Diagnostic Expectations into Housing DSGE and Productive Investment Crowding-Out Effect*

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Abstract

This paper applies diagnostic expectations to analyze expectation formation in housing markets and uncovers a novel investment crowding-out mechanism. Using Korean housing market data, we find systematic overreaction—persistent optimism even as prices decline—that cannot be explained by rational expectations. Incorporating the diagnostic expectations proposed by Bordalo, Gennaioli and Shleifer (2018) into the housing DSGE model of Iacoviello (2005), we examine its macroeconomic spillover effects. When agents with a diagnostic bias overreact to positive housing market news—such as favorable preference shocks or expansionary monetary policy—they form excessively optimistic price expectations, fueling excessive housing demand, particularly among previously constrained agents, and diverting resources from productive investment. Consequently, overheated expectations trigger an investment crowding-out effect in the productive sector. Unlike studies emphasizing bank lending channels, we show that expectation formation itself can misallocate resources. These results imply that effective housing policy should manage expectations through credible communication, not merely target credit conditions.

JEL Classification: E32; E44; R31; D84
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1 Introduction

Housing market expectations constitute a fundamental driver of price dynamics and broader macroeconomic fluctuations. Case and Shiller (2003) demonstrate that economic fundamentals often fail to explain house prices volatility, highlighting the central role of expectations in price formation. This finding gains particular significance in light of Kaplan, Mitman and Violante (2020), who attribute the boom-bust cycles surrounding the Global Financial Crisis primarily to fluctuations in agent beliefs rather than fundamental factors. Given the substantial macroeconomic implications of housing markets (Iacoviello, 2005; Leamer, 2007), understanding expectation formation mechanisms becomes critical for both theoretical modeling and policy design.

The assumption of rational expectations (RE) underlying most housing models faces mounting empirical challenges (Adam, Pfäuti and Reinelt, 2025; Armona, Fuster and Zafar, 2019; Case, Shiller and Thompson, 2012; De Stefani, 2021).[1] This motivates our investigation into housing market expectation dynamics and the macroeconomic implications of alternative expectation formation mechanisms. Specifically, we address two key questions: Do housing market expectations conform to rational expectations? If not, what are the macroeconomic consequences of adopting alternative expectation formation mechanisms?

We examine these questions using Korean data, where housing markets play an exceptionally prominent role in the macroeconomy. According to the 2024 Survey of Household Finance and Living Conditions, real estate comprises 75.2% of household assets in Korea, substantially exceeding comparable figures for the United States (28.5%) and Japan (37%). This concentration amplifies the transmission of housing market fluctuations to key macroeconomic variables including household credit, consumption, and investment, making Korea an ideal laboratory for studying housing-macro linkages.

[1] See Kuchler, Piazzesi and Stroebel (2023) for a detailed survey of housing market expectations.

Our empirical analysis first tests the rational expectations hypothesis in Korean housing markets by estimating impulse responses of forecast errors following Angeletos, Huo and Sastry (2021) and Adam et al. (2025). The results reveal patterns inconsistent with rational expectations: following positive house prices shocks, price expectations remain persistently optimistic even as actual prices begin declining. This systematic forecast error pattern suggests the need for alternative expectation formation mechanisms.

Building on this empirical evidence, we incorporate diagnostic expectations proposed by Bordalo et al. (2018) into Iacoviello (2005)'s housing DSGE framework, following the methodological approaches of Bianchi, Ilut and Saijo (2024a), L'Huillier, Singh and Yoo (2024). Diagnostic expectations capture the representativeness heuristic (Kahneman and Tversky, 1972), whereby agents overweight salient or representative events when forming expectations, leading to systematic overreaction to recent news. This behavioral bias aligns well with survey evidence and psychological experiments, and has proven successful in explaining overreaction patterns across various macroeconomic and financial contexts (Bianchi et al., 2024a; Bordalo et al., 2018; L'Huillier et al., 2024; Maxted, 2024; Na and Yoo, 2025).

Our principal finding is the identification of a novel expectation-driven productive investment crowding-out mechanism operating independently of credit market channels. When agents with a diagnostic bias overreact to positive housing market news—such as favorable housing preference shocks or accommodative monetary policy—they form excessively optimistic price expectations. This optimism fuels excessive housing demand, particularly among previously constrained agents, diverting resources away from productive investment. Consequently, as housing market expectations overheat, an investment crowding-out effect emerges in the productive sector.

This expectation-based crowding-out mechanism represents a fundamentally different channel from existing literature on housing boom effects. While recent studies document how housing booms crowd out productive investment through bank lending chan-

nels (Chakraborty, Goldstein and MacKinlay, 2018; Chen, Liu, Xiong, Zhou et al., 2017; Choi, Kim and Yun, 2025; Hau and Ouyang, 2024; Martín, Moral-Benito and Schmitz, 2021), our analysis reveals that expectation formation itself—independent of credit supply mechanisms—can generate similar crowding-out effects. This channel operates directly through agent behavior rather than financial intermediation, suggesting that diagnostic bias alone can misallocate resources during housing booms even without credit market frictions.

These findings carry important policy implications extending beyond traditional financial stability concerns. Policymakers should recognize that housing booms create resource misallocation not only through credit markets but also through expectation-driven behavior. During diagnostic bias-driven housing booms, expansionary monetary policy may inadvertently exacerbate crowding-out effects by amplifying expectation biases, potentially reducing rather than enhancing long-term growth. This suggests that effective housing market policy requires managing expectations through credible communication and policy consistency, not merely targeting credit conditions.

The remainder of the paper proceeds as follows. Section 2 presents our empirical test of rational expectations in Korean housing markets. Section 3 explains the incorporation of diagnostic expectations into the housing DSGE model. Section 4 analyzes the crowding-out effects by comparing impulse responses under diagnostic versus rational expectations. Section 5 concludes with policy implications and directions for future research.

Related Literature This study contributes to several strands of literature. First, it extends the growing literature analyzing macroeconomic and financial fluctuations through diagnostic expectations. Bordalo et al. (2018) formalized the concept of diagnostic expectations and documented systematic overreaction in credit spreads rather than stock prices specifically. Maxted (2024) introduced diagnostic expectations into a macro-finance model and demonstrated how this framework can explain overreaction patterns in finan-

cial intermediation and risk premia during financial crises. L'Huillier et al. (2024) and Bianchi et al. (2024a) both incorporate diagnostic expectations into New Keynesian models, with the former focusing on deriving general equilibrium implications from diagnostic expectations and the latter emphasizing *diagnostic business cycles* with particular attention to consumption and investment dynamics. Bianchi, Ilut and Saijo (2024b) extends diagnostic expectations to smooth diagnostic expectations, analyzing asymmetric responses to positive and negative shocks. Na and Yoo (2025) employed diagnostic expectations in an open economy RBC model to account for overreaction in external balance fluctuations. Bounader and Elekdag (2024) represents the closest research to our study, as it also incorporates diagnostic expectations into Iacoviello (2005)'s housing DSGE framework. However, compared to Bounader and Elekdag (2024), our study focuses more specifically on how expectation overreaction distorts the transmission mechanisms of economic shocks and identifies novel crowding-out effects.

Second, this study contributes to the literature on crowding-out effects during housing booms. Chen et al. (2017) analyzes how real estate shocks can hamper corporate investment through both speculation and crowding-out channels, showing that firms reduce non-land investment to pursue land speculation while banks redirect credit from non-land-holding to land-holding firms. Chakraborty et al. (2018) found that before the Global Financial Crisis, banks increased mortgage lending while decreasing commercial lending, leading borrowing firms to significantly reduce investment. Martín et al. (2021) documented that banks temporarily reduce non-housing loans to meet mortgage demand during housing booms, creating substantial short-run crowding-out effects for non-housing credit. Choi et al. (2025) demonstrated using micro-level data that banks tighten credit conditions for businesses while easing mortgage lending, leading to resource misallocation. While these studies focus on crowding-out effects through bank-lending channels, our study emphasizes the role of expectation formation itself as a distinct mechanism, complementing the existing literature. Guerron-Quintana, Hirano and Jinnai (2023) rep-

resents the closest research in terms of highlighting expectation-driven crowding-out effects. They develop a model with recurrent bubbles and endogenous growth, demonstrating that expectations about future bubbles generate a novel crowding-out effect: households anticipate future wealth from bubbles, leading them to consume more and invest less in the present, which reduces current economic growth. However, their analysis assumes rational expectations and focuses on *ex-ante* crowding-out effects that occur before bubble realization due to expectations of future bubbles. In contrast to their research, we adopt diagnostic expectations, which appear more realistic based on survey data evidence. Moreover, while their crowding-out effects arise from rational anticipation of future bubbles, our research identifies that crowding-out effects from expectation overreaction can occur *during* and *after* housing booms through persistent diagnostic bias, representing a fundamentally different mechanism operating through systematic expectation errors rather than rational forward-looking behavior.

2 Empirical Analysis

This section examines expectation dynamics in the Korean housing market by estimating impulse responses of forecast errors to house price shocks. Following Angeletos et al. (2021) and Adam et al. (2025), we analyze how the gap between realized prices and expectations evolves dynamically, revealing patterns that static analysis cannot capture.

2.1 Data and Methodology

Given limited survey data on Korean house price expectations, we employ a two-stage approach. First, we construct a forecast error proxy by regressing 12-month ahead price changes on current sentiment:

$$p^h_{t+12} / p^h_t = \alpha + \beta \cdot CSI_t + \varepsilon_t \tag{1}$$

where p_t^h denotes the real house price index and CSI_t is the consumer sentiment index capturing one-year-ahead housing expectations. The residual $\hat{\varepsilon}_t$ serves as our forecast error proxy: positive values indicate under-reaction (prices exceed expectations), while negative values suggest over-reaction (expectations overshoot realizations).

Second, we estimate local projections (Jordà, 2005) to trace dynamic responses:

$$Y_{t+k} = \alpha^{(k)} + \beta^{(k)} \cdot (p_{t-1}^h / p_{t-2}^h) + v_t^{(k)} \tag{2}$$

where $Y_{t+k} \in \{p_{t+k}^h / p_{t-1}^h, \hat{\varepsilon}_{t+k}\}$ represents either cumulative price growth or the forecast error at horizon k. We compute HAC standard errors to account for serial correlation and heteroskedasticity.

The data span January 2013 to January 2025, using the Kookmin Bank Housing Price Index (deflated by CPI) and the Bank of Korea's Consumer Sentiment Index.

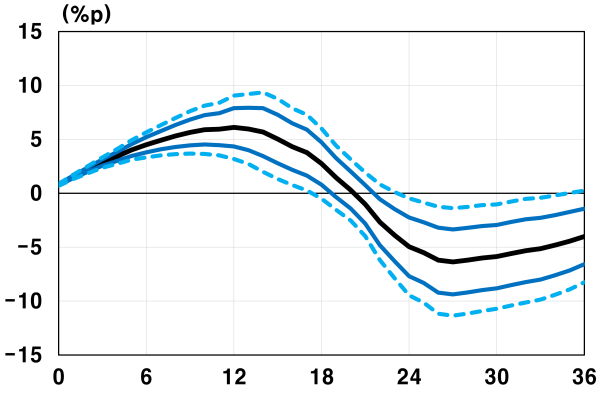
2.2 Empirical Results

Figure 1 presents impulse responses to a one percentage point house price shock. Panel (a) shows that house prices exhibit momentum for approximately 12 months before gradually mean-reverting. The cumulative response peaks at month 12, remains elevated through month 24, and dissipates by month 36. Panel (b) reveals overreaction in expectations: the forecast error turns significantly negative at months 12-25, indicating that expectations overshoot realized prices during this period. Notably, expectations normalize (the error returns to zero) around month 26-27, the time when the price deceleration becomes most pronounced.

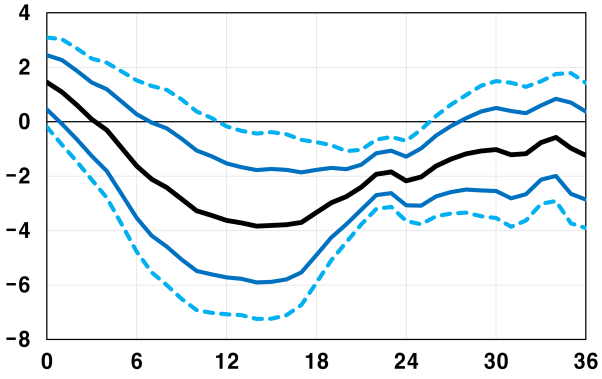
Two key findings emerge. First, expectations exhibit overreactions in housing expectations—initially adjusting appropriately but subsequently overshooting for nearly two years. Second, belief revision occurs abruptly when price reversals become salient, suggesting threshold effects in expectation updating.

Figure 1: Dynamic Responses to House Price Shocks

(a) Cumulative price response



(b) Forecast error response



Notes: Panel (a): cumulative house price response. Panel (b): forecast error response. Shading indicates 68% (dark) and 90% (light) confidence intervals.

Taken together, these findings provide evidence of systematic overreaction in house prices expectations within the Korean housing market. This overreaction dissipates when the actual adjustment in house prices becomes evident. These results are consistent with prior studies documenting that housing market participants' expectations are often distorted relative to actual price movements (Adam et al., 2025; Angeletos et al., 2021; Armona et al., 2019; Case et al., 2012; De Stefani, 2021).

Since this systematic overreaction pattern in expectations cannot be explained by rational expectations, our findings underscore the need for introducing alternative expectation formation mechanisms to better account for housing market dynamics and derive policy implications.

3 Models

We develop a DSGE model that incorporates diagnostic expectations into the two-agent New Keynesian framework of Iacoviello (2005) to analyze housing market dynamics. The structure of this section is as follows. Section 3.1 describes the overall structure of the DSGE model. Section 3.2 introduces the concept of diagnostic expectations and

details the methodology used to incorporate them into the model. Section **??** explains the calibration and estimation results for the model parameters.

3.1 Model Setting

3.1.1 Households

Households consume non-durable goods and housing services, and supply labor. They are classified as *patient* or *impatient* according to their discount factors ($\beta_p > \beta_i$). Impatient households have a stronger preference for current consumption and finance it by borrowing from patient households. Borrowing is collateralized by housing assets, subject to a loan-to-value (LTV) ratio constraint. Both types of households derive utility from housing services, and their preferences are affected by a common housing preference shock j_t, which can be interpreted as a shift in demand for housing services.[2]

Both patient and impatient households face identical prices in the goods market, implying no heterogeneity in price-taking behavior.[3]

Patient households maximize

$$U_p = \log c_{p,t} + j_t \log h_{p,t} - \frac{L_{p,t}^{1+\eta}}{1+\eta} + E_t^{\theta} \sum_{s=1}^{\infty} \beta_p^s \left(\log c_{p,t+s} + j_{t+s} \log h_{p,t+s} - \frac{L_{p,t+s}^{1+\eta}}{1+\eta} \right) \tag{3}$$

subject to the budget constraint

$$P_t c_{p,t} + Q_t h_{p,t} + \frac{B_{p,t+1}}{R_t} \leq B_{p,t} + W_{p,t} L_{p,t} + PF_t + Q_t h_{p,t-1}. \tag{4}$$

[2] j_t follows an AR(1) process and captures reduced-form influences of factors such as demographics, urbanization, or changes in housing market sentiment that are not explicitly modeled (Iacoviello, 2005; Iacoviello and Neri, 2010).

[3] Following Iacoviello (2005), money is implicitly included in the model via the price of consumer goods. If the utility of real money balances is additively separable in the household utility function, money demand does not affect other macroeconomic variables. We thus omit it explicitly in the derivation of equilibrium conditions.

Here, $c_{p,t}$, $h_{p,t}$, $L_{p,t}$ denote consumption, housing services, and labor supply; β_p is the discount factor; η is the inverse Frisch elasticity of labor supply; j_t is the housing preference shock; P_t, Q_t are prices of consumption goods and housing; $1/R_t$ is the price of a one-period bond; $B_{p,t}$ is nominal bond holdings; $W_{p,t}$ is the nominal wage; PF_t is real profits from retailers; and E_t^θ denotes diagnostic expectations.

Impatient households have the same utility form but with a lower discount factor $\beta_i < \beta_p$. Following the collateral framework of Kiyotaki and Moore (1997), creditors recover $(1 - m_i)E_t^\theta[Q_{t+1}]$ upon default. This implies the borrowing constraint

$$P_t c_{i,t} + Q_t h_{i,t} + \frac{B_{i,t+1}}{R_t} \leq B_{i,t} + W_{i,t} L_{i,t} + Q_t h_{i,t-1}, \tag{5}$$

$$-B_{i,t+1} \leq m_i E_t^\theta[Q_{t+1}] h_{i,t}. \tag{6}$$

Here, $c_{i,t}$, $h_{i,t}$, $L_{i,t}$ denote impatient household consumption, housing services, and labor supply; β_i is the impatient household discount factor; m_i is the LTV ratio; and $B_{i,t}$, $W_{i,t}$ are nominal bonds and wages.

3.1.2 Firms

The production side consists of three types of firms. First, *entrepreneurs* produce intermediate goods using capital, labor, and housing. Second, *retailers* operate in monopolistic competition, purchasing intermediate goods from entrepreneurs, differentiating them, and selling them to final goods producers. Third, *final goods producers* operate under perfect competition, aggregating differentiated goods into final goods for household consumption and entrepreneurial investment.

Entrepreneurs produce intermediate goods $Y_{w,t}$ according to the Cobb–Douglas technology

$$Y_{w,t} = A_t K_{t-1}^{\mu} h_{t-1}^{\nu} L_{p,t}^{\alpha(1-\mu-\nu)} L_{i,t}^{(1-\alpha)(1-\mu-\nu)}, \tag{7}$$

where A_t is total factor productivity, evolving as $A_t = (1 - \rho_A)A + \rho_A A_{t-1} + s_A \varepsilon_{A,t}$.

Entrepreneurs borrow from patient households, collateralizing housing, and face capital adjustment costs.

They maximize

$$U_c = \log c_t + E_t^{\theta} \sum_{s=1}^{\infty} \gamma^s \log c_{t+s} \tag{8}$$

subject to

$$P_t c_t + Q_t h_t + B_t + P_t I_t + P_t \hat{\xi}_{k,t} \leq P_t^w Y_{w,t} + \frac{B_{t+1}}{R_t} + Q_t h_{t-1} - W_{p,t} L_{p,t} - W_{i,t} L_{i,t}, \tag{9}$$

$$\hat{\xi}_{k,t} = \frac{\psi}{2\delta} \left(\frac{I_t}{K_{t-1}} - \delta \right)^2 K_{t-1}, \tag{10}$$

$$K_t = I_t + (1-\delta) K_{t-1}, \tag{11}$$

$$-B_t \leq m E_t^{\theta}[Q_{t+1}] h_t. \tag{12}$$

Here, c_t, I_t denote entrepreneur consumption and investment; P_t^w is the price of intermediate goods; B_t is nominal bonds; γ is the entrepreneur discount factor; ψ is the capital adjustment cost parameter; δ is the depreciation rate; and m is the LTV ratio.

Retailers buy intermediate goods from entrepreneurs at P_t^w and sell them to final goods producers at $P_t(z)$. Final goods output is aggregated as

$$Y_t = \left(\int_0^1 Y_t(z)^{\frac{\epsilon-1}{\epsilon}} dz \right)^{\frac{\epsilon}{\epsilon-1}}, \tag{13}$$

where ϵ is the elasticity of substitution across goods. The associated price index and demand function are

$$P_t^{1-\epsilon} = \int_0^1 P_t(z)^{1-\epsilon} dz, \tag{14}$$

$$Y_t(z) = \left(\frac{P_t(z)}{P_t} \right)^{-\epsilon} Y_t. \tag{15}$$

Price adjustment follows the Rotemberg cost specification (Rotemberg, 1982):

$$\frac{\psi_p}{2}\left(\frac{P_t(z)}{P_{t-1}(z)}-1\right)^2 P_t Y_t, \tag{16}$$

and the profit-maximization problem is

$$\max_{P_t(z)}\left\{P_t(z)Y_t(z)-P_t^w Y_t(z)-\frac{\psi_p}{2}\left(\frac{P_t(z)}{P_{t-1}(z)}-1\right)^2 P_t Y_t+E_t^\theta\sum_{s=1}^{\infty}\Lambda_{t,t+s}D_{t+s}\right\}. \tag{17}$$

[4]

3.1.3 Central Bank

Monetary policy follows a Taylor-type interest rate rule:

$$R_t=(\overline{rr})^{1-r_R}(R_{t-1})^{r_R}(\pi_{t-1}^{1+r_\pi})\left(\frac{Y_{t-1}}{\overline{Y}}\right)^{r_Y(1-r_R)} e_{R,t}, \tag{18}$$

where $\overline{rr}$ and $\overline{Y}$ denote steady-state nominal interest rate and output; r_R captures interest rate smoothing; r_π and r_Y measure the policy response to inflation and output; and $e_{R,t}$ is an exogenous monetary policy shock.

3.1.4 Market Clearing Conditions

In equilibrium, the five markets—intermediate goods, final goods, labor, housing, and bonds—clear simultaneously. In the intermediate goods market, entrepreneur supply equals retailer demand:

$$\int_0^1 Y_t(z)dz = A_t K_{t-1}^{\mu} h_{t-1}^{\nu} L_{p,t}^{\alpha(1-\mu-\nu)} L_{i,t}^{(1-\alpha)(1-\mu-\nu)}, \tag{19}$$

[4]Compared with the Calvo (1983) staggered pricing model, the Rotemberg approach is computationally more tractable in the presence of diagnostic expectations, as firms only consider current-period price setting and potential deviations (Bianchi et al., 2024a; L'Huillier et al., 2024).

which simplifies under $P_t(z) = P_t$ and $Y_t(z) = Y_t$ to

$$Y_t = A_t K_{t-1}^{\mu} h_{t-1}^{\nu} L_{p,t}^{\alpha(1-\mu-\nu)} L_{i,t}^{(1-\alpha)(1-\mu-\nu)}. \tag{20}$$

The final goods market clears when aggregate consumption, investment, and capital adjustment costs equal final goods output net of price adjustment costs:

$$c_{p,t} + c_{i,t} + c_t + I_t + \hat{\xi}_{k,t} = Y_t - \xi_{\pi,t}, \tag{21}$$

$$\xi_{\pi,t} = \frac{\psi_p}{2}(\Pi_t - 1)^2 Y_t. \tag{22}$$

The housing market clearing condition requires

$$h_{p,t} + h_{i,t} + h_t = H, \tag{23}$$

and the bond market clearing condition requires

$$B_{p,t} + B_{i,t} + B_t = 0. \tag{24}$$

3.1.5 Steady State and Log-Linearization

Appendix B and Appendix C present the steady-state and log-linearized forms of the model, respectively. The steady state is defined under normalization $Y = 1$, $H = 1$, and $\Pi = 1$. In the log-linearized equations, $\hat{X}_t$ denotes deviation from steady state, defined as $\hat{X}_t \equiv \log X_t - \log X$. Additionally, a cost-push shock term u_t, following an AR(1) process, is introduced into the Phillips curve derived from log-linearization.

3.2 Diagnostic Expectations

The key distinction between our model and that of Iacoviello (2005) lies in the expectation formation mechanism. While economic agents in Iacoviello (2005) form expecta-

tions rationally ($E_t[X_{t+1}]$), this paper introduces diagnostic expectations ($E_t^\theta[X_{t+1}]$). This section first outlines the concept of diagnostic expectations and then discusses how incorporating this expectation formation alters the baseline model of Iacoviello (2005).

3.2.1 Overview of Diagnostic Expectations

Diagnostic expectations, introduced by Bordalo et al. (2018), build on the representativeness heuristic from Kahneman and Tversky (1972). This framework posits that agents overweight salient information when forming expectations, leading to systematic deviations from rational probability assessments. The key insight is that cognitive constraints cause individuals to disproportionately rely on vivid or recent events—a phenomenon termed diagnostic bias—which amplifies economic fluctuations and asset price volatility.[5] We follow L'Huillier et al. (2024) and Bianchi et al. (2024a) in incorporating diagnostic expectations into New Keynesian models. In this framework, agents use previous-period realizations as reference points and form expectations based on salient deviations from this baseline following Bordalo et al. (2018) and L'Huillier et al. (2024).

Consider a random variable w_t following an AR(1) process:

$$w_t = bw_{t-1} + \epsilon_t, \quad 0 \leq b < 1, \quad \epsilon_t \sim N(0, \sigma^2) \tag{25}$$

Let $h(\cdot)$ denote the objective conditional density of w_{t+1} given $w_t = \hat{w}_t$. The subjective probability density under diagnostic expectations, $h_t^\theta(\cdot)$, is:

$$h_t^\theta(\hat{w}_{t+1}) = h(\hat{w}_{t+1} \mid w_t = \hat{w}_t) \cdot \left[\frac{h(\hat{w}_{t+1} \mid w_t = \hat{w}_t)}{h(\hat{w}_{t+1} \mid w_t = b\hat{w}_{t-1})}\right]^\theta \cdot Z^{-1} \tag{26}$$

where Z is a normalization constant ensuring $\int h_t^\theta(w)dw = 1$, and $\theta \in [0, \infty)$ is the diagnosticity parameter governing belief distortion.

[5] Kahneman and Tversky (1972) show that when an attribute appears more frequently in one group than others, individuals perceive it as representative of that group, distorting subjective probabilities. For example, the association of red hair with Irish nationality leads to overestimation of its actual prevalence among the Irish population.

Equation (26) reveals that subjective probability combines two elements: (i) the objective conditional density serves as an anchor, and (ii) this "kernel of truth" is distorted by the representativeness ratio raised to power θ. The ratio $\frac{h(\hat{w}_{t+1}|w_t=\hat{w}_t)}{h(\hat{w}_{t+1}|w_t=b\hat{w}_{t-1})}$ measures how representative the future realization is relative to the reference point. When $\theta = 0$, diagnostic expectations reduce to rational expectations.

Given the normality of ϵ_t, Bordalo et al. (2018) establish that w_t under diagnostic expectations remains normally distributed with unchanged conditional variance σ^2, but with distorted conditional mean:

$$E_t^\theta[w_{t+1}] = E_t[w_{t+1}] + \theta\left(E_t[w_{t+1}] - E_{t-1}[w_{t+1}]\right) \tag{27}$$

Equation (27) shows that diagnostic agents overreact to news: the expectation revision $(E_t[w_{t+1}] - E_{t-1}[w_{t+1}])$ is amplified by factor θ, causing beliefs to overshoot relative to rational expectations.

L'Huillier et al. (2024) and Bianchi et al. (2024a) extend this framework to multivariate settings and develop solution methods for linear DSGE models with diagnostic expectations. We employ their computational approach throughout our analysis.[6]

This expectation formation mechanism offers several advantages over alternative behavioral approaches, as emphasized by Bordalo, Gennaioli and Shleifer (2022) and L'Huillier et al. (2024). First, it is immune to the Lucas critique since agents respond optimally given their subjective beliefs. Second, the underlying representativeness heuristic has extensive empirical support in psychology and behavioral economics (Kahneman, Slovic and Tversky, 1982). Third, Equation (27) provides an analytically tractable characterization of belief distortions. Finally, the diagnosticity parameter θ can be directly estimated from data, facilitating empirical validation and cross-context comparisons.

[6]For detailed solution algorithms for linear DSGE models with diagnostic expectations, see L'Huillier et al. (2024) and Bianchi et al. (2024a).

3.2.2 Calibration

We apply the calibration method to parameters that are either not central to the main analysis or are required for direct comparison with the baseline model. Calibrated values are primarily drawn from previous studies, with necessary adjustments to reflect structural features of the Korean economy. The baseline calibration follows the reference model of Iacoviello (2005), while certain parameters are revised based on Bounader and Elekdag (2024) and domestic studies such as Lee and Song (2015) and Suh (2023). This section highlights calibration settings that deviate from the baseline model. The complete list of calibrated parameter values, along with detailed descriptions and sources, is provided in Appendix D.

3.2.3 Estimation

Parameters were estimated using Bayesian methodology. We generate 50,000 draws using a Metropolis-Hastings algorithm and discard the first 20% as initial burn-in.

For estimation, quarterly data on GDP, inflation, the nominal interest rate, and house prices were utilized. All data are drawn from the Bank of Korea Economic Statistics System. Real GDP was measured as seasonally adjusted GDP per capita. Inflation was computed by seasonally adjusting monthly consumer prices and then applying quarterly averaging. The nominal interest rate series corresponds to the unsecured call rate. House prices were calculated by deflating monthly nominal house prices with the consumer price index, followed by quarterly averaging and detrending using the HP filter.

The estimation sample spans from the first quarter of 2000 to the fourth quarter of 2024. While previous studies often limit the estimation period to avoid structural breaks—such as the global financial crisis or the COVID-19 pandemic—this paper employs a longer sample, reflecting the hypothesis that memory of major macroeconomic events can influence expectation formation and boom-bust dynamics of key variables.[7] Estimation results

[7]Robustness checks using a shorter sample period (2013Q1–2024Q4) confirm that all estimated param-

are presented for the DE model, and comparisons with the RE model are provided where relevant. As with calibration, posterior mean estimates are reported. Full details of the data processing, prior settings, and posterior estimates are available in Appendix D.

4 Results

To assess the role of expectations in the transmission of economic shocks, we compare the difference in impulse responses between the DE and RE models. This approach isolates the incremental effect of diagnostic expectations on the propagation of shocks. We focus on shocks with the most direct influence on house prices—housing preference and monetary policy shocks—to examine how different expectation formation mechanisms alter macroeconomic dynamics. Section 4.1 discusses the direct impulse response patterns, and Section 4.2 explains how these patterns generate crowding effects in the productive sector.

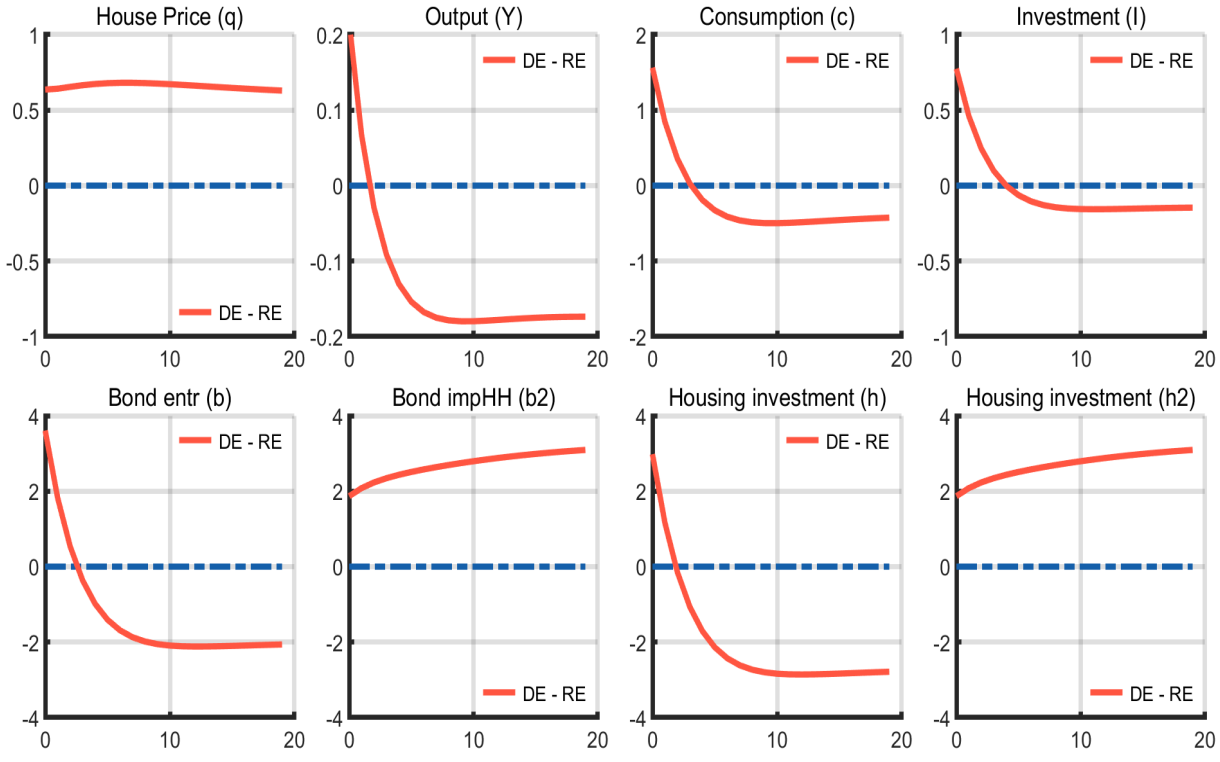
4.1 Impulse Response Analysis

Housing Preference Shocks A positive housing preference shock increases demand for housing across all households. In the RE model, this raises house prices moderately, which in turn relaxes collateral constraints. Both impatient households and entrepreneurs benefit: impatient households increase consumption, while entrepreneurs are able to invest in productive capital alongside housing. The price effect is present but contained, and the gains are more evenly distributed between the household and productive sectors.

Under DE, the adjustment path is markedly different. Impatient households interpret the initial price rise as a strong signal of continued appreciation and extrapolate it

eters, including the diagnosticity coefficient, lie within the 90% credible intervals of the baseline results. Detailed outcomes are reported in Appendix D.

Figure 2: Cumulative IRF differences (DE–RE) for a housing preference shock

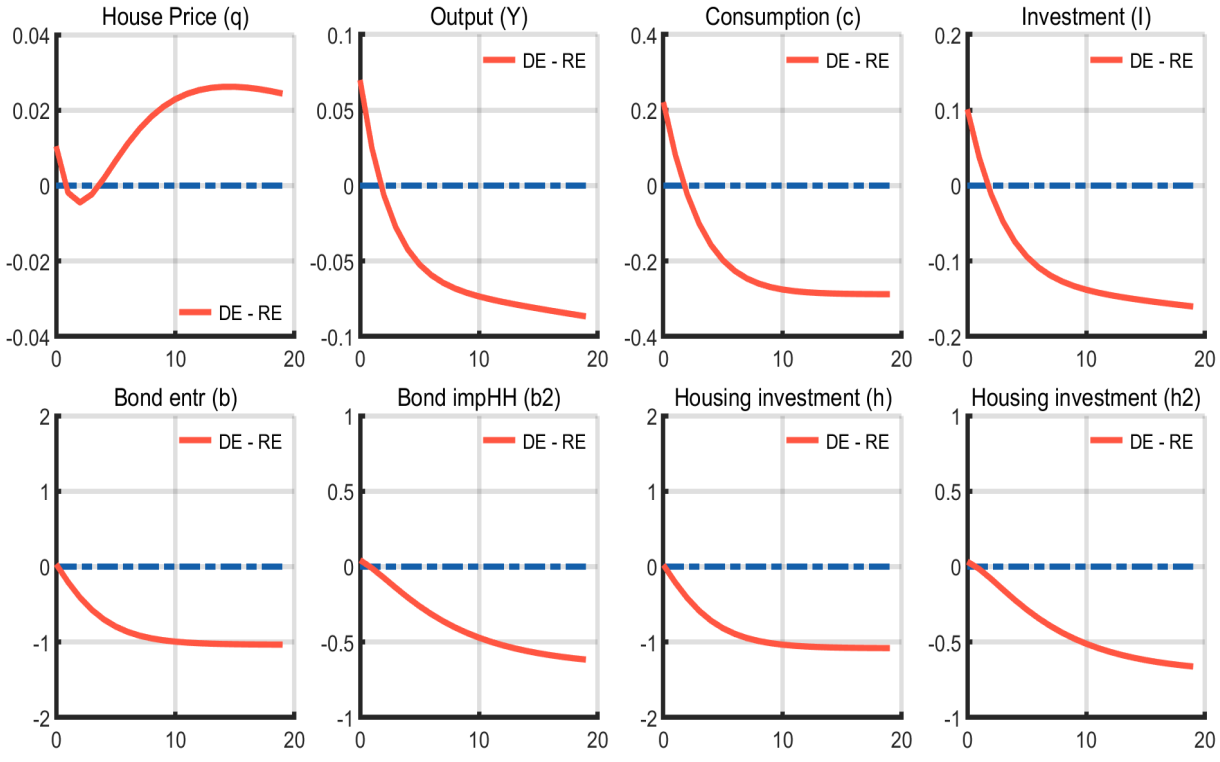


Note: Figure shows the cumulative impulse response differences (DE minus RE) to a one-standard-deviation housing preference shock.

forward. This belief inflates their perceived collateral value, dramatically expanding borrowing capacity beyond fundamentals. Fueled by easier credit, their housing demand accelerates sharply, pushing prices much higher than in the RE case. Entrepreneurs, who require housing as a productive input, now face much higher acquisition costs and reduced access to this essential factor. Even as overall housing demand cools, entrepreneurs remain unable to fully rebuild their housing holdings. This sequence results in an *expectation-driven crowding-out effect*: resources are diverted away from the productive sector toward speculative housing demand. Over time, this reallocation slows capital accumulation and output recovery, despite persistently elevated house prices.

Monetary Policy Shocks An expansionary monetary policy shock—modeled here as a 25bp cut in the policy rate—reduces borrowing costs for all agents. In the RE model, this results in a moderate, short-lived increase in housing demand, a contained rise in

Figure 3: Cumulative IRF differences (DE–RE) for an expansionary monetary policy shock



Note: Figure shows the cumulative impulse response differences (DE minus RE) to a 25bp cut in the policy interest rate.

house prices, and some easing of borrowing constraints that supports both consumption and investment.

In the DE model, however, the same policy action has amplified and asymmetric effects. Impatient households perceive the rate cut as confirmation of sustained housing market strength. Their expectations of future price gains strengthen, prompting them to leverage aggressively to acquire more housing. This speculative demand surge outpaces fundamentals, pushing prices up far more than under RE. As in the case of housing preference shocks, entrepreneurs are crowded out of the housing market by higher prices and tighter effective access to housing as productive capital. Thus, while household balance sheets improve in the short term, productive investment suffers, and the overall boost to output is weaker than in the RE model.

4.2 Overreaction and the Crowding-Out Effect

Expectation-Based Crowding-Out The impulse response results highlight the central contribution of this paper: overreaction in expectations during housing booms can crowd out productive investment through a pure expectation channel, operating independently of credit market frictions. When housing market news is interpreted with a diagnostic bias, impatient households tend to overreact to the initial price movement and project it into the future. This exaggerated optimism raises their perceived collateral values, allowing them to borrow more aggressively and intensify their demand for housing.

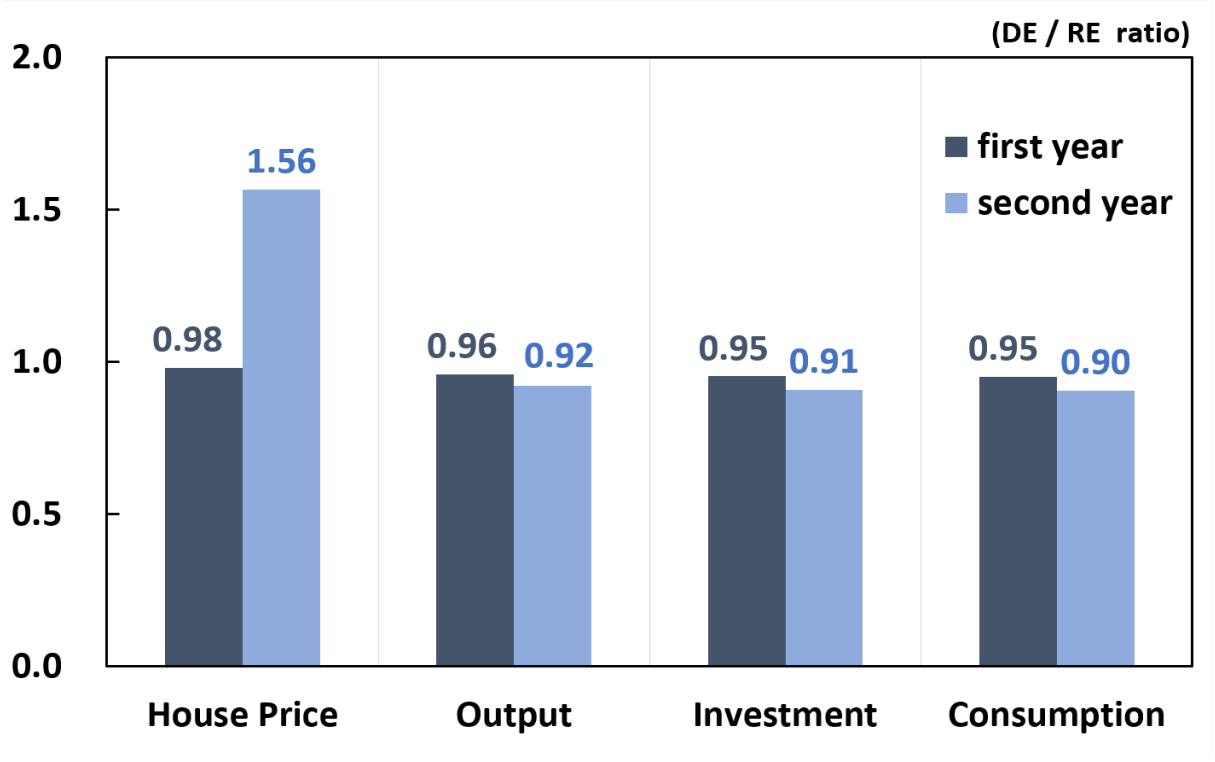
As speculative demand from impatient households grows, housing resources increasingly flow toward non-productive uses. Entrepreneurs—who require housing as a productive input—face higher prices and reduced access, limiting their ability to maintain or expand capital stock. This displacement of housing from the productive sector to speculative household demand is not a short-lived liquidity issue; rather, it becomes a persistent reallocation of resources that slows capital accumulation, dampens output growth, and leaves the economy more vulnerable to volatility. The crowding-out in our model therefore stems directly from distorted beliefs and the behavioral responses they generate, without relying on any change in bank lending supply.

This mechanism is distinct from the well-known bank-lending channel emphasized in previous literature. In the bank-lending story, crowding-out arises because banks reallocate credit away from commercial lending toward mortgage lending during housing booms. In contrast, our findings show that even with unchanged lending behavior, the reallocation of resources can emerge purely from shifts in expectations. The expectation-driven crowding-out mechanism documented here is therefore a separate and complementary channel to those already recognized in the literature.

Monetary Policy Implications These dynamics carry important implications for monetary policy design. When expectations are diagnostic, expansionary monetary policy

tends to amplify optimism in housing markets. This can produce disproportionately strong house price responses while delivering weaker-than-expected gains in output and investment. Figure 4 illustrates the DE/RE ratio of first- and second-year responses to a 25bp policy rate cut across key macroeconomic variables.

Figure 4: Annual spillover effect of 25bp rate cut on key variables (DE/RE ratio)



Note: Ratios above 1 indicate stronger responses under DE; ratios below 1 indicate weaker responses.

The figure shows that by the second year, house prices in the DE model are around 56% higher than in the RE case, while output, investment, and consumption remain roughly 5–10% lower. This pattern is the empirical signature of the expectation-driven crowding-out mechanism: monetary easing fuels speculative housing demand, which absorbs resources that would otherwise support productive investment.

For central banks with a dual mandate to stabilize both real activity and financial conditions, this poses a clear challenge. Overheated price expectations can undermine the intended stimulative effects of rate cuts, leaving the economy with elevated asset prices but without commensurate gains in productive capacity. Policymakers should therefore com-

plement traditional interest rate policy with tools for expectation management— including clear forward guidance, credible communication, and macroprudential measures— to ensure that monetary accommodation does not simply feed speculative housing booms at the expense of long-run growth.

5 Conclusion

This paper examines how expectation formation shapes housing market dynamics and uncovers a novel mechanism through which expectations can generate macroeconomic distortions. Using Korean housing market data, we document systematic overreaction in house price expectations: following positive price shocks, expectations remain persistently optimistic even as actual prices begin to decline. This empirical pattern is inconsistent with rational expectations and motivates the use of an alternative formation mechanism.

We incorporate diagnostic expectations (Bordalo et al., 2018) into the canonical housing DSGE model of Iacoviello (2005) to analyze the macroeconomic consequences of such overreaction. The model reveals an *expectation-driven crowding-out mechanism* that operates independently of financial intermediation channels. When agents with diagnostic bias overreact to favorable housing market news—whether arising from housing preference shocks or accommodative monetary policy—impatient households form excessively optimistic price expectations and aggressively compete for housing assets. This speculative demand raises housing costs for productive agents (entrepreneurs), who also require housing as a factor of production, thereby diverting resources away from productive investment. The resulting misallocation depresses long-run growth potential and amplifies housing market volatility.

This mechanism represents a departure from the existing literature, which largely emphasizes bank-lending channels in explaining crowding-out during housing booms.

While earlier studies focus on how credit is reallocated from commercial lending to mortgages, our analysis shows that distorted expectations alone can trigger similar resource misallocations, even in the absence of changes in bank lending behavior. The channel we identify operates directly through agents' behavioral responses, highlighting the independent role of expectation formation in shaping macroeconomic outcomes.

The findings have clear policy implications. First, housing booms driven by diagnostic bias can create resource misallocation not only via credit markets but also through behavioral channels. In such environments, expansionary monetary policy may inadvertently amplify expectation distortions, worsening crowding-out effects and ultimately undermining long-term growth. Second, these results underscore the importance of expectation management in policy design. When expectations are diagnostic, house prices may overshoot while real economic activity responds weakly to stimulus. Effective housing market policy therefore requires credible and consistent communication, not merely adjustments to credit conditions or policy rates. Finally, for central banks with dual mandates, the asymmetric responses we identify—where house prices overreact while output underreacts—suggest that traditional monetary policy tools may be less effective in economies where expectations are systematically biased.

Overall, our results call for a broader view of housing market stabilization policies—one that explicitly accounts for the formation of expectations and their direct influence on resource allocation. Recognizing and addressing expectation-driven distortions is essential for designing policies that support both macroeconomic stability and long-run productive capacity.

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Appendix

A Equilibrium Conditions in the model

A.1 FOCs of the Patient Household

$$\frac{W_{p,t}}{P_t c_{p,t}} = L_{p,t}^{\eta} \tag{A.1}$$

$$\frac{1}{P_t c_{p,t}} = \beta_p R_t E_t^{\theta}\left[\frac{1}{P_{t+1} c_{p,t+1}}\right] \tag{A.2}$$

$$\frac{q_t}{c_{p,t}} = \frac{j_t}{h_t} + \beta_p E_t^{\theta}\left[\frac{q_{t+1}}{c_{p,t+1}}\right], \quad q_t = \frac{Q_t}{P_t} \tag{A.3}$$

Equation A.1 presents the labor supply condition for the patient household. Equation A.2 is the Euler equation with respect to bond holdings, and Equation A.3 describes the housing demand condition of the patient household.

A.2 FOCs of the Impatient Household

$$\frac{W_{i,t}}{P_t c_{i,t}} = L_{i,t}^{\eta} \tag{A.4}$$

$$\frac{1}{P_t c_{i,t}} = \beta_i R_t E_t^{\theta}\left[\frac{1}{P_{t+1} c_{i,t+1}}\right] + R_t \lambda_{i,t} \tag{A.5}$$

$$\frac{q_t}{c_{i,t}} = \frac{j_t}{h_{i,t}} + \beta_i E_t^{\theta}\left[\frac{q_{t+1}}{c_{i,t+1}}\right] + \lambda_{i,t} m_i E_t^{\theta}[Q_{t+1}] \tag{A.6}$$

Equation A.4 presents the labor supply condition for the impatient household. Equation A.5 is the Euler equation with respect to borrowing, and Equation A.6 describes the housing demand condition of the impatient household. $\lambda_{i,t}$ denotes the nominal shadow price associated with the borrowing constraint of the impatient household; in

other words, it reflects the increase in the household's lifetime utility resulting from a one-unit relaxation of the nominal borrowing constraint.

A.3 FOCs of the Entrepreneur

$$w_{p,t} = \frac{\alpha(1-\mu-\nu)Y_{t,w}}{X_t L_{p,t}} \tag{A.7}$$

$$w_{i,t} = \frac{(1-\alpha)(1-\mu-\nu)Y_{t,w}}{X_t L_{i,t}} \tag{A.8}$$

$$v_t = \frac{1}{c_t}\left[1 + \frac{\psi}{\delta}\left(\frac{I_t}{K_{t-1}} - \delta\right)\right] \tag{A.9}$$

$$v_t = \gamma E_t^\theta \left\{ \frac{1}{c_{t+1}} \left[\frac{\mu Y_{t+1}^w}{X_{t+1} K_t} + \frac{\psi}{\delta}\left(\frac{I_{t+1}}{K_t} - \delta\right)\frac{I_{t+1}}{K_t} - \frac{\psi}{2\delta}\left(\frac{I_{t+1}}{K_t} - \delta\right)^2 \right] \right\} + \gamma(1-\delta)E_t^\theta[v_{t+1}] \tag{A.10}$$

$$\frac{Q_t}{P_t c_t} = \gamma E_t^\theta \left\{ \frac{1}{P_{t+1} c_{t+1}} \left[\frac{\nu Y_{t+1}^w}{X_{t+1} h_t} + Q_{t+1} \right] \right\} + m\lambda_t E_t^\theta[Q_{t+1}] \tag{A.11}$$

$$\frac{1}{P_t c_t} = \gamma R_t E_t^\theta \left[\frac{1}{P_{t+1} c_{t+1}} \right] + \lambda_t R_t \tag{A.12}$$

$X_t = \frac{P_t}{P_t^w}$ denotes the markup, and $w_{p,t} = \frac{W_{p,t}}{P_t}$ and $w_{i,t} = \frac{W_{i,t}}{P_t}$ represent the real wages of patient and impatient households, respectively. Equations A.7 and A.8 capture the entrepreneur's labor demand. v_t is the lifetime utility per unit of capital stock, i.e., the shadow price of capital. Equation A.10 is the Euler equation for capital, while Equations A.11 and A.12 describe the Euler conditions for housing and bond holdings, respectively, where λ_t denotes the lifetime utility gain from relaxing the nominal borrowing constraint by one unit.

A.4 FOC of the Retailers

$$\epsilon - 1 = \frac{\epsilon}{X_t} - \psi_p(\Pi_t - 1)\Pi_t + \frac{\psi_p}{Y_t} E_t^\theta \left[\Lambda_{t,t+1}(\Pi_{t+1} - 1)\Pi_{t+1} Y_{t+1}\right] \tag{A.13}$$

B Steady State in the model

B.1 Steady State of Interest Rate, Capital Stock, and Investment

$$R = \beta_p^{-1} \tag{B.1}$$

$$\frac{K}{Y} = \frac{\mu\gamma}{X\left[1-\gamma(1-\delta)\right]} \tag{B.2}$$

$$I = \delta K \tag{B.3}$$

B.2 Steady State of Consumption

$$\frac{c_p}{Y} = 1 - \frac{c}{Y} - \frac{c_i}{Y} - \delta\frac{K}{Y} \tag{B.4}$$

$$\frac{c_i}{Y} = \left[1 + \frac{jm_i(1-\beta_p)}{1-\beta_i - m_i(\beta_p - \beta_i)}\right]^{-1} \cdot \frac{(1-\alpha)(1-\mu-\nu)}{X} \tag{B.5}$$

$$\frac{c}{Y} = \left[\mu + \nu - \frac{\delta\gamma\mu}{1-\gamma(1-\delta)} - \frac{(1-\beta)m\gamma\nu}{1-\gamma-m(\beta_p-\gamma)}\right] \cdot \frac{1}{X} \tag{B.6}$$

B.3 Steady State of Labor

$$L_p = \left[\frac{\alpha\left(1-\mu-\nu\right)Y}{Xc_p}\right]^{\frac{1}{1+\eta}} \tag{B.7}$$

$$L_i = \left[\frac{(1-\alpha)(1-\mu-\nu)Y}{Xc_i}\right]^{\frac{1}{1+\eta}} \tag{B.8}$$

B.4 Steady State of Housing Market

$$\frac{qh_p}{Y} = \frac{j}{1-\beta_p} \cdot \frac{c_p}{Y} \tag{B.9}$$

$$\frac{qh_i}{Y} = \frac{j}{1-\beta_i - m_i(\beta_p - \beta_i)} \cdot \frac{c_i}{Y} \tag{B.10}$$

$$\frac{qh}{Y} = \frac{\nu\gamma}{1-\gamma - m(\beta_p - \gamma)} \cdot \frac{1}{X} \tag{B.11}$$

$$q = \frac{\gamma\nu}{1-\gamma-(\beta_p-\gamma)m} \cdot \frac{1}{X} + \frac{j}{1-\beta_i - m_i(\beta_p-\beta_i)} \cdot \frac{c_i}{Y} + \frac{j}{1-\beta_p} \cdot \frac{c_p}{Y} \tag{B.12}$$

B.5 Steady State of Collateral Constraints

$$\frac{b_i}{Y} = -m_i \left(\frac{qh_i}{Y}\right) \tag{B.13}$$

$$\frac{b}{Y} = -m \left(\frac{qh}{Y}\right) \tag{B.14}$$

B.6 Steady State of Borrowing Constraints

$$\lambda_i = \frac{1}{Pc_i}\left(\beta_p - \beta_i\right) \tag{B.15}$$

$$\lambda = \frac{1}{Pc}\left(\beta_p - \gamma\right) \tag{B.16}$$

B.7 Others

$$Y = AK^{\mu}h^{\nu}L_p^{\alpha(1-\mu-\nu)}L_i^{(1-\alpha)(1-\mu-\nu)} = 1 \tag{B.17}$$

$$h + h_i + h_p = 1 \tag{B.18}$$

C Log-linearized equations in the model

C.1 Aggregate Demand

$$\hat{Y}_{w,t} = \frac{c}{Y}\hat{c}_t + \frac{c_p}{Y}\hat{c}_{p,t} + \frac{c_i}{Y}\hat{c}_{i,t} + \frac{I}{Y}\hat{I}_t \tag{C.1}$$

$$\hat{c}_{p,t} = E_t^\theta[\hat{c}_{p,t+1}] - \hat{rr}_t \tag{C.2}$$

$$\hat{I}_t - \hat{K}_{t-1} = \gamma E_t^\theta[\hat{I}_{t+1} - \hat{K}_t] + \frac{1-\gamma(1-\delta)}{\psi} E_t^\theta[\hat{Y}_{t+1} - \hat{X}_{t+1} - \hat{K}_t] + \frac{1}{\psi}(\hat{c}_t - E_t^\theta[\hat{c}_{t+1}]) \tag{C.3}$$

C.2 Housing Demand

$$\hat{q}_t = \gamma_e E_t^\theta[\hat{q}_{t+1}] + (1-\gamma_e) E_t^\theta[\hat{Y}_{t+1} - \hat{X}_{t+1} - \hat{h}_t] - m\beta_p \hat{rr}_t - (1-m\beta_p)(E_t^\theta[\hat{c}_{t+1}] - \hat{c}_t) \tag{C.4}$$

$$\hat{q}_t = \gamma_h E_t^q[\hat{q}_{t+1}] + (1-\gamma_h)(\hat{j}_t - \hat{h}_{i,t}) - m_i\beta_p \hat{rr}_t + (1-m_i\beta_p)(\hat{c}_{i,t} - \omega E_t^q[\hat{c}_{i,t+1}]) \tag{C.5}$$

$$\hat{q}_t = \beta_p E_t^\theta[\hat{q}_{t+1}] + (1-\beta_p)\hat{j}_t + \iota_h \hat{h}_t + \iota_j \hat{j}_t + \hat{c}_{p,t} - \beta_p E_t^\theta[\hat{c}_{p,t+1}] \tag{C.6}$$

C.3 Collateral Constraints

$$\hat{b}_t = E_t^\theta[\hat{q}_{t+1}] + \hat{h}_t + E_t^\theta[\pi_{t+1}] + \theta\,(\pi_t - E_{t-1}[\pi_t]) \tag{C.7}$$

$$\hat{b}_{i,t} = E_t^\theta[\hat{q}_{t+1}] + \hat{h}_{i,t} + E_t^\theta[\pi_{t+1}] + \theta\,(\pi_t - E_{t-1}[\pi_t]) \tag{C.8}$$

C.4 Aggregate Supply

$$\hat{Y}_t = \frac{1+\eta}{1+\eta-(1-\nu-\mu)}\left(\hat{A}_t + \nu\hat{h}_{t-1} + \mu\hat{K}_{t-1}\right) - \frac{1-\nu-\mu}{1+\eta-(1-\nu-\mu)}\left(\hat{X}_t + \alpha\hat{c}_{p,t} + (1-\alpha)\hat{c}_{i,t}\right) \tag{C.9}$$

$$\hat{\pi}_t = \beta E_t^{\theta}[\hat{\pi}_{t+1}] - \chi\hat{X}_t + u_t \tag{C.10}$$

C.5 Law of motion for capital and bond

$$\hat{K}_t = \delta\hat{I}_t + (1-\delta)\hat{K}_{t-1} \tag{C.11}$$

$$\frac{b}{RY}(\hat{R}_t - \hat{b}_{t+1}) = \frac{c}{Y}\hat{c}_t + \frac{qh}{Y}\Delta\hat{h}_t + \frac{I}{Y}\hat{I}_t - \frac{b}{Y}(\hat{b}_t - \hat{\pi}_t) - (1-s_p-s_i)(\hat{Y}_t - \hat{X}_t) \tag{C.12}$$

$$\frac{b_i}{RY}(\hat{R}_t - \hat{b}_{i,t+1}) = \frac{c_i}{Y}\hat{c}_{i,t} + \frac{qh_i}{Y}\Delta\hat{h}_{i,t} - \frac{b_i}{Y}(\hat{b}_{i,t} - \hat{\pi}_t) - s_i(\hat{Y}_t - \hat{X}_t) \tag{C.13}$$

C.6 Taylor Rule and Shock Process

$$\hat{R}_t = (1-r_R)(1-r_\pi)\hat{\pi}_{t-1} + r_Y(1-r_R)\hat{Y}_{t-1} + r_R\hat{R}_{t-1} + \hat{c}_{R,t} \tag{C.14}$$

$$\hat{j}_t = \rho_j\hat{j}_{t-1} + \hat{c}_{j,t} \tag{C.15}$$

$$\hat{u}_t = \rho_u\hat{u}_{t-1} + \hat{c}_{u,t} \tag{C.16}$$

$$\hat{A}_t = \rho_A\hat{A}_{t-1} + \hat{c}_{A,t} \tag{C.17}$$

C.7 Others

$$\omega = \frac{\beta_i - m_i\beta_i}{1-m_i\beta_p} \tag{C.18}$$

$$\iota = (1 - \beta_p)\frac{h}{h_p} \tag{C.19}$$

$$\iota_i = (1 - \beta_p)\frac{h_i}{h_p} \tag{C.20}$$

$$\gamma_c = (1 - m)r + m\beta_p \tag{C.21}$$

$$\gamma_h = (1 - m_i)\beta_i + m_i\beta_p \tag{C.22}$$

$$s_p = \frac{\alpha(1 - \mu - \nu) + X - 1}{X} \tag{C.23}$$

$$s_i = \frac{(1 - \alpha)(1 - \mu - \nu)}{X} \tag{C.24}$$

$$\hat{r}_t = \hat{R}_t - E_t^{\theta}\hat{p}_{t+1} + \hat{p}_t \tag{C.25}$$

$$\chi = \frac{\epsilon - 1}{\psi_p} \tag{C.26}$$

D Parameter Setting

D.1 Calibration

The discount factor for patient (saving) households is set to 0.99, consistent with values commonly used in the literature (Bounader and Elekdag, 2024; Iacoviello, 2005). In contrast, the discount factor for impatient (borrowing) households is calibrated to a lower value of 0.95, reflecting the strong housing preference and relatively high borrowing propensity observed among Korean households.[8] The discount factor for entrepreneurs is set to 0.98, as in existing studies, lying between that of patient and impatient households.

The housing share in household asset holdings is calibrated to 0.4, compared to 0.3 in the literature. This upward adjustment reflects the fact that real estate comprises a sig-

[8]This differs from the typical value of 0.97 used in prior studies, and is motivated by empirical observations that Korean households are more actively engaged in home purchases and carry higher debt burdens.

nificant portion of Korean household wealth and serves as collateral in credit markets. The price markup is set to 1.15, higher than the 1.1 in the reference model, following domestic empirical evidence presented by Suh (2023). The loan-to-value (LTV) ratio, which captures collateral constraints, is calibrated at 55%, in line with the average LTV range (50–60%) observed for Korean households and consistent with previous studies.

Finally, parameters related to housing preference and monetary policy shocks are calibrated based on values from prior literature. This approach ensures that the impulse response analysis comparing the DE model and RE model isolates the effects of the diagnosticity parameter under otherwise identical conditions.

Table D1: Calibration

Parameter	Exp	Value	Source
Preference Discount Factor			
Discount factor of the patient household	β_p	0.99	Iacoviello (2005)
Discount factor of the impatient household	β_i	0.95	Iacoviello (2005)
Discount factor of the entrepreneur	γ	0.98	Iacoviello (2005)
Other preference parameters			
Housing preference of the household	j	0.1	Iacoviello (2005)
Technology			
Capital share	μ	0.4	Iacoviello (2005)
Housing share	ν	0.03	Iacoviello (2005)
Wage of the patient household	α	0.64	Iacoviello (2005)
LTV parameter			
LTV ratio of entrepreneur	m	0.89	Iacoviello (2005)
LTV ratio of the impatient household	m_i	0.55	Iacoviello (2005)
Others			
Depreciation rate	δ	0.03	Iacoviello (2005)
Mark-up ratio	X	1.15	Suh (2023)
Substitute elasticity between goods	ϵ	6	L'Huillier et al. (2024)
Shock process			
S.D. of Monetary policy shock	σ_R	0.25	Iacoviello (2005)
AR(1) coefficient of housing preference shock	ρ_j	0.85	Iacoviello (2005)
S.D. of housing preference shock	σ_j	0.2489	Iacoviello (2005)

D.2 Estimation

The diagnosticity parameter θ, a central component of the DE model, is estimated with a posterior mean of 0.6256 and a 90% credible interval of [0.5514, 0.7040]. This is consistent with estimates in existing literature (Bordalo et al., 2018; Bounader and Elekdag, 2024; L'Huillier et al., 2024). Notably, the credible interval does not include zero, the value implied by rational expectations, lending empirical support to the diagnostic expectations hypothesis. Turning to the monetary policy rule, the estimated Taylor rule coefficients in the DE model are 0.8427 for the interest rate smoothing term (r_R), 0.4547 for inflation (r_π), and 0.3595 for output (r_y). These are broadly in line with the RE model estimates (0.8466, 0.4014, and 0.3122, respectively) and consistent with findings from the Korean literature.

The Rotemberg price adjustment cost parameter Φ_π is estimated at 102.3173 under the DE model and 100.6330 under the RE model, closely matching prior beliefs and the range reported in previous studies. This parameter governs the slope of the Phillips curve κ alongside the elasticity of substitution between goods ϵ, and the implied slope value aligns with the conventional value of approximately 0.05. The capital adjustment cost parameter ψ and the inverse of Frisch labor supply elasticity η are also in line with prior values and previous empirical findings. Overall, the estimation results suggest that parameters are identified at reasonable and theoretically consistent levels, providing a reliable foundation for constructing the DE model and comparing its implications against the benchmark RE model.

Table D2: Prior Distribution

Parameter	**Exp**	**Dist**	**(Mean, S.D.)**
Taylor Rule coefficient			
Inertia coefficient	r_R	Beta	(0.80, 0.10)
Inflation coefficient	r_π	Normal	(0.40, 0.10)
Output gap coefficient	r_Y	Normal	(0.20, 0.10)
Structural parameters			
Adjustment cost to price	ψ_p	Normal	(100.0, 25.0)
Adjustment cost to price	ψ	Normal	(2.00, 0.10)
Preference of leisure	$1+\eta$	Normal	(1.01, 0.10)
Diagnosticity coefficient	θ	Normal	(0.80, 0.10)
Shock process parameters			
AR(1) coefficient of productivity shock	ρ_A	Beta	(0.10, 0.10)
AR(1) coefficient of inflation shock	ρ_π	Beta	(0.60, 0.10)
S.D. of productivity shock	σ_A	Inv. Gamma	(0.10, ∞)
S.D. of inflation shock	σ_π	Inv. Gamma	(0.10, ∞)

Table D3: Estimation Results for Posterior Distribution
(Data Span: 2000.1/4 $\sim$ 2024.4/4)

Parameter	**Exp**	**RE**		**DE**	
		Mean	**[0.05, 0.95]**	**Mean**	**[0.05, 0.95]**
Taylor Rule coefficient					
Inertia coefficient	r_R	0.8466	[0.818, 0.874]	0.8427	[0.817, 0.869]
Inflation coefficient	r_π	0.4014	[0.257, 0.539]	0.4547	[0.319, 0.581]
Output gap coefficient	r_Y	0.3122	[0.215, 0.398]	0.3595	[0.275, 0.458]
Structural parameters					
Adjustment cost to price	ψ_p	100.6330	[613.9, 14439]	102.3173	[5707, 13787]
Adjustment cost to price	ψ	2.0032	[1.838, 2.162]	1.9948	[1.830, 2.149]
Preference of leisure	$1+\eta$	1.0881	[0.918, 1.248]	1.0171	[0.868, 1.177]
Diagnosticity coefficient	θ	–	–	0.6256	[0.551, 0.704]
Shock process parameters					
AR(1) coefficient of productivity shock	ρ_A	0.0870	[0.000, 0.188]	0.0219	[0.000, 0.053]
AR(1) coefficient of inflation shock	ρ_π	0.5280	[0.425, 0.627]	0.6177	[0.527, 0.716]
S.D. of productivity shock	σ_A	7.4952	[5.573, 9.192]	7.1725	[5.018, 9.043]
S.D. of inflation shock	σ_π	0.3378	[0.269, 0.409]	0.3964	[0.249, 0.578]

Table D4: Estimation Results for Posterior Distribution
(Data Span: 2013.1/4 $\sim$ 2024.4/4)

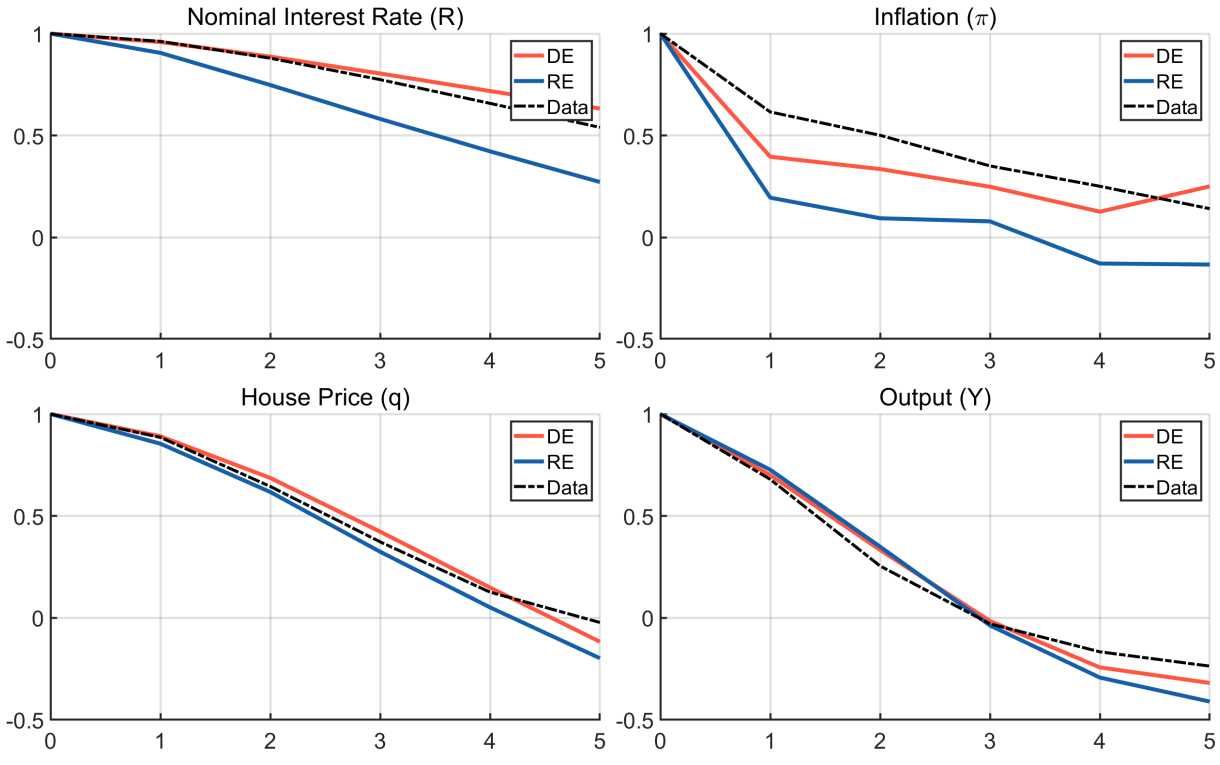
Parameter	**Exp**	**RE**		**DE**	
		Mean	**[0.05, 0.95]**	**Mean**	**[0.05, 0.95]**
Taylor Rule coefficient					
Inertia coefficient	r_R	0.8543	[0.819, 0.890]	0.8608	[0.827, 0.895]
Inflation coefficient	r_π	0.4218	[0.273, 0.584]	0.4159	[0.261, 0.565]
Output gap coefficient	r_Y	0.2876	[0.174, 0.399]	0.3671	[0.225, 0.477]
Structural parameters					
Adjustment cost to price	ψ_p	99.5141	[56.16, 139.12]	101.8304	[58.68, 143.94]
Adjustment cost to price	ψ	2.0091	[1.844, 2.169]	2.0202	[1.833, 2.164]
Preference of leisure	$1+\eta$	1.0571	[0.892, 1.209]	1.0365	[0.872, 1.189]
Diagnosticity coefficient	θ	–	–	0.5564	[0.459, 0.648]
Shock process parameters					
AR(1) coefficient of productivity shock	ρ_A	0.0774	[0.000, 0.173]	0.0273	[0.000, 0.066]
AR(1) coefficient of inflation shock	ρ_π	0.6375	[0.537, 0.731]	0.6425	[0.539, 0.737]
S.D. of productivity shock	σ_A	6.7674	[4.976, 8.404]	7.1407	[5.251, 8.739]
S.D. of inflation shock	σ_π	0.223	[0.164, 0.282]	0.3016	[0.106, 0.365]

E Model Performance and Data Fit

This section evaluates the explanatory power of the diagnostic expectations model compared to the rational expectations model. We compare the models from two perspectives. First, to assess the explanatory power for key macroeconomic variables, we compute moments of key macroeconomic variables, such as autocorrelations and cross-correlations, and compare them with their data counterparts. Model fit is evaluated based on second-moment statistics, specifically the autocorrelation of individual variables and cross-correlations between variables.

Figure E1 compares the autocorrelation of key variables between the model and the data. The results indicate that both models reproduce the data reasonably well. However, the DE model exhibits stronger empirical fit than the RE model across all variables. Notably, the DE model consistently generates higher autocorrelation coefficients, suggesting that diagnostic expectations enhance the persistence of shocks. This implies that when economic shocks occur, their effects are more enduring due to the extrapolative behavior embedded in agents' expectations.

Figure E1: Autocorrelation of Key Variables

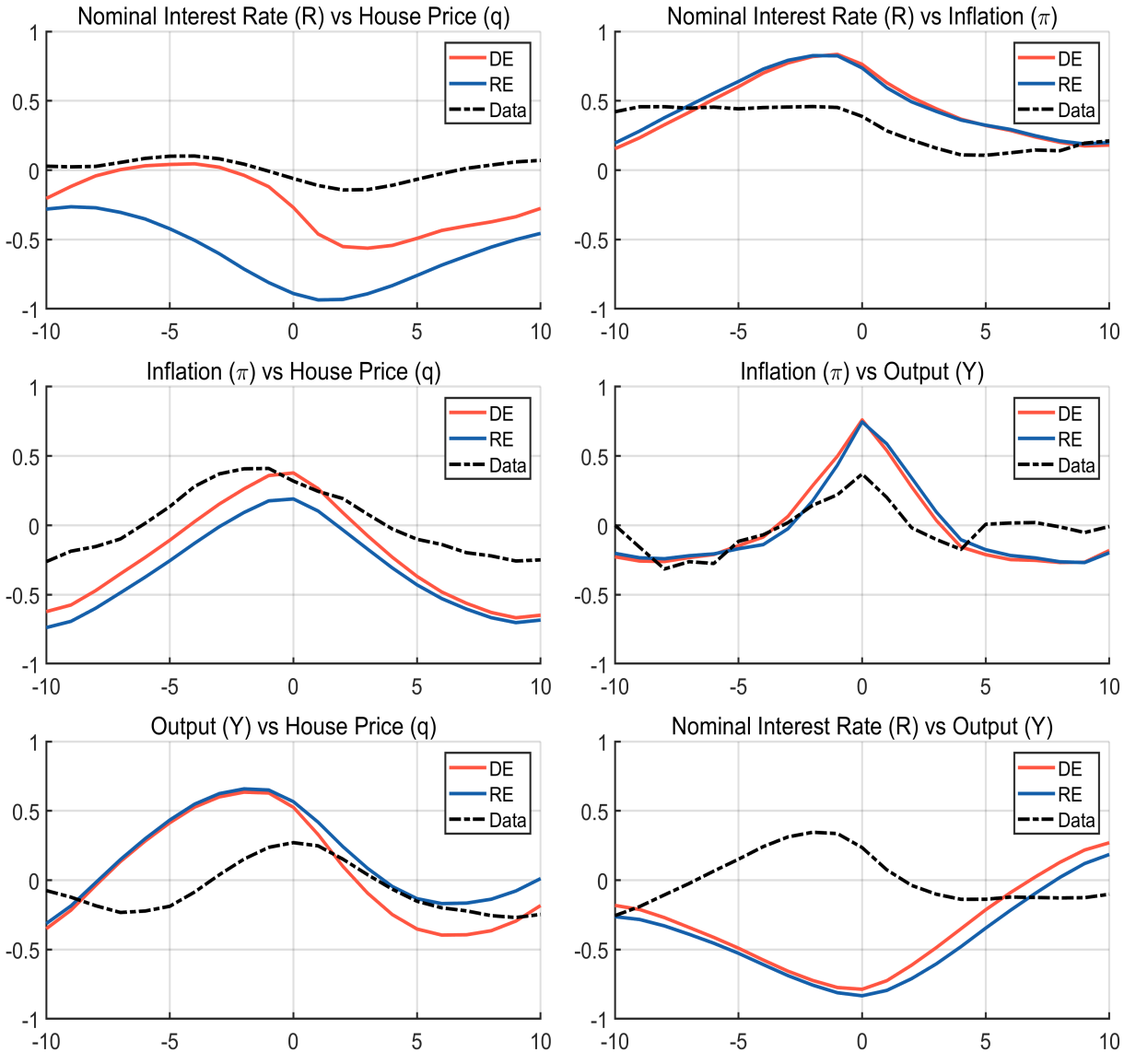


Note: The x-axis denotes the period horizon and the y-axis denotes the autocorrelation. The autocorrelations of the data are computed using a VAR(2) process with four key variables.

Figure E2 compares the cross-correlation coefficients between key variables in the model and those observed in the data. We focus particularly on the cross-correlation between house prices, the primary variable of interest in this study, and other macroeconomic indicators.

The results indicate that both the DE and RE models broadly replicate the correlation

Figure E2: Cross-Correlation of Key Variables



Note: The x-axis denotes the period horizon and the y-axis denotes the correlation coefficient.

patterns found in the data. However, discrepancies emerge in the covariation between house prices and other variables, most notably with interest rates. In the DE model, the correlation between house prices and interest rates deviates more substantially from the RE model and better aligns with the empirical data. This result can be interpreted as a consequence of the diagnostic expectation mechanism, wherein agents adjust their house price expectations in response to interest rate movements in an exaggerated manner.

While the model captures the covariance among most variables relatively well, some deviations persist. For instance, the model implies a strong negative correlation between interest rates and output due to its structural specification, whereas the empirical data do not clearly exhibit this relationship. This discrepancy likely reflects the challenge of identifying structural relationships in the presence of endogeneity in the data. Despite such limitations, the overall moment comparison suggests that the model is well-suited for analyzing the propagation mechanisms of housing market shocks.