The Expectation Channel of Mortgage Policy

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Abstract

Mortgage-borrowing restrictions, including caps on loan-to-value (LTV) and payment-to-income (PTI) ratios, are widely understood to affect housing markets by tightening or relaxing household credit constraints. This paper shows that these policies also shape housing market outcomes by altering homebuyers' expectations. I study a major relaxation of LTV/PTI limits in South Korea in 2014, which signaled that the government would take a more supportive stance toward the housing market. After the reform, the strongest price increases occurred in areas where the borrowing limits were of limited importance but where house prices were sensitive to shifts in expectations. In these areas, homebuyers became more optimistic and engaged in speculative home purchases. Some of this activity was financed through interest-free, peer-to-peer lending that was not subject to formal credit regulations. Taken together, the findings show that mortgage policies influence housing markets not only through their direct, mechanical effects on credit constraints but also by shaping how homebuyers form expectations about future conditions.

Keywords: Housing Markets, Expectations, Macroprudential Policy, Mortgage Credit, Shadow Banking

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I Introduction

Economic policies are characterized not only by their technical parameters, such as interest rates or regulatory credit limits, but also by the signals they send to markets that shape expectations directly. These signals can influence how economic agents interpret the policy environment and form beliefs about future economic conditions. Housing markets can be especially responsive to such signals because home purchases involve forward-looking decisions, long-lived assets, and substantial leverage. As a result, policies that appear similar in their mechanical design may generate different market responses depending on how they are interpreted by households.

Regulations on household borrowing limits provide a natural example. These regulations include caps on loan-to-value (LTV) and payment-to-income (PTI) ratios and are commonly used across countries to manage household leverage and promote financial stability (Cerutti et al. (2017a,b)). However, despite their widespread use, these policies are typically viewed as operating primarily through credit constraints, with changes in borrowing limits transmitted mechanically to outcomes such as household borrowing and house prices (Acharya et al. (2022); Greenwald (2018); Tzur-Ilan (2023)). This interpretation partly reflects the empirical difficulty of capturing the direct effect of such policies on expectations, which can influence market outcomes in their own right. In practice, borrowing-constraint policies often modify credit constraints and, in doing so, shape expectations, making it difficult to assess how expectations affect housing market outcomes apart from the effects of changes in borrowing limits.

This paper attempts to address these empirical challenges by exploiting a unique setting in South Korea. In this setting, a borrowing-constraint policy conveyed a signal about the government's stance toward the housing market, and credit-constrained areas diverged from those responsive to this signal, thereby making it possible to observe how policy-shaped expectations affect household borrowing and house prices. More specifically, this paper studies a major relaxation of LTV/PTI limits in Korea in 2014. In July of that year, the authorities relaxed these caps to unprecedented levels and announced that the policy was intended to stimulate the housing market, signaling a more accommodative stance toward housing booms and speculative activity. Following this reform, mortgage credit expanded and house prices rose in areas where these caps had been binding, consistent with the conventional credit-constraints channel. However, even larger price increases occurred in regions where credit constraints played only a limited role but where house prices were sensitive to shifts in expectations. These expectation-sensitive areas had previously experienced pronounced booms and had developed extrapolative beliefs that were later dampened by sustained policy interventions. The 2014 relaxation renewed these beliefs and triggered a surge in speculative buy-to-let activity. A notable feature of this episode is that part of this speculative activity was financed through interest-free peer-to-peer lending. Because these loans lie outside formal credit regulations, including the LTV/PTI policies, they are unrelated to changes in homebuyers' credit constraints. Thus, this pattern suggests that housing demand in these areas was driven primarily by shifts in expectations rather than by changes in borrowing limits.

The key feature of the 2014 reform is that it marked a sharp departure from previous borrowing-constraint regulations, which had been implemented countercyclically in response to local housing and credit conditions. Despite generally robust housing markets at the time, the reform raised LTV/PTI limits to unprecedented levels nationwide rather than locally, triggering a broad expansion in mortgage credit (Figures 1(a) and 1(b)). Furthermore, being explicitly framed as a housing market stimulus rather than a passive countercyclical adjustment, it lifted house price expectations across the country (Figure 1(c)). This expectations shock materialized even in regions where borrowing constraints were less binding. This context therefore makes the 2014 reform a particularly suitable setting for examining how expectations shape house prices in areas where changes in credit constraints played a limited role.

To study the impact of the 2014 reform on mortgage credit and house prices, I combine loan-level mortgage data, a unique high-frequency weekly house price index, and records on Korea's past policy interventions to curb housing booms, which offer a distinctive way to trace how expectations respond to policy changes and in turn affect house prices. I implement a difference-in-differences (DiD) framework that exploits cross-sectional variation in the extent to which city districts—the smallest geographic unit for housing market regulations—were exposed to the reform.

Exposure to the policy takes two forms. First, constraint exposure measures how tightly city districts had been constrained by LTV/PTI caps before the reform. Using pre-reform mortgage origination data, I calculate the share of loans issued within two percentage points below the prevailing regulatory caps. Loans clustered in this range were effectively constrained by regulations, so districts with larger near-cap shares were more credit constrained. Thus, they are more likely to experience mortgage expansion and housing booms once the caps were relaxed, making them constraint-sensitive areas.

Second, the signal exposure measure captures the extent to which price expectations and house prices are influenced by policy signals about the government's stance toward housing booms. The measure draws on the history of "Speculation Area" designations, a unique Korean policy instrument used to curb speculative housing booms before 2012. Districts placed under this designation experienced rapid price increases prior to designation, implying that homebuyers likely formed higher house price expectations, as past asset returns are known to shape future price beliefs (Greenwood and Shleifer, 2014; Barberis et al., 2015). Prices slowed immediately after the designation because it triggered stricter borrowing rules and higher property tax rates. The muted price responses around de-designation, however, suggest that extended periods of designation persistently dampened house price expectations, consistent with the mechanism proposed by Chi et al. (2024). As a result, longer designation histories implied more deeply suppressed expectations, leaving these districts primed for the strongest rebound if the 2014 reform—explicitly framed as a housing market stimulus—revived beliefs. This makes the duration of designation a policy-based proxy for the expectations channel of the 2014 mortgage policy and helps identify areas that were sensitive to this channel.

Evidence based on the constraint exposure measure shows that the policy operated through a conventional credit-constraint channel by expanding access to mortgage credit for credit-constrained borrowers. Specifically, the DiD estimates reveal a pronounced increase in mortgage origination in districts where LTV/PTI caps had been most binding prior to the reform.

However, I subsequently document a more striking pattern: while house prices jumped across all districts, including constraint-sensitive ones, they surged most in expectation-sensitive areas. In particular, using *weekly* house price data, I show that prices in these districts began diverging almost immediately after the July 2014 announcement—*even before* the new lending rules took effect.

Further evidence supports the expectations channel. Survey data show that house price expectations rebounded more sharply in expectation-sensitive districts, and housing transaction records reveal a corresponding surge in speculative buy-to-let purchases in these areas. Interestingly, a notable portion of this activity was financed through an informal peer-to-peer credit arrangement known as the Chonsei contract. Under this contract specific to South Korea tenants provide a large, interest-free loan to landlords in lieu of monthly rent for the duration of the tenancy. This financing mechanism is particularly informative because the Chonsei contract is not governed by formal credit policies, including LTV/PTI regulations, and was therefore unaffected by the credit-constraint changes induced by the 2014 reform. Moreover, tenants' outside option of a standard monthly-rental contract and their utility from housing services remained essentially unchanged around the reform, leaving tenants little reason to supply more credit than usual during this period. Taken together, the rise in Chonsei-financed buy-to-let activity is more naturally interpreted as expectations-driven housing speculation rather than a response to changes in credit constraints or an expansion in credit supply.

Reflecting this speculative activity, homeownership rates declined in expectation-sensitive areas relative to other districts. Moreover, subsequent policy changes in 2018 further reinforce this finding. When the government raised property taxes on non-primary residences to discourage speculative ownership in 2018, many multiple-homeowners responded by transferring properties to their children. This form of tax avoidance was disproportionately concentrated in expectation-sensitive areas, suggesting that speculative demand had been particularly strong in those markets since the 2014 mortgage policy.

A series of robustness exercises provide additional perspective on whether the 2014 house price surge may have reflected factors such as macroeconomic shocks or local conditions other than the borrowing-constraint reform. First, monetary policy does not appear to account for the timing or the cross-sectional pattern of the price response. Although the Bank of Korea lowered its policy rate in August 2014, house prices began to diverge immediately after the July 24 announcement, which precedes the rate change by several weeks. Moreover, expectation-sensitive districts do not seem to have been differentially responsive to interest rate movements in earlier periods. Local projection estimates indicate that monetary policy tends to affect house prices only with a considerable lag, and additional analyses suggest that expectation-sensitive areas do not display a stronger response to rate changes than other districts.

A related exercise further examines whether expectation-sensitive areas might have overlapped with areas where the informal peer-to-peer lending market known as the Chonsei market is more prevalent. Prior work suggests that districts with greater use of Chonsei financing tend to be more responsive to interest-rate movements (Jing et al., 2024), so any overlap could make the post-reform pattern appear more closely tied to monetary policy than to expectations. To assess this possibility, a horse-race specification includes both the expectation-sensitivity measure and a measure of historical buy-to-let activity financed through the Chonsei market. The results indicate that the post-reform price response aligns more closely with expectation sensitivity, while the Chonsei-related measure provides only limited explanatory power. This pattern thus suggests that expectation-sensitive areas did not substantially overlap with historically Chonsei-prevalent districts and that the price surge in these areas was unlikely to have been driven by rate changes transmitted through the Chonsei market. The evidence also appears inconsistent with a pure market-segmentation mechanism in which informal credit persistently and mechanically flowed into historically Chonsei-intensive districts and generated the post-2014 housing boom.

Local housing supply conditions also do not seem to explain the sharper boom in expectation-sensitive areas. Before the reform, building permits had already been trending upward in fast-growing districts regardless of their speculative history. Following the reform, permits continued to rise in expectation-sensitive areas, which provides only limited support for the view that tighter supply constraints were responsible for their stronger price response. Finally, re-estimating all main specifications while excluding outlier districts in Seoul yields results that are broadly similar to those from the full sample. Taken together, these exercises suggest that the effects of the 2014 mortgage-policy change are best understood through an expectations-driven channel rather than alternative explanations. More broadly, the findings show that mortgage policies influence housing markets not only through their direct, mechanical effects on credit constraints but also by shaping how homebuyers form expectations about future conditions.

I.A Related Literature and Contribution

This paper contributes to three strands of literature. First, it adds to research on macroprudential policy and its effects on housing credit and prices. While prior studies emphasize the credit channel—how policies affect house prices and price expectations *indirectly* through borrowing constraints and credit availability (Acharya et al., 2022; Chi et al., 2024; Johnson, 2020)—this paper highlights the expectation channel, focusing on how policy signals *directly* shape beliefs, credit demand, and house prices, independent of changes in credit constraints.[1] By exploiting a unique setting in South Korea where constraint- and expectation-sensitive areas diverge and the mortgage policy was explicitly framed as a housing market stimulus, this paper shows that expectation-driven booms can emerge following looser borrowing-constraint policies. To the best of my knowledge, this is the first empirical study to document the expectation effects of borrowing-constraint policies on housing credit and house prices, separately from their effects operating through credit constraints. In doing so, this paper extends survey-based evidence on the effects of macroprudential policy on house price expectations (Kuang et al., 2025); complements work emphasizing beliefs and expectations as key drivers of house prices (Baldauf et al., 2020; Kaplan et al., 2020); and relates to research on the informational role of policy communication (Beutel et al., 2021; Binder et al., Forthcoming; Blinder et al., 2008, 2024; Caballero and Siksek, 2025; MacKay et al., 2016; Woodford, 2001, 2005).

In a related vein, this paper contributes to the literature on how housing-credit demand shapes house prices (Adelino et al., 2016, 2017; Foote et al., 2021). Prior studies emphasize that housing-credit demand—often shaped by rising price expectations—fueled the housing boom preceding the Global Financial Crisis (GFC).[2] This paper builds on that insight but establishes a tighter empirical link between house price expectations and housing-credit demand. It exploits a distinct form of informal peer-to-peer housing credit known as Chonsei credit and shows that mortgage policy triggers housing-credit demand through its effect on expectations. Moreover, because Chonsei credit represents a form of shadow credit that lies outside the formal credit system, the paper highlights the role of shadow credit in housing finance and connects this study to related work (Buchak et al., 2018; Gete and Reher, 2021; Jiang, 2023).

[1] Johnson (2020) show that areas subject to tighter debt-to-income (DTI) policies imposed by Freddie Mac experienced sharp contractions in both credit and house prices, with long-run price patterns consistent with dampened price expectations shaped by credit conditions. Chi et al. (2024) exploit spatially targeted LTV policies in Taiwan to show that local house price growth slowed following stricter policies. They also find that prices in those areas remained stable after the policies were lifted, suggesting persistently subdued expectations. Similarly, Acharya et al. (2022) find that stricter LTV limits in Ireland led to a reallocation of mortgage credit toward less affected groups and regions, triggering price booms in those unaffected segments through those credit changes.

[2] Adelino et al. (2016) and Adelino et al. (2017) document broad mortgage growth across income and credit-score groups before the GFC, suggesting that borrower demand was influenced by rising price expectations. Foote et al. (2021) find that the distribution of mortgage credit and defaults remained stable across income groups before and during the crisis, consistent with shocks to house price expectations. In addition, Ferreira and Gyourko (2023) and Korevaar (2023) show that purchases by high-income households played an important role in the housing boom.

Lastly, this paper contributes to the literature on speculation in housing markets. Similar to recent studies emphasizing the role of speculative investors during housing booms, this paper examines how speculative home purchases affect prices (Bayer et al., 2021; DeFusco et al., 2022; Gao et al., 2020; Mian and Sufi, 2022).[3] However, it differs by showing that mortgage policy can induce speculation by signaling a lenient policy stance toward housing investment. It further demonstrates that this speculation was financed through informal credit *outside* the reach of mortgage regulation, indicating that speculative activity was driven primarily by expectations rather than by policy-induced changes in formal credit availability.

Drawing on these findings, the paper offers two policy implications. First, by emphasizing the informational aspect of mortgage credit policies, it shows that their effectiveness often depends more on the signals they convey than on their technical parameters. This paper views the unique features of the 2014 LTV/PTI relaxation—characterized by a departure from previous intervention patterns and the government's explicit framing of the policy as a housing market stimulus—as a key factor driving the empirical patterns documented in this study. The analysis therefore highlights the importance of communicating policy objectives and trajectories throughout implementation. Second, the paper shows that speculative home purchases can be financed through informal credit outside formal regulatory oversight. This finding thus underscores the limitations of policies that focus narrowly on regulated credit channels and calls for broader, more comprehensive approaches to housing market stabilization.

I.B Outline

This paper is structured as follows. Section II develops a simple conceptual framework that clarifies how policy signals and credit constraints affect housing demand and prices. Section III provides institutional details on the 2014 mortgage policy. Section IV describes the data sources and

[3] Bayer et al. (2021) show that housing speculation spread through social contagion, as novice investors imitated nearby investors and amplified the housing boom. DeFusco et al. (2022) document that short-term investors—those who rapidly resold homes—played a central role in the housing boom-bust, generating excess price and volume fluctuations by trading based on extrapolative expectations. Gao et al. (2020) exploit cross-state variation in capital gains taxes and provide causal evidence that speculative home buying fueled housing booms and deepened subsequent busts. Mian and Sufi (2022) show that exogenous expansion in mortgage credit supply from the rise of private-label securitization in 2003 fueled speculative purchases by leveraged investors, amplifying the housing boom and bust through the interaction of credit and expectations.

outlines the construction of key variables, along with the empirical strategy. Section V presents the main empirical findings. Section VI discusses additional evidence and alternative explanations, including the role of other policies, placebo outcomes, and post-2018 reforms. Finally, Section VII concludes.

II Conceptual Framework

This section presents a simple housing demand model to illustrate how both government policy signals and credit constraints shape equilibrium house prices. The model highlights two channels, which operate independently:

> **Expectations channel**: When the government signals greater tolerance for rising house prices, households revise their expectations upward and become more willing to pay. As a result, new buyers who had previously stayed out of the market but now perceive investment opportunities are drawn in.
>
> **Credit channel**: RRelaxed credit constraints reduce required down payments, enabling previously credit-constrained marginal homebuyers to purchase housing.[4]

In the model, there is a continuum of households i, each choosing whether to buy a house or to save: $H \in \{0, 1\}$, where $H = 1$ denotes purchasing a house. Each household has wealth W_i and an intrinsic valuation of housing b_i. The government sends a signal G, which shifts expectations of future prices $E[P_1 \mid G]$.[5] Preferences are CES:

$$U_i(C, H; G, P) = \Big[(1-\omega)C^{\rho} + \omega\big(\max\{\Theta_i(G, P), 0\}\big)^{\rho} H\Big]^{1/\rho}$$

where

$$\Theta_i(G, P) = b_i + \beta E[P_1 \mid G] - P.$$

[4] This is effectively the same as relaxing the loan-to-value (LTV) ratio. As explained below, the LTV ratio is the main way policy affects house prices in South Korea.

[5] While this formulation is highly stylized, it captures the key mechanism. For example, suppose government credit policies are countercyclical, tightening when house prices rise. If the government signals that it will no longer respond this way, households would revise their expectations about the future trajectory of house prices.

The budget constraint is

$$C_i = W_i - (1 - L)PH \geq 0$$

where $L \in [0, 1]$ is the maximum LTV ratio.

As shown in Appendix A.A and A.B, households in this model have a well-defined, downward-sloping demand schedule. This forms the basis for how reservation prices—and thus equilibrium house prices—respond to government signals and credit constraints. The following propositions formalize these results.

Proposition 1 (Comparative Statics of Reservation Price)**.** *The individual reservation price $p_i(L, G, W_i$ is strictly increasing in both the credit constraint L and the government signal G:*

$$\frac{\partial p_i}{\partial L} > 0, \quad \frac{\partial p_i}{\partial G} > 0.$$

Proof. See Appendix A.C. □

Proposition 2 (Market Equilibrium)**.** *Let housing supply be fixed at $\bar{S} = 1$. Then there exists a unique equilibrium price $P^*(L, G)$ such that aggregate demand equals supply:*

$$\int_0^1 \mathbf{1}\{p_i(L, G, W_i) \geq P^*(L, G)\}\, di = \bar{S}.$$

Moreover, $P^*(L, G)$ is strictly increasing in both L and G.

Proof. See Appendix A.D. □

Taken together, the two propositions show that a policy intervention can shift equilibrium house prices through two distinct channels. First, by relaxing financial constraints (L), the policy allows liquidity-constrained households to enter the market. Second, by signaling a more tolerant government stance toward future price appreciation (G), the policy operates through an expectations channel: households raise their reservation prices, and new buyers who had previously stayed out are drawn into the market. These two channels both increase housing demand and thereby raise house prices when supply is inelastic, as is typically the case in the short run.

With this framework in hand, the next section turns to the 2014 LTV/PTI relaxation, which provides a unique setting to compare the two channels.

III Institutional Background: 2014 LTV/PTI Relaxation

Since their introduction, Korean regulators have adjusted LTV/PTI limits in response to local credit conditions and house prices.[6] While these adjustments were frequent and often localized, the reform announced on July 24 and implemented on August 1, 2014 (Table I) marked a sharp departure from earlier policies.

The 2014 relaxation provides a unique setting to study how policy-induced changes in expectations can affect house prices independently of credit supply for three reasons. First, unlike earlier adjustments that applied only to specific city districts, the 2014 relaxation was implemented nationwide. This design thus makes it possible to distinguish two sets of areas: those where house prices responded mainly to credit conditions, and those where price expectations played a larger role. By comparing house price changes across these areas, one can directly test the relative importance of the credit and expectation channels.

Second, unlike earlier policies that first tightened LTV/PTI limits during local housing booms and then relaxed them back to their original levels, the 2014 reform broke from this pattern. It was the first to raise limits beyond their initial levels, creating the potential for a stronger effect on both mortgage credit and house prices.[7]

Third, and most importantly, the 2014 reform was explicitly presented as a housing market stimulus. In the official announcement, the government stated that it aimed to stimulate household consumption by "normalizing" housing markets. The choice of the term *normalization* reflected a broader shift in policy stance under the new administration, which had taken office in 2013 and appointed a new economic team in mid-2014. Against this backdrop, the reform was broadly interpreted as part of a

[6] South Korea's administrative divisions have multiple layers. The first tier consists of provinces and metropolitan cities such as Seoul, Incheon, and Gyeonggi. The second tier comprises cities or districts (Gus), where LTV/PTI policies are implemented. In this paper, I refer to the first-tier divisions as 'province' and the second-tier divisions as 'city district'. See Figure C.1 for details.

[7] See Figure C.2 for typical LTV policies before 2014.

renewed effort to revive housing activity, likely signaling that the government would remain passive in the face of future housing booms. Extensive media coverage helped ensure that this signal was clearly conveyed to the public.[8]

However, the timing of the reform suggests that it was unlikely to have been automatic or an endogenous response to weak market conditions.[9] As Figures 3(a) and 3(b) show, GDP growth was solid compared with previous years, and national house prices were recovering from their trough. Consistent with this interpretation, the daily composite bank stock index—which reflects expectations about future mortgage lending—jumped sharply only after the announcement, indicating that the policy came as a surprise (Figures 3(c)).

IV Data, Measurement, and Empirical Strategy

IV.A Empirical Strategy

To examine the impact of the 2014 relaxation on mortgage credit and house prices, I estimate the following difference-in-differences (DiD) specification:

$$\Delta log(y_{ct}) = \beta Exposure_c Post_t + \gamma X_c Post_t + \alpha_c + \alpha_{p(c\in p),t} + \varepsilon_{ct} \tag{1}$$

where c indexes city districts, p provinces, and t year–quarter (or year–month).

The main outcome variables, $\Delta \log(y_{ct})$, capture mortgage origination or house price growth. The key independent variable, $Exposure_c$, measures either how binding LTV/PTI policies were before the 2014 relaxation (constraint exposure) or how sensitive local price expectations were to policy shifts (signal exposure). The construction of these measures is described in Section IV.B. The vector X_c includes controls such as the average age and credit score, capturing the presence of marginal

[8]For instance, *Chosun Ilbo*, South Korea's largest newspaper, called it a 'Blockbuster Real Estate Stimulus.' In total, more than 300 media reports covered the reform on the day of the policy announcement and in the days that followed, across leading outlets, including prime-time broadcasts by major television networks.

[9]Some observers interpreted the 2014 relaxation as part of an electoral strategy, as it was announced just six days before the July 30 by-elections and was widely credited with the ruling party's sweep (*KAFA LIFE*, September 2014). Subsequent commentary described the measures as emblematic of the stimulus agenda of Finance Minister Kyunghwan Choi, who had assumed office shortly before the reform (*Maeil Business Newspaper*, August 7, 2017).

homebuyers and life-cycle variation in housing demand. Standard errors are clustered at the life-zone level—which corresponds to the commuting zone in the US—to account for potential spatial correlation among city districts that share local labor and housing market conditions.

The key identification assumption in DiD is that, absent the 2014 relaxation, areas with different exposure would have followed parallel trends in the outcome variables. I test this assumption using a dynamic DiD framework:

$$log(y_{ct}) = \sum_{k \neq Jul2014} \beta_k \mathbb{1}(t = k) Exposure_c + \alpha_c + \alpha_{p(c \in p),t} + \varepsilon_{ct}. \tag{2}$$

I thus exploit the pre-treatment period for placebo tests and test whether outcomes responded only after the policy change.

IV.B Data and Measurement

IV.B.1 Exposure to LTV/PTI Constraints

I measure exposure to the LTV/PTI constraints (constraint exposure) at the city district level using loan-level mortgage origination data from a major South Korean commercial bank.[10] The dataset reports loan amounts, LTV and PTI ratios, other loans included in the LTV calculation, and the neighborhood-level address of each purchased home. It covers the period from August 2012 to July 2016 and accounts for about 20 percent of all residential mortgage originations nationwide (Korean Investors Service).

The constraint exposure of each city district is measured using pre-reform bunching at the regulatory caps (blue histograms in Figures 2 and C.4). Specifically, I calculate the share of loans originated with LTV/PTI ratios within two percentage points of the prevailing limits.[11] These loans were effectively constrained by regulation, so when the caps were relaxed, loan amounts could expand. Districts

[10] Unlike the US, where mortgage origination data are centralized (e.g., HMDA), South Korea only provides aggregate mortgage loan balance data at the national or provincial level. This limitation required collecting more detailed origination data from alternative sources.

[11] As shown in Figures 2 and C.4, LTV policies are more binding than PTI policies, indicating that credit constraints in practice are mainly driven by LTV limits. This is mainly because the PTI regulation applies only to mortgage loans exceeding 100 million KRW, and its formula includes only interest payments on other loans. As a result, it is widely viewed as less restrictive and less effective in limiting borrowing in South Korea. Reflecting this, new PTI rules that include principal payments on all other loans were introduced and implemented in 2024.

with a larger near-cap share were therefore more exposed to the 2014 LTV/PTI relaxation and are expected to exhibit stronger post-reform growth in mortgage origination.

Table II shows that about half of loans were originated near the regulatory thresholds, highlighting the effectiveness of borrowing constraint policies. Yet this bunching varied substantially across districts (Figure C.5(a)). Areas more constrained by the caps tended to have lower house prices, less price volatility, and be home to younger, less creditworthy, lower-income households (Figure 3).

Figure C.6 confirms that constraint exposure is accurately measured despite being based on a single bank's data. Panel (a) compares city district-level LTV ratios at origination with those from Korea Credit Bureau (KCB) balance data. Panel (b) contrasts average loan amounts at origination with average balances in the KCB data. Despite differences in measurement (originations versus balances) and timing (August 2012–July 2014 versus December 2012), the correlations are strong, indicating that the bank-based measure reflects broader market patterns.

IV.B.2 Exposure to Policy Signal

To identify areas whose house prices were likely shaped by policy signals and price expectations (expectation-sensitive areas), I use the duration of their designation as Speculation Areas (see Appendix B.A for institutional details). The Speculation Area designation is a housing policy unique to South Korea that was implemented to curb local housing booms and speculative activity prior to 2012; districts under this designation were subject to stricter LTV/PTI and property tax rules. As the name suggests, districts with longer designation histories had previously experienced stronger housing booms and therefore likely held higher house price expectations. Over time, however, repeated interventions dampened both house prices and expectations. When the 2014 reform signaled a more permissive stance toward housing booms and speculation, these districts were therefore likely to exhibit a rebound in expectations.

The evidence aligns with this logic. Figure 3 shows that districts with longer designation histories experienced larger housing booms. Since prior work on asset price expectations finds that investors' beliefs tend to be shaped by past returns (Greenwood and Shleifer, 2014; Barberis et al., 2015), these historical booms suggest that homebuyers in long-designated districts would have expected higher price growth in the absence of regulatory interventions, linking the duration of designation to house price expectations. Yet, unlike direct measures of past price increases—which rely on researcher-defined choices about time windows and thresholds—the government's designation decisions provide a more objective indicator of where expectations were likely to have been most elevated.

House price patterns around designation, however, indicate that longer Speculation Area histories had dampened those expectations, leaving greater scope for rebound when policy later signaled a looser government stance. More interestingly, while Figure 7(a) shows that price growth slowed sharply once districts were designated, Figure 7(b) shows that price growth did not rebound after de-designation even though LTV/PTI limits and property tax rates reverted to their original levels. Consistent with Chi et al. (2024), who argue that LTV policy can permanently dampen expectations, this pattern suggests that what mattered was not temporary changes in credit or taxes, but rather a shift in beliefs about how the government would respond to future housing booms and speculative activity.

Survey evidence supports this interpretation (Table III). Before the 2014 relaxation, residents in heavily designated districts reported lower expected price growth than those in less-affected areas, consistent with expectations being dampened by past interventions. After the reform signaled a more lenient stance, expectations in these districts rebounded more strongly—even though they were, on average, less credit constrained (Figure 3). This pattern shows that the Speculation Area–based measure captures sensitivity to the informational dimension of policy, identifying where expectations had been most dampened and where they were most responsive to the 2014 reversal.

IV.B.3 Other Data and Summary Statistics

This paper focuses on apartments, which in Korea are equivalent to US condos. They account for about 65% of the housing stock (2010 Census) and are the primary target of housing policies (Igan and Kang, 2011; Kim, 2016; Lee, 2016; Moon, 2019). Unless otherwise noted, I refer to apartments as houses throughout this paper.

House price data are sourced from the Korean Real Estate Board (REB), a public institution under the Ministry of Land, Infrastructure, and Transport (MOLIT). What makes the REB data distinctive is that it provides weekly house price indices, in addition to monthly ones. This unique feature allows me to examine with unusual precision how house prices responded immediately to the 2014 policy announcement.

Housing transaction data are also obtained from the REB. The data distinguishes sales from non-sales transfers such as gifts, and I use this distinction to test whether Speculation Areas contained more non-owner-occupied homes purchased for speculative purposes. To highlight the underlying patterns, I adjust the transaction data to remove cyclical fluctuations.

Another key dataset is the unit-level housing sales and Chonsei agreement records from MOLIT (see Appendix B.B for details on the Chonsei system in Korea). These monthly data include apartment floor-level addresses, unit sizes, and transaction prices. Using this detail, I match sales with Chonsei agreements signed within six months of the transaction and aggregate them at the city district level to construct a monthly measure of 'buy-to-let' activity.

Demographic variables such as mean annual income, credit score, and age are sourced from KCB microdata as of December 2012. Homeownership rates and the share of speculative ownership are taken from the 2010 Census, while province-level household net wealth is drawn from the 2014 Korean Housing Survey. Summary statistics for all variables are reported in Table II.

V Results

V.A Mortgage Origination

The 2014 relaxation was, primarily, a credit policy. By relaxing borrowing constraints to unprecedented levels, it naturally spurred a sharp increase in mortgage origination. The distribution of LTV makes this clear: new mortgages quickly bunched around the new limits (Figure 2). As a result, origination amounts surged relative to the pre-reform period (Figure 1(a)), and aggregate mortgage balances also rose well above trend once the reform took effect (Figure 1(b)).

However, these increases were not uniform across the country: they were concentrated in areas where LTV/PTI rules had previously been more binding. A DiD analysis using the constraint exposure measure from Section IV.B.1 indicates that monthly originations rose by 5 to 9 percent in such areas after the relaxation (Table IV). Column (2) sharpens this comparison by exploiting variation across provinces, adding province-by-time fixed effects $\alpha_{p(c\in p),t}$ to compare city districts within the same province. Column (3) further controls for average age and credit score at the district level to account for marginal homebuyers and lifecycle variation. Across these specifications, the pattern is robust: ex-ante constraints explain the post-reform surge in mortgage credit, with significance at the 1% level.

Figure 4 provides supporting evidence. Panel (a) splits districts into those above and below the median exposure and shows that credit growth was nearly identical in both groups before the reform. After July 2014, however, originations jumped precisely in the more exposed districts, underscoring the relaxation's causal role. Panel (b) confirms this formally using the dynamic DiD specification in equation (2).[12] The figure plots the estimated coefficients together with 95% confidence intervals, showing that treatment effects are close to zero in the pre-reform periods but turn sharply positive immediately after 2014Q2. The estimates remain significantly above zero in subsequent quarters, indicating a persistent increase in mortgage origination in high-exposure districts.

V.B House Prices

The aggregate house price index shows that prices rose nationwide after the 2014 relaxation (Figure 3(b)). Yet the areas most constrained by LTV/PTI rules were not the ones that saw the largest gains. To examine this more directly, Table V explores how quarterly house prices evolved differentially by borrowing constraints. The results suggest otherwise: house prices in these areas grew more slowly—or at best no faster—than elsewhere.

Table VI sheds light on why. It horse-races credit and signal exposure within the DiD framework, using monthly house price growth as the outcome variable. The results highlight two key findings. First, within provinces where identical LTV/PTI rules applied—so that constraint exposure had a consistent meaning across city districts—the coefficients on constraint exposure remain positive (Columns (4) and (5)). This finding thus suggests that credit still mattered for house prices, reaffirming the credit channel documented by prior work (Mian and Sufi, 2009, 2022). However, more importantly, the results also show that only the coefficients on signal exposure are statistically significant. Therefore, the results indicate that prices rose mainly in expectation-sensitive areas, underscoring the central role of expectations in shaping the post-reform house price response.

[12] As illustrated in Table I, LTV/PTI regulations differed across provinces. This means that the same share of mortgages constrained by the rules could have different implications depending on location. To account for this variation, the specification includes province-by-time fixed effects, $\alpha_{p(c \in p),t}$.

Figure 5 checks whether house prices in expectation-sensitive and -insensitive areas shared similar trends before July 2014 and diverged only afterward. Panel (a) splits city districts at the median signal exposure and shows that prices moved in parallel before the reform and diverged soon after. Within a year, they rose by about 4.5% in expectation-sensitive areas compared with 3% elsewhere. Panel (b) formalizes this comparison in a DiD framework, confirming that the divergence began immediately after the July 2014 announcement and widened in the following months.

Analysis based on Korea's unique weekly house price index further pin down the timing of the house price response. Figure 6 reports DiD estimates based on weekly data, with week 0 denoting the policy announcement week. The results show that the divergence began in week 1, immediately after the announcement, but before the new LTV/PTI rules were implemented in week 2. Therefore, this timing indicates that the policy signal, rather than the subsequent easing of credit, triggered the rise in house prices.

V.C House Price Expectations and Speculation

Expectations about future house prices are key drivers of home buying and price growth (Armona et al. (2019); Glaeser and Nathanson (2017); Kaplan et al. (2020)). Survey data collected just before and after the 2014 relaxation (August 2013 and August 2014) document a sharp rise in expectations following the policy change (Figure 1(c)). Table III further shows that these shifts were concentrated in expectation-sensitive areas, suggesting that house price changes in those regions were closely tied to elevated expectations.

The evidence also helps rule out an alternative explanation that house price increases reflected spillovers from credit-affected regions. Under this view, homebuyers would have shifted to expectation-sensitive areas anticipating overvaluation or defaults in borrowing-constrained regions. The survey results instead show that expectations rose most in expectation-sensitive areas, inconsistent with a spillover channel. The default-based explanation is also unlikely. Even after relaxation, the median LTV ratio in Korea remained only about 60 percent, well below the 77 percent observed in the US, and Korea has not experienced a mortgage default crisis as of 2025.

Surveys, however, are imperfect. Responses may not fully reflect beliefs, beliefs may not translate into behavior, and increases in reported expectations by local residents do not necessarily imply higher expectations for house prices in their own districts. To address these concerns, I study how expectations are revealed through speculative behavior. My analysis focuses on Korea's distinctive Chonsei system, in which home purchases are financed by large, interest-free deposits provided by tenants in lieu of monthly rent (see Appendix B.B for institutional details). These buy-to-Chonsei transactions are inherently speculative and frequently used to amplify leveraged returns on housing investment (Jing et al., 2024).

Another key feature of the Chonsei market is that Chonsei credit is informal and lies entirely outside formal credit policies, including LTV/PTI regulations. Consequently, although the system enables homeowners to borrow substantial sums from tenants, it is unaffected by changes in regulated borrowing constraints. In addition, tenants' option to choose standard monthly-rental contracts remained essentially unchanged around the 2014 reform, and the utility they derive from housing services was also unlikely to shift over such a short period. Finally, because Chonsei credit can substitute for mortgage borrowing, buy-to-Chonsei transactions would have been expected to decline following the relaxation if they were used solely to meet financing needs.[13]

Figure 7(a) shows instead that buy-to-let transactions financed by Chonsei credit rose sharply in expectation-sensitive areas after the relaxation, while remaining flat in expectation-insensitive areas. Panel (b) confirms this pattern with a formal DiD estimation. Together, these results indicate that the post-reform house price growth in expectation-sensitive areas was fueled by speculative activity facilitated through unregulated Chonsei credit. In contrast, mortgage borrowing in expectation-insensitive areas appears to have been used largely for non-speculative, owner-occupied purchases, responding less to shifts in expectations.

Further evidence comes from Table VII, which examines changes in homeownership rates. Following the reform, homeownership rates in expectation-sensitive areas declined relative to those in expectation-insensitive areas, producing a sustained divergence of roughly 1 to 2.5 percentage points. This decline is consistent with an increase in speculative buying pressure, as higher investment demand crowds out potential owner-occupiers in these markets.

[13] In practice, banks do not allow homebuyers to combine mortgage credit with Chonsei credit when purchasing a property for non-owner-occupying purposes.

VI Discussion

VI.A Speculation Revealed After 2018 Tax Reform

The speculative behavior concentrated in expectation-sensitive districts after the 2014 relaxation became more visible with subsequent policy changes. In September 2018, the government announced higher property taxes on non-primary residences, to be applied from 2019. As shown in Table C.2, the reform raised the tax burden for multiple-homeowners by 0.1 to 1.2 percent depending on property values. The measure was intended to discourage speculative ownership by increasing the costs of holding additional homes.

Instead of selling their non-primary residences, many owners responded to the policy by transferring them to their children. As a result, the share of housing gifts among total transactions rose sharply following the reform and continued to grow thereafter (Figure C.8(a)).

Interestingly, Figure C.8(b) shows that this increase was concentrated in expectation-sensitive districts, where speculative activity had expanded after the 2014 relaxation. This pattern, therefore, suggests that the earlier surge in speculative demand later resurfaced as a tax avoidance strategy when property taxes increased.

VI.B Effects from Other Economics Policies

The 2014 LTV/PTI relaxation was the only housing credit policy introduced at the time, but it was not the only economic policy change. Three weeks later, on August 14, the Bank of Korea (BoK) cut its policy rate. Since interest rates affect house prices through both the cost of housing and the structure of mortgage financing, it is important to assess whether the rate cut drove house prices in 2014 (Di Maggio et al., 2017; Poterba, 1984).

Several considerations suggest otherwise. First, as shown earlier in Figure 6, house prices began to rise immediately after the July 24 announcement of the relaxation, well before the Bank of Korea's rate cut. This timing makes it unlikely that the rate cut was the initial driver.

Second, although one might argue that prices rose in anticipation of lower interest rates, further evidence rules out this possibility. Following Jing et al. (2024), who show that house prices in areas with more Chonsei agreements are more sensitive to interest rate changes, Table C.3 compares price growth across Chonsei-prevalent areas and expectation-sensitive areas. The results show that while prices in Chonsei-prevalent areas rose somewhat, the surge in expectation-sensitive areas was considerably stronger, pointing to a policy-signal effect rather than an interest rate channel.

More broadly, monetary policy is unlikely to have been a major driver of house prices in 2014 because its effects typically unfold with a lag. Using the Jordà local projection method (Figure C.9) and instrumenting the BoK's policy rate changes with those of China and the US, I find that it takes 24 to 36 months for house prices to decline in response to an increase in interest rates. Building on this result, Table C.4 examines how house prices in expectation-sensitive and -insensitive areas respond to interest rate changes after such lags. The estimates show that expectation-sensitive areas have not historically been rate-sensitive, since the sum of the coefficients on Δ*Korea Rates* and Δ*Korea Rates* $\times$ *Signal Exposure* is close to zero. Taken together, these findings confirm that the 2014 surge in house prices was driven by the policy signal from relaxation rather than by the subsequent interest rate cut.

VI.C Placebo Test: Commercial Real Estate Prices

To assess whether broader macroeconomic changes around mid-2014 could explain the observed rise in housing prices, I conduct a placebo test using commercial real estate prices. This exercise extends the analysis of interest rate effects in the previous section and asks whether the housing response reflected shifts in the overall macroeconomic environment rather than the LTV/PTI reform itself.

Commercial properties provide a useful benchmark because they were not directly affected by LTV/PTI regulations or by housing market stimulus. Prior research also shows that commercial real estate prices are sensitive to macroeconomic conditions (Alter et al., 2023; Naranjo and Ling, 1997). Therefore, if broader macroeconomic shocks were driving the housing market, commercial prices should have exhibited similar changes around the reform.

The data show no such pattern. Table C.5 reports that coefficients on credit and signal exposures are consistently insignificant across specifications. Figure C.10 further confirms that commercial price trends remained stable even after the reform. Unlike housing, commercial prices neither accelerated nor diverged across areas.

This null result is informative. If the interest rate cut that followed relaxation, or other coinciding macroeconomic shocks such as demand or productivity shifts, had been the main drivers, commercial prices should also have responded. The absence of any systematic change reinforces the conclusion that the 2014 relaxation specifically influenced the housing market, working primarily through expectations rather than through broader macroeconomic channels.

VI.D Differential Income Shocks and Housing Supply

Income or productivity shocks concentrated in expectation-sensitive areas could also, in principle, explain the post-reform house price surge. This concern is particularly relevant if housing supply in those areas was relatively inelastic. Under such conditions, house prices could have risen independently of changes in borrowing constraint policy.

To evaluate this possibility, I first consider KCB microdata, which aggregate individual-level income at the city district level on a monthly basis. I also use semi-annual unemployment rates reported at the city level. Since the July 2014 reform falls at the boundary between reporting periods, these data make it possible to compare labor market conditions just before and after the policy change.

The results provide no evidence of relevant shocks. Figure C.11 shows that income trends remained stable around July 2014, with expectation-sensitive areas continuing to record gains relative to other regions. Likewise, unemployment rates did not diverge across areas, suggesting that improved local larbor market conditions cannot explain the rise in house prices.

Housing supply also does not appear to have constrained the market response. Table C.6 shows that between 2011 and 2013, housing permits were issued predominantly in areas already experiencing price increases, regardless of whether they were speculative. Table C.7 extends the analysis to 2014–2015, showing that permits rose substantially in expectation-sensitive areas after relaxation. Thus, supply in these areas expanded rather than contracted. Taken together, these findings rule out the possibility that the house price surge was driven by a combination of local income shocks and limited housing supply.

VI.E Influences from Outliers

One concern with the main analysis is that the measure of Speculation Area duration is right-skewed. As shown in Figure 5(b), designations are concentrated in the Seoul Capital Area, and three Seoul districts—Gangnam, Seocho, and Songpa—were designated for over 100 months, creating potential outliers. This raises the possibility that the results are driven by comparisons between Seoul and the rest of the country.

I address this in two ways. First, Figure C.12 plots annual house price growth against Speculation Area duration before and after the reform. Before July 2014, price growth showed no systematic relationship with designation length. Afterward, however, house price growth rose in clear proportion to the duration of designation, consistent with the main results.

Second, I re-estimate the main specification focusing only on the Seoul Capital Area, which contains most Speculation Areas and over half of the national population. Table C.8 shows that the results remain stable, even when excluding the three longest-designated districts. Coefficient magnitudes are nearly identical to those in the full-sample analysis, implying that monthly house price growth in Speculation Areas exceeded that in other districts by 3 to 6 basis points, or roughly 0.5–0.7 percent over the year following the reform.

Together, these results confirm that the main findings are not driven by outliers or regional composition, but reflect a robust relationship between past designation and post-reform house price growth.

VII Conclusion

This paper has examined the 2014 LTV/PTI relaxation in South Korea as a natural experiment to distinguish between the credit-constraints and expectation channels of mortgage policy in the housing market. The evidence shows that while mortgage credit expanded most in credit-constrained districts, house prices increased primarily in areas long designated as Speculation Areas, where expectations are more responsive to policy interventions. This divergence indicates that the observed increase in house prices reflected shifts in expectations triggered by policy signals, rather than the expansion of credit supply itself.

A series of robustness tests confirm that the house price surge was not driven by alternative channels. Expectation-sensitive areas have not historically been rate-sensitive, ruling out monetary policy as the explanation. Commercial real estate prices, which normally respond to macroeconomic shocks, showed no change around the reform. Income and unemployment trends also remained stable, and housing supply in expectation-sensitive areas expanded rather than contracted. The results also remain robust when excluding potential outliers such as the three longest-designated Seoul districts. Finally, subsequent tax reforms in 2018 revealed the speculative nature of these areas more clearly. When higher property taxes were imposed on non-primary residences, housing gifts surged disproportionately in expectation-sensitive districts, consistent with earlier speculative demand manifesting as tax avoidance.

Taken together, the findings show that government policy can move house prices not only by relaxing credit constraints but also by shaping expectations about future interventions. In the South Korean context, the 2014 relaxation worked primarily through the latter channel, generating a government-induced housing boom that later evolved into more speculative behavior.

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Figure 1: Mortgage Credit and Price Expectations Around the 2014 LTV/PTI Relaxation

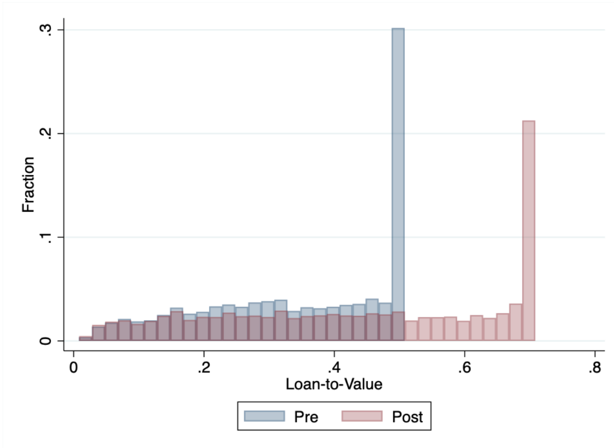
(a) Mortgage Loan Origination

(b) Mortgage Loan Balance

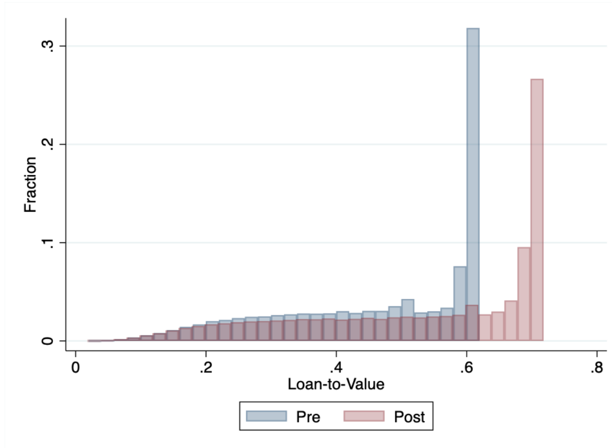
(c) Price Optimism

Notes: The figure shows mortgage credit and house price expectation growth around the LTV/PTI deregulation announced on July 24, 2014, and implemented on August 1, 2014. Panel (a) reports monthly mortgage originations from a major commercial bank, expressed relative to the same month before July 2013. Panel (b) plots the aggregate mortgage loan balance from the Bank of Korea (solid red line) together with its long-run trend (dotted blue line), estimated using data prior to July 2014. Panel (c) uses data from the Survey of Housing Finance and reports the share of respondents expecting stable or higher house prices over the next year. "Before" refers to August 2013, and "After" to August 2014.

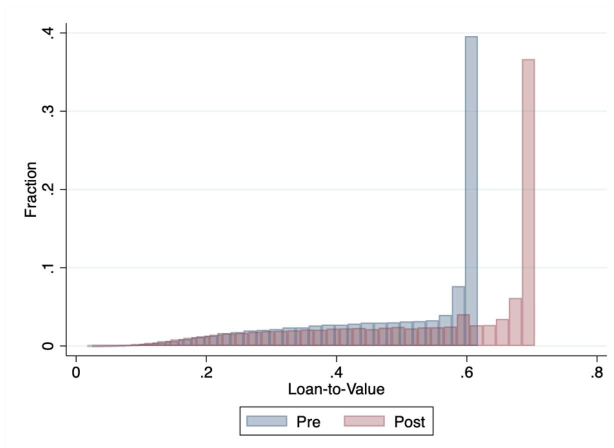
Figure 2: Distribution of LTV Ratios for Originated Mortgage Loans



(a) SCA, HP > 600



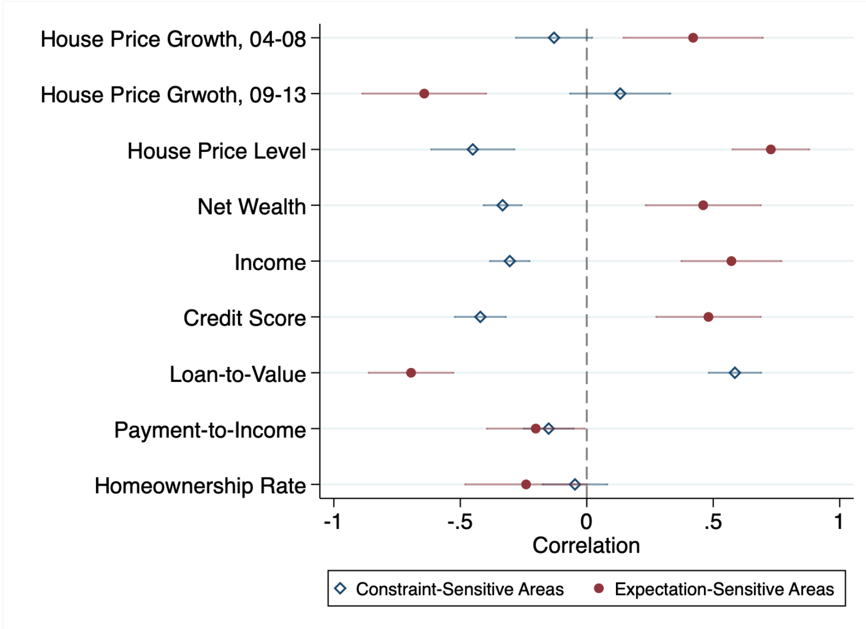
(b) SCA, HP ≤ 600



(c) Non-SCA

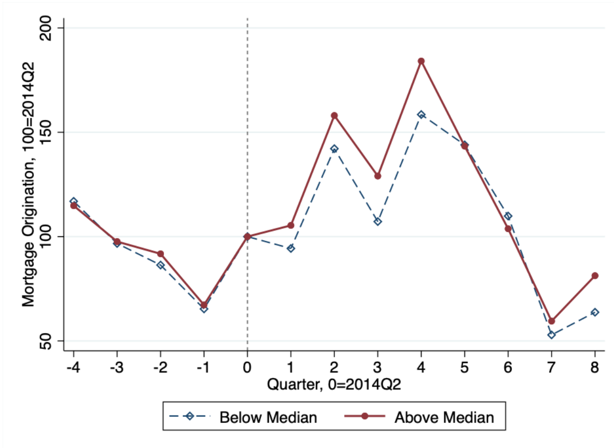
Notes: The figure shows the distribution of originated mortgage loans by their loan-to-value (LTV) ratios. The blue histogram represents loans originated between August 2012 and July 2014, and the red histogram represents loans originated between August 2014 and July 2016. Panel (a) shows loans for houses priced above 600 million KRW in the Seoul Capital Area (SCA), which includes Seoul, Incheon, and Gyeonggi. Panel (b) shows loans for houses priced below 600 million KRW in the SCA. Panel (c) shows loans for houses located outside the SCA.

Figure 3: Geographic Characteristics of Constraint- and Expectation-Sensitive Areas

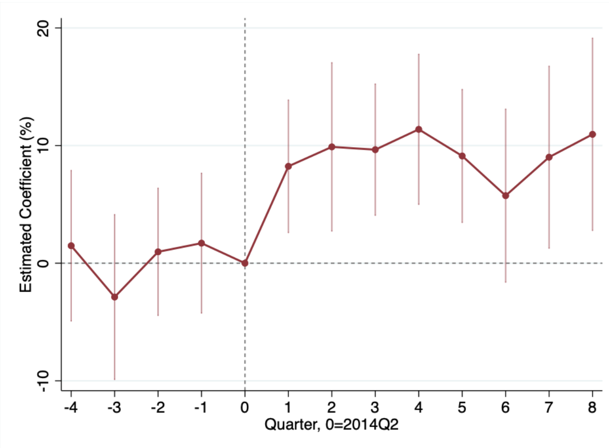


Notes: The figure illustrates the geographic characteristics of two area types—LTV/PTI-binding and expectation-sensitive areas—by showing the correlations between two exposure measures (credit and signal exposure) and selected geographic characteristics. All variables are standardized, and capped spikes indicate 95% confidence intervals. The geographic characteristics include house price growth during 2004–2008 and 2009–2013, average house prices (December 2012), average income (December 2012), average credit scores (December 2012), average LTV and PTI ratios for loans originated between August 2012 and July 2014, and the homeownership rate (2010). Average net wealth (July 2014) is measured at the provincial level; all other variables are measured at the city-district level.

Figure 4: Mortgage Origination Growth in LTV/PTI-Bound Areas



(a) Constraint Exposure: Below vs. Above Median



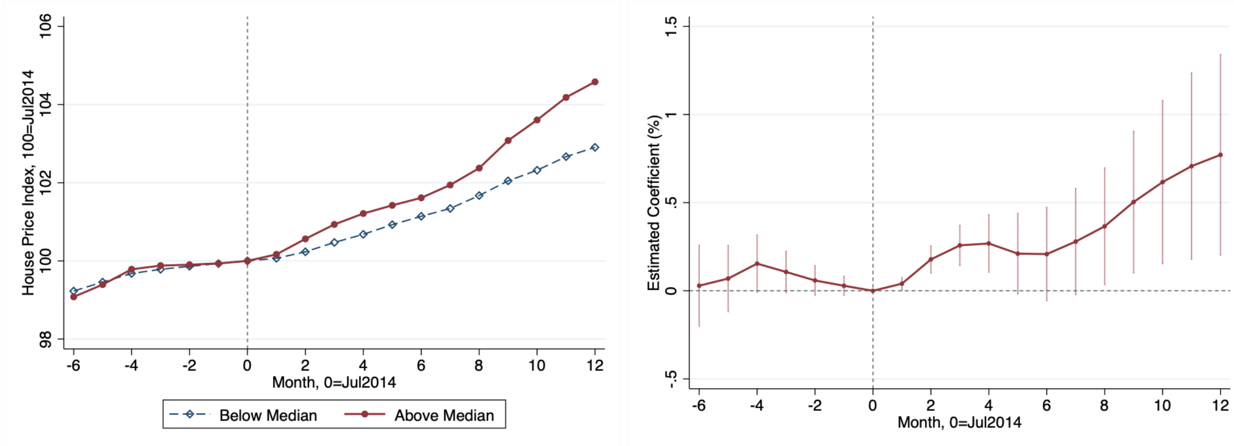
(b) DiD Estimates

Notes: The figure illustrates the impact of the 2014 deregulation on mortgage credit expansion. Panel (a) divides city districts into those above and below the median constraint exposure—measured by the share of mortgage loans originated within two percent of the LTV or PTI limits before July 2014—and shows quarterly mortgage loan originations for each group. Amounts are expressed relative to mortgage originations in Q2 2014, indexed to 100. Panel (b) presents results from the dynamic difference-in-differences estimation with 95 percent confidence intervals:

$$log(y_{ct}) = \sum_{k \neq Jul2014} \beta_k \mathbb{1}(t = k) Exposure_c + \alpha_c + \alpha_{p(c \in p),t} + \varepsilon_{ct}.$$

where c and t denote city district and quarter, respectively. It uses mortgage origination data aggregated to the quarterly level as the outcome variable and constraint exposure as the explanatory variable. Standard errors are clustered at the life-zone level.

Figure 5: House Prices in Expectation-Sensitive Areas



(a) Signal Exposure: Below vs. Above Median

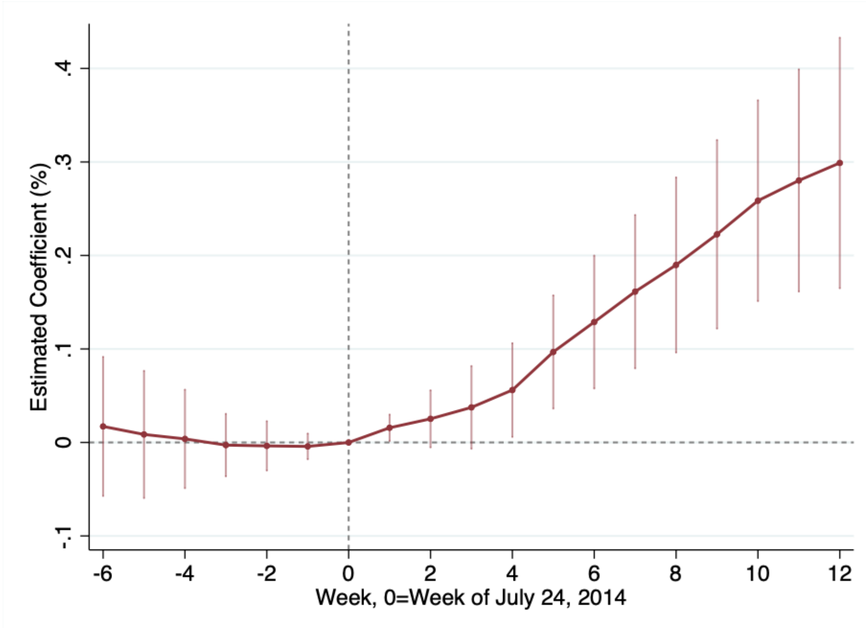
(b) DiD Estimates

Notes: The figure illustrates the impact of the 2014 relaxation on house prices. Panel (a) divides city districts into those above and below the median signal exposure—measured by the duration of their designation as Speculation Areas before May 2012—and shows monthly house prices for each group. Prices are expressed relative to those in July 2014, indexed to 100. Panel (b) presents results from the following dynamic difference-in-differences estimation with 95 percent confidence intervals:

$$log(y_{ct}) = \sum_{k \neq Jul2014} \beta_k \mathbb{1}(t = k) Exposure_c + \alpha_c + \alpha_t + \varepsilon_{ct}.$$

where c and t denote city district and month, respectively. It uses monthly house price data as the outcome variable and signal exposure as the explanatory variable Standard errors are clustered at the life-zone level.

Figure 6: Timing of House Price Divergence

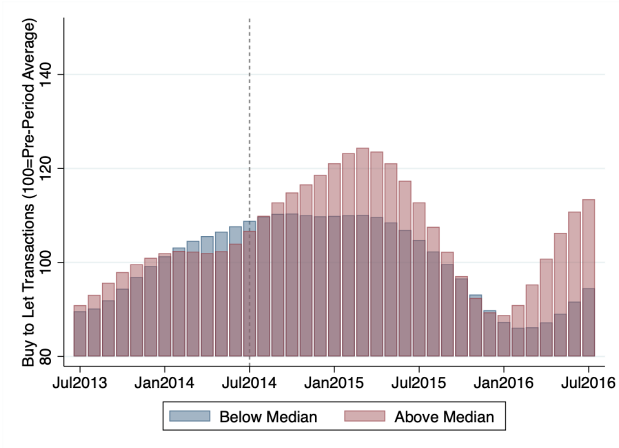


Notes: The figure presents results from the following dynamic difference-in-differences estimation with 95 percent confidence intervals:

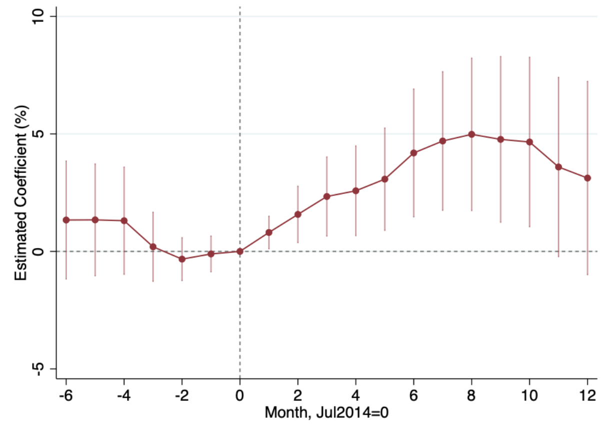
$$log(y_{ct}) = \sum_{k \neq 24Jul2014} \beta_k \mathbb{1}(t = k) Exposure_c + \alpha_c + \alpha_t + \varepsilon_{ct}.$$

where c and t denote city district and week, respectively. It uses weekly house price data as the outcome variable and signal exposure as the explanatory variable. The figure reports coefficient estimates with 95 percent confidence intervals. Standard errors are clustered at the life-zone level.

Figure 7: Speculative Transactions around the 2014 LTV/PTI Relaxation



(a) Signal Exposure: Below vs. Above Median



(b) DiD Estimates

Notes: The figure illustrates the impact of the 2014 LTV/PTI relaxation on speculative housing transactions, defined as housing sales followed by Chonsei contracts within six months of purchase. Panel (a) divides city districts into those above and below the median signal exposure—measured by the duration of Speculation Area designation before May 2012—and shows monthly transaction volumes for each group. The values are expressed relative to the average transaction level before July 2014, indexed to 100. Panel (b) reports results from the following dynamic difference-in-differences estimation (Equation (2)) with 95 percent confidence intervals:

$$log(y_{ct}) = \sum_{k \neq Jul2014} \beta_k \mathbb{1}(t = k) Exposure_c + \alpha_c + \alpha_{p(c \in p),t} + \varepsilon_{ct}.$$

where c and t denote city district and month, respectively. It uses the log of speculative housing transactions as the outcome variable and signal exposure as the explanatory variable. Standard errors are clustered at the life-zone level.

TABLE I: LTV/PTI Policies Before and After the 2014 Relaxation

Province	Category	Pre (%)	Post (%)
Panel A. Loan-to-value (LTV) Ratio			
Seoul, Incheon, and Gyeonggi	House Price > 600 Million KRW	50	70
	House Price ≤ 600 Million KRW	60	70
Others	All	60	70
Panel B. Payment-to-income (PTI) Ratio			
Seoul	Loans > 100 Million KRW	50	60
	Loans ≤ 100 Million KRW	-	-
Incheon and Gyeonggi	Loans > 100 Million KRW	60	60
	Loans ≤ 100 Million KRW	-	-
Others	All	-	-

Notes: The table outlines the base LTV/PTI limits before and after the 2014 LTV/PTI relaxation, announced on July 24, 2014, and implemented on August 1, 2014. In addition to the base PTI limits reported in the table, borrowers could qualify for an extra 15 percent (10 percent after the relaxation) allowance if certain conditions were met: the mortgage was fixed-rate (5 percent), fully amortized (5 percent), non-balloon (5 percent), or if the borrower had a high credit score (5 percent).

TABLE II: Summary Statistics

	N	Mean	SD	P10	P50	P90
Panel A. City-District-Level Data						
Constraint Exposure (%)	252	51.0	10.3	38.8	50.4	63.6
Signal Exposure (Months)	252	18.8	25.9	0.0	0.0	64.0
Singal Exposure, Seoul Capital Area (Months)	79	45.9	25.1	10.0	48.0	66.0
Speculative Homeownership (%)	244	18.4	8.7	8.4	17.2	29.8
Homeownerhsip Rate (%)	244	60.9	14.1	46.2	62.1	77.7
Mean Loan-to-Value Ratio (%)	252	50.2	3.5	45.7	50.8	54.0
Mean Payment-to-Income Ratio (%)	252	37.2	3.4	33.4	36.7	42.0
Mean Annual Income (Million KRW)	252	27.3	2.2	25.5	26.6	29.7
Mean Credit Score	252	5.7	0.3	5.4	5.7	6.1
Mean Age	252	44.0	2.9	41.1	43.1	48.8
Panel B. City-District × Year-Month-Level Data						
Originated Mortgage Amount (Billion KRW)	3,231	15.9	19.5	0.2	8.2	46.0
Monthly House Price Growth (%)	3,297	0.3	0.4	-0.1	0.2	0.7
Housing Transactions	3,325	349.3	243.7	71.0	305.0	697.0
Speculative Housing Transactions	3,325	114.4	97.7	10.0	86.0	263.0

Notes: This table reports summary statistics for the variables used in the analysis. Constraint exposure is defined as the share of mortgage loans originated within 2 percent of the LTV or PTI limits before July 2014, calculated from mortgage origination data provided by a major commercial bank. Signal exposure is measured by the number of months each city district was designated as a Speculation Area before 2012, based on public announcements from the Ministry of Economy and Finance. Speculative homeownership refers to the share of homes with Chonsei agreements, drawn from the 2010 Census. The mean loan-to-value (LTV) and payment-to-income (PTI) ratios of originated loans are derived from the same mortgage origination data. Mean annual income, mean credit score (on a 1–10 scale, with 1 being the highest), and mean population age are taken from the Korea Credit Bureau (KCB) microdata as of December 2012. The house price index and housing transaction data are obtained from the Korea Real Estate Board. Speculative housing transactions are defined as housing sales followed by Chonsei agreements within six months of purchase, based on microdata from the Ministry of Land, Infrastructure, and Transport (MOLIT).

TABLE III: House Price Expectations

Dep. Var:	Price Optimism		
	(1)	(2)	(3)
Signal Exposure × Post	0.0359*	0.0366**	0.0338**
	(0.0182)	(0.0156)	(0.0149)
Singal Expoure	-0.0489***	-0.0405	-0.0316
	(0.0152)	(0.0240)	(0.0226)
Post	0.0861***	0.0859***	0.0846***
	(0.0129)	(0.0113)	(0.0111)
Province FEs		Yes	Yes
Controls			Yes
Adjusted R^2	0.0178	0.0191	0.0271
#Obs	6,276	6,276	6,276

Notes: This table uses data from the Survey of Housing Finance conducted in August 2013 and August 2014 and presents the estimation results for the β coefficients from the following specification:

$$Optimism_{it} = \beta_1 Post_t + \beta_2 Exposure_c \cdot Post_t + \beta_3 Exposure_c + \Gamma X_{it} + \alpha_{c\in p} + \varepsilon_{it}$$

where i and t denote individuals and survey years, respectively. $Optimism_{it}$ is a binary variable equal to 1 if respondents expected house prices to remain stable or rise over the next year. $Post_t$ equals 1 for the survey conducted in August 2014. $Exposure_c$ measures signal exposure, defined as the number of months a district was designated as a Speculation Area prior to 2012. The control vector X_{it} includes log income, log age, and dummies for sex and housing tenure. $\alpha_{c\in p}$ denotes province fixed effects. The sample is restricted to survey respondents living in apartments. Standard errors, clustered at the city level, are reported in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

TABLE IV: Mortgage Origination Growth in LTV/PTI-Bound Areas

Dep. Var:	Log(Mortgage Originations)		
	(1)	(2)	(3)
Constraint Exposure × Post, Standardized	0.0515***	0.0897***	0.0676***
	(0.0145)	(0.0179)	(0.0238)
City District FEs	Yes	Yes	Yes
Year-Quarter FEs	Yes		
Province × Year-Quarter FEs		Yes	Yes
Controls			Yes
Adjusted R^2	0.971	0.978	0.978
#Obs	3,166	3,166	3,166

Notes: This table presents the results from a difference-in-differences estimation based on the following specification:

$$\Delta \log(y_{ct}) = \beta\, Exposure_c\, Post_t + \gamma X_c Post_t + \alpha_c + \alpha_{p(c \in p),t} + \varepsilon_{ct}$$

where c and t denote city district and quarter, respectively. The outcome variable is the log difference of mortgage originations, and the key explanatory variable is constraint exposure, defined as the share of mortgage loans originated within 2 percent of the LTV/PTI limits before July 2014. Control variables include the city-district–level average age and credit score, which account for the presence of marginal homebuyers and variation in homebuying behavior over the life cycle. The sample includes four quarters before and eight quarters after the policy change. Standard errors, clustered at the life-zone level, are reported in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

TABLE V: House Price Growth in LTV/PTI-Bound Areas

Dep. Var:	Quarterly House Price Growth (%)		
	(1)	(2)	(3)
Constraint Exposure × Post, Standardized	-0.320**	0.116	-0.0162
	(0.132)	(0.107)	(0.121)
City District FEs	Yes	Yes	Yes
Year-Quarter FEs	Yes		
Province × Year-Quarter FEs		Yes	Yes
Controls			Yes
Adjusted R^2	0.434	0.711	0.719
#Obs	2,198	2,198	2,198

Notes: This table presents the results from a difference-in-differences estimation based on the following specification:

$$\Delta \log(y_{ct}) = \beta\, Exposure_c\, Post_t + \gamma X_c Post_t + \alpha_c + \alpha_{p(c\in p),t} + \varepsilon_{ct}$$

where c and t denote city district and quarter, respectively. The outcome variable is the log difference of house prices, and the key explanatory variable is constraint exposure, defined as the share of mortgage loans originated within 2 percent of the LTV/PTI limits before July 2014. Control variables include the city-district–level average age and credit score, which account for the presence of marginal homebuyers and variation in homebuying behavior over the life cycle. The sample includes four quarters before and eight quarters after the policy change. Standard errors, clustered at the life-zone level, are reported in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

TABLE VI: House Price Growth in Expectation-Sensitive Areas

Dep. Var:	Monthly House Price Growth (%)				
	(1)	(2)	(3)	(4)	(5)
Signal Exposure × Post, Standardized	0.0653***		0.0573**	0.0312**	0.0457**
	(0.0194)		(0.0252)	(0.0152)	(0.0194)
Constraint Exposure × Post, Standardized		-0.0804**	-0.0283	0.0551	0.0348
		(0.0344)	(0.0401)	(0.0417)	(0.0488)
City District FEs	Yes	Yes	Yes	Yes	Yes
Year-Month FEs	Yes	Yes	Yes		
Province × Year-Month FEs				Yes	Yes
Controls					Yes
Adjusted R^2	0.477	0.472	0.477	0.599	0.600
#Obs	3,216	3,216	3,216	2,931	2,931

Notes: This table presents the results from a difference-in-differences estimation based on the following specification:

$$\Delta \log(y_{ct}) = \beta\, Exposure_c\, Post_t + \gamma X_c Post_t + \alpha_c + \alpha_{p(c \in p),t} + \varepsilon_{ct}$$

where c and t denote city district and month, respectively. The outcome variable is the log difference of house prices, and the key explanatory variables are (i) signal exposure, defined as the number of months a district was designated as a Speculation Area prior to 2012, and (ii) constraint exposure, defined as the share of mortgage loans originated within 2 percent of the LTV/PTI limits before July 2014. Control variables include the city-district–level average age and credit score, which account for the presence of marginal homebuyers and variation in homebuying behavior over the life cycle. The sample covers the six months preceding and the twelve months following the policy change. Standard errors, clustered at the life-zone level, are reported in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

TABLE VII: Homeownership Rate in Expectation-Sensitive Areas

Dep. Var:	Homeownership Rate (%)		
	(1)	(2)	(3)
Signal Exposure × Post, Standardized	-2.601***	-0.798*	-0.916**
	(0.437)	(0.436)	(0.447)
City District FEs	Yes	Yes	Yes
Year FEs	Yes		
Province × Year FEs		Yes	Yes
Controls			Yes
Adjusted R^2	0.768	0.850	0.857
#Obs	826	751	751

Notes: This table presents the results from a difference-in-differences estimation based on the following specification:

$$y_{ct} = \beta \, Exposure_c \, Post_t + \gamma X_c Post_t + \alpha_c + \alpha_{p(c \in p),t} + \varepsilon_{ct}$$

where c and t denote city district and year, respectively. The outcome variable is homeownershp rates, and the key explanatory variable is signal exposure, defined as the number of months a district was designated as a Speculation Area prior to 2012. Control variables include the city-district–level average age and credit score, which account for the presence of marginal homebuyers and variation in homebuying behavior over the life cycle. The sample spans 2000 to 2020, with five-year intervals corresponding to the years when the census was conducted. Standard errors, clustered at the life-zone level, are reported in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

Online Appendix

Appendix A Proofs for the Conceptual Framework

A.A Lemma 1. Upper Bound of Reservation Price

A necessary condition for household i to purchase housing is

$$P \le p_i^u(G) \equiv b_i + \beta \mathbb{E}[P_1 \mid G].$$

Proof. For purchase to be optimal,

$$U_{i,Buy} \ge U_{i,Save} \iff U^{\rho}_{i,Buy} - U^{\rho}_{i,Save} \equiv \Delta_i(P; G, L) \ge 0$$

where

$$\Delta_i(P; G, L) = (1-\omega)\Big[(W_i - (1-L)P)^{\rho} - W_i^{\rho}\Big] + \omega\big(\max\{\Theta_i(G, P), 0\}\big)^{\rho}.$$

The first term is weakly negative, so $\Delta_i \ge 0$ requires $\Theta_i(G, P) \ge 0$. Thus, $P \le b_i + \beta \mathbb{E}[P_1 \mid G]$. □

A.B Lemma 2. Existence and Uniqueness of Reservation Price

For each household i, there exists a unique reservation price $p_i^*(G, W_i, L) \in (0, p_i^u(G))$ *such that*

$$H = 1 \iff P \le \min\left\{p_i^*(G, W_i, L), \frac{W_i}{1-L}\right\}.$$

Proof. As $P \downarrow 0$, we have $\Delta_i(P; G, L) \ge 0$. As $P \uparrow p_i^u(G)$, we have $\Theta_i(G, P) \downarrow 0$ so $\Delta_i < 0$. Furthermore, $\Delta_i(P; G, L)$ is continuous and strictly decreasing in P. Differentiating,

$$\frac{\partial \Delta_i}{\partial P} = (1-\omega)\rho(W_i - (1-L)P)^{\rho-1}(-(1-L)) + \omega\rho(b_i + \beta\mathbb{E}[P_1 \mid G] - P)^{\rho-1}(-1) < 0.$$

Thus, by the intermediate value theorem, there exists a unique $p_i^* \in (0, p_i^u(G))$ satisfying $\Delta_i(p_i^*; G, L) =$

0. Combining with the credit constraint $W_i \geq (1-L)P$, the effective cutoff is

$$\min\left\{p_i^*, \frac{W_i}{1-L}\right\}.$$

□

A.C Proposition 1. Comparative Statics of Reservation Price

Proof. The reservation price p_i satisfies the implicit equation $\Delta_i(p_i; G, L) = 0$. Differentiating,

$$\frac{\partial p_i}{\partial x} = -\frac{\partial \Delta_i/\partial x}{\partial \Delta_i/\partial P}, \quad x \in \{G, L\}.$$

Then,

$$\frac{\partial \Delta_i}{\partial P} = (1-\omega)\rho(W_i - (1-L)P)^{\rho-1}(-(1-L)) + \omega\rho(b_i + \beta\mathbb{E}[P_1 \mid G] - P)^{\rho-1}(-1) < 0,$$

$$\frac{\partial \Delta_i}{\partial L} = (1-\omega)\rho(W_i - (1-L)P)^{\rho-1} \cdot P > 0,$$

$$\frac{\partial \Delta_i}{\partial G} = \omega\rho(b_i + \beta\mathbb{E}[P_1 \mid G] - P)^{\rho-1} \cdot \beta\frac{\partial \mathbb{E}[P_1 \mid G]}{\partial G} > 0.$$

Since $\frac{\partial \Delta_i}{\partial P} < 0$, it follows that $\frac{\partial p_i}{\partial L} > 0$ and $\frac{\partial p_i}{\partial G} > 0$. □

A.D Proposition 2. Market Equilibrium

Proof. From Lemma 2, each household's demand is characterized by a cutoff rule $H_i = 1 \Leftrightarrow P \leq \min\{p_i^*(G, W_i, L), W_i/(1-L)\}$. Hence aggregate demand is weakly decreasing in P. Since demand is 1 at $P = 0$ and 0 at sufficiently large P, a unique clearing price $P^*(G, L)$ exists satisfying $\int_0^1 H_i \, di = \bar{S}$. Monotonicity in G and L follows from Proposition 1. □

Appendix B Institutional Backgrounds

B.A Designation of Speculation Areas

Before 2012, South Korean regulators designated specific city districts as *Speculation Areas* to curb local housing booms and speculative activity. Once designated, these areas were subject to stricter capital gains taxation and tighter LTV/PTI regulations.

Speculation Area status was determined primarily by house price growth. Although the designation was at the discretion of the Minister of Economy and Finance, general rules stated that an area would be designated if the following two conditions were met:

1. House price increases in the area exceeded the national consumer price increase in the previous month.

2. House prices had increased by 30% more than the national average over the past two months, or house prices had risen over the past year by more than the national average over the past three years.

Once designated, a capital gains tax was levied on the basis of actual transaction prices rather than appraisal values. Since transaction prices are generally more than 30% higher than appraisal values, this measure was intended to curb speculative housing transactions.

Because of these features, Speculation Area designation has been widely regarded as the strictest anti-housing-boom policy in South Korea and has proven to be effective. As shown in Panel (a) of Figure C.7, areas designated as Speculation Areas experienced a significant reduction in house price growth immediately following designation. More intriguingly, Panel (b) of Figure C.7 shows that even after de-designation—when LTV/PTI regulations and capital gains taxes reverted to their original levels—house price growth did not rebound to pre-designation levels. These findings suggest that Speculation Area designation exerted a lasting influence in suppressing house-price expectations in designated areas.

As reported in Appendix Table C.1, the first Speculation Areas were designated in February 2003. However, all designations were lifted by May 2012, so there were no Speculation Areas in place by July 2014, when the LTV/PTI deregulation studied in this paper was implemented.

B.B Chonsei System in South Korea

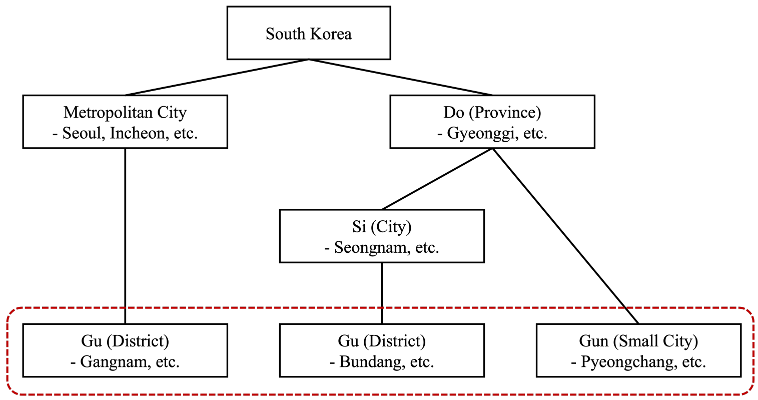
The *Chonsei* is a distinctive rental arrangement in South Korea. Households in Korea seeking to rent rather than purchase a home typically face two options. The first is a standard rental contract, in which tenants make monthly rent payments to the landlord. The second is a Chonsei agreement, in which tenants provide the landlord with a lump-sum deposit—typically 60–80% of the home's value, referred to as Chonsei credit—in lieu of rent for the contract period, usually two years. At the end of the lease, the landlord must return the deposit in full, without interest. Chonsei agreements are widely used, accounting for roughly half of all rental contracts in Korea (Jing et al. (2024)).

Because of these features, the Chonsei can be regarded as a peer-to-peer housing credit system, in which landlords effectively borrow large, interest-free deposits from tenants. Operating outside the scope of formal financial regulation, Chonsei credit also constitutes a form of shadow credit.

Moreover, since landlords typically repay departing tenants' deposits with funds provided by incoming tenants, Chonsei credit functions as the economic equivalent of an interest-free mortgage with indefinite maturity. In practice, landlords often employ these funds to finance speculative secondary home purchases, thereby leveraging their housing investments.

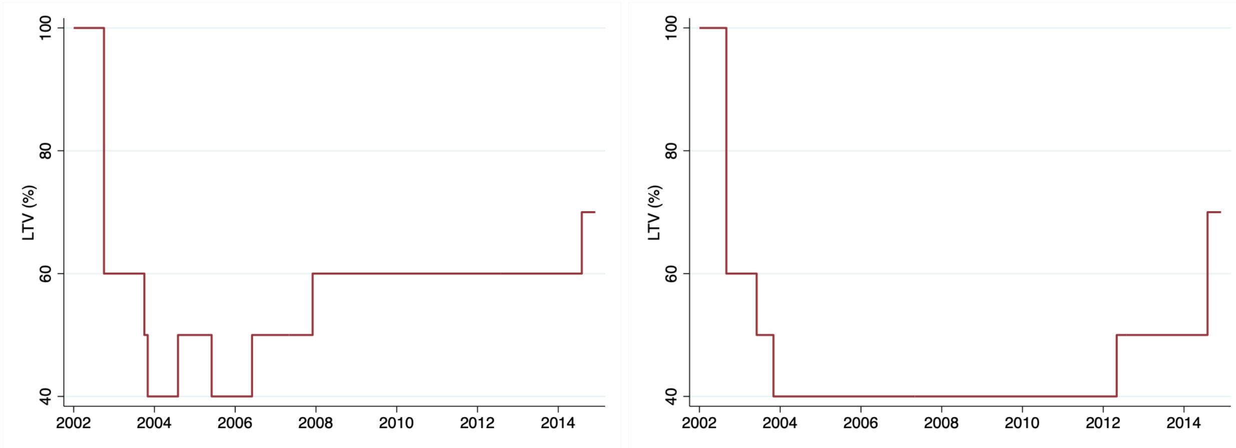
Appendix C Figures and Tables

Figure C.1: Administrative Divisions in South Korea



Notes: This figure illustrates the structure of South Korea's administrative divisions, organized into multiple layers. The first tier includes provinces and metropolitan cities, such as Seoul, Incheon, and Gyeonggi. Provinces consist of cities, with some large cities further subdivided into districts called "Gu." All metropolitan cities are also subdivided into districts (Gu). The smaller cities within provinces that are not subdivided into districts, along with the districts within larger cities and metropolitan cities (highlighted in red), represent the smallest administrative units for which house price indexes are available. They also serve as the regulatory units to which LTV/PTI policies and Speculation Area designations are applied. In this paper, I refer to the first-tier divisions—provinces and metropolitan cities—as "provinces," and the second-tier divisions—smaller cities and districts within both metropolitan and large cities—as "city districts."

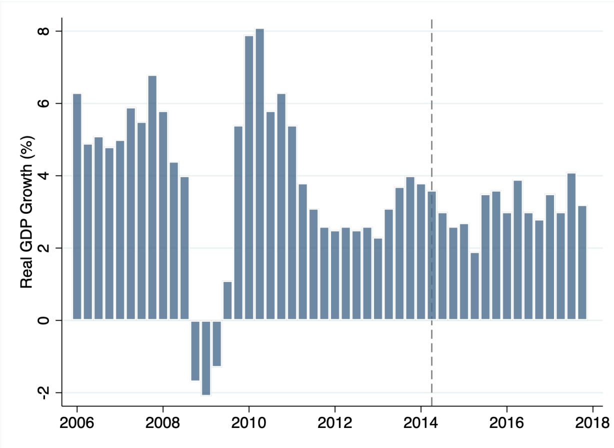
Figure C.2: Typical LTV Policies Prior to the 2014 LTV/PTI Relaxation



(a) Suseong District, Daegu (b) Gangnam District, Seoul

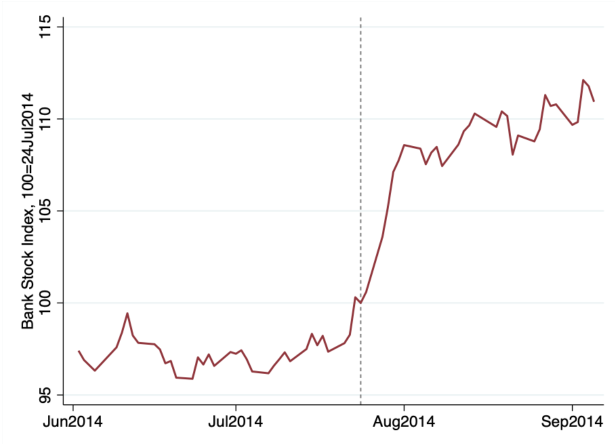
Notes:This figure illustrates typical LTV policies prior to the 2014 LTV/PTI relaxation. Panel (a) shows the LTV policies applied to Suseong District in Daegu, while panel (b) shows those applied to Gangnam District in Seoul.

Figure C.3: House Prices and Bank Stock Prices Around the 2014 LTV/PTI Deregulation



(a) Quarterly Real GDP Growth

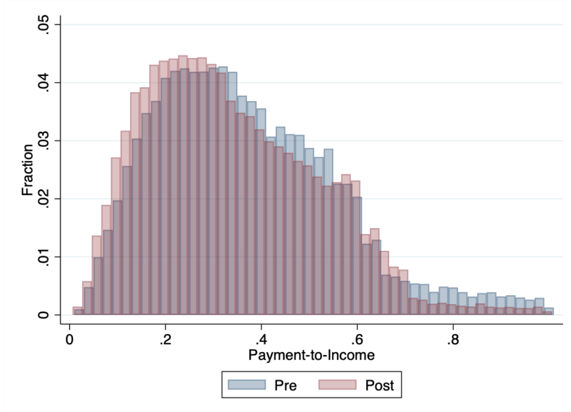
(b) Monthly House Prices



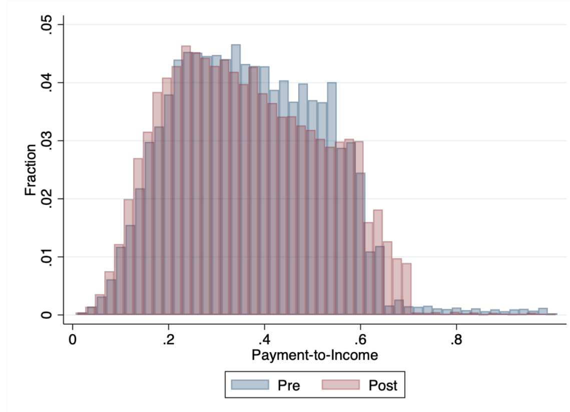
(c) Daily Bank Stock Prices

Notes: This figure illustrates quarterly GDP growth (panel (a)), aggregate monthly house prices (panel (b)), and the daily bank stock index (panel (c)) surrounding the LTV/PTI relaxation, which was announced on July 24, 2014, and implemented on August 1, 2014. Both the house price index and the bank stock index are normalized to 100 on the announcement date, indicated by the vertical dotted line.

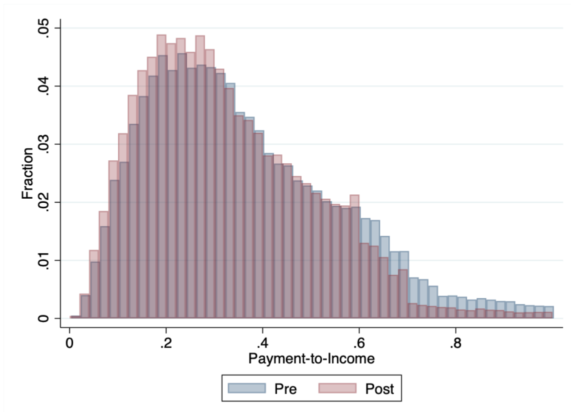
Figure C.4: Distribution of PTI for Originated Mortgage Loans



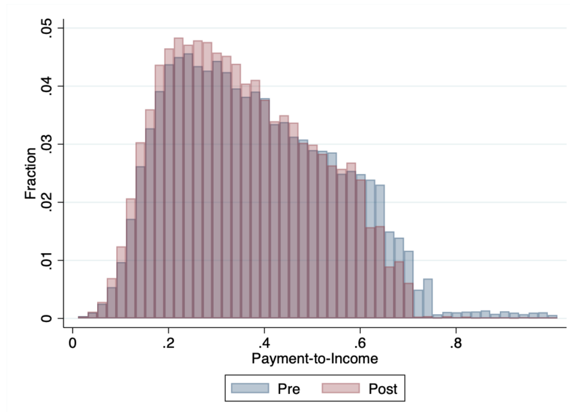
(a) Seoul, All



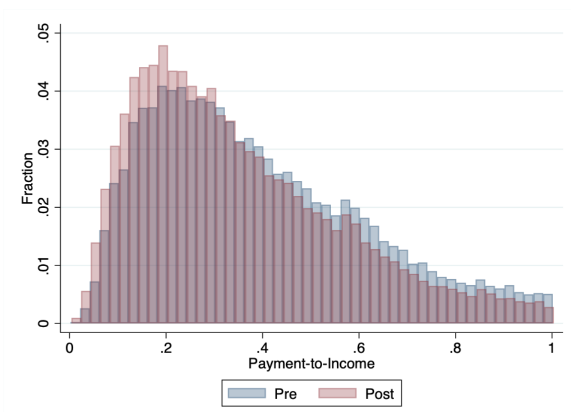
(b) Seoul, Loan > 100



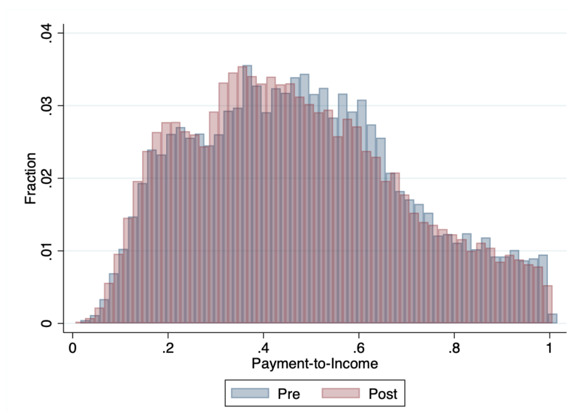
(c) Incheon and Gyeonggi, All



(d) Incheon and Gyeonggi, Loan > 100



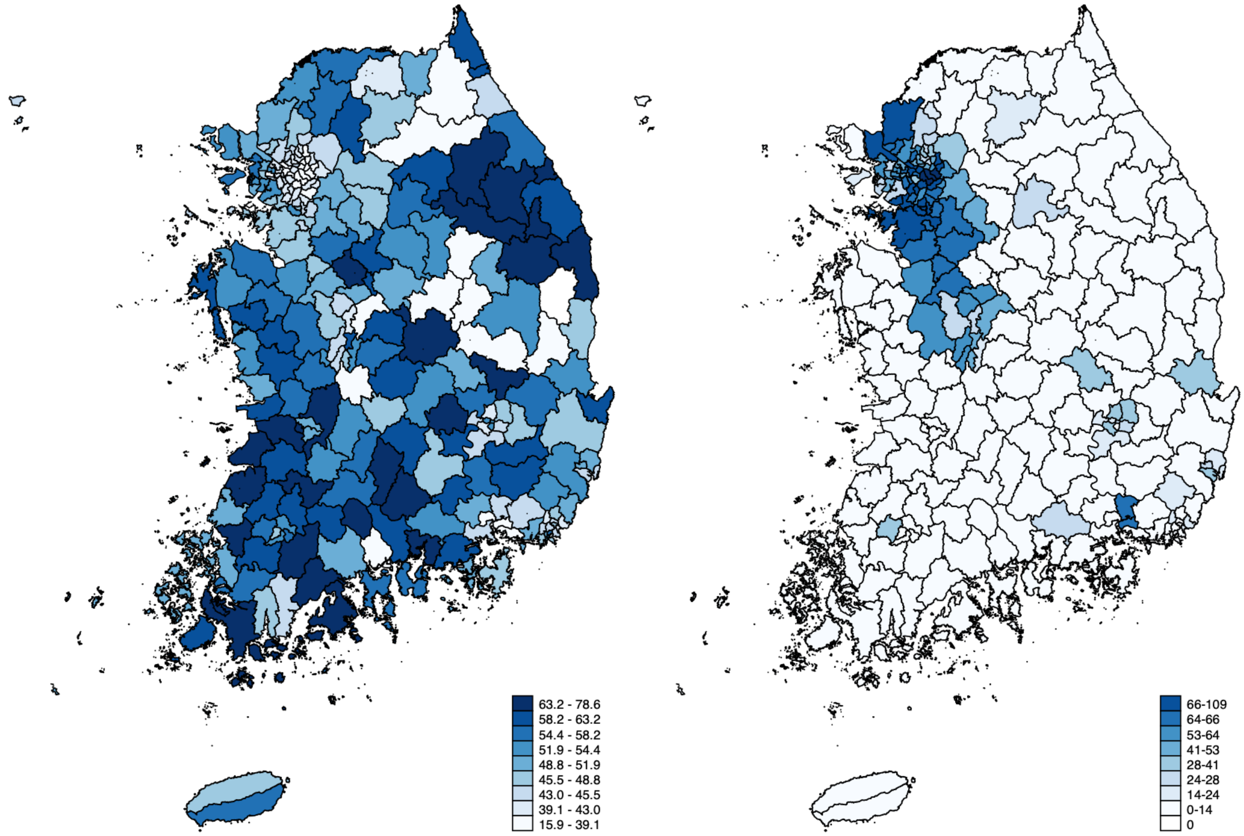
(e) Non-SCA, All



(f) Non-SCA, Loan > 100

Notes: This figure presents the distribution of originated mortgage loans by their payment-to-income (PTI) ratios. The blue histogram shows loans originated between August 2012 and July 2014, while the red histogram shows loans originated between August 2014 and July 2016. Panels (a) and (b) present distributions for loans on houses located in Seoul. Panels (c) and (d) display distributions for loans in Incheon and Gyeonggi. Panels (e) and (f) depict distributions for loans originated outside the Seoul Capital Area (SCA). Panels (b), (d), and (f) restrict the sample to loans exceeding 100 million KRW, which were subject to PTI regulations.

Figure C.5: Credit and Signal Exposures

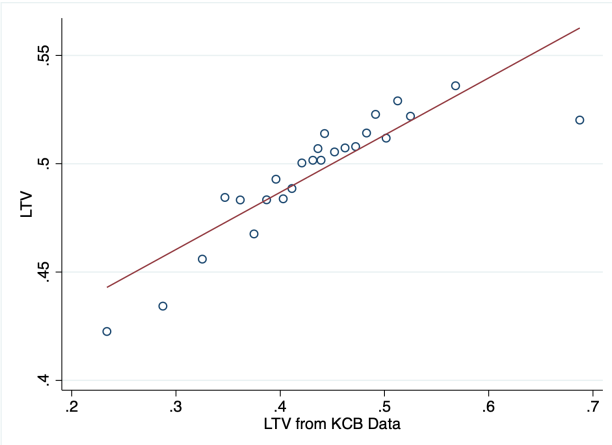


(a) Constraint Exposure

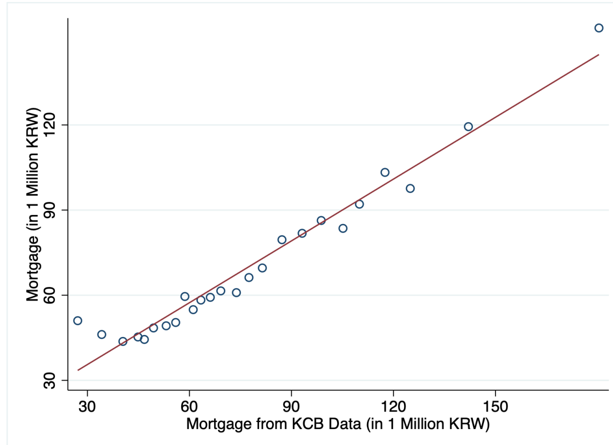
(b) Signal Exposure

Notes: This figure presents city-district–level heat maps of constraint exposure (panel (a)) and signal exposure (panel (b)). constraint exposure is measured as the share of mortgage loans originated within 2 percent of the LTV or PTI limits before July 2014. Signal exposure is defined as the total number of months each district was designated as a Speculation Area prior to May 2012.

Figure C.6: Consistency between Bank and KCB Mortgage Data



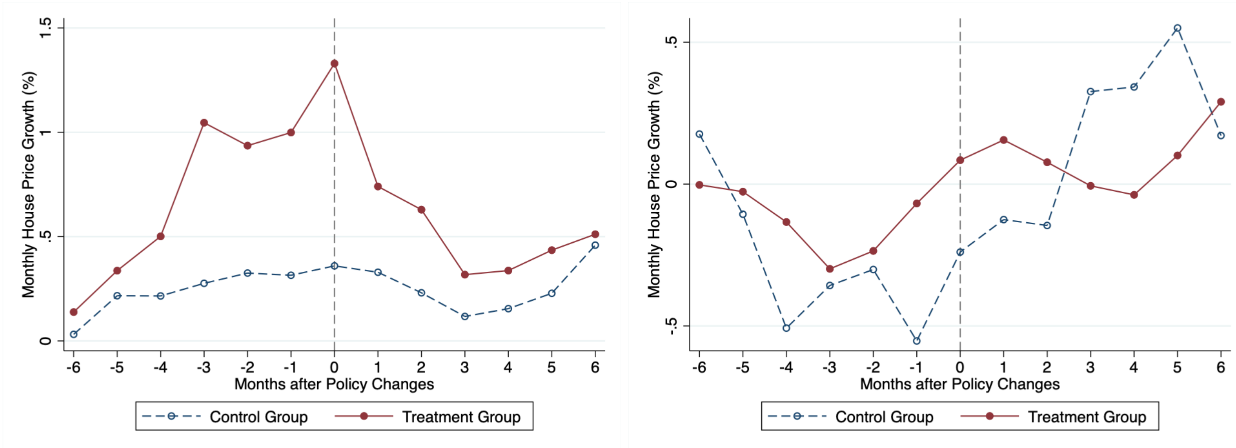
(a) Loan-to-value Ratio



(b) Loan Amount

Notes: This figure compares mortgage origination data from a major commercial bank with loan balance data from the Korea Credit Bureau (KCB), which covers the entire Korean population. Panel (a) plots city-district–level average loan-to-value (LTV) ratios from the mortgage origination data against those from the KCB data. Panel (b) compares city-district–level average loan amounts from the mortgage origination data with average loan balances from the KCB data. The mortgage origination data reflect loans made before July 2014, while the KCB loan balance data are from December 2012. To compute LTV ratios using KCB data, the KCB matched individuals' addresses with historical house prices from Real Estate 114.

Figure C.7: House Prices around Speculation Area Designations

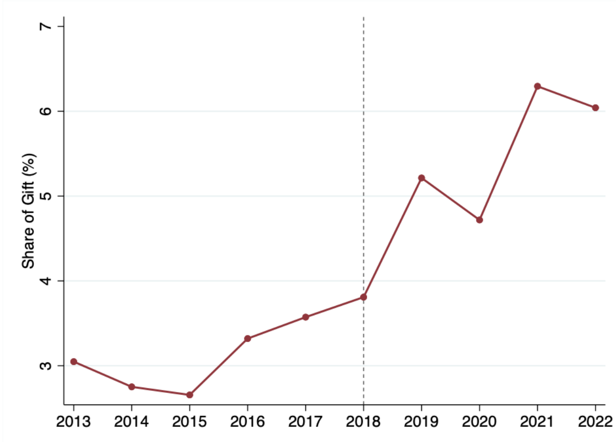


(a) Around Designation

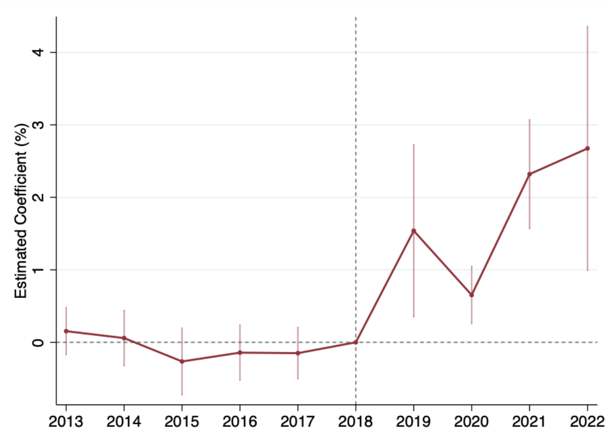
(b) Around De-Designation

Notes: This figure illustrates average monthly house price growth around Speculation Area designations. Panel (a) focuses on periods surrounding designation, and panel (b) examines periods surrounding de-designation.

Figure C.8: Housing Gifts Following the 2018 Property Tax Change



(a) Share of Housing Gifts



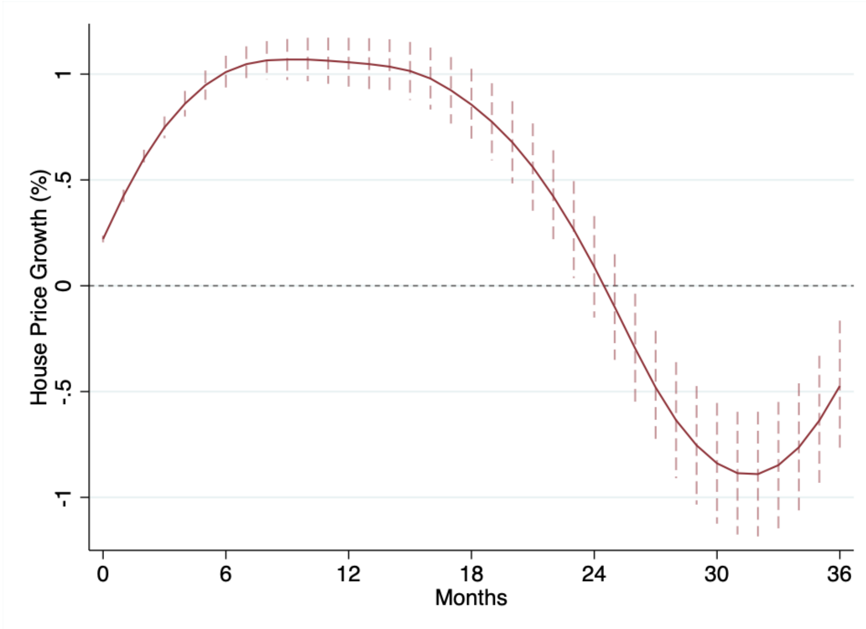
(b) DiD Estimates

Notes: This figure illustrates the impact of changes in annual property taxes, announced in September 2018 and implemented in 2019, on housing transfers made as gifts. Panel (a) shows the share of housing gifts as a percentage of total housing transactions from 2013 to 2022. Panel (b) presents results from the following dynamic difference-in-differences estimation with a 95% confidence interval:

$$log(y_{ct}) = \sum_{k \neq Jul2014} \beta_k \mathbb{1}(t = k) Exposure_c + \alpha_c + \alpha_t + \varepsilon_{ct}.$$

where c and t denote city district and year, respectively. The analysis uses the share of housing gifts as the outcome variable and signal exposure as the explanatory variable. Standard errors are clustered at the life-zone level.

Figure C.9: Interest Rates and House Prices: Jordà's Local Projection



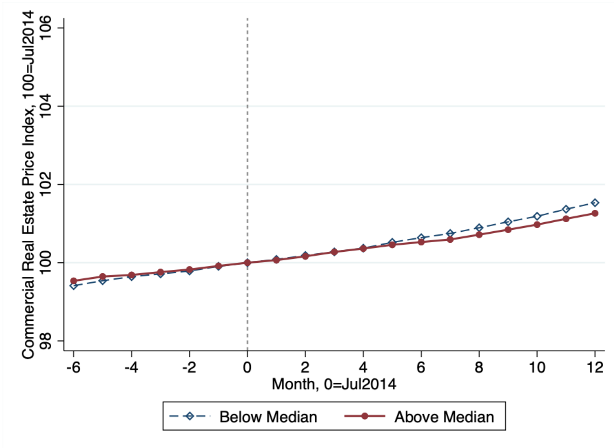
Notes: This figure presents estimation results based on Jordà's local projections:

$$\text{1st Stage: } \Delta\text{Rate}_{KR,t} = \alpha + \delta_1 \Delta\text{Rate}_{CN,t} + \delta_2 \Delta\text{Rate}_{US,t} + \varepsilon_t$$

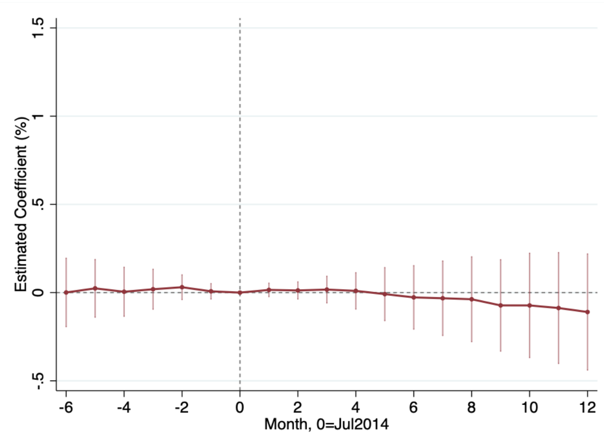
$$\text{2nd Stage: } \Delta\text{House Prices}_{t+h} = \gamma + \beta_h \widehat{\Delta\text{Rate}}_{KR,t-1} + \nu_{t+h}$$

where changes in the Bank of Korea's policy rate are instrumented with policy rate changes in China and the US to identify the relationship between monetary policy and house price growth in South Korea. The figure plots the estimated coefficients β_h from these local projection specifications with 95% confidence interval

Figure C.10: Commercial Real Estate Prices in Expectation-Sensitive Areas



(a) Signal Exposure: Below vs. Above Median



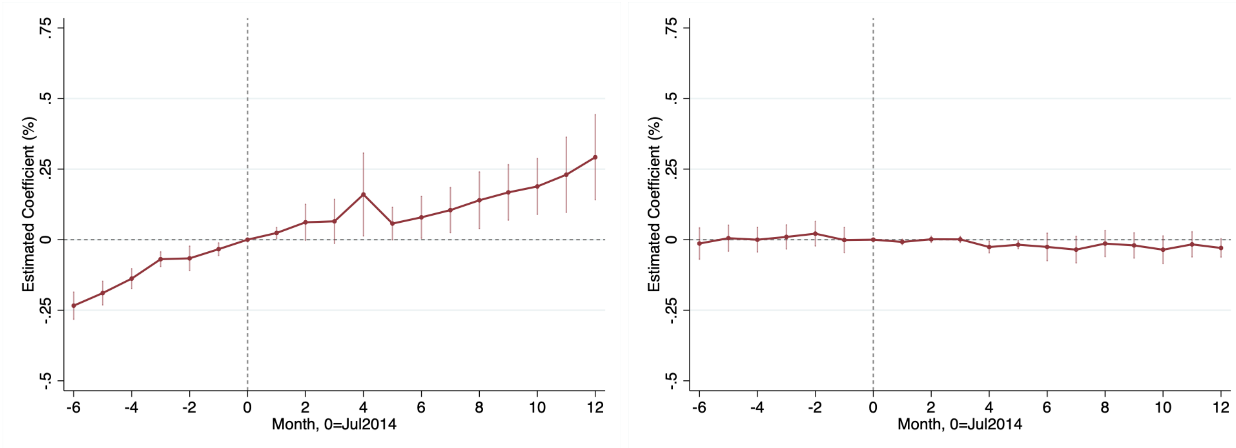
(b) DiD Estimates

Notes: This figure illustrates the impact of the 2014 LTV/PTI relaxation on commercial real estate prices. Panel (a) divides city districts into those above and below the median signal exposure—measured by the duration as Speculation Areas before May 2012—and shows monthly commercial real estate prices for each group. Prices are expressed relative to the level in July 2014, which is indexed to 100. Panel (b) presents results from the following dynamic difference-in-differences estimation with 95 percent confidence intervals:

$$log(y_{ct}) = \sum_{k \neq Jul2014} \beta_k \mathbb{1}(t = k) Exposure_c + \alpha_c + \alpha_t + \varepsilon_{ct}.$$

The outcome variable is the log commercial real estate price index, and the explanatory variable is signal exposure. Standard errors are clustered at the life-zone level.

Figure C.11: Income and Unemployment Rate in Expectation-Sensitive Areas



(a) Income

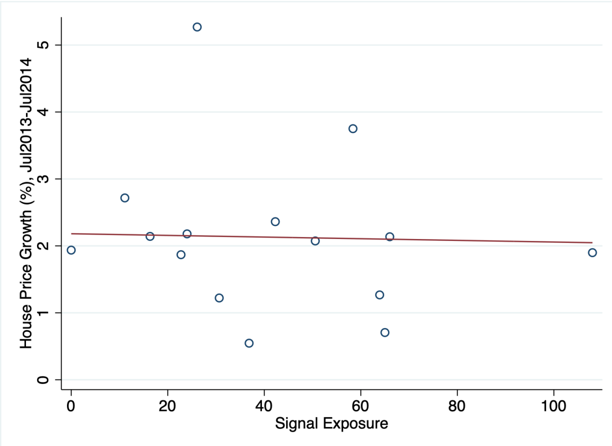
(b) Unemployment Rate

Notes: This figure presents results from the following dynamic difference-in-differences estimation with 95 percent confidence intervals:

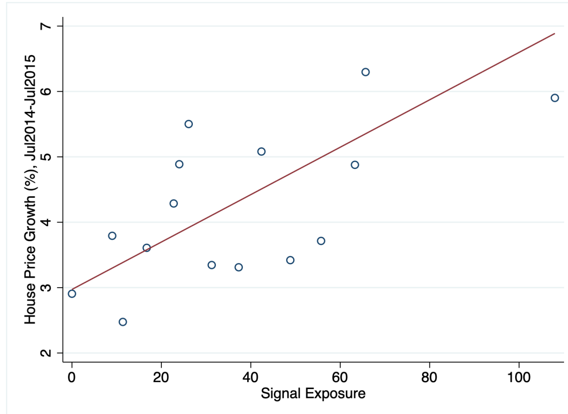
$$\log(y_{ct}) = \sum_{k \neq \text{Jul 2014}} \beta_k \mathbb{1}(t = k)\text{Exposure}_c + \alpha_c + \alpha_t + \varepsilon_{ct}.$$

Panel (a) uses the log of unemployment rates, and panel (b) uses the log of income as outcome variables. Both panels use signal exposure as the explanatory variable.

Figure C.12: Linearity between House Price Growth and Signal Exposure



(a) Pre-Period: July 2013–July 2014



(b) Pre-Period: July 2014–July 2015

Notes: This figure illustrates the linear relationship between house price growth and signal exposure. Panel (a) plots house price growth from July 2013 to July 2014 against signal exposure, while Panel (b) plots house price growth from July 2014 to July 2015 against signal exposure.

TABLE C.1: Sample of City Districts Designated as Speculation Areas

Province	City District	Periods as Speculation Areas	Duration (Months)
Panel A. Top 5			
Seoul	Gangnam	Apr2003-Apr2012	109
Seoul	Songpa	May2003-Apr2012	108
Seoul	Seocho	Jun2003-Apr2012	107
Gyeonggi	Yeongtong, Suwon	May2003-Oct2008	66
Gyeonggi	Sangnok, Ansan	May2003-Oct2008	66
Panel B. Bottom 5			
Gyeonggi	Dongducheon	Dec2007-Oct2008	11
Incheon	Dong	Jan2008-Oct2008	10
Gyeongsangnam	Yangsan	Oct2003-Jul2004	10
Daegu	Seo	Oct2003-Jul2004	10
Daegu	Dalseong	Sep2005-May2006	9
Panel C. First Areas			
Chungcheongnam	Seobuk, Cheonan	Feb2003-Dec2007	59
Chungcheongnam	Dongnam, Cheonan	Feb2003-Dec2007	59
Daejeon	Yuseong	Feb2003-Nov2004; May2005-Nov2007	53
Daejeon	Seo	Feb2003-Nov2004; May2005-Aug2007	50

Notes: This table presents the top 5 and bottom 5 city districts based on the duration of their designation as Speculation Areas, along with the city districts that were first designated as Speculation Areas in February 2003.

TABLE C.2: Changes in Annual Property Taxes in 2018

House Prices	Pre-2019 (%)	Post-2019 (%)	
		Speculators	Others
Below 300 Million KRW	0.50	0.60	0.50
300–600 Million KRW	0.50	0.90	0.70
600–1.2 Billion KRW	0.75	1.3	1
1.2–5 Billion KRW	1	1.8	1.4
5–9.4 Billion KRW	1.5	2.5	2
Above 9.4 Billion KRW	2	3.2	2.7

Notes: This table summarizes the changes in annual property taxes announced in September 2018 and implemented in 2019. "Speculators" refer to owners of multiple residential properties.

TABLE C.3: House Price Growth in Rate- and Expectation-Sensitive Areas

Dep. Var:	Monthly House Price Growth (%)				
	(1)	(2)	(3)	(4)	(5)
Signal Exposure × Post, Standardized	0.0653***		0.0508**	0.0277	0.0464**
	(0.0194)		(0.0247)	(0.0176)	(0.0215)
Chonsei Prevalence × Post, Standardized		0.0707**	0.0304	-0.0183	-0.00480
		(0.0269)	(0.0316)	(0.0450)	(0.0454)
City District FEs	Yes	Yes	Yes	Yes	Yes
Year-Month FEs	Yes	Yes	Yes		
Province × Year-Month FEs				Yes	Yes
Controls					Yes
R^2	0.477	0.474	0.477	0.599	0.600
#Obs	3,216	3,216	3,216	2,931	2,931

Notes: This table presents the results from the following difference-in-differences specification:

$$\Delta \log(y_{ct}) = \beta, Exposure_c, Post_t + \gamma X_c Post_t + \alpha_c + \alpha_{p(c\in p),t} + \varepsilon_{ct}$$

where c and t denote city district and month, respectively. The outcome variable is the log difference in house prices. The key explanatory variables are (i) signal exposure, defined as the number of months a district was designated as a Speculation Area prior to 2012, and (ii) Chonsei prevalence, defined as the share of homes under Chonsei agreements. Control variables include the city district–level average age and credit score, which account for the presence of marginal homebuyers and variation in homebuying behavior over the life cycle. The sample covers the six months preceding and the twelve months following the policy change. Standard errors are clustered at the life-zone level and reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

TABLE C.4: Expectation-Sensitive Area's Interest-Rate Sensitivity

	L24.Rates			L36.Rates		
	1st Stage	1st Stage	2nd Stage	1st Stage	1st Stage	2nd Stage
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Var:	Δr(%)	Δr(%)×Sig	ΔHP(%)	Δr(%)	Δr(%)×Sig	ΔHP(%)
Δr_{US}(%)	0.0943***	-0.0120***		0.110***	-0.0134***	
	(0.000177)	(0.00420)		(0.000319)	(0.00476)	
Δr_{CN}(%)	1.036***	0.0266***		1.002***	0.00896**	
	(0.00126)	(0.00951)		(0.00207)	(0.00392)	
Δr_{US}(%)×Signal Exposure, Std	0.000622***	0.118***		0.00114***	0.138***	
	(0.000193)	(0.000339)		(0.000316)	(0.000170)	
Δr_{CN}(%)×Signal Exposure, Std	-0.00384***	0.985***		-0.00571***	0.976***	
	(0.00105)	(0.00187)		(0.00165)	(0.000550)	
$\widehat{\Delta r}$(%)			-1.572***			-0.830**
			(0.559)			(0.373)
Δr(%) × $\widehat{\text{Signal}}$ Exposure			1.352***			0.616***
			(0.319)			(0.167)
Constant	-0.188***	-0.0928***	4.090***	-0.164***	-0.0853***	4.010***
	(0.000965)	(0.0325)	(0.178)	(0.00214)	(0.0289)	(0.184)
Adjusted R^2	0.790	0.763	0.0257	0.754	0.742	0.00755
#Obs	16,686	16,686	16,686	16,686	16,686	16,686

Notes: This table uses house price data prior to the 2014 deregulation and presents the estimation results for the following specification:

$$\text{1st Stage: } \Delta r_{KR,t} = \alpha_1 + \delta_1 \Delta r_{CN,t} + \delta_2 \Delta r_{US,t} + \delta_3 \Delta r_{CN,t} \cdot Exposure_{ct} + \delta_4 \Delta r_{US,t} \cdot Exposure_{ct} + \nu_{1,t}$$

$$\text{1st Stage: } \Delta r_{KR,t} \cdot Exposure_c = \alpha_2 + \gamma_1 \Delta r_{CN,t} + \gamma_2 \Delta r_{US,t} + \gamma_3 \Delta r_{CN,t} \cdot Exposure_c + \gamma_4 \Delta r_{US,t} \cdot Exposure_c + \nu_{1,t}$$

$$\text{2nd Stage: } \Delta HousePrices_{c,t} = \alpha + \beta_1 \Delta \widehat{Rate}_{KR,t-h} + \beta_2 \Delta r_{KR,t-h} \widehat{\cdot Exposure}_c + \varepsilon_{c,t}$$

where c and t denote city district and month, respectively. $\Delta r_{KR,t}$, $\Delta r_{US,t}$, and $\Delta r_{CN,t}$ denote policy interest rates in Korea, US, and China, respectively. $Exposure_c$ denotes signal exposure, defined as the number of months a district was designated as a Speculation Area prior to 2012. The sample spans from November 2011 to June 2014. Standard errors, clustered at the life-zone level, are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

TABLE C.5: Placebo Test: Commercial Real Estate Prices

Dep. Var:	Monthly Commercial Real Estate Price Growth (%)				
	(1)	(2)	(3)	(4)	(5)
Signal Exposure × Post, Standardized	-0.009		-0.0121	-0.0071	-0.0039
	(0.0063)		(0.0077)	(0.0111)	(0.0124)
Constraint Exposure × Post, Standardized		0.0007	-0.009	-0.0075	-0.0127
		(0.0121)	(0.0137)	(0.0199)	(0.0241)
City District FEs	Yes	Yes	Yes	Yes	Yes
Year-Month FEs	Yes	Yes	Yes		
Province×Year-Month FEs				Yes	Yes
Controls					Yes
Adjusted R^2	0.129	0.128	0.129	0.143	0.142
#Obs	4,567	4,567	4,567	3,826	3,826

Notes: This table presents the results from a difference-in-differences estimation based on the following specification:

$$\Delta \log(y_{ct}) = \beta\, Exposure_c\, Post_t + \gamma X_c Post_t + \alpha_c + \alpha_{p(c\in p),t} + \varepsilon_{ct}$$

where c and t denote city district and month, respectively. The outcome variable is the log difference of commercial real estate prices, and the key explanatory variables are (i) signal exposure, defined as the number of months a district was designated as a Speculation Area prior to 2012, and (ii) constraint exposure, defined as the share of mortgage loans originated within 2 percent of the LTV/PTI limits before July 2014. Control variables include the city-district–level average age and credit score, which account for the presence of marginal homebuyers and variation in homebuying behavior over the life cycle. The sample covers the six months preceding and the twelve months following the policy change. Standard errors, clustered at the life-zone level, are reported in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

TABLE C.6: House Price Growth and Housing Supply

Dep. Var:	Ln(Permit)		Ln(Relative Permit)	
	(1)	(2)	(3)	(4)
ΔPrice(%)	0.0097**	0.0070**	0.0096**	0.0064*
	(0.0039)	(0.0034)	(0.0040)	(0.0034)
ΔPrice(%)× Signal Exposure, Standardized	0.0005	-0.0006	0.0012	0.0000
	(0.0032)	(0.0035)	(0.0032)	(0.0036)
City FEs	Yes	Yes	Yes	Yes
Year FEs	Yes		Yes	
Province × Year FEs		Yes		Yes
Adjusted R^2	0.9511	0.9727	0.9453	0.9696
#Obs	390	390	390	390

Notes: This table reports estimates of the β coefficients from the following specification:

$$\ln(Permit)_{ct} = \beta_1 \Delta HousePrice_{ct-1} + \beta_2 \Delta HousePrice_{ct-1} \cdot Exposure_c + \alpha_c + \alpha_{c\in p,t} + \varepsilon_{ct}$$

where c and t denote city district and year, respectively. Columns (1) and (2) use the log of housing construction permits as the outcome variable, while Columns (3) and (4) use the log of housing construction permits relative to the number of houses in the previous year. Exposure refers to the number of months an area was designated as a Speculation Area before 2012. The sample spans from 2011 to 2013. Standard errors, clustered at the life-zone level, are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively

TABLE C.7: Housing Supply in Expectation-Sensitive Areas

Dep. Var:	Ln(Permit)		Ln(Relative Permit)	
	(1)	(2)	(3)	(4)
Signal Exposure × Post, Standardized	0.2968*	0.2596**	0.2992*	0.2589**
	(0.1480)	(0.1196)	(0.1489)	(0.1202)
City District FEs	Yes		Yes	
Year FEs	Yes		Yes	
Province×Year FEs		Yes		Yes
Adjusted R^2	0.6157	0.4193	0.7199	0.3635
#Obs	306	306	306	306

Notes: This table presents the results from a difference-in-differences estimation based on the following specification:

$$y_{ct} = \beta\, Exposure_c\, Post_t + \gamma X_c Post_t + \alpha_c + \alpha_{p(c \in p),t} + \varepsilon_{ct}$$

where c and t denote city district and year, respectively. The outcome variables are the log of housing construction permits (Columns (1) and (2)), and the log of housing construction permits relative to the number of houses in the previous year (Columns (3) and (4)). The key explanatory variable is signal exposure, defined as the number of months a district was designated as a Speculation Area prior to 2012. Control variables include the city-district–level average age and credit score, which account for the presence of marginal homebuyers and variation in homebuying behavior over the life cycle. The sample spans from 2014 to 2015. Standard errors, clustered at the life-zone level, are reported in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

TABLE C.8: House Price Growth in Seoul Capital Area (SCA)

Dep. Var:	Monthly House Price Growth (%)			
	(1)	(2)	(3)	(4)
Signal Exposure × Post, Standardized	0.0511***	0.0357**	0.0475***	0.0634**
	(0.0142)	(0.0143)	(0.0176)	(0.0247)
Sample	All	All	All	Excl. Outliers
City District FEs	Yes	Yes	Yes	Yes
Year-Month FEs	Yes			
Province × Year-Month FEs		Yes	Yes	Yes
Controls			Yes	Yes
Adjusted R^2	0.563	0.570	0.571	0.560
#Obs	1,330	1,330	1,330	1,273

Notes: This table presents the results from a difference-in-differences estimation based on the following specification:

$$\Delta \log(y_{ct}) = \beta, Exposure_c, Post_t + \gamma X_c Post_t + \alpha_c + \alpha_{p(c \in p),t} + \varepsilon_{ct}$$

where c and t denote city district and month, respectively. The sample is restricted to city districts in the Seoul Capital Area (SCA), which includes Seoul, Incheon, and Gyeonggi. Column (4) further excludes three districts in Seoul—Gangnam, Seocho, and Songpa. The outcome variable is the log difference in house prices, and the key explanatory variable is signal exposure, defined as the number of months a district was designated as a Speculation Area prior to 2012. Control variables include the city district–level average age and credit score, which account for the presence of marginal homebuyers and variation in homebuying behavior over the life cycle. The sample covers the six months preceding and the twelve months following the policy change. Heteroskedasticity-robust standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively.