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Developmental balance and youth migration attraction: Structural effects of urban system coordination in Chinese cities

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ABSTRACT

Youth migration has become an important force shaping urban population structures and development trajectories in developing countries. Drawing on 2023 data from eleven selected Chinese cities, this study develops a dual-subsystem framework to examine a city's attractiveness to young immigrants through two key dimensions: a material-economic subsystem and an institutional support subsystem. Using the entropy weighting method, we construct development scores for multiple indicators in both dimensions. We then apply these development scores to the Coupling Coordination Degree Model to assess the balance or coordination between the two subsystems. We then use Pearson and Spearman correlation analyses to explore the associations between overall development, subsystem coordination, and population inflows. The results show that both composite development scores and coordination degrees are positively associated with population inflows. However, these relatively modest associations must be interpreted with caution given the small sample size. Overall, the findings suggest that youth migration depends not only on economic opportunities, but also on the coordinated provision of institutional support such as education, healthcare, and public services. Our study provides preliminary, exploratory, yet useful evidence that a balanced or well-coordinated urban system plays a role in attracting immigration to Chinese cities.

Contribution/Originality: This study contributes to the literature by integrating economic conditions and institutional support into a dual-subsystem framework to assess the effect of a city's coordination of subsystems on youth migration. By combining the entropy weighting method, the coupling coordination approach, and correlation analysis, our study offers exploratory yet useful evidence on how balanced urban development relates to population inflows in Chinese cities.

1. INTRODUCTION

In an era of intensifying competition among cities, young people's residency or settlement decisions play a key role in urban vitality and regional development. Economists often view migration as a result of an adjustment process toward an equilibrium for expected wages and employment opportunities, as suggested by Harris and Todaro (1970). Broader spatial equilibrium frameworks further include a set of factors: wages, amenities, public services, and living costs, when migrants decide where to settle (Glaeser & Gottlieb, 2009; Roback, 1982; Rosen, 1979). There is, however, a need for more integrated approaches to examining what makes a city attractive to migrants, particularly young, skilled migrants. Investigation ought to go beyond individual indicators or domains and examine whether they interact and reinforce (or constrain) each other rather than analyzing them in isolation.

This need is especially relevant in developing countries such as China. Rapid urbanization and population redistribution across regions and cities in the developing world have led some cities to not only retain their populations but also attract immigrants, while others experience emigration and population decline. These cities differ greatly in their economic strength and institutional capacity and exhibit different patterns of immigration or population change. Yet the mechanisms underlying these differences in migration and population change remain only partially understood, despite helpful insights from the existing literature. Such differences in developing countries' cities undeniably provide a good opportunity for empirical research to examine whether and how a city's attractiveness stems mainly from one or more individual factors, or from how well these factors are matched with and support one another. Precisely, is a city's attractiveness mainly attributed to its raw economic power, or to how well its economic vigor is matched and supplemented by the supportive institutions it offers its residents?

We thus aim to tackle this question through China's experience. With its large number of cities and their high diversity, China offers a suitable setting for exploring whether a city's attractiveness arises primarily from strength in individual domains, especially economic vigor, or from coordination among multiple urban subsystems, and how economic conditions and institutional support jointly influence a city's attractiveness. Some Chinese cities have been experiencing rapid economic growth, attracting young migrant workers; others have been seeing dwindling local economies and population declines, while many others are in between. Furthermore, these cities vary widely in employment capacity, income levels, education and healthcare resources, and public service accessibility. These multiple facets of variation make the Chinese experience especially well-suited to understanding the mechanisms behind a city's attractiveness and the role of interaction between the city's economic conditions and its institutional support. Also, the Chinese experience can shed light on and offer lessons for many developing countries as they undergo rapid urbanization, population redistribution, demographic shifts, and rising regional inequalities.

To answer whether and how economic conditions and institutional support jointly influence a city's attractiveness, we ask three specific questions: (1) Is stronger overall urban development associated with greater attractiveness to migrants? (2) Does better coordination between the economic and institutional subsystems correspond to larger population gains? And (3) Does a systemic coordination perspective offer additional insight beyond simply examining economic or institutional factors on their own? In addressing these questions, this study brings migration theory and urban systems thinking into closer conversation and provides preliminary city-level evidence from China on the value of balanced development.

To address these questions, our approach dissects a city's urban system into two subsystems. The material-economic subsystem comprises indicators such as employment, wages, industrial structure, income, and living costs. The institutional-support subsystem comprises indicators such as education, healthcare, and public services. We then apply entropy-weighted scores and the Coupling Coordination Degree Model (CCDM) to data on eleven Chinese cities reported for 2023. The CCDM analysis reflects the level of development balance between the material-economic subsystem and the institutional-support subsystem. We then perform a correlation analysis to assess whether the level of balance between a city's two subsystems helps explain differences in population change.

The results of our empirical analysis show that both the two subsystems' overall development performance and their coordination are positively associated with net population growth. Cities with more balanced development appeared to experience population growth. These findings should, however, be interpreted with caution. Because our analysis employs only eleven cities and relies on correlations rather than causal identification, the evidence remains preliminary and exploratory. Nonetheless, these findings suggest that a city's attractiveness arises not only from individual domains, such as economic vigor and institutional support, but also from the coordinated interplay between them.

2. LITERATURE ON YOUTH MIGRATION AND URBAN ATTRACTIVENESS

Scholars have explored migration in terms of economic incentives and human capital investment. Such a perspective views individuals' migration or relocation as an investment decision. Thus, the cost-benefit analysis weighs the expected costs and returns of moving (Sjaastad, 1962). Harris and Todaro (1970) further argue that migration decisions are driven not only by "current" disparities or dissatisfaction, such as present wage gaps, but also by expectations, such as expected income and the probability of finding employment. These traditional explorations advance our understanding of why cities with stronger labor markets, higher income prospects, and more dynamic economies tend to attract population inflows.

Recent studies that explore migration have shown that economic considerations alone do not fully explain why an individual relocates. For example, Massey et al. (1993) find that institutional, household, and social circumstances also play a role.

Others propose that migration decisions are a complex process. King and Skeldon (2010) suggest that internal and international migration are not two isolated decisions but rather an interconnected, integrated process. Paul (2011) conceptualizes migration as unfolding, rather than as a single, direct move from origin to destination, in stepwise or sequential stages. These additional perspectives may be particularly relevant for young migrants, whose decisions extend beyond current employment and careers to include educational opportunities, long-term career prospects, and family and friendships.

Empirical studies of youth mobility that focus on post-secondary education students lend support to this complex view of migration, which is influenced by multiple factors and at various stages. For example, Brooks and Waters (2011) highlight the role of educational capital in shaping young people's spatial choices. Tremblay (2005) connects academic mobility to immigration and skilled migration. King and Sondhi (2018) show that international student migration is generally affected by educational goals and destination characteristics. Carling and Collins (2018) suggest that young adults' migration decisions are substantially affected by psychological factors. For instance, their aspirations and desires greatly influence their residency choices. Thus, young migrants' decisions may reflect their expectations about lifestyle, social mobility, and prospects, as well as material incentives. In the Chinese context, Wang, Cui, Yu, and Wang (2023) demonstrate that many young, educated individuals follow a sequential migration path from their place of origin to university and then to work. Such a path is shaped by human capital, family background, institutions, and destination attributes.

This body of literature suggests that youth migration has evolved from a narrow labor-market response to a residency choice with multiple dimensions and stages. Young people evaluate destinations not only as places of employment but also as sites for education, career development, lifestyle, and long-term settlement. However, many prior studies continue to examine these factors in isolation, such as income, education, or employment, with little attention paid to how the overall level of urban development, combining economic and institutional conditions, relates to youth migration attraction.

A parallel strand of literature does not examine migration but the factors that make a city attractive to young immigrants. Studies in this area focused primarily on economic factors, and their findings corroborate those reported in the migration literature. Cities with stronger industrial structures, more diversified employment opportunities, and higher income levels were seen as natural magnets for migrants (Buch, Hamann, Niebuhr, & Rossen, 2014; Glaeser & Gottlieb, 2008; Glaeser & Gottlieb, 2009). This economic perspective effectively explains why vibrant labor markets continue to draw population inflows.

Spatial equilibrium theory (Roback, 1982; Rosen, 1979) further offers a broader view, arguing that a city's attractiveness rests on its comparisons of wages, rents, prices, amenities, and overall quality of life with other cities. A high-income city may lose appeal if living costs are high or public services deteriorate, while a medium-sized but prosperous city may remain attractive through better amenities and institutional support. Later studies reinforce this understanding of a city's attractiveness as multidimensional. Coulter and Scott (2015) and Czaika and Vothknecht

(2014) suggest that the attractiveness of a city extends beyond its economic conditions to include household circumstances, lifestyle considerations, and aspirations, which are closely tied to the perceived well-being the city can provide rather than to objective income alone. Together, these studies establish that various factors, rather than a single economic, material, or monetary factor, make a city attractive.

Empirical studies that explore the attractiveness of a city lend firsthand support to this view. For example, Yu, Zhang, Tao, and Liang (2019) reinforce economic opportunities as a main driver of a city's attractiveness in the context of China. Liao and Wang (2019) find that in China, urban amenities, such as healthcare, education, and transportation, play a role. Florida (2019) highlights the importance of creative environments and urban amenities. Other studies further point to the roles of public services, urban integration, housing availability, city size, and overall living conditions in influencing a city's appeal (Chen, Wu, Liu, & Wang, 2020; Lin & Zhu, 2022; Song, Zhu, & Luo, 2022).

These two strands of literature jointly illustrate that employment, wages, industrial development, and related economic attributes contribute to a key part of a city's appeal and provide the material foundation for migration, while education, healthcare, public services, and housing shape long-term settlement expectations and further enhance the city's charm and thus supplement and complement its economic attributes.

2.1. From Individual Factors to System Coordination

Despite these advances, these prior studies largely treat each individual factor of material-economic conditions and each element of institutional support as separate determinants. While such an approach may effectively identify individual influences, it offers limited insight into how they interact with one another. A city might, for instance, possess strong economic foundations such as abundant employment opportunities but offer weak public services. Such a city may struggle with long-term retention of young people. Alternatively, a city can have plenty of excellent educational institutions and provide quality healthcare but still be short on job creation. Cities of this sort likely fail to attract young migrants in the first place. Employment and wages may draw migrants initially, but education, healthcare, housing, and public services play a crucial role in shaping their longer-term settlement decisions, as Zhou et al. (2021) demonstrate. These imbalances are likely to undermine the sustainability of population inflows over time.

Scholars, such as Batty (2013) argue that cities are complex systems in which economic activities, infrastructure, institutions, public services, and population flows are deeply interconnected. A city's charm may thus depend not only on the strength of individual components but also on whether different subsystems develop in a coordinated manner. Evidently, Young (2013) shows that migration patterns are shaped by broader structural inequalities, rather than by isolated factors alone.

Building on the literature reviewed above, we propose two hypotheses:

H_1: A higher level of multidimensional urban development is positively associated with stronger youth migration attraction.

H_2: A higher degree of coordination between the material-economic subsystem and the institutional support subsystem is positively associated with stronger youth migration attraction.

To more systematically examine whether a city's attractiveness also depends on whether different factors or subsystems jointly function in a coordinated manner, coupling coordination analysis apparently offers a readily available and useful methodological tool. In the migration context, this approach suggests that.

2.2. Research Gaps and Contribution of This Study

The existing literature provides useful insights into migration and a city's attractiveness. Yet important gaps remain. First, classical migration theories center on monetary incentives such as income and employment prospects. More recent studies highlight aspirations, personal development, settlement intentions, and the role of institutional factors at the destination, including public services, housing, and healthcare. These two lines of research are rarely integrated, even though young migrants' decisions typically involve both economic and institutional considerations.

Second, literature on the attractiveness of cities also largely examines potential factors in isolation. This practice makes it difficult to determine whether cities attract migrants through strengths or through the coordinated development of multiple subsystems. In particular, the interplay or coordination between material-economic conditions and institutional support has rarely been explored.

To address these gaps, we develop a dual-subsystem framework that distinguishes between a city's material-economic subsystem and its institutional support subsystem. Using 2023 data from eleven Chinese cities, we not only apply the entropy weighting method but also adopt CCDM and subject the CCDM results and data on population inflows to correlation analysis. Given the small sample size, we do not claim to establish causal effects. Nonetheless, our empirical findings, although exploratory and preliminary, offer insightful evidence on the relationship between balanced urban development and population inflows. Moreover, one of the key contributions of this study lies in shifting the focus of the literature on migration and cities' attractiveness away from isolated advantages and toward the structural coordination of urban systems.

3. EMPIRICAL STRATEGIES

To examine the proposed H1 and H2, our analysis proceeds in four stages: (1) data collection and sample selection, (2) indicator normalization and entropy-based weighting, (3) construction of subsystem development scores and coupling coordination degrees, and (4) correlation-based assessment of associations with population inflows.

3.1. Data Sources and Sample Selection

China offers a suitable single-country setting for examining migration and a city's attractiveness. A within-country analysis helps reduce heterogeneity in institutions that likely arises in cross-national comparisons, including differences in legal systems, policy regimes, and statistical standards. At the same time, Chinese cities offer substantial variation in economic capacity, industrial structure, public service provision, and population growth. This diversity makes Chinese cities well-suited for exploring whether and how the coordination level of a city's subsystems relates to its migration pattern.

Our sampling method employs a stratified purposive approach, selecting cities listed in the 2024 PwC Cities of Opportunity report (China Development Research Foundation & PwC China, 2024). To reflect sufficient diversity in development levels, industrial structures, and public service capacities while ensuring consistent city-level data availability, our sampling method yields eleven cities. They are Shenzhen, Guangzhou, Hefei, Changsha, Hangzhou, Ningbo, Jinan, Chengdu, Fuzhou, Quanzhou, and Nanjing. The small sample size makes the analysis, at best, exploratory rather than statistically representative of all Chinese cities. Therefore, the results and findings from our correlation investigation should be interpreted with caution regarding their generalizability.

Our analytical framework includes twelve indicators. They are evenly grouped into two subsystems. The six indicators in the material-economic subsystem are (1) employment, (2) average wage, (3) high-tech industry development measure, (4) per capita GDP, (5) per capita disposable income, and (6) the consumer price index. The six indicators in the institutional support subsystem are (1) higher education scale index, (2) number of undergraduate institutions, (3) compulsory education resources, (4) public health index, (5) number of Grade-A hospitals, and (6) medical infrastructure capacity.

Because not all eleven cities exhibit or report comparable youth-specific migration, overall population growth is inevitably used as a second-best proxy for youth migration in the ultimate correlation analysis between the coordination level of a city's two subsystems and its youth population change. We assess population change using population growth in 2023, defined as the ratio of the net increase in permanent residents to the total population at the beginning of the year.

All data are gathered from official or authoritative sources, including the National Bureau of Statistics of China, local statistical yearbooks, municipal and provincial statistical reports, and relevant regional publications circulated by professional institutions such as PwC.

3.2. Data Normalization and Indicator Weight Development

The twelve indicators are measured differently. To ensure "comparability" across indicators, we applied min-max normalization to transform all values to a common scale from 0 to 1. Not only does this step remove differences in measurement units, but it also enables meaningful aggregation if needed.

However, before normalization, each indicator was classified as either positively oriented (where higher values indicate better performance, such as wages or educational resources) or negatively oriented (where higher values indicate poorer performance, such as the consumer price index). For positively oriented indicators, the normalized value is calculated as follows:

$$X'_{ij} = \frac{X_{ij} - \min(X_j)}{\max(X_j) - \min(X_j)} \qquad (1)$$

On the other hand, we use the reverse formula for negatively oriented indicators.

$$X'_{ij} = \frac{\max(X_j) - X_{ij}}{\max(X_j) - \min(X_j)} \qquad (2)$$

Here, X_{ij} is the original value of city i on indicator j, while X'_{ij} represents the corresponding normalized value. The terms $\min(X_j)$ and $\max(X_j)$ are the minimum and maximum values of indicator j across the sample.

We then applied the entropy weighting method to assign objective weights to the twelve indicators. Unlike subjective weighting approaches that arbitrarily assign weights, the entropy weighting method reduces subjective bias by allowing the data's actual variation to determine the relative importance of each indicator. Indicators that show greater dispersion across the eleven cities receive higher weights because they contain more informative variation.

The entropy-weighting procedure involves four steps. First, we calculate the proportion of each city's value for a given indicator.

$$p_{ij} = \frac{X'_{ij}}{\sum_{i=1}^{11} X'_{ij}} \qquad (3)$$

Next, the entropy value for each indicator is computed as:

$$e_j = -k \sum_{i=1}^{11} p_{ij} \ln(p_{ij}) \qquad (4)$$

Where $k = \frac{1}{\ln(11)}$. Please note that 11 reflects the total number of cities. When an indicator has similar values across cities, e_j approaches one. The redundancy degree, which reflects the amount of useful information contained in an indicator, is then defined as:

$$d_j = 1 - e_j \qquad (5)$$

Finally, the weight for each indicator is obtained by normalizing the redundancy value.

$$w_j = \frac{d_j}{\sum_{j=1}^{m} d_j} \qquad (6)$$

Here m is the total number of indicators.

3.3. City Development Scores

To gauge the development level of each subsystem, we applied the previously derived entropy weights to the normalized indicators. The overall development score of each city is calculated as:

$$U = \sum_{k=1}^{12} w_k \cdot X'_k \qquad (7)$$

We also obtained each city's development score for each subsystem. The economic subsystem score (U_1) and institutional subsystem score (U_2) are computed separately as:

$$U_1 = \sum_{k=1}^{6} w_k \cdot X_k{}' \qquad (8)$$

and

$$U_2 = \sum_{k=7}^{12} w_k \cdot X_k{}' \qquad (9)$$

Here, w_k denotes the entropy-derived weight for indicator k, and X_k' represents the normalized value of that indicator.

3.4. CCDM Analysis

Once the development scores for the two subsystems were obtained, we applied the Coupling Coordination Degree Model (CCDM) to evaluate the level of coordination or balance between the material-economic subsystem and the institutional support subsystem. The model produces two key measures: the coupling degree (C_i) and the coordination degree (D_i). The coupling degree captures the relative balance between the two subsystem scores. The degree of coordination incorporates both the relative balance and the overall development level of the two subsystems. These measures allow us to distinguish cities with relatively balanced development from those with uneven patterns, for example, strong economic performance paired with weaker institutional support.

The coupling degree is calculated as:

$$C_i = \frac{2\sqrt{U_{1i}U_{2i}}}{U_{1i}+U_{2i}} \qquad (10)$$

Where U_{1i} represents the material-economic subsystem score of a city i, and U_{2i} represents its institutional support subsystem score. The value of C_i ranges from zero to one. A value closer to one indicates a higher degree of balance between the two subsystem scores, while a lower value indicates greater disparity between the two subsystems.

The index for assessing the development level of the two subsystems is calculated as:

$$T_i = 0.5U_{1i} + 0.5U_{2i} \qquad (11)$$

Where T_i represents the average development level of the two subsystems for a city i. Here, we assign equal weights to both subsystems because we consider material-economic conditions and institutional support of equal importance.

We then computed the coordination degree as:

$$D_i = \sqrt{C_i T_i} \qquad (12)$$

Where D_i denotes the degree of coordination between the material-economic subsystem and the institutional support subsystem. Higher values of D_i indicate more coordinated development, reflecting not only elevated balance between subsystems but also the overall level of development of the two subsystems.

3.5. Correlation Analysis Design

Our correlation analysis therefore treats D_i as the measure of subsystem coordination. Given the small sample size (n=11), this study does not aim to conduct regression analyses. Instead, we rely on correlation analysis to explore whether the observed patterns between the measure of subsystem coordination D_i and population changes are consistent with the hypotheses: H1 and H2.

We begin with Pearson correlation coefficients to examine linear associations between the subsystem coordination measure D_i and population changes. We also explore Spearman rank correlations, which are better suited to small samples because they assess monotonic relationships based only on ranks rather than raw-value normality.

The analysis focuses on two main relationships: (1) the association between the composite urban development score and the population growth rate (relevant to H1); (2) the association between the coordination degree and the population growth rate (relevant to H2).

For each relationship, we report both Pearson and Spearman coefficients, along with their p-values. Given the small sample size and the correlation analysis, we should be cautious when interpreting the results and their statistical significance. Coefficients that are significant at the 10% level are viewed as suggestive rather than confirmatory. All positive coefficients are treated as associations rather than causal effects.

4. EMPIRICAL RESULTS

In this section, we present the analysis results. We begin with descriptive statistics, followed by subsystem development scores, coupling coordination measures, and finally, correlation results.

4.1. Descriptive Statistics

The eleven cities exhibit considerable variation in population size, population growth, development level, and resource availability, reflecting diverse development and capacities to retain existing residents and host new residents, as shown in Table 1. Shenzhen and Guangzhou recorded the largest net population increases, followed by Hefei and Changsha. These patterns suggest that first-tier cities and some rapidly developing regional centers were able to attract immigrants, resulting in population growth.

Table 1. Descriptive Statistics of Urban Development Indicators across 11 Sample Cities, 2023.

City	Shenzhen	Guangzhou	Hefei	Changsha	Hangzhou	Ningbo	Jinan	Chengdu	Fuzhou	Quanzhou	Nanjing
Total Population# (in 10,000s)	1798.95	1897.8	1000.2	1061.7	1262.4	977.7	951.5	2147.4	850.1	891.4	957.7
Newly Added Population@ (in 10,000s)	19.94	15.1	14.9	10.39	10.2	8	7.8	7.1	3.2	3.1	3
Population Growth Rate# (%)	1.12%	0.80%	1.51%	0.99%	0.81%	0.82%	0.80%	0.33%	0.38%	0.35%	0.31%
Urban employment numbers#	1228.9	1138.8	586.1	521.36	770.2	607.3	476.8	1167.85	407	510	486.55
Average wage levels#	174478	159312	119182	125162	162774	138210	108131	110177	124215	95586	129220
High-tech industry index$	55	50	41	54	52	37	39	48	34	22	45
Per capita GDP#	20.6	17.9	15.8	14.3	17.9	16.9	13.9	16.6	13.8	12.8	17.5
Per capita disposable income#（Yuan）	81123	76711	54049	66343	74109	70829	56882	48175	57339	57845	66354
Consumer Price Index$	7	11	14	44	18	10	19	42	47	51	8
Higher education scale index$	15	57	44	49	39	21	40	53	33	24	50
Number of undergraduate institutions #	7	29	10	14	12	4	9	19	8	2	24
Number of compulsory education schools#	939	1440	732	1135	854	626	843	1110	1105	1316	686
Public health index$	54	46	24	8	50	49	36	28	25	11	42
Number of top-tier (Grade-A) hospitals#	32	38	10	18	22	6	12	54	13	10	25
Medical infrastructure scale index$	28	49	37	40	57	27	51	54	13	10	53

Note: # means from local government database; $ means from PWC report; @ means authors' calculations.

Shenzhen's material-economic subsystem stands out for having the highest levels of employment and average wages, while Guangzhou, Hangzhou, and Ningbo also perform strongly. In terms of high-tech industry development, Shenzhen and Changsha score particularly high. In contrast, Quanzhou records a low value. There are substantial differences in these cities' industrial composition and structure.

In the institutional support subsystem, Guangzhou hosts the most undergraduate institutions and has a high higher-education scale index, followed by Nanjing and Chengdu. Guangzhou and Nanjing have relatively large numbers of top-tier hospitals, while Quanzhou and Jinan show comparatively weaker healthcare resources.

Overall, the descriptive statistics reveal substantial differences among the sampled cities in both economic strength and institutional support. These variations provide the foundation for constructing subsystem development scores, gauging coupling coordination between subsystems, and ultimately evaluating whether the coordination matches population changes.

4.2. Coupling System Scoring

The entropy weighting method produces the weights for the twelve indicators reported in Table 2. Urban employment receives the highest weight within the material-economic subsystem, while the number of top-tier hospitals carries substantial weight in the institutional support subsystem. In contrast, the high-tech industry index receives the lowest weight in this sample.

Table 2. Entropy-Based Weights of the 12 Indicators.

Indicator	Weight
Urban employment numbers	0.139
Average wage levels	0.077
High-tech industry index	0.044
Per capita GDP	0.079
Per capita disposable income	0.070
Consumer Price Index	0.084
Higher education scale index	0.065
Number of undergraduate institutions	0.094
Number of compulsory education schools	0.090
Public health index	0.071
Number of top-tier (Grade-A) hospitals	0.119
Medical infrastructure scale index	0.069

Using these weights, we calculated overall or composite development scores for each of the eleven cities, as shown in Table 3. Guangzhou and Shenzhen achieve the highest overall scores, reflecting strong performance in both the material-economic and institutional-support subsystems. Chengdu, Hangzhou, and Nanjing also record relatively high scores.

Table 3. Composite Urban Development Scores for the 11 Selected Cities.

City	Score
Shenzhen	0.706
Guangzhou	0.855
Hefei	0.350
Changsha	0.382
Hangzhou	0.606
Ningbo	0.367
Jinan	0.342
Chengdu	0.619
Fuzhou	0.231
Quanzhou	0.143
Nanjing	0.544

In contrast, Hefei and Changsha record sizable population increases despite only moderate composite development scores. This pattern suggests that population inflows do not always align closely with overall multidimensional performance. Cities such as Quanzhou and Fuzhou display the two lowest composite scores, indicating comparatively weaker performance across the selected indicators than all other cities.

4.3. Coupling Coordination Analysis Using the CCDM

To assess the balance or coordination between the material-economic and institutional support subsystems, we applied the CCDM to calculate the coupling degree (C), the average development index (T), and the coordination degree (D) for each city. The results are reported in Table 4.

Table 4. Coupling and Coordination Measures Derived from the CCDM.

City	U1	U2	C	T	D
Shenzhen	0.492	0.214	0.919	0.353	0.570
Guangzhou	0.411	0.444	0.999	0.428	0.654
Hefei	0.192	0.158	0.995	0.175	0.417
Changsha	0.158	0.224	0.985	0.191	0.434
Hangzhou	0.336	0.270	0.994	0.303	0.549
Ningbo	0.263	0.104	0.902	0.183	0.407
Jinan	0.137	0.205	0.980	0.171	0.409
Chengdu	0.233	0.386	0.969	0.309	0.548
Fuzhou	0.081	0.150	0.955	0.115	0.332
Quanzhou	0.038	0.105	0.883	0.071	0.251
Nanjing	0.245	0.300	0.995	0.272	0.520

Guangzhou and Shenzhen exhibit the highest coordination degrees, indicating relatively strong balanced development or coordination between the two subsystems. Hangzhou, Chengdu, and Nanjing also show solid coordination.

In contrast, Hefei, Changsha, and Jinan fall in the middle range, indicating only moderate coordination between their two subsystems. Quanzhou and Fuzhou exhibit the lowest coordination degrees, pointing to noticeable imbalances between economic conditions and institutional support.

Table 5 brings together these key measures, including population growth, composite development scores, and coordination degrees for easier comparison.

Table 5. Population Increase, Composite Development Scores, and Coordination Degrees of the 11 Sample Cities.

City	Total population (in 10,000s)	Newly added population (in 10,000s)	Population increase rate	Composite development score	D
Shenzhen	1799.0	19.9	0.011	0.706	0.570
Guangzhou	1897.8	15.1	0.008	0.855	0.654
Hefei	1000.2	14.9	0.015	0.350	0.417
Changsha	1061.7	10.4	0.010	0.382	0.434
Hangzhou	1262.4	10.2	0.008	0.606	0.549
Ningbo	977.7	8.0	0.008	0.367	0.407
Jinan	951.5	7.8	0.008	0.342	0.409
Chengdu	2147.4	7.1	0.003	0.619	0.548
Fuzhou	850.1	3.2	0.003	0.231	0.332
Quanzhou	891.4	3.1	0.004	0.143	0.251
Nanjing	957.7	3.0	0.003	0.544	0.520

The patterns reported thus far are generally consistent with H1 and H2. Cities with higher composite development scores and higher coordination degrees generally experienced larger population increases. For example, Shenzhen has a relatively high composite development score and coordination degree. The city recorded one of the largest net inflows in 2023. On the contrary, Fuzhou shows lower scores on both indicators and a small population increase. These descriptive patterns from eyeballing are promising but require more rigorous assessment through correlation analysis, especially given the small sample.

4.4. Correlation Analysis

We conducted the correlation analyses specified in Section 3.5 to examine the associations among urban development, subsystem coordination, and population inflows more systematically. Table 6 reports both Pearson correlation coefficients and Spearman rank correlation coefficients. Pearson correlations, while Spearman correlations provide a robustness check based on ranked values.

Table 6. Pearson and Spearman Correlation Analysis.

Panel A. Pearson correlations			
Variables	**(1)**	**(2)**	**(3)**
Population growth	1.000		
Composite development score	0.599*	1.000	
Coordination degree (D)	0.582*	0.988**	1.000
Panel B. Spearman rank correlations			
Variables	(1)	(2)	(3)
Population growth	1.000		
Composite development score	0.545*	1.000	
Coordination degree (D)	0.591*	0.964**	1.000

Note: Pearson correlation coefficients are reported in Panel A, and Spearman rank correlation coefficients are reported in Panel B. As no reported p-values fall between 0.01 and 0.10, the table reports only two significance levels rather than the conventional three-star notation. * $p < 0.10$, ** $p < 0.01$.

The Pearson correlations assessing linear associations show positive associations between population growth and both the composite urban development score ($r = 0.599$, $p < 0.10$) and the coordination degree ($r = 0.582$, $p < 0.10$). Similarly, the Spearman rank-based correlation measures exhibit similar patterns: $r = 0.545$ and $p < 0.10$ for the composite development score, while $r = 0.591$ and $p < 0.10$ for the coordination degree. These results again imply that cities with higher overall development levels and better subsystem coordination tended to experience stronger population growth.

In addition, it is worth noting a high correlation between the composite development score and the degree of coordination: Pearson correlation $r = 0.988$ and Spearman rank correlation $r = 0.964$, both $p < 0.01$. Such results imply that the degree of coordination is not an entirely independent factor but rather a related structural measure capturing the balance between the two subsystems.

Overall, the correlation results provide some exploratory support for the idea that multidimensional urban development and subsystem coordination are positively associated with population attraction. These results are generally consistent with the two hypotheses.

5. DISCUSSION AND POLICY IMPLICATIONS

5.1. Discussion: Systemic Balance and Attractiveness to Migrants

Drawing on data from eleven Chinese cities, this study examined the associations between subsystem coordination and population inflows. The empirical results are generally consistent with our two hypotheses. The composite development score is positively correlated with population growth. The coordination degree is also positively correlated with population growth. However, the relationships appear modest in strength, as they reach statistical significance only at the 10% level. Given the small sample size and cross-sectional design, it is not surprising that these correlation coefficients fail to register statistical significance.

The patterns point to an important insight: youth migration attraction appears linked to overall urban development, but the connection is not uniformly monotonic. Guangzhou and Shenzhen, for example, perform strongly on both measures and attract substantial inflows, consistent with the conventional thought that emphasizes employment opportunities, income prospects, and broader urban conditions (Harris & Todaro, 1970; Roback, 1982; Sjaastad, 1962). At the same time, cities such as Hefei and Changsha achieved notable population gains despite only moderate composite development scores. This suggests that specific local advantages, such as industrial upgrading, educational resources, or relative affordability, can sometimes drive inflows even when overall development levels are not exceptionally high.

The results are also consistent with a broader understanding of a city's attractiveness: migration and long-term settlement decisions are shaped not only by wages and jobs but also by education, healthcare, public services, housing conditions, and overall quality of life (Chen et al., 2020; Glaeser & Gottlieb, 2009; Liao & Wang, 2019; Lin & Zhu, 2022; Rosen, 1979; Song et al., 2022). This is consistent with the perspective that cities function as complex systems in which economic, institutional, infrastructural, and social elements are deeply interconnected (Batty, 2013). Cities with strong economic foundations but insufficient institutional support may struggle to attract and retain young migrants over time. For young immigrants, employment and wages may provide the initial motivation to move, but education, healthcare, and public services often determine whether they choose to stay. Alternatively, those with good institutional support, such as strong education and healthcare provisions but weaker employment opportunities, may also struggle to attract population inflows. In short, a city's attractiveness seems to emerge from the interplay between material-economic opportunities and institutional support.

At the same time, the exceptionally high correlation between the composite development score and the coordination degree warrants some careful consideration. The two measures are closely interrelated, so the degree of coordination should not be interpreted as a fully independent driver. Rather, it serves as a structural indicator of balance that is tightly linked to overall development levels. This close relationship helps avoid overstating the distinct contribution of coordination on its own.

5.2. Policy Implications

The findings suggest that efforts to attract young-aged immigrants should move beyond narrow, single-dimensional talent policies and pay greater attention to the coordinated development of urban subsystems. Both material-economic conditions and institutional support matter. Cities are likely to benefit from strategies that improve the overall environment in which young people settle, work, and live, rather than relying heavily on a single policy or a few, such as wage subsidies, housing incentives, or short-term recruitment campaigns.

For a city that already performs well across all dimensions, such as Guangzhou and Shenzhen, the main challenge is maintaining balance as the city develops and grows. Such a city possesses strong employment markets and institutional resources, but it may face rising living costs, housing pressure, and strain on public services. Policy priorities here should include expanding affordable housing, improving access to quality education and healthcare, and ensuring that public service capacity keeps pace with population growth. The real challenge goes beyond attracting young migrants to converting inflows into long-term settlement.

Cities that have experienced strong population growth despite only moderate development scores, such as Hefei and Changsha, appear to benefit from specific advantages like industrial upgrading or educational resources, but these may not be enough without broader improvements in public services, healthcare, housing, and career development. The policy focus should be twofold. Policies ought first to identify the real cause of the strong population inflow and strengthen its positive effects. Second, policies also need to effectively convert short-term attraction to sustainable retention.

Cities with relatively low development scores and coordination degrees, such as Fuzhou and Quanzhou, face a more fundamental challenge. Rather than imitating the talent policies of first-tier cities, they should prioritize building foundational capacity and provision in both economic and institutional domains. Large-scale subsidies or high-profile talent programs are unlikely to produce lasting results without adequate job creation and public services.

A more appropriate course involves gradual, sustained improvements in all aspects, including but not limited to employment opportunities, industrial restructuring, education and healthcare resources, and the provision and accessibility of public services.

Finally, cities that perform relatively well in institutional support but attract weaker inflows, such as Nanjing and Chengdu, may benefit from better linking their existing strengths to job market development and job creation. Good educational resources, accessible healthcare, and abundant provision of public services can improve settlement expectations, but they are rarely enough without attractive career opportunities. These cities could usefully strengthen innovation platforms, university-industry collaboration, entrepreneurship support, and professional job markets so that their institutional advantages translate more effectively into migration attraction. Such differentiated strategies are likely to be more realistic and effective than uniform, one-size-fits-all policies.

6. CONCLUSION, CAVEATS, AND FUTURE DIRECTIONS

This study employs the entropy weighting method, the CCDM, and correlation analysis to examine the associations between urban development, subsystem coordination, and population inflows. The analysis centers on two key dimensions of a city's attractiveness: the material-economic subsystem (including employment, income, industrial structure, and living costs) and the institutional support subsystem (including education, healthcare, and public service resources).

Based on 2023 data from eleven Chinese cities, the empirical results are, in general, consistent with our hypotheses. Cities with higher composite development scores and greater coordination between the two subsystems tended to experience stronger population inflows. Given the small sample size, the statistical evidence is modest and suggestive, so these findings should be interpreted with some caution. Moreover, the very high correlation between the composite development score and the coordination degree suggests that the two measures are closely related and should not be viewed as fully independent factors.

Overall, the results substantiate that a city's attractiveness is not solely attributable to its economic environment. Youth migration appears to be shaped by both material opportunities and the quality of institutional support. By employing the CCDM analysis, in which entropy weighting is used to ensure comparable comparisons among indicators, our study offers an exploratory yet useful insight into how the coordination among a city's subsystems relates to migration outcomes. In doing so, this study contributes to the literature by moving beyond single-factor explanations toward a more integrated, systemic understanding of urban development and its implications for attracting young migrants.

There are several limitations and caveats to note. First, the sample includes only eleven cities, which not only reduces the statistical power of the analysis but also may restrict the generalizability of the findings. Second, the study relies on cross-sectional data from a single year and therefore cannot capture dynamic changes over time. Third, because compatible youth-specific migration data were not available for all cities, we used overall population growth as the second-best proxy. This measure reflects total inflows rather than the movement of young people specifically. Fourth, it is also worth noting that Chinese cities are interconnected through complex economic networks, so the city-level observations are not fully independent. Lastly, although the twelve individual indicators capture important perspectives on urban attractiveness, there are other potentially relevant factors, such as housing affordability, hukou policies, and residents' subjective perceptions.

Future research could address these limitations in several ways. Larger samples covering more Chinese cities would enable more robust statistical analysis and greater generalizability, although obtaining comparable data across a wider range of cities remains a serious challenge. Panel data, where available, would be particularly useful for examining how dynamic changes in urban development and subsystem coordination relate to migration outcomes over time. Finally, future studies could draw on additional data sources, such as localized surveys, administrative records on talent programs, or city-level policy experiments, to better capture young migrants' preferences, experiences, and settlement decisions.

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