

Article

Urban Environment Quality and Migrant Settlement Intentions: Evidence from China's Hygienic Cities Initiative

Dan Sun ¹  and Guochang Zhao ^{2,*}

¹ School of Economics, Hunan Institute of Engineering, Xiangtan 411104, China; sundan2002@gmail.com

² Research Institute of Economics and Management, Southwestern University of Finance and Economics, Chengdu 611130, China

* Correspondence: guochang.zhao@hotmail.com

Abstract: The number of internal migrants in China reached 376 million in 2020, accounting for about one-fourth of the total population. Therefore, promoting their settlement in cities and integration into urban life is crucial for both sustainability and for their well-being. Drawing on data from the 2014–2018 China Migrants Dynamic Survey and taking the “Hygienic Cities Initiative” as a quasi-experiment, this research study analyzes the influence of improving the urban environment quality on migrants’ settlement intentions within a difference-in-difference (DID) framework. The study findings indicate that the creation of “Hygienic Cities” demonstrates a significant positive effect on migrants’ settlement intentions, thereby leading to a 4.57% increase. Further analysis highlights that the creation of “Hygienic Cities” primarily affects migrants’ settlement intentions by (1) improving local air quality and (2) increasing the sanitation of the urban environment. In addition to this, the effect of “Hygienic Cities” on migrants’ settlement intentions is stronger for migrants with higher education and income levels, shorter migration experience, unmarried males, and employers or self-employed individuals. This research article confirms that the urban residential environment has become a critical factor influencing Chinese migrants’ settlement intentions. As a result, further attention to environmental protection and improvements in urban environmental sanitation is crucial in city management for attracting talent and investments to cities, but such initiatives may also lead to potential gender imbalance in cities.

Keywords: environmental quality; internal migrant; settlement intention; National Hygienic Cities



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1. Introduction

Over the past two decades, there has been a continuous expansion in the scale of China's internal migration. By the end of 2020, China had a total of 376 million internal migrants, accounting for about one-fourth of the total population, with an increase of 69.73% compared to 2010 (Seventh National Population Census, 2021). Consequently, this large-scale migration has not only optimized resource allocation but has also made a significant contribution to China's economic growth [1]. However, internal migrants in China have mostly served as temporary workers in cities for a long time period, thus making it difficult for them to both settle down in cities and integrate into urban life [2]. Owing to the prominent trend of migrants becoming younger and the continuous improvement in educational levels, more migrants at present intend to settle in cities [3]. From this perspective, it is of vital significance for scholars and policymakers to explore the factors that influence the settlement intentions of migrants.

A substantial amount of research has carried out systematic reviews of the residence-related decisions of migrants. Previous studies most often focus on the economic factors that stimulate migration decisions. Accordingly, the classic “push pull theory” holds that the factors affecting migration can be classified into “push factors” and “pull factors,” both of which exist simultaneously in the origin and destination regions of migration. In the

context of the origin area, surplus labor force and the scarcity of rural land are the key push factors influencing rural labor to shift to cities in China [4], whereas the restriction of the dual rural urban household registration system is the major pull factor inhibiting the settlement of surplus rural labor in cities [5]. From the standpoint of destination areas, high income serves as a critical pull factor for labor migration and settlement [6], while high housing prices constitute the main push factor for migrants' settlement [7].

Migration is often described as a strategy for households to diversify risks, influenced by household and individual characteristics, as well as the characteristics of the origin and destination location [8,9]. In addition to economic factors, a growing body of the literature explains the residence decisions of migrants from non-economic viewpoints such as public service levels, urban branding, education, and social integration [10–14]. Furthermore, environmental factors are also assumed as one of the vital non-economic factors affecting the residence-related decisions of migrants. Since environmental migration not only carries the potential to change the population structure of a region but also strongly influences the socio-economic development of both origin and destination areas [15], exploring the effect of urban environmental quality on migrants' residence decisions holds valuable practical implications.

Some research studies have found that, as residents' income levels increase, they increasingly pursue healthier lifestyles. Therefore, environmental factors come to have important influences on migration decisions [16,17]. Statistics show that an increasing number of families are abandoning regions with severe environmental pollution, in order to settle down in cities with suitable air quality and better living environments [18,19]. Nevertheless, migration driven by environmental factors typically involves domestic migration due to restrictions in international immigration policies; therefore, there is not a significant increase in international migration [20]. Additionally, an adverse ecological situation tends to escalate the probability of short-term migration to rural and urban areas by reducing residents' income or triggering local conflicts, while simultaneously decreasing the likelihood of long-term migration to rural areas and foreign countries [21,22]. Meanwhile, different groups demonstrate varying levels of concern for urban environmental quality when migrating to desired regions. For instance, older persons, those who are married or have children, the non-agricultural household registration population, male migrants, and those with higher levels of education are inclined to be highly sensitive to urban environmental quality during migration [23].

Nonetheless, the empirical evidence on whether environmental migration exists in China is still insufficient due to two major constraints. Firstly, the empirical studies on environmental migration are limited by the difficulty of obtaining the population's migration data. Hence, certain scholars have employed a hedonic housing price model, using housing prices as a proxy variable for studying environmental migration [24,25]. Since costless population migration leads to migration competition and the intensity of migration competition is capitalized upon in local housing prices under market clearing conditions, the effect of the environment on housing prices eventually reflects the impact of environmental migration. However, the fundamental premise for housing prices to represent the extent of migration competition triggered by the environment is market clearing, where the initial supply of housing is equal to demand. This does not align with the actual situation in China [26]. Thus, housing prices are not suitable as a proxy variable for population migration to investigate the concerns regarding environmental migration in China.

Secondly, existing researchers encountered difficulty in effectively resolving the matters of omitted variables and reverse causality endogeneity issues. Specifically, environmental quality is closely associated with various socioeconomic factors. The regression results are expected to be biased when an unobservable variable simultaneously impacts both environmental quality and migrants' settlement intentions or when the settlement of migrants simultaneously influences urban environment quality [27]. Based on this, this

research article attempts to identify the causal effect between environmental quality and migrants' settlement intentions.

This research paper employs the creation of "Hygienic Cities" as a quasi-natural experiment to explore the influence of urban environmental quality on migrants' settlement decisions. "Hygienic Cities" represent the highest honor in national urban environmental sanitation management, with their evaluation criteria centered around cities having a favorable urban appearance and a clean environment. Therefore, "Hygienic Cities" can be regarded as cities with a better environmental quality. By observing the impact of the creation of "Hygienic Cities" on the settlement intentions of migrants, we can gain insights into the connection between urban environmental quality and migrants' settlement intentions.

This research paper contributes to the extant literature in the following ways. Firstly, this study examines the pull effect of environmental factors on migrants' settlement intentions in the context of destination cities. Since the present scholars have chiefly analyzed the push effect of adverse climate and ecological pollution in the place of origin on the local residents, this article attempts to ascertain the effect of improved environmental quality in the destination city on the long-term willingness of migrants to settle down. This shall not only enrich the present literature on environmental migration but also serve as a significant supplement to the studies on settlement matters of migrants.

Secondly, the creation of "Hygienic Cities" is adopted as a quasi-natural experiment, and a difference-in-differences (DiD) approach is employed in this paper to address the endogeneity problem between urban environmental quality and migration decisions. The primary objective of this study is to identify the causal relationship between urban environmental quality and migration settlement decisions. However, when endogeneity issues exist in the regression model, such as omitted variables or bidirectional causal relationships between urban environmental quality and migration settlement decisions, it can affect the consistency of the estimates and thereby compromise the robustness of causal inferences. Employing a quasi-natural experiment method can effectively address endogeneity issues in regression analysis, and the key lies in identifying an external event that affects the dependent variable without influencing the explanatory variables. The creation of "Hygienic Cities" is unrelated to urban economic development and other city characteristics, but largely relies on the urban managers' decisions, thereby making it a reasonable exogenous policy shock. Moreover, different robustness tests are undertaken using propensity score matching (PSM) to effectively resolve the potential endogeneity between urban environmental quality and migrants' settlement intentions, addressing the concern that the policy shock is not completely random.

Finally, this study not only scrutinizes the influence of urban environmental quality on migrants' settlement intentions but also determines the possible individual heterogeneity in this effect, which is crucial to exploring the changes in population structure and sustainable development trends in destination areas. In particular, the proposed impact is studied on highly educated and high-income individuals, self-employed laborers, unmarried males, employers, and new migrants. This provides valuable insights into possible issues that may arise in the urbanization process while offering empirical analysis on urban sustainable development.

The structure of the remainder of this research article is as follows: Section 2 presents the research background and theoretical analysis; subsequently, Section 3 introduces the empirical methods and data used in this paper; thereafter, Section 4 focuses on the empirical analysis and robustness test results; after this, Section 5 discusses the mechanisms and individual heterogeneity of the urban environmental quality's influence on the residency intentions of migrants; Section 6 presents a detailed discussion of the research results; and lastly, Section 7 concludes with certain policy implications.

2. Literature Review and Hypothesis Development

2.1. The National Hygienic Cities Initiative in China

The National Hygienic Cities Initiative (1989) in China represents a nationwide environment sanitation campaign that was initiated under the leadership of the National Patriotic Health Campaign Committee (NPHCC), as an effort to improve urban living conditions and strengthen the Patriotic Health Movement. Hygienic Cities are nationally recognized for their outstanding environmental sanitation management. The scope of selection for National Hygienic Cities includes prefecture-level cities, districts under municipalities, and county-level cities. As the highest honor in urban environmental sanitation management in China, winning the Hygienic Cities Award has always been perceived as a significant political achievement by local governments. As of 2021, 438 cities or districts have been named National Hygienic Cities, accounting for 57.5% of the total number of cities. Apparently, the National Hygienic Cities initiative has effectively driven various areas to comprehensively improve their urban environmental and sanitary conditions, thereby resulting in a substantial improvement in terms of the urban living qualities.

In line with the 2014 edition of the “National Hygienic City Standard” [28], the evaluation criteria for National Hygienic Cities mainly include 8 primary assessment indicators and 40 secondary assessment indicators. The primary assessment indicators cover areas such as the management of patriotic health organizations, urban environmental sanitation, environmental protection, and health education. Furthermore, since standards for application and assessment are stringent, there is therefore a highly regulated selection process. Consistent with this, the selection of National Hygienic Cities follows a cycle of every 3 years, with the cities being officially designated in the 3rd year of the cycle. Subsequently, once the local government formally submits the application report, there is a need to undergo a rigorous evaluation process performed by the NPHCC and the provincial patriotic health campaign committee. The proposed assessment process consists of anonymous inspections, comprehensive reviews, technical evaluations, and public announcements. Consequently, the final designation is performed by the NPHCC. However, cities are subject to a reassessment every three years, after being designated as a National Hygienic City. In accordance with the reassessment results, the cities that meet the standards are reconfirmed, whereas those that fail to fulfill the standards may have their designation revoked or deferred by the relevant authorities [29].

It is evident that the cities declared as National Hygienic Cities have significantly improved upon their urban environmental quality, as per the rigorous assessment criteria and strict selection process of the National Hygienic Cities. Based on the Tiebout hypothesis, which believes that consumers reveal their preferences by “voting with their feet”, improvement in urban environmental quality may foster the willingness of migrants to settle down in the city [30]. As a result, the following hypothesis H1 is postulated in this research study:

H1: *The creation of National Hygienic Cities enhances migrants’ settlement intentions.*

2.2. Air Quality and the Residency Intention of Migrants

Air quality exerts the most direct influence on the public, among various environmental concerns. Firstly, there is a positive association between air quality and public health. Specifically, detrimental substances and particulate matter in the air may trigger respiratory diseases such as chronic bronchitis, rhinitis, and asthma, while also aggravating medical conditions including rheumatic diseases, diabetes, and cognitive and neurodegenerative disorders, which in severe cases can lead to hospitalization or even death [31]. Secondly, primary and secondary pollutants can not only contribute to climate change but also to more extreme climatic circumstances that exert many adverse influences on local production and living beings, thus leading to possible food crises and public health incidents [32]. Finally, air pollution may also exhibit negative impacts on economic practices. For instance, severe air pollution can affect industries such as hospitality and tourism [33]. Additionally,

air pollution can also supplement social security and medical expenditures, thereby placing an additional burden on the economy [34].

To sum up, air pollution has brought about serious adverse effects on the productivity and livelihood of residents. Therefore, migrants may make decisions to settle when the creation of National Hygienic Cities leads to a significant improvement in urban air quality. Therefore, the researchers put forward hypothesis H2 as follows:

H2: *The construction of National Hygienic Cities enhances the willingness of migrants to settle down in these cities by improving urban air quality.*

2.3. The Urban Environmental Sanitation and the Residency Intention of Migrants

Prominently, urban environment sanitation and the cityscape significantly influence various aspects of urban residents' lives. Firstly, the cityscape and urban environment sanitation directly affect the attractiveness and image of a city, and a well-organized, clean, and orderly cityscape is a major prerequisite for residents to appreciate a higher quality of life [35]. Accordingly, cities with sound environment sanitation and an attractive cityscape exhibit a positive impression, exerting a strong attraction effect on migrants and providing them with strong aspirations for city life. Secondly, urban environment sanitation is closely associated with public health. Specifically, neat environment sanitation controls the presence of bacteria, viruses, parasites, insects, and other animals in the environment, cutting off their contact with humans as a result. This helps to reduce possible health risks by reducing the likelihood of migrants contracting infectious diseases, food poisoning, and other public health incidents [36]. Finally, urban environment sanitation and the cityscape also affect the sense of belonging and social integration of migrants. In particular, a comfortable and harmonious living environment develops a favorable social atmosphere, enhances migrants' sense of belonging in the destination city, strengthens their community cohesion, and fosters a harmonious environment of coexistence and prosperity [37]. Based on the several benefits that an improved cityscape and urban environment sanitation can bring to migrants, this research article presents the below hypothesis H3:

H3: *The development of National Hygienic Cities increases migrants' willingness to settle in cities by improving the cityscape and urban environment sanitation.*

3. Research Methodology

3.1. Model Specification

The creation of National Hygienic Cities is based on a three-year cycle. Although the list of cities awarded the title of National Hygienic City is announced at the end of each cycle, a small number of cities may be named earlier during the cycle. The NPHCC successively announced 5 batches of National Hygienic Cities, between 2014 and 2018. This study used Equation (1) for analysis, in order to observe the impact of the National Hygienic City creation on migrants' willingness to settle in cities:

$$Y_{ict} = \beta_0 + \beta_1 \text{HygienicCity}_{ct} + \beta_2 X'_{ict} + u_c + u_t + \varepsilon_{ict} \quad (1)$$

In the aforementioned expression, Y_{ict} represents the dependent/explained variable depicting the migrant's settlement intentions. In addition, the subscripts i , c , and t stand for the individual migrant, destination city, and year, respectively. On the other hand, the core explanatory variable is taken as the dummy variable for National Hygienic City, determining whether a city is designated as a National Hygienic City while estimating its progress in creating a Hygienic City. Meanwhile, X'_{ict} indicates a series of control variables that impact migrants' willingness to settle, including years of education, family annual income, age, gender, family annual expenditure, general budget expenditure, destination city's per capita GDP, permanent resident population size, and so forth. Subsequently, u_c and u_t denote the city and year-fixed effects, respectively, thereby controlling for the city-level characteristics that do not change over time and the macroeconomic shocks at

the national level. Meanwhile, ε_{ict} represents the random disturbance term in the model. Finally, β_1 denotes the estimated coefficient of interest in this research, capturing the effect of National Hygienic City creation on migrants' willingness to settle down in cities.

3.2. Data Source and Processing

Micro-level data on migrants were obtained from the China Migrant Dynamic Survey (CMDS) administered between 2014 and 2018 and organized by the National Health Commission of China. CMDS micro-data are obtained for the years 2009 to 2018; however, questions related to migrants' settlement intentions were not included in the CMDS surveys conducted in 2009, 2010, 2011, and 2013, and thus the research period for this study was chosen to be from 2014 to 2018. Furthermore, CMDS randomly selected the sample points in areas with a substantial number of migrants in 31 provinces (municipality or autonomous region) and Xinjiang Production and Creation Corps across China. This research survey undertook questionnaire interviews with migrants aged 15 and above in the proposed regions, in order to cover various aspects such as basic information regarding the family members, employment status, income and expenditure, migration trends and settlement intentions, marriage and childbearing, and health literacy of migrants. Parallel to this, the urban-level data were sourced from annual "China Urban Statistical Yearbooks", local statistical yearbooks, and bulletins of autonomous leagues, prefectures, and provinces' directly administered counties and cities. At the same time, missing values at the city level were filled using linear interpolation. Altogether, this research study obtained micro-level data on 885,940 migrants from 360 cities, including prefecture-level cities, municipalities, autonomous prefecture, leagues, provincial directly administered counties and county-level cities, and "uniting divisions and cities" in the Xinjiang Production and Creation Corps (excluding cities and counties under agency management).

- (1) Dependent/explained variable: migrants' settlement intention. Accordingly, a dummy variable anticipating the willingness of migrants to settle was built based on the responses in the CMDS questionnaire. Primarily, from 2014 to 2016, the CMDS provided different queries to the survey participants as follows: "Do you plan to live in this area for a long time (more than 5 years) in the future?" On the one hand, samples that answered "Yes" were assigned a value of 1; on the other hand, samples that responded "No" or "undecided" were assigned a value of 0. Subsequently, the corresponding question in the CMDS questionnaire from 2017 to 2018 was switched to, "How long do you plan to live in this area in the future?" As a result, samples that responded "settle", "6–10 years", or "more than 10 years" were assigned a value of 1, whereas samples that answered "undecided", "1–2 years", or "3–5 years" were assigned a value of 0. It is important to note that, due to the inclusion of year-fixed effects in the model which capture macroeconomic shocks at the national level, any differences in the measurement criteria of the explanatory variable in 2017 and 2018 will not affect the robustness of the regression results. In other words, the rewriting of questions in the CMDS questionnaire from 2017 to 2018 will not lead to inconsistencies in our regression results.
- (2) Core explanatory/independent variable: National Hygienic City. This research article incorporated the 360 cities sampled in the CMDS as the basic units to develop the city-level variables. The NPHCC announced 5 batches of National Hygienic Cities from 2014 to 2018, and some of them are county-level cities under the agency management of prefecture-level cities or districts under the administration of municipalities which exist as components of large cities and are not regarded as distinct basic city units. In this circumstance, in order to capture the unbiased policy effects, a continuous treatment intensity was used in this research to replace the binary treatment status. Specifically, a continuous variable ranging from 0 to 1 was employed to scale the completion level of cities' efforts to create a Hygienic City and serves as the dummy variable for National Hygienic City. The policy effects cover the entire city and the dummy variable for National Hygienic City was assigned a value of 1 when

prefecture-level cities or municipalities are the subjects of the creation. Contrary to this, the policy effects only influence parts of the city's region, and the dummy variable for National Hygienic City was assigned a value equal to the population's proportion in the creation region to the city's total population when the district under the administration of municipalities or county-level cities under agency management of prefecture-level cities are the subjects of the creation. For instance, Tengzhou City, which was under the agency management of Zaozhuang City, was successfully named a National Hygienic City in 2017. Reportedly, this city had $\text{HygienicCity}_{2017, \text{Zaozhuang}} = \text{population of Tengzhou} / \text{population of Zaozhuang}$. In addition, the number of National Hygienic Cities created prior to 2014 stands at 162, while the number created between 2014 and 2018 is recorded to be 156. During the stated period, 4 cities temporarily withdrew due to failing the reexamination. As a consequence, their dummy variables for National Hygienic City were assigned a value of 0 during the withdrawal period; afterward, their dummy variables were restored after passing the reexamination. In addition, to provide a clearer explanation of the data structure at the city level in this paper, we outline the distinctions between different types of cities in Figure A1.

- (3) Control variables: Recognizing that individual and family characteristics may influence migrants' settlement intentions, this study included control variables that encompass the personal attributes of migrants such as age, gender, and years of education, as well as family attributes like family annual income, local family size, family annual expenditure, and so on. Additionally, acknowledging the significance of economic factors as pull factor for migrants in destination cities, we control for characteristics of the target cities, including permanent population size, per capita GDP, industrial structure, and general budgetary expenditure. Drawing from prior research findings, older individuals, those with higher levels of education and income, larger local family sizes, self-employed individuals, managers, professionals, and those with urban employee medical insurance are more inclined to settle in urban areas [14,23]. However, whether married individuals or males are more predisposed to settle in urban areas has yielded varying conclusions in different studies [14,23].

Correspondingly, the summary statistics of relevant variables are depicted in Table 1. In our sample, the average age of migrants was 34.9 years, with an average of 10.08 years of education. Overall, 79% were married, 68% had spouses in the local area, and 49% had children residing locally. In addition, the mean household size for local families was 2.56. Overall, 53% of migrants intended to reside long-term in the destination urban areas. Furthermore, it is noteworthy that the gender ratio among migrants stands at 108, indicating a significant gender imbalance among this group.

Table 1. Summary statistics.

Variable	Mean	Std. Dev.	Observations
Dependent Variable			
Migrant's settlement intention	0.530	0.500	885,940
Core explanatory variable:			
National Hygienic City	0.450	0.490	1741
Individual and Family-level Characteristics			
Age	34.90	10.41	885,940
Male	0.540	0.500	885,940
Years of Education	10.08	3.170	885,940
Married	0.790	0.410	885,940

Table 1. *Cont.*

Variable	Mean	Std. Dev.	Observations
Local Family Size	2.560	1.200	885,940
Spouse Resides Locally	0.680	0.470	885,940
Children Reside Locally	0.490	0.500	885,940
Ln (Annual Family Income)	8.610	0.590	885,940
Ln (Annual Family Expenditure)	7.930	0.630	885,940
Urban Employee Medical Insurance	0.190	0.400	885,940
Interprovincial Migration	0.500	0.500	885,940
Duration of Migration	4.960	5.450	885,940
Rural Household Registration	0.840	0.370	885,940
Self-employed	0.340	0.470	885,940
Managers or Professional Technicians	0.0700	0.260	885,940
Working in the Secondary Industry	0.250	0.430	885,940
Working in the Tertiary Industry	0.570	0.490	885,940
City-level Characteristics			
Ln (Per Capita GDP)	10.71	0.560	1741
Ln (General Budgetary Expenditure)	5.580	1.040	1741
Ln (Permanent Population)	14.75	0.940	1741
Proportion of Secondary Industry Added Value in GDP	0.430	0.120	1741
Proportion of Tertiary Industry Added Value in GDP	0.430	0.100	1741

Data Source: Compiled and estimated based on CMD5 data from 2014 to 2018, data from the “China Urban Statistical Yearbook,” and data from statistical yearbooks and bulletins of autonomous prefectures, leagues, and provinces’ directly administered counties and cities. Data for the following tables and figures are from the same sources as Table 1 unless otherwise specified.

4. Research Results and Robustness Analysis

4.1. Baseline Regression Results

Table 2 illustrates the baseline regression results of this study. In column (1), the sample period is from 2014 to 2018, with migrants’ settlement intentions as the dependent/explained variable and the National Hygienic City as the core explanatory variable. In addition to this, control variables include individual and family-level characteristics, city-fixed effects, and year-fixed effects, with standard errors adjusted by clustering at the city level. Subsequently, destination city characteristics are further controlled in column (2). Certainly, the estimated coefficient of the core explanatory variable anticipates the influence of creating National Hygienic Cities on migrants’ settlement intentions.

Table 2. Creating National Hygienic Cities and Migrants’ Settlement Intentions.

Variable	(1) Migrant’s Settlement Intention	(2) Migrant’s Settlement Intention
National Hygienic City	0.0466 ** (0.0215)	0.0457 ** (0.0227)
Age	0.0011 *** (0.0001)	0.0011 *** (0.0001)
Male	−0.0091 *** (0.0020)	−0.0090 *** (0.0020)
Years of Education	0.0118 *** (0.0007)	0.0118 *** (0.0007)
Married	0.0701 *** (0.0078)	0.0699 *** (0.0077)
Local Family Size	0.0222 *** (0.0013)	0.0222 *** (0.0013)
Spouse Resides Locally	−0.0387 *** (0.0077)	−0.0389 *** (0.0077)
Children Reside Locally	0.0725 *** (0.0028)	0.0725 *** (0.0028)

Table 2. Cont.

Variable	(1) Migrant's Settlement Intention	(2) Migrant's Settlement Intention
Ln (Annual Family Income)	0.0287 *** (0.0034)	0.0291 *** (0.0034)
Ln (Annual Family Expenditure)	0.0900 *** (0.0038)	0.0901 *** (0.0038)
Urban Employee Medical Insurance	0.1038 *** (0.0051)	0.1039 *** (0.0051)
Interprovincial Migration	−0.0904 *** (0.0057)	−0.0904 *** (0.0057)
Duration of Migration	0.0148 *** (0.0003)	0.0148 *** (0.0003)
Rural Household Registration	−0.0334 *** (0.0046)	−0.0334 *** (0.0046)
Self-employed	0.0321 *** (0.0036)	0.0320 *** (0.0035)
Managers or Professional Technicians	0.0461 *** (0.0035)	0.0460 *** (0.0035)
Working in the Secondary Industry	−0.0744 *** (0.0059)	−0.0740 *** (0.0058)
Working in the Tertiary Industry	−0.0313 *** (0.0055)	−0.0310 *** (0.0055)
City-level Characteristics	No	Yes
City Fixed Effects	Yes	Yes
Time Fixed Effects	Yes	Yes
Observations	885,940	885,940
R ²	0.183	0.183

Note: ** and *** stands for the significance levels at the 5% and 1% level, respectively. Further, the regression model adopts the city-level clustered robust standard errors. Unless otherwise specified, the same applies to the following tables.

The baseline regression estimations align with the researchers' expectations: the regression results in column (2) suggest that creating National Hygienic Cities still significantly enhances migrants' settlement intentions even after controlling for a series of variables reflecting the economic development level and industrial structure of destination cities. This implies that the improvement in environmental quality plays a favorable role in migrants' decision-making process regarding their residence.

4.2. Parallel Trends Test

This study implements a multi-period (DiD) model to analyze the possible effect of creating National Hygienic Cities on migrants' settlement intentions. According to the baseline regression results, the creation of National Hygienic Cities significantly augments the local residency intention of migrants. In order to ensure the reliability of the identification results, the event study design is applied to confirm the parallel trend assumption and observe the dynamic influences of building National Hygienic Cities. The specific model is expressed in Equation (2):

$$Y_{ict} = \beta_0 + \beta_k \sum_{k=-4}^8 \text{SanitaryCity}_{ck} D_{t_{c0}+k} + \beta_2 X'_{ict} + u_c + u_t + \varepsilon_{ict} \quad (2)$$

where $D_{t_{c0}+k}$ serves as a set of dummy variables, with the subscript $t_{c0}+k$ indicating the year when City c created the National Hygienic City; accordingly, the value of 1 is taken in that year, and 0 otherwise. Moreover, HygienicCity_{ck} denotes the completion extent of creating a National Hygienic City in City c , particularly the ratio of the National Hygienic City's population to the city's total population. When k is greater than or equal to 0, it takes its real value. Conversely, when k is less than 0, it takes its maximum value during the sample period. For instance, Tengzhou City, under the agency management of Zaozhuang City, developed a National Hygienic City in 2017, with $\text{HygienicCity}_{2017, \text{Zaozhuang}} = \text{population of Tengzhou} / \text{population of Zaozhuang}$, which is equal to 0.41. Afterward, Zaozhuang City

successfully became a National Hygienic City in 2018, with $\text{HygienicCity}_{2018, \text{Zaozhuang}} = 1$. Hence, $\text{HygienicCity}_{k, \text{Zaozhuang}} = 1$ when k is less than 0. In addition, the baseline group omitted in Equation (2) refers to the group 5 years or more before the National Hygienic City was created by the developers. Further, the parameter β_k in the model connotes the relative effects of the National Hygienic City policy on migrants' residency intention in the k -th year, in comparison to the baseline year.

The results of the parallel trends test are demonstrated in Figure 1. The derived results signify that the coefficients of β_k are not significantly different from zero in the 1–4 years before the creation of the National Hygienic City. This infers that there exists an insignificant difference in the changing trend of residency intention among migrants between the treatment and the control group prior to the creation of National Hygienic Cities, thereby satisfying the parallel trends assumption. However, the residency intention of the treatment group is found to be significantly higher than that of the control group in the year of successfully creating National Hygienic Cities and the subsequent years. This shows that the influence of the policy effect is both significant and sustained over time.

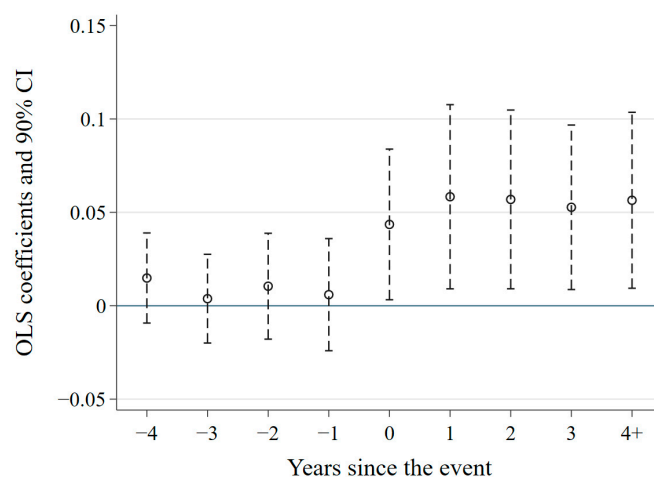


Figure 1. Parallel trend test. The circle shapes represent the OLS estimates of β_k at the horizontal axis where k equals, while the dashed line(s) depict the 90% confidence interval corresponding to those OLS estimates.

4.3. Robustness Test

A series of robustness tests are performed to ensure the reliability of the baseline regression results. First, the four recognized first-tier cities are excluded, namely: Beijing, Shanghai, Guangzhou, and Shenzhen. The proposed first-tier cities possess a substantially higher level of public service quality and economic development as compared to other cities. In particular, the “first-tier city” brand signal instills confidence in migrants concerning the future development of the stated cities, and therefore the environment quality of the current city may not be a significant factor affecting the residency intention of migrants [14]. Thereafter, this paper further restricts the sample age range to between 16 and 59 years, considering that retired individuals and minors who have not reached legal working age may demonstrate different considerations regarding their residency intention in the destination city than the other age groups. Therefore, such persons are excluded from the sample, thus resulting in a sub-sample of working-age migrants. Moreover, dummy variables are further controlled to represent “National Civilized Cities” and “National Low-Carbon Cities” in order to eliminate the interference of other policies during the same period. The corresponding regression results are presented in columns (1)–(3) of Table 3. Evidently, the magnitude and direction of the coefficients are commonly aligned with the baseline regression results. Based on this, the effect of National Hygienic City creation on migrants' residency intention remains significantly positive, and therefore the conclusion remains robust and consistent.

Table 3. Robustness test.

	(1)	(2)	(3)	(4)	(5)	(6)
National Hygienic City	0.0462 ** (0.0227)	0.0462 ** (0.0230)	0.0434 ** (0.0197)	0.0384 * (0.0228)	0.1372 ** (0.0672)	0.0457 ** (0.0227)
National Civilized Cities			0.0168 (0.0214)			
Low-Carbon Cities			−0.0134 (0.0154)			
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
City Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	802,458	867,266	885,940	885,940	885,940	882,795
R ²	0.183	0.186	0.184	0.184	0.146	0.184

Note: * and ** stands for the significance levels at the 10% and 5% level, respectively.

Additionally, the following robustness tests are conducted to rule out model and variable specification errors. Firstly, different ways of defining National Hygienic Cities are adopted in this paper. Referring to the approach established in the present literature [38], only prefecture-level cities, municipalities, provincial directly administered cities, and Xinjiang Production and Creation Corps “Corps and City Combined” cities, who have won the National Hygienic Cities award, are defined as National Hygienic Cities. Conversely, the creation achievements of lower-scale regions are not considered National Hygienic Cities. Consistently, when the sample is derived from a National Hygienic City, the variable is assigned a value of 1; otherwise, it is assigned a value of 0. Secondly, Probit regression is applied for robustness tests in order to avoid model specification bias, as the dependent variable is a binary variable with values of 0 or 1. Thirdly, the creation of Hygienic Cities may not be entirely random, which increases the likelihood of bias in policy evaluation. Therefore, propensity score matching (PSM) is employed to eliminate sample selection bias and avoid systematic bias caused by sample self-selection. Afterward, the new matched sample is utilized to re-estimate the model using Equation (1). Fourthly, the development of National Hygienic Cities is implemented at different time points, which is the focus of this research study. Since the estimation coefficients obtained from the two-way fixed effects model may be biased, the impact of the National Hygienic City creation is evaluated based on the approach of Sun and Abraham [39]. Specifically, the individual and family-level variables are transformed into city-level means and subsequently regressed. The regression results for the stated robustness tests are presented in columns (4)–(6) of Table 3 and Figure 2, respectively. The relevant results establish that the regression results obtained from various estimation methods all support the significant positive effect of the creation of National Hygienic Cities on migrants’ residency intention, thus confirming the robustness of the estimation results.

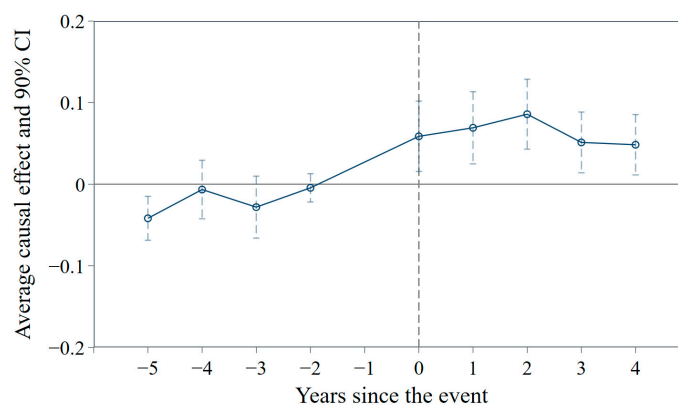


Figure 2. Sun and Abraham’s approach. The circular shapes represent the average causal effect during the period represented by the values on the horizontal axis, while the dashed line(s) illustrate the 90% confidence interval corresponding to those average causal effects.

Finally, a placebo test is carried out, in order to rule out the possibility that the influence of National Hygienic City creation on migrants' settlement intentions is driven by certain random factors. Specifically, the "treatment groups" and "control groups" in the original sample are simulated by randomly selecting cities that participated in the National Hygienic Cities campaign. Evidently, the number of cities simulated that won the National Hygienic City title each year stands at the same value as in reality. Thereafter, the regression estimation is performed again using the dummy variable for simulated Hygienic Cities. This process is repeated 1000 times, thus resulting in 1000 regression coefficients and t-statistics. Meanwhile, the distribution of these coefficients and t-values is depicted in Figure 3. The kernel density estimates and t-values from the simulation process are centered around 0, which are significantly distant from the t-statistics and coefficients estimated using the baseline model under the real "National Hygienic City creation" policy shock (reflected by the vertical dashed lines in Figure 3a,b). In addition, the coefficients estimated using the baseline model lie beyond two standard deviations (SDs) of the simulation results' distribution. These findings indicate that there is no statistical significance in terms of the influence of National Hygienic City creation for the simulated treatment groups. Therefore, the estimation results obtained earlier are found to be robust.

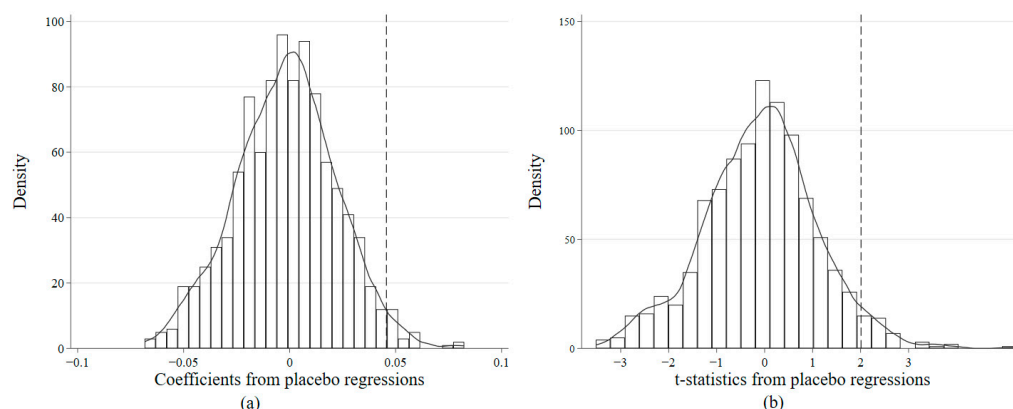


Figure 3. Placebo test. (a) Coefficients from placebo regressions and (b) t-statistics from placebo regressions. The line overarching the columns represent the kernel density estimation of 1000 regression coefficients in (a) and 1000 t-statistics in (b), all of which are derived from the placebo test.

5. Mechanism Testing and Heterogeneity Analysis

5.1. Mechanism Test

This research article explores the mechanisms through which National Hygienic City creation impacts migrants' settlement intentions while focusing on two major aspects: improving the local air quality and enhancing the local environment sanitation. Drawing on the existing literature [40], an economic mechanism test is undertaken for the paths using Equation (3).

$$\text{Mediator}_{ct} = \beta_0 + \beta_1 \text{SanitaryCity}_{ct} + \beta_2 X'_{ct} + u_c + u_t + \varepsilon_{ct} \quad (3)$$

where Mediator_{ct} signifies the economic mechanism variable, whereas the rest of the city-level control variables and cluster adjustments to standard errors are in line with the baseline regression estimations. Consistent with hypotheses H2 and H3, this research initially hypothesizes that the creation of National Hygienic Cities may affect migrants' settlement intentions through the paths of enhancing local environment sanitation and improving local air quality. Below, the researchers empirically examine these mechanisms separately.

5.1.1. National Hygienic City Creation and Urban Air Quality

The “National Hygienic City Standard”, released in 2014, establishes explicit requirements for National Hygienic City creation. The proposed standard provides specific creation standards for environmental factors such as noise, air, and water quality. Specifically, these standards require more than 300 days of excellent air quality throughout the year, the average environmental noise level to not exceed 60 dB, and the annual average concentration of major air pollutants to meet the national second-level standard. Therefore, there should be a significant improvement in local air quality due to National Hygienic City creation.

Referring to the previous study of reference [17], this study incorporates the number of excellent air quality days throughout the year as a measure of local air quality while applying Equation (3) to predict the influence of National Hygienic City creation on local air quality. Correspondingly, the regression results are reported in Table 4, column (1). The results highlight that the coefficient of the effect of National Hygienic City creation on the number of excellent air quality days is significantly different from zero (0) at the 5% level of significance. This infers that National Hygienic City creation displays a positive effect on urban air quality. Hence, National Hygienic City creation can significantly improve the urban air quality, thereby fostering migrants’ settlement intentions. This result supports hypothesis H2 of this study.

Table 4. Mechanism Test.

Variables	Excellent Air Quality Days in a Year	Harmless Treatment Rate of Urban Household Waste
National Hygienic City	12.0632 ** (5.9245)	3.4369 *** (1.2839)
City-level Control Variables	Yes	Yes
City Fixed Effects	Yes	Yes
Time Fixed Effects	Yes	Yes
Observations	1461	1425
R ²	0.885	0.631

Note: ** and *** stands for the significance levels at the 5% and 1% level, respectively. The samples are derived from 321 prefecture-level administrative regions and 4 direct-controlled municipalities. In addition, the missing samples are all due to missing data for the dependent variable. Further, this study undertook parallel trend tests for the regression analyses in the Section 5.1 and established no significant differences between the treatment and the control group in the three periods before National Hygienic City creation, thus meeting the parallel trends assumption.

5.1.2. National Hygienic City Creation and Urban Environment Sanitation

One of the other prominent focuses of National Hygienic City creation is to improve urban environment sanitation. Accordingly, specific requirements include compliance with the “Urban Appearance Standards” [41] for the urban cityscape and environment sanitation, adequate placement of waste collection containers such as garbage bins, smooth urban roads without unauthorized posting, writing, or stall setups, sufficient and well-located sanitation facilities, such as waste transfer stations, and a harmless treatment rate of urban household waste exceeding 90%. Therefore, there should be a significant improvement in urban environment sanitation through the National Hygienic City creation.

In this study, the harmless treatment rate of urban household waste is utilized as a proxy variable for urban environment sanitation [42]. The proposed variable is employed as the explained variable, whereas Equation (3) is applied for regression analysis in order to estimate the impact of National Hygienic City creation on urban environment sanitation. The regression results are summed up, in Table 4, column (2), as follows: the estimated coefficient of National Hygienic City creation stands at 3.43, thereby suggesting that the creation efforts have uplifted the harmless treatment rate of urban household waste by 3.43%, which is significantly different from zero at the 1% level. As a result, the regression results validate hypothesis H3, expressing that National Hygienic City creation significantly

improves local environment sanitation, offering a more comfortable living environment for migrants and consequently boosting their willingness to reside in cities.

5.2. Heterogeneity Analysis

Firstly, the researchers examine the heterogeneity in terms of the impact of National Hygienic City creation on migrants' settlement intentions based on various income levels. For this purpose, a dummy variable is generated for the high-income group using the median of the sample's annual household income as the threshold, and its interaction with the National Hygienic City dummy is included in Equation (1) for regression analysis. Further, the regression results are represented in column (1) of Table 5. Reportedly, the coefficient of the interaction term is significantly positive, hence implying that the promotion effect of National Hygienic City creation on migrants' residence willingness is stronger for migrants with higher income levels.

Table 5. Heterogeneity tests.

	(1)	(2)	(3)	(4)	(5)	(6)
National Hygienic City	0.0362 (0.0227)	0.0391 * (0.0221)	0.0554 ** (0.0230)	0.0406 * (0.0234)	0.0374 (0.0227)	0.0440 ** (0.0198)
National Hygienic City × Higher income	0.0234 *** (0.0048)					
National Hygienic City × Higher education		0.0434 *** (0.0082)				
National Hygienic City × Migration duration			−0.0020 *** (0.0006)			
National Hygienic City × Self employed				0.0139 * (0.0076)		
National Hygienic City × Male					0.0156 *** (0.0036)	
National Hygienic City × unmarried male						0.0134 ** (0.0055)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
City Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	885,940	885,940	885,940	885,940	885,940	183,549
R ²	0.184	0.184	0.184	0.184	0.184	0.169

Note: *, **, and *** stands for the significance levels at the 10%, 5%, and 1% level, respectively.

Secondly, this paper also determines whether the influence of National Hygienic City creation on the willingness to reside varies among migrants with different education levels. The authors define the population with a college diploma and above as the highly educated group, and the interaction term between the highly educated group dummy and the National Hygienic City dummy is added in the baseline regression. Subsequently, the regression results are presented in column (2) of Table 5. As per the derived results, the coefficient of the interaction term is significantly positive, consequently signaling that the positive impact of the National Hygienic City creation is stronger for migrants with higher levels of education.

Moreover, this research study ascertains whether the influence of National Hygienic City creation on the willingness to reside differs among migrants with different durations of migration. The regression results are presented in column (3) of Table 5, where the coefficient of the interaction term between the length of migration and the National Hygienic City dummy is significantly negative. This means that the shorter the length of migration, the higher the effect of National Hygienic City creation on migrants' residence willingness.

Finally, as illustrated in columns (4)–(6) of Table 5, when analyzing the heterogeneity of different employment statuses and genders of migrants, the researchers find that the effect of National Hygienic City creation is more significant for employers and self-employed workers than employees. Additionally, the positive impact of National Hygienic City creation is more prominent for male migrants or unmarried male migrants, as opposed to female migrants or unmarried female migrants, respectively.

To sum up, high-income and highly educated groups, newly arrived migrants, employers or self-employed workers, and unmarried males are more attentive to the changes

brought about by National Hygienic City creation. These groups of migrants are more concerned about local environmental quality when taking into account their long-term residence in a city. Hence, National Hygienic City creation exerts a relatively more positive effect on attracting high-quality talents, unmarried male migrants, investments, and new migrants.

6. Discussions

This research article takes the creation of “National Hygienic Cities” as a quasi-natural experiment to analyze the influence of urban environmental quality improvement on migrants’ settlement intentions. The study findings indicate that the creation of National Hygienic Cities significantly increases migrants’ residence willingness, thereby leading to an increase of 4.57% points in the proportion of migrants willing to reside in the destination city in the long term. The proposed impact not only carries statistical significance but also holds economic value: alternatively, the successful development of a National Hygienic City in the destination city boosts the long-term intention to reside among migrants by 4.57% points, which equates to the influence of an average increase of 4 years in the years of education for migrants in that specific city. Moreover, if this effect persists, when all Chinese cities enhance their environmental quality to meet the “National Hygienic City standard” [28], while maintaining the consistency of other influencing factors, an additional 4.57% of migrants within the total migrant population of 376 million, which corresponds to approximately 171.83 million migrants, would express an intention to settle in these cities. This scenario would consequently lead to substantial growth in housing demand and consumption in cities, and reduce the number of children being left behind due to parents’ temporary migration, thus providing better educational and health outcomes for them [43–46].

Further analysis shows that the number of days with excellent air quality and the rate of harmless treatment of domestic waste in the local area have significantly improved through the creation of National Hygienic Cities. This implies that the creation of National Hygienic Cities principally affects migrants’ settlement intentions by improving local air quality and ameliorating the environment’s sanitary conditions. This finding aligns with the existing literature [17,26,47]. With the rise in residents’ income levels, non-economic factors such as fundamental public health services, education, climate change, and urban environmental quality have emerged as pivotal determinants influencing migrants’ decisions regarding their place of residence [10,48,49]. As the National Hygienic City campaigns continue to advance urban environment and infrastructure in the future [42], it is anticipated that this will further facilitate the process of migrant citizenization, which is a pivotal factor for the sustainable development of a city.

Finally, the heterogeneity analysis predicts that, relatively, the influence of National Hygienic City creation is more significant for highly educated migrants or high-income groups than less educated migrants and low-income groups. In addition, employers or self-employed workers, newly arrived migrants, and unmarried males are more likely to change their settlement intentions in the city due to the environmental changes brought about by the creation of National Hygienic Cities compared with employees, migrants with a longer duration of residence, and unmarried female migrants. First, this proposed finding aligns with Maslow’s hierarchy of needs theory [50]. Thus, the group with higher income levels typically encounters fewer economic constraints, and therefore such a group has a higher level of needs, thus attaching greater significance to the environmental quality of the city. Contrarily, the group with lower income levels may focus more on income conditions and employment opportunities in order to meet their lower-level needs.

Second, the group with higher education levels possesses a deeper understanding not only of the risks and hazards associated with environmental pollution but also of the possible benefits from the talent support policies introduced in cities, which also contributes to their higher mobility to move between cities. As a result, these migrants are more sensitive to changes in the surrounding environmental quality, eventually making their

decisions to reside more susceptible to the effect of city environmental quality. Moreover, the improvement in urban environmental quality's attracting effect on highly educated talents is not only statistically significant but also economically substantial. The magnitude of the increase in settlement intentions of highly educated migrants due to the creation of National Hygienic Cities is twice as large as the impact brought about by local talent introduction policies, underscoring the significant role of excellent urban environmental hygiene in attracting highly educated talents [51].

Third, the shorter the migration duration, the less migrants form a fixed impression of the city [3]. Under such circumstances, suitable environmental quality can better shape their positive impression of the destination city, thereby having a stronger influence on their willingness to reside. Fourth, in comparison to employees, the self-employed group's employment status causes them to demonstrate higher mobility to move between cities [52], which causes the destination city to exhibit fewer existing pull factors for them. Therefore, National Hygienic City creation can demonstrate a stronger effect on their residents' willingness.

Furthermore, it is worth noting that the positive impact of National Hygienic City creation is more prominent for male migrants or unmarried male migrants, as opposed to female migrants or unmarried female migrants, respectively. This means that compared with female and unmarried females, for males, especially unmarried males, their willingness to reside is more susceptible to the local environmental quality. Additionally, considering that there are already more single male migrants willing to settle in cities compared to females, in our sample, among the single immigrant population willing to settle in cities, males account for 53.75%, while females account for 46.25%. Therefore, as urban environmental quality improves further, unmarried males opting to settle in cities might outnumber unmarried females, potentially leading to a further increase in the urban gender ratio. Given that the current gender balance in Chinese cities is relatively stable (Seventh National Population Census, 2021), this trend may not result in a significant gender imbalance in the short term. However, the possibility of shifts in urban population gender composition deserves further attention in future research.

According to the existing literature, migrants with better human capital are more inclined to settle down in cities [23,53–55]. Meanwhile, our research findings imply that the heterogeneity of migrants regarding settlement intentions would be more significant in cities with higher environment qualities, which further enhances the agglomeration effect of talent in these cities.

7. Conclusions and Implications

Drawing upon the enhancement of local air quality and the improvement in environmental sanitation, the research results strongly indicate that the establishment of Hygienic Cities can notably amplify migrants' inclination to settle in these cities. Notably, segments of the population with elevated educational attainment and income levels, recent migrants, unmarried males, and employers or self-employed workers exhibit heightened sensitivity to fluctuations in the urban environment's quality.

The study conclusions have significant policy implications not only for China but also for other emerging economies. Firstly, this paper calls for a reevaluation of the association between economic growth and environmental protection in order to promote the orderly integration of migrants into urban citizenship. Owing to the world's entry into a new stage of development, the concepts related to environmental protection and health have become more deeply ingrained in society. As a consequence, the influence of economic factors such as employment and income gradually diminishes when migrants consider settling down, whereas the effect of soft environmental factors strengthens, such as ecology and environmental protection. Based on this, cities with better environmental quality are more capable of attracting migrants to settle down. Contrary to this, cities with poorer environmental conditions witness migrants beginning to "vote with their feet". Therefore, it becomes essential to moderately increase investment in environmental protection measures in order to enhance regional environmental quality when urban economic development

reaches a certain level. Eventually, this shall strengthen migrants' residence willingness and support their integration into the destination cities. In addition, it serves as one of the vital measures for driving sustainable urban development.

Secondly, there is a need to fully understand the demands of high-quality migrants for a favorable environmental quality and to develop high-quality livable cities that attract and retain talent. Recently, major cities have increasingly realized the imperative role of talent and capital in development, thus leading to fierce competition for projects and investments, and intense "talent wars" for highly educated professionals [56]. However, our research findings indicate that the creation of National Hygienic Cities has a relatively strong impact on the residential intentions of highly educated and high-income individuals. Additionally, the residency intentions of self-employed workers and employers are also more influenced by the urban environmental quality. Moreover, it is noteworthy that the effect of improved environmental quality on the residency intentions of highly educated talents far surpasses the effects brought about by local talent introduction policies. Therefore, local governments must fully identify the importance of urban environmental quality in the "talent and capital competition". Moreover, national authorities should prioritize improving the overall city quality, placing special emphasis on creating a favorable environmental quality in the competition relating to attracting international talent.

Lastly, it is imperative to pay close attention to the potential issue of urban gender imbalance that may arise in the creation of a National Hygienic City, as this could have adverse effects on the stability and sustainable development of cities. The research findings indicate that with further improvement in urban environmental quality, the willingness of unmarried males to settle in cities is further strengthened. However, this situation might lead to an increase in the gender proportion of males in cities with superior environmental quality, causing males, especially male migrants, to be at a disadvantage in the marriage market and struggle to find suitable marriage partners. This becomes particularly significant considering the current low fertility rate in China, which has contributed to negative population growth in recent years. The predicament of unmarried male migrants in the urban marriage market could exacerbate the trend of negative population growth in China. Therefore, during the process of creating National Hygienic Cities, policymakers need to address the potential issue of a gender imbalance in cities, striving to mitigate the rural urban boundary in China's marriage market. This is crucial for maintaining the stability and sustainable development of cities.

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Appendix A

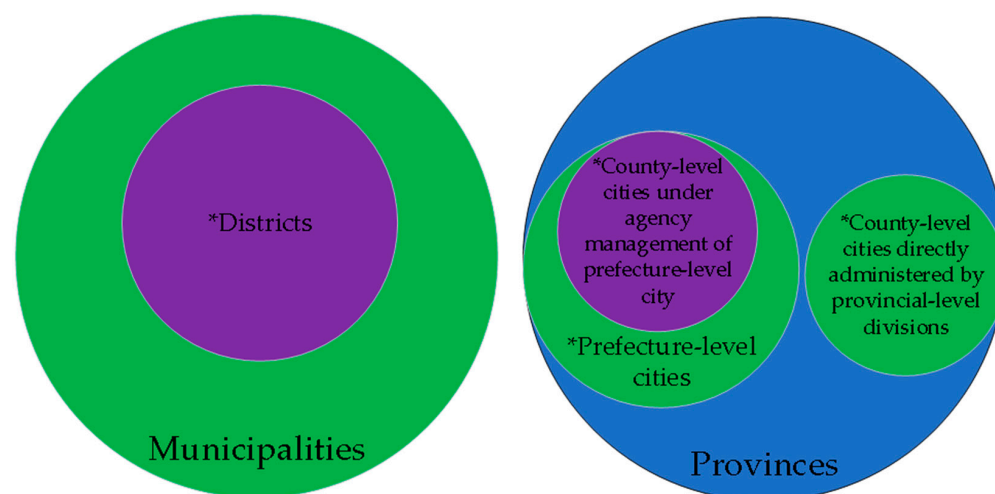


Figure A1. Cities with different administrative statuses in China. The size of the circles represents the administrative level; Units marked with an asterisk (*) are candidates to become National Hygienic Cities. Green color indicates an individual city, which also serves as the basic city unit in CMDS. In this study, we construct city-level variables based on the basic city unit of CMDS. This implies that if a “purple” unit creates a National Hygienic City, its creation achievement needs to be reflected at the level of a “green” unit.

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