The Fiscal-Property Nexus: How Local Government Finance Shapes Housing Market Resilience During China's Real Estate Downturn

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Abstract

This paper analyzes housing price resilience across China's urban hierarchy during the post-2021 market correction. Using panel data for over 300 cities, we document a "barbell effect": top-tier and bottom-tier cities show greater price stability than mid-tier cities, challenging the "flight-to-safety" pattern observed in Western markets. Panel regressions reveal that fiscal instruments operate asymmetrically across market phases, city tiers, and regions. General bonds stabilize prices only during the downturn, while off-budget implicit debt becomes a significant drag as refinancing tightens. Mid-tier cities with high implicit leverage experience the deepest corrections and persistent liquidity frictions. The findings demonstrate how fiscal geography shapes the spatially differentiated capacity to absorb housing-market shocks.

Keywords: Fiscal geography; Housing price resilience; Local government debt; Land finance; Housing Financialization; Market correction

JEL Classification: H74; H63; P35; R31; R51

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1. Introduction

Since late 2021, China's housing market has entered a sustained correction. Nationwide indicators show broad price declines, but the adjustment has not been spatially uniform (See Figure OA.3). Some lower-income or demographically weaker cities have remained comparatively stable, while parts of more developed regions have experienced sharper corrections. This uneven geography of housing price resilience [1] is not well captured by a simple urban-hierarchy gradient, and it contrasts with the "flight-to-safety" pattern often emphasised for Western housing markets (Amaral et al., 2025; Daams et al., 2024). What, then, explains why some cities prove more resilient than others during China's housing correction?

Classic urban and housing models link price dynamics to migration, income, and amenities (Glaeser and Gyourko, 2005; Roback, 1982). While the structural drivers of China's housing boom—rising income expectations, constrained household portfolios, and implicit state backstops—have been extensively analyzed (Chen and Wen, 2017; Fang et al., 2016), the post-2021 correction presents a distinct analytical challenge. The shock has been not only a market correction but also a fiscal one, because local governments are financially embedded in land and housing markets. Nationally, revenue from the transfer of land-use rights fell sharply after its 2021 peak, tightening local fiscal space precisely when stabilisation pressures rose (Ministry of Finance, 2025). As a result, local governments became not only regulators but also constrained interveners, and cross-city differences in fiscal capacity and debt portfolios are likely to translate into spatial differences in housing price resilience.

We study this place-based buffering capacity through a fiscal-geography lens (Tapp and Kay, 2019). The central idea is a fiscal–property resilience nexus: local fiscal structures and debt composition condition market outcomes when private demand and liquidity weaken. In China's land-based local public finance system, downturn transmission is closely tied to market turnover and land-related cash flow. This makes local fiscal conditions especially salient after 2021, because land finance, debt service, and land supply decisions can reinforce each other as transactions slow.

Our framework highlights three fiscal components that condition local intervention capacity in downturns: dependence on land-based revenues, the composition of on-budget local government bonds (general versus special-purpose), and off-budget liabilities associated with Local Government Financing Vehicles (LGFVs). These elements matter because they jointly shape the resources available for stabilization and the constraints that become binding when market turnover weakens. We further examine land supply adjustment as a key transmission channel linking fiscal stress to housing price resilience, consistent with evidence that local-government strategies can generate price–volume divergence in land and housing markets (Chang et al., 2025). LGFV-related liabilities are treated as an off-budget channel that has played a central role in financing local development and is widely discussed as a distinct component of China's local debt landscape (IMF, 2022). Institutionally, local government bond issuance is shaped by quota administration and project selection aligned with central policy objectives, which can limit short-run flexibility and contribute to heterogeneity in special bonds effects (Li et al., 2024).

Using a city-level dataset covering over 300 Chinese cities from 2016 to 2024, we estimate

[1] We use "housing price resilience" to denote the place-specific capacity to resist and absorb a common downturn shock, following the resilience framework in economic geography (Martin and Sunley, 2015).

fixed-effects panel models and explicitly compare expansion and correction phases. We ask: (1) how housing price resilience differs across space during the downturn period; (2) how local fiscal conditions and debt composition are associated with that resilience; and (3) whether land supply mediates these relationships, and whether the mediation changes across market phases.

The analysis yields three main findings. First, housing price resilience exhibits a barbell-shaped pattern across the urban hierarchy: both top-tier and lower-tier cities display relatively greater price stability than many mid-tier cities. Second, fiscal associations are strongly phase-dependent. General bonds are more positively associated with housing price resilience during the correction, consistent with an on-budget stabilization channel, whereas LGFV-related liabilities are more negatively associated with resilience once market turnover weakens and refinancing constraints tighten. Third, heterogeneity across city tiers helps explain the barbell pattern: top-tier cities are more sensitive to explicit on-budget fiscal capacity, while in lower-tier cities stabilization is more consistent with vertical support and budget smoothing; mid-tier, land-finance-reliant cities face tighter constraints where off-budget liabilities and land-market dependence interact with volume shocks.

This paper contributes to work on fiscal geography and the political economy of urban development by showing how local fiscal structures shape the spatially uneven capacity to buffer housing-market shocks (Tapp and Kay, 2019). We add to the fiscal–property nexus literature by distinguishing debt types—general bonds, special-purpose bonds, and LGFV-related liabilities—and by documenting that their associations with housing outcomes depend on market phase. We further clarify the role of land supply as a transmission channel linking fiscal stress to housing-market adjustment across cities (Wu et al., 2015).

The remainder of the paper is organised as follows. Section 2 develops the fiscal-geography framework and China's land-based local public finance context. Section 3 describes the data, periodization, and empirical strategy. Sections 4 to 6 document spatiotemporal patterns, estimate baseline and heterogeneous effects, and examine land-supply mechanisms. Section 7 concludes with implications for local fiscal sustainability and housing-market stabilization.

2. Fiscal Geography and the Financialization of Urban Governance

2.1 Fiscal Geography and Market Adjustments

Fiscal geography, as Tapp and Kay (2019) frame it, asks how taxation and public budgets shape urban development—a question distinct from financial geography's focus on private capital. The theoretical lineage of this field is rooted in the "fiscal crisis of the state," where O'Connor (1973) identified the inherent contradictions in modern states simultaneously satisfying accumulation and legitimation demands. This dual imperative creates structural fiscal strain, compelling local governments to absorb the increasing costs of economic development while private interests appropriate the resulting surplus (Friedland et al., 1977).

In response to these structural constraints, local governments have historically devised diverse coping strategies. As federal or central interventions decrease, localities increasingly depend on "back-door" financing mechanisms to circumvent budgetary limits (Kirkpatrick and Smith, 2011).

This shift marks the transition from managerialism to entrepreneurialism, and increasingly, to financialization. For instance, Weber (2010) demonstrated through her analysis of Tax Increment Financing (TIF) that fiscal instruments are not merely neutral accounting tools but active mechanisms that reshape spatial value, often creating "financialized enclaves" where future tax revenues are securitized to fund current growth.

However, the interaction between these fiscal maneuvers and housing market adjustments is constrained by market fundamentals. Standard urban economic theory posits that housing markets exhibit "downward price stickiness." As Glaeser and Gyourko (2005) argue, housing is a durable asset; when demand shocks occur, prices often do not adjust downward immediately. Instead, the market clears through a reduction in transaction volume—a "liquidity freeze"—as owners refuse to sell at a loss. Stein (1995) formalizes this mechanism: equity-constrained sellers cannot transact without realizing losses that prevent their next purchase, causing volume to collapse before prices fully adjust. Empirically, Genesove and Mayer (2001) show that loss aversion amplifies this stickiness, as sellers anchor to prior purchase prices and accumulate stale inventory rather than accept nominal losses.

This "volume-over-price" adjustment mechanism becomes critically important when intersected with fiscal geography. As Davidson and Ward (2022) note, fiscal deterioration significantly reconfigures local governments' intervention capacity. In financialized governance regimes, where local debts are often implicitly or explicitly backed by real estate values, the natural price stickiness described by Glaeser becomes a fiscal necessity. Local governments have a vested interest in reinforcing this stickiness to protect their balance sheets, transforming a market phenomenon into a strategy of financialized statecraft (Li et al., 2025).

2.2 Land-based Local Public Finance and the Volume Shock Channel in China

Urban development has long supported local public finance, but the institutional basis differs. Western systems typically tax asset stocks through recurrent property levies; China's system depends on transaction flows—revenue realized when land changes hands.

In the United States, property taxes account for about 70% of local tax collections (Yushkov, 2025). This stock-based system provides a fiscal floor in downturns: as long as physical assets exist and assessments adjust with lags, the revenue stream remains comparatively stable, insulated from short-run swings in market turnover (Slack and Bird, 2014).

China's fiscal relationship with real estate is organized differently. A broad-based recurrent residential property tax has not been adopted nationwide; instead, property tax has been piloted only in a small number of cities, and revenues have remained limited relative to the overall local fiscal system (OECD, 2021).

Local governments have therefore relied heavily on land-based revenues (Gyourko et al., 2022). A key institutional feature of this system is the Local Government Financing Vehicle (LGFV). Because local governments were prohibited from borrowing directly until 2015, they established these state-owned enterprises to raise funds for infrastructure and land development, typically using land assets as collateral or implicit state backing (Chen et al., 2020; IMF, 2022; Pan et al., 2017). LGFVs thus became the primary off-budget channel linking local public finance to land markets, and their liabilities—while not recorded on government balance sheets—represent a substantial implicit fiscal exposure.

Nationally, revenue from the transfer of land-use rights peaked at about RMB 8.7 trillion in 2021 and fell to about RMB 5.8 trillion in 2023 as the property downturn deepened (Yao and Zhang, 2024). Moreover, land-based dependence is not limited to land transfer fees: a 2024 "Land Finance" report estimates that in 2023 land transfer fees contributed about 31.6% of local fiscal revenue and real-estate "five taxes" contributed about 10.1%, implying a combined direct contribution of over 40% (Ren, 2024).In what follows, we emphasize land transfer fees because they are (i) the most discretionary component that local governments can influence via land release and auction strategies, and (ii) the most directly intertwined with LGFV financing arrangements and land-market expectations.

This dependence on flow revenue implies that the primary fiscal vulnerability in a housing downturn is not only price depreciation, but volume shocks—a contraction in transactions that interrupts cash flow. Housing markets often clear through quantity adjustments during busts (Glaeser and Gyourko, 2005). When transaction volumes fall sharply, land transfers can stall and fiscal cash flow can drop quickly even if posted prices remain relatively sticky. We refer to this exposure as a volume shock channel: downturns become fiscally acute when turnover collapses, because the local state's revenue base is closely coupled to market clearing.

This context motivates our focus on housing price resilience as a place-based outcome shaped by local public finance. If local governments are financially embedded in property and land markets, then fiscal conditions can influence both the willingness and the capacity to intervene—through spending, land supply management, and the choice of debt instruments. The next section specifies how debt composition maps into stabilization tools versus constraints during the post-2021 adjustment.

2.3 Debt Composition and Local Intervention Capacity

When housing markets weaken, the local state becomes a more consequential actor. Private demand retreats, liquidity thins, and price dynamics increasingly hinge on whether governments can credibly backstop expectations—or whether their own balance sheets become part of the problem. The post-2021 adjustment in China presents exactly this situation: a common macro shock filtered through highly uneven local fiscal structures. Cities entered the downturn with different debt portfolios, different revenue bases, and therefore different capacities to respond.

We focus on three fiscal components that shape this intervention capacity: implicit liabilities channeled through Local Government Financing Vehicles (LGFVs), on-budget general bonds, and special-purpose bonds. Figure 1 summarizes the transmission channels from fiscal conditions to housing-market outcomes.

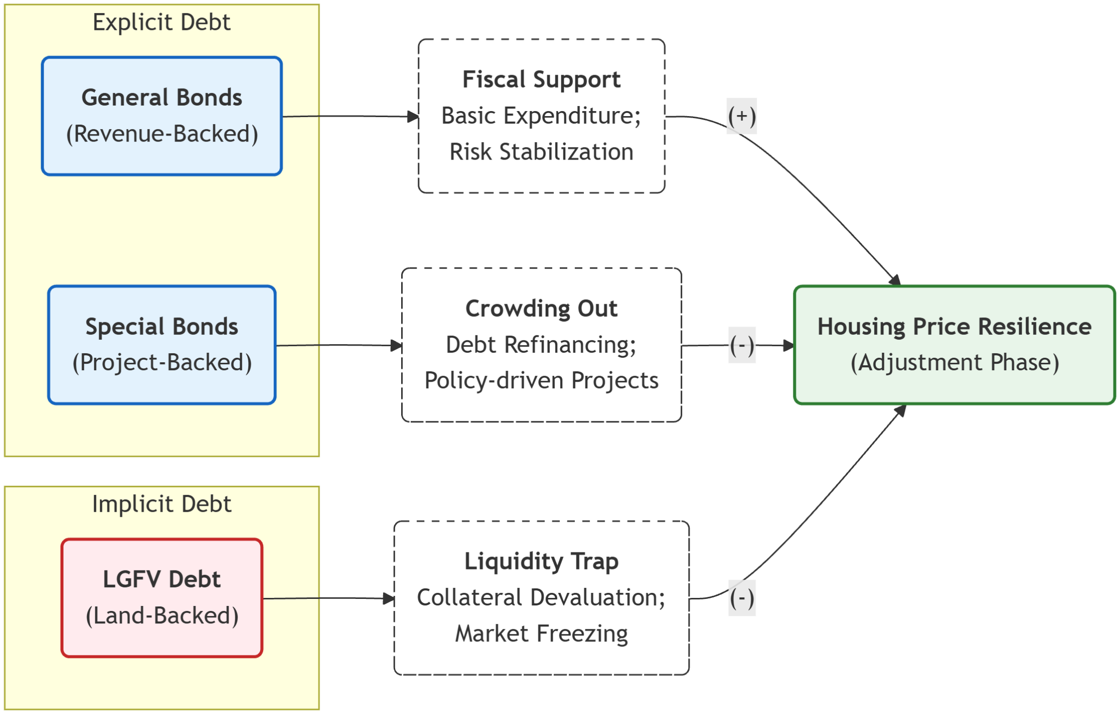

Figure 1: The Fiscal-Property Resilience Nexus

The story of LGFV debt is fundamentally a story of leverage that worked—until it didn't. During the boom, these vehicles allowed local governments to fund infrastructure and land development outside formal budget constraints, using land assets as implicit collateral (Feng et al., 2025; Pan et al., 2017). The arrangement was self-reinforcing: rising land values supported borrowing, and borrowed funds financed development that pushed land values higher. But this same circularity becomes a trap when market turnover weakens. Refinancing that was routine in 2019 becomes difficult in 2023; land parcels pledged as collateral lose their valuation anchor; and the implicit state guarantee that once reassured creditors now raises questions about fiscal sustainability. Cities carrying heavy LGFV burdens find themselves defending land valuations not as a policy choice but as a balance-sheet necessity—a posture that compresses flexibility precisely when flexibility matters most.

General bonds operate through a different logic. Serviced through the general public budget and embedded in intergovernmental transfer arrangements, they represent fiscal capacity that does not depend on land-market cash flow. A city with room to issue general bonds can sustain baseline spending during a revenue drought; it can signal continued public investment without liquidating land assets at distressed prices. This matters more in downturns than in booms. When private liquidity is abundant, the marginal contribution of government fiscal space to market confidence is limited. When private buyers retreat, the credibility of sovereign-backed commitment becomes more salient.

Special-purpose bonds are explicitly backed by the state, but several design features limit how much they can stabilize local markets. Unlike general bonds, they are tied to specific projects: issuance is quota-based and funds must be allocated to designated, revenue-linked investments (Li et al., 2024). This structure is meant to impose discipline (Li et al., 2023). In downturns, it also creates rigidity. Money earmarked for a project cannot be used to cover general fiscal shortfalls, and many policy-driven projects do not generate enough cash flow, leaving repayment to rely on already strained local budgets.

A related problem is where the money goes. Since the "Three Red Lines" period, a larger share of special-purpose bond financing has been directed to affordable housing (Li et al., 2025). The social rationale is clear, but the market timing can be awkward: it shifts demand away from the commercial segment just when the private market is short of buyers. Some eligible households move from market purchases to subsidized units; land earmarked for these projects is taken out of commercial auctions; and developers read the policy signal as a reweighting away from market-rate housing. In that sense, special-purpose bonds are on-budget and intended to be countercyclical, yet their sector-specific targeting can end up amplifying the adjustment in the commercial housing market.

Land supply threads through all three channels. Local governments can restrict land release to support valuations, or accelerate sales to generate liquidity—but not both simultaneously. In downturns, this trade-off sharpens. A city under fiscal pressure faces a coordination problem: withholding supply protects prices but forgoes desperately needed revenue; releasing supply generates cash but risks pushing prices lower when demand is already weak (Chang et al., 2025). Cities with heavy implicit leverage face this dilemma most acutely, because their balance sheets are directly exposed to land valuations. Cities with stronger on-budget capacity have more room to wait out the cycle.

These mechanisms do not affect all cities equally. Top-tier cities combine deep markets with substantial fiscal resources; they can absorb shocks through both private demand and public capacity. Lower-tier cities, while fundamentally weaker, often benefit from central transfer dependence and targeted support programs that partially insulate them from land-market volatility. The most exposed position may be the middle: cities that leveraged aggressively during the boom, built fiscal structures around land revenue, and now face deleveraging pressure without the market depth of Tier 1 or the transfer cushion of Tier 4. If this logic holds, we hypothesize that housing price resilience will exhibit a barbell pattern: prices remain relatively stable at both the top and bottom of the urban hierarchy, while the most pronounced corrections are concentrated in the middle tier.

3. Empirical framework

3.1 Data and Sample

We assemble city-level panel data covering over 300 Chinese cities from 2016 to 2024. Housing prices are measured as monthly average listing prices for second-hand apartments on Anjuke, one of China's largest real estate platforms. Listing prices have been validated as a sensitive barometer for market turning points since Wu et al. (2014), and recent work confirms the reliability of Anjuke data for city-level panel analysis (Chen et al., 2025).

Our sample period begins in 2016 to ensure consistent fiscal data availability across the urban hierarchy and to avoid survivorship bias from the earlier boom years, when coverage was concentrated in top-tier cities. The resulting sample accounts for approximately 94% of China's total GDP in 2022; effective sample sizes vary by specification and are reported in each table.

To limit the influence of outliers, we winsorize housing price growth at the 1st and 99th percentiles. We benchmark Anjuke trends against the National Bureau of Statistics' 70-city indices for major metropolitan areas. For further validation, we cross-check the listing series against 5.8 million second-hand transactions from Beike covering 112 cities over 2018–2024. The correlation is 0.982 for price levels and 0.725 for growth rates (Figure OA.1). Transaction prices run consistently below listings, with a median bargaining discount of 3.8%.

Fiscal and economic indicators come from several sources. Local government debt variables—general bonds, special bonds, and LGFV debt—are compiled from the Enterprise Warning Database (qiye yujing tong).[2] Macroeconomic and demographic statistics are drawn from China City Statistical Yearbooks; land supply data from China Index Academy.

Market liquidity measures are constructed from Beike's transaction-level microdata. Days on Market (DOM) captures the interval from listing to sale. "Stale share" denotes the proportion of listings unsold for more than one year, proxying for persistent illiquid inventory. For analysis, we divide the sample into an expansion phase (2016–2021) and an adjustment phase (2022–2024). This periodization follows from structural break analysis (Section 3.2), which identifies late 2021 to early 2022 as the predominant turning point across the urban hierarchy.

3.2 Structural Break Detection and Periodization

To rigorously identify the critical turning points in China's real estate market cycles, we employ the multiple breakpoint detection framework proposed by Bai and Perron (1998) and Bai and Perron (2003). Unlike imposing an arbitrary cutoff date, this data-driven approach allows us to determine structural shifts based on the statistical properties of the monthly housing price series from April 2015 to December 2024.

We implement the test using the strucchange package in R, determining the optimal number of breakpoints via the Bayesian Information Criterion (BIC) and verifying their significance with the Chow test. The analysis identifies a statistically significant structural break in September 2021, which coincides with the intensification of the liquidity crisis among major developers (e.g., Evergrande).

Although the statistical break occurs in late 2021, our fiscal and economic control variables are recorded annually. To align the structural shift with our annual panel data structure, we define 2022 as the start of the "Adjustment Phase". This choice is methodologically conservative: it treats late 2021 as a transitional period and ensures that the "Adjustment Phase" captures the full transmission of the market downturn into local fiscal conditions. Consequently, our regression analysis divides the sample into an Expansion Phase (2016–2021) and an Adjustment Phase (2022–2024).

[2] LGFV debt follows the standard classification of local financing vehicles whose primary function is infrastructure and land development. We acknowledge that LGFV boundaries remain contested in the literature; our results should be interpreted with this measurement caveat in mind.

3.3 Empirical Model Specification

Our analytical approach combines spatial pattern analysis with panel regression techniques. The regression framework employs fixed effects panel models that control for unobserved city-specific characteristics and common time trends.[3] The baseline specification is:

$$\Delta P_{i,t} = \alpha + \beta \cdot F_{i,t-1} + \gamma \cdot X_{i,t-1} + \mu_i + \lambda_t + \varepsilon_{i,t}$$

To test whether fiscal impacts differ between the boom phase and the adjustment phase, we also estimate an interaction specification:

$$\Delta P_{i,t} = \alpha + \beta \cdot F_{i,t-1} + \delta \cdot (F_{i,t-1} \times Adj_t) + \gamma \cdot X_{i,t-1} + \mu_i + \lambda_t + \varepsilon_{i,t}$$

Where:

- $\Delta P_{i,t}$ represents housing price growth in city i at time t.
- $F_{i,t-1}$ represents a vector of lagged local government fiscal indicators, capturing debt structure, revenue composition, and fiscal capacity:
  - **Debt Structure**: General bond balance/GDP; Special-purpose bond balance/GDP; LGFV debt balance/GDP.
  - **Fiscal capacity and revenue structure**: Land finance dependency (land transfer revenue / general public budget revenue); Fiscal self-sufficiency (general public budget revenue / general public budget expenditure); Unutilized debt capacity (borrowing headroom).
- Adj_t is an indicator equal to 1 for the Adjustment Phase (2022–2024) and 0 for the Boom Phase (2016–2021). Since the model includes time fixed effects λ_t, the main effect of Adj_t is absorbed and therefore not included separately.
- $X_{i,t-1}$ represents control variables for economic fundamentals and housing demand: GDP growth rate, tertiary industry ratio, population growth rate, and housing price-to-income ratio.
- μ_i and λ_t represent city and time fixed effects, respectively.

[3] We interpret our estimates as conditional associations rather than strictly causal effects. A key identification challenge is potential reverse causality, where deteriorating housing market conditions might trigger compensatory fiscal responses (e.g., emergency borrowing or accelerated land sales). We mitigate this simultaneity bias by lagging all fiscal regressors by one year. This approach is institutionally defensible given the temporal mismatch between fiscal planning and market pricing: local debt limits and bond issuance quotas in China are determined through a centralized, multi-year planning process that precedes the fiscal year (Li et al., 2023). Consequently, fiscal variables function as slow-moving stock measures that are unlikely to adjust instantaneously to within-year housing price movements. While this does not rule out anticipation effects, it ensures that the fiscal composition used in our model is predetermined relative to the concurrent price dynamics.

- $\varepsilon_{i,t}$ is the error term.

To address potential endogeneity concerns—specifically the reverse causality where current housing market conditions might drive immediate fiscal responses (e.g., emergency borrowing)—we lag all fiscal and economic explanatory variables by one year ($t-1$). This specification assumes that while past fiscal structures constrain current market outcomes (a "stock" effect), current price shocks do not instantaneously alter the previous year's fiscal composition.

A critical challenge in identifying fiscal impacts on housing prices is the presence of complex error structures. Housing price shocks are rarely spatially isolated; they exhibit strong cross-sectional dependence, as a significant Breusch–Pagan LM test reveals, likely due to regional economic integration and common policy shocks. Models are moreover subject to heteroskedasticity, as a prior studentized Breusch-Pagan test reveals. This is likely related to the "barbell" effect by city size found below. They are also subject to serial correlation, revealed by a Breusch-Godfrey/Wooldridge test.

Standard clustering at the city level assumes independence across cities, which may underestimate standard errors when cross-sectional dependence is present. For our main specifications pooling the full sample period, we therefore employ the Driscoll and Kraay (1998) non-parametric covariance matrix estimator. This approach produces standard errors that are robust to general forms of cross-sectional dependence, as well as heteroskedasticity and serial correlation up to a lag order of 2 ($T^{1/4}$). This ensures that the statistical significance of our estimated coefficients is robust to unmodelled spatial or temporal correlations, preventing potential Type I errors driven by regional clustering. We moreover include the AR-1 to model serial correlation.

3.4 Supply Adjustment and Liquidity Outcomes

To examine how fiscal structures shape housing market resilience beyond price effects, we analyze two outcome dimensions: land supply adjustment and market liquidity.

First, we estimate whether fiscal–financial conditions correlate with local governments' supply behavior during the downturn. The dependent variable is the annual change in per-capita listed land supply ($\Delta\text{Supply}_{i,t}$), regressed on lagged fiscal variables interacted with an adjustment-phase indicator ($Adj_t = 1$ for 2022–2024; 0 otherwise). This specification tests whether fiscal exposure constrains or facilitates supply retrenchment when market conditions deteriorate.

Second, we examine liquidity stratification using two measures: Days on Market (DOM) and "stale share." The stale share regression includes a lagged dependent variable to capture persistence dynamics—a high autoregressive coefficient indicates persistent illiquidity consistent with a self-reinforcing liquidity trap where market frictions accumulate rather than clear.

Both analyses employ two-way fixed effects (city and year). Standard errors are clustered at the city level given the short adjustment window ($T = 4$) and the interaction-saturated specifications. Rather than claiming strict causal identification, we interpret these estimates as conditional associations that illuminate how fiscal structures correlate with supply behavior and liquidity outcomes across the urban hierarchy.

3.5 Robustness Tests

To assess the robustness of our results to measurement and timing choices, we conduct three complementary checks, reported in Section 7. We (i) shift the boom–adjustment cutoff to 2021 to address heterogeneity in peak timing across cities, (ii) benchmark our price dynamics against the NBS 70-city second-hand housing price indices as an external reference for spatial patterns, and (iii) re-estimate the baseline models using a transaction-based outcome. For (iii), we construct a city–year hedonic (constant-quality) transaction price index from Beike micro transaction records for the overlapping set of cities and replace the listing-based outcome with this market-clearing measure. Across these exercises, the key qualitative patterns remain intact, supporting the interpretation that the fiscal–housing nexus is state-dependent rather than an artifact of a specific cutoff or price measure.

4. Spatiotemporal Patterns of China's Housing Market Adjustment

4.1 Timing and Structural Breaks

The Chinese housing market has exhibited distinct cyclical patterns with significant variation in peak timing across the urban hierarchy (Figure OA.2). According to the median peak dates, the majority of Chinese cities reached their price peaks between mid-2021 and early 2022: Tier 3 cities in May 2021, Tier 2 cities in July 2021, New Tier 1 cities[4] in August 2021, and Tier 4 and below cities in January 2022, with only Tier 1 cities peaking later in August 2022.

Using a balanced panel of monthly housing prices, breakpoint analysis identifies four structural shifts between April 2015 and December 2024: December 2016, October 2018, September 2021, and May 2023 (Figure 2; all significant at 1% per Chow test).

[4]City tiers follow Yicai's "New First-Tier City" rankings. "New Tier 1" designates 15 cities—including Chengdu, Hangzhou, and Suzhou—that function as secondary economic centers. We retain this category separately because these cities exhibit distinct fiscal characteristics: higher LGFV leverage and land-finance dependence than either Tier 1 or Tier 2 cities.

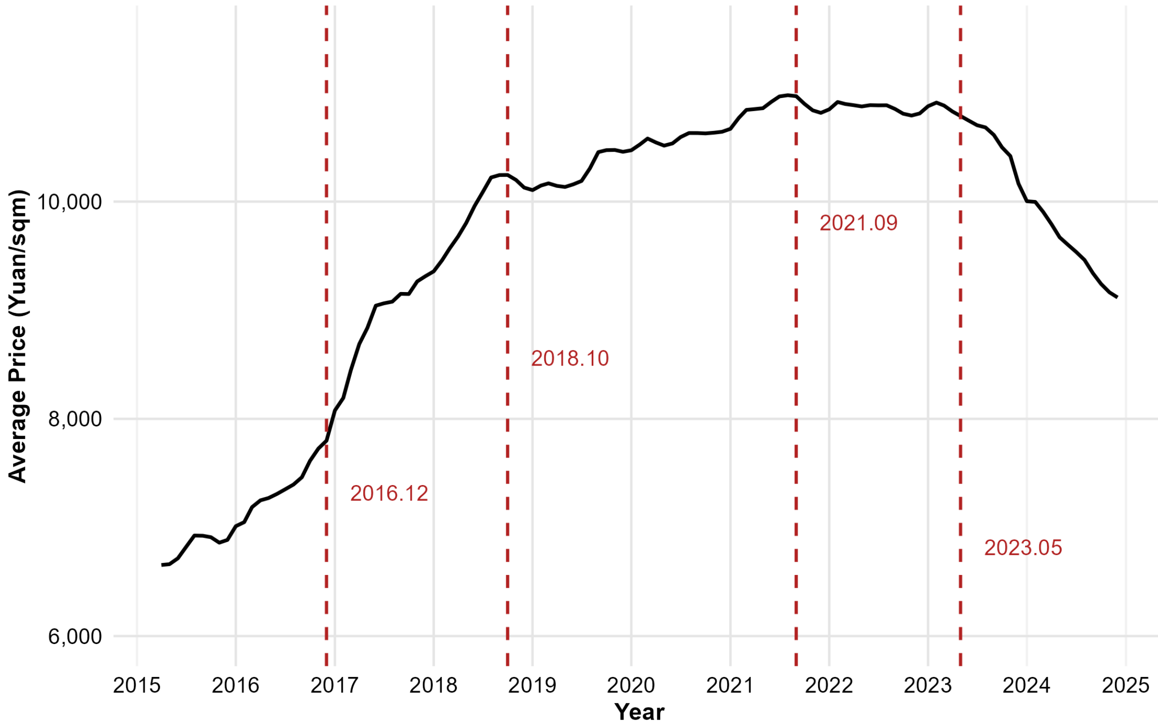

Figure 2: Structural Breakpoints in China's Housing Market Prices, 2015-2025

Segmented regression analysis further illuminates the characteristics of each market phase. During the first two phases, housing prices rose rapidly at average monthly rates of 1% and 1.2%, respectively. Between October 2018 and September 2021 (coinciding precisely with the collapse of Evergrande), the growth rate decelerated significantly to 0.2%, reflecting a market adjustment transition period. Subsequently, the monthly growth rate turned negative at -0.07%, signaling the market's entry into a downturn. Following May 2023, the downward trajectory intensified substantially, with prices declining at an average monthly rate of -0.84%.

The spatial diffusion of price decline reveals distinctive patterns (Figure 3). Northeastern provinces, Inner Mongolia, areas surrounding Beijing, and the outer Pearl River Delta experienced the earliest drops. The map demonstrates a "siphoning effect" around first-tier cities: surrounding cities began declining earlier than the cores themselves, echoing the core-periphery divergence noted by Gong et al. (2016). In contrast, the Yangtze River Delta and southern provinces exhibited greater resilience.

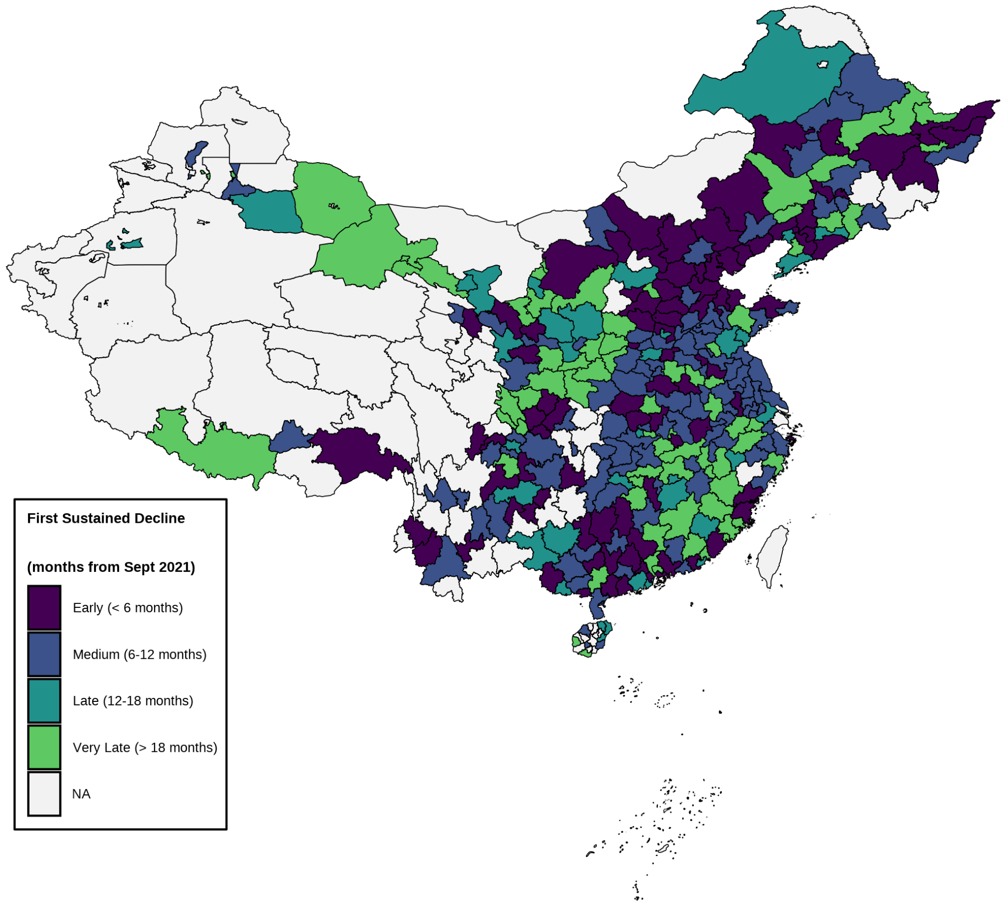

Figure 3: Spatial diffusion of housing price decline after 2021

We select January 2022 as the demarcation point between expansion and adjustment phases. Although the structural break occurs in September 2021, using 2022 aligns with our annual fiscal data structure and ensures most cities had entered correction. Alternative cutoffs (2021; city-specific price peaks) yield qualitatively similar results (Table OA.5).

4.2 The Barbell Pattern Across City Tiers

Housing price corrections follow a barbell pattern across the urban hierarchy (Figure 4). Both Tier 1 cities (-17.2% from peak, -8.60% during 2022-2024) and Tier 4+ cities (-15.1% from peak, -7.42% during 2022-2024) demonstrate substantially greater price resilience compared to mid-tier cities. New Tier 1, Tier 2, and Tier 3 cities experienced significantly more pronounced corrections, with peak-to-2024 declines of -25.8%, -26.6%, and -22.1% respectively. This U-shaped resilience distribution diverges from the linear 'superstar city' hypothesis documented in developed markets (Amaral et al., 2025), challenging the expectation that market stability scales strictly with city size.

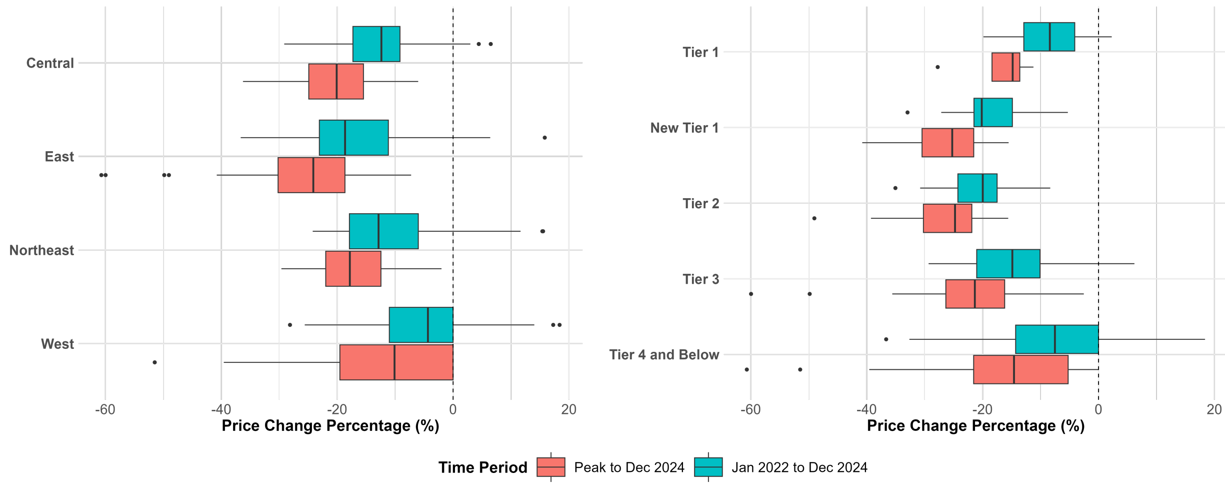

Figure 4: Housing Price Changes by City Tier and Region (Peak-to-2024 and 2022-2024)

Geographic patterns reveal additional complexity beyond the urban hierarchy effects. The East region experienced the most severe corrections, closely mirroring the vulnerability of mid-tier cities. Figure OA.3 visualizes this spatial evolution, confirming that price corrections were heavily clustered in the fiscally exposed Yangtze River Delta and Pearl River Delta regions, presenting a noteworthy inversion of traditional regional development hierarchies where economically advanced areas experienced the most severe corrections.

4.3 Fiscal Indicators and Structural Transformation

Table Table 1 reports summary statistics for the full sample. Fiscal indicators have diverged sharply across city tiers over the past decade (Figure OA.4, Table OA.1), and this divergence helps explain the resilience patterns.

First, we observe a clear trade-off between fiscal self-sufficiency and reliance on explicit government credit. Lower-tier cities (Tier 3/4+), facing the steepest deterioration in self-sufficiency, have increasingly relied on explicit debt (general and special bonds) to maintain basic expenditures. In contrast, Mid-Tier cities (New Tier 1 and Tier 2) exhibit a distinct vulnerability: they have most aggressively leveraged implicit LGFV debt—which tripled over the last decade—to fund infrastructure, creating a massive exposure to shadow banking risks. Simultaneously, their dependency on land transfer revenue was the highest among all groups during the boom, often exceeding their general budget revenue, making them uniquely susceptible to the post-2021 volume collapse.

This differentiation creates a structural mismatch that explains the barbell effect. Mid-tier cities are trapped with the highest burden of toxic implicit debt and land-revenue exposure, yet they lack the high levels of sovereign-backed explicit bond support enjoyed by bottom-tier cities or the robust organic tax bases of Tier 1 metropolises. Mid-tier cities thus carry high implicit leverage but lack the fiscal backing available to other tiers, leaving them particularly exposed when market turnover weakens.

Table 1: Overall Sample Descriptive Statistics (Mean and Distribution)

Variable	N	Mean	SD	Median
Housing Price Growth Rate	2259	0.034	0.108	0.015
Fiscal Self-Sufficiency Rate	2803	0.372	0.213	0.325
Land Revenue/Fiscal Revenue	2300	0.667	0.501	0.552
Unutilized Debt Capacity	2648	0.067	0.066	0.050
General Bond Balance/GDP	2636	0.288	0.150	0.260
Special Bond Balance/GDP	2608	0.135	0.091	0.114
LGFV Debt Balance/GDP	2499	0.254	0.245	0.180
Land Supply per 10,000 Persons	1401	1.140	0.807	0.953
GDP Growth Rate	2872	0.055	0.030	0.059
Tertiary Industry Ratio	2778	0.483	0.089	0.480
Population Growth Rate	2350	-0.001	0.025	0.000
Housing Price-to-Income Ratio	2183	0.209	0.100	0.186

Notes: The Land Supply per 10,000 Persons variable is measured in square meters per ten thousand persons (m^2 per 10,000 persons).

4.4 Boom-Bust Asymmetries

We first examine the bivariate association between housing price growth and fiscal variables across market regimes. As shown in Figure OA.5, the sign and strength of relationships shift systematically: explicit debt variables tend to be weakly negatively related to price growth during booms but become positive stabilizers during downturns.

Furthermore, we address whether the observed spatial heterogeneity simply reflects mechanical mean reversion. Evidence provided in Figure OA.6 rules out this interpretation; the slope between boom-period appreciation and adjustment-period decline is approximately 0.079, far below the perfect-symmetry benchmark. Formal regression tests confirm that fiscal-structural determinants add significant explanatory power beyond prior appreciation (Table OA.2).

5. The Fiscal-Property Nexus

This section presents the empirical results regarding the link between local government finance and housing market resilience. We first report the baseline estimates of the association between fiscal instruments and housing price growth, distinguishing between the boom and adjustment phases. We then examine how these effects vary across the urban hierarchy and different geographic regions. Finally, we analyze the mechanism through which fiscal constraints influence market liquidity.

5.1 Baseline Results

Table 2 reports the baseline fixed effects estimates using Driscoll and Kraay (1998) standard errors to account for cross-sectional dependence. The results reveal a stark asymmetry in how fiscal structures interact with market cycles.

Table 2: Fiscal-Housing Price Relationships Across Market Phases

	Full Period	Interaction	Boom Phase	Adj. Phase
Price Change (t-1)	0.255^{***}	0.201^{***}	0.084	0.199^{***}
	(0.056)	(0.061)	(0.054)	(0.061)
General Bond (t-1)	0.279^{***}	0.278^{***}	0.016	0.410^{***}
	(0.059)	(0.042)	(0.021)	(0.060)
Special Bond (t-1)	-0.393^{***}	-0.201^{**}	-0.029	-0.290^{**}
	(0.115)	(0.096)	(0.070)	(0.123)
LGFV Debt (t-1)	-0.014	0.064^{**}	-0.009	-0.128^{***}
	(0.026)	(0.025)	(0.008)	(0.010)
Land Revenue Dep. (t-1)	-0.009	-0.004	-0.020^{**}	0.018^{***}
	(0.010)	(0.012)	(0.010)	(0.004)
Fiscal Self-Sufficiency (t-1)	0.084^{***}	0.050^{*}	0.051^{***}	0.053^{***}
	(0.025)	(0.029)	(0.006)	(0.013)
Unutilized Debt Cap. (t-1)	0.058^{***}	0.106^{***}	0.002	0.198^{***}
	(0.022)	(0.022)	(0.058)	(0.040)
GDP Growth (t-1)	0.086	-0.004	0.208	0.033
	(0.067)	(0.050)	(0.164)	(0.048)
Tertiary Ind. Ratio (t-1)	-0.078^{*}	-0.051	0.160^{***}	-0.173^{**}
	(0.045)	(0.044)	(0.058)	(0.079)
Pop. Growth (t-1)	0.281^{***}	-0.011	0.134	0.216^{***}
	(0.032)	(0.010)	(0.120)	(0.020)
Price-to-Income (t-1)	-1.474^{***}	-1.496^{***}	-0.548^{***}	-2.301^{***}
	(0.193)	(0.127)	(0.152)	(0.104)
General Bond × Adjustment		0.116^{***}		
		(0.009)		
Special Bond × Adjustment		-0.249^{***}		
		(0.083)		
LGFV Debt × Adjustment		-0.060^{***}		
		(0.009)		
Land Rev. × Adjustment		0.002		
		(0.005)		
City FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
DK Robust SE	Yes	Yes	Yes	Yes
R^2	0.271	0.299	0.115	0.377
Num. obs.	1693	1539	1198	749

Notes. The table reports fixed effects panel estimates of housing price growth on lagged fiscal variables. Column (1) pools all years; Column (2) includes interaction terms with the Adjustment dummy; Columns (3)-(4) report split-sample estimates for boom (2016-2021) and adjustment phases separately. All explanatory variables are lagged by one year. Regressions include city and year fixed effects and socioeconomic controls. Driscoll-Kraay standard errors. ***p<0.01; **p<0.05; *p<0.1.

Explicit fiscal capacity shows little association with price dynamics during the boom but is positively associated with price resilience during the downturn. During the boom phase, the coefficient on general bonds is statistically indistinguishable from zero. However, in the adjustment phase, general bond issuance is associated with significantly higher price resilience at the 1 percent level. The insignificant boom-phase coefficient serves as a placebo check: if the association were driven by time-invariant omitted variables correlated with both fiscal capacity and housing appreciation, we would expect significance in both phases. The phase-specific pattern is more consistent with a state-dependent stabilization channel that activates only when private liquidity retreats.The estimate implies that a one percentage point increase in the general bond-to-GDP ratio is associated with approximately 0.41 percentage points higher housing price growth during the downturn, effectively anchoring market expectations when private liquidity retreats.

In marked contrast, reliance on implicit leverage and project-based debt transforms into a binding constraint. While LGFV debt is insignificant during the expansion, it becomes a significant drag on asset prices during the correction. This asymmetry echoes findings from the household leverage literature: just as high household debt amplified the U.S. recession (Mian and Sufi, 2015), off-budget local government leverage acts as a distinct drag during China's correction. The pattern is also consistent with evidence that credit-fueled asset booms produce deeper and more protracted downturns (Jordà et al., 2015). Specifically, a one percentage point increase in the LGFV debt ratio reduces housing price growth by 0.13 percentage points in the adjustment period. Similarly, special-purpose bonds exhibit a negative impact, lowering price growth by 0.29 percentage points for every percentage point increase in debt. High leverage does not automatically buy stability. If it is not anchored in the general public budget, it tightens the binding constraint in the downturn—refinancing becomes harder, spending space shrinks, and the correction tends to deepen.

Finally, land finance dependency presents a more nuanced picture. While split-sample estimates suggest a sign reversal, the interaction term is statistically indistinguishable from zero—we cannot reject equality of slopes across phases. Land revenue reliance thus plays a secondary role compared to debt instruments.

Column (2) confirms the structural shifts for debt instruments. The interaction term between general bonds and the adjustment dummy is positive and significant at the 1 percent level, confirming that the stabilizing power of explicit credit is statistically larger in the downturn than in the boom. Conversely, the negative interaction terms for both special bonds and LGFV debt underscore a systematic regime shift where shadow banking finance becomes a fiscal burden during deleveraging.

5.2 Regional Heterogeneity

Table 3 examines how the fiscal-property nexus varies across China's economic geography. Due to the saturation of interaction terms within the limited time window of the adjustment phase ($T = 4$), we report standard errors clustered at the city level to ensure numerical stability.

The results reveal a stark geographic stratification in how government debt stabilizes—or destabilizes—housing markets. General bonds serve as the primary anchor in the Eastern region, exhibiting the strongest positive association with price resilience. One possible interpretation is that in more market-oriented coastal cities, shocks are transmitted and priced more quickly, so on-budget

Table 3: Regional Heterogeneity in Fiscal-Property Nexus (Interaction Model)

	(1)
Price Change (t-1)	0.178***
	(0.042)
East × General Bond/GDP (t-1)	0.893***
	(0.268)
Northeast × General Bond/GDP (t-1)	0.488*
	(0.273)
West × General Bond/GDP (t-1)	0.390**
	(0.163)
East × Special Bond/GDP (t-1)	0.003
	(0.122)
Northeast × Special Bond/GDP (t-1)	0.144
	(0.334)
West × Special Bond/GDP (t-1)	0.418**
	(0.186)
East × LGFV Bond/GDP (t-1)	-0.124**
	(0.055)
Northeast × LGFV Bond/GDP (t-1)	-0.095***
	(0.024)
West × LGFV Bond/GDP (t-1)	-0.088
	(0.118)
Observations	738
R^2	0.828
Adjusted R^2	0.727
Within R^2	0.419
City Fixed Effects	Yes
Time Fixed Effects	Yes

Note: The table reports coefficients from regressions of housing price growth on interactions between regional dummies and lagged fiscal variables during the adjustment phase. The reference region is Central. All explanatory variables are lagged by one year. Regressions include city and year fixed effects and socioeconomic controls. Standard errors are clustered at the city level. ***p<0.01; **p<0.05; *p<0.1.

fiscal room is more likely to translate into a visible stabilizing effect. By contrast, in regions where housing markets are thinner and administrative interventions play a larger role, the same on-budget support may not map into prices as directly. The West region also benefits from general bonds, but the estimated stabilization is less than half that of the East.

Notably, the utility of special-purpose bonds is confined solely to the West. While project-based debt fails to support prices in the developed East or the contracting Northeast, it exerts a robust positive effect in the Western region. This implies that in inland provinces where infrastructure gaps remain, project-based investment still yields positive returns, whereas in saturated coastal markets, it has ceased to function as a growth engine.

LGFV debt, by contrast, exerts a negative drag in both the developed East and the declining Northeast. The Eastern region suffers the largest negative drag from implicit leverage, indicating that high-valuation markets are acutely sensitive to the risks of shadow banking deleveraging. The Northeast also shows a significant negative coefficient, consistent with implicit debt weighing more heavily in shrinking economies. The West, by comparison, shows no significant effect from LGFV exposure.

5.3 City-Tier Heterogeneity

Table 4 examines the heterogeneity across the urban hierarchy. We interact fiscal variables with city-tier indicators, using the 'Middle Tier' (New Tier 1 and Tier 2 cities) as the reference group. Due to the limited time dimension of the adjustment phase subsample ($T = 4$), we report cluster-robust standard errors to ensure numerical stability, while the baseline results remain robust to cross-sectional dependence corrections.

Fiscal capacity translates into resilience unevenly across tiers, forming a U-shaped pattern. Tier 1 cities demonstrate an exceptional sensitivity to explicit sovereign credit. The marginal effect of general bonds in these top-tier markets is substantially larger than in the middle tier, suggesting that in core asset markets, sovereign-backed liquidity serves as a decisive anchor for expectations. Furthermore, Tier 1 cities also exhibit a positive market response to special-purpose bonds, indicating that top-tier markets value multiple forms of explicit government support as credible signals of stability. Conversely, the market enforces strict discipline regarding implicit leverage. The negative impact of LGFV debt is most severe in Tier 1 markets, underscoring that resilience in core metropolises relies on maintaining a healthy explicit balance sheet rather than relying on shadow financing.

At the other end of the hierarchy, Tier 4+ cities benefit from broader fiscal support. Unlike the middle tier, these smaller economies show a positive response to both general and special-purpose bonds. This pattern is consistent with a direct subsidy mechanism: in lower-tier cities with smaller economic bases, explicit fiscal spending more effectively stabilizes local aggregate demand, preventing market liquidity from freezing. While Tier 4+ cities also face a penalty for implicit leverage relative to the middle tier, the magnitude of this drag is considerably smaller than that observed in Tier 1.

This configuration places the Middle Tier in a position of comparative disadvantage. Relative to Tier 1 (which benefits from market depth and balance-sheet discipline) and Tier 4+ (which benefits from transfer dependence), the Middle Tier derives significantly less stabilization from explicit

Table 4: City-Tier Heterogeneity in Fiscal-Property Nexus (Interaction Model)

	(1)
Price Change (t-1)	0.204***
	(0.040)
Tier 1 × General Bond/GDP (t-1)	14.1***
	(5.32)
Tier 3 × General Bond/GDP (t-1)	0.399*
	(0.237)
Tier 4+ × General Bond/GDP (t-1)	0.442***
	(0.164)
Tier 1 × Special Bond/GDP (t-1)	1.66**
	(0.711)
Tier 3 × Special Bond/GDP (t-1)	0.080
	(0.136)
Tier 4+ × Special Bond/GDP (t-1)	0.325***
	(0.120)
Tier 1 × LGFV Bond/GDP (t-1)	-0.955**
	(0.381)
Tier 3 × LGFV Bond/GDP (t-1)	-0.074
	(0.066)
Tier 4+ × LGFV Bond/GDP (t-1)	-0.125***
	(0.040)
Observations	738
R^2	0.827
Adjusted R^2	0.727
Within R^2	0.417
City Fixed Effects	Yes
Time Fixed Effects	Yes

Note: The table reports coefficients from regressions of housing price growth on interactions between city-tier dummies and lagged fiscal variables during the adjustment phase. The reference group is the Middle Tier (New Tier 1 and Tier 2 cities). All explanatory variables are lagged by one year. Regressions include city and year fixed effects and socioeconomic controls. Standard errors are clustered at the city level. ***p<0.01; **p<0.05; *p<0.1.

debt while gaining no comparative advantage from implicit leverage. This structural mismatch underpins the U-shaped resilience pattern documented in Section 4.2.

5.4 Sensitivity Analysis

We subject our baseline findings to a series of robustness checks, with detailed results reported in the Online Supplementary Material. First, benchmarking our data against the official NBS 70-city indices confirms that the "barbell" resilience pattern is a structural feature of the market rather than a data artifact (Table OA.3). Second, to address concerns about listing price stickiness, we constructed a constant-quality hedonic price index using transaction-level microdata. The regime-dependent effects of implicit and explicit debt hold when using this market-clearing price measure (Table OA.4). Finally, re-estimating the models using 2021 as the boom-adjustment cutoff year yields qualitatively identical results, confirming that the functional transformation of fiscal instruments is robust to periodization choices (Table OA.5).

6. Mechanisms: Supply Adjustment and Liquidity

Section 5 shows that fiscal–financial exposure constrains housing price resilience during the downturn, particularly in the middle of the urban hierarchy. The remaining question is through which channel this constraint operates. A natural candidate is land supply, where local governments exercise direct administrative control. If fiscal stress systematically shapes housing outcomes, it should be visible in how supply is adjusted when demand collapses.

6.1 Land Supply and Inventory Pressure

To characterize supply conditions, we construct an inventory pressure index defined as the ratio of listed land to land actually sold. Figure 5 decomposes these dynamics into administrative actions (listed supply versus sold demand, Panel A) and market outcomes (inventory pressure, Panel B).

Three patterns are evident. Tier 1 cities exhibit a relatively smooth adjustment path: inventory pressure declines over time, consistent with strong absorption capacity even after 2021. Middle-tier cities experience a markedly different trajectory. Demand contracts sharply after the peak, while inventory pressure remains elevated despite reductions in listed supply. This combination points to a high-pressure equilibrium in which retrenchment lags behind the scale of the demand shock. In the housing supply literature, Saiz (2010) shows that geographic constraints create inelastic supply and amplify price volatility. In China's institutional context, fiscal and administrative constraints—land quotas, LGFV collateral requirements, revenue dependence—function analogously to geographic barriers, producing supply rigidities that prevent market clearing (Glaeser et al., 2008). This rigid supply response suggests a 'balance-sheet constraint': consistent with the collateral channel mechanisms identified by Wu et al. (2015) and Feng et al. (2025), local governments are compelled to maintain land listings to anchor the valuation of assets pledged as implicit collateral. A sharp withdrawal of supply would erode this collateral value, triggering broader financial risks. Tier 3/4+ cities display higher absolute pressure ratios, but also some improvement after 2021, reflecting larger quantity responses on the supply side.

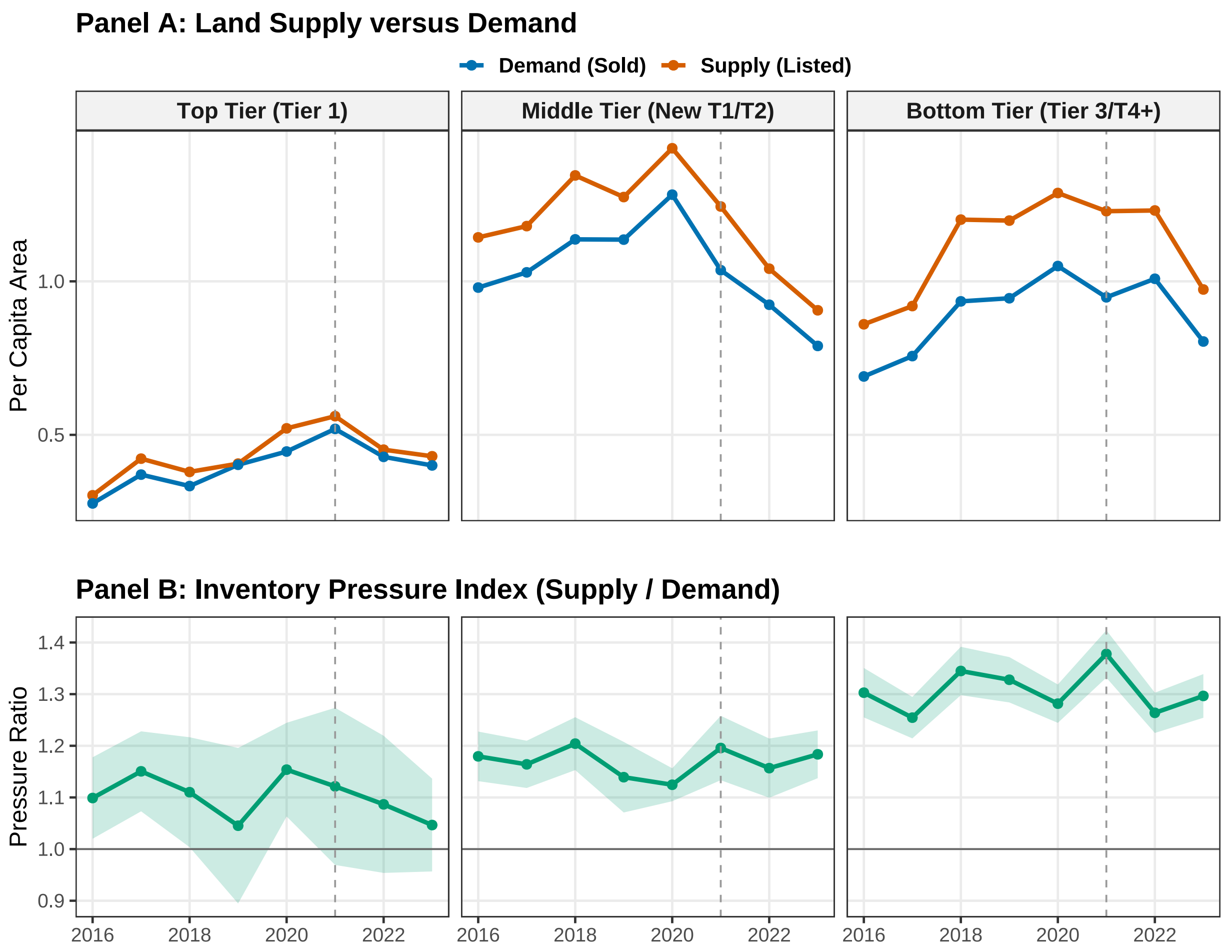

Figure 5: Land supply and inventory dynamics (2016–2023).

Note: Panel A displays per-capita listed land (supply) versus sold land (demand). Panel B shows the inventory pressure ratio (Supply/Demand). Shaded areas represent 95% confidence intervals.

Table 5: Fiscal incentives and land supply adjustment (Dependent variable: $\Delta Supply$).

	Middle Tier Cities (New Tier 1/Tier 2)				Bottom Tier Cities (Tier 3/4+)			
	Land Fee	LGFV Debt	Gen Bond	Spec Bond	Land Fee	LGFV Debt	Gen Bond	Spec Bond
Land supply level (t-1)	-0.613***	-0.622***	-0.564***	-0.567***	-0.566***	-0.564***	-0.545***	-0.539***
	(0.084)	(0.080)	(0.084)	(0.081)	(0.081)	(0.073)	(0.071)	(0.071)
Price growth (t-1)	0.718*	0.693	0.722	0.698	0.075	-0.057	-0.053	-0.079
	(0.425)	(0.420)	(0.446)	(0.437)	(0.254)	(0.249)	(0.258)	(0.255)
Fiscal variable (t-1)	0.171	0.597***	0.171	0.775	0.185**	0.349**	-0.361	-0.004
	(0.162)	(0.224)	(0.834)	(0.971)	(0.080)	(0.154)	(0.500)	(0.681)
Fiscal $\times$ Bust	0.240	-0.174	-0.462	-0.822	-0.129	-0.163	-0.325	-0.531
	(0.164)	(0.171)	(0.362)	(0.704)	(0.094)	(0.176)	(0.365)	(0.715)
Num. Obs.	243	262	262	262	740	857	857	857
R^2	0.297	0.300	0.268	0.273	0.267	0.271	0.265	0.263
RMSE	0.40	0.40	0.41	0.41	0.50	0.51	0.51	0.51

Notes. The table reports fixed effects panel estimates of the annual change in per-capita listed land supply on lagged fiscal variables and their interactions with the Bust dummy. Results are reported separately for middle-tier and bottom-tier cities. Regressions include city and year fixed effects and controls. Wald tests for the total downturn effect (β + δ = 0) show statistical significance only for land revenue dependency in middle-tier cities (p=0.004). Standard errors are clustered at the city level. ***p<0.01; **p<0.05; *p<0.1.

6.2 Fiscal Incentives and Supply Adjustment

Table 5 reports two-way fixed-effects regressions with the annual change in per-capita listed land supply as the dependent variable. Fiscal variables are lagged and interacted with a downturn indicator (Bust = 1 for 2022 onward). Results are reported separately for middle-tier and bottom-tier cities, with standard errors clustered at the city level.

Across tiers, supply adjustment exhibits strong mean reversion: higher lagged supply levels predict subsequent contraction, consistent with administrative correction following earlier expansion. In the middle tier, lagged price growth is also positively associated with supply expansion, indicating responsiveness to market signals.

Evaluating total fiscal effects during the downturn, only land-fee dependence in the middle tier yields a statistically significant result (Wald test: $p = 0.004$). Dependent cities cut supply less aggressively, consistent with the revenue constraints identified by Gyourko et al. (2022). Here, debt obligations force a prioritization of immediate cash flow over market clearing, driving land sales via rigid fiscal necessity rather than market fundamentals. Conversely, stock measures of leverage (LGFV debt, explicit bonds) exhibit no robust effects. This implies that supply rigidity is primarily a function of liquidity constraints (immediate expenditure needs) rather than solvency constraints (debt stocks), as the latter can often be rolled over in the short term.

These results do not imply that middle-tier governments failed to retrench supply. Figure 5 (Panel A) shows that listings declined after 2021. The point is that supply adjustment is uneven and constrained, and it does not scale proportionately with the collapse in demand. Supply behavior alone therefore cannot account for the pronounced differences in housing price resilience across tiers.

6.3 Liquidity Persistence and Market Clearing

Figure 6 plots smoothed median Days on Market (DOM) across city tiers. Before 2021, liquidity conditions are broadly similar. After 2021, they diverge sharply. Middle-tier cities experience the largest and most persistent increase in DOM, while Tier 1 and Tier 3/4+ cities show more moderate changes.

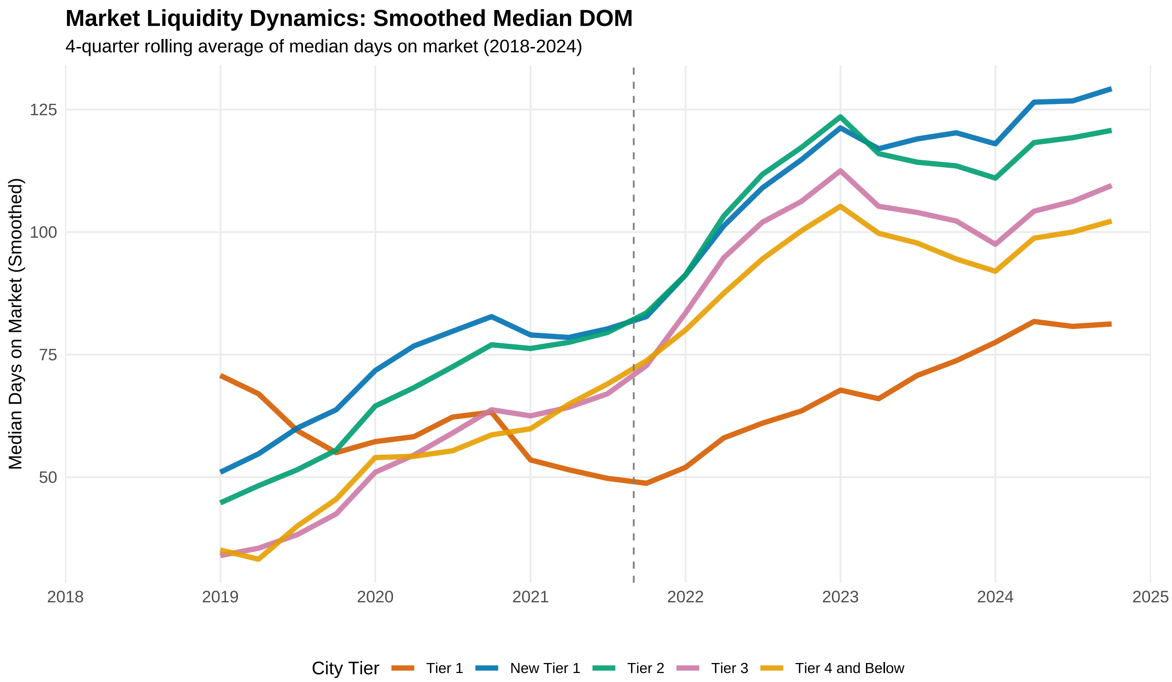

Figure 6: Liquidity stratification across the urban hierarchy.

Note: The chart displays the smoothed median Days on Market (DOM). Post-2021, liquidity dynamics diverge into a "liquidity barbell," with the middle tier experiencing the most severe freezing.

DOM captures transaction speed but not whether illiquidity accumulates as persistent inventory. We therefore examine stale share, defined as the proportion of listings unsold for more than one year. Table 6 reports city-level regressions of stale share on its lag, supply levels and adjustments, fiscal variables (and their Bust interactions), and fundamentals.

The dominant result is persistence. In the middle tier, the autoregressive coefficient on stale share ranges from 0.40 to 0.48 across specifications, nearly twice the magnitude observed in Tier 3/4+ cities (0.19–0.22). Once illiquidity emerges in middle-tier markets, it tends to reproduce itself over time. By contrast, stale accumulation in the bottom tier is less persistent, suggesting that inventory clears more readily.

We further evaluate whether supply adjustment mitigates or amplifies stale dynamics during the downturn by testing the marginal effect of lagged supply adjustment when Bust = 1. For the middle tier, Wald tests reject a zero marginal effect across all fiscal specifications, while no such effect is detected for the bottom tier. The estimated marginal effects in the middle tier are negative: stronger supply contraction is associated with higher stale share. This pattern is consistent with reactive retrenchment that follows liquidity deterioration rather than preventing it.

Table 6: Liquidity frictions and stale accumulation (Dependent variable: stale share).

	Middle Tier Cities (New Tier 1/Tier 2)				**Bottom Tier Cities (Tier 3/4+)**			
	Land Fee	LGFV Debt	Gen Bond	Spec Bond	Land Fee	LGFV Debt	Gen Bond	Spec Bond
Outcome (t-1)	0.397***	0.475***	0.453***	0.448***	0.214**	0.217**	0.188**	0.187**
	(0.083)	(0.055)	(0.056)	(0.057)	(0.106)	(0.096)	(0.093)	(0.092)
Land supply level (t-1)	0.013***	0.013***	0.011**	0.011**	-0.011*	-0.008	-0.009	-0.009
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)
Price growth (t-1)	-0.115***	-0.080***	-0.093***	-0.092***	-0.020	-0.034	-0.051	-0.049
	(0.034)	(0.021)	(0.021)	(0.020)	(0.032)	(0.031)	(0.032)	(0.032)
ΔSupply (t-1)	-0.009	-0.008	-0.006	-0.006	0.007	0.006	0.005	0.005
	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)
ΔSupply $\times$ Bust	-0.004	-0.006	-0.007	-0.007	-0.002	-0.002	-0.001	0.000
	(0.009)	(0.007)	(0.007)	(0.007)	(0.005)	(0.005)	(0.004)	(0.004)
Fiscal variable (t-1)	-0.027***	-0.036	0.001	-0.006	0.014	-0.026*	-0.020	-0.049
	(0.010)	(0.024)	(0.087)	(0.104)	(0.009)	(0.014)	(0.069)	(0.117)
Fiscal $\times$ Bust	0.021**	0.025**	-0.018	-0.045	0.001	0.022	-0.017	-0.029
	(0.010)	(0.012)	(0.023)	(0.030)	(0.007)	(0.014)	(0.053)	(0.094)
Num. Obs.	244	263	263	263	227	259	258	258
R^2	0.409	0.372	0.359	0.362	0.109	0.082	0.077	0.080
RMSE	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02

Notes. The table reports fixed effects panel estimates of stale share (proportion of listings unsold for more than one year) on lagged fiscal variables and their interactions with the Bust dummy. Results are reported separately for middle-tier and bottom-tier cities. Regressions include city and year fixed effects and controls. Wald tests for the marginal effect of lagged supply adjustment during the downturn show statistical significance for middle-tier cities but not for bottom-tier cities. Standard errors are clustered at the city level. ***p<0.01; **p<0.05; *p<0.1.

Standard asset pricing theory posits that lower liquidity should command a higher risk premium (Amaral et al., 2025; Stein, 1995). Consistent with this, we find that mid-tier cities, which suffer the most severe 'liquidity freeze', also experience the sharpest price corrections. These findings indicate that fiscal–financial exposure constrains housing-market resilience primarily by impairing market clearing. In middle-tier cities, inventory accumulation, prolonged time on market, and constrained fiscal capacity reinforce one another, producing a self-sustaining liquidity trap. These dynamics corroborate the price-volume divergence documented by Chang et al. (2025), illustrating how fiscal constraints impede the quantity adjustments required for market stabilization. Supply adjustment occurs, but it arrives too late and at too limited a scale to offset the persistence of illiquidity. Lower-tier cities, despite weaker fundamentals, exhibit less persistence in stale accumulation, allowing quantity adjustment to translate more effectively into market clearing.

7. Conclusion

China's post-2021 housing correction did not sort cities along a simple "bigger is safer" gradient. Price resilience follows a U-shaped pattern, with Tier 1 and Tier 4+ cities showing greater stability than the squeezed middle. This barbell pattern suggests that in China's fiscal-property nexus, resilience during crises derives from a dual logic—market depth at the top and institutional backstops at the bottom—rather than a monotonic flight-to-safety (Amaral et al., 2025; Daams et al., 2024). This divergence from Western patterns reflects the fundamental difference between stock-based and flow-based fiscal systems. Recurrent property taxation insulates Western local governments from turnover shocks, whereas China's land finance transmits volume contractions directly into fiscal stress, a transmission that proves most acute in the leveraged middle tier.

The spatial impact of fiscal instruments is structurally distinct across market phases. During the boom, explicit on-budget capacity has little marginal effect on housing prices. Once the market turns, the picture changes: general bonds become a meaningful stabilizer, while LGFV debt becomes a constraint when turnover weakens and refinancing tightens, despite its prominent role in financing local growth during the expansion (Chen et al., 2020; Ye et al., 2022). This regime asymmetry echoes the broader housing-cycle literature, which shows that financial and policy arrangements can affect downturn-related outcomes in ways that differ from boom periods, and that greater government involvement does not necessarily cushion housing busts (Agnello et al., 2020).

This structural shift explains the uneven geography of the crisis. Tier 1 cities translate explicit state credit into resilience more strongly, as core markets react sharply to on-budget signals. Tier 4+ cities, although weaker on fundamentals, are buffered by broad fiscal support and transfer dependence. Mid-tier cities sit in the most exposed position: they leveraged heavily during the boom, but the liabilities that were easiest to carry in good times become harder to roll over in bad times. The result is not simply "mid-tier cities are weaker," but a particular mismatch between high exposure to implicit leverage and limited institutional backstops.

The fiscal-property nexus shows up most clearly in market functioning rather than prices alone. In the cities with heavier implicit leverage, we see a more persistent build-up of stale inventory, an illiquidity problem that reinforces itself over time. The adjustment is not only about how far prices fall, but about how long markets remain unable to clear. This extends the asymmetry identified by Glaeser and Gyourko (2005): housing durability slows physical supply adjustment, but fiscal entanglement with land markets can freeze the clearing process itself.

Uniform stabilization packages are unlikely to work well when the underlying constraints differ by tier. In Tier 1 cities, balance-sheet quality is part of the pricing mechanism, so managing implicit leverage is central to stabilization. In the mid-tier, resolving the debt overhang is closer to a precondition than a complement: stimulus on its own may not restore confidence if refinancing pressure remains. More broadly, the results point to the value of relying more on explicit, on-budget channels for countercyclical management, given the stronger stabilizing role of general bonds during the downturn.

The data and sample window constrain interpretation. The adjustment period (2022–2024) is short, and the correction is still unfolding, which makes it hard to judge whether the patterns documented here are transitional or durable. Our aggregate fiscal data also cannot cleanly distinguish special-purpose bonds used for productive investment from those absorbed by refinancing or affordable housing. More fundamentally, the identification strategy relies on lagged regressors, which mitigate but do not fully resolve reverse causality between housing prices and fiscal responses. Future research exploiting exogenous policy shocks—such as centrally-imposed debt quota adjustments or transfer formula changes—could help sharpen causal claims. Yet whatever the precise mechanisms, the findings challenge the common treatment of local government debt as a undifferentiated risk (IMF, 2022). The same correction that exposed LGFV leverage as a vulnerability revealed general bonds as a stabilizing anchor. Not all debt is created equal, and the fiscal-property nexus cannot be understood without disaggregating what "local debt" actually means.

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Online Appendix

OA.1 Data Quality Validation (Micro-level)

To validate the reliability of our listing price data (Anjuke), Figure OA.1 compares it against a proprietary micro-level dataset of 5.8 million verified housing transactions covering 112 major cities (2018–2024). Panel A shows a near-perfect correlation in price levels ($r = 0.982$), while Panel B confirms that the listing price growth rates track transaction price growth rates closely ($r = 0.725$).

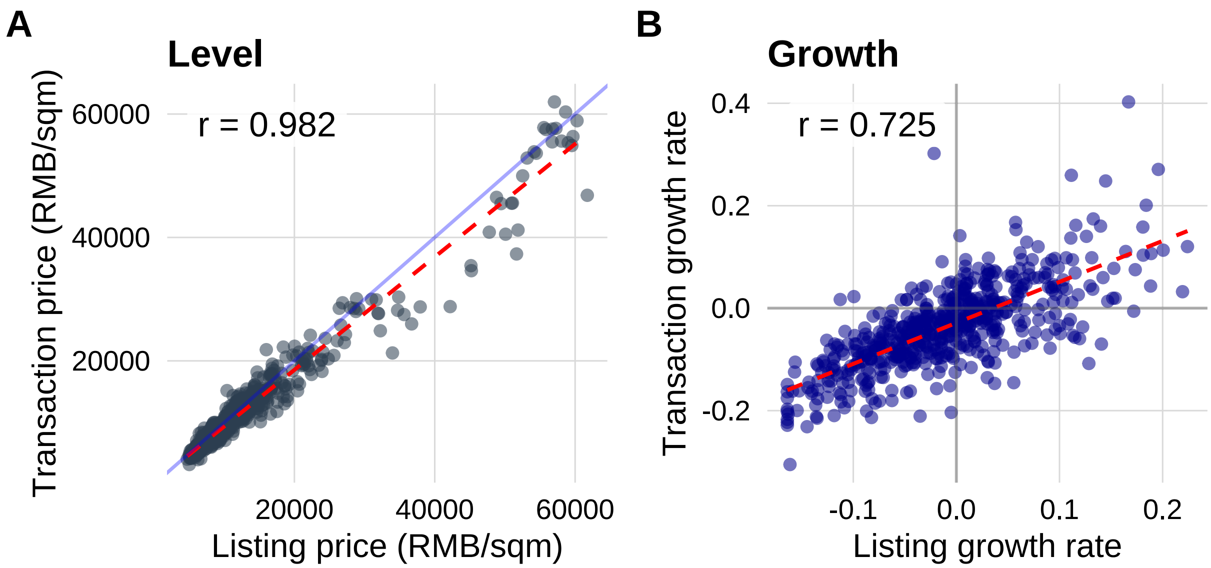

Figure 7: Data quality validation using micro transactions. Panel (A): Levels comparison. Panel (B): Growth rate dynamics.

OA.2 Temporal Heterogeneity in Market Peaks

Figure OA.2 illustrates the variation in peak timing across city tiers. While Tier 1 cities peaked later (August 2022), the majority of mid-tier and lower-tier cities reached their price peaks between mid-2021 and early 2022. This structural break justifies our use of regime-switching models centered around 2021/2022.

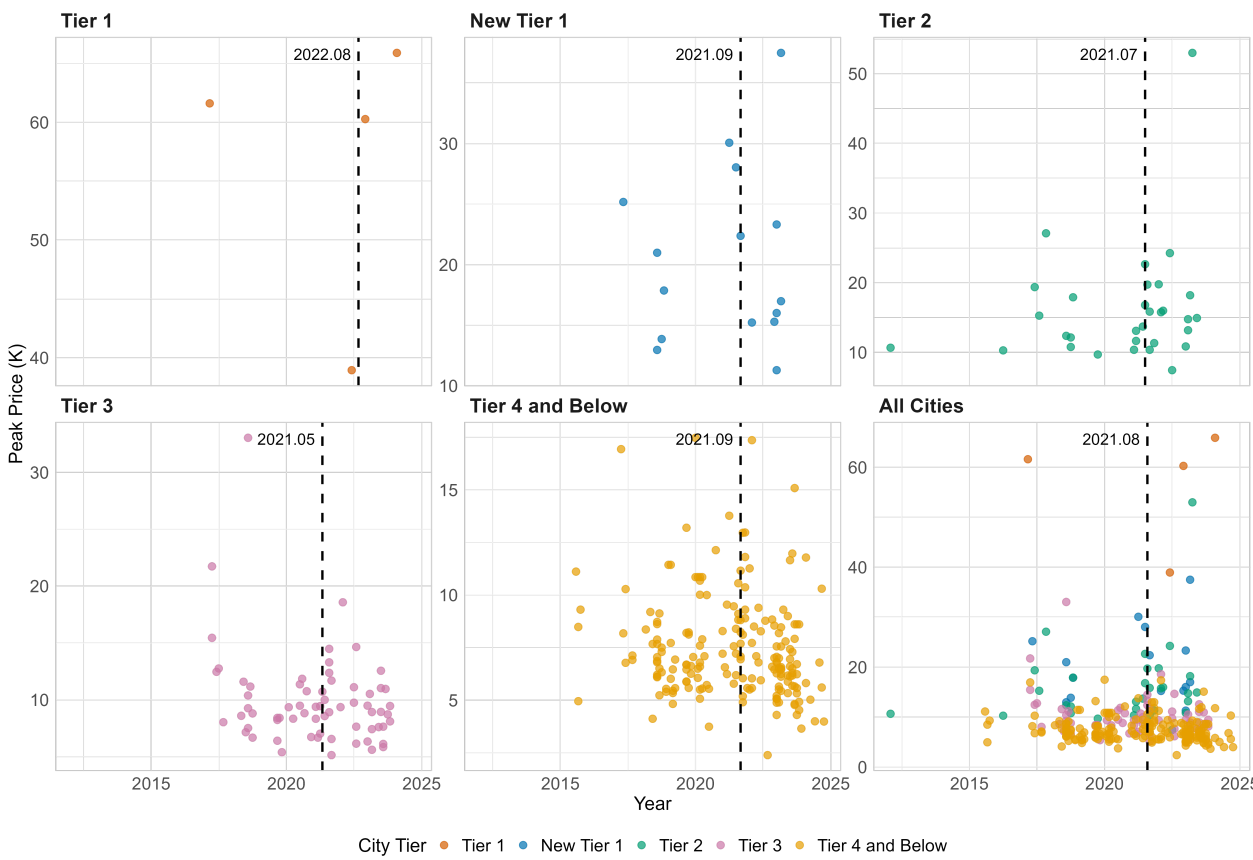

Figure 8: Housing Price Changes by City Tier and Region: Peak Timing Distribution.

OA.3 Spatial Distribution of Price Changes

Figure OA.3 visualizes the spatial evolution of housing price changes. Panel A (2016-2021) shows broad-based appreciation, while Panel B (2022-2024) reveals the distinct clustering of price corrections. Notably, corrections are concentrated in the economically advanced Eastern coastal regions (Yangtze River Delta, Pearl River Delta), presenting an inversion of traditional regional hierarchies.

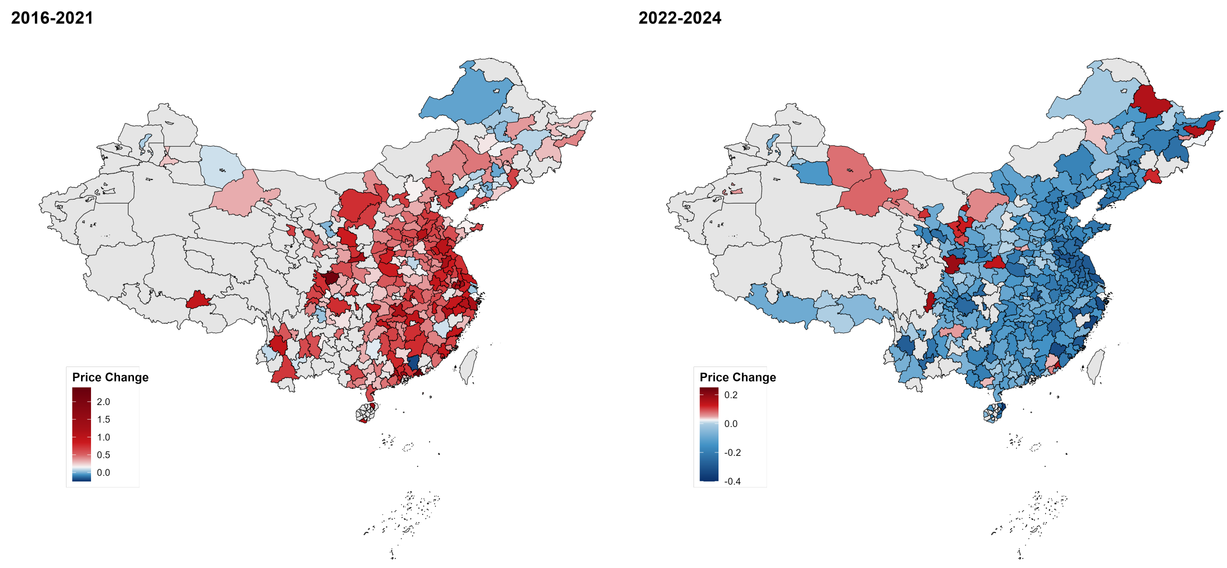

Figure 9: Housing Price Changes During Boom (2016-2021) and Adjustment (2022-2024) Periods Across 303 Chinese Cities.

OA.4 Fiscal Indicator Trends

Figure OA.4 highlights the structural divergence in local government finance. Mid-tier cities (New Tier 1/Tier 2) exhibit the most aggressive expansion in implicit LGFV debt (Panel c), while bottom Tier cities (especially Tier 4+) rely increasingly on General Bonds (Panel e) and face the steepest decline in fiscal self-sufficiency (Panel a).

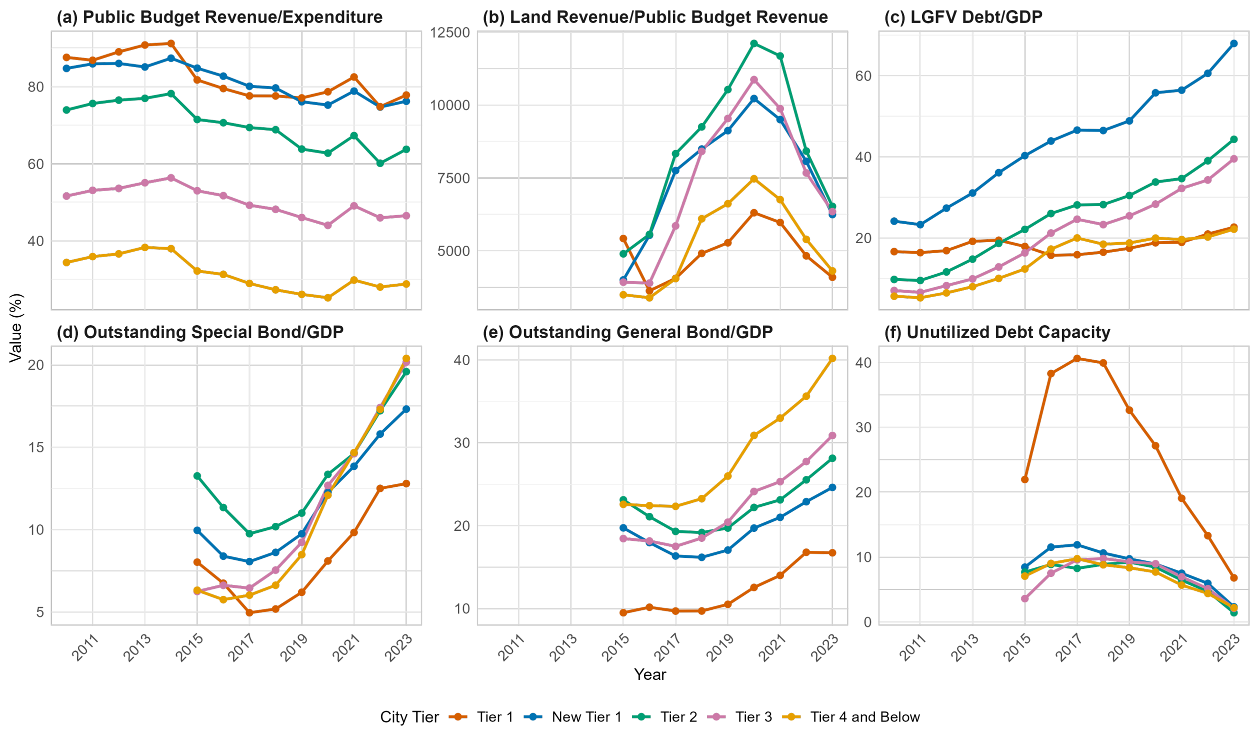

Figure 10: Evolution of Fiscal Indicators by City Tier (2010-2023).

OA.5 Detailed Descriptive Statistics by City Tier

Table OA.1 provides the granular year-by-year descriptive statistics for all key variables across the five city tiers, supplementing the summary trends discussed in the main text.

Table 7: Descriptive Statistics by City Tier and Year (Mean Values)

	Tier 1			New Tier 1			Tier 2			Tier 3			Tier 4 and Below		
Variable	2017	2021	2023	2017	2021	2023	2017	2021	2023	2017	2021	2023	2017	2021	2023
Number of Cities	4	4	4	14	14	14	30	30	30	65	65	65	129	181	189
Housing Price Growth Rate	0.122	0.027	-0.004	0.256	0.063	-0.028	0.214	0.034	-0.042	0.202	0.027	-0.012	0.126	0.016	0.001
Fiscal Self-Sufficiency Rate	0.776	0.825	0.778	0.806	0.791	0.763	0.694	0.673	0.638	0.493	0.491	0.465	0.344	0.335	0.315
Land Revenue/Fiscal Revenue	0.516	0.597	0.409	0.763	0.935	0.606	0.833	1.169	0.652	0.585	0.988	0.634	0.480	0.748	0.461
Unutilized Debt Capacity	0.406	0.191	0.068	0.120	0.075	0.023	0.083	0.064	0.014	0.096	0.069	0.021	0.095	0.059	0.020
General Bond Balance/GDP	0.097	0.140	0.167	0.163	0.211	0.247	0.193	0.231	0.281	0.175	0.253	0.309	0.209	0.313	0.379
Special Bond Balance/GDP	0.050	0.098	0.128	0.079	0.138	0.173	0.098	0.146	0.196	0.064	0.146	0.202	0.061	0.145	0.201
LGFV Debt Balance/GDP	0.159	0.189	0.227	0.467	0.529	0.632	0.282	0.346	0.443	0.246	0.322	0.395	0.198	0.204	0.231
Land Supply/Population	0.422	0.561	0.430	1.160	1.178	0.850	1.187	1.283	0.960	1.057	1.340	1.118	0.830	1.150	0.879
GDP Growth Rate	0.073	0.081	0.052	0.078	0.080	0.053	0.075	0.078	0.054	0.075	0.077	0.056	0.068	0.079	0.053
Tertiary Industry Ratio	0.706	0.723	0.704	0.550	0.575	0.571	0.508	0.536	0.532	0.446	0.479	0.488	0.453	0.460	0.465
Population Growth Rate	0.025	0.002	0.004	0.022	0.014	0.006	0.020	0.007	0.004	0.001	0.001	-0.002	-0.005	-0.002	-0.001
Housing Price-to-Income Ratio	0.780	0.654	0.632	0.333	0.305	0.278	0.297	0.275	0.239	0.225	0.212	0.192	0.185	0.172	0.163

OA.6 Exploratory Analysis: Asymmetry and Mean Reversion

This section presents exploratory evidence supporting the regression models. Figure OA.5 visualizes how the correlation between fiscal variables and housing price growth shifts between boom (red) and bust (blue) periods. Figure OA.6 tests for mean reversion; the shallow slope indicates that boom-period appreciation does not mechanically predict adjustment-period declines one-for-one. Table OA.2 formally tests this by comparing a "prior appreciation only" model against a model including fiscal variables, confirming that fiscal structures add significant explanatory power.

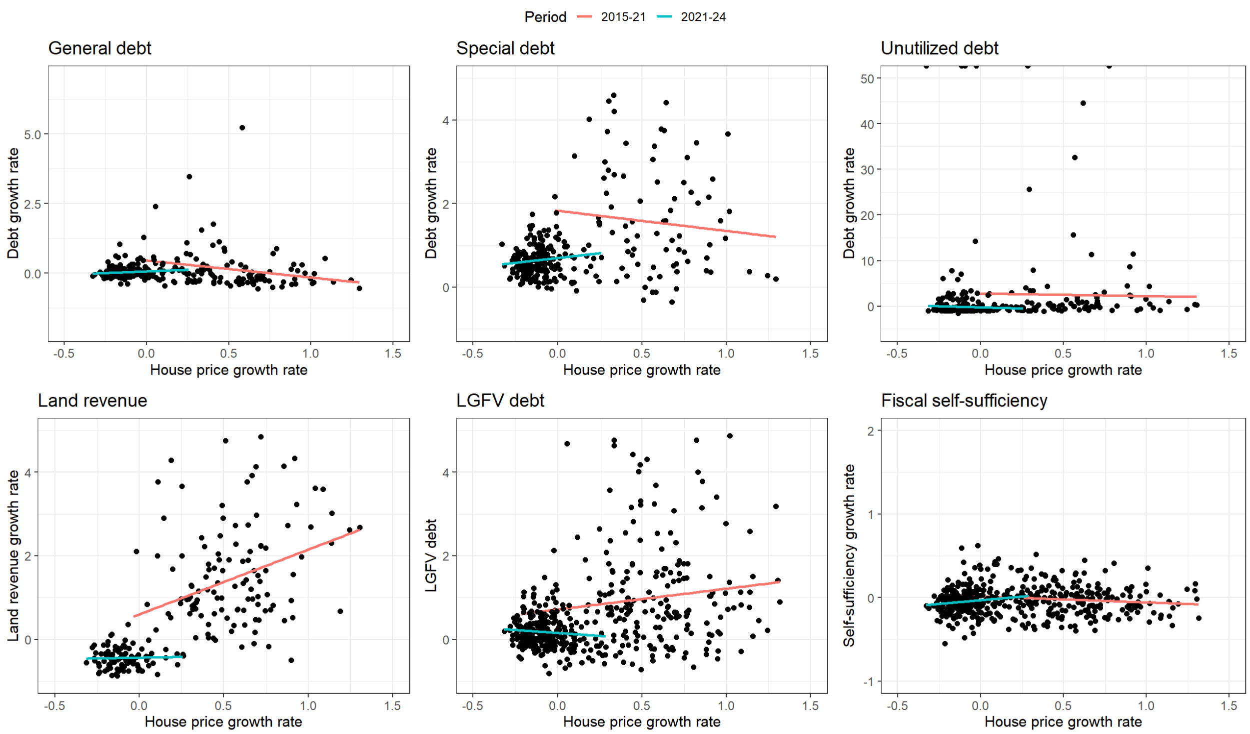

Figure 11: Boom–Bust Shifts in the Fiscal–Housing Growth Relationship.

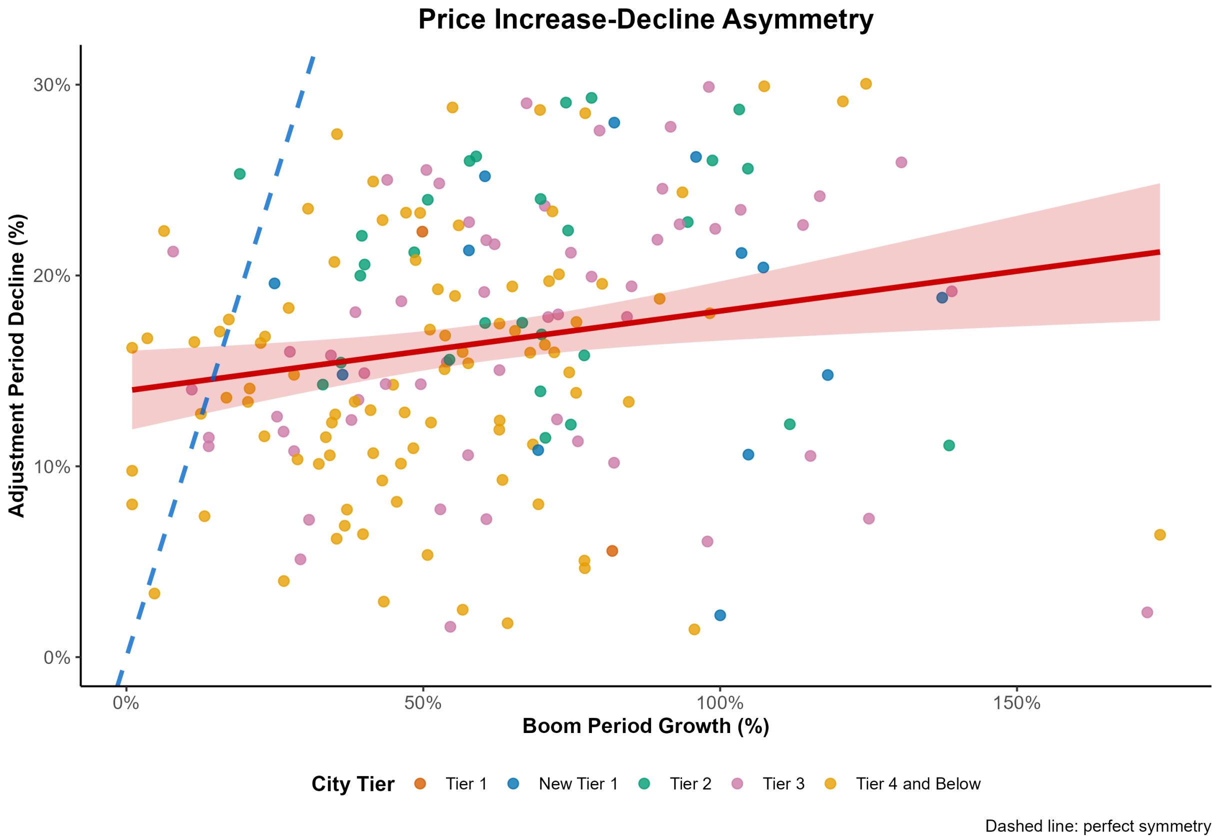

Figure 12: Testing for Mean Reversion: Boom Period Growth vs. Adjustment Period Decline.

Table 8: Prior Appreciation vs. Fiscal-Structural Determinants (Regression Results)

Model	Prior Growth Coef.	R^2	ΔR^2	N
(1) Prior Appreciation Only	0.079 ***	0.101	–	202
(2) + Fiscal Variables	0.053 ***	0.221	+ 0.119	202
(3) + All Controls	0.055 ***	0.233	+ 0.132	202

Note: Dependent variable is adjustment period price decline (2022-2024). *** $p < 0.01$.

OA.7 Robustness Check: Official Statistics

Table OA.3 benchmarks our city-tier and regional price correction patterns against the National Bureau of Statistics (NBS) 70-city second-hand residential price indices. Despite methodological differences, the "Barbell Effect" and East-West divergence patterns are consistent across both datasets.

Table 9: Comparison of Housing Price Changes by City Tiers (Validation against NBS Data)

	Peak to 2024 Change (%)		2022 to 2024 Change (%)		Num of cities	
City Category	Our data	Official data	Our data	Official data	Our data	Official data
By Tier						
Tier 1	-17.2	-12.8	-8.60	-9.35	4	4
New Tier 1	-25.8	-15.2	-19.00	-12.5	15	13
Tier 2	-26.6	-19.9	-20.40	-17.0	30	20
Tier 3	-22.1	-17.8	-14.80	-15.1	65	20
Tier 4 and Below	-15.1	-21.0	-7.42	-16.9	189	13
By Region						
Central	-19.9	-18.1	-12.50	-15.4	82	16
East	-25.2	-17.8	-16.70	-15.1	91	28
Northeast	-16.9	-24.3	-10.10	-19.6	33	8
West	-12.3	-16.4	-5.29	-12.9	97	18

Notes: The NBS second-hand residential price indices are survey-based (N=70).

OA.8 Robustness Check: Transaction-Based Prices

Table OA.4 presents the re-estimated baseline models using a constant-quality hedonic price index constructed from micro-level transaction records (Beike) instead of listing prices. This addresses concerns about listing price stickiness.

Table 10: Robustness Check: Listing vs. Transaction Prices Across Market Phases

	Adjustment Phase (2022-2024)		Boom Phase (2016-2021)	
	Listing	Transaction	Listing	Transaction
Price Change (t-1)	0.449^{***}	0.280^{***}	0.131^{*}	0.104
	(0.079)	(0.060)	(0.076)	(0.074)
General Bond/GDP (t-1)	-0.058	-0.156	-0.115	0.133
	(0.117)	(0.102)	(0.129)	(0.134)
Special Bond/GDP (t-1)	-0.103	0.118	0.249	-0.095
	(0.152)	(0.132)	(0.179)	(0.183)
LGFV Bond/GDP (t-1)	-0.044^{***}	-0.039^{***}	0.001	0.028
	(0.015)	(0.013)	(0.022)	(0.023)
Land Revenue/Fiscal Revenue (t-1)	0.027^{**}	0.016^{*}	-0.014	-0.019
	(0.010)	(0.009)	(0.013)	(0.013)
Controls	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
R^2	0.398	0.331	0.075	0.082
Num. obs.	294	294	259	259

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

OA.9 Robustness Check: Alternative Periodization

Table OA.5 presents the results using an alternative boom-adjustment cutoff year (2021 instead of 2022). The core findings regarding the regime-dependent nature of fiscal instruments remain robust.

Table 11: Robustness Check with Alternative Market Phase Demarcation (2021)

	Boom Phase (2015-2020)	Adjustment Phase (2021-2024)
Price Change (t-1)	0.08^{**}	0.39^{***}
	(0.04)	(0.04)
General Bond/GDP (t-1)	-0.05	0.06^{**}
	(0.07)	(0.03)
Special Bond/GDP (t-1)	0.02	-0.24^{***}
	(0.17)	(0.05)
LGFV Bond/GDP (t-1)	-0.00	-0.02^{**}
	(0.03)	(0.01)
Land Revenue/Fiscal Revenue (t-1)	-0.08^{***}	0.03^{***}
	(0.01)	(0.00)
Fiscal Self-Sufficiency (t-1)	0.08^{**}	0.01
	(0.03)	(0.02)
Unutilized Debt Capacity (t-1)	0.12	0.29^{***}
	(0.09)	(0.05)
Controls	Yes	Yes
City Fixed Effects	Yes	Yes
Time Fixed Effects	Yes	Yes
R^2	0.22	0.31
Num. obs.	556	983

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$