Challenges and Prospects of Urban Construction Land in the Context of Population Shrinkage: A Case Study of Three Northeastern Provinces in China

YI Xiaoxiang, WANG Shuyu, ZHANG Haoping, ZOU Zhichong, YUAN Zhaokun, ZHANG Liyue

Abstract: The acceleration of urban population shrinkage in China's Three Northeast ern Provinces in recent years has introduced new challenges to urban development. This paper systematically assesses the current status of urban development in these provinces, aiming to comprehend challenges, explore solutions, and generate ideas for high-quality development in shrinking cities. Sequentially employing three models—namely, human-land relationship decoupling model, super-efficiency SBM-DEA model, and spatial econometric model—the paper evaluates the scale and efficiency of urban construction land and analyzes their relationship based on the urban population trends in the Three Northeastern Provinces. The research reveals that urban population shrinkage can easily lead to imbalances between population and land use. Currently, the utilization of urban construction land in the Three Northeastern Provinces has reached the stage of diminishing returns to scale, underscoring the need to address efficiency issue in land-use. Furthermore, the paper clarifies approaches to urban development in the context of population shrinkage. Specific strategies to achieve high-quality urban development are proposed from three aspects: technical preparation, institutional guarantee, and market regulation.

Keywords: Northeast revitalization; shrinking cities; human-land relationship; construction land-use efficiency; territorial space

Reform and opening-up led to a sustained decline in economic growth in the Northeast China region, known as the "Northeast Phenomenon," due to challenges in adapting to economic system transitions. In response to the development challenges faced by old industrial bases, with the Northeast as a representative, the Chinese Communist Party and the State Council issued the "Several Opinions on Implementing the Revitalization Strategy of Old Industrial Bases, Including the Northeast Region" in 2003. This initiative aimed to vigorously promote regional economic and social reforms, as well as industrial structural transformation, marking the beginning of the "Golden Decade" for Northeast revitalization. While this period saw some improvements in development, it did not fundamentally address issues such as outdated development concepts, market fragmentation, technological lag, and insufficient innovation. After 2014, the Northeast economy experienced a renewed decline, giving rise to the "New Northeast Phenomenon," plunging the region into a more severe demographic contraction and economic recession "chill," posing new and formidable challenges for the revitalization.

1. Research Background

1.1 New Situations and Challenges for Northeast Revitalization

The current context of Northeast revitalization is vastly different from the implementation of the strategy in 2003. In simple terms, both population and economic development were characterized by "slowing growth" back then, indicating continued growth. However, today, it is characterized by "negative growth," with population contraction and economic decline. Economically, the three northeastern provinces witnessed a significant downturn in the past decade, with GDP growth rates plummeting after 2011 and turning negative after 2015 (see Figure 1). Population-wise,

the total population in the three northeastern provinces experienced negative growth after 2010 (see Figure 2), accompanied by a noticeable deterioration in population structure, marked by severe aging, declining birth rates, and significant loss of the population aged 15–64. According to the seventh national census data, from 2010 to 2020, the total population in the three northeastern provinces decreased by approximately 11 million people. The population aged 15–64 decreased by over 15.1 million, while the population aged 0–14 decreased by over 2 million. Meanwhile, the population aged 65 and above increased by over 6.1 million, leading to higher levels of aging and depopulation compared to the national average (see Figure 3).

During this process, the contradictions arising from rapid urbanization became increasingly prominent. From 2010 to 2020, the urban population in the three northeastern provinces increased by 5.64%, while the urban construction land area grew by 10.66%. The expansion of urban land far exceeded urban population growth. Although this phenomenon is not unique to the Northeast, the challenges it faces are both specific and severe. In regions experiencing population growth, excessive urban land expansion can gradually be absorbed through stock renewal adjustments and ongoing urbanization. However, for regions facing population decline, even if urban space no longer expands, the lingering issues of spatial redundancy during the expansion period continue to exacerbate. More critically, urban areas experiencing contraction often face the paradoxical coexistence of continuous population loss and ongoing spatial expansion. For instance, all 11 prefecture-level cities in the three northeastern provinces witnessed the reverse evolution of urban population size reduction and urban construction land expansion from 2010 to 2020. Against the backdrop and trend of urban population contraction, this paradoxical phenomenon is bound to pose significant challenges to the high-quality development of urban construction land.

In summary, for the Northeast, the demographic dividend is no longer present, and fiscal constraints on land are increasingly apparent. The development model reliant on national policies and fixed investments during the "Golden Decade of Northeast Revitalization" has become unsustainable. Particularly as urbanization slows and population continues to shrink, the issue is no longer the total population but the urban population contraction. With further urban population contraction, Northeastern cities are likely to face severe contradictions in the relationship between people and land, as well as challenges related to extensive urban construction land use, potentially leading to further economic decline. As noted by scholars like Shao Xuefeng, the three northeastern provinces have long relied on expanding cities to drive land finance. However, this model of economic development driven by excessive land input is unsustainable, as the over-supply of land resources leads to misallocation and hinders high-quality economic development. Similarly, as stated by Xue Ling and others, urban land development in the Northeast is in a "stage of diminishing returns," and excess land supply not only hinders economic development but also restricts it. Therefore, it is crucial to recognize the severity of Northeast's population contraction, especially urban population contraction, promptly address the seriousness of the spatial redundancy problem left over from the rapid urbanization period, and explore effective paths for the high-quality development of urban construction land to better support Northeast revitalization.

1.2 Research Questions, Methods, and Approach

To further examine the aforementioned phenomena and actively respond to future challenges, three

research questions are proposed:

First, is the issue of urban population contraction severe in the Northeast?
Second, what challenges does urban population contraction pose to the development of construction land?
Third, how can urban construction land achieve high-quality development in the context of population contraction?

Regarding the first question, based on national census and statistical yearbook data, an in-depth examination of the urban population contraction evolution in the three northeastern provinces will be conducted to assess future development trends. This serves as the basic premise for this study. Concerning the second question, three hypotheses are presented: first, due to the ease of increasing construction land and difficulty in reducing it, population contraction is likely to exacerbate contradictions in the relationship between people and land, resulting in the redundancy of construction land; second, due to the increase in per capita construction land and population density dilution, population contraction may lead to inefficient development of construction land; third, under the backdrop of population contraction, expansive expansion of construction land may not promote economic development and might even have a constraining effect. Therefore, based on national land survey, national census, and statistical yearbook data, the study will use the "decoupling model of population-land relationship" to measure the relationship between population and construction land. Additionally, the study will employ the super-efficiency SBM-DEA model to evaluate the efficiency of construction land utilization and employ a "spatial econometric model" to analyze the relationship between construction land input factors and economic development. This will examine the scale issues, efficiency issues, and the relationship between scale and efficiency of construction land, representing the core objectives of this study. Regarding the third question, building on the conclusions drawn from the first two questions, the study will clarify the correct development logic of urban construction land during the period of population contraction and explore effective paths and strategies for promoting the high-quality development of urban construction land. This represents the primary applied value of this research.

Throughout the text, the term "contracting city" is used to refer to a prefecture-level administrative region where the urban population has decreased within a certain time frame, while "non-contracting city" refers to the opposite scenario.

2. Analysis of Urban Population Contraction Trends in the Three Northeastern Provinces

2.1 Evolution of Urban Population Size

Overall, the urban population in the three northeastern provinces showed growth from 2010 to 2020. However, when examining specific time periods and provinces, a clear trend of urban population contraction has emerged in recent years and is intensifying (see Figure 4). More than half (19) of the prefecture-level cities experienced urban population contraction, resulting in a total decrease of 2.623 million people. This contraction affected 155 county-level administrative units, with 66.67% (80) in Heilongjiang Province, 80% (48) in Jilin Province, and 27% (27) in

Liaoning Province experiencing urban population contraction. In 2016, the total urban population in the three northeastern provinces declined for the first time, and this negative trend reoccurred in 2018 and 2019. Except for 2018, Heilongjiang Province has experienced continuous urban population decline for five consecutive years since 2015, with a total reduction of 426,000 urban residents from 2010 to 2020. Jilin Province has seen four consecutive years of urban population decline since 2017, and Liaoning Province faced urban population contraction in 2019.

2.2 Scope of Urban Population Contraction

Over the past decade, the phenomenon of urban population contraction in the three northeastern provinces has manifested on a larger scale. The areas with urban population contraction in the three northeastern provinces have expanded continuously from 2010 to 2020 (see Figure 5). Compared to the period from 2000 to 2010, an additional 12 prefecture-level cities have experienced urban population contraction (with no improvement observed). As of 2020, more than half (19) of the prefecture-level cities in the three northeastern provinces, comprising 262.30 million people, have undergone urban population contraction, affecting 155 county-level administrative units. Heilongjiang Province, Jilin Province, and Liaoning Province reported urban population contractions in 66.67% (80), 80% (48), and 27% (27) of their county-level units, respectively.

2.3 Degree of Urban Population Contraction

From 2010 to 2020, the degree of urban population contraction in the three northeastern provinces has been escalating, with severe contractions observed in several areas. Looking at prefecture-level cities, nine cities in the three northeastern provinces experienced a reduction in urban population exceeding 10% (see Table 1). Among them, Tonghua City and the Daxing'anling area faced the most serious urban contraction issues, with urban populations decreasing by 35.85% and 31.17%, respectively. At the county-level administrative units, a total of 74 counties in the three northeastern provinces had urban population contractions exceeding 15%. Heilongjiang Province exhibited the most prominent urban population contraction issue, with five county-level units experiencing contractions exceeding 50%, and 37 counties witnessing contractions surpassing 15%. Jilin Province and Liaoning Province followed, with 30 and 7 counties, respectively, reporting urban population contractions exceeding 15%.

2.4 Conclusion: Evident Contraction Trend

In summary, the phenomenon of contraction in the three northeastern provinces is an objective reality, with the urban population contraction trend becoming more pronounced and the degree of contraction deepening continuously. The contraction scope is expanding. Concerningly, the three northeastern provinces also face challenges such as economic development rates consistently lower than the national average, a higher degree of aging and population decline compared to the national average, which may further exacerbate urban population contraction. As noted by scholars like Mazzo Peng et al. [3], the economic cycles in the three northeastern provinces lag behind the national average, and challenges such as difficult industrial structure upgrades, reduced employment

opportunities, and declining urban competitiveness may prolong the urban contraction process to some extent. Liu Fengbao et al. [1] also pointed out that population contraction is driven by various factors, including regional industries, economics, and systems, making it difficult to halt the sustained population contraction phenomenon in the context of declining development. Given the inevitable urban population contraction trend in the northeastern region, it is imperative to monitor the development of urban construction land, promptly adjust development patterns and strategies, and promote high-quality development of urban construction land.

3. Urban Construction Land Scale Analysis Based on Population-Land Relationship

3.1 Research Method: Decoupling Model of Population-Land Relationship

"Decoupling" is a concept from physics used to analyze the response relationship between two or more physical quantities[14]. Decoupling methods can, according to research needs, establish a comparative relationship between the growth rates of variables, calculate elasticity coefficients, and reflect the changing conditions and coupling relationships between variables[15]. The Organisation for Economic Co-operation and Development (OECD) first applied the concept of "decoupling" to describe the relationship between economic development and environmental pollution. Subsequently, Tapio deduced and transformed the concept of the OECD decoupling model, using the "elasticity concept" to dynamically reflect the decoupling relationship between variables, providing a better representation of the changing trends and characteristics of relevant elements[16]. Based on the basic principles and methods of Tapio's decoupling model, this study constructs an index model of the relationship between urban population change and construction land change, as shown in Equation (1). This formula calculates the ratio of the urban population change rate to the urban construction land change rate over a certain period, reflecting the coordination relationship between urban population change and construction land change.

$$\alpha = \triangle P / \triangle L \quad (1)$$

Here, α represents the elasticity coefficient of population-land increase or decrease, ΔP is the urban population change rate, and ΔL is the urban construction land area change rate. Based on the positive or negative values of ΔP and ΔL and the critical value of Tapio's elasticity coefficient, the decoupling relationship between urban population and construction land change is divided into eight types.

The decoupling relationship reflects a certain relationship status and evolutionary trend between population and land change development. However, it is not sufficient to determine whether this population-land relationship and development trend are reasonable. It is necessary to combine the per capita construction land indicator in the "Urban Land Classification and Planning Construction Land Standards" (referred to as "Standards") for a comprehensive judgment. Specifically, when the per capita construction land indicator is high, two situations may exist: one is that the development trend of the population-land relationship leads to a continuously high or further increase in per capita construction land, which is considered unreasonable; the other is that the development trend of the population-land relationship results in a decrease in per capita construction land, approaching a reasonable range, which is considered reasonable. The reverse is true. Additionally,

when the per capita urban construction land indicator is within the prescribed range and the population–land relationship changes in the same direction, it is also considered reasonable. For specific types of decoupling relationships and the rationality of trends, refer to Table 2.

The data for this study includes: ① Urban construction land data sourced from the Second and Third National Land Surveys. Urban construction land includes urban land and built-up town land. ② Urban population data sourced from the Sixth and Seventh National Population Censuses. In the Sixth Census, urban population includes city population and built-up town population; in the Seventh Census, it refers to urban population.

3.2 Conclusion: Imbalanced Population–Land Relationship

Based on the decoupling model of the population–land relationship, this study analyzes the rationality of the scale of urban construction land and the development trend of the population–land relationship in 36 prefecture-level cities in the three northeastern provinces from 2010 to 2020 (see Table 3 and Figure 6). Due to the majority of cities having a per capita construction land area far exceeding the prescribed range (65 - 115m²/person) in the "Standards," the trends of "strong negative decoupling," "expansion negative decoupling," "expansion connection," and "decline connection" are considered relatively ideal development trends for the three northeastern provinces. Overall, 72% of prefecture-level cities in the Northeast are in an irrational state of the population–land relationship development trend. Specifically, 53% of prefecture-level cities are in a state of strong decoupling and irrational trends, with Qiqihar being the most severe; 11% of prefecture-level cities are in a relatively coordinated development state of "expansion connection" and "decline connection"; 17% of prefecture-level cities are in a relatively reasonable trend state of "strong negative decoupling" and "expansion negative decoupling."

Further correlating the analysis with the situation of urban population contraction in the three northeastern provinces (see Table 4), it is observed that the types of decoupling relationships and the rationality of development trends are closely related to population contraction. Specifically, in the 84% of prefecture-level cities among the 19 contracting cities, the population–land relationship is in an extremely uncoordinated state, with 69% of cities experiencing "strong decoupling" and 31% experiencing "decline decoupling." Moreover, over 89% of cities are in an irrational state of the population–land relationship development trend, with per capita construction land areas far exceeding the specified values. In the 17 non-contracting cities, 53% of prefecture-level cities are in a favorable state of "strong negative decoupling," "expansion negative decoupling," and "expansion connection."

In summary, due to the relatively extensive development of urban construction land in the three northeastern provinces, urban population contraction is likely to cause imbalances in the population–land relationship. Against the backdrop of sustained urban population contraction, more and more cities in the three northeastern provinces will likely face the issue of continually rising per capita construction land and increasingly extensive development of construction land, posing potential risks

4. Urban Construction Land Efficiency Evaluation Based on Input–Output Analysis

4.1 Research Method: Super-Efficiency SBM-DEA Model

Data Envelopment Analysis (DEA), proposed by Charnes, Cooper, and Rhode in 1978, is an efficiency calculation method used for the relative efficiency evaluation of multiple-factor inputs and outputs between decision units[18-20]. The DEA model has been widely applied in quantitative analysis and evaluation of sustainable land use and efficiency[21]. In this study, we utilize the Super-Efficiency SBM-DEA model, as introduced by Tone and others[24], to overcome the limitations of the traditional DEA-BCC model. The Super-Efficiency SBM-DEA model addresses issues such as the inability to rank and discern efficiency when all decision units have a relative efficiency of 1 and input-output slack in the traditional DEA-BCC model. Referring to relevant literature[25-28], we define urban construction land efficiency from the perspective of input and output, considering various factors such as land, capital, and labor. The Super-Efficiency SBM-DEA model quantifies the efficiency of urban construction land in the three northeastern provinces. When the comprehensive efficiency is greater than or equal to 1, it indicates relatively high efficiency, and vice versa, indicating relative inefficiency where input and output are mismatched. The specific calculation formula can be found in the relevant literature[24].

Based on the issues and connotations related to construction land addressed in this study and in consideration of existing indicators[18,20,25-26,29], we construct an urban construction land efficiency evaluation system from the perspective of input-output (see Table 5). Using prefecture-level cities as units, we analyze the urban construction land efficiency in the three northeastern provinces from 2009 to 2019. The data include: ① Urban construction land data from the main data bulletins of the second and third national land surveys in various prefecture-level cities. ② Employment in the secondary and tertiary industries and the output value of the secondary and tertiary industries from the statistical yearbooks of provinces and prefecture-level cities from 2010 to 2020. ③ Social fixed asset investment data from the "Statistical Bulletin of National Economic and Social Development (2019-2019)."

4.2 Conclusion: Caution Needed for Inefficiency

The analysis (see Table 6) reveals that between 2009 and 2019, the overall efficiency of urban construction land in the three northeastern provinces was relatively low and exhibited a "fluctuating decline," with a mean of 0.79, representing a 6.10% decrease. Only 6 (16.7%) prefecture-level cities achieved DEA effectiveness. Specifically, Liaoning Province had a mean urban construction land efficiency of 0.82, higher than Heilongjiang Province (0.77) and Jilin Province (0.78). Over the decade, Liaoning Province's mean efficiency increased by 6.10%, which was significantly better than Heilongjiang Province (-19.28%) and Jilin Province (-8.22%), aligning with the relatively favorable situation of population and economic development in Liaoning Province within the three northeastern provinces.

Further correlation analysis with urban population contraction and the development of population-land relationships reveals a close connection. Among 19 contracting cities, 84% of prefecture-level cities are in an extremely uncoordinated state of population-land relationships, with 69% experiencing "strong decoupling" and 31% experiencing "decline decoupling." Moreover, over 89% of cities are in an irrational state of population-land relationship development trend,

with per capita construction land areas far exceeding the specified values. Among 17 non—contracting cities, 53% of prefecture—level cities are in a favorable state of "strong negative decoupling," "expansion negative decoupling," and "expansion connection."

In summary, although urban population contraction may lead to a continuous increase in per capita urban construction land indicators, it does not necessarily result in land inefficiency. For contracting cities, proactive transformation and innovative development can achieve efficient urban construction land development. However, optimism should be cautious, as the study has revealed serious hidden dangers in the construction land of contracting cities. If the old path of expansion—oriented development continues, these risks could transform into crises. Therefore, it is necessary to further examine the relationship between urban construction land scale input and efficiency in the context of population contraction, monitoring the efficiency of construction land utilization to prevent inefficiency in the trend of population contraction and extensive land development.

5. Study on the Relationship between Urban Construction Land Scale and Efficiency Based on Input—Output

5.1 Research Method: Spatial Econometric Model

The Cobb—Douglas production function, as a classical model for analyzing economic growth, is widely used for measuring the contribution of land factors to economic growth. The specific formula can be found in relevant literature[30]. However, ordinary panel models often overlook the non—equilibrium and mutual influences among multiple factors, such as land allocation, policy support, and economic development, which act on the economic development of each city. To overcome these limitations, spatial panel models are used to analyze spatial autocorrelation, accounting for spatial weight matrices. In spatial econometric models, the Spatial Lag Model (SLM) represents the influence of the development of one area on its neighboring areas, indicating spatial spillover effects. The Spatial Error Model (SEM) is used to reduce the impact of unobserved variables not included in the model on the dependent variable. In this study, SLM and SEM models are utilized to verify the spatial effects indicated by spatial correlation. According to Tobler's First Law of Geography, a reverse distance spatial weight matrix is constructed to reflect features of non—adjacent elements but with circulating factors and to exhibit the essential characteristic that weights decrease as spatial distance increases.

Based on existing research[30,32—33], the secondary and tertiary industry output values of each prefecture—level city are selected as the dependent variable, measuring economic development. The explanatory variables include capital stock (representing capital factors), urban construction land area (representing land factors), and the number of employees in the secondary and tertiary industries (representing labor factors). To determine whether there is a correlation between land scale input and economic efficiency, a Moran I index verification is conducted on panel data for 36 prefecture—level cities in the three northeastern provinces from 2009 to 2019. The results show spatial clustering of economic growth in the three northeastern provinces at a 95% confidence level, indicating the existence of spatial correlation. Furthermore, based on the Hausman test results from panel data, with a P—value less than 0.001, the null hypothesis of random effects is significantly rejected at the 1% significance level. Therefore, a fixed—effects model is chosen

for spatial regression analysis. Utilizing the fixed-effects SLM and SEM models, as described in relevant literature[35], we aim to explore the relationship between land scale input and economic efficiency.

The data include: ① Construction land data sourced from the main data bulletins of the second and third national land surveys in various prefecture-level cities. ② Employment in the secondary and tertiary industries and the output value of the secondary and tertiary industries from the statistical yearbooks of provinces and prefecture-level cities from 2009 to 2020. ③ Social fixed asset investment data

5.2 Conclusion: Diminishing Returns to Scale

Based on the aforementioned methods, estimations were conducted using Stata software. Examining the overall situation in the three northeastern provinces (see Table 7), it is evident that the inputs of labor and capital are significantly positively correlated with economic growth. This aligns with growth theories and empirical results from domestic scholars[36], indicating that appropriate investment in labor and capital contributes to regional economic development. Conversely, the input of land factors shows a significant negative correlation with economic growth. In other words, overall, as the scale of urban construction land increases in the three northeastern provinces, the economic efficiency of cities tends to decrease. When differentiating based on urban population contraction (see Table 8), it is observed that both labor and capital inputs are significantly positively correlated with economic growth in both contracting and non-contracting cities. However, in terms of land factors, there is a notable difference—non-contracting cities exhibit a significant positive correlation, while contracting cities show a significant negative correlation.

In summary, the overall urban construction land development in the three northeastern provinces has entered a stage of "diminishing returns to scale." Further increasing the investment in urban construction land would not only be detrimental to economic growth but could also constrain economic development, especially in contracting cities. From another perspective, the current situation in the three northeastern provinces is closely associated with the phenomenon of large-scale and extensive urban population contraction. As indicated by the analysis above, the input of urban construction land in contracting cities is significantly negatively correlated with economic growth, unlike in non-contracting cities. Research by Xue Ling and others[12] suggests a "inverted U-shaped relationship" between land input and high-quality economic development, indicating that the marginal contribution to economic development begins to decline when land input surpasses a certain threshold. For the three northeastern provinces, particularly in contracting cities, relying on the economic growth model driven by the expansion of construction land is no longer feasible and may even become a stumbling block to regional development.

6. Discussion and Recommendations

6.1 Challenges

According to the analysis above, the phenomenon of urban population decline in the three northeastern provinces is intensifying, and there are significant risks in the development of urban

construction land. On one hand, during the process of population decline, imbalances in the human–land relationship are inevitable. Unlike the basic logic of simultaneous expansion of construction land during periods of population growth, attempting to reduce construction land in sync with population decline is not only lacking in motivation but also extremely challenging. Therefore, during periods of population decline, the development of construction land becomes extremely difficult. Even if the land does not expand further, continuous population decline will widen the gap between population and land, resulting in conflicting human–land relationships. Moreover, in reality, during periods of population growth, the phenomenon of land urbanization often exceeds population urbanization. This phenomenon becomes more pronounced during population decline. Many cities tend to continue expanding construction land for a certain period, leading to the paradox of population decrease and spatial growth. Thus, if the development pattern of construction land is not actively transformed, the human–land conflicts faced by contracting cities will be severe. On the other hand, during population decline, the development of construction land faces greater risks of inefficiency. Its expansion does not stimulate economic growth but rather constrains high–quality economic development. This inefficiency is primarily manifested in the strong directionality of new construction land. Firstly, the addition of new construction land lowers the relative cost of construction, directing more resources and capital into the construction sector, squeezing investments in advanced technologies and equipment, inhibiting technological progress, and industrial upgrading. Secondly, the surge in investment due to new construction land leads to rapid increases in funds allocated for infrastructure such as roads and electricity. When such investment is not aligned with population structure and economic development, it fails to convert into output, resulting in accumulated stagnation. Thirdly, the development cost of new construction land is relatively low, especially in regions with shrinking populations and economic downturns, which need to attract investment through "low–price land supply." This perpetuates the cost gap between incremental development and stock renewal, restraining stock land development and urban renewal[11]. This directionality is beneficial during periods of population growth to adapt to development needs and stimulate economic growth. However, during population decline, it works in the opposite way, rendering stock construction land unable to renew, leading to continuous deterioration of space. In addition, new land additions become ineffective, and investments continuously stagnate, causing contracting cities to enter a vicious cycle of "old problems persisting and new problems arising." Particularly for traditional industrial and resource–based cities, it becomes even more challenging to break free from "path dependence" and "resource curse" to achieve transformational development.

The above analysis provides a macro–level examination of the relationship between population decline, construction land, and economic development. When applied to the meso and micro levels, the imbalances in human–land relationships and the inefficiencies in construction land usage triggered by population decline will involve a series of more direct and tangible issues. Specifically, during the process of urban population decline, the human–land conflict is manifested in the continuous exacerbation of the "urban space redundancy" phenomenon. Its direct reflection is the problem of "vacancy" of land and houses, a key term of interest in international studies on shrinking cities. Vacancy itself is not the issue; the problem lies in the large–scale vacancy phenomenon causing spatial deterioration issues such as garbage dumping, dilapidation of houses, environmental degradation, and socio–economic decline issues like the breeding of crime, damage to regional

image, decline in vitality, and declining property prices. These chain reactions further intensify population decline and spatial vacancy, plunging contracting cities into a dilemma of "spiral decline"[13]. According to international experiences, the key to preventing the evolution of vacancy issues into an overall crisis lies in the "preservation" of vacant land and houses, transforming "useless" land into "useful" land. This requires innovative models and mechanisms for urban renewal[37]. Returning to the construction land scale and efficiency issues discussed in this paper, if contracting cities continue to add new construction land, it will significantly hinder the development of the stock renewal market, increasing the risk of the postponement of vacancy issues and its triggering chain reactions. Therefore, for contracting cities, avoiding blind expansion of construction land, maintaining the coordinated development of human–land relationships, is not only a prerequisite for the latter but also one of the goals. Both are crucial for addressing the crisis of vacancy, preventing spatial deterioration, achieving efficient development of construction land, and promoting high-quality economic development.

6.2 The Way Forward

Most of the contracting cities in the three northeastern provinces are in the early stages of population decline, with the contradictions between humans and land becoming apparent. In the context of the new round of national spatial planning, the development of construction land in contracting cities is at a crucial "watershed." On one side is expansive development, and on the other is intensive development. In the situation of exacerbated population decline, slowed urbanization, and the unsustainable nature of land finance, the development of construction land in contracting cities has entered a stage of diminishing returns to scale in the external expansion model. If the old path of extensive expansion continues, it will inevitably result in inefficient allocation of land resources. Not only will it be detrimental to economic growth, but it will also exacerbate human–land conflicts and trigger extensive spatial vacancy issues and their cascading crises, leading contracting cities into a vicious cycle of "population decline, inefficient land use, and economic recession." Conversely, by avoiding blind expansion and focusing on the development of existing land, promoting efficient allocation of land resources, it is possible to not only propel the development of construction land into a stage of internal intensive growth but also to mitigate spatial vacancy crises associated with population decline, creating new opportunities for socio-economic growth.

Most of the contracting cities in the three northeastern provinces are traditional resource-based and industrial cities, with resource depletion, path dependence, and inappropriate transitions being the main causes of population decline. According to international experiences, on the one hand, the phenomenon of population decline in such cities may persist for a certain or even a long period. On the other hand, population decline is not inherently problematic; it only tends to bring problems easily. Actively exploring and achieving transformative development, population decline can coexist with social and economic growth. Therefore, objectively accepting the trend of population decline, proactively addressing the human–land relationship, and optimizing land resource allocation are crucial steps to promote the efficient development of construction land and socio-economic growth during the process of population decline. For this reason, contracting cities must abandon the past model of extensive expansion and promote the development of construction land towards efficient intensive growth. On the one hand, actively optimizing existing

land is crucial to achieving efficient land development. On the other hand, avoiding blind expansion, or even strictly controlling land growth, is a prerequisite for optimizing existing land. Specifically, it is necessary to deploy a combination of technical, institutional, and market measures to "strictly control increment," compelling the "optimization of stock." In addition, incentives mechanisms should be used to promote stock renewal and planning reduction, systematically optimizing the human–land relationships and land resource allocation in contracting cities.

To achieve this, the following strategies are recommended:

1. **Technical Preparation and Multi–level Coordination:** Conduct comprehensive assessments of the coordination of human–land relationships at the macro level, focusing on whether the scale and structure of population and construction land are mutually appropriate. Orientate towards the "supply–demand balance

" of land, monitor and alert regularly, and apply assessment results to national spatial planning and land–use control. At the meso level, monitor areas within cities with severe population decline, examining the matching capabilities and operational levels of public services, infrastructure, and spatial environmental quality. Orientate towards the "quantity and quality unification" of land, strengthen technical analysis and guidance, and implement them in urban renewal and quality improvement actions to avoid triggering a vicious cycle of population decline and spatial deterioration. At the micro level, identify and evaluate vacant and inefficient land during population decline, incorporating such land into urban spatial pattern optimization. Dispose of this land by formulating suitable land renewal or reduction plans based on characteristics such as scale, type, location, and building conditions, reshaping the value of this "useless" land to promote the efficient development of stock land.

2. **Institutional Safeguards and Type–specific Controls:** Set strict thresholds for new construction land, cautiously use construction land indicators, and restrict general real estate development projects and industrial projects that do not align with the city's development goals. Avoid deterioration of land structure and guide the market towards stock land. For suitable investment projects and necessary public projects, strengthen the suitability analysis of land selection and scale, avoiding the improper use of land and maximizing the release of land value. Provide policy guidance for stock renewal projects, offer tax reductions and exemptions, and more relaxed administrative permits based on project importance and difficulty to promote social capital participation in urban renewal and old community transformation.

3. **Effective Market Regulation to Improve Construction Land Index Efficiency:** For contracting cities, even though the demand for construction land is decreasing, it does not mean that surplus construction land indicators are useless. On the contrary, if surplus indicators are reasonably utilized through market mechanisms, they can create more value for the city. With the establishment of a unified national market, it is expected that surplus indicators linked to the increase and decrease of urban and rural construction land can achieve larger–scale and more flexible cross–regional transfers. It may even expand the flow from "rural" to "rural" and from "urban" to "rural," bringing more opportunities for the development of contracting cities. On one hand, surplus construction

land indicators can be used to compensate local finances through cross—regional trading mechanisms, including unused urban construction land indicators and surplus indicators released by rural population decline. On the other hand, for contracting cities in large agricultural areas, surplus construction land indicators are conducive to adapting to the needs of township industrial development and promoting regional revitalization.

7. Conclusion

Population decline poses new challenges to urban development. As a fundamental element of economic development and an essential carrier of urban operations, the high—quality development of construction land plays a crucial role in the sustainable development and socio—economic revitalization of contracting cities. Given the regional urban population decline phenomenon in the three northeastern provinces with an escalating trend, it is imperative that the development of construction land in contracting cities follows an intensive development path, strictly controlling increments, revitalizing stock, and moderately reducing land. Actively adapting to the trend of population decline, stabilizing and optimizing human—land relationships and land resource allocation is vital for promoting the high—quality development of construction land, providing impetus for the comprehensive revitalization of the northeast in the new era.

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