

Research on the Characteristics of Population Flow in Yanbian State Influenced by Policy Environment Based on Non-parametric Tests

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Abstract. Focusing on the Yanbian State, this paper applies non-parametric tests to analyze the impact of the policy environment on the characteristics of population flow. It not only focuses on policy factors directly related to population flow, such as the household registration system and cross-border management measures, but also deeply explores indirect influencing factors such as public service and tax policies. The study shows that the household registration system and cross-border management measures significantly affect the purpose of population flow related to employment and business, but have no significant effect on the other purposes and the frequency of flow. The effects of public service and tax policies on frequency and purpose are also insignificant, indicating that although policy factors have a significant role in guiding population flow in specific aspects, there are differences in the overall effects. This paper provides empirical evidence for optimizing the policy environment and promoting rational regional flow. This paper aims to systematically analyze the phenomenon of population mobility in the Yanbian region through the policy environment, reveal its internal laws and action mechanisms, provide theoretical support for promoting the modernization of border governance, and offer scientific basis and decision-making references for policy optimization, regional coordinated development, and social harmony and stability in the Yanbian region and even other border areas.

Keywords: Characteristics of Population Flow, Non-parametric Tests, Yanbian State.

1. Introduction

The Yanbian State occupies an important position in the regional development of Northeast Asia in China, and its phenomenon of population flow has a profound impact on regional development. At present, many scholars have conducted in-depth research on the impact of population flow and policy environment. Duan Chenggong [1] et al. explored the impact and mechanism of population flow on population security in border areas; Han Songyu [2] analyzed the problem of population over shrinkage in Yanbian State; and Li Meihua [3] et al. researched the population flow of ethnic minorities and the dilemma of social governance in border areas. At present, relevant research in this field mainly focuses on separate investigations of population structure changes, economic development status, health levels, etc., in the Yanbian State. It has not yet effectively conducted a comprehensive analysis of the specific impacts of the policy environment on the population flow characteristics in Yanbian State, nor has it carried out a systematic analysis of how the policy environment affects population mobility phenomena in the region. And the policy environment, as one of the key factors affecting population flow, has a crucial role in the characteristics of population flow in Yanbian flow [4]. This paper focuses on Yanbian State and explores the specific influence of policy environment on the characteristics of population flow by empirical analysis. The study selects four core policy factors, namely household registration system, cross-border management, public service and tax policy, and utilizes non-parametric tests to conduct a systematic study by referring to the literature of predecessors and combining questionnaire data. Specifically, this paper aims to explore how different policy affect the main purpose of population flow, whether the policy environment plays a significant role in the frequency, and the synergistic effect and optimization path among policies. The results of the study will provide theoretical support and decision-making basis for the rational guidance and policy optimization of population flow in Yanbian State. The results of

the study will effectively conduct a comprehensive analysis of the specific impacts of the policy environment on the population mobility characteristics in Yanbian State, and carry out a systematic analysis of the policy environment and population mobility phenomena in Yanbian State, providing theoretical support and decision-making basis for the rational guidance and policy optimization of population flow in Yanbian State.

2. Non-parametric tests on the policy environment affecting population flow in Yanbian State

The non-parametric tests method is a statistical analysis method that does not rely on the hypothesis of the overall distribution, and is suitable for the situation where the sample size is small or the overall distribution is unknown. This paper mainly applies the Kruskal-Wallis's test statistic to analyze the relationship between different policy factors and the characteristics of population flow. The research data originated from the questionnaire survey, a total of 260 questionnaires were distributed, and 213 valid questionnaires were recovered, and the questionnaires as a whole were tested by the reliability and validity test, and the results were good (the reliability coefficient of the scales was 0.873, meanwhile, the KMO value was 0.970), to ensure that the data are reliable and valid, covering basic information of residents, characteristics of population flow and evaluation of policy environment.

It may be hypothesized that the policy environment (e.g., lowering the threshold for household registration, simplifying household registration relocation procedures, providing employment and entrepreneurship support, etc.) can significantly affect the scale, direction and speed of population movements, including the hukou system, cross-border management, public services, and tax policies [5]. The Kruskal-Wallis H-test was used because the data for the dichotomous variables purposes such as employment and doing business showed non-normal distribution by the Shapiro-Wilk test ($W=0.89$, $p<0.05$), and the samples of the policy groups in the household registration system 11 groups and the cross-border management 10 groups were independent.

2.1. Household registration system and the purpose of flow

Table 1. Results of non-parametric tests of household registration system and purpose of flow
($p<0.05$ ** $p<0.01$)

Household registration system (median)	employment	business	study abroad	family reunion	improvement of living conditions
1.0	0.000	1.000	1.000	0.000	0.000
1.5	1.000	0.500	0.500	1.000	0.000
2.0	1.000	0.000	1.000	0.000	0.500
2.5	0.000	1.000	1.000	0.000	0.000
3.0	0.000	1.000	1.000	0.000	0.000
3.5	0.000	1.000	1.000	1.000	0.000
4.0	0.000	1.000	0.500	1.000	0.000
4.5	0.000	0.500	1.000	0.500	0.000
Kruskal-Wallis test statistic H-value	10.912	11.421	1.983	0.387	4.386
p	0.028*	0.022*	0.739	0.984	0.356

Based on the data in Table 1 above, the effect of household registration system on the main purpose of flow was analyzed using the Kruskal-Wallis test statistic, which showed that the H-value of employment was 10.912 with a p-value of 0.028* ($p<0.05$), while the H-value of doing business was 11.421 with a p-value of 0.022* ($p<0.05$), and studying abroad, family reunion, improvement of living conditions have p-values greater than 0.05, so there is a significant difference between the samples of different household registration systems in terms of the main purpose of flow (employment and business), while there is no significant difference in terms of studying abroad, family reunion, improvement of living conditions and others.

(1) Comparison of the medians has significant differences in the main purpose of flow (employment) among the samples with different household registration systems.

Groups with medians of 1.5 and 2.0 indicate that respondents in these groups are more likely to have employment as the main purpose of flow in contrast, groups with a median of 2.5 and above indicate that respondents in these groups are less inclined to have employment as the primary purpose of flow.

The household registration system significantly affects the choice of employment among the main purposes of flow. For instance, a median of 1.0 for certain household registration system groups indicates that respondents in these groups are more likely to choose employment as the main purpose of flow. This may be due to the fact that these household registration systems offer better employment opportunities, career development platforms, or related benefits, attracting more people to move for the sake of employment. On the contrary, groups with a median of 2.5 may imply that respondents under these household registration systems are less inclined to move for employment, possibly due to a saturated local job market, limited distribution of industries or a lack of suitable job opportunities.

For the household group with a higher median, it is possible to learn more about the advantages of its employment policies, such as whether it provides employment training, vocational guidance or entrepreneurial support, and to generalize these successful experiences to other regions. As for the lower median group, an in-depth analysis of the factors hindering employment mobility, such as the existence of industry entry barriers, asymmetric employment information or labor market segmentation, is needed, so that targeted policies can be formulated to improve the employment environment, and to promote the rational mobility and optimal allocation of the labor force [6].

(2) There are significant differences in the main purpose of mobility (business) between the samples of different household registration systems when comparing medians.

Groups with a median of 1.0 indicate that respondents in these groups are more likely to have business as the main purpose of flow. Groups with a median of 2.0, on the other hand, indicate that respondents in these groups are less inclined to have business as the main purpose of flow.

In terms of doing business, there are also significant differences between the samples of different household registration systems. Groups with a median of 1.0 indicate that these respondents are more inclined to do business as the main purpose of their flow, probably because the areas where these household registration systems are located have a vibrant business atmosphere, a well-developed market system, and good policy support, which provide entrepreneurs with a wide range of space for development and opportunities for profitability. The group with a median of 2.0, on the other hand, may face problems such as a poor business environment, unstable policies or difficulties in mobilizing capital, resulting in a lower willingness to move in business.

For household groups with a high willingness to do business, the policy drivers behind them can be further studied, such as the provision of tax incentives, business start-up subsidies or simplification of the business registration process, in order to create a favorable entrepreneurial environment on a wider scale. Meanwhile, for the group with lower willingness to do business, it is necessary to understand their specific difficulties and needs, and formulate corresponding supportive policies, such as providing entrepreneurship training, financial support, or setting up business cooperation platforms, etc., to stimulate their motivation and creativity in doing business, and to promote the diversified development of the regional economy [7].

In summary, this study found that the household registration system has a significant effect on the main purpose of flow (employment and business). There are differences in the propensity of the samples to have employment and business as the main purpose of mobility across the household registration system.

2.2. Cross-border management and the purpose of flow

Table 2. Results of non-parametric tests of cross-border management and the purpose of flow
(* $p < 0.05$ ** $p < 0.01$)

Cross-border management (median)	employment	business	study abroad	family reunion	improvement of living conditions
1.0	0.000	0.500	1.000	1.000	0.000
1.5	0.000	1.000	1.000	0.000	0.000
2.0	1.000	0.000	1.000	1.000	0.000
2.5	0.500	0.500	1.000	0.000	0.000
3.0	0.000	1.000	1.000	0.000	0.000
3.5	0.000	1.000	1.000	1.000	0.000
4.0	0.000	1.000	1.000	0.000	0.000
4.5	1.000	1.000	0.000	0.000	0.000
Kruskal-Wallis test statistic H-value	10.559	5.389	1.894	1.982	0.329
p	0.014*	0.145	0.595	0.576	0.955

According to the data in Table 2 above, the effect of cross-border management on the main purpose of flow was analyzed using the Kruskal-Wallis test statistic, and the results were significant as the H-value of employment was 10.559 with a p-value of 0.014* ($p < 0.05$), and the p-values of business, studying abroad, family reunion, and improvement of living conditions were all greater than 0.05, so that there was a significant difference between samples with the cross-border management in terms of the main purpose of flow (employment), while there is no significant difference in doing business, studying abroad, family reunion and improving living conditions.

The median comparison shows that there are significant differences in the main purpose of flow (employment) across the cross-border management samples. A median of 2.0 indicates that respondents in these groups are more likely to have employment as the main purpose of flow. In contrast, groups with a median of 1.0 or 1.5 indicate that respondents in these groups are less inclined to have employment as the main purpose of flow.

There is also a significant effect of cross-border management measures on employment among the main purposes of flow. The cross-border management group with a median of 1.0 indicates that respondents in these regions are more likely to move for employment purposes, probably because of their strong economic ties with neighboring countries, active cross-border job markets, and relatively lenient cross-border management policies that provide convenient services such as visa processing and work permit applications, which lower the thresholds and costs of cross-border employment. On the other hand, groups with a median of 1.0 or 1.5 may face problems such as poor information on cross-border employment, cumbersome procedures or language and cultural barriers, which limit their willingness to move across borders in terms of employment.

For management groups with high willingness to cross-border employment, their successful experiences, such as how to strengthen international labor cooperation, establish cross-border employment information platforms or provide language and cultural training, can be summarized and promoted in other regions. Meanwhile, for the group with lower willingness to cross-border employment, it is necessary to deeply understand the specific barriers they face and formulate corresponding policies and measures, such as simplifying cross-border employment procedures, providing legal aid or establishing cross-border employment services, etc., so as to promote the rational flow of cross-border labor and strengthen inter-regional economic cooperation and exchanges [8].

Thus cross-border management has a significant effect on the main purpose of flow (employment), and there are differences in the propensity for employment as the main purpose of flow across the cross-border management sample.

2.3. Comprehensive analyses

In this survey of population mobility in Yanbian State, we applied non-parametric tests to analyze the relationship between several variables in depth. However, the test results for some combinations of variables did not present statistical significance, and these results likewise provide important information for our understanding of the phenomenon population flow.

In analyzing the relationship between factors such as household registration system, cross-border management, public services and tax policies and the frequency of flow, the test results show that these factors do not have a significant impact on the frequency. Specifically, the samples with different household registration systems show a high degree of consistency in the frequency, indicating that household registration systems do not significantly constrain or promote the frequency. Similarly, differences in cross-border management measures do not have a significant impact on the frequency, implying that the frequency is relatively stable regardless of changes in cross-border management. Differences in public services and tax policies also do not show significance in affecting the frequency, suggesting that these policy factors do not have a significant effect on the frequency under the current sample and test conditions [9].

Further, when we examine the relationship between public services and tax policy and the primary purpose of flow, we find that these factors again do not significantly affect the primary purpose of flow. For public services, samples with different levels or types of services do not show significant differences in the primary purpose of flow, suggesting that differences in public services do not significantly drive changes in the purpose. In terms of tax policy, neither tax incentives nor differences in tax burdens have a significant impact on the primary purpose of flow, implying that tax is not a key determinant of the purpose in the current tax policy environment.

These nonsignificant results suggest that a more comprehensive and in-depth consideration of the various possible influencing factors is needed when studying the phenomenon of population flow. Although the above policy factors did not show significant effects in this analysis, it does not mean that they are useless in practice. It may be due to factors such as sample characteristics, data collection methods, or changes in the external environment that the impact of these factors has not been fully captured in this test. Future research can dig deeper into the potential impact of these factors on the flow of population by expanding the sample size, optimizing the data collection method, and combining with qualitative research, so as to provide a more scientific and comprehensive basis for policy formulation.

3. Non-parametric tests study result on the policy environment affecting population flow in Yanbian State

The above significant differences suggest that the household registration system and cross-border management have an important impact on the main purposes of population flow in some respects. Specifically speaking, certain household registration systems and cross-border management measures may be more conducive to the promotion of employment- and business-related mobility, while others may be less supportive of the purposes. This provides policymakers with a basis for targeting and optimizing relevant policies to better promote rational population flow and regional economic development.

Significant differences indicate that different household registration systems and cross-border management measures in Yanbian State differ in terms of their adaptability and flexibility. Some policies are better suited to the local economic structure and the needs of population flow, such as certain household registration systems that provide good support for employment and business, and certain cross-border management measures that promote cross-border employment. This suggests that policymaking needs to be tailored to local conditions, taking into account regional differences and the diversified needs of the population.

There is a need for greater synergy between the household registration system, cross-border management and public service and taxation policies. For example, it is necessary to optimize the

synergy between the household registration system and the job market and business environment, and to adjust the match between cross-border management and public service and taxation policies, so as to form policy synergies and jointly promote rational population flow and regional economic development.

At the same time, policymakers should optimize existing policies and innovate management methods based on significant differences. Such as, they should promote successful experiences in household registration systems and cross-border management, formulate special supportive policies for weak links, and create a favorable policy environment to promote rational population mobility and coordinated regional economic development [10].

4. Conclusion

On the whole, this study pioneers an innovative exploration into population mobility-policy linkages in Yanbian, revealing significant disparities in the guiding effects of policy factors. The findings demonstrate that household registration systems and cross-border management measures exert substantial influence on employment- and business-driven mobility. Certain household registration policies attract labor migration by lowering residency thresholds and providing employment support, while specific cross-border measures stimulate transnational employment through streamlined visa procedures and enhanced cross-border labor cooperation. Integrating multifaceted policy factors, including household registration, cross-border management, public services, and taxation policies, this research establishes a comprehensive analytical framework for border-region population mobility.

Methodologically, we employed Kruskal-Wallis nonparametric tests to analyze complex policy-mobility relationships, providing robust policy assessment tools. The experimental model, rigorously constructed with theoretical foundations, incorporated multidimensional questionnaires to ensure data reliability. Algorithmic quantification of policy factors used rank-based assignment and chi-square tests to determine significance, enhancing analytical precision. These non-significant effects may relate to policy implementation efficacy and individual perception. This result offers vital guidance for policymakers. Future initiatives should center on enhancing the positive effects of the household registration and cross-border management systems. This can be achieved by refining supportive policies, harnessing the unutilized potential within public service and taxation frameworks, and cultivating policy synergy. These efforts aim to encourage rational population movement and bolster coordinated regional economic development in Yanbian. Furthermore, the models and methodologies developed herein provide transferable references for similar studies in other border regions. This contributes to optimizing frontier governance policies, enhancing stability and prosperity in border areas, and furnishing scientific evidence and decision-making support for modernizing national border governance systems.

References

- [1] Duan Chengrong, Sheng Danyang, Liu Tao. Impact and mechanism analysis of population mobility on population security in border areas [J]. *Human Geography*, 2022, 37 (4): 149 - 157.
- [2] Han Songyu. Research on overpopulation alienation in border areas - A case study of Yanbian Korean Autonomous Prefecture [J]. *Journal of Population*, 2019, 41 (4): 104 – 112.
- [3] Li Meihua, Cui Jinnan. Minority Population Mobility and the Dilemma of Borderland Social Governance-Taking Yanbian Korean Autonomous Prefecture as an Example J. *Journal of Chongqing Three Gorges College*, 2019, 35 (4): 40 - 48.
- [4] Ma Shengchun. Spatial Analysis of the Characteristics and Influencing Factors of Interprovincial Population Flows in China J. *Population Studies*, 2022, 46 (6): 59 - 71.
- [5] Ma Nianzhai, Sun Weizeng. Household Registration Reform, Equalization of Public Services, and Consumption of Floating Population Families—Take Residence Permits as an Example [J]. *Journal of World Economy*, 2025, (2): 20 - 47.

- [6] Xu S.Y., Cai Golan. Population changes dynamics and population development orientation analysis in China's border areas J. Population Research, 2025, 49 (1): 53 - 69.
- [7] Fan Xiaoyue. Analysis of Influential Factors of Population Mobility in Liaoning Province [D]. Harbin Normal University, 2023.
- [8] Feng Jia. Research on the interactive impact of population mobility and industrial agglomeration in China [D]. Jilin University, 2024.
- [9] Zhou Hao, Liu Wenbo. Stability of the macro-selection mechanism of the inflow place of China's interprovincial migrant population - Theoretical extension and empirical test of the gravity model J. Journal of Population, 2023, 45 (2): 38 - 52.
- [10] Su Hongji. Quantitative Analysis of the Cost of Interprovincial Population Mobility in China J. Journal of Jinan University (Social Science Edition), 2024, Vol. 34 No. 4.