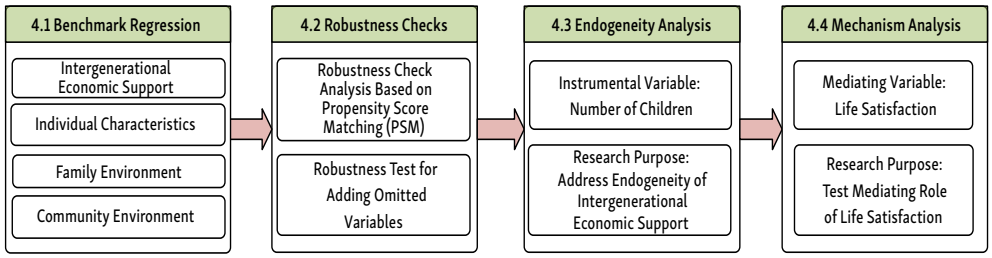

Figure 4. Testing methods used in results and analysis

4.1. Benchmark regression analysis

To avoid potential multicollinearity issues when there are numerous independent variables and to more clearly reflect the differences in the impacts of independent variables at different levels on the pension risks of ecological migrants, this study employs a linear regression method, as shown in Table 4.

Table 4. Linear regression results of factors influencing elderly migrants' pension risk perception

Variable type	Variable name	(1)	(2)	(3)
Core explanatory variable	Intergenerational economic support	–1.715*** (0.123)	–1.421*** (0.117)	–1.199*** (0.112)
Individual characteristic variables	Age	–0.002 (0.008)	–0.001 (0.008)	–0.001 (0.007)
	Gender	–0.464** (0.142)	–0.280** (0.134)	–0.215* (0.126)
	Ethnicity	0.083 (0.126)	–0.019 (0.117)	0.087 (0.109)
	Household registration status	–0.987*** (0.137)	–1.156*** (0.129)	–0.998*** (0.120)
	Marital status	1.438*** (0.125)	1.232*** (0.117)	1.028*** (0.110)
	Health condition	–0.688*** (0.055)	–0.465*** (0.055)	–0.296** (0.053)
	Education level	–0.596*** (0.054)	–0.342** (0.052)	–0.237** (0.050)
Family environment variables	Family income		–0.662*** (0.086)	–0.495*** (0.081)
	Family savings		–0.798*** (0.066)	–0.488*** (0.064)
	Family size		–0.252** (0.044)	–0.172** (0.042)
	Family relationship		–0.150** (0.050)	–0.122** (0.047)
Community environment variables	Community identity			–0.186 (0.119)
	Community economy			–0.127* (0.050)
	Community transportation			–0.211** (0.051)
	Neighbourhood relationship			–0.364*** (0.046)
	Community elderly care institution			–1.686** (0.120)
F-value		136.154***	130.558***	124.437***
R^2		0.664	0.652	0.627
Adjusted R^2		0.661	0.648	0.623

Note: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. The values in parentheses represent standard errors.

4.1.1. Intergenerational economic support

Column (1) shows that intergenerational economic support has a significant negative effect on the pension risk perception of ecological migrants (β = –1.715, $P < 0.01$). This result indicates that intergenerational economic support significantly reduces the pension risks of ecological migrants, supporting H1. Possible explanations are as follows:

First, after relocation, ecological migrants often lose access to traditional means of production (such as land) and stable economic resources, making their economic adaptability weaker, especially under the pressure of living expenses and medical costs. Financial support from children directly provides ecological migrants with a stable economic resource, alleviating their difficulties related to basic living and medical security and thus significantly reducing economic security risks.

Second, intergenerational economic support is not only material assistance but also a reflection of familial responsibility. This support strengthens the emotional connection between ecological migrants and their family members while reducing their sense of social isolation. Through close interactions with their children, ecological migrants are better able to access community resources and social support (such as pension services and medical security), further mitigating the risks associated with caregiving and improving their quality of life.

This explanation suggests that in ecological migrant resettlement areas, emphasis should be placed on fostering a favourable environment for intergenerational support. Efforts should be made to ensure employment opportunities and family support networks for the children of ecological migrants, thus reducing pension risks for elderly ecological migrants.

4.1.2. Individual characteristic variables

(1) Gender. Column (1) shows that gender has a significant negative effect on the pension risks of ecological migrants (β = –0.464, $P < 0.05$). This result indicates that female ecological migrants face higher pension risks than their male counterparts do. Several factors may contribute to this outcome: in old age, female migrants often face greater economic pressures. Older women are more likely than men to experience economic insecurity, inadequate health protection, and social isolation when dealing with pension issues, thus increasing their concerns about pension risks. Therefore, it is essential to strengthen social security and community support systems for female ecological migrants to enhance their post-relocation living conditions and access to pension-related resources.

(2) Marital status. Column (1) shows that marital status has a significant positive effect on the pension risks of ecological migrants (β = 1.438, $P < 0.01$). This result indicates that compared with unmarried individuals, married ecological migrants face higher pension risks. This phenomenon may be attributed to the dual burden faced by married elderly ecological migrants after relocation. On the one hand, they need to care for their spouses, which increases both the financial and emotional pressures within the family. On the other hand, married individuals may rely more strongly on family support, but their adaptability to the relocated environment is relatively poor, resulting in weaker social support networks and limited access to community resources. This combined pressure contributes to the elevated pension risks among married ecological migrants. Therefore, it is recommended that resettlement areas offer more targeted services for married elderly ecological migrants,

including couple-oriented community activities, psychological counseling, and enhanced medical support, to help alleviate their pension burdens.

(3) Health status. Column (1) shows that health status has a significant negative effect on the pension risks of ecological migrants (β = –0.688, P < 0.01). This result indicates that healthier ecological migrants face lower pension risks. A possible explanation is that healthy elderly ecological migrants tend to have greater self-care capacity and lower medical demand, thereby reducing their dependence on pension-related services. Furthermore, they are more capable of participating in community activities and building new social networks after relocation, alleviating loneliness and psychological stress, which significantly lowers their pension risks. In resettlement areas, the role of health status in mitigating pension risks is particularly prominent, which suggests that strengthening health management services, providing regular health monitoring, and ensuring medical support are essential measures to reduce pension risks among ecological migrants.

4) Household registration status. Compared to ecological migrants with rural household registration, those with urban registration face lower levels of perceived pension risk. One possible explanation is that elderly ecological migrants with urban household registration typically enjoy better access to social security and healthcare services, thereby reducing their pension risks. In contrast, elderly ecological migrants with a rural household registration may lack these advantages, leading to higher pension risks. Therefore, the type of household registration plays a crucial role in influencing pension security for ecological migrants, particularly in the adaptation process after relocation. Migrants with a rural household registration face more pronounced disadvantages in accessing pension resources. To address this issue, it is recommended to optimize the allocation of pension resources in rural resettlement areas, expand the coverage of pension and social security services, and enhance targeted support for elderly ecological migrants with rural household registration.

(5) Education level. Column (1) shows that education level has a significant negative effect on the pension risks of ecological migrants (β = –0.596, P < 0.01). This result indicates that ecological migrants with higher education levels face significantly lower pension risks. The reason may be that better-educated elderly ecological migrants are more capable of accessing and understanding information and resources related to pensions, such as social security policies, community services, and health management knowledge, enabling them to better plan for and address pension-related issues. Additionally, they tend to have stronger social adaptation and communication skills, allowing them to quickly build social support networks in new environments, thus reducing feelings of loneliness and insecurity and significantly lowering their pension risks. This highlights the importance of providing targeted support for less-educated groups in resettlement areas. Strengthening information dissemination and skill training can enhance the ability of less-educated migrants to access resources and integrate into communities, thereby reducing their pension risks.

(6) Age and ethnicity. Column (1) shows that age and ethnicity do not have a significant effect on the pension risks of ecological migrants (β = –0.002, P > 0.10; β = 0.083, P > 0.10). This result indicates that the relationships between these variables and pension risks are not

statistically significant. Possible explanations include the following: the age distribution of elderly ecological migrants in the sample is relatively concentrated, with minimal variation within the group, which makes the impact of age on pension risks less significant. Additionally, pension risks are more influenced by comprehensive factors such as health status, economic income, and social support, whereas the independent effect of age as a single variable is weak. With respect to ethnicity, the gradual convergence of lifestyles among different ethnic groups during the resettlement process may weaken the influence of ethnic characteristics. Moreover, inclusive resettlement policies may have provided relatively equal support to all ethnic groups, resulting in ethnicity having no significant effect on pension risks.

4.1.3. Family characteristic variables

(1) Family income. Column (2) shows that household income has a significant negative effect on the pension risk of ecological migrants (β = –0.662, $P < 0.01$). This finding suggests that higher household income is significantly associated with lower levels of perceived pension risk. Higher income provides sufficient financial security for elderly ecological migrants, enabling them to cover medical expenses, living costs, and caregiving fees. Additionally, increased household income enhances financial stability, alleviating the psychological burden caused by economic pressure and thus further reducing pension risks. In the context of ecological migration, household income is particularly critical for mitigating the economic adaptation challenges faced by elderly migrants after relocation, and it plays a vital role in ensuring their pension security.

(2) Family savings. Column (2) shows that household savings have a significant negative effect on the pension risks of ecological migrants (β = –0.798, $P < 0.01$). This result indicates that an increase in household savings can significantly reduce pension risks. Household savings provide elderly ecological migrants with sufficient economic security to cover various pension-related expenses while enhancing their financial sense of security and reducing anxiety caused by economic instability. In resettlement areas after relocation, the protective role of savings is particularly prominent, as it not only provides financial support for families but also enhances the safety and quality of life for elderly migrants in an environment with greater uncertainties. Therefore, household savings play an important role in reducing pension risks among ecological migrants.

(3) Family size. Column (2) clearly shows that family size has a significant negative effect on the pension risks of ecological migrants (β = –0.252, $P < 0.05$). This result indicates that an increase in the number of family members can effectively reduce pension risks for elderly ecological migrants. The reason may be that larger families can alleviate economic pressure through resource sharing among members and provide elderly migrants with more emotional support and daily care. Furthermore, collaboration among multiple family members may increase total household income, improving overall quality of life and further reducing pension risks for elderly individuals. In the context of ecological migration, the protective role of family size is especially significant, particularly in resettlement areas where resources are scarce or social support is insufficient. The cooperative capacity of large families is critical for alleviating pension-related pressures.

(4) Family relationship. Column (2) shows that family relationships have a significant negative effect on the pension risks of ecological migrants (β = –0.150, $P < 0.05$). This result indicates that harmonious family relationships can effectively reduce pension risks for elderly ecological migrants. The reason may be that positive family relationships not only provide emotional support and psychological comfort to elderly migrants, reducing feelings of loneliness and insecurity, but also lessen life pressures and economic burdens through mutual care and financial assistance among family members. In resettlement areas after relocation, harmonious family relationships effectively compensate for the disadvantages caused by insufficient external resources, offering significant protection for the pension security of elderly ecological migrants. Therefore, fostering harmonious family relationships should be an essential strategy for reducing pension risks among ecological migrants.

4.1.4. Community characteristic variables

(1) Community transportation. Column (3) shows that community transportation has a significant negative effect on the pension risks of ecological migrants (β = –0.211, $P < 0.05$). This finding suggests that well-developed community transportation can effectively mitigate perceived pension risks among ecological migrants. In the context of relocation, ecological migrants rely heavily on transportation for daily travel and access to services. Specifically, on the one hand, convenient transportation improves mobility, encouraging greater participation in community activities and social interactions, which helps alleviate loneliness. On the other hand, good transportation conditions make it easier for ecological migrants to access medical and living services, meeting their health needs promptly and significantly reducing pension risks. This suggests that enhancing transportation infrastructure and improving travel conditions in resettlement areas are crucial for reducing pension risks for ecological migrants.

(2) Neighbourhood relationship. Neighbourhood relationship exert a significant negative effect on the perceived pension risks of ecological migrants (β = –0.364, $p < 0.01$). This result indicates that good neighbourhood relationships can effectively lower pension risks. The reason may be that relocated ecological migrants, especially elderly individuals, often face the challenge of disrupted social networks in their new environment. Harmonious neighbourhood relationship provide emotional support and daily assistance to elderly migrants, helping alleviate loneliness and insecurity. Additionally, such ties facilitate elderly migrants' integration into the community, enhance their social participation, improve their overall quality of life, and further reduce perceived pension risks.

(3) Community elderly care institution. Community elderly care institutions have a significant negative effect on the pension risks of ecological migrants (β = –1.686, $P < 0.05$). This result indicates that these institutions can effectively lower pension risks. Possible explanations include the fact that community elderly care institutions provide professional care and services, alleviating pressure related to daily living and health concerns, thereby enhancing the quality of life of ecological migrants. Furthermore, these institutions organize social and community activities, offering opportunities for elderly individuals to expand their social support networks, which helps mitigate the loneliness and insecurity caused by insufficient social integration after relocation, further reducing pension risks. Therefore, establishing community

elderly care institutions in resettlement areas is highly important for reducing pension risks for elderly ecological migrants.

(4) Community identity. Community identity does not have a significant effect on the pension risks of ecological migrants (β = –0.186, $P > 0.10$). This result indicates, that, statistically, the identity of ecological migrants within the community does not significantly influence their pension risks. Possible explanations include the following: On the one hand, the pension risks of ecological migrants may be more strongly influenced by other factors, such as economic status, health conditions, or social support, making the influence of community identity relatively minor. On the other hand, this result may also suggest that in some resettlement areas, there is no significant difference in resource access or pension services between ecological migrants and other residents; thereby diminishing the potential impact of community identity on pension risks.

(5) Community economy. The community economy has a significant negative effect on the pension risks of ecological migrants (β = –0.127, $P < 0.10$). One possible explanation is that more developed community economies offer better access to public services and infrastructure-such as healthcare and eldercare facilities-which improve living conditions for ecological migrants and help reduce risks associated with aging and retirement. Moreover, a thriving community economy provides better employment opportunities, enabling ecological migrants and their family members to increase their income and thus alleviating financial pressure and further lowering pension risks. This highlights that improving the economic level of resettlement communities is a key strategy for reducing pension risks among ecological migrants.

4.2. Robustness analysis

4.2.1. Robustness test based on PSM

(1) Common support test. Initially, this study utilized the logit model to estimate the propensity scores of intergenerational economic support. To ensure the rationality and effectiveness of the PSM estimation, a common support hypothesis test was conducted. Figure 5 presents the kernel density distribution of the propensity scores after matching. As shown in Figure 5, after PSM, the kernel density functions of the propensity scores for the treatment and control groups are relatively close. Most sample propensity scores fall within the region of common support, indicating that the matching quality is high and the estimation results are credible.

(2) Balance test. The research results above indicate that intergenerational economic support helps reduce the pension risks of ecological migrants. However, due to limitations in data and variable limitations, the observed effect may be subject to self-selection bias. This means that intergenerational economic support may not satisfy the conditions of random sampling. Additionally, directly regressing these variables could lead to selection bias in the estimation results due to non-random sampling. Therefore, to reduce the impact of sample selection bias and potential endogeneity issues on the empirical results, this study employs the Propensity Score Matching (*PSM*) method to construct a counterfactual framework for the effect of intergenerational economic support on the pension risks of ecological migrants. This approach is used to conduct robustness checks and correct the regression results mentioned above.

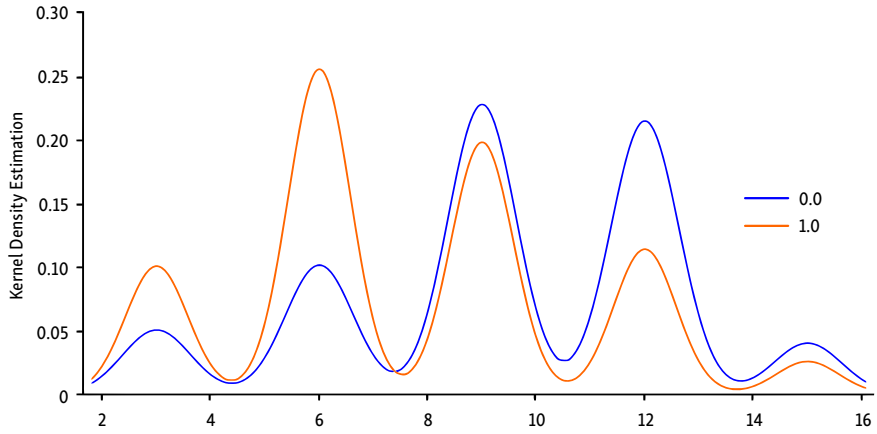

Figure 5. Kernel density plot after propensity score matching

The idea behind constructing a counterfactual framework using PSM is to divide the sample into a "treatment group" and a "control group". First, propensity scores for the samples are calculated based on covariates, commonly using the logit regression method. Second, samples from the treatment and control groups are matched according to their propensity scores. Common matching methods include nearest neighbour matching, radius matching, and kernel matching. Finally, PSM is used to perform a balance test on the two groups to ensure that, apart from the treatment indicator variable, there are no systematic differences in other explanatory variables between the two groups. This method effectively reduces sample selection bias, thereby improving the accuracy and credibility of the empirical findings. In this study, the sample of migrants receiving intergenerational economic support is considered the treatment group, whereas the sample of migrants not receiving such support is considered the control group. Propensity score matching is conducted using the nearest neighbour matching (k = 1). The balance test results of the variables obtained are presented in Table 5.

As shown in Table 5, before matching the samples, the absolute values of the standardized bias for all variables, except age, were greater than 5%, with most of them being significant at the 5% level. After sample matching, the P values for most variables were greater than 0.05, indicating that there were no significant differences in these covariates between the experimental and control groups. Furthermore, the results of most t tests did not reject the null hypothesis of no systematic differences between the experimental and control groups (except for age and ethnicity). After matching, the standardized biases for most variables were significantly reduced, and the systematic differences for most control variables were not significant. This result suggests that the matching process effectively balanced the data and that PSM successfully reduced the systematic differences between the two groups, meeting the requirements of a randomized experiment.

(3) Estimation of average treatment effect. Based on the quality check of matching and the common support test, new treatment and control groups were obtained using the Propensity Score Matching (*PSM*) method. These two groups represent the same ecological migrants under two different conditions: whether they receive intergenerational economic support

Table 5. Balance test results

Variables	Status	Treatment group	Control group	Standardized bias (%)	Reduction in standardized bias (%)	T-Value	P-Value
Ethnicity	Before matching	0.653	0.707	–11.62%	23.71%	–2.488	0.013
	after matching	0.653	0.695	–8.86%		–1.600	0.010
Household registration	Before matching	0.531	0.727	–41.48%	42.83%	–8.955	0.000
	after matching	0.531	0.647	–13.71%		–4.290	0.100
Gender	Before matching	0.590	0.650	–12.49%	50.93%	–2.671	0.008
	after matching	0.590	0.620	–6.13%		–1.101	0.271
Age	Before matching	23.582	23.259	1.16%	71.21%	0.248	0.804
	after matching	23.582	23.676	–0.34%		–0.060	0.952
Marital status	Before matching	0.632	0.655	–4.76%	88.02%	–1.016	0.060
	after matching	0.632	0.629	0.57%		0.102	0.919
Health condition	Before matching	2.639	2.579	4.87%	54.30%	–1.039	0.029
	after matching	2.639	2.611	2.23%		0.397	0.692
Education level	Before matching	2.085	1.884	16.33%	20.58%	–3.543	0.000
	after matching	2.085	1.912	9.78%		2.534	0.110
Family income	Before matching	1.090	0.895	27.06%	34.93%	–5.803	0.000
	after matching	1.090	0.977	9.71%		2.864	0.104
Family savings	Before matching	1.431	1.240	19.94%	14.10%	–4.255	0.000
	after matching	1.431	1.262	9.13%		3.039	0.102
Family size	Before matching	2.996	3.337	–26.42%	34.14%	–5.636	0.000
	after matching	2.996	3.226	9.40%		3.091	0.122
Family relationship	Before matching	3.953	3.798	9.49%	57.93%	–2.824	0.005
	after matching	3.953	3.889	5.68%		0.990	0.323
Community identity	Before matching	0.277	0.204	17.20%	18.98%	3.710	0.000
	after matching	0.277	0.215	9.45%		2.641	0.008
Community economy	Before matching	3.487	3.827	–33.77%	40.46%	–7.416	0.000
	after matching	3.487	3.695	9.11%		3.776	0.110
Community transportation	Before matching	2.662	2.247	40.70%	32.06%	–8.746	0.000
	after matching	2.662	2.364	6.28%		5.344	0.125
Neighbourhood relationship	Before matching	2.901	2.777	9.14%	–15.27%	–1.956	0.051
	after matching	2.901	2.758	10.54%		1.900	0.158
Community elderly care institution	Before matching	0.365	0.255	23.90%	22.16%	–5.151	0.000
	after matching	0.365	0.278	10.61%		3.388	0.101

Note: The t-value and p-value are related to the significance of the differences between the groups before and after matching.

from their children or not. Thus, it becomes theoretically feasible to estimate the impact of children's intergenerational economic support on the pension risk of ecological migrants. Table 6 presents the calculation results of the average treatment effect of children's intergenerational economic support on the pension risk of ecological migrants using different matching methods. The results estimated using three different matching methods are essentially consistent, indicating that the findings of this study are strongly robust.

Table 6. Multiple propensity score matching results

Variables	Matching method	Treatment group	Control group	ATT	Standard deviation	t-Value	p-Value
Pension risk perception	Nearest neighbor matching (1:1)	7.706	9.033	–1.327	0.135	–9.863	0.000
	Radius matching (caliper = 0.01)	7.706	9.015	–1.309	0.132	–9.942	0.000
	Radius matching (caliper = 0.20)	7.706	9.015	–1.309	0.132	–9.942	0.000

This paper further examines the average treatment effect on the treated (*ATT*) between the two groups of samples: those who have received intergenerational economic support and those who do not. Regardless of whether nearest neighbour matching or radius matching is used, the *ATT* results indicate that after eliminating or weakening the systematic differences between samples, ecological migrants who receive intergenerational economic support have a lower pension risk. Specifically, with respect to pension risk perception, the *ATT* values derived from all three matching methods pass the t-statistic test, which is consistent with the negative impact derived from the benchmark regression. This result suggests that intergenerational economic support helps reduce the pension risk of ecological migrants.

4.2.2. Robustness test incorporating omitted variables

Given the particularity of the ecological migrant group and the uncertainty of the socio-economic situation, there are many uncertainties in the factors affecting the pension risk of ecological migrants. Therefore, the benchmark regression model might have omitted variables. Based on the current situation of pension risk among the ecological migrant population in China, this paper selects three variables as control variables to reduce the error caused by omitted variables: community elderly care services, community nursing services, and medical service conditions. The selection of these three omitted variables is based on the following:

(1) Community elderly services can facilitate social interaction among ecological migrants, thereby promoting their physical and psychological well-being. These services also contribute to spiritual enrichment, which helps alleviate perceived pension risks. **(2)** Community services can meet the diverse and multi-level needs of elderly migrants and address the life care and long-term nursing problems of elderly people, empty nesters, solitary elderly people, and disabled elderly people, thereby promoting their physical and psychological health. **(3)** The availability and quality of medical services can significantly reduce the pension risks of ecological migrants. A well-developed medical care and insurance system ensures timely access to high-quality healthcare resources for elderly migrants. This, in turn, safeguards their health and reduces perceived pension risks.

Based on the analysis above, this paper adds three omitted variables to the original baseline model to further test the robustness of the model (see Table 7). The estimation results of models 5–8 in Table 7 show that community elderly care services, community nursing services, and medical service conditions have a significant negative effect on the pension risk perception of ecological migrants, indicating that these services help reduce the pension risk of ecological migrants. Moreover, intergenerational economic support has a significant negative

effect on the pension risk perception of ecological migrants, which is consistent with the negative effect derived from the benchmark regression. These findings confirm that incorporating the omitted variables enhances the robustness of the regression results.

Table 7. Robustness test results (Incorporating potential omitted variables)

Variable type	Variable name	(1)	(2)	(3)	(4)
Core explanatory variable	Intergenerational economic support	–0.107*** (0.019)	–0.079*** (0.019)	–0.038** (0.017)	–0.045*** (0.013)
Individual characteristic variables	Age	–0.001 (0.001)	–0.001 (0.001)	–0.001 (0.001)	–0.001 (0.001)
	Gender	–0.069** (0.022)	–0.060** (0.022)	–0.059** (0.019)	–0.06** (0.014)
	Ethnicity	–0.007 (0.019)	0.005 (0.019)	–0.014 (0.016)	0.006 (0.012)
	Household registration status	–0.031* (0.021)	–0.015* (0.021)	–0.051** (0.018)	–0.013* (0.014)
	Marital status	–0.203*** (0.019)	–0.182*** (0.019)	–0.138*** (0.016)	–0.101*** (0.012)
	Health condition	–0.089** (0.008)	–0.059** (0.009)	–0.025** (0.008)	–0.018** (0.006)
	Education level	–0.062** (0.008)	–0.033** (0.008)	–0.019** (0.007)	–0.005** (0.006)
Family environment variables	Family income		–0.095*** (0.014)	–0.067*** (0.012)	–0.049*** (0.009)
	Family savings		–0.086*** (0.011)	–0.020** (0.009)	–0.019** (0.007)
	Family size		–0.014** (0.007)	–0.03* (0.006)	–0.05* (0.005)
	Family relationship		0.003 (0.008)	–0.003 (0.007)	–0.02* (0.005)
Community environment variables	Community identity			–0.024 (0.018)	–0.028 (0.013)
	Community economy			–0.010* (0.007)	0.008 (0.006)
	Community transportation			0.033*** (0.008)	–0.019** (0.006)
	Neighbourhood relationship			0.041*** (0.007)	–0.039*** (0.005)
	Community elderly care institution			0.430*** (0.018)	–0.259*** (0.015)
Omitted variable	Medical service condition				–0.013** (0.005)
	Community nursing service				–0.335*** (0.014)
	Community elderly care service				–0.313*** (0.014)
F-value		66.873***	59.990***	96.151***	209.861***
R^2		0.619	0.575	0.563	0.689
Adjusted R^2		0.616	0.570	0.558	0.686

Note: ***, **, and * respectively indicate significance at the 1%, 5%, and 10% statistical level.

4.3. Endogeneity analysis

The endogeneity problem in the benchmark regression model may arise from two main aspects: omitted variable bias and reverse causality. Therefore, this study uses the instrumental variable (*IV*) method to address potential endogeneity problem. Following Oliveira (2016) and Zheng and Zheng (2017), this study selects the number of children as an instrumental variable to address the endogeneity problem in this research on the impact of intergenerational economic support on the perceived pension risks of ecological migrants. The primary reasons for this choice are as follows:

There is a strong correlation between the number of children and intergenerational economic support. In Chinese culture, the traditional belief that "the more children, the more blessings" suggests that families with more children tend to provide more intergenerational economic support to their parents. This means that parents with more children receive more economic support, emotional support, and daily care. The number of children satisfies the requirement of exogeneity. It is closely related to the endogenous variable (*intergenerational economic support*) and relatively independent of the perceived pension risks of ecological migrants. It does not directly affect the dependent variable, thus effectively solving the reverse causality problem and ensuring the accuracy and reliability of the estimation results. Based on the above analysis, this study chooses the number of children as an instrumental variable to mitigate endogeneity in estimating the effect of intergenerational economic support on the perceived pension risks of ecological migrants.

Following Wang and Li (2022), this study employs the two-stage least squares (*2SLS*) method to conduct endogeneity tests and analysis. The instrumental variable regression and test results presented in Table 8 indicate a significant positive correlation between the instrumental variable (*number of children*) and intergenerational economic support. This finding suggests that families with more children are more likely to provide higher levels of intergenerational economic support. A series of tests on the instrumental variable shows a strong correlation between the instrumental variable (*number of children*) and the endogenous variable

Table 8. Instrumental variable regression

Variables	(1)	(2)
	First stage	Second stage
	Intergenerational economic support	Pension risk perception
Intergenerational economic support		–0.132*** (0.021)
Number of children	0.036** (0.018)	
Control variables	Control	Control
F-Value	4.016***	40.779***
p-Value	0.020	0.021
R^2	0.552	0.621
Sample Size	1915	1915

Note: *** p < 0.01, ** p < 0.05, * p < 0.10.

(*intergenerational economic support*), satisfying the relevance condition for instrument validity. The second-stage regression coefficients reveal that the estimated coefficients for intergenerational economic support are significantly negative at the 1% level, as shown in Column (2). The analysis results indicate that after the instrumental variable (*number of children*) is included, intergenerational economic support continues to reduce the pension risk perception of ecological migrants. The analysis results above show that after the number of children is added as an instrumental variable, intergenerational economic support still effectively reduces the perceived pension risks of ecological migrants.

4.4. Mechanism analysis

This paper employs a stepwise testing method to examine the mediating role of life satisfaction (see Table 9). Specifically, as shown in Column (3), intergenerational economic support has a significant negative effect on the perceived pension risks of ecological migrants, demonstrating that intergenerational economic support is beneficial for reducing their pension risk perception ($\beta = -1.199$, $P < 0.01$). As shown in Column (2), intergenerational economic support for ecological migrants has a significant positive effect on life satisfaction, suggesting that such support helps improve ecological migrants' life satisfaction. As shown in Column (1), life satisfaction has a significant negative effect on the perceived pension risks of ecological migrants, indicating that life satisfaction plays a significant mediating role between intergenerational economic support and the pension risk perception of ecological migrants. According to the calculations, the proportion of the mediating effect in the total effect is (0.482 * 0.533)/1.199 = 0.2143, which implies that life satisfaction can explain 21.43% of the impact of intergenerational economic support on the pension risk perception of ecological migrants. From the analysis above, it is evident that for ecological migrants, receiving economic support from their children helps improve their economic conditions and enhances their life satisfaction, thus reducing their perceived pension risks. Hence, H5 is supported.

As a possible explanation, on the one hand, intergenerational economic support directly improves the economic situation of ecological migrants, providing security for their basic living needs and reducing their perceived pension risks from a material perspective; On the other hand, this intergenerational economic support further enhances the life satisfaction of elderly individuals, improving their psychological well-being and social adaptability and thus indirectly alleviating their perceived pension risks through the enhancement of their subjective well-being. This indicates that intergenerational economic support not only plays a direct role in economic improvement but also serves as an important mediator by increasing life satisfaction, which in turn reduces pension risks. Therefore, life satisfaction plays a significant mediating role in the relationship between intergenerational economic support and the perceived pension risks of ecological migrants, explaining how intergenerational economic support indirectly reduces pension risks by improving life satisfaction. This finding emphasizes the need to further optimize the family support environment at resettlement sites for ecological migrants, promote intergenerational interaction, and comprehensively reduce the pension risks of elderly ecological migrants through enhanced psychological care and social integration.

Table 9. Mediation effect test results of life satisfaction

Variables	Pension risk perception	Life satisfaction	Pension risk perception
	(1)	(2)	(3)
Intergenerational economic support		0.533***	–1.199*** (0.112)
Life satisfaction	–0.482*** (0.039)		
Age	0.001 (0.002)	0.002 (0.001)	0.000 (0.002)
Gender	–0.221* (0.125)	–0.054 (0.071)	–0.215* (0.126)
Ethnicity	0.151 (0.108)	0.046 (0.062)	0.088 (0.109)
Household registration status	–0.876*** (0.118)	–0.089 (0.068)	–0.999*** (0.120)
Marital status	0.999*** (0.109)	–0.053 (0.062)	1.028** (0.110)
Health condition	–0.182** (0.053)	0.248*** (0.030)	–0.296*** (0.053)
Education level	–0.188*** (0.049)	0.102*** (0.028)	–0.236*** (0.050)
Family income	–0.413*** (0.081)	0.281*** (0.046)	–0.495*** (0.081)
Family savings	–0.409** (0.064)	0.179** (0.036)	–0.487*** (0.064)
Family size	0.167*** (0.042)	–0.088** (0.024)	0.172** (0.042)
Family relationship	–.0122** (0.046)	0.043 (0.026)	–0.121** (0.046)
Community identity	–.0339** (0.117)	–0.160** (0.067)	–0.186 (0.119)
Community economy	–0.114** (0.049)	0.047* (0.028)	–0.027* (0.050)
Community transportation	–0.233*** (0.050)	0.096** (0.029)	–0.211*** (0.051)
Neighbourhood relationship	–0.273*** (0.046)	0.152** (0.026)	–0.364*** (0.046)
Community elderly care institution	–1.587*** (0.120)	0.438*** (0.068)	–1.687** (0.120)
F-Value	128.603***	60.082***	124.433**
R^2	0.636	0.550	0.647
Adjusted R^2	0.631	0.546	0.643

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

5. Discussion

The empirical analysis results of this paper indicate that intergenerational economic support can effectively reduce the perceived pension risks of ecological migrants. This conclusion remains valid in the robustness tests, thus supporting H1. The results suggest that intergenerational economic support alleviates perceived pension risks through various channels, including financial assistance, strengthened social networks, and emotional support. The findings of this study are consistent with those of Abruquah et al. (2019) and S. Li and Zhang (2022). Additionally, this study utilizes field survey data to conduct a detailed analysis of the impact of intergenerational economic support on ecological migrants' perceived pension risks and its underlying mechanisms. This approach overcomes the limitations of previous research, and an instrumental variable method is employed to address the endogeneity problem, thereby ensuring the accuracy and reliability of the result of this study.

In complex socio-economic environments, intergenerational economic support requires well-designed processes and mechanisms to effectively reduce the pension risks perceived by ecological migrants. This study explores the mechanisms through which intergenerational economic support influences ecological migrants' perceptions of pension risks and verifies the mediating effect of life satisfaction. This perspective is innovative and provides a new direction for research on the pension risks faced by ecological migrants. The mechanism analysis reveals that life satisfaction plays a significant mediating role in the relationship between intergenerational economic support and ecological migrants' pension risk perceptions, thus supporting H5. This result suggests that improving the life satisfaction of ecological migrants is a key approach to reducing their perceived pension risks. This finding emphasizes that enhancing the psychological well-being and satisfaction of ecological migrants is also an effective means of mitigating pension risks, which aligns with the conclusions of scholars such as Gorry et al. (2018). Therefore, when designing pension security policies, policy-makers should focus on improving the life satisfaction of ecological migrants. This objective can be achieved through measures such as improving social services, offering psychological counselling, and organizing recreational activities, thereby effectively reducing their pension risks. This recommendation aligns closely with the empirical findings of Tur-Sinai and Spivak (2021).

This study suggests that intergenerational economic support can be applied to pension security for ecological migrants in China and other countries. However, its implementation should take into account cross-national variations in family structures, cultural traditions, ecological migrant characteristics, social security systems, and environmental protection policies. Specifically, the following dimensions warrant careful attention: **(1)** Cultural differences. Cultural backgrounds profoundly influence family roles, pension concepts, and intergenerational relationships. In some countries, pension provision relies more heavily on familial support than on formal social security systems. Therefore, when promoting intergenerational economic support, local cultural traditions must be carefully considered to enhance policy acceptance and effectiveness. **(2)** Differences in the characteristics of ecological migrants. Ecological migrants in different countries face distinct challenges and require flexible pension security policies to meet their diverse needs. **(3)** Differences in social security systems. In many developing countries, social security systems are underdeveloped, making intergenerational

economic support particularly crucial in pension provision. When promoting the Chinese experience, it is necessary to focus on how to supplement and improve relevant policies while also compensating for institutional deficiencies through family support.

This study has two areas for improvement: **(1)** Limitation in the sample scope. This study focuses on ecological migrants in China, which offers a certain degree of representativeness. However, owing to China's specific socio-economic context, the generalizability of the findings may be limited. Future research could expand the sample scope by including ecological migrants from more countries and regions, conducting cross-regional and cross-cultural comparative studies to validate the applicability of the conclusions, and exploring the unique and common aspects of pension risks faced by ecological migrants in different contexts. **(2)** Need for expansion of the research variables. In examining the perceived pension risks of ecological migrants, this study primarily relies on a limited set of variables. Although these variables were selected based on authoritative studies and China's current situation, future research may enhance these variables and measurement instruments through approaches such as structured surveys, in-depth interviews, and expert consultations, thereby improving their applicability and validity.

6. Conclusions

Drawing on survey data from 1,915 ecological migrants in China, this study systematically investigates the impact of intergenerational economic support on ecological migrants' perceptions of pension risk, analyzes the underlying mechanisms of this influence, and examines the mediating role of life satisfaction within this relationship. The principal findings of the study are summarized as follows:

6.1. Main findings

The findings can be summarized as follows: **(1)** Intergenerational economic support has a significant negative effect on ecological migrants' pension risk perception, and enhancing such support effectively alleviates their concerns about pension risks, thus confirming H1. To ensure the scientific rigor and validity of the conclusions, the study employed the PSM method and instrumental variables to overcome endogeneity issues. **(2)** Empirical analysis indicates that the family environment, community environment, and individual characteristics significantly influence ecological migrants' pension risk perception, confirming H2, H3, and H4. Furthermore, the study reveals that intergenerational economic support mitigates pension risk perceptions by enhancing life satisfaction, thereby validating H5. **(3)** These findings provide new theoretical insights for optimizing pension security policies for ecological migrants while highlighting the instrumental role of intergenerational economic support and life satisfaction in mitigating the pension risk perception of ecological migrants.

6.2. Main contributions

(1) Existing studies on pension risks have focused predominantly on the general ageing population, whereas the pension risks of ecological migrants remain under explored in

research. This study extends the theoretical and practical perspectives in this domain by employing a novel empirical investigation of ecological migrants aged 60 and above. **(2)** This paper reveals the pension risk issues faced by ecological migrants during relocation, and it systematically analyses the complex interplay of factors, including resource allocation, household heterogeneity, economic pressures, challenges related to socio-cultural adaptation, and intergenerational economic support, thereby highlighting the emerging vulnerabilities of ecological migrant groups in achieving pension security. **(3)** By investigating the impact of intergenerational economic support on ecological migrants' perception of pension risks, this study further expands the empirical focus on the mechanisms of intergenerational economic support in special groups and provides valuable insights and lessons for other developing countries facing similar challenges.

6.3. Practical recommendations and managerial implications

6.3.1. Practical recommendations

Based on the analysis above, the findings of this study provide significant guidance for the pension security policy for ecological migrants in China. To effectively reduce ecological migrants' pension risk perception, policy interventions across multiple dimensions are needed. The specific recommendations are as follows:

(1) Strengthening the intergenerational economic support system for ecological migrants. This study shows that intergenerational economic support, particularly economic support from children, which plays a key role in alleviating pension risk perception, has a significant negative effect on ecological migrants' pension risk perception. Therefore, policies should strengthen the construction of the intergenerational economic support system, for instance, by providing tax incentives or subsidy policies to encourage the younger generation to support elderly ecological migrants, thus promoting family harmony. Special policy attention should be given to ecological migrants who are female, married, possess lower educational attainment, or come from rural households, as these subgroups are more vulnerable to pension insecurity and are especially reliant on intergenerational economic support.

(2) Optimizing the social security system and family support policies. This study indicates that family income, savings, and the harmony of family relationships directly influence pension risk perception. Therefore, policy interventions should strengthen family-oriented support systems, such as enhancing pension benefits, unemployment insurance, and health insurance, especially in poverty-stricken rural areas. Additionally, subsidies and educational rewards for children can be provided to low-income families to improve family economic levels and cohesion, thereby reducing pension risk perception.

(3) Improving the community environment and enhancing the quality of life of ecological migrants. This study shows that community transportation, economic conditions, and neighbourhood relationships have a significant effect on ecological migrants' pension risk perception. Accordingly, policy efforts should prioritize improving the community environment in ecological migrant resettlement areas, with particular emphasis on infrastruc-

ture development and public service provision. In communities characterized by inadequate transportation and underdeveloped economies, targeted measures – such as infrastructure enhancement, job creation, and healthcare improvement – should be implemented to elevate the quality of life of ecological migrants, strengthen community cohesion, and mitigate perceived pension risks.

(4) Enhancing life satisfaction and mental health support for ecological migrants. This study finds that life satisfaction plays a significant mediating role in the relationship between intergenerational economic support and pension risk perception among ecological migrants. Therefore, policies should focus on improving the overall life satisfaction of ecological migrants, especially by expanding mental health services and providing psychological counselling, social activities, and cultural entertainment facilities to improve their psychological well-being. Additionally, the government should further improve living conditions and build a more comprehensive social support network to strengthen social ties among ecological migrants, thereby enhancing life satisfaction and effectively reducing pension risk perception.

6.3.2. Managerial implications

This study provides policy recommendations for addressing the pension risk perception of ecological migrants in China and offers valuable insights for other countries and regions facing similar challenges. The specific policy implications are as follows:

(1) Enhancing economic security for ecological migrants from multiple dimensions. Drawing on China's experience, developing countries should prioritize the establishment and improvement of intergenerational economic support mechanisms within ecological migrant communities. Empirical research indicates that intergenerational economic support significantly alleviates pension risk perception, especially in countries with high poverty rates and weak social security systems. It is recommended that the governments in these countries strengthen intergenerational economic support for ecological migrants and, while enhancing social welfare, adopt policies similar to China's "dual-track system of pensions and family support", encouraging family members to provide economic support for ecological migrants.

(2) Strengthening community governance and optimizing the pension service environment. Community infrastructure and economic conditions directly impact ecological migrants' pension risk perception. China's experience demonstrates that improvements in transportation, employment opportunities, and neighbourhood relationships can effectively reduce pension risk perception. Other countries can enhance the cohesion of migrant communities and improve the quality of life of ecological migrants by promoting local economic development, improving infrastructure, and providing more employment opportunities, thus reducing pension risk perception.

(3) Promoting cross-national experience exchange and international cooperation. Pension risks for ecological migrants are a global challenge, particularly for developing countries facing similar issues. China can strengthen its cooperation with other countries to share successful experiences in managing pension risks for ecological migrants. By holding cross-national seminars, field visits, and other collaborative activities, countries can learn from each

other in terms of ecological migration governance and collectively reduce the pension risks faced by ecological migrants worldwide.

(4) Improving social security systems and welfare support. The social security system is at the core of pension risk governance for ecological migrants. China's experience shows that improving life satisfaction can significantly reduce pension risk perception. Developing countries should expand social security coverage for ecological migrants and increase the accessibility of medical, pension, and unemployment benefits, particularly in rural and remote areas. By offering affordable healthcare services, mental health counselling, and improved living conditions, governments can enhance ecological migrants' sense of security and overall well-being, thereby mitigating their perceived pension risks.

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Author contributions

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APPENDIX

Survey questionnaire on the current status of ecological migration and elderly care in the upper Yangtze River Region of China

Questionnaire Number: Questionnaire Review: 1. Qualified 2. Invalid Reviewer: _____
Investigator A: _____ Investigator B: _____ Province (City): _____
County (District) _____ Town (Village) _____;
Survey Date: _____ Year _____ Month _____ Day; Start Time: _____ Hour _____ Minute;
End Time: Hour _____ Minute

Dear Respected Migrant,

Hello! We are members of the "Ecological Migration Research" project team. For research purposes, we kindly ask you to take a few moments to answer some questions. Please check the answers that best match your personal situation. This survey is anonymous, and the results will only be used for research purposes. Your personal information will never be disclosed. We greatly appreciate your participation and support!

Sincerely,

Ecological Migration Research Project Team

Table A1. Your basic information (single choice)

Question Number	Content	Options
A1	Your age?	_____ years
A2	Your gender?	(1) Male (2) Female
A3	Your ethnicity?	(1) Han (2) Ethnic Minority
A4	Your household registration?	(1) Urban Household (2) Rural Household
A5	Your marital status?	(1) Single (2) Married (3) Divorced (4) Widowed
A6	Your health status?	(1) Very poor (2) Poor (3) Average (4) Good (5) Very good
A7	Your education level?	(1) Primary school or below (2) Junior high school (3) High school or vocational school (4) College (5) Bachelor's degree or above
A8	Which province do you live in?	(1) Chongqing (2) Sichuan (3) Guizhou (4) Yunnan (5) Other provinces
A9	When did you relocate?	_____ year
A10	Where is your home located?	(1) Completely rural (2) Suburban town (3) Small city outskirts (4) Medium city outskirts (5) Large city outskirts
A11	How far is your child's home from yours?	(1) In the same village/community (2) Within the same county/city (3) Outside the same county/city

End of Table A1

Question Number	Content	Options
A12	Have you received government support?	(1) Yes (2) No
A13	Does your household receive minimum living standard support?	(1) Yes (2) No
A14	Do you have health insurance?	(1) Yes (2) No
A15	Have you received government subsidies?	(1) Yes (2) No

Table A2. Current status of pension risks among ecological migrants and its influencing factors (single choice)

Question number	Content	Options
B1	I am very worried about not having an economic source in old age.	(1) very worried (2) quite worried (3) neutral (4) slightly worried (5) not worried at all
B2	I am very worried about not having money to go to the hospital when I am old.	(1) very worried (2) quite worried (3) neutral (4) slightly worried (5) not worried at all
B3	I am very worried that my children will not provide me with living expenses when I am old.	(1) very worried (2) quite worried (3) neutral (4) slightly worried (5) not worried at all
B4	I am very worried that no one will take care of me when I get sick in old age.	(1) very worried (2) quite worried (3) neutral (4) slightly worried (5) not worried at all
B5	I am very worried that no one will help me with household chores in old age.	(1) very worried (2) quite worried (3) neutral (4) slightly worried (5) not worried at all
B6	I am very worried that no one will take care of my affairs after I pass away.	(1) very worried (2) quite worried (3) neutral (4) slightly worried (5) not worried at all
B7	I am worried that my children will not be willing to listen to my heartfelt words in old age.	(1) very worried (2) quite worried (3) neutral (4) slightly worried (5) not worried at all
B8	I am very worried that no one will accompany me to chat and relieve boredom in old age.	(1) very worried (2) quite worried (3) neutral (4) slightly worried (5) not worried at all
B9	I am worried that I will become increasingly estranged from others in old age.	(1) very worried (2) quite worried (3) neutral (4) slightly worried (5) not worried at all
B10	In the past year, have your children/ grandchildren given you any money?	(1) No (2) Yes, if your children gave you money, how much did they give you in the past year? ____
B11	What is your household's annual income?	_____ ten thousand yuan, per capita net income _____ ten thousand yuan/year (2020)

End of Table A2

Question number	Content	Options
B12	How much savings do you have in your household?	( ) ten thousand yuan
B13	How many people are in your household?	( ) people
B14	How is your relationship with your family?	(1) Very poor (2) Poor (3) Average (4) Good (5) Very good
B15	What is your occupation in the village/community?	(1) Village cadre (2) Doctor (3) Teacher (4) Manager (5) General public
B16	What is the economic situation in your community?	(1) Very poor (2) Quite poor (3) Average (4) Quite wealthy (5) Very wealthy
B17	How convenient is the transportation in your community?	(1) Very inconvenient (2) Quite inconvenient (3) Average (4) Quite convenient (5) Very convenient
B18	How is your relationship with your neighbors?	(1) Very poor (2) Quite poor (3) Average (4) Quite good (5) Very good
B19	Does your community/village have any pension institutions?	(1) Yes (2) No
B20	How many children do you have?	( ) children
B21	Are you satisfied with your current life?	(1) Very satisfied (2) Quite satisfied (3) Average (4) Quite dissatisfied (5) Very dissatisfied
B22	Are you satisfied with the medical services in your area?	(1) Very satisfied (2) Quite satisfied (3) Average (4) Quite dissatisfied (5) Very dissatisfied
B23	Does your area have community nursing services?	(1) Yes (2) No
B24	Does your area have community pension services?	(1) Yes (2) No
B25	The shortest distance from your residence to a large shopping mall:	_____ meters, by car _____ minutes