

Discussion and Verification: Chinese Development Path

Yifan Li *

School of Economics & Management, Tongji University, Shanghai, China

Abstract: This paper examines the long-term implications of China's extensive investment in infrastructure and real estate, suggesting that the country may have reached a stage where returns on such investments are significantly diminishing. Merely loosening lending regulations is unlikely to yield sustainable benefits and could, in fact, worsen the financial strain on local governments, particularly when accounting for hidden liabilities from local government financing vehicles (LGFVs), which are projected to surpass half of the country's GDP. The heavy dependence of local governments on land sales for revenue further complicates the issue, as a downturn in the real estate sector could lead to a dramatic decline in this vital income source. While these challenges are theoretically solvable, they are extremely difficult to address in practice. The paper stresses the need for a more balanced and diversified approach to economic development, particularly in addressing local government debt and finding new revenue streams beyond land sales.

Keywords: China development path, Investment, Local government financing vehicles.

1. Introduction

In this paper, we argue that China, after decades of rapid infrastructure and real estate investment, has likely reached a stage where the returns on these investments are diminishing [1, 2]. Simply easing lending restrictions is unlikely to create long-term benefits and could even worsen the financial pressures on highly-indebted local governments, especially given the substantial liabilities from local government financing vehicles (LGFVs), which are estimated to exceed 50% of GDP. This issue is further compounded by the reliance of local governments on land sales for revenue, a system that may collapse if the real estate market declines. While these challenges may not be insurmountable, they present significant difficulties in practice. China's extraordinary economic growth, particularly between 1980 and 2012, averaged 8.9% according to official data, with the pace slowing to 6.4% between 2013 and 2019 [3-5]. Alternative data sources, such as the PWT, report slightly lower figures but still acknowledge the country's impressive growth, lifting millions out of poverty and transforming China into one of the world's largest economies. However, recent signs suggest a slowdown in medium-term growth, particularly as China's post-COVID recovery falters [6].

For many economists, it has been clear that China's growth rates would eventually decelerate. Factors such as an aging population, exacerbated by the one-child policy, and a slowdown in total factor productivity contribute to this trend. Additionally, China's ability to expand through exports is increasingly constrained by its significant share of global GDP and exports, alongside shifts in global production strategies like 'China plus one.'

Research has shown that China's heavy reliance on real estate and infrastructure for growth may have reached a point where the returns on new investments in these sectors have declined [8]. In 2021, real estate contributed 22% of China's GDP, with infrastructure investments pushing the combined share to 31%. While a slowdown in the real estate sector poses financial risks, particularly due to rising local government debt, China's central government retains significant power to manage these challenges, reducing the likelihood of a Western-style financial crisis. However, servicing LGFV debt

is becoming increasingly difficult, especially as property markets cool.

Although policies such as increased revenue transfers from the central government or the introduction of local property taxes could help address these issues, they are complex to implement amid a broader economic slowdown. Moreover, China's households have a significant portion of their wealth tied up in real estate, complicating the adjustment process. Nevertheless, China's historical success in navigating economic challenges has led some experts to remain optimistic about the country's ability to avoid a sharp downturn or financial crisis [9-11].

The first section of this paper examines the growing share of China's real estate and infrastructure sectors in GDP since 2000. By comparing China to various OECD countries, it becomes clear that only Spain, prior to the global financial crisis, had a similar level of investment in these sectors. We also highlight how China's per capita floor space has nearly caught up to that of the United States and other developed countries, emphasizing the scale of the country's construction boom. When infrastructure investments are included, China's buildup is even more striking. In the following section, this paper leverages a newly-developed city-level database that provides detailed insights into the stock of housing and real estate investments, with a breakdown by city tier. The data reveals that housing construction growth has been especially pronounced in China's smaller, less affluent cities, which are categorized here as tier 3 cities. These cities, located outside the top two tiers, have seen a substantial increase in per capita floor space. We then present formal evidence showing that as housing capital has expanded in individual cities, the marginal growth benefits of further real estate investment have diminished, confirming the trend of diminishing returns. Additionally, recent studies indicate that cities with higher levels of real estate investment are also experiencing a significant buildup of local debt, exacerbating financial strain. The paper also expands the analysis to commercial real estate, where the issues in tier 3 cities are similarly evident. Finally, we explore the distribution of infrastructure investment, such as roads, sewer systems, and high-speed rail. These investments have also been heavily concentrated in tier 3 cities, raising concerns about their long-term sustainability.

The final section provides conclusions based on these findings.

2. The Outsize Footprint of Real Estate and Infrastructure in China

China's rapid growth over the past few decades has been closely tied to massive investments in real estate and infrastructure. This sector's outsized presence in the economy is one of the most significant features of the country's development model. Beginning in the early 2000s, a considerable portion of China's GDP has been driven by the expansion of both residential and commercial real estate, along with large-scale infrastructure projects like roads, railways, and urban utilities. In many areas, the scale of construction has reached or even surpassed levels seen in advanced Western economies. Real estate, in particular, has accounted for a staggering share of China's economic activity, with estimates indicating that its direct and indirect impact represented over 30% of GDP at its peak [12]. This includes not only the buildings themselves but the related services and industries that rely on real estate development.

However, as China continues to urbanize and develop, questions have emerged regarding the sustainability of this real estate- and infrastructure-heavy growth model [13]. The diminishing returns on investment are becoming more apparent, especially as housing and infrastructure capacity in many regions, particularly in smaller and lower-tier cities, approaches saturation. These cities have been disproportionately targeted for real estate and infrastructure

investment, but the payoff in terms of economic growth is diminishing, raising concerns about over-investment [14, 15].

China's real estate sector holds an immense and influential position within its economy. In 2021, the direct contribution of the real estate construction sector to GDP was nearly 5%, with real estate services adding an additional 7%. However, when considering the entire economic impact, including upstream industries linked to real estate development and using China's 2019 input-output table, the sector accounted for approximately 22% of GDP. When imported content is also considered, this figure rises to nearly 25%. This broad influence reflects the extensive demand that real estate creates for materials, services, and other industries. Table 1, updated from [16], highlights how the real estate sector, when combined with infrastructure development, forms a significant portion of China's total economic activity. The column marked "total final demand" illustrates the share of GDP that arises from all domestic activities tied to final demand for real estate and construction. This includes the value added by upstream sectors such as material production and service industries that are closely connected to construction. A notable aspect of this sector's impact is the inclusion of imported components. When the final demand for real estate is calculated with these components, it slightly reduces the share in recent years, with a peak of 26% of GDP in 2018, dropping to 24.9% in 2020 and 24.4% in 2021. This trend suggests that the sector may be moving past its peak, with potential concerns about diminishing returns from continued investment in real estate and infrastructure projects.

Table 1. The demand for real estate and infrastructure

| | Direct value added (%) | | | | | | Total final demand (%) | | | | | |
|--|------------------------|------|------|------|------|------|------------------------|------|------|------|------|------|
| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
| Real estate construction | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 4.9 | 17.5 | 17.5 | 17.5 | 17.1 | 16.8 | 16.5 |
| Real estate services | 6.7 | 6.9 | 7.0 | 7.1 | 7.2 | 6.8 | 5.2 | 5.3 | 5.4 | 5.3 | 5.4 | 5.0 |
| Imported component | 2.8 | 3.0 | 3.1 | | 2.7 | 2.9 | | | | 2.9 | | |
| Total real estate activity | 11.3 | 11.9 | 12.4 | 12.2 | 12.4 | 11.6 | 25.5 | 25.8 | 26.0 | 25.3 | 24.9 | 24.4 |
| Infrastructure construction | 1.9 | 2.0 | 2.1 | 2.1 | 2.2 | 2.1 | 6.8 | 7.0 | 7.3 | 7.2 | 7.5 | 7.3 |
| Real estate and infrastructure contribution to economy | 13.2 | 13.8 | 14.4 | 14.3 | 14.6 | 13.7 | 31.3 | 32.0 | 32.9 | 32.5 | 32.4 | 31.7 |

The scale of China's real estate and infrastructure sectors is staggering, significantly impacting the country's economy. As of 2021, the direct contribution of real estate construction to China's GDP was just under 5%, with real estate services contributing an additional 7%. When accounting for the entire economic chain, including upstream industries and imported components, real estate and associated sectors collectively represented about 22% of GDP. Including infrastructure, which constitutes approximately 30% of total construction activities, the combined share of real estate and infrastructure reaches over 30% of GDP. This is particularly notable when compared internationally.

Figure 1 illustrates this remarkable scale. In 2021, China's real estate sector, including imported content, accounted for approximately 31% of GDP, far exceeding the peak levels seen in Ireland and rivaling Spain at the height of its real estate bubble. This contrasts sharply with the U.S., where the real estate and infrastructure sectors contribute an average of

19% to GDP [17]. The enduring high share of real estate and infrastructure in GDP raises important questions about the sustainability of this investment strategy. China's rapid expansion in these sectors is evident when examining the stock of housing. From 2010 to 2021, China's housing stock per capita increased from 36 m² to nearly 49 m², closing the gap with Western countries like France and the United Kingdom, and in some cases surpassing them. This rapid expansion highlights the intense pace of development across the country.

A significant portion of this development has occurred in tier 3 cities, which, despite their smaller size and lower wealth levels, have seen substantial real estate investment. In 2021, these tier 3 cities accounted for almost 80% of the national housing stock. However, this surge in construction has not translated into comparable economic growth. Tier 3 cities have experienced stagnant or declining real estate prices, exacerbating financial strain within the construction industry.

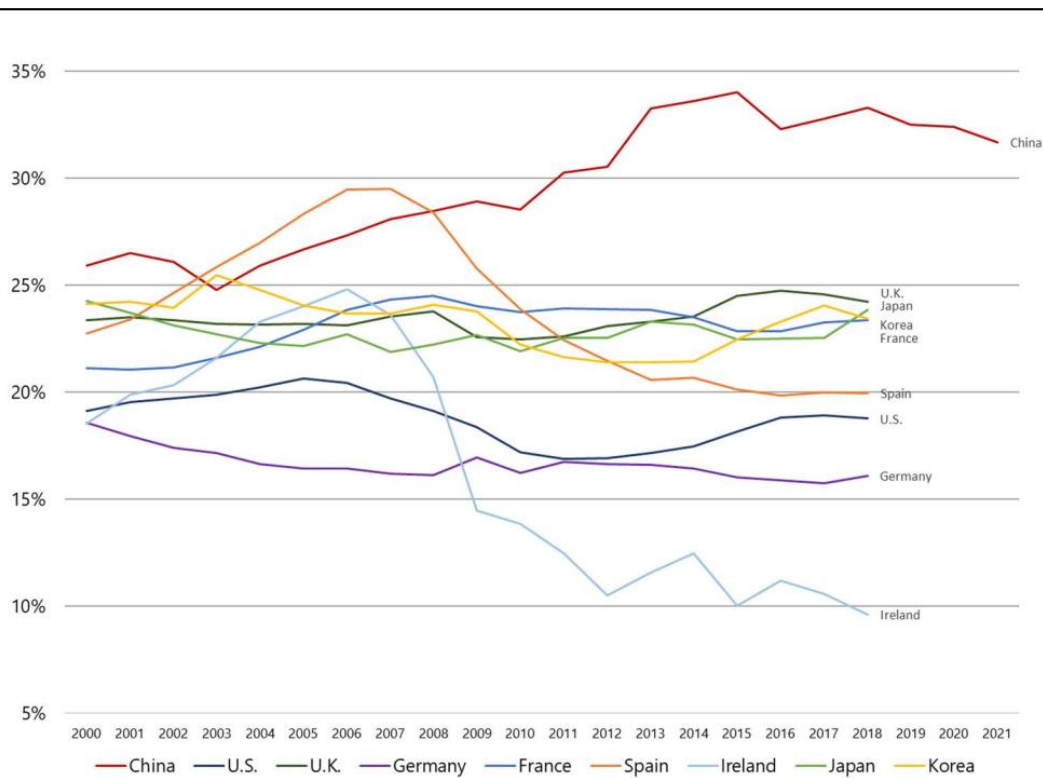


Figure 1. Demand for real estate and infrastructure

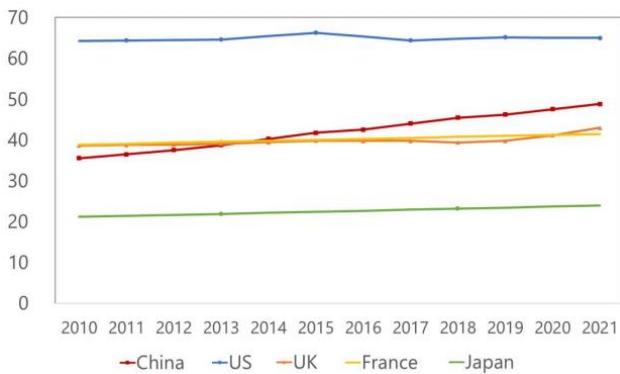


Figure 2. Per capita floor space

Figure 2 illustrates the stock of housing per capita in China relative to other countries. China's housing stock per capita grew from 36 m² in 2010 to nearly 49 m² in 2021, narrowing the gap with the U.S., France, and the United Kingdom. This figure emphasizes the rapid increase in housing stock and the closing gap with Western standards. China's per capita housing stock increased from 36 m² in 2010 to nearly 49 m² in 2021. This rapid growth has substantially narrowed the gap with Western countries, including the U.S., France, and the UK. Despite having a higher growth rate, China's per capita housing stock is nearing parity with these developed nations. This reflects China's significant investment in residential construction, aimed at improving living standards and addressing urban housing needs.

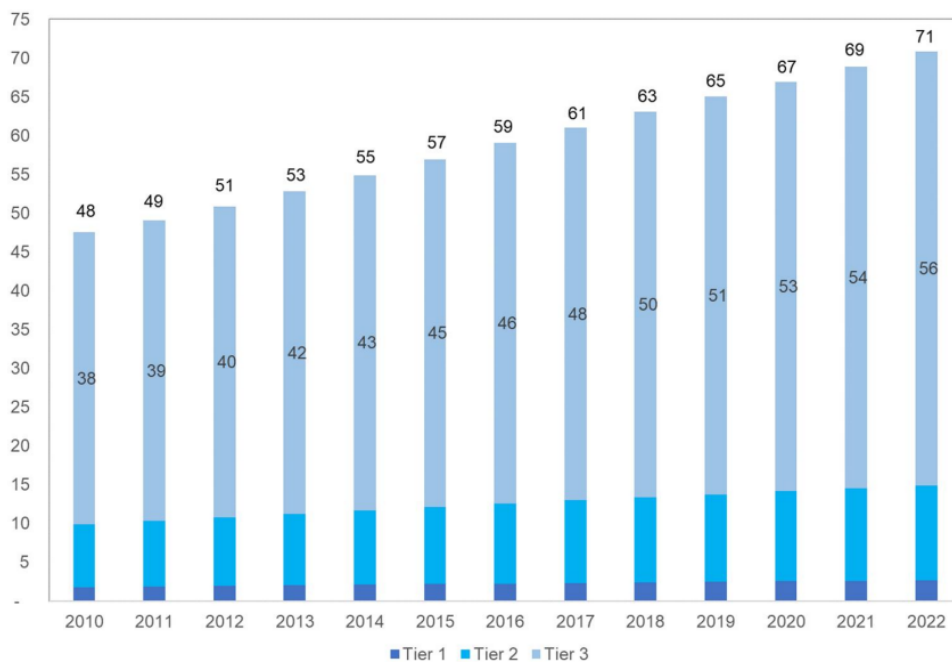


Figure 3. Total housing stock by city tier

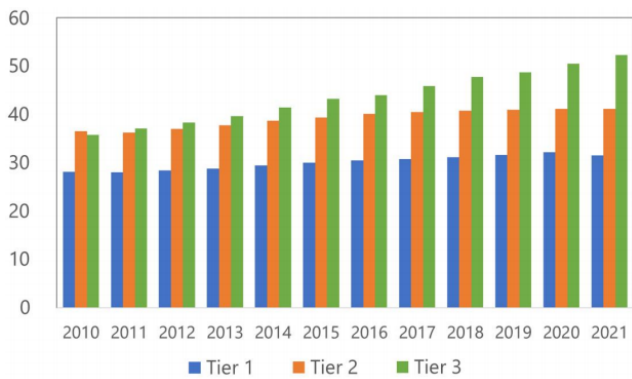


Figure 4. City capita floor space

Figure 3 and Figure 4 present the national aggregate housing stock, which expanded from 49 billion m² to nearly 70 billion m² over recent years. The majority of this growth has been concentrated in tier 3 cities, which now account for nearly 80% of the total housing stock [18]. These figures highlight the substantial expansion of residential space in these smaller cities. The figures reveal a dramatic increase in China's total housing stock, with tier 3 cities contributing almost 80% of this growth. This concentration highlights the large-scale investment in these smaller cities, despite their economic challenges. The substantial rise in housing stock indicates both the extensive construction activities and the need to manage this surplus in areas with limited economic growth [19].

Figure 5 shows the regional distribution of construction, revealing that tier 3 cities have absorbed a significant share of new real estate investments. Despite their substantial construction, these cities have not experienced corresponding income growth. This divergence is evident as real estate prices in tier 1 cities have stabilized, while those in tier 3 cities have fallen, reflecting the strain on the real estate market. The data show a significant rise in real estate investment in tier 3

cities, from 32% of total investment in 2000 to over 60% in 2021 [20]. This shift indicates a strategic focus on expanding housing and infrastructure in less economically advanced areas. However, the flattening of real estate prices in tier 1 cities, coupled with declining prices in tier 3 cities, suggests that the rapid investment may not have yielded proportional economic benefits.

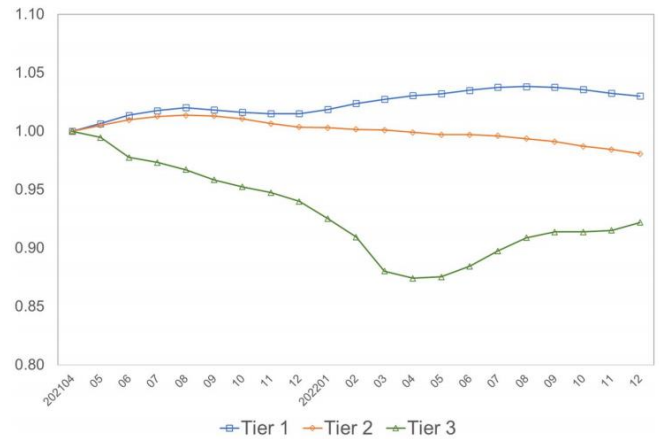


Figure 5. Housing price change

Figure 6 illustrates the ratio of new housing construction to completed projects in tier 3 cities. In 2020, this ratio was 10.6, up from just over 6 in 2011. A high ratio indicates overbuilding and potential market distress, where developers face challenges completing projects due to insufficient demand and funding issues. In 2020, the ratio of housing under construction to completed projects in tier 3 cities was 10.6, up from just over 6 in 2011. This high ratio indicates an overabundance of ongoing construction relative to completed units, suggesting potential overbuilding and market strain. Such a high ratio points to a mismatch between supply and demand, with developers struggling to complete projects due to a lack of buyers and financing challenges.

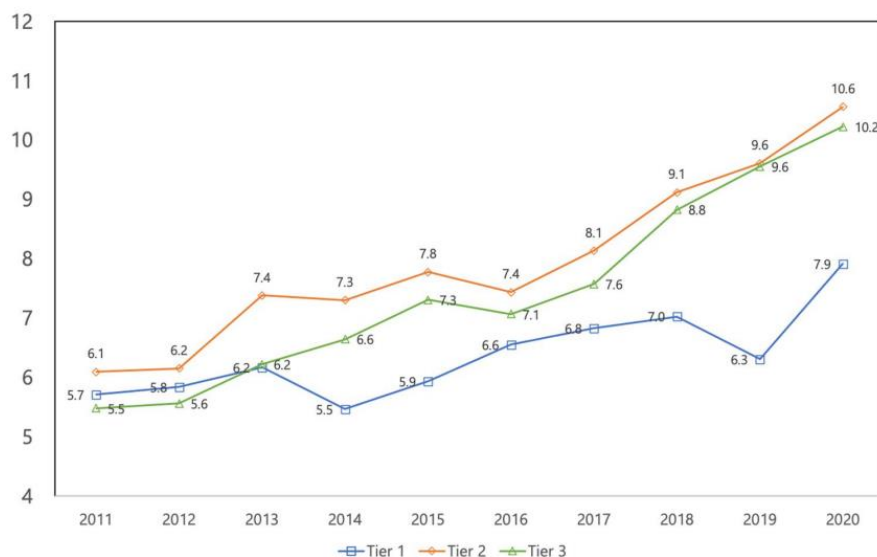


Figure 6. Under construction houses

Figure 7 extends this analysis to commercial real estate, showing a similar trend where the ratio of commercial real estate under construction to completed projects has been steadily increasing. This reflects ongoing overinvestment and financial strain within the commercial real estate sector. The ratio of commercial real estate under construction to completed projects has steadily increased, mirroring the trends in residential real estate [21]. This growing disparity

highlights similar issues of overinvestment and financial pressure in the commercial sector, where excessive construction may lead to oversupply and market imbalances.

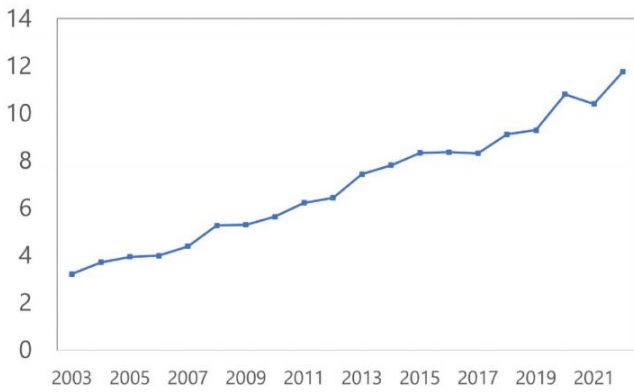


Figure 7. Ratio of commercial real estate floor space under construction to annual completed projects

Figure 8 depicts China's high-speed rail network, highlighting its extensive growth compared to other countries. Despite the significant financial liabilities of entities like China State Railway Group, the expansion of the high-speed rail network continues to outpace passenger growth, indicating an imbalance between investment and usage. Despite facing significant financial liabilities and operational losses, China's high-speed rail network continues to expand rapidly [22]. The figure demonstrates China's commitment to infrastructure development, with a network that vastly exceeds the size and utilization of other countries' systems. This aggressive expansion underscores China's strategic focus on enhancing transportation infrastructure, even as passenger growth lags behind.

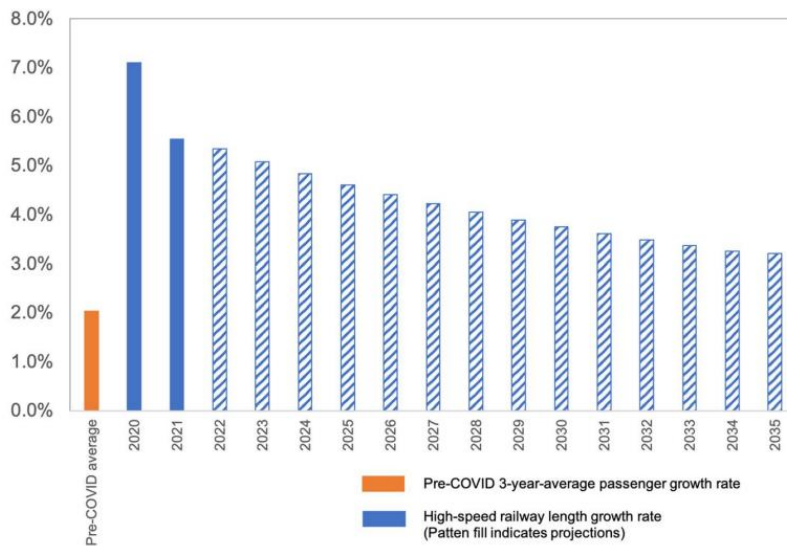


Figure 8. Comparative analysis of high-speed railway passenger growth and construction expansion

Figure 9 shows the stock of sewage pipes in tier 3 cities, revealing a heavy concentration of infrastructure investment in these smaller cities. This figure underscores the disproportionate allocation of infrastructure resources to tier 3 cities. The data reveal a heavy concentration of sewage infrastructure investment in tier 3 cities, reflecting a significant allocation of resources to these areas. This disproportionate investment indicates a focus on improving basic infrastructure in less developed cities, although it also raises questions about the efficiency and effectiveness of such investments given the economic challenges faced by these regions.

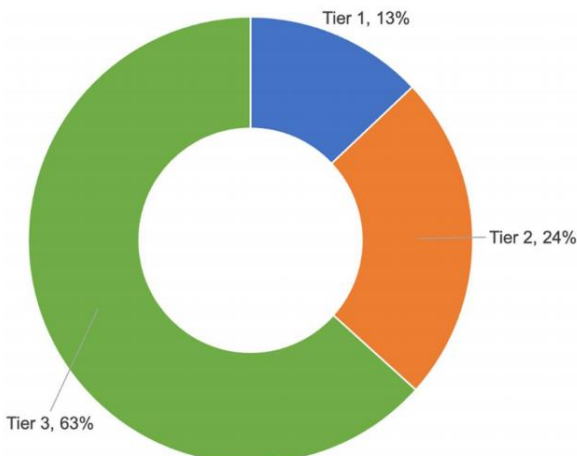


Figure 9. Length of sewage pipes by city tier

Figure 10 presents the flow of new road construction, reflecting similar trends as other infrastructure investments. The data indicate a substantial ongoing investment in road infrastructure, particularly in tier 3 cities. The data highlight substantial ongoing investment in road infrastructure, particularly in tier 3 cities. This trend is consistent with other infrastructure investments, reinforcing the pattern of directing resources toward smaller cities. The figures illustrate the extensive efforts to enhance transportation networks, although they also suggest potential oversupply and financial strain in areas with limited economic growth [23].

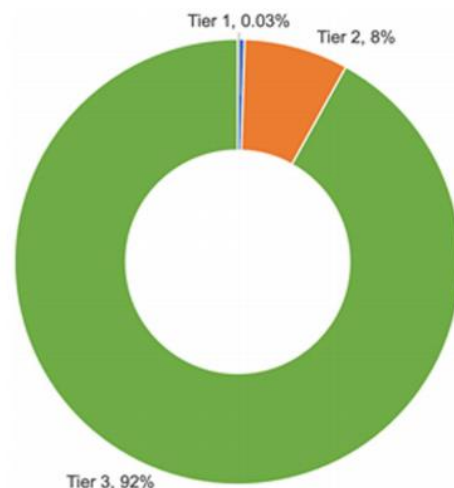


Figure 10. New road construction from 2012 to 2020

Evidence of overbuilding is particularly stark in tier 3 cities, where the ratio of housing under construction to completed projects stood at 10.6 in 2020, up from just over 6 in 2011. This high ratio indicates a market under significant stress, where developers struggle to complete projects due to a lack of final buyers and funding challenges. This problem is mirrored in the commercial real estate sector, where the ratio of commercial properties under construction to those completed has also been rising steadily.

Infrastructure investment has similarly been substantial, with China boasting the world's largest and most extensively used high-speed rail network. Despite the significant financial liabilities of entities like China State Railway Group, the expansion of this network continues at a pace far exceeding passenger growth. The majority of infrastructure investment has also been directed toward tier 3 cities. For example, Figure 9 reveals that sewage infrastructure investment is disproportionately concentrated in these smaller cities, while Figure 10 illustrates a similar trend in road construction.

In summary, while China's real estate and infrastructure sectors have played a crucial role in the country's development, the enormous scale of investment and construction poses serious challenges. Overbuilding, particularly in tier 3 cities, coupled with financial strains, suggests a need for strategic reassessment of future investment in these sectors.

3. Analysis of Real Estate Investment and Economic Growth Regressions

We have proposed that, given the extensive cumulative investment in real estate, diminishing returns to such investments are likely starting to emerge. To substantiate this hypothesis with empirical evidence, we conduct a statistical analysis. Table 2 details the results from regressions examining city-level growth rates. To mitigate endogeneity concerns—where real estate investments may be both a response to and a driver of growth—we employ a shift-share instrumental variable approach, following the methodology of Goldsmith-Pinkham et al. (2020). This approach integrates lagged city-level real estate investment ratios with national-level real estate investment growth to form the instrument. Our results, demonstrate that the conclusions are stable across various alternative instruments, reinforcing the reliability of our findings.

$$X_{i,t+1} = \alpha + \beta + IV_{i,t} \times B + IV_{i,t} \times S_{i,t-1} \prod Control_{i,t} + \delta_i + \varepsilon_{i,t} \quad (1)$$

$$Y_{i,t+1} = a + b + IV_{i,t} \times B + IV_{i,t} \times S_{i,t-1} \prod Control_{i,t} + \delta_i + \varepsilon_{i,t} \quad (2)$$

In this study, we analyze city-level data to investigate the impact of cumulative real estate investment on economic growth, particularly focusing on the potential diminishing returns associated with such investments. The analysis is structured as follows:

(1) First-Stage Regression: We perform a regression of the city-level real estate investment ratio $X_{i,t+1}$ on an instrumental variable $IV_{i,t}$ and a set of control variables. These control variables include lagged real GDP growth, per capita real GDP, population growth, urbanization rate, and the industrial structure. The model incorporates city-specific fixed effects α and year-specific fixed effects δ_i , with $\varepsilon_{i,t}$ representing the residual error term.

(2) Second-Stage Regression: To explore the effects of accumulated housing capital on the returns of new real estate investments, we introduce an interaction term between the flow of real estate investment and the stock of cumulative housing capital. Specifically, we include the sum of residential real estate investments in real terms up to year a in city δ_i , denoted as $S_{i,t-1}$. This cumulative housing capital is lagged by one period to isolate its effect from contemporaneous factors, under the assumption that a higher previous investment stock could diminish the productivity of subsequent investments.

Table 2. A City-Level regression approach

| Variable | Real GDP growth |
|---|----------------------|
| Real estate investment/GDP (Instrumented) | 0.770*** (0.112) |
| Real estate investment/GDP (Instrumented) \times cumulative housing capital | -0.080*** (0.018) |
| Lagged real GDP growth | 0.272*** (0.026) |
| Per capita real GDP | -0.126*** (0.009) |
| Population growth | -0.008 (0.061) |
| Urbanization rate | 0.218*** (0.036) |
| Industrial structure | 0.010** (0.004) |
| Constant | 0.119 (0.083) |
| Number of observations | 4,779 |
| R-squared | 0.398 |
| Year fixed effects | Yes |
| City fixed effects | Yes |

In the second stage of our analysis, we examine the relationship between city-level real GDP growth $Y_{i,t+1}$ and the instrumented real estate investment ratio $X_{i,t+1}$. We also include an interaction term between the real estate investment flow and the stock of housing capital. The significance of the coefficient on this interaction term would indicate whether the contribution of real estate investment to growth is influenced by the level of accumulated housing capital. Our findings, presented in Table 1, Column (1), suggest that while real estate investment positively affects growth, this effect diminishes as the stock of housing capital increases. This trend is consistent with the role of real estate in China's investment-driven economic model throughout the 21st century. The first-stage results, demonstrate that the instrumental variables used are appropriate, with an F-statistic exceeding 10 and passing the CLR test.

The phenomenon of diminishing returns to real estate investment aligns with previous studies, which indicate that economic returns typically decline as the housing capital stock grows due to overbuilding. Excessive housing supply reduces the need for further investment, as housing capital is durable and an oversupply diminishes the demand for additional investment. Given the substantial role of the real estate sector and related infrastructure in China's economy, the adjustment costs of reallocating resources and shifting away from real estate as a growth driver are significant. This issue of diminishing returns is reminiscent of challenges faced by other rapidly growing economies, such as Japan and the former Soviet Union.

Quantitatively, considering the relative stability of the real estate investment ratio post-2008, the negative coefficient on the interaction term implies that a city with an average stock of housing capital in 2020 would experience a 2.2% slower real GDP growth compared to a similar city in 2010, given that housing capital increased more than fourfold on average. Moreover, a city with a housing stock one standard deviation above the mean in 2020 would have a 1.1% lower annual real growth rate compared to an average city in the same year. These estimates reflect the impact of accumulated housing capital on growth, highlighting the challenges associated with overinvestment in real estate.

4. The Impact of Real Estate Investment on Local Government Debt: A Regression Analysis

In the context of declining economic growth impacting real estate prices, local governments in China face significant vulnerability due to their reliance on land sales for revenue. As illustrated in Figure 11 and highlighted by Huang (2023), tier 3 cities are particularly dependent on land sales, which account for 43% of their fiscal revenue. This dependency is even more pronounced in tier 2 cities, where land sales contribute 46% of fiscal revenue, while tier 1 cities, despite their lower reliance, still derive 30% of their revenue from land sales.

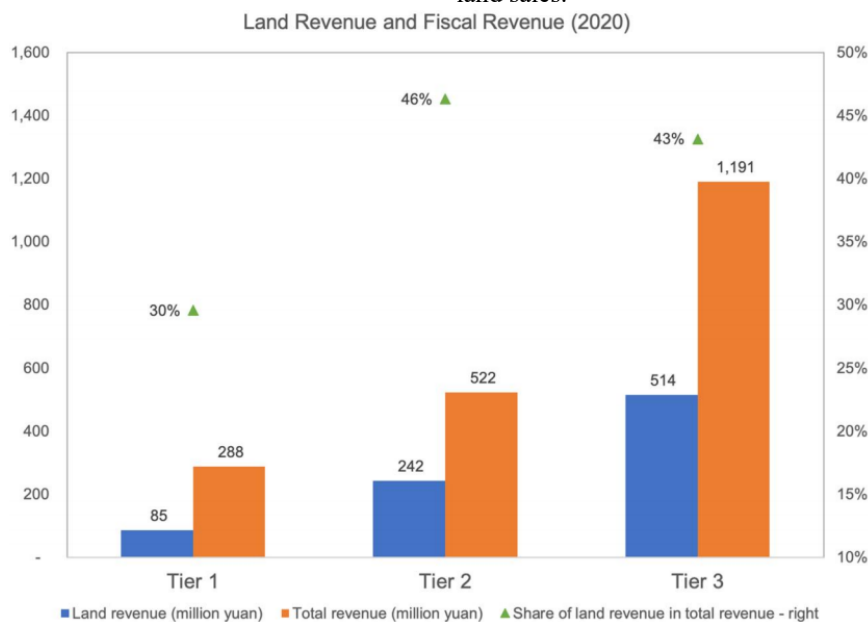


Figure 11. Land Revenue of fiscal revenue in 2020

Figure 11 In 2020, the fiscal revenues at the local government level in China were comprised of four key components: general public budgetary revenues, government fund revenues, state-owned capital operating revenues, and social security fund revenues. General public budgetary revenues primarily include tax revenues and transfers from the central government. Government fund revenues, which are a significant form of non-tax revenue, are largely derived from land use rights transfers and are allocated to specific public service projects. State-owned capital operating revenues come from profits generated by state-owned enterprises, while social security fund revenues are used to finance social security programs. Land use rights transfers represent a substantial portion of government fund revenues, illustrating the heavy reliance of local governments on land sales for funding. This dependence underscores the vulnerability of local governments to fluctuations in real estate markets and the challenges associated with shifting to a growth model that relies less on real estate.

Our analysis suggests that transitioning to a growth model that is less dependent on real estate will be particularly challenging for China. This difficulty is compounded by the substantial levels of both direct and indirect local government debt. Addressing this issue will require China to find alternative revenue sources for local governments to fund essential services, such as healthcare and education, in order to facilitate a smoother transition away from a real estate-

driven growth model.

Figure 12 presents a conservative estimate of local government debt incurred through Local Government Financing Vehicles (LGFVs), illustrating the scale of the debt issue. To investigate the relationship between real estate investment and local government debt accumulation, we employ across-city time series panel regressions, similar to the approach used in Section 3. This analysis utilizes the same instrumental variable as in previous regressions to address endogeneity concerns. The results consistently hold across different instrumental variable specifications.

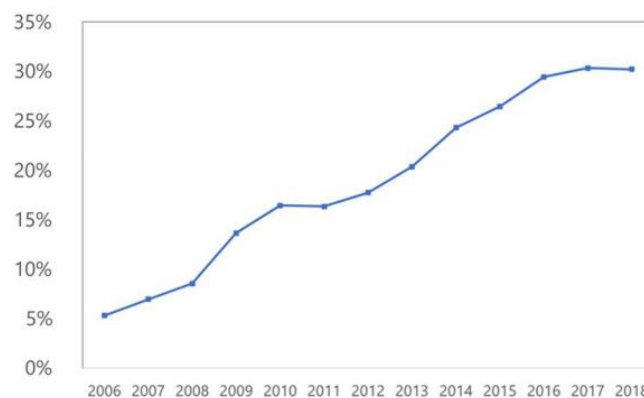


Figure 12. Local Government Debt Associated with LGFVs

In the initial stage, X indicates the ratio of real estate investments at the city level, while IV refers to the shift-share

instrumental variable. C consists of a vector of control variables, including lagged per capita real GDP, population growth, urbanization rates, and the balance of city bonds. The term θ_i represents city-level fixed effects, which account for unobserved heterogeneity between cities. μ_t signifies year fixed effects that capture macroeconomic shocks occurring nationwide. Finally, ε_i denotes the error term.

$$X_{i,t+1} = \alpha_0 + A_1 IV_i + A_2 \times C_{i,t} + \mu_t + \varepsilon_i \quad (3)$$

$$d_{i,t+1} = \beta_0 + \beta_1 IV_i + B \times C_{i,t} + \mu_t + \varepsilon_i \quad (4)$$

In the second stage, $d_{i,t+1}$ refers to the ratio of debt to GDP or the ratio of city bonds to GDP for city i in the year t . Adopting a methodology commonly found in existing studies [23], we consider two metrics: the first includes the total debt incurred by Local Government Financing Vehicles (LGFVs), as this so-called “hidden debt” is often viewed as a reliable indicator of local government liabilities. Alternatively, we examine the amount of city investment bonds issued by LGFVs to reflect the flow of local government debt. The compilation of LGFVs is based on data from the China Banking Regulatory Commission (CBRC) [24]. Bond issuance linked to these entities is gathered from the official site of the China Central Depository and Clearing Company Limited (CCDC) and validated against data from sources like Hexun Bond and the CEInet Statistics Database [25] to ensure accuracy. The final dataset covers the years from 2006 to 2018. The key coefficient of interest, $b1b_1b1$, indicates that a positive and significant result would imply that increased reliance on real estate correlates with higher levels of local government debt.

Table 3. Local government debt

| Variable | (1) Debt/GDP | (2) City bond/GDP |
|--|---------------------|----------------------|
| Real estate investment/GDP (Instrumented) | 0.510*** (0.105) | 0.060*** (0.018) |
| Per capita real GDP | 0.067*** (0.011) | 0.010*** (0.002) |
| Population growth | 0.072* (0.038) | 0.030*** (0.009) |
| Urbanization rate | 0.291*** (0.063) | 0.032*** (0.011) |
| City bond balance | 0.025*** (0.002) | 0.001*** (0.000) |
| Constant | 0.097 (0.063) | -0.005 (0.013) |
| Number of observations | 3,188 | 3,188 |
| R-squared | 0.881 | 0.580 |
| City fixed effects | YES | YES |
| Year fixed effects | YES | YES |

Table 3 summarizes the results. In Column (1), the dependent variable is the debt-to-GDP ratio, and it includes controls for per capita GDP, population growth, and urbanization rates. The coefficient for the instrumented real estate investment ratio is found to be positive and significant at the 1% level, suggesting that real estate development has a notable impact on increasing local government debt. Results in Column (2) further indicate that a rise in real estate investment is associated with a significant increase in the issuance of city bonds. While this sustained investment has advanced urbanization and improved infrastructure, the accompanying rise in local government debt may restrict fiscal flexibility and negatively affect future growth potential.

5. Conclusion

In conclusion, this study provides valuable insights into the complex relationship between real estate investment and local government debt levels. Our analysis reveals a clear and significant correlation between the ratio of real estate investments and the debt-to-GDP ratio at the city level. This finding underscores the critical role that real estate development plays in shaping the financial landscape of local governments. As cities increasingly depend on real estate as a primary driver of economic growth, it becomes evident that such reliance can lead to substantial increases in local government debt burdens. The results suggest that as real estate investment intensifies, so too does the scale of debt incur by local governments. This is particularly evident through the mechanism of Local Government Financing Vehicles (LGFVs), which have been utilized extensively to finance urban development projects. Our findings indicate that the total outstanding debt of LGFVs, often referred to as "hidden debt," serves as an appropriate measure of the actual financial liabilities faced by local governments. The use of LGFVs highlights the innovative yet risky financial strategies employed by local authorities to fund infrastructure and urbanization efforts.

Moreover, the study identifies a notable increase in the issuance of city bonds as a consequence of rising real estate investments. This trend points to a dual dynamic where, while local governments seek to capitalize on the economic benefits of real estate development, they simultaneously create additional financial obligations. The substantial growth in bond issuance can facilitate urbanization and infrastructure enhancement, contributing to the overall development of the city. However, this burgeoning debt could potentially constrain the fiscal flexibility of local governments, limiting their ability to respond to economic fluctuations and future investment needs. The implications of these findings are particularly relevant in the context of China's ongoing urbanization efforts and the critical need for sustainable development practices. Policymakers must recognize that while real estate investment can stimulate immediate economic activity, it also carries the risk of escalating debt levels that may jeopardize long-term fiscal health. A careful balance is required to ensure that the benefits of real estate development do not come at the expense of fiscal sustainability.

As local governments navigate the challenges associated with rising debt, it is essential to implement comprehensive debt management strategies. This could include enhancing transparency in debt reporting, adopting prudent borrowing practices, and ensuring that real estate projects are aligned with broader economic goals. By prioritizing fiscal responsibility and sustainable development, local governments can mitigate the risks associated with high debt levels while still fostering economic growth.

Additionally, this study highlights the need for ongoing research into the long-term impacts of real estate investment on local government finances. Future studies should explore the mechanisms through which real estate development influences debt dynamics and assess the effectiveness of various policy interventions. Understanding these relationships will be crucial for designing strategies that promote both economic growth and fiscal health.

In summary, this research contributes to the growing body of literature on local government finance and urban

development, emphasizing the intricate interplay between real estate investment and debt levels. The findings serve as a reminder of the potential risks associated with excessive reliance on real estate for economic growth, urging policymakers to adopt a balanced approach that ensures sustainable development while managing debt responsibly. As cities continue to evolve, the lessons drawn from this study will be essential for guiding future investment strategies and fostering resilient local economies.

References

- [1] Zou L, Shen J H, Zhang J, et al. What is the rationale behind China's infrastructure investment under the Belt and Road Initiative [J]. *Journal of Economic Surveys*, 2022, 36(3): 605-633.
- [2] Démurger S. *Infrastructure in China* [M]//The Oxford Companion to the Economics of China. Oxford University Press Oxford, 2014: 348-352.
- [3] Xiao H, Zheng X, Xie L. Promoting pro-poor growth through infrastructure investment: Evidence from the Targeted Poverty Alleviation program in China [J]. *China Economic Review*, 2022, 71: 101729.
- [4] Liu Z, Schindler S, Liu W. Demystifying Chinese overseas investment in infrastructure: Port development, the Belt and Road Initiative and regional development [J]. *Journal of Transport Geography*, 2020, 87: 102812.
- [5] Saez L. A comparison of India and China's foreign investment strategy toward energy infrastructure [J]. *The Journal of Developing Areas*, 1998, 32(2): 199-220.
- [6] Li Z. *Infrastructure and Urbanization in the People's Republic of China* [J]. 2017.
- [7] Ma X, Zhao K, Li Y, et al. Infrastructure investment and sustainable development in coastal areas in China [J]. *Journal of Coastal Research*, 2019, 94(SI): 67-72.
- [8] Corkin L, Burke C, Davies M. China's Role in the Development of Africa's Infrastructure [J]. *Documents de travail du SAIS dans African Studies*, 2008 (04-08).
- [9] Siddiqui K. One Belt and One Road, China's massive infrastructure project to boost trade and economy: an overview [J]. *International Critical Thought*, 2019, 9(2): 214-235.
- [10] Lam R W, Rodlauer M, Schipke A. China's Economic Success and Reforms: Investing in Soft Infrastructure [J]. *Modernizing China—Investing in Soft Infrastructure*, 2017: 1-31.
- [11] Ke X, Lin J Y, Fu C, et al. Transport infrastructure development and economic growth in China: recent evidence from dynamic panel system-GMM analysis [J]. *Sustainability*, 2020, 12(14): 5618.
- [12] Egor K. Financing of large infrastructure projects: Chinese experience and Russian practice [J]. *Review of Business and Economics Studies*, 2022, 10(2): 56-90.
- [13] Shen L, Lu W, Peng Y, et al. Critical assessment indicators for measuring benefits of rural infrastructure investment in China [J]. *Journal of Infrastructure Systems*, 2011, 17(4): 176-183.
- [14] Li C, Song Y, Chen Y. Infrastructure development and urbanization in China [J]. *China's urbanization and socioeconomic impact*, 2017: 91-107.
- [15] Kaya A, Kilby C, Kay J. Asian Infrastructure Investment Bank as an instrument for Chinese influence? Supplementary versus remedial multilateralism [J]. *World Development*, 2021, 145: 105531.
- [16] Magazzino C, Mele M. On the relationship between transportation infrastructure and economic development in China [J]. *Research in Transportation Economics*, 2021, 88: 100947.
- [17] Zhao T, Xiao X, Dai Q. Transportation infrastructure construction and high-quality development of enterprises: Evidence from the quasi-natural experiment of high-speed railway opening in China [J]. *Sustainability*, 2021, 13(23): 13316.
- [18] Ahmad E. Multilevel financing of sustainable infrastructure in China—Policy options for inclusive, resilient and green growth [J]. *Journal of Infrastructure, Policy and Development*, 2021, 5(1).
- [19] Banerjee A, Duflo E, Qian N. On the road: Access to transportation infrastructure and economic growth in China [J]. *Journal of Development Economics*, 2020, 145: 102442.
- [20] Wei W, Wu X, Wu X, et al. Regional study on investment for transmission infrastructure in China based on the State Grid data [J]. *Frontiers of Earth Science*, 2017, 11: 162-183.
- [21] Huaxia L A I, Lentner G M. Paving the Silk Road BIT by BIT: an analysis of investment protection for Chinese infrastructure/projects under the Belt & Road Initiative [M]//The Belt and Road Initiative. Brill Nijhoff, 2018: 250-283.
- [22] Wu Y, Li X, Lin G C S. Reproducing the city of the spectacle: Mega-events, local debts, and infrastructure-led urbanization in China [J]. *Cities*, 2016, 53: 51-60.
- [23] Alves A C. China's 'win-win' cooperation: Unpacking the impact of infrastructure-for-resources deals in Africa [J]. *South African Journal of International Affairs*, 2013, 20(2): 207-226.
- [24] Trichur G K. East Asian developmental path and land-use rights in China [J]. *Journal of World-Systems Research*, 2012: 69-89.
- [25] Li Y, Lazonick W. China's development path: government, business, and globalization in an innovating economy [J]. *Institute for New Economic Thinking Working Paper Series*, 2022 (190).