

## Regional Heterogeneity in Housing Price: Panel Evidence from Korea \*

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This study examines the determinants of regional housing prices in South Korea, focusing on spatial and structural heterogeneity across housing markets. Using monthly panel data for 17 regions from June 2015 to September 2025, it estimates panel regression models with interaction terms based on metropolitan status and long-run housing price growth regimes. The results show that housing-market fundamentals play a central role in price formation. Jeonse prices have a strong and stable positive association with housing prices, while demand-supply conditions also exert a positive average effect. Inflation, mortgage interest rates, and population mobility are likewise associated with housing prices at the national level. In contrast, monthly rental prices are systematically negatively related to housing sale prices, and this negative association is stronger in metropolitan and high-growth regions, consistent with tighter affordability constraints and stronger tenure-substitution effects. Overall, the findings suggest that regional housing price dynamics cannot be explained by a single set of universal determinants but instead reflect market-specific interactions shaped by spatial structure and long-run growth trajectories.

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## 1. INTRODUCTION

Housing in South Korea serves as both a fundamental residential necessity and a significant financial asset, rendering housing prices susceptible to macroeconomic conditions, household borrowing capacity, and institutional arrangements such as the Jeonse lease system. In this context, housing price movements are widely regarded as key indicators of macroeconomic stability and have become a central focus of policy debate. Similar to other advanced economies, housing markets tend to exhibit strong price persistence, expectation-driven behavior, and sluggish adjustment to fundamentals, implying that observed prices may deviate from long-run equilibrium levels and evolve heterogeneously across regions.

Early empirical evidence highlights these characteristics. Deviations from market efficiency and pronounced price inertia are well documented in the seminal work of Case and Shiller (1989). Subsequent theoretical and empirical studies further suggest that housing markets are highly responsive to changes in interest rates, inflation, credit availability, and demographic conditions, which jointly shape housing demand and price expectations (Poterba, 1984; DiPasquale and Wheaton, 1994). This literature establishes housing prices as an important transmission channel through which macroeconomic shocks affect real economic activity.

Since the onset of the COVID-19 pandemic, the Korean housing market has experienced pronounced cyclical fluctuations, highlighting its sensitivity to monetary and financial conditions. In 2020, the Bank of Korea lowered the policy rate to historically low levels as part of its pandemic response, triggering a rapid expansion of mortgage lending and a sharp nationwide increase in housing prices. A broad macroeconomic literature suggests that accommodative monetary policy stimulates housing demand by easing borrowing constraints and reducing the user cost of housing, consistent with the collateral-based transmission emphasized by Iacoviello (2005) and valuation-based mechanisms linking housing prices to financing costs and expected returns (Himmelberg *et al.*, 2005). The subsequent policy reversal further reinforces this sensitivity. Beginning in August 2021, the Bank of Korea entered a tightening cycle, raising the policy rate in multiple steps over 2021-2022, reaching 3.50 percent in early 2023. This shift coincided with a sharp contraction in transaction activity and a gradual deceleration in housing prices. Although policy rates stabilized after mid-2023 and were partially reduced during 2024-2025, borrowing conditions have remained relatively tight compared with the pre-pandemic period, contributing to a delayed recovery in housing market activity.

Recent developments also reveal growing spatial divergence in housing market outcomes. While the Seoul Metropolitan Area (SMA) stabilized earlier and saw partial price recovery, many non-metropolitan regions continue to experience weak transaction volumes, limited liquidity, and persistent price stagnation or declines. This divergence aligns with macro-financial frameworks in which housing prices interact with credit conditions and household balance sheets. In particular, asset price fluctuations may amplify regional business cycle dynamics through collateral and financial accelerator channels, as emphasized by Bernanke and Gertler (1989). Empirical evidence further indicates that house prices, credit conditions, and macroeconomic

activity are closely intertwined over the cycle, suggesting that monetary shocks may propagate unevenly across regions with different structural characteristics (Goodhart and Hofmann, 2008).

A substantial body of research has examined the determinants of housing prices in Korea from macroeconomic, financial, and institutional perspectives. On the demand side, housing prices are influenced by income growth, demographic change, interest rates, and financing conditions, as formalized in the dynamic framework of DiPasquale and Wheaton (1994) and adapted to the Korean context by Kim (2004). Complementing this perspective, financial-oriented studies emphasize the critical role of credit conditions, showing that mortgage expansion and relaxed borrowing constraints are key drivers of housing booms (Glaeser *et al.*, 2013).

Institutional features further distinguish the Korean housing market from those of other economies. Regulatory frameworks and land-use controls have long been recognized as key determinants of housing price formation, with early evidence showing that institutional constraints play an important role in shaping housing market outcomes (Kim *et al.*, 1993). Building on this perspective, subsequent studies emphasize the unique role of the Jeonse system in Korea's housing market, highlighting its influence on market liquidity, tenure choice, and the interaction between rental and ownership markets. Empirical analyses document strong linkages between rental prices and macroeconomic conditions, reflecting the central role of deposit-based leases in transmitting financial and demand-side shocks (Kim *et al.*, 2012). Complementing this evidence, policy-oriented research underscores the historical importance of the Jeonse system in mediating the relationship between rental and transaction markets within Korea's housing finance structure (Kim and Park, 2016).

From an asset-pricing perspective, housing values can also be interpreted through the user-cost framework, which links housing prices to expected capital gains and financing costs (Poterba, 1984). Consistent with this view, empirical evidence from Korea indicates strong interactions among Jeonse prices, transaction volumes, and housing sale prices, particularly in metropolitan areas, suggesting bidirectional spillover between the rental and sales markets over time (Han, 2020; Park, 2023). In addition, policy evaluations indicate that housing market interventions may exert asymmetric and time-varying effects depending on prevailing market conditions and regional regulatory environments (Kim and Kim, 2020).

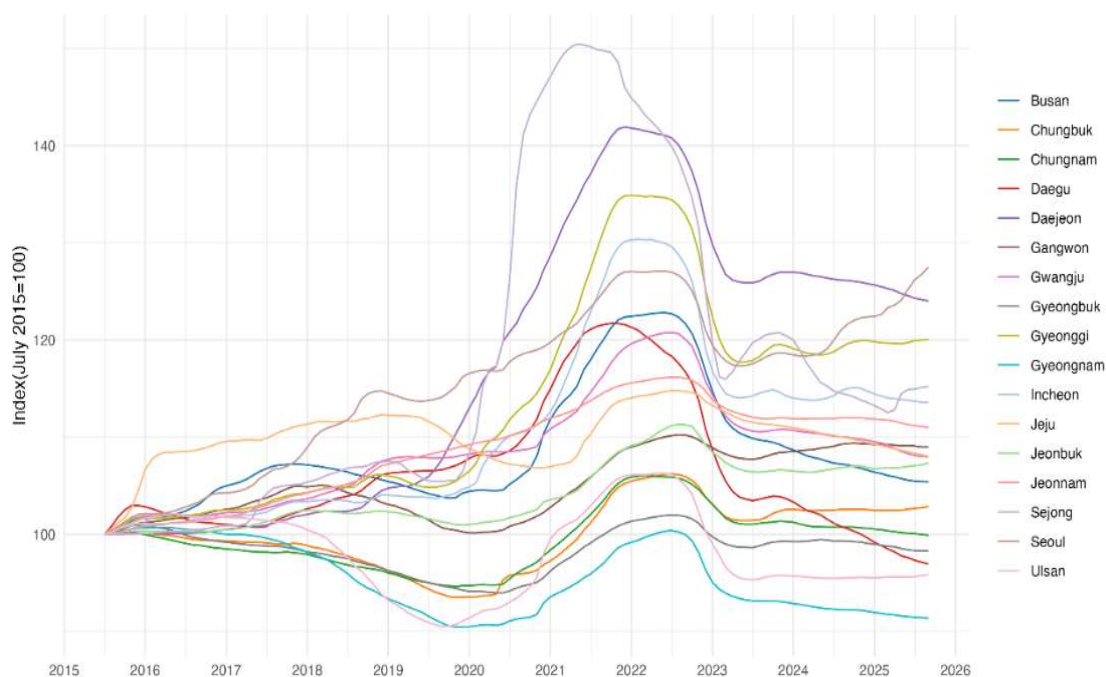
More recently, greater attention has been paid to regional heterogeneity in housing price responses. An expanding body of literature shows that the effects of interest rates, inflation, and mortgage lending conditions vary systematically across market types, particularly between capital and non-capital regions. Empirical studies of local housing markets demonstrate that macroeconomic shocks generate diverse price responses across regions (Han, 2020; Lee and Chai, 2022), a pattern reinforced by differences in regional economic growth and household financial constraints (Lee and Hong, 2023). Within the Korean context, Kim (2011) represents an early and systematic regional panel study that jointly examines purchase prices and Jeonse prices across major cities, showing that while the two price series share similar time-series properties at the national level, they exhibit substantial differences in their cross-sectional structures and form distinct convergence clubs rather than a unified national housing market. Nevertheless, much

of the existing literature relies on national-level data or focuses primarily on the Seoul Metropolitan Area, providing limited comparative evidence across provincial regions.

This study contributes to the literature on housing price dynamics in several important ways. First, it provides a unified monthly panel analysis of regional housing prices in Korea that explicitly accounts for both spatial heterogeneity and long-run growth regimes within a single interaction-based framework. By jointly incorporating metropolitan status and growth-based classifications, the empirical design disentangles geographic effects from bigger structural differences in regional housing price formation. Second, the study documents a robust negative relationship between monthly rental prices and housing sale prices, highlighting the role of affordability constraints and tenure substitution. This aspect has received limited attention in the existing Korean housing literature, which has largely emphasized Jeonse prices or aggregate demand conditions. Third, by allowing the transmission of macroeconomic variables and rental-market mechanisms to vary systematically across market environments, the analysis provides new evidence on how institutional features, macro-financial conditions, and long-run growth trajectories jointly shape regional housing price dynamics in Korea.

To address these limitations, this study constructs a monthly panel dataset covering 17 administrative regions in South Korea from July 2015 to September 2025 and estimates a fixed-effects panel regression model. The empirical framework incorporates macroeconomic indicators — including inflation, mortgage interest rates, and population mobility — alongside housing-market-specific variables such as Jeonse prices, monthly rent, transaction volume, and a demand-supply sentiment index. Interaction terms are introduced to assess whether housing price responses differ systematically between capital and non-capital regions and across long-run growth regimes, thereby providing new evidence on regional heterogeneity in housing market dynamics.

Before proceeding to the empirical analysis, it is helpful to review recent regional housing price trends. Figure 1 presents the indexed housing price series for all 17 regions, normalized to 100 in July 2015. The figure reveals a marked divergence after 2020. Housing prices increased most sharply in Sejong, while the Seoul Metropolitan Area — particularly Seoul, Gyeonggi, and Incheon — also experienced substantial price appreciation during the pandemic-driven expansion, followed by partial correction and stabilization after 2022. In contrast, many non-metropolitan regions recorded more moderate price gains and prolonged periods of stagnation. These patterns underscore the uneven evolution of housing prices across regions, consistent with earlier evidence on regional segmentation in Korea's housing market (Lee *et al.*, 2013).

**Figure 1 Evolution of Regional Housing Price Indices in Korea, 2015-2025**

This study contributes to the literature on housing price dynamics by introducing a structural approach to analyzing regional differences in Korea's housing market. Rather than relying solely on geographic categories, it classifies regions by long-term patterns in housing price growth. It examines how pricing mechanisms vary across spatial and structural dimensions within a unified monthly panel framework. The results show that regional housing price differences are influenced not only by location but also by enduring growth trends that affect the relative importance of rental-market mechanisms, demand-supply conditions, and macroeconomic factors.

Building on this descriptive evidence, the next chapter explains the data sources, how variables are constructed, and the empirical strategy used to determine whether macroeconomic and housing-market factors have systematically different effects across regional housing markets.

## 2. DATA AND ESTIMATION METHOD

### 2.1. Data and Variables

This study uses a monthly panel dataset covering all 17 provincial-level regions in South Korea from June 2015 to September 2025. The dataset includes macroeconomic indicators and housing-market-specific variables relevant to the analysis of regional housing price formation. Most variables are expressed in natural logarithms, while the housing mortgage interest rate is included in level form, and POP is measured as a population mobility rate. This specification facilitates elasticity-based interpretation for the log-transformed variables and enables the analysis to focus on persistent relationships between housing prices and their determinants.

The empirical framework employs panel regression models that exploit variation across heterogeneous regional housing markets while controlling for unobserved, time-invariant regional characteristics. This setting is well-suited to examining cross-regional variation in housing price levels and structural differences in pricing mechanisms.

The dependent variable is the Housing Sale Price Index (SP),<sup>1)</sup> obtained from the Korea Real Estate Board (REB). SP is expressed in logarithmic form so that the analysis focuses on proportional differences in housing prices across regions and allows the estimated coefficients to be interpreted as elasticities. Although housing prices exhibit an overall upward trend during the sample period, substantial regional disparities remain in both price levels and growth trajectories, motivating an empirical framework that explicitly accounts for regional heterogeneity.

The explanatory variables are grouped into macroeconomic indicators and housing-market-specific characteristics. The macroeconomic variables include the Consumer Price Index (CPI), the Housing Mortgage Interest Rate (HMR), and POP, which proxy inflationary pressures, borrowing costs, and demographic demand, respectively. HMR is interpreted as a measure of the financing conditions households face in the housing market. POP is measured as a population mobility rate and is intended to capture migration-related demographic pressures across regions.

The housing-market-specific variables consist of the Jeonse Price Index (JP), the Monthly Rent Index (RP), transaction volume (Q), and a demand–supply balance index (DS). The Jeonse Price Index reflects Korea’s unique lump-sum rental system and is closely linked to housing demand through its implicit role in financing, especially in metropolitan areas (Kim *et al.*, 2012; Kim and Park, 2016). The Monthly Rent Index captures short-term rental costs, while transaction volume serves as a proxy for market liquidity and trading activity. Because Jeonse contracts involve large upfront deposits and implicit financing channels, whereas monthly rent contracts primarily reflect recurring cash-flow obligations, JP and RP capture different segments of the rental market and may therefore exert distinct effects on housing sale prices. The demand–supply balance index (DS), published monthly by the Korea Real Estate Board, is a survey-based diffusion-type indicator of perceived market tightness in the housing sales market.<sup>2)</sup>

Table 1 provides detailed definitions, data sources, and transformation methods for all variables used in the analysis.

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<sup>1)</sup> Both SP, JP, and RP are official housing price indices compiled by the Korea Real Estate Board (REB). These indices are reported as fixed-base indices normalized to 100 in a common base period determined by the statistical authority and are constructed consistently across regions. The sale price index (SP) reflects movements in housing transaction prices, while the Jeonse (JP) and monthly rent (RP) indices are based on newly contracted rental prices. As index measures, they capture relative price dynamics rather than absolute price levels, ensuring comparability across regions and over time. Since the empirical analysis focuses on price changes and relative variations, the specific choice of the base period does not affect the estimation results. The Jeonse (JP) and monthly rent (RP) indices are based on standard Jeonse and monthly rental contracts as defined by the Korea Real Estate Board and do not separately distinguish mixed or semi-Jeonse (banjeonse) arrangements.

<sup>2)</sup> The demand–supply balance index (DS) is the official housing transaction demand–supply indicator published monthly by the Korea Real Estate Board (REB). It is a diffusion-type index constructed from surveys of real estate market professionals and reflects the relative balance between buyers and sellers in the housing sales market. Higher values indicate buyer-dominant market conditions, while lower values indicate seller-dominant conditions. As a sentiment-based indicator, DS captures perceived market tightness rather than actual transaction prices or volumes.

**Table 1 Variable Description**

	Statistic	Source
Dependent Variable	SP: Housing sales price index	REB OPEN API
Explanatory Variables	JP: Jeonse price index	REB OPEN API
	RP: Monthly rent index	REB OPEN API
	Q: Number of real estate transactions	REB OPEN API
	DS: Supply-demand balance index of the housing sales market (survey-based)	REB OPEN API
	CPI: Consumer price index	Bank of Korea OPEN API
	HMR: Housing mortgage interest rates	Bank of Korea OPEN API
	POP: Net migration rate of the regional population	KOSIS

## 2.2. Empirical Strategy and Model Specification

To investigate the determinants of regional housing price dynamics, this study employs a panel regression approach using log-level monthly data.<sup>3)</sup> The baseline econometric model is specified as follows:

$$SP_{i,t} = \alpha + \beta_1 CPI_{i,t} + \beta_2 HMR_{i,t} + \beta_3 POP_{i,t} + \beta_4 RP_{i,t} + \beta_5 JP_{i,t} + \beta_6 DS_{i,t} + \beta_7 Q_{i,t} + \mu_i + \varepsilon_{i,t} \quad (1)$$

Where  $SP_{i,t}$  denotes the natural logarithm of the housing sale price index for region  $i$  at time  $t$ , the term  $\mu_i$  captures region-specific fixed effects that control for unobserved, time-invariant characteristics such as long-term demographic structures, regulatory differences, or spatial market constraints. All variables are specified in natural logarithms, except for the mortgage interest rate (HMR). Coefficients on logged variables can therefore be interpreted as elasticities, while the coefficient on HMR represents a semi-elastic effect.

To assess whether the impacts of key determinants vary across spatial structures, the model is extended to include interaction terms based on a regional classification dummy:

<sup>3)</sup> The empirical specification controls for region-specific fixed effects to account for time-invariant unobserved heterogeneity across regions. Time-fixed effects are not included because several key macroeconomic variables vary primarily at the national level and capture common time-varying influences across regions. As a result, aggregate unobserved factors are at least partially absorbed by these national-level variables, allowing the analysis to retain the economic interpretation of the macroeconomic coefficients.

$$SP_{i,t} = \alpha + \sum_{k=1}^7 \theta_k X_{k,i,t} + \theta_8 D_{SMA,i} + \sum_{k=1}^7 \gamma_k (D_{SMA,i} \cdot X_{k,i,t}) + \mu_i + \varepsilon_{i,t} \quad (2)$$

Where  $D_{SMA,i} = 1$  if region  $i$  belongs to the Seoul Metropolitan Area (Seoul, Gyeonggi, Incheon), and 0 otherwise.  $X_{k,i,t}$  denotes the set of seven explanatory variables included in the baseline specification. The interaction terms ( $D_{SMA,i} \cdot X_{k,i,t}$ ) allow the marginal effects of macroeconomic and housing-market variables to differ between metropolitan and non-metropolitan regions, thereby explicitly capturing spatial heterogeneity in housing price responsiveness.

To further examine whether the responsiveness of housing price determinants varies across market environments with different long-term growth patterns, an additional interaction specification is estimated by introducing a dummy variable to distinguish between high- and low-growth regions. This classification is based on cumulative changes in housing prices over the sample period, with the national average serving as the cutoff. The resulting specification is:

$$SP_{i,t} = \alpha + \sum_{k=1}^7 \theta_k X_{k,i,t} + \theta_8 D_{high,i} + \sum_{k=1}^7 \gamma_k (D_{high,i} \cdot X_{k,i,t}) + \mu_i + \varepsilon_{i,t} \quad (3)$$

Where  $D_{high,i} = 1$  for regions whose average growth rate of the housing sale price index over the sample period from July 2015 to September 2025 exceeds the national mean, and 0 otherwise. The national mean is defined as the cross-regional average of region-specific mean monthly growth rates in the housing sale price index, computed over the full sample period. This growth-based classification distinguishes regions characterized by persistently higher average price growth from those with more moderate long-term price dynamics, rather than reflecting administrative or geographic boundaries.

Given the strong possibility that unobserved regional characteristics are correlated with housing market fundamentals, all models are estimated using a fixed-effects specification. Hausman test results are consistent with this choice, particularly for models with metropolitan-area interactions, suggesting that the random-effects assumption is unlikely to hold in metropolitan housing markets.

### 3. ESTIMATION RESULTS

#### 3.1. Descriptive Statistics

Table 2 reports descriptive statistics for the transformed variables used to capture short-run changes in the main housing-market and macroeconomic indicators. Most variables in this table are expressed as first differences of natural logarithms, scaled by 100, so that they can be interpreted as approximate monthly percentage changes rather than levels. The mortgage interest rate (HMR) is reported as a level, while POP is measured as a population mobility rate.

Although the panel regressions are estimated using log-level variables, the transformed series in Table 2 are reported to show the short-run direction and variability of changes and to make

dispersion more comparable across regions and variables measured on different scales. Because first differencing removes the initial observation from each regional time series, the number of observations in Table 2 is slightly smaller than that in the regression sample.

**Table 2 Descriptive Statistics (National-Level, Log-Differenced Data)**

Variable	Mean	Max	Min	Sd.	Obs.
SP	0.060	7.409	-5.130	0.547	2,091
JP	0.015	5.965	-4.970	0.615	2,091
RP	0.019	3.711	-3.521	0.221	2,091
DS	-0.071	22.871	-22.456	3.067	2,091
Q	-0.351	165.444	-151.170	21.740	2,091
CPI	0.171	1.057	-0.747	0.339	2,091
HMR	0.008	0.440	-0.320	0.107	2,091
POP	0.016	2.448	-0.962	0.221	2,091

To analyze structural differences across regional housing markets, the study adopts two complementary classification schemes. First, it distinguishes the Seoul Metropolitan Area (SMA) from non-SMA regions. The SMA includes Seoul, Gyeonggi, and Incheon, which together form the country's most integrated metropolitan housing market. In contrast, the remaining fourteen regions are classified as non-SMA areas, where housing market dynamics tend to be more heterogeneous.

Second, the study introduces a growth-based regional classification to capture differences in long-run housing price trajectories. Specifically, monthly housing price growth is calculated as the first difference of the log of the Housing Sale Price Index, and the average monthly growth rate is then computed for each region over the sample period. Regions whose average housing price growth exceeds the overall cross-regional mean are classified as high-growth regions, while the remaining regions are classified as low-growth regions. This classification is intended to identify structural differences in housing price formation associated with long-run growth performance rather than geographic location alone.

Rather than presenting separate descriptive statistics for each region, these differences are examined empirically through dummy variables and interaction terms in the regression models. This approach enables a systematic evaluation of whether key factors, such as price indicators, demographic pressures, and financial conditions, exert differential effects across regional market structures and long-run growth regimes. The regional classifications thus provide the analytical basis for the subsequent empirical analysis.

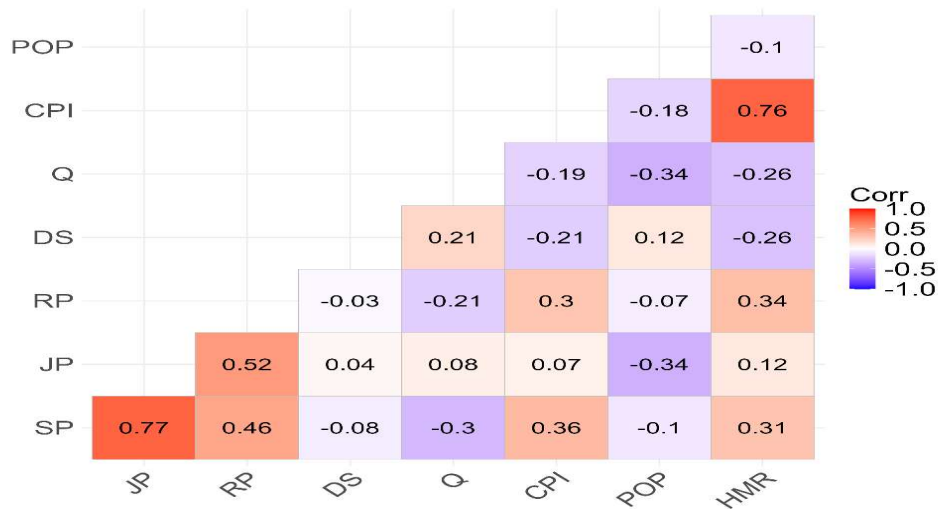
### 3.2. Correlation Matrix and Multicollinearity Check

In addition to descriptive statistics, pairwise correlations are calculated to provide an initial overview of the linear relationships among the variables. This diagnostic step helps assess the

extent of comovement among key macroeconomic and housing-market indicators and serves as a preliminary check for potential multicollinearity before conducting the panel regression analysis.

Figure 2 presents the correlation matrix for the variables used in the baseline analysis. The Housing Sale Price Index (SP) is most strongly correlated with the Jeonse Price Index (JP) (0.77), indicating a close linkage between transaction prices and lump-sum rental contracts. SP also exhibits a moderate correlation with the Monthly Rent Index (RP) (0.46), suggesting meaningful interactions between ownership and rental market dynamics.

**Figure 2 Correlation Matrix (Log-Transformed Data)**



Among macroeconomic indicators, SP shows weak-to-moderate correlations with the Consumer Price Index (CPI) (0.36) and the housing mortgage interest rate (HMR) (0.31), suggesting that inflation and financing conditions co-move with housing prices but are unlikely to be the sole drivers of price fluctuations. The correlation between CPI and HMR is relatively high (0.76), consistent with standard monetary transmission mechanisms.

Overall, the correlation patterns indicate economically meaningful linkages between the housing market and macroeconomic variables, with no evidence of severe multicollinearity at the pairwise level. Since pairwise correlations capture only unconditional linear relationships and do not account for regional heterogeneity or dynamic adjustment, a multivariate panel regression framework is required, as developed in the next section.

### 3.3. Baseline Panel Regression Results

Table 3 reports the baseline panel regression results based on log-level specifications. The estimates indicate that housing-market fundamentals play a dominant role in shaping regional housing price levels, with powerful effects arising from rental-market dynamics.

Among housing-market-specific variables, the Jeonse Price Index (JP) emerges as a key determinant of housing sale prices. The estimated elasticity is close to unity, implying that a 1%

increase in Jeonse prices is associated with a nearly 1% increase in housing transaction prices. This near one-for-one pass-through highlights the central institutional role of the Jeonse system in Korea, where lump-sum rental deposits function not only as a tenure arrangement but also as an implicit financing channel that tightly links the rental and ownership markets.

By contrast, monthly rent (RP) exhibits a sizeable and statistically significant negative relationship with housing prices. A 1% increase in monthly rent is associated with a 0.36% decline in housing sale prices. Rather than necessarily signaling stronger housing demand or tighter fundamentals, rising monthly rents may reflect a tenure-substitution mechanism associated with liquidity and credit constraints. Unlike Jeonse contracts, which involve large upfront deposits that can be partially recovered and often serve as a stepping stone toward homeownership, monthly rent constitutes a recurring flow cost that reduces households' disposable income and savings capacity. As monthly rental burdens rise, households may face greater difficulty accumulating down payments and meeting mortgage obligations, thereby delaying or discouraging transitions to owner-occupied housing. In this sense, higher monthly rents are likely to weaken effective purchase demand and place downward pressure on housing prices, even when rental-market conditions tighten.

This interpretation aligns closely with the housing tenure choice and household finance literature, which emphasizes the role of cash-flow constraints, borrowing frictions, and affordability considerations in shaping the rent-buy decision (Poterba, 1984; Ortalo-Magné and Rady, 2006; Campbell and Cocco, 2007; Genesove and Mayer, 2001). Within this framework, rental price increases driven by affordability pressures may decouple rental and ownership markets, generating a negative correlation between monthly rents and house prices. This mechanism is particularly relevant in the Korean institutional context, where the coexistence of Jeonse and monthly rental contracts implies that rising monthly rents are more likely to capture financial stress and constrained access to homeownership than an expansion of housing service demand.

Beyond rental-market mechanisms, indicators of market conditions also play an important role. The demand-supply sentiment index (DS) is positively associated with housing prices, suggesting that more optimistic market expectations and perceived market tightness translate into higher prices. In contrast, transaction volume (Q) shows a small but negative relationship with prices, indicating that periods of unusually high trading activity may be followed by mild price adjustments consistent with short-term overheating or reversal dynamics.

Macroeconomic fundamentals further contribute to regional variation in housing prices. Inflation (CPI) is strongly positively associated with housing prices, supporting the view that housing assets serve as an effective hedge against inflation. POP, measured as a population mobility rate in its original form, also exerts a significant positive effect, suggesting that stronger migration-related inflows generate meaningful demand pressure in regional housing markets.

Finally, higher housing mortgage interest rates (HMR) are associated with lower housing prices, consistent with standard theoretical predictions that rising borrowing costs suppress housing demand and place downward pressure on prices.

**Table 3 Baseline Panel Regression Result**

	Dependent variable: <i>SP</i>
	SP
RP	-0.360*** (0.030)
JP	0.987*** (0.013)
DS	0.024*** (0.006)
Q	-0.026*** (0.002)
CPI	0.459*** (0.015)
POP	3.868*** (0.450)
HMR	-0.012*** (0.002)
Constant	
Observations	2,108
$R^2$	0.823
Adjusted $R^2$	0.821
$F$ -Statistic	1,388.132*** (df = 7; 2084)

Note: \* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

Overall, the baseline model demonstrates strong explanatory power, with housing-market fundamentals and macroeconomic conditions jointly accounting for a substantial share of regional variation in housing prices. The following section examines whether these relationships differ systematically across regional housing markets by introducing interaction-based specifications.

### 3.4. Regional Heterogeneity: Seoul Metropolitan Area Dummy

Table 4 reports the panel regression results with interaction terms between key explanatory variables and the Seoul Metropolitan Area (SMA) dummy. The estimates reveal pronounced spatial heterogeneity in how macroeconomic conditions and housing-market mechanisms are capitalized into regional housing price levels.

Among macroeconomic variables, the overall price level has a notably stronger influence on metropolitan housing markets. In regions outside the SMA, a 1% rise in CPI is associated with a 0.36% increase in housing prices. Conversely, this relationship is significantly stronger in the SMA: combining the baseline and interaction effects suggests that a 1% increase in CPI leads to approximately a 1.10% increase in housing prices in metropolitan areas. This indicates that

inflation-driven price pressures are incorporated into housing values to a greater degree in metropolitan core markets. Consistent with the asset-pricing literature, housing prices in dense, supply-limited urban areas tend to be more responsive to inflationary trends, as housing in these markets functions more like a financial asset rather than a purely consumption good (Piazzesi *et al.*, 2007; Goodhart and Hofmann, 2008; Gyourko *et al.*, 2013).

Demographic effects vary significantly across regions. In non-metropolitan areas, POP, defined as a population mobility rate, is strongly and positively associated with housing prices, suggesting that population inflows are associated with stronger housing demand and price pressures. Conversely, this relationship is reversed in the Seoul Metropolitan Area when metropolitan-specific dynamics are taken into account. This pattern indicates that population inflows into the SMA are less likely to result in proportional increases in housing prices and are instead absorbed through adjustments in housing density, increased reliance on rental markets, or changes in tenure structure, rather than through sustained appreciation in owner-occupied housing values.

Housing-market mechanisms show clear spatial differences through the rental channel. In areas outside the SMA, higher monthly rents are associated with lower housing prices: a 1% rise in rent corresponds to a 0.52% drop in housing prices. This negative relationship is much stronger in metropolitan areas. After including the interaction effect, a 1% increase in monthly rent within the SMA is associated with housing prices that are roughly 0.90% lower. This magnitude suggests that rising rental burdens are more likely to erode households' purchasing capacity in high-cost urban markets, where affordability is more constrained, thereby suppressing effective demand for owner-occupied housing rather than being capitalized into higher prices.

The interaction estimates indicate that sentiment effects are markedly attenuated in metropolitan areas. Specifically, while a 1% increase in sentiment is associated with about a 0.029% increase in housing prices outside the SMA, the implied association in the SMA becomes  $-0.036\%$  once the interaction effect is incorporated, implying a metropolitan-non-metropolitan difference of roughly 0.065%. This muted response is consistent with greater inertia and structural rigidity in metropolitan housing markets, where price levels are shaped more by long-run constraints and affordability conditions than by short-term shifts in market sentiment.

By contrast, transaction activity serves a different function in metropolitan housing markets. Outside the SMA, higher transaction volumes are linked to only slight price changes. In metropolitan areas, however, this negative correlation is significantly weakened. The interaction effect suggests that the price impact of transaction volume is roughly 0.017 percentage points greater in SMA regions than in non-SMA regions, yielding a net effect close to zero. This pattern aligns with stronger liquidity effects and potentially more noticeable speculative activities in dense urban markets.

**Table 4 Panel Regression with Seoul Metropolitan Area Dummy Interactions**

	Dependent variable:
	SP
CPI	0.357*** (0.014)
HMR	-0.006*** (0.002)
POP	3.335*** (0.398)
JP	0.997*** (0.012)
RP	-0.521*** (0.029)
DS	0.029*** (0.006)
Q	-0.019*** (0.002)
SMA	
CPI*SMA	0.747*** (0.047)
HMR*SMA	-0.003 (0.005)
POP*SMA	-9.314*** (2.273)
JP*SMA	0.041 (0.036)
RP*SMA	-0.378*** (0.109)
DS*SMA	-0.065*** (0.023)
Q*SMA	0.017*** (0.006)
Observations	2,108
$R^2$	0.871
Adjusted $R^2$	0.869
$F$ -Statistic	998.008*** (df = 14; 2077)

Note: \* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

Finally, the relationship between Jeonse prices and housing sale prices remains remarkably stable across different regions. In both urban and rural areas, changes in Jeonse prices are almost directly reflected in housing prices. A 1% increase in Jeonse prices is associated with a nearly proportional rise in housing prices, with little variation across regions. This consistency highlights the institutional role of the Jeonse system as a nationwide financing tool that closely links rental and ownership markets nationwide.

Overall, the results in Table 4 show that spatial heterogeneity in Korea's housing price dynamics reflects not only differences in rental-market mechanisms but also fundamentally different channels through which macroeconomic and demographic conditions are incorporated into housing values across regions. While inflation-related price-level factors and rental-market pressures play a particularly significant role in metropolitan housing markets, demand effects driven by population changes are noticeably weaker. These findings emphasize the importance of considering regional market structures when analyzing factors influencing housing prices and support the subsequent examination of heterogeneity in long-term housing price growth patterns.

### 3.5. Regional Heterogeneity: Growth-Based Area Dummy Interactions

While the SMA-based specification focuses on spatial heterogeneity associated with metropolitan status, the growth-based model examines whether housing price dynamics also differ systematically across regions with distinct long-run price trajectories, independent of geographic location. Table 5 reports the estimation results from this growth-based interaction specification.

In this model, the baseline coefficients capture the marginal associations for low-growth regions ( $high = 0$ ). In these regions, housing-market fundamentals remain the primary drivers of housing prices. Jeonse prices play a central role: a 1% increase in the Jeonse Price Index is associated with housing prices approximately 0.88% higher, indicating that Jeonse dynamics continue to anchor price formation even in markets with relatively modest long-run growth. By contrast, monthly rent is negatively associated with housing prices: a 1% increase in monthly rent is associated with housing prices about 0.24% lower, suggesting that rising rental burdens weaken effective housing demand by constraining household cash flow and purchasing power.

This pattern is consistent with the structure of low-growth housing markets, in which price appreciation is limited, owner-occupied demand predominates, and speculative or investment-driven motives are relatively subdued. In such environments, increases in monthly rents primarily reflect affordability pressures rather than strengthening demand, thereby hindering households' ability to transition into homeownership and exerting downward pressure on housing prices.

Market conditions also matter in low-growth areas. Demand-supply sentiment is positively linked to housing prices: a 1% rise in sentiment leads to about a 0.04% increase in housing prices, showing that perceived market tightness supports prices even in regions with slow long-term growth. Meanwhile, transaction volume has a small but notable effect on prices: a 1% rise in

transaction volume typically results in a 0.02% drop in housing prices, reflecting mild price adjustments after times of increased market activity.

Among macroeconomic variables, both the general price level and POP, measured as a population mobility rate, have positive and statistically significant effects on housing prices in low-growth regions. Conversely, the baseline effect of the mortgage interest rate is not statistically significant, suggesting that financing costs are not a primary factor driving housing price changes in these markets.

The interaction terms offer clear evidence of growth-related differences in how housing prices respond. Housing prices in high-growth areas react more strongly to inflation-related price changes. The positive and highly significant interaction between CPI and the high-growth dummy indicates that an increase in the overall price level leads to a much larger rise in housing prices in high-growth areas than in low-growth areas. Likewise, the interaction between Jeonse prices and the high-growth dummy shows a stronger connection from Jeonse prices to housing prices: a 1% increase in Jeonse prices results in an additional 0.11% rise in housing prices in high-growth regions, compared to low-growth regions.

In contrast, rental-market pressures have a disciplining effect in high-growth areas. The negative and highly significant interaction between monthly rent and the high-growth indicator indicates that, in such regions, a 1% rise in monthly rent is associated with an additional 0.46% drop in housing prices. This finding suggests that even in markets with strong price momentum, increasing rental costs can slow further price gains by making housing less affordable and reducing the number of marginal buyers.

Consistent with this interpretation, the interaction between demand-supply sentiment and the high-growth dummy is negative and statistically significant only at the 10% level, suggesting that housing prices in high-growth regions are less sensitive to short-term sentiment fluctuations and increasingly shaped by structural and longer-term forces.

Among macro-financial variables, the interaction between the mortgage interest rate and the high-growth dummy is negative and highly significant, indicating that increases in borrowing costs suppress housing prices more strongly in regions experiencing rapid long-run growth. By contrast, the interaction terms involving population growth and transaction volume are not statistically significant, suggesting that the marginal effects of these variables do not differ systematically across growth regimes.

**Table 5 Panel Regression with Growth-Based Area Dummy Interactions**

	Dependent variable:
	SP
CPI	0.239*** (0.022)
HMR	-0.002 (0.002)
POP	3.350** (1.420)
JP	0.882*** (0.026)
RP	-0.244*** (0.039)
DS	0.041*** (0.009)
Q	-0.024*** (0.004)
high	
CPI*high	0.458*** (0.030)
HMR*high	-0.013*** (0.003)
POP*high	1.884 (1.492)
JP*high	0.113*** (0.030)
RP*high	-0.461*** (0.058)
DS*high	-0.025* (0.013)
Q*high	0.002 (0.005)
Constant	
Observations	2,108
$R^2$	0.848
Adjusted $R^2$	0.846
$F$ -Statistic	829.104*** (df = 14; 2077)

Note: \* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

Table 5 shows that long-run growth regimes capture structural differences in price formation beyond metropolitan status, particularly through stronger inflation and interest-rate sensitivity, tighter rental affordability constraints, and stronger transmission from Jeonse prices to housing prices in high-growth regions.

Overall, the results from the SMA-based interaction model and the growth-based specification indicate that housing price responses differ systematically across regions. While the SMA interactions capture heterogeneity associated with metropolitan status, the growth-based interactions reveal an additional dimension of heterogeneity linked to long-run housing price trajectories that is not fully accounted for by geographic location alone.

Across both specifications, rental-market mechanisms, particularly monthly rent dynamics, emerge as one of the most salient sources of regional heterogeneity. This finding underscores the central role of affordability constraints and tenure choice in shaping regional housing price responses. Variation in demand-supply sentiment also contributes to regional differences; however, this channel appears primarily associated with spatial heterogeneity in metropolitan markets and is comparatively weaker and less systematic across growth-based regimes.

The interaction estimates further suggest that macroeconomic and financial variables are transmitted heterogeneously across regional contexts. Inflation-related price pressures exert a more decisive influence in both metropolitan areas and high-growth regions, consistent with heightened sensitivity to macroeconomic conditions in markets characterized by tighter supply constraints or sustained price appreciation. By contrast, heterogeneity in interest-rate sensitivity is more closely linked to long-run growth regimes than to geographic location, with borrowing costs exerting a more pronounced dampening effect in high-growth regions.

Taken together, the SMA- and growth-based interaction models suggest that a single set of universal determinants cannot summarize regional housing price dynamics in Korea. Instead, the observed heterogeneity reflects the joint role of spatial market structure, long-run growth trajectories, and institutional rental-market mechanisms in shaping how macroeconomic and housing-market conditions are capitalized into housing prices.

#### 4. CONCLUSION

This study examines the determinants of regional housing sale prices in Korea using a monthly panel regression framework, with a particular emphasis on spatial and structural heterogeneity across housing markets. By incorporating interaction terms based on metropolitan status and long-run housing price growth regimes, the analysis allows the transmission of macroeconomic variables and housing-market fundamentals to vary systematically across market environments, providing a unified framework for distinguishing geographic effects from deeper structural differences in regional housing price formation.

The baseline results confirm that housing-market fundamentals significantly contribute to regional differences in housing prices. Jeonse prices stand out as a key factor, highlighting the

institutional importance of the Jeonse system as a vital link between rental and ownership markets. Demand-supply conditions also have a strong positive effect, while inflation, mortgage interest rates, and POP, measured as a population mobility rate, show meaningful average impacts at the national level.

Notably, the interaction results reveal heterogeneity that would be hidden in a homogeneous panel framework. Spatial interactions indicate that housing prices in the Seoul Metropolitan Area are more sensitive to inflationary pressures and less responsive to short-term demand-supply sentiment, consistent with greater market inertia in dense urban environments. At the same time, the negative relationship between monthly rents and housing prices is significantly strengthened in metropolitan areas, highlighting the role of affordability constraints in shaping effective housing demand.

Beyond geographic distinctions, classifying regions by long-run housing price growth uncovers an additional layer of structural heterogeneity. High-growth regions exhibit price dynamics that cannot be fully explained by metropolitan status alone. In these markets, housing prices respond more strongly to macro-financial conditions, and the transmission from Jeonse prices to housing prices also strengthens. At the same time, rental-market pressures exert a pronounced disciplining effect, suggesting that financing constraints and tenure dynamics play a key role in sustaining regional price divergence over time.

Overall, the findings underscore the importance of allowing for heterogeneous transmission mechanisms in empirical housing market analysis. By jointly accounting for spatial structure and long-run growth regimes, this study demonstrates that a single set of universal determinants cannot adequately characterize regional housing price dynamics in Korea; rather, these dynamics reflect market-specific interactions among institutional arrangements, macroeconomic conditions, and long-run growth trajectories.

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