

Social Security System Differences and Population Mobility: Evidence from the Guangdong–Hong Kong–Macao Greater Bay Area

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Abstract

Background and Objectives: Population mobility plays a critical role in promoting regional economic integration, labor market efficiency, and balanced development. In the Guangdong–Hong Kong–Macao Greater Bay Area (GBA), one of China’s most dynamic economic regions, population movement has intensified alongside rapid urbanization and cross-border economic activity. However, institutional differences—particularly in social security systems—remain a significant barrier to the free and efficient movement of labor. Due to the “one country, two systems” framework and the coexistence of multiple administrative, legal, and welfare regimes, substantial disparities exist in social security coverage, benefit structures, contribution rates, and financing mechanisms across Guangdong, Hong Kong, and Macao. These differences generate institutional costs that may distort migration decisions and hinder optimal allocation of human resources. Against this backdrop, this study aims to examine how differences in social security systems within the GBA affect population mobility, both theoretically and empirically, and to identify the mechanisms through which these institutional costs influence migration patterns.

Methodology: The study adopts a mixed theoretical–empirical approach. First, it develops a conceptual framework grounded in new institutional economics and migration cost–benefit theory, conceptualizing differences in social security systems as institutional costs that influence mobility decisions. These costs are categorized into three components: public costs (government fiscal expenditures on social security), enterprise costs (employer contributions), and individual costs (employee contributions). Second, the study employs panel data from 11 cities in the Guangdong–Hong Kong–Macao Greater Bay Area over the period 2018–2021, a timeframe selected

based on key policy changes enabling cross-border participation in mainland social insurance systems. A two-way fixed effects model is estimated to control for both regional heterogeneity and time effects. Population mobility is measured using comparable indicators across jurisdictions, while social security cost variables are constructed based on harmonized financial and institutional data. The analysis further incorporates control variables including wage income, economic development level, unemployment rate, and fiscal expenditure. Robustness checks are conducted using alternative dependent variables, extended sample periods, and additional controls, including pandemic-related factors and structural characteristics of the labor force.

Key Findings: The empirical results reveal three main findings. First, differences in social security systems significantly hinder population mobility in the GBA. Higher total social security costs—arising from institutional fragmentation, benefit non-portability, and transfer inefficiencies—are associated with lower levels of population inflows. This finding confirms the hypothesis that institutional costs act as barriers to labor mobility, even in economically integrated regions. Second, the effects of social security costs vary across responsible agents. Public costs and enterprise costs exert a statistically significant negative impact on population mobility, reflecting fiscal pressure, congestion effects in public services, and increased labor costs for firms. In contrast, individual costs exhibit a positive relationship with mobility, suggesting that higher personal contributions may signal better employment conditions and stronger social protection, thereby attracting labor. Third, the impact of social security costs is heterogeneous across city types. Non-core cities and those within the Pearl River Delta are more sensitive to increases in social security costs, while core cities and special administrative regions show weaker or statistically insignificant effects. Additional robustness tests confirm the stability of these findings and highlight the role of external shocks, such as the COVID-19 pandemic, in reinforcing the stabilizing function of social security systems.

Policy Implications: The findings underscore the importance of institutional coordination in promoting efficient population mobility within the GBA. First, policymakers should prioritize the harmonization and interoperability of social security systems across jurisdictions, focusing on improving benefit portability, transfer continuity, and mutual recognition mechanisms rather than pursuing full institutional unification. Establishing a regional coordination platform and expanding pilot integration zones could help reduce institutional barriers. Second, optimizing the cost-sharing structure among governments, enterprises, and individuals is essential to balance fiscal sustainability with labor market efficiency. Reducing excessive enterprise burdens and improving fund management can enhance labor demand and economic vitality. Third, reforms should address the non-portability of welfare benefits and rigid eligibility conditions that disproportionately affect mobile populations. Measures such as cross-regional settlement systems, pension portability frameworks, and unified service platforms can significantly lower migration costs. Overall,

strengthening institutional convergence while maintaining regional flexibility is key to fostering a more integrated and dynamic labor market in the Greater Bay Area.

Keywords: Population Mobility; Social Security Systems; Institutional Costs; Greater Bay Area; Fixed Effects Model

JEL Classification Codes: J61; H55; R23; O15

1. Introduction

With the development of the market economy and the progress of urbanization in China, the spatial distribution of the population has undergone continuous transformation. Large-scale population movement has become one of the most prominent and profound social phenomena. Institutional designs across countries are shaped by their respective national conditions. Developed economies generally adopt a relatively open approach to population mobility, where individuals enjoy a high degree of freedom to migrate and relocate. These countries are typically supported by well-established social security and social assistance systems, through which governments and enterprises address social issues arising from population movement, including education, housing, and welfare provision. For example, Europe's "post-migration registration" system, the United States' "Social Security Number" system, and Japan's "residence registration follows the person" system generally do not impose institutional exclusion on migrant populations. As a result, there is minimal disparity in rights between migrants and residents.

In contrast, China's social security system originated during the planned economy era and was shaped by specific political, economic, and social functions. This has resulted in a system that differs fundamentally from those in developed countries, particularly in relation to migrant populations. Although continuous reforms have improved the standardization and expanded the coverage of China's social security system, challenges remain. In the context of regional development imbalances and decentralized governance, fragmentation persists due to differences in local systems, difficulties in benefit transfer and continuation, and the lack of portability. These institutional constraints not only weaken the economic and social functions of social security but also increase the costs and barriers associated with population mobility.

The Guangdong–Hong Kong–Macao Greater Bay Area (GBA) provides a unique context for examining these issues. The GBA encompasses nine cities in the Pearl River Delta—Guangzhou, Shenzhen, Foshan, Dongguan, Huizhou, Zhuhai, Jiangmen, Zhongshan, and Zhaoqing—together with the special administrative regions of Hong Kong and Macao. Covering approximately 56,000 square kilometers and home to 86.6923 million people in 2021 (Sun et al., 2022), the region exhibits strong economic performance, strategic geographic advantages, and a high concentration of innovation resources. These factors have significantly enhanced its attractiveness to mobile populations. Between 2010 and 2020, the total population of the GBA increased by more than 35%, with both interprovincial inflows and intra-provincial mobility

ranking first among China's major urban agglomerations. The region is therefore characterized by rapid population growth, high-density agglomeration, and uneven spatial distribution. However, due to differences in political, economic, and cultural contexts, the social security systems across the GBA display substantial variation in institutional design, coverage, and financing mechanisms, resulting in distinct and heterogeneous models.

Compared with disparities observed across mainland regions (Sun et al., 2022), differences in social security systems within the GBA pose even greater challenges to population mobility. These include the non-transferability of pension benefits when changing employment, regulatory constraints on early withdrawal from the Mandatory Provident Fund (MPF), and insufficient medical coverage for elderly individuals relocating to mainland China. As population mobility is a key driver of economic vitality and regional competitiveness, enhancing coordination and cooperation in social security systems across Guangdong, Hong Kong, and Macao has been identified as a priority in the Development Plan Outline for the Guangdong–Hong Kong–Macao Greater Bay Area. Addressing institutional differences and understanding their impact on mobility is therefore of critical importance.

Building on this context, this study takes differences in social security systems in the GBA as a central analytical entry point and conceptualizes them as institutional costs affecting population mobility. The paper aims to examine both the mechanisms and empirical effects through which these institutional differences influence migration decisions. This analysis contributes to a deeper understanding of the role of institutional factors in shaping population mobility and offers important insights for promoting more efficient and integrated regional development.

The remainder of the paper is organized as follows. Section 2 reviews the related literature. Section 3 outlines the differences in social security systems in the Guangdong–Hong Kong–Macao Greater Bay Area. Section 4 develops the theoretical framework and impact mechanisms. Section 5 describes the data and methodology. Section 6 presents the empirical results and discussion, followed by Section 7, which concludes the study. Section 8 provides the policy implications.

2. Literature Review

Research on population mobility spans multiple disciplines, including population geography, development economics, and political economy. Traditional migration theories—such as the push–pull framework and dual economy models—primarily emphasize economic drivers of mobility. However, with the advancement of institutional economics, increasing attention has been directed toward the role of institutional factors. North (1990) argues that “institutional change determines the way social evolution occurs,” thereby linking demographic dynamics to broader institutional frameworks. In this context, international studies have explored how institutional arrangements—particularly in education, social security, and taxation—influence migration patterns. For example, Dahlberg et al. (2012) find that the provision of local

public services, including education, childcare, and elderly care, serves as an important pull factor for migrants, while tax systems may act as barriers. Similarly, Lee and Braham (2020) demonstrate that housing security systems and the quality of education significantly shape residential location choices.

In the context of China, institutional factors play an even more critical role in shaping population mobility (Li, 2003). The household registration (hukou) system and its associated welfare arrangements constitute major institutional barriers to rural–urban migration. Yang (2017) argue that the hukou system creates a form of institutional identity, effectively forming a “segregation wall” that fundamentally influences mobility patterns. This institutional segmentation gives rise to what has been described as “dual rejection effects,” limiting migrants’ access to public services and social security benefits. These constraints are often conceptualized as institutional costs. Zhao and Zhang. (2012), for instance, define such costs as transfer costs arising from imperfections in housing, household registration, and social security systems. Empirical evidence further supports this perspective. Liu and Zhang (2016) and Wang and Fu (2019) show that institutional barriers significantly increase the cost of labor mobility, while Yang et al. (2022) find that reducing welfare acquisition costs can enhance migrants’ willingness to settle in destination regions.

As a crucial socioeconomic system, China’s social security framework plays an important role in promoting economic growth, reducing urban–rural disparities, and facilitating urbanization at the macro level (Yang & Shen, 2016; Zhang, 2014). At the micro level, it contributes to increased consumption, employment, and overall life satisfaction (Jiang et al., 2010; Wu & Hu, 2016). However, despite ongoing reforms, systemic fragmentation has not been fully resolved. Xiao (2016) attributes this persistence to China’s dual urban–rural structure, regional development imbalances, and diverse social identities, which together give rise to segmentation across urban–rural, regional, and social dimensions.

Existing research on the relationship between social security differences and population mobility can be broadly categorized into two strands. The first focuses on how such differences influence mobility decisions. Chen and Zhang (2018) find that rural social insurance schemes tend to “push” labor outflows, whereas urban schemes generate “pullback” effects. Xie et al. (2020) highlight the role of the welfare safety net in shaping migration behavior, while Zhou and Jiang (2021) and Lu (2020) demonstrate that variations in contribution rates and benefit levels significantly affect individuals’ willingness to migrate. The second strand emphasizes the inhibitory effects of social security disparities. Huang and Ga (2011) identify the existence of institutional and mobility traps, while Xiang and Wu (2011) stress the importance of improving fairness and adaptability to mobility. From an international perspective, Holzmann and Koettl (2015) analyze the negative consequences of welfare non-portability, and Zou (2021) shows that differences in social security systems alter the cost–benefit structure of migration decisions.

The unique institutional environment of the Guangdong–Hong Kong–Macao Greater Bay Area (GBA) further complicates these dynamics. Comparative studies (Guo, 2019; Wang, 2010) suggest that systemic differences across jurisdictions hinder labor mobility, particularly for cross-border populations such as retirees facing challenges in benefit portability (Cao, 2020). Wang and Liu. (2022) further emphasize the need for institutional innovation to support the development of an integrated “Greater Bay Area cycle.”

While the existing literature provides valuable insights into institutional barriers to mobility, studies focusing specifically on the GBA have largely concentrated on identifying causes and highlighting the need for coordination, rather than empirically examining the underlying mechanisms. This study addresses this gap by quantitatively analyzing how differences in social security systems generate institutional costs that influence population mobility, thereby contributing to a more comprehensive understanding of mobility dynamics in the GBA context.

3. Social Security System Differences in the Greater Bay Area

3.1 Differences in the Conceptual Foundation of Social Security Systems

The conceptual underpinnings of the social security systems in the GBA reflect distinct regional philosophies. In Guangdong Province and mainland China broadly, the system is legislatively established on the principle of balancing fairness and efficiency. It aims to ensure the basic living rights of citizens and foster a harmonious socio-economic environment where members share in societal benefits, while simultaneously emphasizing economic efficiency to support stable development and workforce reproduction.

Hong Kong's system is a hybrid, influenced by both Western welfare culture and Eastern Confucian ethics. It centers on social relief, with the government providing essential support to vulnerable groups to mitigate market deficiencies. This model strongly emphasizes social mutual assistance and family responsibility, seeking an equilibrium between economic growth and social welfare.

Macao's system is guided by principles of equality, efficiency, mutual assistance, and participation. The government assumes the primary role in planning and welfare policy, operating in a cooperative relationship with civil society organizations. The focus is on supporting vulnerable groups and strengthening community and family functions while encouraging public participation in welfare matters.

3.2 Unique Characteristics of Social Security Systems at Different Levels

The structural design of social security systems varies significantly across the GBA. In Guangdong and mainland China, the system is predominantly based on social insurance, supplemented by social assistance, welfare, and preferential treatment/resettlement schemes. The state leads reforms and bears significant responsibility, with costs shared across society.

Hong Kong operates a social assistance-centric model. Its core consists of government-provided welfare subsidies, such as the Comprehensive Social Security Assistance Scheme, complemented by occupational welfare and healthcare services offered by employers.

Macao has implemented a "dual-layered social security system." The first layer is the foundational social security system, and the second is a central provident fund. This structure includes mandatory and voluntary contribution systems, funded by employers, employees, fiscal surpluses, and gaming revenues. It delivers nine primary benefit types—including pensions, disability, and unemployment benefits—to provide residents with basic security.

3.3 Disparities in the Coverage of Social Security Systems

Coverage levels and effectiveness differ notably among the three jurisdictions. In Guangdong, coverage is continuously expanding, with integration between urban-rural resident insurance and urban employee insurance schemes. By the end of 2022, participation in the three major social insurance types (pension, unemployment, work-related injury) reached 156 million, approaching universal coverage.

In Hong Kong, the Comprehensive Social Security Assistance Scheme offers broad theoretical coverage for issues like old age and disability, but stringent eligibility criteria and complex procedures result in a relatively low actual beneficiary rate. Conversely, the Mandatory Provident Fund Scheme achieves high coverage, with a participation rate of nearly 80% among relevant employers and employees by 2021.

Since its handover, Macao has consistently expanded its system coverage and increased subsidy amounts. By the end of 2021, approximately 500,000 beneficiaries were registered, including about 129,200 pensioners—effectively covering the population aged 65 and over. There were 387,492 contributors, representing 56.4% of the total population.

3.4 Diversification of Social Security Financing Mechanisms

The financing mechanisms for social security also exhibit diversity. In Guangdong and mainland China, funding is jointly borne by the state, enterprises, and individuals through social insurance contributions, with the government acting as the ultimate guarantor by subsidizing welfare and relief projects.

Hong Kong and Macao employ a mix of government and market mechanisms. In Hong Kong, financing channels are diversified, relying primarily on government subsidies but also incorporating social fundraising, donations, and service charges. The Mandatory Provident Fund uses a fully funded, privately managed accumulation model.

Macao's system is characterized by a high welfare component and low individual contribution rates. As gaming is a pillar industry, social security funds heavily depend on government allocations and gaming taxes, supplemented by employer/employee contributions and social donations.

4. Impact Mechanisms of Social Security System Differences on Population Mobility

Drawing on New Institutional Economics and Schultz's migration cost–benefit theory, this study conceptualizes differences in social security systems as institutional costs that influence population mobility. These costs can be interpreted as a net welfare loss incurred by migrants.

For cross-border migrants (e.g., Hong Kong and Macao residents relocating to the Pearl River Delta), such differences create substantial barriers. Despite improvements in regional connectivity and policy initiatives—such as residence permits and expanded social insurance participation rights—significant institutional obstacles remain. For example, elderly individuals who retire to the mainland may encounter difficulties in accessing comparable elderly care and medical services. They may also risk losing eligibility for benefits in their place of origin while being required to contribute to mainland social insurance schemes. Furthermore, integration between Hong Kong and Macao's Mandatory Provident Fund (MPF) system and mainland social insurance systems is constrained by differences in financing mechanisms and contribution structures (e.g., lump-sum versus monthly pension arrangements). In some cases, early withdrawal of MPF savings may even require the forfeiture of permanent residency rights.

For internal migrants within mainland China, social security-related costs also arise. Existing regulations often link pension eligibility to the place of household registration (*hukou*) if contribution periods in any single city are less than ten years—a condition that is difficult for highly mobile individuals to satisfy. This limited portability imposes additional costs, as migrants may ultimately receive benefits based on less favorable standards in their place of origin rather than those in higher-income destination regions.

Mainland migrants moving to Hong Kong or Macao face similarly high thresholds for accessing social welfare, which is closely tied to residency status. Obtaining non-permanent or permanent residency (with the latter typically requiring seven years of continuous residence) involves meeting strict requirements related to education, age, and income under various talent admission schemes.

Overall, differences in social security systems within the Greater Bay Area (GBA) lead to limited benefit portability and inefficient transferability. These institutional frictions increase the financial burden on mobile populations and, in turn, hinder population mobility. Based on this reasoning, the following hypothesis is proposed:

Hypothesis 1 (H1): There is a negative relationship between social security system costs and population mobility; that is, regions with lower social security costs tend to experience higher population inflows.

Building on cost-sharing theory, the allocation of costs among participating entities is determined by the distribution of benefits received. Drawing on this framework, prior studies have developed indicators to measure social security costs and

constructed methods for estimating the costs associated with population mobility. In the GBA, differences in social security systems are reflected in institutional design, contribution rates, coverage scope, and financing mechanisms. As population mobility involves the transfer of social security entitlements, migrants may gain access to higher levels of benefits and contribute to more comprehensive systems in destination regions. The resulting increase in social security expenditures constitutes the social security system costs of population mobility.

This study categorizes these costs into three components: public costs, enterprise costs, and individual costs.

(1) Public costs refer to government expenditures incurred when migrants are granted social security benefits equivalent to those of local residents in the destination area. In the nine cities of the Pearl River Delta, such expenditures include fiscal subsidies to social security funds, direct subsidies for residents participating in social insurance, minimum living allowances, and employment-related subsidies. These items are generally classified under “social security and employment” in fiscal expenditure accounts. In Hong Kong, comparable spending falls under the “social welfare” category, while in Macao it is classified under “social security.” Public costs are measured as per capita fiscal expenditure on social security in each GBA city.

(2) Enterprise costs refer to expenditures incurred by firms when migrants participate in local social security systems. Under China’s Labor Law, employers and employees in the nine cities of the Pearl River Delta are required to participate in social insurance schemes, including pension, medical, work-related injury, maternity, and unemployment insurance. Contribution rates are determined by provincial and municipal governments and generally do not exceed 20% of total wages. Since flexible workers are typically required to contribute only to pension and medical insurance, this study focuses on enterprise contributions to these two schemes. Enterprise costs are therefore calculated as:

average annual wages of urban employees $\times$ (enterprise pension contribution rate + enterprise medical insurance contribution rate).

In Hong Kong, employers are required to contribute 5% of employees’ monthly salaries to MPF accounts, subject to a cap of HK\$1,500. Enterprise costs are thus defined as:

average annual salary $\times$ 5% (Mandatory Provident Fund Schemes Authority, 2026).

In Macao, employers are required to make fixed monthly contributions of MOP\$60 under the mandatory system, and enterprise costs are defined accordingly.

(3) Individual costs refer to the contributions made by individuals to attain social security coverage comparable to that of local residents in destination regions. In the Pearl River Delta cities, employees contribute jointly with employers to pension and medical insurance according to local standards. Individual costs are calculated as:

average annual wages of urban employees $\times$ (individual pension contribution rate + individual medical insurance contribution rate).

In Hong Kong, employees contribute 5% of their monthly salary to MPF accounts, and individual costs are defined as:

average annual salary $\times$ 5%.

In Macao, employees are required to contribute MOP\$30 per month under the mandatory system, and individual costs are defined accordingly (Fundo de Seguranga Social de Macau, n.d.).

Based on the above analysis, the following hypothesis is proposed:

Hypothesis 2 (H2): The effects of social security costs on population mobility differ depending on whether the costs are borne by governments, enterprises, or individuals.

5. Data and Methodology

5.1 Data Source

This paper analyzes panel data from 11 cities in GBA from 2018 to 2021. The reason for selecting data after 2018 for analysis is that the calculation method of social security system costs in this paper is based on the premise that people moving from Hong Kong and Macao to the mainland can participate in mainland social insurance. By reviewing relevant policy documents, it can be found that in July 2018, the State Council officially canceled the work permit requirement for residents from Taiwan, Hong Kong, and Macao working in the mainland. The Ministry of Human Resources and Social Security simultaneously issued the "Notice on Matters Concerning Employment of Residents from Hong Kong, Macao, and Taiwan in Mainland China", which stipulates that residents from Hong Kong, Macao, and Taiwan who seek employment in the mainland can use valid identity documents such as the Residence Permit for Hong Kong, Macao, and Taiwan Residents or the Exit-Entry Permit for Travelling to and from Hong Kong and Macao to handle various human resources and social security-related matters. To safeguard the legitimate rights and interests of Hong Kong, Macao, and Taiwan residents working, residing, and studying in the mainland to participate in social insurance and enjoy social insurance benefits, the Ministry of Human Resources and Social Security drafted the "Interim Measures for Hong Kong, Macao, and Taiwan Residents to Participate in Social Insurance in Mainland China (Draft for Solicitation of Opinions)" in October 2018. The draft for solicitation of opinions clarifies that employers should timely and fully pay social insurance premiums for Hong Kong, Macao, and Taiwan personnel lawfully employed, further specifying the scope of personnel and types of insurance that residents from Hong Kong, Macao, and Taiwan can participate in. Therefore, based on the time points of the issuance of the above policy documents, this paper selects panel data from 2018 to 2021 to make the research more feasible and scientific. Data sources include the China City Statistical Yearbook, Guangdong Statistical Yearbook, Macao Statistical Yearbook, Hong Kong Statistical Yearbook, World Bank database, statistical yearbooks, and statistical bulletins of various prefecture-level cities in the Guangdong-Hong Kong-Macao

Greater Bay Area. Hong Kong dollar and Macao pataca data are converted into Renminbi based on the average annual exchange rate.

5.2 Variable Description

5.2.1 Dependent Variable: Population Mobility (PM)

There are certain differences in the relevant indicators of population migration and mobility among the GBA. In Hong Kong, the definition of mobile residents is those Hong Kong residents who have stayed in Hong Kong for at least 1 month but less than 3 months in the 6 months before the reference date, or those who have stayed in Hong Kong for at least 1 month but less than 3 months in the 6 months after the reference date (Hong Kong Census and Statistics Department, 2021). In Macao, mobile population mainly includes immigrants from mainland China, non-permanent residents, non-local employees, and non-local students. In the nine cities of the Pearl River Delta, the scale of mobile population, which is the difference between the end-of-year population and the end-of-year registered population, is mainly used as the measure of population mobility. This difference mainly includes people who do not have local household registration but have lived in the local area for more than half a year, people who have local household registration but have left the local area for less than half a year, and people who have not registered their household in any place but live in the local area.

5.2.2 Explanation of Variable: Social Security Cost (SSC)

The social security cost for mobile populations refers to the total economic inputs required for individuals to obtain social security benefits and services in the destination area during the process of migration. Due to data limitations, for empirical research convenience, this paper calculates the social security costs generated during population mobility to more intuitively measure the differences in social security systems within the GBA. Drawing from studies on the sharing mechanisms of social security costs by Kang (2014), Fu et al. (2014), and Zhang and Shu. (2015), the costs are categorized into public costs (SSCP), enterprise costs (SSCB), and individual costs (SSCI). Finally, the comprehensive cost ($SSC=SSCP+SSCB+SSCI$) is aggregated to scientifically evaluate the differences in social security systems within the GBA.

5.2.3 Control Variables

Control variables represent other factors that influence urban population mobility. Drawing from domestic studies on the impact of social security systems on population mobility, this paper selects control variables including urban wage income level (SA), economic development level (ED), labor market unemployment rate (UE), and local fiscal expenditure (FE).

(1). Wage Income Level (SA) selects the average wage of employees in positions as the proxy variable. Employment and business opportunities are the main reasons for population mobility. According to the cost-benefit analysis mentioned earlier, the wage income differential before and after population mobility is the most significant monetary benefit.

(2). Economic Development Level (ED) selects per capita regional gross domestic product (GDP) as the proxy variable. The per capita GDP of a city can reflect the economic situation of the region. Economically developed areas have relatively better material conditions, healthcare, education, environment, etc. Mobile populations tend to pursue a higher quality of life and make mobility choices accordingly.

(3). Unemployment Rate (UE) selects the ratio of registered urban unemployed individuals to the total urban labor force as the proxy variable. Cities in the Guangdong-Hong Kong-Macao Greater Bay Area have strong employment absorption capacity. However, mobile populations face uncertainty regarding unemployment risks. Cities with higher unemployment rates indicate reduced job opportunities, exerting a push factor on population mobility.

(4). Local Fiscal Expenditure (FE) selects local fiscal expenditure as the proxy variable. Local productive and consumptive fiscal expenditures can effectively support urban industrial development and improve residents' quality of life, influencing population mobility.

The measurement and descriptive statistics of each variable are presented in Table 1 and Table 2.

Table 1. Descriptive Statistics of Variables

Variables and Identifiers	Measurement	Units
Dependent Variable		
Population Mobility (PM)	Mainland China uses the scale of floating population to represent population mobility;	Million People
	Hong Kong adopts the term "floating residents" to represent population mobility;	
	Macao uses the term "floating population" to represent mainland Chinese immigrants, residents permitted to reside, non-resident employees in Macao, and non-local students.	
Independent Variable		
Total Social Security Costs (SSC)	Public Costs + Enterprise Costs + Individual Costs	Ten Thousand Yuan
Public Social Security Costs (SSC _P)	Per Capita Expenditure On Social Security	Ten Thousand Yuan
Social Security Enterprise Costs (SSC _B)	Corporate Burden	Ten Thousand Yuan
Social Security Personal Costs (SSC _I)	Personal Burden	Ten Thousand Yuan
Control Variable		
Wage Income Level (SA)	Average wage of employees on the job	Ten Thousand Yuan

Variables and Identifiers	Measurement	Units
Economic Development Level (ED)	Per capita regional gross domestic product (GDP)	Ten Thousand Yuan
Unemployment Rate (UE)	Registered urban unemployment rate/total urban labor force	Percentage
Local Fiscal Expenditure (FE)	Total local fiscal expenditure	Ten Billion Yuan

Source: China Urban Statistical Yearbook; Guangdong Statistical Yearbook; Macao Statistical Yearbook; Hong Kong Statistical Yearbook; and authors' compilation.

Note: Variable definitions are provided in the table. Monetary values are expressed in RMB (CNY 10,000 unless otherwise stated).

Table 2. Descriptive Statistics of Each Variable (n = 44)

Variable	Mean	Standard Deviation	Minimum	Maximum
PM	3.04	3.54	-0.45	12.49
SSC	4.18	1.39	2.17	7.72
SSC _P	1.78	1.04	0.55	4.14
SSC _B	1.55	0.72	0.06	2.99
SSC _I	0.84	0.34	0.03	1.55
SA	11.08	3.49	6.99	19.00
ED	15.13	11.93	5.19	56.49
UE	2.42	0.77	1.20	6.60
FE	16.39	18.08	3.16	72.57

Source: China Urban Statistical Yearbook; Guangdong Statistical Yearbook; Macao Statistical Yearbook; Hong Kong Statistical Yearbook; World Bank, World Development Indicators; and authors' calculations.

Note: All monetary values are converted into RMB using annual average exchange rates.

5.2.4 Model Construction

Through the analysis of the influencing mechanisms mentioned above, it is known that differences in social security systems are important factors affecting population mobility. The data used in this study are panel data, which have both cross-sectional and time dimensions. This allows for the control of individual heterogeneity, and the constructed regression equation can make more accurate predictions. The specific model suitable for panel data is determined using F-test and Hausman test. The results of the tests are both significant, indicating that the fixed effects model is more suitable. In order to reduce the impact of individual characteristics and time effects on the model, this study constructs a two-way fixed effects model to explore the impact of differences in social security systems on population mobility. Based on variable selection and processing, the specific formula for the time-individual fixed effects model is as follows:

$$PM_{it} = \alpha_0 + \alpha_1 SSC_{it} + \alpha_2 SSC_{Pit} + \alpha_3 SSC_{Bit} + \alpha_4 SSC_{Iit} + \alpha_5 SA_{it} + \alpha_6 ED_{it} + \alpha_7 UE_{it} + \alpha_8 FE_{it} + \lambda_i + \gamma_t + \varepsilon_{it}$$

$$i=1, \dots, 11; t=1, \dots, 4$$

Here, PM_{it} represents population mobility, SSC_{it} represents social security costs, SSC_P represents public social security costs, SSC_{it} represents corporate social security costs, and SSC_I represents individual social security costs. The subscripts i and t represent regional entities and years, respectively. SA_{it} , ED_{it} , UE_{it} , FE_{it} represent wage income level, economic development level, unemployment rate, and local fiscal expenditure, respectively. λ_i and γ_t denote the individual-specific and time-specific heterogeneity intercept terms, while ε_{it} represents the error term in the model.

6. Empirical Results and Discussion

6.1 Baseline Regression Results and Analysis

First, a multicollinearity test was conducted on the variables. The results, as shown in Table 3, indicate that all VIF values are less than 10, suggesting that there is no multicollinearity. Table 4 reports the regression results of the time-individual two-way fixed effects model. Model (1) considers the influence of social security costs and wage income levels on population mobility in the Guangdong-Hong Kong-Macao Greater Bay Area. It can be observed that wage income levels have a significantly positive impact on population mobility, which is consistent with reality. The social security cost has a clear negative impact on the mobility of population. For example, the results in Model (2) show that, other things being equal, an average one-unit increase in the total social security cost resulting from differences in social security systems among cities in the Guangdong-Hong Kong-Macao Greater Bay Area is associated with an average decrease of 1.2711 units in the floating population size.

However, social security costs have a significant negative effect on population mobility; an increase in social security costs leads to outflows of mobile populations. This indicates that in the process of population mobility in the Greater Bay Area, besides considering wage benefits, individuals also take into account social security costs. Model (2) incorporates other control variables. The results show that the coefficient of the core explanatory variable, social security costs, remains negative and statistically significant. This suggests that differences in social security systems are important factors influencing population mobility in the Greater Bay Area. Higher social security costs hinder population mobility, while reducing social security costs can effectively promote population inflow. With the development of society and the improvement of people's living standards, the material and spiritual needs of individuals are increasing. There is a growing emphasis on social fairness and welfare benefits in cities, especially among mobile populations with special needs and uncertainties. They are particularly concerned about the social security issues in the destination areas. In the process of population mobility, in addition to economic factors, the institutional

costs brought by differences in social security systems between destination and origin areas are negatively correlated with population mobility. Hence, H1 is confirmed.

Based on the previous classification of social security costs, the model incorporates public costs, enterprise costs, and individual costs to examine the impact of social security costs shared by different responsible entities on population mobility. The regression results of Model (3) show that both the public costs and enterprise costs of social security have a significant negative impact on population mobility. The congestion effect of local public goods brought by population inflows increases the pressure on government fiscal expenditure, while a high proportion of enterprise social security contributions can burden companies excessively. This may lead to the exclusion of mobile populations from government welfare subsidy policies, or companies not providing social security contributions for temporary workers with high mobility. Therefore, the increase in public costs and enterprise costs hinders population mobility. However, the impact of individual costs on population mobility turns positive. This may be due to several reasons.

First, the calculation of individual social security costs in this study is highly positively correlated with wage levels, and the improvement of economic income remains a key driving force for population mobility in the Greater Bay Area. The overall age structure of the Greater Bay Area is characterized by a young population, with mobile populations concentrated in the 21-40 age group. Young labor forces are more concerned about economic factors such as job opportunities and salary income in the destination areas. Second, the social security systems in Hong Kong and Macao are characterized by "high welfare," with low individual contribution burdens. However, the advantages of employment opportunities, living costs, and housing environments in mainland cities within the Greater Bay Area attract residents from Hong Kong and Macao to study, start businesses, and retire in the mainland. During their migration to the mainland, they pay mainland social security contributions and bear certain personal social security costs. At the same time, they can also enjoy mainland social security services and related benefits. Consequently, the increase in individual costs caused by differences in social security systems in the Greater Bay Area does not hinder the migration of populations from Hong Kong and Macao to the mainland. Hence, H2 is confirmed: social security costs from different responsible entities have different impacts on population mobility.

In terms of control variables, the coefficient of government fiscal expenditure is significantly negative. The impact of government fiscal expenditure on population mobility is characterized by specificity and complexity. The increase in fiscal expenditure guarantees the supply of public services, indirectly reducing the cost of living, which can enhance the disposable income of labor force. However, influenced by the household registration system, it is challenging for a large number of mobile populations to access local public services. Additionally, regions with high fiscal expenditure often accompany higher local tax burdens, which present certain resistance to population inflows.

Table 3. Multicollinearity Test

Variable	VIF	1/VIF
SSC	5.61	0.178137
SA	9.62	0.103995
ED	8.47	0.118083
UE	1.53	0.654067
FE	4.12	0.242636
ES	2.04	0.490279
IS	9.59	0.104276
Epi	1.51	0.661271
Mean VIF	5.31	

Source: Authors' calculations.

Note: VIF denotes variance inflation factor.

Table 4. Benchmark Regression Results

Variables	Dependent Variable: Size of Urban Migrant Population (PM)		
	Model (1)	Model (2)	Model (3)
SSC	-0.7642* (-1.80)	-1.2711** (-2.57)	
SSC _p			-1.0535* (-2.45)
SSC _B			-6.7977*** (-3.67)
SSC _I			13.5373* (2.77)
SA	0.5899** (3.27)	1.1244*** (3.73)	0.7256 (1.64)
ED		-0.0607 (-1.46)	-0.0333 (-0.88)
UE		0.1651 (0.33)	0.2758 (0.65)
FE		-0.1983** (-2.44)	-0.1307* (-2.12)
Individual Fixed Effects	Controls	Controls	Controls
Time Fixed Effects	Controls	Controls	Controls
_cons	3.9850 (1.52)	3.7845 (1.45)	3.6843 (1.51)
Observations	44	44	44

Source: Authors' calculations.

Note: *t*-statistics are reported in parentheses. *, **, and *** denote statistical significance at the 5%, 1%, and 0.1% levels, respectively.

6.2 Robustness Test

To further examine the impact of social security costs on population mobility and to assess the robustness of the model, this study employs a variable substitution approach. Following the estimation strategy of Gan et al. (2015), the dependent variable is replaced with the proportion of the migrant population (RPR), defined as the ratio of the floating population to the registered population, to capture the scale of population mobility. Two-way fixed effects regressions are then estimated. As reported in Models (4)–(6) in Table 5, the direction and statistical significance of the estimated coefficients remain largely unchanged after the substitution, indicating that the model passes the robustness test.

To further identify the role of social security costs and enhance the robustness of the analysis, this study accounts for potential distortions arising from the COVID-19 pandemic and examines the stationarity of the data. Both dependent and independent variables are transformed into logarithmic form. In addition, the sample period is extended from 2018–2021 to 2018–2024. To mitigate potential omitted variable bias, several additional variables are incorporated into the model, including the one-period lag of population mobility, a pandemic dummy variable, measures of the educational and industrial structure of the floating population, and interaction terms between social security costs and the pandemic variable. These supplementary variables are defined in Tables 5 and 6.

Table 5. Definitions and Measurements of Variables

Variables and Symbols	Measurement	Unit
Dependent Variable		
Population Mobility (lnPM)	Measured by the scale of the floating population in mainland cities; by mobile residents in Hong Kong; and by the floating population in Macao, including immigrants from mainland China, authorized residents, non-resident workers, and non-local students.	Million people
Total Social Security Cost (lnSSC)		
Population Mobility (lnPM)	Public Cost (lnSSC _P) + Enterprise Cost (lnSSC _B) + Individual Cost (lnSSC _I)	Ten thousand yuan (CNY 10,000)
Public Social Security Cost (lnSSC _P)	Per Capita Fiscal Expenditure on Social Security	Ten thousand yuan (CNY 10,000)
Enterprise Social Security Cost (lnSSC _B)	Portion borne by enterprises	Ten thousand yuan (CNY 10,000)
Individual Social Security Cost (lnSSC _I)	Portion borne by individuals	Ten thousand yuan (CNY 10,000)
Control Variables		
Wage Income Level (SA)	Average Wage of On-the-Job Employees	Ten thousand yuan

Variables and Symbols	Measurement	Unit
		(CNY 10,000)
Level of Economic Development (ED)	Per Capita Gross Regional Product (GRP)	Ten thousand yuan (CNY 10,000)
Unemployment Rate (UE)	Registered Urban Unemployed / Total Urban Labor Force	Percentage (%)
Local Fiscal Expenditure (FE)	Total Local Government Expenditure	Billion yuan (CNY 100 million)
Educational Structure of the Floating Population (ES)	Theil Index Calculated Based on Educational Distribution	
Industrial Structure of the Floating Population (IS)	Theil Index Calculated Based on Industrial Distribution	
Pandemic (Epi)	Assigned a value of 0 for 2018–2019, indicating the pre-pandemic period; a value of 1 for 2020–2022, indicating the pandemic lockdown period; and a value of 2 for 2023–2024, indicating the post-pandemic period.	

Source: China Urban Statistical Yearbook; Guangdong Statistical Yearbook; Macao Statistical Yearbook; Hong Kong Annual Digest of Statistics; World Bank, World Development Indicators; and authors' compilation.

Note: lnPM and lnSSC denote log-transformed variables. Monetary values are expressed in RMB (CNY 10,000). Additional variables include lagged population mobility, pandemic indicator, and structural characteristics of the floating population.

Table 6. Descriptive Statistics of Variables (n = 77)

Variable	Mean	SD	Min	Max
LnPM	1.03	0.93	-0.61	2.60
lnSSC	1.70	0.26	1.15	2.27
lnSSC _P	1.01	0.32	0.44	1.74
lnSSC _B	0.97	0.35	0.06	1.50
lnSSC _I	0.65	0.24	0.03	1.02
SA	11.13	3.38	6.99	19.00
ED	16.06	11.84	5.19	56.49
UE	2.60	0.69	1.20	6.60
FE	18.58	19.82	3.16	72.57
ES	-0.27	0.07	-0.45	-0.15
IS	-0.19	0.13	-0.48	-0.01
Epi	1.00	0.76	0.00	2.00

Source: China Urban Statistical Yearbook; Guangdong Statistical Yearbook; Macao Statistical Yearbook; Hong Kong Annual Digest of Statistics; World Bank, World Development Indicators; and authors' calculations.

Note: Variables are defined in Table 5. All monetary values are expressed in RMB.

Table 5 presents the definitions and measurements of the variables. Population mobility (lnPM) is measured using the scale of the floating population across mainland cities, as well as mobile residents in Hong Kong and Macao. Total social security costs (lnSSC) are decomposed into public costs (lnSSCP), enterprise costs (lnSSCB), and individual costs (lnSSCI), all expressed in logarithmic form. Control variables include wage income (SA), economic development level (ED), unemployment rate (UE), fiscal expenditure (FE), and structural indicators such as the educational structure (ES) and industrial structure (IS) of the floating population. The pandemic variable (Epi) captures three phases: pre-pandemic (2018–2019), pandemic period (2020–2022), and post-pandemic recovery (2023–2024).

Table 6 reports the descriptive statistics of the variables. The results indicate reasonable variation across all variables, suggesting that the dataset is suitable for regression analysis and subsequent robustness checks.

To further validate the baseline findings, this study conducts additional robustness checks by decomposing social security costs into their respective components and introducing exogenous moderating variables. The results are broadly consistent with the baseline regressions and provide further insights into the underlying mechanisms.

As shown in Table 7, the negative impact of total social security costs (lnSSC) on the size of the urban floating population (lnPM) remains robust across different model specifications. In Model (1), the coefficient of lnSSC is -0.346 ($p < 0.05$), indicating that higher social security costs exert a significant crowding-out effect on population inflows. This finding is consistent with the baseline results and confirms the stability of the core relationship.

When examining the heterogeneity of cost structures, the decomposition of total social security costs into public (lnSSCP), enterprise (lnSSCB), and individual (lnSSCI) components reveals differentiated effects. The coefficient of public costs (lnSSCP) in Model (2) is -0.245 ($p < 0.05$), suggesting a significant negative effect on population mobility. This implies that higher public social security expenditures, potentially reflecting increased fiscal pressure, may reduce the attractiveness of cities.

In contrast, the coefficients of enterprise costs (lnSSCB) and individual costs (lnSSCI) in Models (4) and (5) are 0.266 ($p < 0.05$) and 0.403 ($p < 0.05$), respectively, indicating significant positive effects. These results suggest that higher enterprise and individual contributions may reflect a more formalized labor market and stronger social security expectations, thereby enhancing the attractiveness of destination cities and generating a “pull effect” on population mobility.

Regarding the moderating mechanism, the pandemic variable (Epi) and its interaction terms with social security costs are introduced to extend the static framework of the baseline model. The results show that the pandemic variable has a significantly positive effect across all models at the 0.1% level, indicating a strong rebound in population mobility during the post-pandemic period.

Moreover, the interaction terms ($\ln\text{SSCP} \times \text{Epi}$, $\ln\text{SSCB} \times \text{Epi}$, $\ln\text{SSCI} \times \text{Epi}$) are all significantly positive at the 1% or 0.1% levels, suggesting that the pandemic has strengthened the stabilizing role of social security systems in supporting population mobility. This finding provides a dynamic complement to the baseline cost–mobility relationship.

The estimates of the control variables are also robust. The unemployment rate (UE) consistently exhibits a negative effect, while the industrial structure (IS) shows a positive and significant effect in several specifications. These results indicate that employment opportunities and industrial diversification remain key drivers of population mobility.

In summary, the robustness checks confirm the core finding that total social security costs reduce population mobility, while the effects vary depending on the cost-bearing entity. Furthermore, external shocks such as the pandemic appear to reinforce the role of social security systems. These results mitigate concerns regarding measurement bias and model misspecification, thereby strengthening the credibility and explanatory power of the empirical findings and providing robust support for Hypotheses H1 and H2.

Table 7. Robustness Checks

Variable	Dependent Variable: Urban Floating Population Size ($\ln\text{PM}$)				
	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
L. $\ln\text{PM}$	0.283** (2.850)	0.268* (2.550)	0.218* (2.050)	0.096 (0.870)	0.103 (0.960)
$\ln\text{SSC}$	-0.346* (-2.300)				
$\ln\text{SSC}_\text{P}$		-0.245* (-2.630)	-0.131* (-1.26)		
$\ln\text{SSC}_\text{B}$		-0.036 (-0.130)		0.266 (1.970)	
$\ln\text{SSC}_\text{I}$		-0.140 (-0.330)			0.403* (2.220)
SA	-0.011 (-0.660)	-0.004 (-0.250)	0.023 (1.240)	0.023 (1.350)	0.024 (1.380)
ED	0.002 (0.830)	0.002 (0.550)	0.001 (0.280)	-0.003 (-1.060)	-0.004 (-1.230)
UE	-0.044* (-2.330)	-0.047* (-2.470)	-0.029 (-1.310)	-0.037 (-1.710)	-0.043 (-1.970)
FE	-0.003 (-1.890)	-0.003 (-1.470)	-0.001 (-0.430)	-0.001 (-0.480)	-0.001 (-0.480)
ES	-0.527 (-0.870)	-0.546 (-0.870)	-1.500* (-2.160)	-1.469* (-2.230)	-1.278 (-1.930)
IS	0.888 (0.910)	0.857 (0.860)	3.015** (2.810)	2.425* (2.370)	2.396* (2.33)
Epi	0.220*** (5.810)	0.209*** (5.330)			
	0.222*** (4.330)	0.201*** (3.610)			

Variable	Dependent Variable: Urban Floating Population Size (lnPM)				
	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
lnSSC _p #Epi			0.067** (3.000)		
lnSSC _B #Epi				0.068*** (3.630)	
lnSSC _t #Epi					0.106*** (3.720)
Individual Fixed Effects	Control Variables	Control Variables	Control Variables	Control Variables	Control Variables
Time Fixed Effects	Control Variables	Control Variables	Control Variables	Control Variables	Control Variables
Constant	1.461*** (4.730)	1.195*** (4.500)	0.023*** (3.520)	0.601* (2.360)	0.651** (2.690)
Observations	77	77	77	77	77

Source: Authors' calculations.

Note: *t*-statistics are reported in parentheses. *, **, and *** denote statistical significance at the 5%, 1%, and 0.1% levels, respectively.

7. Conclusions

Building on the findings of this study and considering the unique characteristics of the Guangdong–Hong Kong–Macao Greater Bay Area (GBA)—including “one country, two systems,” multiple customs regimes, and different currencies—this paper highlights the broader implications of social security system differences for regional integration.

From the essence of the results, the inhibiting effect of institutional costs arising from differences in social security systems on population mobility reflects a fundamental tension between institutional coordination and factor mobility in the GBA. While economic factors remain the primary driver of population mobility, the implicit costs associated with fragmented social security systems have increasingly become a bottleneck in the efficient allocation of labor. Compared to other urban agglomerations, such as the Yangtze River Delta, the GBA faces greater challenges in coordinating social security systems across jurisdictions, particularly in terms of benefit portability. As a result, some migrants adopt a pattern of “short-term mobility with long-term return,” which weakens the formation of a stable labor supply and constrains regional industrial and talent integration.

The empirical findings further demonstrate that the effects of social security costs vary across responsible entities, reflecting the inherent tension between cost sharing and welfare balance. Public social security expenditure has a negative effect on population mobility, suggesting that higher fiscal spending does not necessarily translate into greater attractiveness for migrants. Instead, excessive public expenditure may generate fiscal pressure, higher taxes, and congestion in public services.

Similarly, enterprise social security costs exert a negative impact on population mobility. Given the industrial structure of the GBA, where manufacturing and service sectors are highly sensitive to labor costs, higher employer contributions may

discourage hiring—particularly among small and medium-sized enterprises—thereby reducing labor demand and limiting population inflows.

In contrast, individual social security costs show a positive relationship with population mobility. This does not imply that higher personal contributions are inherently beneficial but rather reflects migrants' demand for secure employment and reliable social protection. It indicates that workers place value on the accessibility and completeness of social security benefits, suggesting that perceived welfare gains can offset the burden of individual contributions.

Overall, the study confirms that differences in social security systems generate institutional costs that significantly shape population mobility patterns in the GBA, with heterogeneous effects across cost components and city types.

8. Policy Implications

Based on the theoretical and empirical analysis, several policy implications can be drawn to promote more efficient and orderly population mobility in the Guangdong–Hong Kong–Macao Greater Bay Area.

First, given the objective existence of differences in social security systems across the GBA, policymakers should prioritize institutional coordination rather than full equalization. Drawing on the experience of the European Union, efforts should focus on establishing mechanisms that enhance compatibility and connectivity across systems. This includes creating a coordinated platform for social security cooperation, identifying linkages among existing systems, and promoting unified planning and implementation. Expanding pilot initiatives—such as social security integration programs and one-stop service platforms—can help reduce institutional barriers and facilitate cross-regional mobility.

Second, it is necessary to optimize the cost-sharing structure among governments, enterprises, and individuals. On the public side, improving the efficiency of social security expenditure and diversifying financing channels can reduce fiscal pressure while maintaining sustainability. On the enterprise side, appropriately adjusting contribution rates can alleviate labor cost burdens and enhance the vitality of market entities. On the individual side, increasing income levels and strengthening incentives for participation in social insurance can improve both coverage and effectiveness. A balanced allocation of social security costs across stakeholders can support a virtuous cycle of economic development and population inflows.

Third, reforms should address the non-portability and discontinuity of social security benefits, which represent a major source of institutional costs. At the cross-border level, policies should be refined to improve access to pensions, healthcare, and employment support for mobile populations, particularly for Hong Kong and Macao residents moving to the mainland. Measures such as expanding medical service provision, supporting entrepreneurship, and improving elderly care systems can help reduce welfare gaps. At the regional level within the Pearl River Delta, local governments should update policies to remove unnecessary restrictions linked to

household registration and employment status. For example, adopting flexible pension calculation mechanisms and promoting interoperability of medical insurance systems can significantly reduce the costs associated with mobility.

In summary, adhering to the principles of “money follows people” and “benefits follow mobility,” improving the portability and accessibility of social security systems, and reducing institutional barriers are essential for enhancing population mobility and advancing regional integration in the Greater Bay Area.

9. Ethics Statement

This study used secondary data from publicly available sources and did not involve human participants, personal identifiable information, or primary data collection. Therefore, ethics committee approval was not required.

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