

The Effect of Housing on Portfolio Choice: House Price Risk and Liquidity Constraint*

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Abstract

Housing crowds out households' risky financial assets through a *liquidity constraint channel* and a *house price exposure channel*, which previous studies could not separate because homeowners are exposed to both. I exploit *jeonse*, a unique Korean housing tenure in which the tenant pays a large deposit (about two-thirds of house value) instead of rent and receives it back in full, so that the tenant bears the liquidity constraint but not the exposure to house prices. Using two Korean household panel datasets, I show that both *jeonse* tenancy and homeownership substantially crowd out risky financial asset holdings on average, but the *jeonse* crowding-out fades among wealthier households, while the homeownership crowding-out persists at all wealth levels. A standard life-cycle model with three tenures cannot replicate these patterns. Simulation analysis shows that replicating them requires a consumption-based money-in-advance constraint, under which households must hold liquid assets against everyday expenditure, and a small per-period stock-market participation cost. Comparative statics show that higher house price volatility mainly shifts housing tenure choice itself, barely affecting the homeowner crowding-out, whereas indexing the *jeonse* deposit to house prices makes its crowding-out persist, as homeownership's does.

Keywords: Life-cycle Portfolio Choices, Housing Tenure Choices, Liquidity Constraints, House Price Risk, Crowding-out Effect

JEL Classification: G11, G51, D15, R21

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1 Introduction

Housing is the largest asset on most households' balance sheets and accounts for a sizable share of the typical household portfolio. Its effect on the demand for other assets—risky financial assets in particular—is therefore a first-order portfolio question. Most papers in the literature predict that housing crowds out households' risky financial asset holdings. In particular, they attribute this crowding-out to two channels: a *liquidity constraint channel*, in which wealth tied up in illiquid housing-related assets is unavailable for financial investment, and a *house price risk channel*, in which exposure to stochastic housing returns discourages further risk-taking (Grossman and Laroque 1990; Flavin and Yamashita 2002; Cocco 2005; Yao and Zhang 2005). In practice, house price risk is one part of a broader exposure: ownership ties the household's wealth to the return on its house, which carries not only risk but also an expected capital gain and a hedge against rent risk (Sinai and Souleles, 2005). Throughout the paper, I refer to all of these together as the *house price exposure channel*. While distinguishing the two channels empirically would sharpen our understanding of the crowding-out effect and its implications across households, the literature has not examined them separately: a household that purchases a house is exposed to both simultaneously, so comparisons of homeowners and renters alone cannot disentangle them. As a result, our understanding of the mechanism behind the crowding-out effect remains limited.

In this paper, I exploit a unique Korean housing tenure type called *jeonse*, which provides economically meaningful variation in exposure to the two channels. Under a *jeonse* contract, the tenant does not pay rent. Instead, at the beginning of the contract, the tenant pays a large lump-sum deposit to the landlord—typically about two-thirds of the house value. In return, the tenant resides in the house for the contract period (usually two years), and at expiration, the landlord returns the deposit in full. This contract structure exposes the *jeonse* tenant to the liquidity constraint channel, since a substantial portion of wealth is tied up in the illiquid deposit, but not to the house price exposure channel, since the deposit repayment does not depend on house price movements. By comparing *jeonse* tenants with renters, who bear no house price exposure and post a far smaller deposit, I measure the crowding-out associated with the liquidity commitment. By further comparing *jeonse* tenants with homeowners, I measure the additional, ownership-specific component of the crowding-out, which reflects the house price exposure channel among other factors.

Using two Korean household panel datasets—the Korea Labor and Income Panel Study (KLIPS, 2000–2021) and the Household Finance and Welfare Panel Survey of Korea (HFWP-KOR, 2013–2021)—I construct four portfolio-choice measures for each household-year observation: the ratio of financial assets to net wealth, the risky asset share of financial assets, the ratio of risky financial assets to net wealth (the product of the previous two), and a stock-market participation indicator. I first regress each outcome on *jeonse* and homeowner indicators, with renters as the omitted category, controlling for household and year fixed effects and a rich set of household characteristics. The *jeonse* coefficient thus proxies for the liquidity constraint channel, while the homeowner coefficient proxies for the sum of the liquidity constraint and house price exposure channels.

On average, both *jeonse* tenancy and homeownership crowd out risky financial asset hold-

ings, and the effects are economically large. In KLIPS, jeonse tenancy lowers the financial asset ratio by 20.5 percentage points and homeownership by 30.8, about one-half and three-quarters of the renter mean (42.6%); they lower the risky financial asset ratio by 0.80 and 1.25 percentage points; the former is about three-quarters of the renter mean (1.1%) and the latter exceeds it. Homeownership also lowers the risky share of financial assets by 0.71 and stock-market participation by 1.12 percentage points, about two-fifths and one-third of the renter means, while the jeonse coefficients on these two margins are small and imprecise. Among households that ever hold risky assets, the crowding-out of the risky financial asset ratio is far more severe: -4.9 and -6.4 percentage points for jeonse tenancy and homeownership, against a renter mean of 7.7%. Overall, the homeownership effects are larger than the jeonse effects, but on average the two tenures do not differ qualitatively.

However, once I allow the effects to vary across households, by interacting the tenure indicators with wealth-to-income and age bins, a sharp difference between jeonse tenancy and homeownership emerges. The jeonse crowding-out effect on the risky financial asset ratio shrinks substantially with the wealth-to-income ratio—in KLIPS from -0.91 percentage points in the lowest bin, significant at the 1% level, to -0.16 in the top bin, statistically indistinguishable from zero—and this decline is consistent with a change in the composition of financial assets rather than their level: the jeonse coefficient on the financial asset ratio is flat across the wealth distribution, while its coefficient on the risky share of financial assets, α , rises with wealth. This pattern is consistent with the liquidity constraint channel: if the crowding-out arises only from wealth tied up in an illiquid housing commitment, it should disappear once households are wealthy enough that the commitment no longer binds.

The homeowner crowding-out effect, by contrast, persists across the entire wealth distribution in the financial asset ratio and the risky financial asset ratio. The homeowner persistence and the weakening of the jeonse crowding-out of α appear in both datasets; the jeonse fade in the risky financial asset ratio is sharp in KLIPS and weaker in HFWPKOR. Formally, from the lowest to the highest wealth bin, the jeonse coefficient on the risky financial asset ratio rises by 1.03 percentage points more than the homeowner coefficient in KLIPS (4.40 among households that ever hold risky assets), a difference significant at the 5% level; in HFWPKOR the difference has the same sign but is imprecisely estimated. Beyond this contrast, two additional facts emerge. First, the crowding-out of stock-market participation is concentrated among low-wealth households for both tenures. Second, across age, the patterns are flatter, with limited heterogeneity. Overall, these findings show that both jeonse tenancy and homeownership strongly crowd out risky asset holdings, but that the two crowding-out effects differ qualitatively in how they vary with wealth.

The estimated coefficients are not guaranteed to have a causal interpretation: tenure choice is endogenous, and unobserved preference heterogeneity—risk aversion is the canonical example—could jointly drive tenure choice and stock-market participation (Vestman 2019). To mitigate such endogeneity in the analysis, I combine household and year fixed effects with a rich set of controls, so that the estimates rest on within-household tenure transitions. In the Korean context these transitions are largely driven by demographic events (marriage, childbirth, relocation), in which housing is the first-order concern and portfolio

allocation only second-order, so the implied tenure change is plausibly exogenous to transient portfolio-choice shocks. A useful diagnostic for how much cross-sectional selection this specification absorbs is the sign reversal between the unconditional and conditional estimates: without controls, jeonse tenants and homeowners look *more* active in risky financial markets than renters—reflecting the selection of wealthier households into both tenure and stockholding—but once household and year fixed effects and controls—the level and change of the wealth-to-income ratio, age, education, household size and its change, and marital status and events—are in place, these large positive gaps shrink markedly and most tenure coefficients on participation turn negative. While endogeneity concerns cannot be fully resolved, I take this reversal as evidence that the specification absorbs the selection of wealthier households into both housing and stockholding. At the very least, the estimates are conditional moments of how the crowding-out effect varies across households, which the structural model in Section 4 is built to match.

Given these patterns, I complement the empirical analysis with a structural life-cycle portfolio-choice model to understand the mechanism behind them. I start from a standard life-cycle model with housing (Cocco, 2005; Yao and Zhang, 2005), extended so that households choose among renting, jeonse, and homeownership and allocate financial wealth between safe and risky assets. This standard structure already produces the substitution between financial assets and housing-related assets common to both tenures, but it predicts no variation in the risky share or in participation within the wealth range observed for Korean households.

To address these shortcomings, I add two frictions one at a time, so that each empirical pattern can be traced to a specific friction. The first is a consumption-based money-in-advance (c-MIA) constraint, adapted from Telyukova (2013): households must hold a fraction of their consumption and housing expenditure in safe liquid assets as a buffer. In the model-implied optimal portfolio choices, the required buffer absorbs a large share of the small financial wealth that a low-wealth jeonse tenant or homeowner keeps after its housing commitment, which pushes its risky share below the renter’s; as wealth grows, the required buffer becomes a small share of financial assets, and the risky share rises again.

The second is a small per-period stock-market participation cost, a standard device in the literature for explaining limited stock-market participation (Vissing-Jørgensen 2002; Fagereng, Gottlieb and Guiso 2017; Brandsaas 2021); I add it to examine its role in the housing crowding-out effect. A household then enters the stock market only when the gain from its desired risky position exceeds the cost. In the model-implied portfolio choices, the cost delays stock-market entry for homeowners, whose housing commitment leaves them with limited financial assets: the return on a small stock position cannot cover the cost, which keeps them out of the market. The effect is weaker for jeonse tenants, but combined with the c-MIA constraint, the cost also delays their entry and further delays homeowners’ entry, while renters participate from the lowest cash-on-hand level.

To assess the model’s quantitative performance, I simulate a panel of Korean households and compare it directly with the data. The simulated economy also serves as a laboratory: by switching off each friction or changing the features of a tenure, I examine how each shapes

the housing crowding-out effect. Because a model with homogeneous households predicts far more stock-market participation than observed, I follow [Vestman \(2019\)](#) and populate the economy with two belief types: a small share of households, chosen to match the aggregate participation rate, expects a positive equity premium, and the rest expect a negative one. This split is motivated by the fact that only a minority of Korean retail investors earn positive net returns on their stock investments ([Kim and Kim 2021](#); [Kang and Kim 2026](#)).

Concretely, I use the KLIPS panel itself as the simulated population. Each household is assigned a type once, at random, and keeps it in every wave. For each household-year, I take its observed age, tenure, wealth-to-income ratio, and, for owners, house value, and ask what portfolio a household of its type would choose in the model at these states. This yields a model-generated counterpart of the KLIPS panel: the same households and years, with portfolios chosen by the model. I then estimate exactly the same regressions on this panel. The simulated coefficients show that the standard model, without either friction, fails to match the data both qualitatively and quantitatively: it produces almost no crowding-out of the risky share or of participation, so its crowding-out of the risky financial asset ratio comes almost entirely from the financial asset ratio, and the jeonse coefficient barely fades with wealth (from -1.9 to -1.3 percentage points across wealth bins, against -0.9 to -0.2 in the data).

However, once the c-MIA constraint is incorporated into the model, it generates the weakening of the risky-share crowding-out with wealth for both tenures and the fading jeonse *RFAR* gradient (from -1.5 to -0.2), whose top-bin value matches the data. The participation cost, together with the c-MIA constraint, reproduces the participation crowding-out among low-wealth households for both jeonse tenants and homeowners, at magnitudes comparable to the data. This suggests that understanding the housing crowding-out effect requires accounting for how housing commitments interact with the liquidity needs of everyday consumption, not just the housing commitment itself.

Comparative statics in the simulated economy sharpen the interpretation. The c-MIA constraint is necessary for most of these patterns, and the participation cost becomes more effective in combination with it; for jeonse tenants, it crowds out participation only in that combination. A mean-preserving tripling of housing-return volatility, from the index value to a scenario informed by individual-apartment data, moves the portfolio coefficients by less than 0.1 percentage point and instead shifts tenure choice. In a hypothetical jeonse contract whose deposit is exposed to house prices, tenants choose larger houses, and their crowding-out deepens and no longer fades with wealth, as homeowners' does. This model result implies that the persistence of the homeownership crowding-out, in contrast to the fading jeonse crowding-out, comes from ownership's exposure to house prices. Housing thus crowds out risky asset holdings through both channels: a liquidity constraint channel that fades with wealth and a house price exposure channel that does not.

The paper connects to three literatures (see [Gomes, Haliassos and Ramadorai 2021](#) for the field survey). First, the structural literature on housing and life-cycle portfolio choice. [Grossman and Laroque \(1990\)](#), [Flavin and Yamashita \(2002\)](#), [Cocco \(2005\)](#), and [Yao and Zhang \(2005\)](#) formalize and quantify how housing crowds out risky financial assets, and subsequent work refines the friction and preference structure: [Vestman \(2019\)](#) introduces Epstein–

Zin preferences and type heterogeneity to explain the owner–renter participation gap, and [Fagereng, Gottlieb and Guiso \(2017\)](#) show that a small per-period participation cost, together with a small disaster probability, fits life-cycle participation and exit. Relative to this literature, I add jeonse as a third endogenous tenure and, more substantively, use the distinct tenure coefficients to discipline each friction separately—a friction *decomposition* based on which cross-sectional coefficient each friction can and cannot produce. [Boar, Gorea and Midrigan \(2022\)](#)’s calibrated model, which implies that most U.S. homeowners are liquidity-constrained in their housing equity, supports the centrality of the liquidity channel.

Second, the empirical literature on housing and portfolios. [Chetty, Sándor and Szeidl \(2017\)](#) use house price variation across U.S. states and over time, instrumented with housing supply elasticities, to separate property-value from home-equity effects; [Lyng and Zhou \(2023\)](#) document portfolio dynamics around purchase; related evidence includes [Beaubrun-Diant and Maury \(2016\)](#). My decomposition is complementary but distinct: rather than decomposing *price* variation, I exploit a *contract* that carries the housing commitment without exposure to house prices—institutional variation that exists at scale only in Korea—and document a new fact, the contrasting wealth gradients of the jeonse and owner crowding-out effects.

Third, the literature on the jeonse institution itself: contract structure and default risk ([Ambrose and Kim 2003](#); [Moon 2018](#)), institutional rationale and financing role ([Kim 2013](#); [Kim and Shin 2013](#)), deposit determination ([Jing, Park and Zhang 2022](#); [Park and Pyun 2020](#)), and evolution ([Ronald and Jin 2015](#)). On the landlord side, [Ahn and Ryu \(2024\)](#) study a landlord’s optimal switch from jeonse to monthly rent in an infinite-horizon portfolio-choice model and show that tighter bank credit sustains jeonse. These papers treat jeonse as the object of study. I contribute to this literature by documenting how jeonse tenants invest in the stock market and by providing, to my knowledge, the first quantitative life-cycle model in which households choose among renting, jeonse, and ownership jointly with their stock portfolios.

The remainder of the paper is organized as follows. Section 2 describes the jeonse contract and explains how it separates exposure to the two channels. Section 3 presents the empirical analysis, documenting the crowding-out effect of jeonse and homeownership on household portfolio choice and its heterogeneity across the wealth-to-income and age distributions. Section 4 introduces the life-cycle model with endogenous tenure, the c-MIA constraint, and a stock-market participation cost, and Section 5 calibrates it. Section 6 describes the optimal policies of the standard model and of the model with the c-MIA constraint and the participation cost, and Section 7 simulates an economy with two belief types and compares its crowding-out coefficients with the data. Section 8 reports comparative statics on the mechanisms: the response of the coefficients to the strength of the c-MIA constraint, the interaction between the participation cost and the c-MIA constraint, and the roles of house price risk and of house price exposure as a whole. Section 9 concludes.

2 Institutional Background: The Jeonse Contract

In this section, I describe the contract structure of jeonse¹ and explain how it allows me to decompose the crowding-out effect into the liquidity constraint channel and the house price exposure channel.

2.1 Contract Structure

Under a jeonse contract, the tenant and the landlord agree on the size of a lump-sum deposit and the contract period, which is typically two years. At the beginning of the contract, the tenant pays the jeonse deposit to the landlord. In return, the tenant resides in the house for the agreed-upon period without paying any periodic rent. At the end of the contract, the landlord must return exactly the same nominal amount of the deposit to the tenant, and the tenant vacates the house. In essence, jeonse can be understood as a form of collateralized lending in which the house serves as collateral and the housing service acts as interest.

The jeonse deposit is substantial. According to the Korea Real Estate Board (formerly the Korea Appraisal Board), the national average jeonse deposit for all housing types from 2012 to 2019 was approximately 63.8% of the house value. For many households, the jeonse deposit accounts for most of their net wealth or even exceeds it. Importantly, there is a well-developed mortgage market for jeonse tenants in Korea, similar to that for home purchasers. Jeonse tenants can borrow from banks to finance their deposit, subject to loan-to-value (LTV) restrictions analogous to those applied to home purchase mortgages.² This means that transitioning from renting to a jeonse contract requires a large upfront commitment of liquid wealth, much like purchasing a house.

2.2 Why Jeonse Isolates the Liquidity Constraint Channel

The jeonse contract exposes the tenant to the liquidity constraint channel but not to the house price exposure channel. On the one hand, jeonse tenants face a substantial liquidity constraint: a large portion of their wealth is locked in the illiquid jeonse deposit for the duration of the contract. Given that the deposit typically amounts to about two-thirds of the house value, and that many households finance part of it through mortgage borrowing subject to LTV constraints, jeonse tenants are left with limited liquid wealth available for financial investment.

On the other hand, jeonse tenants are exposed to only a second-order house price risk. Over the two-year contract, the landlord is obligated to return the deposit in exact nominal terms regardless of house price movements, so the tenant neither gains from rising prices nor loses from falling prices. Jeonse tenants do bear some residual exposure from two sources. First, at renewal, the deposit size can be renegotiated—typically upward if local prices have risen—and this renewal risk resembles the rent-fluctuation risk described in [Sinai and Souleles \(2005\)](#), though it is shared with conventional renters and is not a source of *differential*

¹In other papers, this is referred to as *chonsei* or *chonsae*. I use “jeonse” throughout this paper.

²At the calibrated contract parameters, a jeonse tenant must fund $\delta_f \bar{J} \approx 34\%$ of house value from own funds (deposit ratio $\bar{J} = 0.64$ times the unfinanced share $\delta_f = 0.53$), compared with the owner’s $\delta \approx 65\%$; initiating a jeonse contract therefore requires a substantial upfront commitment even with mortgage financing—roughly half of an owner’s, with 47% of the deposit borrowed, compared with 35% of the house price for an owner.

crowding-out vis-à-vis renting. Second, landlord default risk is in principle nonzero: if the landlord cannot return the deposit, the tenant can auction the underlying property, but the tenant must absorb the difference between the deposit and the auction proceeds when the property value is low.³ Both exposures are second-order relative to the primary risk faced by homeowners, whose net wealth moves one-for-one with housing returns. I therefore interpret the jeonse coefficient as primarily reflecting the liquidity constraint channel.

This contrast between jeonse and ownership is the paper’s empirical design. The regression in Section 3 estimates two tenure effects relative to the omitted renter category: a (jeonse – renter) coefficient and a (homeowner – renter) coefficient. The first measures the liquidity constraint channel, since jeonse differs from renting primarily in requiring the illiquid deposit. The second reflects everything ownership adds beyond a housing commitment: a larger housing equity position, exposure to house prices, and smaller differences in transaction costs and maintenance obligations. The difference between the two coefficients therefore measures an *ownership-specific* component of the crowding-out, which includes the house price exposure channel, without—on its own—revealing whether that component operates through the riskiness of the housing return or through its expected capital gain. The prior literature interprets it as house price risk; Sections 8.3 and 8.4 use the structural model to examine it.

2.3 Life-Cycle Housing Tenure Patterns

Figure 1 illustrates that the housing tenure distribution in Korea differs markedly from that of the United States, both across age groups (top row) and across the net wealth-to-income ratio (bottom row). In Korea, renting is most common among households under 30, the jeonse share is highest among households under 40, and ownership rises steadily with age. This cross-sectional profile is consistent with a housing ladder from renting to jeonse to ownership, with a large upfront commitment at each step. In the United States, where jeonse does not exist, the owner share rises directly as the renter share falls.

The bottom row of Figure 1 shows that tenure and the wealth-to-income ratio are tightly linked in Korea: renters dominate the lowest W/Y deciles, jeonse peaks in the second and third deciles, and homeowners dominate the upper deciles. Two features matter for the empirical analysis in Section 3. First, the tight W/Y –tenure association makes it essential to control for wealth and related household characteristics when estimating tenure effects, since pooled tenure comparisons would otherwise conflate tenure and wealth. Second, every W/Y bin still contains non-negligible shares of renters and jeonse tenants alongside homeowners, so within-bin tenure comparisons are feasible and support the wealth-gradient heterogeneity analysis.

³Historical default events were rare: the Korea Housing and Urban Guarantee Corporation (HUG) recorded 27 deposit-guarantee default events in 2016. The count of default events rose gradually to 2,799 by 2021 before surging to 5,443 in 2022 and 19,350 in 2023 during the widely publicized wave of jeonse defaults. To keep the analysis sample free of this wave, I restrict the empirical analysis to survey years ≤ 2021 throughout. Appendix B documents the timing of the default surge using the official HUG time series.

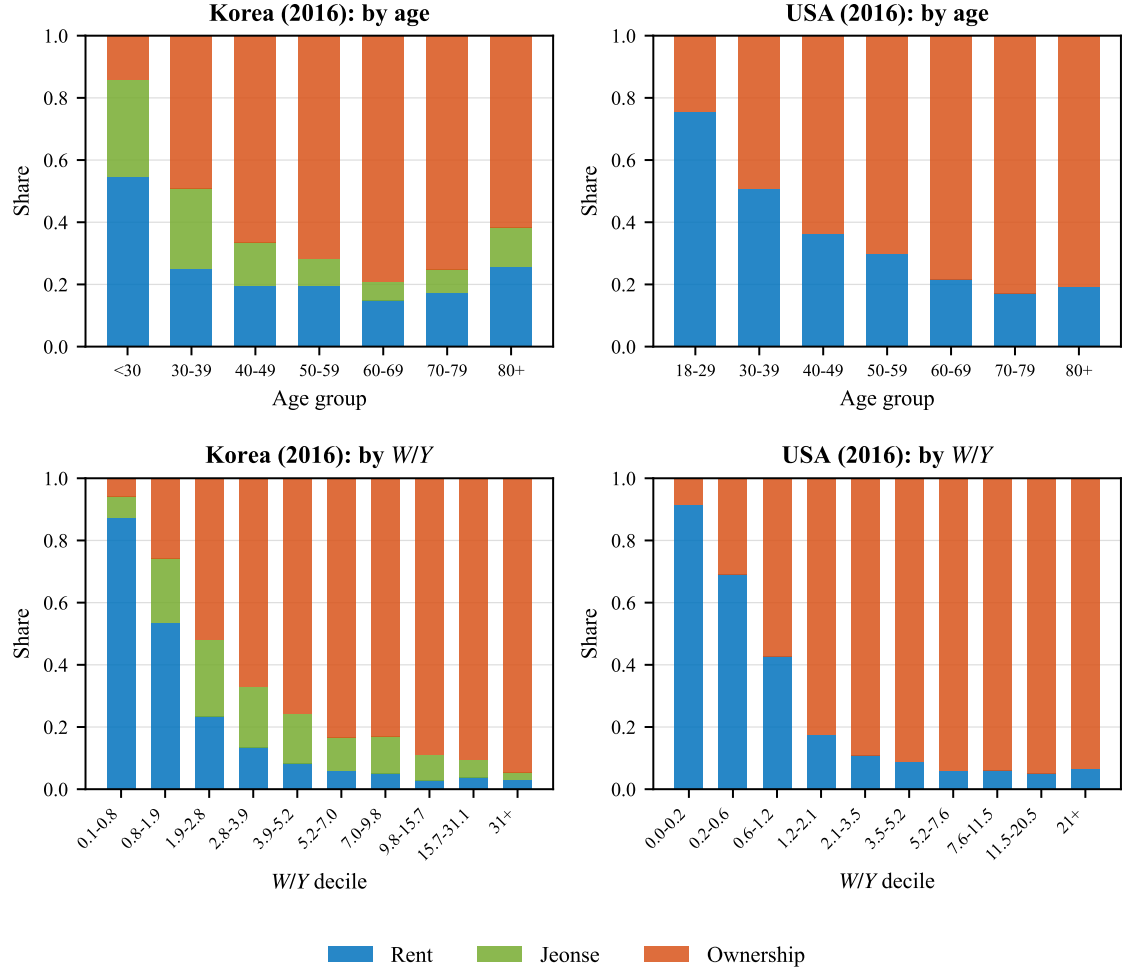


Figure 1: Housing Tenure Distribution: South Korea vs. the United States

Notes: Survey-weighted share of households in each housing tenure. Top row: by age of the household head. Bottom row: by decile of the wealth-to-income ratio W/Y ; deciles contain equal numbers of observations, and tick labels give the decile bounds. Korea: HFWPKOR survey year 2016, analysis sample of Section 3; W/Y is net wealth over non-capital income. United States: 2016 Survey of Consumer Finances (Board of Governors of the Federal Reserve System); households that own their home versus all others (shown as rent). The U.S. W/Y panel uses households with positive net worth and income, with total income (including capital income) in the denominator. Jeonse exists only in Korea.

3 Empirical Analysis

In this section I use two Korean household panel datasets to quantify the crowding-out effect of jeonse tenancy and homeownership on household portfolio choices, separate the liquidity-constraint component from the ownership-specific component via the tenure comparison, and examine how the two components vary across household characteristics.

3.1 Data

Data sources. I use two Korean household panel datasets. The first is the Korea Labor and Income Panel Study (KLIPS), conducted annually by the Korea Labor Institute since 1998, which tracks roughly 12,000 households and contains detailed information on households' demographics, income, expenditures, assets, and debts. The second is the Household Finance

and Welfare Panel Survey of Korea (HFWPKOR), jointly conducted by Statistics Korea and the Bank of Korea since 2012, which surveys approximately 18,000 households per year and provides more detailed information on financial asset holdings.⁴ Both datasets are constructed to be nationally representative through survey weights. I restrict attention to KLIPS survey waves 3–24 (calendar years 2000–2021) and HFWPKOR survey years 2013–2021, stopping before the wave of jeonse defaults that began in 2022.⁵

Variable construction. I construct balance sheet and portfolio choice variables following standard definitions. Net wealth W is the sum of financial assets FA and real assets RA minus total liabilities LB . Financial assets include bank deposits, mutual funds, stocks, bonds, saving insurance products, and private lending, but exclude jeonse and rent deposits. Risky financial assets RFA comprise stocks and bonds in KLIPS and stocks, bonds, and funds in HFWPKOR. Real assets include real estate (including the primary residence), vehicles, land, and other tangible assets. Non-capital income Y includes labor income, pensions, social insurance, and family transfers. From these balance-sheet aggregates I construct four portfolio-choice measures: the financial asset ratio $FAR = FA/W$, the risky asset share of financial assets $\alpha = RFA/FA$ (set to zero for households with no financial assets), the risky financial asset ratio $RFAR = RFA/W = FAR \cdot \alpha$, and a stock-market participation indicator $SMP = \mathbb{1}[RFA > 0]$, which measures participation in risky financial assets broadly. The wealth-to-income ratio W/Y serves as the main cross-sectional heterogeneity dimension. Housing tenure is classified into three categories: renter, jeonse tenant, and homeowner. Full details of the variable construction, including the precise KLIPS and HFWPKOR variable codes used for each aggregate, are provided in Appendix A.

Sample selection. I apply the following sample selection criteria, common across both datasets. I remove households with non-positive net wealth, those with annual non-capital income below 1,200,000 Korean won (approximately \$1,017 at the 2020 annual average exchange rate of 1,180 KRW/USD), and the top and bottom 1% of both the W distribution and the W/Y distribution. Finally, I exclude renters and jeonse tenants whose other real estate assets exceed half of their jeonse or rent deposit, as these households likely own substantial housing wealth elsewhere and do not represent typical renters or jeonse tenants. All observations passing these filters are retained regardless of how many waves a household appears in; the within-household identification uses the year-to-year variation available for each

⁴The two surveys differ primarily in the granularity of the financial-asset module: HFWPKOR separately records stocks, bonds, mutual funds, and saving insurance at the household level in every wave since 2013, whereas KLIPS aggregates several of these categories in certain early waves and records the detailed breakdown only for households whose balance-sheet responses are non-trivial. As a result, α and $RFAR$ can be constructed more precisely in HFWPKOR than in KLIPS, but KLIPS provides a longer time series and a richer demographic and employment history.

⁵KLIPS waves 1–2 (1998–1999) are dropped because several asset and debt subcategory variables (auto assets, auto loans, “other” assets) were only introduced in wave 3 or later. The HFWPKOR 2012 wave is dropped because it predates the household-level breakdown of stocks, bonds, and mutual funds, so $RFAR$ and α cannot be constructed on a basis comparable to 2013+ waves. I stop the analysis window at 2021 to exclude the 2022–2024 survey waves that overlap with the Korea-wide wave of jeonse defaults; Appendix B documents the timing of the default surge using official HUG statistics.

household.⁶ The regressions use observations with complete data on all controls. Because the first-differenced controls and the marriage and divorce shocks are defined only when the household’s previous observation is available, and KLIPS marital status is missing in some waves, the estimation samples contain 80,805 KLIPS and 89,415 HFWPKOR household-years (about 70% and 67% of the selected samples), and HFWPKOR estimation starts in 2014.

Table 1: Descriptive Statistics by Housing Tenure (KLIPS)

	Full sample				EverSMP sample			
	All	Renter	Jeonse	Homeowner	All	Renter	Jeonse	Homeowner
Observations	116,316	15,677	20,706	79,923	26,627	1,963	5,121	19,541
Households	14,269	4,245	5,253	10,205	2,192	526	1,134	1,870
<i>Panel A: Demographics</i>								
Age	52.3	46.7	45.1	55.3	48.1	40.5	41.1	50.6
HH Size	3.0	2.1	2.8	3.2	3.3	2.2	3.0	3.5
<i>Panel B: Income & Wealth (USD thousands, 2020 real prices)</i>								
Y	37.4	25.6	33.6	40.8	52.2	34.7	45.0	55.8
W	189.1	30.5	92.9	247.4	274.7	51.6	138.2	330.4
FA	24.7	14.1	18.9	28.4	43.5	28.1	33.7	47.5
RFA	1.7	0.7	1.8	1.8	6.3	5.2	6.9	6.3
<i>Panel C: Portfolio</i>								
W/Y	6.9	1.4	3.5	9.0	6.6	1.8	3.7	7.8
FA/W	0.171	0.426	0.185	0.116	0.194	0.536	0.231	0.151
α	0.025	0.016	0.028	0.026	0.094	0.111	0.106	0.089
RFA/W	0.007	0.011	0.009	0.006	0.026	0.077	0.035	0.019
SMP	0.055	0.032	0.060	0.058	0.205	0.222	0.228	0.198

Notes: Survey-weighted means over household-year observations in the KLIPS analysis sample (survey years 2000–2021), representing the national population of Korean households. Observations and Households are unweighted counts; because households move across tenure categories over time, tenure-specific household counts sum to more than the All column. Monetary values (Panel B) are converted from 10,000 KRW in 2020 prices (CPI-deflated) to thousands of 2020 USD at the 2020 annual average exchange rate of 1,180 KRW per USD. *W* is net wealth, *Y* non-capital income, *FA* financial assets excluding housing deposits, *RFA* risky financial assets; *FA/W*, $\alpha = RFA/FA$, *RFA/W* and *SMP* = $\mathbb{1}[RFA > 0]$ are fractions. The EverSMP sample keeps households observed with *RFA* > 0 in at least one wave. Source: Korea Labor Institute, Korean Labor and Income Panel Study (KLIPS).

Descriptive statistics. Table 1 reports survey-weighted means by housing tenure for the KLIPS sample, representing the national population of Korean households. Homeowners are older and wealthier than jeonse tenants and renters, consistent with the life-cycle tenure trajectory documented in Section 2 (average *W/Y* is 1.4 for renters, 3.5 for jeonse tenants, and 9.0 for homeowners). Renters hold the highest financial asset ratio, consistent with renters holding most of their (relatively small) net wealth in financial form, while jeonse tenants and homeowners have much of their wealth locked in housing-related assets. Stock market participation is low—only 5.5% in the full sample. Importantly, jeonse tenants and homeowners participate *more* than renters in these unconditional data (6.0% and 5.8% vs. 3.2%), reflecting the selection of wealthier households into both jeonse/ownership and stockholding (Vestman 2019) rather than a causal effect of tenure. Table 7 in Appendix C reports the same statistics

⁶Within the 2000–2021 (KLIPS) and 2013–2021 (HFWPKOR) windows, these filters drop 17.2% of KLIPS and 19.1% of HFWPKOR household-year observations. The largest exclusions are non-positive net wealth (8,971 KLIPS and 4,790 HFWPKOR observations), income below the threshold (4,490 and 10,830), and renters or jeonse tenants with large other real-estate holdings (5,485 and 9,741); the 1% trims of *W* and *W/Y* remove the remainder.

for HFWPKOR, which show similar tenure patterns; participation is higher in HFWPKOR (19.8%), whose risky-asset field also includes funds. These unconditional patterns motivate the regression analysis below, which adds household and year fixed effects together with a rich set of controls to isolate the conditional crowding-out effect.

3.2 Regression Analysis

The regression analysis proceeds in two steps. I first estimate the pooled crowding-out effect of jeonse and homeownership on the four portfolio-choice outcomes, comparing the conditional coefficients to the unconditional Table 1 patterns. I then examine heterogeneity by interacting tenure indicators with wealth-to-income and age bins, so that each tenure-by-bin interaction measures the conditional crowding-out effect at that wealth-to-income or age level.

3.2.1 Pooled Crowding-Out Effect

I first pool across all household-year observations to estimate the average crowding-out effect of jeonse and homeownership on the four portfolio-choice outcomes. The regression specification is

$$PF_{it} = \beta_J \cdot Jeonse_{it} + \beta_O \cdot Owner_{it} + \gamma' X_{it} + \alpha_i + \delta_t + \epsilon_{it}, \quad (1)$$

where PF_{it} is one of the four portfolio-choice variables, $Jeonse_{it}$ and $Owner_{it}$ are tenure dummies (with renters as the omitted category), X_{it} is a vector of controls including W/Y , $\Delta(W/Y)$, age, education group, household size, Δ household size, marital status, marriage shock, and divorce shock, α_i is a household fixed effect, and δ_t is a year fixed effect. Standard errors are two-way (household $\times$ year) clustered.

Table 2 reports the results, which I discuss outcome by outcome. First, both jeonse and homeownership are associated with a substantially lower financial asset ratio (FAR) in both datasets, consistent with housing-related commitments substituting for financial assets in net wealth. In KLIPS, the jeonse coefficient is -20.5 percentage points relative to renters and the homeowner coefficient -30.8 ; the HFWPKOR estimates are larger at -22.2 and -38.8 . These magnitudes are large relative to the renter baseline: the average renter FAR in KLIPS is 42.6% (Table 1), so the jeonse coefficient equals roughly half of the renter mean and the homeowner coefficient roughly three-quarters; in HFWPKOR, whose renters hold 58.7% (Table 7), the ratios are about two-fifths and two-thirds. The homeowner effect exceeds the jeonse effect in both samples, consistent with homeownership imposing both a mechanically larger liquidity constraint than jeonse (the owner down payment ties up a larger share of liquid wealth than the jeonse down payment) and an additional house price exposure channel.

Second, the pooled tenure coefficients on the risky asset share of financial assets (α) are modest in magnitude and mixed in sign across the two datasets. In KLIPS, both coefficients on α are negative, but only the homeowner coefficient is significant: -0.71 percentage points in the full sample and -2.86 in the EverSMP subsample (both at 5%), against -0.41 and -1.69 for jeonse. In HFWPKOR, the point estimates on the jeonse side are positive but statistically indistinguishable from zero, while the homeowner coefficients are near zero. Among the four

Table 2: Pooled Crowding-Out Effect: Housing Tenure and Portfolio Choice

Dependent variable	KLIPS				HFWPKOR			
	(1) <i>FAR</i>	(2) α	(3) <i>RFAR</i>	(4) <i>SMP</i>	(5) <i>FAR</i>	(6) α	(7) <i>RFAR</i>	(8) <i>SMP</i>
<i>Panel A: Full sample</i>								
Jeonse	−20.49*** (1.32)	−0.41 (0.31)	−0.80*** (0.24)	−0.59 (0.54)	−22.16*** (1.60)	0.32 (0.45)	−0.38* (0.19)	1.35 (1.02)
Homeowner	−30.83*** (1.46)	−0.71** (0.31)	−1.25*** (0.29)	−1.12*** (0.43)	−38.83*** (2.37)	−0.23 (0.35)	−1.42*** (0.26)	−0.28 (0.92)
<i>N</i>	80,805	80,805	80,805	80,805	89,415	89,415	89,415	89,415
Within R^2	0.080	0.003	0.005	0.003	0.050	0.001	0.003	0.001
<i>Panel B: EverSMP sample</i>								
Jeonse	−28.62*** (4.07)	−1.69 (1.58)	−4.93*** (1.33)	−2.12 (2.58)	−25.03*** (3.24)	1.07 (1.60)	−1.95*** (0.73)	4.87 (3.72)
Homeowner	−39.91*** (4.31)	−2.86** (1.43)	−6.37*** (1.41)	−4.21** (1.99)	−39.33*** (4.49)	−0.80 (1.17)	−4.93*** (0.85)	−0.60 (3.28)
<i>N</i>	17,878	17,878	17,878	17,878	28,171	28,171	28,171	28,171
Within R^2	0.094	0.011	0.023	0.013	0.047	0.002	0.009	0.005
Household FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Household-year observations from KLIPS (survey years 2000–2021) and HFWPKOR (2014–2021) with complete data on all controls, after the sample selection described in the text. Each column regresses the outcome on jeonse and homeowner indicators (renters omitted) with household and year fixed effects. Outcomes ($FAR = FA/W$, $\alpha = RFA/FA$, $RFAR = RFA/W$, $SMP = \mathbb{1}[RFA > 0]$) are multiplied by 100, so coefficients are in percentage points. Panel A uses the full sample; Panel B restricts to households observed holding risky financial assets ($RFA > 0$) in at least one wave. Controls (KLIPS): W/Y , $\Delta(W/Y)$, age, education group, household size, Δ household size, marital status, marriage shock, divorce shock. Controls (HFWPKOR): W/Y , $\Delta(W/Y)$, age, household size, Δ household size, marital status, marriage shock, divorce shock. Regressions are unweighted. Standard errors in parentheses are two-way clustered by household and year. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

outcomes, α is the noisiest at the household level, which partly accounts for the differences across datasets. One source of this noise is visible once heterogeneity is permitted: as I show in Section 3.2.2, the tenure coefficients on α are negative at low W/Y and turn positive at high W/Y , so the pooled coefficient depends on how the W/Y distribution of each sample weights the two regions. I return to this pattern in the next subsection. Given the large crowding-out of FAR documented above, the small tenure coefficients on α are consistent with the FAR crowding-out carrying over to the risky financial asset ratio $RFAR = FAR \cdot \alpha$.

Third, both jeonse and homeownership are associated with a substantially lower risky financial asset ratio ($RFAR$) in both datasets. In the full sample, the jeonse coefficient is -0.80 percentage points in KLIPS and -0.38 in HFWPKOR, and the homeowner coefficient -1.25 and -1.42 . In the EverSMP subsample the magnitudes are several times larger: -4.93 and -1.95 for jeonse, and -6.37 and -4.93 for homeownership. These effects are large relative to the renter baseline. The average renter $RFAR$ in KLIPS is 1.1% in the full sample and 7.7% in the EverSMP subsample (Table 1); the jeonse coefficient thus amounts to roughly three-quarters of the renter baseline in the KLIPS full sample and the homeowner coefficient exceeds it. With α barely responding to tenure, this pattern is consistent with the FAR crowding-out carrying over to $RFAR$.

Finally, the stock-market participation dummy (SMP) shows a negative homeowner coeffi-

cient in KLIPS (-1.12 percentage points, $p < 0.01$) but a near-zero, insignificant coefficient in HFWPKOR. Since unconditional tenure-specific participation rates are higher for jeonse tenants and homeowners than for renters (Table 1), the attenuation after controlling for household and year fixed effects indicates that the controls absorb much of the Vestman (2019)-style selection of wealthier households into both tenure and stockholding. The large positive unconditional gaps shrink in both datasets and three of the four conditional coefficients turn negative (the HFWPKOR jeonse coefficient stays positive but insignificant), confirming that the conditional estimates—not the raw descriptive statistics—are what the model is asked to match. As with α , the *SMP* crowding-out is heterogeneous across the wealth distribution—substantial at low W/Y and weakening at high W/Y —which contributes to the cross-dataset noise in the pooled estimates. I return to this pattern in Section 3.2.2.

Overall, the pooled analysis shows a crowding-out effect operating primarily through the *FAR* margin, which carries over to *RFAR* because α barely responds to tenure. The noisier pooled α and *SMP* results, however, invite a closer look at heterogeneity across households: the pooled estimates are averages that may obscure patterns which emerge only when the sample is partitioned by relevant household characteristics. The next subsection examines how the jeonse and homeowner coefficients vary across the wealth-to-income and age distributions.

3.2.2 Heterogeneity of the Crowding-Out Effect Across Households

The liquidity constraint channel should operate heterogeneously along at least two dimensions. First, its strength should decline with the wealth-to-income ratio W/Y . The jeonse deposit or down payment scales with the house the household occupies, and hence with its income; a household with low W/Y therefore commits most of its net wealth to housing and has little liquid wealth left for financial investment, whereas a household with high W/Y meets the same commitment and still holds substantial liquid wealth. Second, age matters: younger households typically have less accumulated wealth but more future labor income, while older households have the reverse, so the same tenure commitment implies very different portfolio consequences at different stages of the life cycle. The house price exposure channel, by contrast, arises from holding housing equity whose value moves with house prices; this exposure does not shrink with wealth (wealthier homeowners tend to own more valuable houses) or with age (older homeowners remain exposed to the same housing returns), so the crowding-out impact of this channel should be approximately flat across W/Y and age. These two contrasting predictions motivate examining how the jeonse and homeowner crowding-out coefficients vary across the wealth-to-income and age distributions.

Heterogeneity by W/Y . To examine whether the crowding-out effect varies with the wealth-to-income ratio, I interact the housing tenure dummies with W/Y bin indicators:

$$PF_{it} = \sum_{Q=1}^K \gamma_Q \cdot Jeonse_{it} \cdot \mathbb{1}[W/Y \in Bin_Q]_{it} + \sum_{Q=1}^K \sigma_Q \cdot Owner_{it} \cdot \mathbb{1}[W/Y \in Bin_Q]_{it} + \gamma' X_{it} + \alpha_i + \delta_t + \epsilon_{it} \quad (2)$$

where $\mathbb{1}[W/Y \in \text{Bin}_Q]_{it}$ is an indicator for household i being in the Q -th bin of the W/Y distribution in year t . I use five bins: $[0, 2)$, $[2, 3)$, $[3, 5)$, $[5, 8)$, and $[8, \infty)$. The cutpoints are chosen to balance the jeonse-tenant and renter samples within each bin—renters concentrate at low W/Y while jeonse tenants cluster in the W/Y range 1–6, so a coarse first bin and wider middle bins keep both tenures adequately represented in every cell. The coefficients γ_Q and σ_Q capture the crowding-out effect of jeonse and homeownership, respectively, for households in each W/Y bin, relative to renters in the same bin.

Figure 2 plots the estimated coefficients γ_Q (jeonse) and σ_Q (homeownership) across W/Y bins for the four portfolio-choice variables, with both ± 1 standard-error bands (darker shading) and 90% confidence intervals (lighter shading) overlaid. The figure is laid out as a 4×2 grid: rows correspond to the outcomes FAR , α , $RFAR$, SMP (in that order); the left column uses KLIPS and the right column uses HFWPKOR, with a common y -axis within each row so that magnitudes can be compared directly across datasets. Appendix Figure 13 repeats the exercise on the EverSMP subsample (households holding risky financial assets in at least one observed wave). The same patterns appear, with the risky-asset coefficients (α , $RFAR$, SMP) several times larger and the FAR coefficients only modestly larger, because the full-sample coefficients average over the many households that never hold risky assets. The model in Section 4 is compared with the full-sample coefficients.

For FAR , both the jeonse and homeowner coefficients are large and negative at every W/Y bin, with the homeowner coefficient running roughly 10 percentage points (KLIPS) to 15 percentage points (HFWPKOR) below the jeonse coefficient throughout. Neither series exhibits a pronounced W/Y gradient: the jeonse coefficient ranges from -20 to -21 across bins in KLIPS and from -20 to -24 in HFWPKOR, and the homeowner coefficient shifts from about -29 at the bottom to -33 at the top in KLIPS and from about -34 to -41 in HFWPKOR. The heterogeneity expected from the liquidity constraint channel does not appear in this outcome, consistent with the substitution effect (wealth tied up in housing-related assets rather than financial assets) being roughly proportional to wealth. The EverSMP coefficients are only modestly larger and show the same flat profile.

For α , the jeonse coefficient changes sign across the W/Y distribution. At the bottom of the W/Y distribution the jeonse coefficient on α is negative (about -0.7 percentage points in KLIPS), indicating that jeonse tenants with tight liquidity buffers hold a smaller risky share of their financial assets than comparable renters. The coefficient then rises with W/Y and turns *positive* in the top bin, reaching about $+0.5$ percentage points. HFWPKOR shows the same sign-flip pattern: the jeonse coefficient rises from about -0.3 percentage points at the bottom to $+1.1$ percentage points at the top, with the positive value in the $W/Y \in [5, 8)$ bin marginally distinguishable from zero and the top-bin estimate positive but less precisely estimated. The homeowner coefficient on α also weakens with W/Y : in HFWPKOR it crosses zero in the upper bins, in KLIPS it stays negative but attenuates. In the EverSMP subsample the jeonse sign-flip is more pronounced, from -3.2 to $+3.4$ percentage points in KLIPS and from -1.3 to $+3.5$ percentage points in HFWPKOR. I return to the interpretation of this sign-flip pattern in Section 3.3.

The most informative outcome for the two-channel decomposition is $RFAR$. In KLIPS, the

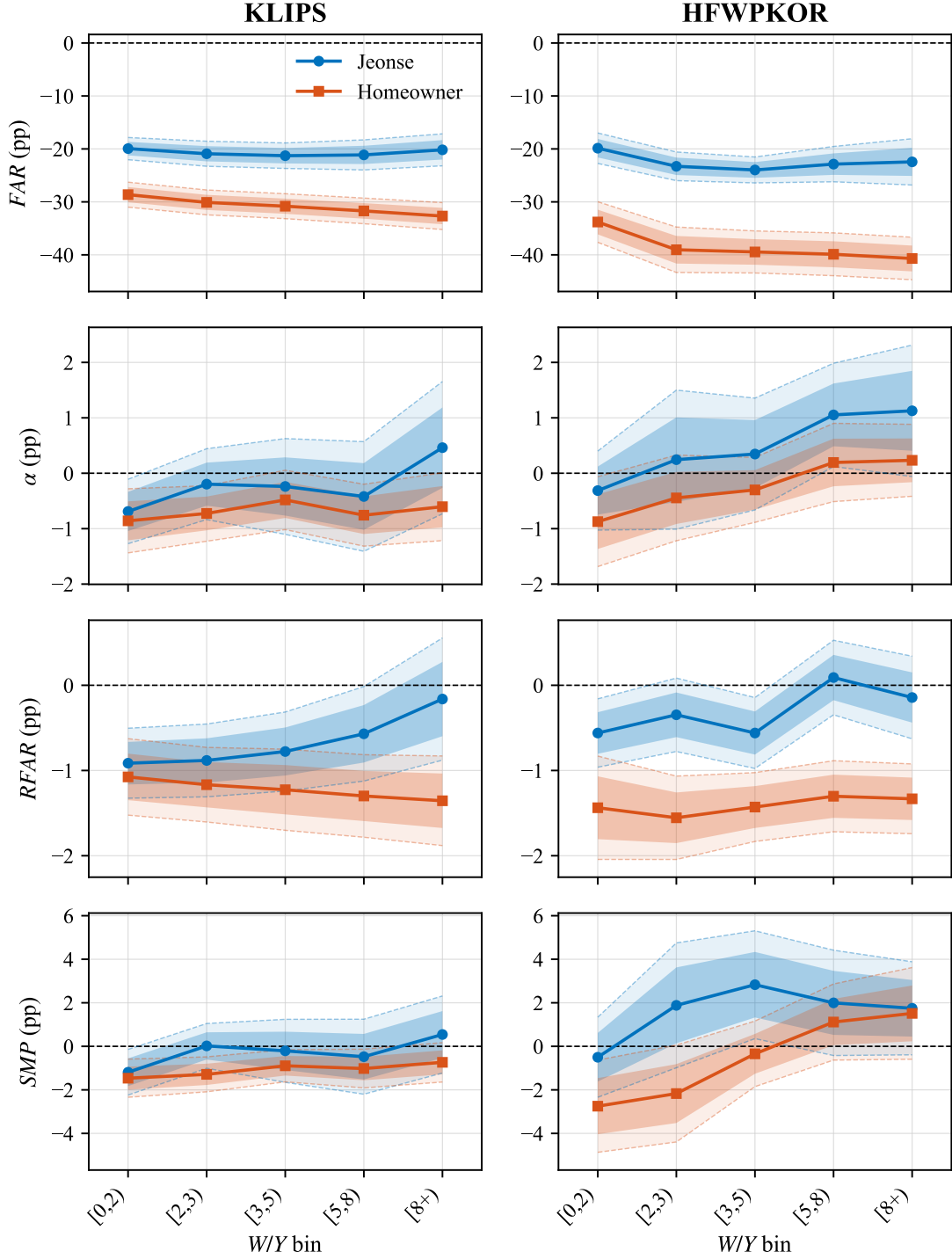


Figure 2: Crowding-Out Effects by W/Y (full sample)

Notes: Each point shows the estimated coefficient on the tenure $\times$ W/Y bin interaction from Equation 2. Shaded bands show ± 1 standard error (darker) and 90% confidence intervals (lighter), both based on two-way (household $\times$ year) clustered standard errors. Rows (top to bottom): FAR, α , RFAR, SMP, in percentage points. Columns: KLIPS (left), HFWPKOR (right). y-axes are harmonized within each row.

jeonse coefficient on *RFAR* declines monotonically in magnitude from about -0.9 percentage points at the bottom of the *W/Y* distribution to about -0.2 percentage points at the top, a fivefold shrinkage that leaves the top-bin estimate statistically indistinguishable from zero. In HFWPKOR the jeonse coefficients are smaller and their decline is weaker and non-monotone (-0.56 percentage points in the lowest bin, statistically indistinguishable from zero in the two upper bins). The homeowner coefficient on *RFAR*, by contrast, is flat and highly significant across every *W/Y* bin, sitting at roughly -1.1 to -1.4 percentage points in KLIPS and -1.3 to -1.6 percentage points in HFWPKOR. This contrast is the central empirical result of the paper: the jeonse crowding-out fades with wealth, consistent with the liquidity constraint channel relaxing as the deposit becomes a smaller fraction of net wealth; the homeowner crowding-out persists, consistent with the house price exposure channel, which does not relax with wealth. The EverSMP subsample shows the same contrast at several times the magnitude: the jeonse coefficient fades from -5.5 to -1.9 percentage points in KLIPS (from -2.6 to -1.3 percentage points in HFWPKOR), while the homeowner coefficient stays near -6 percentage points in KLIPS (-4.6 to -5.3 percentage points in HFWPKOR).

The jeonse fade is consistent with a change in the composition of financial wealth rather than its level. The jeonse *FAR* coefficient is flat across the *W/Y* bins (-19.9 to -21.3 percentage points in KLIPS), so the shrinking jeonse *RFAR* coefficient is consistent with a rising risky asset share: the jeonse α coefficient rises from -0.69 to $+0.46$ percentage points. Homeowners, by contrast, are crowded out in both *FAR* and *RFAR* at every wealth level.

For *SMP*, the jeonse and homeowner coefficients are most negative at the bottom of the *W/Y* distribution and attenuate toward zero at the top. In KLIPS the jeonse coefficient moves from -1.2 percentage points in the lowest bin to near zero in the upper bins, and the homeowner coefficient from -1.5 percentage points to -0.7 percentage points. In HFWPKOR the homeowner coefficient attenuates in the same way (from -2.8 to $+1.5$ percentage points), while the jeonse coefficients are imprecise and positive in the middle bins. Unlike *RFAR*, which distinguishes the two tenures through their different *W/Y* gradients, the extensive-margin *SMP* effect attenuates similarly for both tenures. I read this as evidence that the extensive margin—whether to hold any risky financial assets at all—is disproportionately shaped by the tightness of the liquidity buffer, pushing low-wealth households toward non-participation regardless of tenure type.

The homeowner persistence and the jeonse sign-flip on α appear in both KLIPS and HFWPKOR despite differences in sample periods, sample sizes, and variable definitions. Together these patterns support the two-channel decomposition: the liquidity constraint channel fades as wealth accumulates, while the house price exposure channel operates regardless of wealth. Because the jeonse *RFAR* fade is sharper in KLIPS than in HFWPKOR, I next test the cross-tenure contrast formally.

Formal tests. Table 3 tests these patterns directly. For each tenure it reports the difference between the coefficient in the top and the bottom *W/Y* bin, $\beta_5 - \beta_1$; because the crowding-out coefficients are negative, a positive value means that the crowding-out effect shrinks as the wealth-to-income ratio rises. The “jeonse – homeowner” rows test whether this shrinkage

differs between the two tenures within the same regression. Except for the homeowner *RFAR* coefficients in KLIPS, which if anything grow with wealth, every crowding-out effect shrinks as households become wealthier, and the shrinkage is concentrated among jeonse tenants: five of the eight jeonse estimates are significant at the 10% level or better. For α , both tenures' coefficients rise with wealth in HFWPKOR, so the sign-flip is strongest, but not unique, for jeonse. The central contrast—the jeonse *RFAR* effect shrinks while the homeowner effect does not—is positive in all four samples. It is imprecisely estimated in HFWPKOR but significant at the 5% level in both KLIPS samples, where from the bottom to the top W/Y bin the jeonse *RFAR* coefficient shrinks by 1.03 percentage points more than the homeowner coefficient in the full sample and by 4.40 percentage points more among ever-participants.

Table 3: Formal Tests of the W/Y Patterns

$\beta_5 - \beta_1$	KLIPS		HFWPKOR	
	Full	EverSMP	Full	EverSMP
α : jeonse	+1.15 (0.75)	+6.58** (3.15)	+1.44* (0.83)	+4.82* (2.87)
α : homeowner	+0.26 (0.30)	+1.66 (1.09)	+1.11** (0.48)	+3.43** (1.52)
α : jeonse – homeowner	+0.90 (0.72)	+4.93 (3.01)	+0.33 (0.82)	+1.39 (2.98)
<i>RFAR</i> : jeonse	+0.75* (0.43)	+3.56** (1.78)	+0.42 (0.38)	+1.24 (1.39)
<i>RFAR</i> : homeowner	−0.28*** (0.11)	−0.84** (0.42)	+0.10 (0.25)	+0.28 (0.82)
<i>RFAR</i> : jeonse – homeowner	+1.03** (0.45)	+4.40** (1.82)	+0.31 (0.40)	+0.96 (1.48)
N (<i>RFAR</i> regression)	80,805	17,878	89,415	28,171

Notes: Difference between the coefficients on the top ($[8, \infty)$) and bottom ($[0, 2)$) W/Y bins, $\beta_5 - \beta_1$, from Equation (2), estimated separately for each dataset and sample with household and year fixed effects and the controls of Table 2. A positive value means that the coefficient is less negative (or more positive) at high W/Y . “Jeonse – homeowner” is the difference between the two tenures' $\beta_5 - \beta_1$ within the same regression. Outcomes are multiplied by 100, so estimates are in percentage points. Full: full estimation sample of Table 2; EverSMP: households holding risky financial assets in at least one wave. Standard errors in parentheses use the two-way (household $\times$ year) clustered covariance of the coefficients. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Heterogeneity by Age. I conduct an analogous analysis across age groups by interacting tenure dummies with age bin indicators:

$$PF_{it} = \sum_{Q=1}^4 \gamma_Q \cdot Jeonse_{it} \cdot \mathbb{1}[Age \in Bin_Q]_{it} + \sum_{Q=1}^4 \sigma_Q \cdot Owner_{it} \cdot \mathbb{1}[Age \in Bin_Q]_{it} + \gamma' X_{it} + \alpha_i + \delta_t + \epsilon_{it} \quad (3)$$

where I use four age bins: $[0, 35)$, $[35, 45)$, $[45, 60)$, and $[60, \infty)$. The cutpoints are chosen to balance the renter, jeonse-tenant, and homeowner samples within each bin while respecting two life-cycle facts in Korea: homeowners are rare at very young ages (so a coarse $[0, 35)$ bottom bin keeps the young-owner cell adequately populated), and a large share of workers

retire from firm employment around 60 (so a $[60, \infty)$ top bin captures the post-retirement phase).

Appendix Figures 14 and 15 plot the estimated coefficients across age bins; the layout mirrors the W/Y figures. As in the W/Y cross-section, the FAR crowding-out is large and significant in every age bin for both tenures: in KLIPS the jeonse coefficient lies between -19 and -22 percentage points and the homeowner coefficient near -31 percentage points; in HFWP-KOR the jeonse coefficient lies between -19 and -23 percentage points and the homeowner coefficient between -33 and -46 percentage points. For α , the KLIPS jeonse coefficients decline mildly with age (from -0.07 to -0.54 percentage points), although none is significant, and HFWPKOR shows no age pattern. The $RFAR$ coefficients show significant crowding-out without an age gradient for both tenures: in KLIPS they lie between -0.69 and -0.87 percentage points for jeonse tenants and between -1.2 and -1.3 percentage points for homeowners, and in HFWPKOR between -1.3 and -1.5 percentage points for homeowners. The HFWP-KOR jeonse $RFAR$ coefficients are smaller and imprecise (-0.15 to -0.69 percentage points) but follow no clear trend. Overall, the crowding-out effect is present in every age bin, but it shows no gradient or pattern as clear as in the W/Y cross-section. The SMP coefficients do not deliver a consistent message across the two datasets. Most of these results hold in the EverSMP samples, where the risky-asset coefficients are larger and the $RFAR$ coefficients more sharply estimated. Age therefore does not appear to shape the crowding-out effect, which suggests that the liquidity constraint channel is not tied to the life-cycle income profile. The liquidity channel operates through the wealth buffer, not through age itself, which is why the W/Y cross-section, not the age cross-section, carries the relevant variation.

3.3 Discussion

The patterns documented in Sections 3.2.1 and 3.2.2 have a natural interpretation in terms of the two channels from Section 2. I read them outcome by outcome. The large negative and roughly flat FAR coefficients for both tenures are consistent with a substitution effect—housing-related commitments move wealth out of financial assets and into housing-linked wealth proportionately, regardless of how wealthy the household is. The persistent homeowner $RFAR$ coefficient, sitting around -1.1 to -1.6 percentage points uniformly across W/Y bins in both datasets, is consistent with the house price exposure channel, which does not relax with wealth. The jeonse $RFAR$ coefficient, by contrast, declines more than fivefold from low to high W/Y in KLIPS (and is statistically indistinguishable from zero in the top bin), consistent with the liquidity constraint channel: as the deposit becomes a smaller fraction of net wealth, the household’s residual buffer grows and the crowding-out effect fades.

The W/Y cross-section of α adds a complementary piece of evidence. The jeonse coefficient on α is negative among low- W/Y households (significant at the 10% level in KLIPS) and positive in the upper bins, although the positive branch is estimated imprecisely (Section 3.2.2). One interpretation is that when the deposit binds the household’s liquidity, the household is pushed toward safer assets on what remains of its financial portfolio (jeonse $\alpha < 0$ at low W/Y); once the deposit stops binding, the near-riskless deposit in effect substitutes for some of the household’s safe financial wealth, allowing the household to tilt the liquid portfolio

toward risky assets (jeonse $\alpha > 0$ at high W/Y). The homeowner α coefficient also weakens with wealth—it stays negative in KLIPS and turns slightly positive in HFWPKOR—so the sign-flip is not a jeonse-exclusive feature. The jeonse response is nevertheless larger: in KLIPS the jeonse coefficient rises by 1.15 percentage points from the bottom to the top W/Y bin, against 0.26 percentage points for homeowners, consistent with the deposit acting as a substitute for safe financial assets once it no longer binds. The *SMP* results are consistent with the same interpretation on the extensive margin: the *SMP* coefficients are lowest at low W/Y and rise with W/Y for both tenures, indicating that tight liquidity buffers push households toward non-participation regardless of tenure, while at high W/Y the participation decision is no longer dominated by liquidity concerns. The age cross-section shows no comparable gradient (Section 3.2.2).

Taken together, these results show that the housing crowding-out effect, simple as it appears in the pooled regressions, has a rich internal structure across the W/Y distribution: the *FAR* coefficients are roughly constant, the jeonse α coefficient changes sign, the *RFAR* coefficient fades for jeonse tenants but persists for homeowners, and the *SMP* coefficients attenuate for both tenures. These W/Y gradients are new facts in their own right, and they challenge the standard life-cycle portfolio model, which cannot replicate the fading jeonse effect or the participation pattern (Section 7). They also imply that the effect of a housing market shock on household equity holdings is not a single elasticity: it depends on whether the shock tightens households' liquidity or changes their housing position, and on where the affected households are located in the W/Y distribution. The next section extends the standard model to account for these facts and uses the model that matches them to study the mechanisms behind the crowding-out effect.

4 Model

To interpret the empirical findings, I build a quantitative life-cycle model in the tradition of Cocco (2005), Yao and Zhang (2005), and Vestman (2019) in which households endogenously choose among renting, jeonse, and homeownership in addition to consumption, savings, and the risky-asset portfolio share. The goal is to provide an economic explanation for the features of the crowding-out effect documented in Section 3. Relative to Cocco (2005) and Yao and Zhang (2005), the model introduces four additional ingredients.

First, jeonse enters as a third endogenous tenure option alongside renting and ownership. A jeonse tenant posts a large deposit, which commits liquidity to housing without exposure to house prices. Jeonse therefore lets the model compare a housing commitment with and without exposure to house price changes, the same contrast the empirical analysis draws.

Second, a consumption-based money-in-advance (c-MIA) constraint requires the household to hold safe financial assets in proportion to its consumption and housing-related cash outflows. The liquidity constraint is therefore determined endogenously by the household's own consumption and tenure choices rather than imposed as a fixed limit. It is motivated by the household need for liquidity documented by Telyukova (2013): households keep low-return liquid assets, even while carrying credit-card debt, to pay for expenditures that cannot be made on credit, including mortgage and rent payments. The c-MIA constraint is, to my

knowledge, new to the life-cycle portfolio-choice literature: Cocco (2005), Yao and Zhang (2005), and Vestman (2019) impose only collateral (down-payment) borrowing limits and, in Cocco's and Vestman's cases, a one-time stock-market entry cost.

Third, the model carries a per-period stock-market participation cost sc (Fagereng, Gottlieb and Guiso 2017; Brandsaas 2021), paid in each period in which the household holds stocks. Fourth, following Vestman (2019), I adopt Epstein–Zin (EZ) preferences, which separate the coefficient of relative risk aversion γ from the elasticity of intertemporal substitution ψ .

Together, these ingredients aim to capture the portfolio choice that Korean households face while reflecting the liquidity constraints they encounter in practice. They also allow me to determine which elements of the model account for the patterns documented in the data.

4.1 Model Set-up

Demographics and risks. Households enter at age 30 and make decisions every two years through age 98, so they solve a 35-period problem in which one period corresponds to two years—the conventional rent and jeonse contract length. Each period they survive to the next with probability $1 - \pi_a$, where π_a is the age-specific mortality hazard; a household alive at age 100 dies and leaves its wealth as a bequest.

Stock, housing, and labor income processes. The three exogenous stochastic processes are written as deterministic drifts plus i.i.d. mean-zero Gaussian innovations. Let R_{a+1} denote the gross stock return and R_f the gross risk-free rate, P_{a+1}^H the unit housing price, and Y_{a+1} the non-capital income level. All three processes are specified in lognormal form, following Vestman (2019) and Yao and Zhang (2005):

$$\ln R_{a+1} - \ln R_f = \mu_s + \epsilon_{a+1}^S, \quad (4)$$

$$\ln P_{a+1}^H - \ln P_a^H = \mu_h + \epsilon_{a+1}^H, \quad (5)$$

$$\ln Y_{a+1} - \ln Y_a = g_{a+1} + \epsilon_{a+1}^Y, \quad a = 0, 1, \dots, 34, \quad (6)$$

where g_{a+1} is the age-specific deterministic growth of labor income and μ_s is the household's expected log excess-return premium. The three innovations are drawn jointly from a multivariate normal,

$$\begin{pmatrix} \epsilon_{a+1}^S \\ \epsilon_{a+1}^H \\ \epsilon_{a+1}^Y \end{pmatrix} \sim \mathcal{N}(\mathbf{0}, \Sigma), \quad \Sigma \equiv \begin{pmatrix} \sigma_s^2 & \rho_{sh} \sigma_s \sigma_h & \rho_{sl} \sigma_s \sigma_L \\ \rho_{sh} \sigma_s \sigma_h & \sigma_h^2 & \rho_{hl} \sigma_h \sigma_L \\ \rho_{sl} \sigma_s \sigma_L & \rho_{hl} \sigma_h \sigma_L & \sigma_L^2 \end{pmatrix}. \quad (7)$$

The correlations ρ_{sh} , ρ_{sl} , and ρ_{hl} allow comovement among the three processes. Following Yao and Zhang (2005), the labor income shock is permanent: a realized ϵ^Y is absorbed into $\log Y$ one-for-one and persists. Retirement enters through the age profile $\{g_a\}$, while the permanent shock continues throughout. Section 5 describes the calibration of these processes.

Preferences. Households derive flow utility from a Cobb–Douglas bundle $u_a = C_a^{1-\omega} H_a^\omega$ of non-durable consumption C_a and housing services H_a , with ω the expenditure share on

housing. I order continuation utility streams with the [Epstein and Zin \(1989\)](#) aggregator, which separates the coefficient of relative risk aversion γ from the elasticity of intertemporal substitution ψ . Define $\rho \equiv 1 - 1/\psi$ and the certainty equivalent

$$\text{CE}_a(X) \equiv (\mathbb{E}_a[X^{1-\gamma}])^{1/(1-\gamma)}. \quad (8)$$

The household's value function satisfies the EZ recursion

$$V_a = \left[u_a^\rho + \beta(1 - \pi_a) \text{CE}_a(V_{a+1})^\rho + \beta\pi_a \text{CE}_a(B_{a+1})^\rho \right]^{1/\rho}, \quad (9)$$

where V_{a+1} is the next-period continuation value, B_{a+1} is the bequest continuation defined below, π_a is the mortality hazard at age a , and β is the time-discount factor. The CRRA specification used by [Cocco \(2005\)](#) and [Yao and Zhang \(2005\)](#) is the knife-edge case $\gamma\psi = 1$.

Bequest motive. When the household dies, descendants inherit the remaining wealth X_{a+1} . Following [Yao and Zhang \(2005\)](#), the descendants convert the bequest into a T_b -period annuity at the risk-free rate and spend each payment on non-durable consumption and rented housing at the inheritance-date price P_{a+1}^H . I value this stream with the household's own Epstein–Zin aggregator, as in [Vestman \(2019\)](#), which gives a bequest continuation that is linear in real wealth:

$$B_{a+1} = \kappa_b \cdot \frac{X_{a+1}}{(P_{a+1}^H)^\omega}, \quad (10)$$

where $(P_{a+1}^H)^\omega$ is the Cobb–Douglas price deflator at the inheritance date and κ_b is a constant determined in closed form by T_b , β , ψ , ω , τ , and R_f ([Appendix D.1](#)).

4.2 First-Stage Problem: Tenure Choice

At the beginning of each age period, households solve the first-stage problem regarding the housing tenure choice. Depending on whether a household owns a house from the previous period, it solves either the owner's problem or the non-owner's problem. Each period, an owner receives an exogenous moving shock with probability ξ ; an owner hit by the shock must sell the house and solves the non-owner's problem.

Owner. For the owner, state variables are cash on hand X_a , which is the sum of net wealth and contemporaneous labor income; the labor income Y_a ; the quantity of housing purchased in the previous period H_{a-1} ; and the unit price of housing good P_a^H . Households know the distributions of stock returns, housing returns, and labor income shocks, as well as the deterministic life-cycle profile of labor income growth. Owners who chose to buy a house in the previous period and did not get the exogenous moving shock solve the following problem:

$$\widehat{V}_a(X_a, H_{a-1}, Y_a, P_a^H) = \max(\bar{V}_a(X_a, Y_a, P_a^H), V_a^s(X_a, H_{a-1}, Y_a, P_a^H)) \quad (11)$$

where $\widehat{V}_a$ denotes the optimal value of an owner at age a , $\bar{V}_a$ the optimal value of a non-owner, and V_a^s the optimal value of staying in the previously purchased house. The owner can therefore either sell the house and move to the non-owner's problem or stay and solve the stayer's problem; choosing the larger of the two values determines the tenure choice.

Non-owner. Non-owners who chose to rent or to enter a jeonse contract in the previous period, owners hit by a moving shock, and owners who choose to sell solve the following problem.

$$\bar{V}_a(X_a, Y_a, P_a^H) = \max(V_a^r(X_a, Y_a, P_a^H), V_a^j(X_a, Y_a, P_a^H), V_a^b(X_a, Y_a, P_a^H)) \quad (12)$$

where V_a^r , V_a^j , and V_a^b denote the optimal values of renting, entering a jeonse contract, and purchasing a house. Choosing the largest of the three values determines the tenure choice.

4.3 Second-Stage Problem: Portfolio and Consumption Choice

After households solve the first-stage problem, depending on their housing tenure choice (rent, jeonse, purchase, stay), they solve the second-stage problem in which they choose the optimal level of consumption, housing value (except for stayers, whose house is given), saving, and risky asset share.

The consumption-based money-in-advance (c-MIA) constraint. All four tenure-specific problems include the c-MIA constraint. Motivated by the household need for liquidity documented by [Telyukova \(2013\)](#), the household must hold at least ζ_c times its per-period cash outflow as safe (risk-free) financial assets, where the per-period cash outflow includes both consumption C_a and the housing cash the household spends in the period:

$$(1 - \alpha_a) A_a \geq \zeta_c \cdot [C_a + \vartheta_{\text{cMIA}}^t \cdot P_a^H \cdot H_a], \quad (13)$$

where A_a is financial savings, α_a the share of financial savings invested in risky assets, $\zeta_c \geq 0$ the c-MIA parameter, C_a non-durable consumption, H_a the quantity of housing, P_a^H the unit price of housing, and $\vartheta_{\text{cMIA}}^t$ the per-unit-housing cash-flow rate of tenure $t \in \{r, j, b, s\}$ (renter, jeonse tenant, buyer, stayer). The rate $\vartheta_{\text{cMIA}}^t$ captures real cash that leaves the household this period and that cannot be funded by current-period risky-asset returns:

$$\begin{aligned} \vartheta_{\text{cMIA}}^r &= \tau && \text{(renter: rent)} \\ \vartheta_{\text{cMIA}}^j &= \bar{J} \cdot [\phi_J + (1 - \delta_J)(R_M - 1)] && \text{(jeonse: fee + mortgage interest on borrowed deposit)} \\ \vartheta_{\text{cMIA}}^b &= \chi + \phi_b + (1 - \delta)(R_M - 1) && \text{(buyer: maintenance + entry fee + mortgage interest)} \\ \vartheta_{\text{cMIA}}^s &= \chi + (1 - \delta)(R_M - 1) && \text{(stayer: maintenance + mortgage interest)} \end{aligned}$$

Here τ is the rent-to-price ratio, $\bar{J}$ the jeonse deposit-to-price ratio, ϕ_J the jeonse transaction cost, δ_J and δ the down-payment shares of the jeonse deposit and of the house price, R_M the gross mortgage rate, χ the maintenance-and-property-tax rate, and ϕ_b the owner pur-

chase cost, all per unit of house value except R_M . Refundable principal—the renter’s security deposit, the jeonse deposit, and the owner’s down payment—is excluded because the household recovers it at the end of the contract rather than spending it, and it is already paid out of cash on hand in the budget constraint. Non-refundable payments of the period, including the buyer’s one-time purchase cost ϕ_b , are included. Mortgage interest is charged only on the borrowed portion ($1 - \delta_J$ for jeonse, $1 - \delta$ for owner). The renter’s c-MIA rate is τ , since rent is paid entirely in cash. When $\zeta_c = 0$ the constraint is slack and the model nests the standard life-cycle setup.

Per-period stock-market participation cost. The model also includes a per-period stock-market participation cost sc , paid out of X_a when $\alpha_a > 0$, following [Fagereng, Gottlieb and Guiso \(2017\)](#) and [Brandsaas \(2021\)](#). This cost captures the time and informational frictions associated with active stockholding: [Ball \(2008\)](#) motivates a per-period cost as the time cost of managing a portfolio.

Renter. Given the c-MIA constraint and the participation cost, households that decide to rent solve

$$\begin{aligned}
 V_a^r(X_a, Y_a, P_a^H) = \max_{C_a, H_a, A_a, \alpha_a} & \left[(C_a^{1-\omega} H_a^\omega)^\rho + \beta(1 - \pi_a) \text{CE}_a(\bar{V}_{a+1})^\rho + \beta \pi_a \text{CE}_a(B_{a+1})^\rho \right]^{1/\rho} \\
 \text{s.t. } & X_a \geq A_a + C_a + (\tau + \tau_{\text{dep}}) P_a^H H_a + \mathbb{1}[\alpha_a > 0] sc Y_a \\
 & X_{a+1} = A_a R_f + \alpha_a A_a (R_{a+1} - R_f) + Y_{a+1} + \tau_{\text{dep}} P_a^H H_a \\
 & \alpha_a \in [0, 1], A_a \geq 0, C_a \geq 0, H_a \geq 0, \\
 & (1 - \alpha_a) A_a \geq \zeta_c \cdot (C_a + \tau \cdot P_a^H H_a). \quad [\text{c-MIA, Eq. (13)}]
 \end{aligned}$$

The last constraint is the renter-specific instance of Equation (13): with $\vartheta_{\text{cMIA}}^r = \tau$, the renter must hold safe financial assets covering at least ζ_c times the sum of consumption and rent expenditure this period. τ_{dep} is the renter’s security-deposit ratio: under a standard rent contract, the renter pays non-refundable rent $\tau P_a^H H_a$ and a refundable security deposit $\tau_{\text{dep}} P_a^H H_a$, typically very small, as cash outflows this period, and receives the deposit back at the start of the next period. A renter remains a non-owner at the start of the next period, so its continuation value is the non-owner’s value $\bar{V}_{a+1}$.

Jeonse tenant. The jeonse tenant chooses C_a , H_a , A_a , and α_a to maximize the same objective as the renter, which defines $V_a^j(X_a, Y_a, P_a^H)$, but faces different constraints:

$$\begin{aligned}
 \text{s.t. } & X_a \geq A_a + C_a + (\delta_J + \phi_J) \bar{J} P_a^H H_a + \mathbb{1}[\alpha_a > 0] sc Y_a \\
 & X_{a+1} = A_a R_f + \alpha_a A_a (R_{a+1} - R_f) + Y_{a+1} + P_a^H H_a \bar{J} (1 - (1 - \delta_J) R_M) \\
 & \alpha_a \in [0, 1], A_a \geq 0, C_a \geq 0, H_a \geq 0, \\
 & (1 - \alpha_a) A_a \geq \zeta_c \cdot \left(C_a + \bar{J} [\phi_J + (1 - \delta_J) (R_M - 1)] P_a^H H_a \right).
 \end{aligned}$$

where $\bar{J}P_a^H H_a$ is the jeonse deposit. The household pays the down payment $\delta_J \bar{J}P_a^H H_a$ and the contract cost $\phi_J \bar{J}P_a^H H_a$ out of cash on hand and finances the remaining $(1 - \delta_J) \bar{J}P_a^H H_a$ with a jeonse loan at the gross mortgage rate R_M . At the end of the period the landlord returns the deposit at its nominal value, so the deposit is not exposed to house prices, and the household repays the loan with interest.

The key difference from renting is the timing of housing costs. To obtain housing services, the jeonse tenant must post a deposit of $\bar{J}$ per unit of house value upfront, a large share of it out of its own cash on hand. In return, its per-period cost—the interest on the jeonse loan and the forgone return on its own funds in the deposit—is typically smaller than the rent a renter pays for the same house.

Buyer and stayer. A household that buys a house solves

$$\begin{aligned}
V_a^b(X_a, Y_a, P_a^H) &= \max_{C_a, H_a, A_a, \alpha_a} \left[(C_a^{1-\omega} H_a^\omega)^\rho + \beta(1 - \pi_a) \mathcal{M}_a^{\rho/(1-\gamma)} + \beta \pi_a \text{CE}_a(B_{a+1})^\rho \right]^{1/\rho} \\
\text{s.t. } X_a &\geq A_a + C_a + (\chi + \delta + \phi_b) P_a^H H_a + \mathbb{1}[\alpha_a > 0] \text{sc } Y_a \\
X_{a+1} &= A_a R_f + \alpha_a A_a (R_{a+1} - R_f) + Y_{a+1} + P_a^H H_a (R_{a+1}^H (1 - \phi) - (1 - \delta) R_M) \\
\alpha_a &\in [0, 1], A_a \geq 0, C_a \geq 0, H_a \geq 0, \\
(1 - \alpha_a) A_a &\geq \zeta_c \cdot (C_a + [\chi + \phi_b + (1 - \delta)(R_M - 1)] P_a^H H_a),
\end{aligned}$$

where $\mathcal{M}_a \equiv \zeta \mathbb{E}_a[\bar{V}_{a+1}^{1-\gamma}] + (1 - \zeta) \mathbb{E}_a[\hat{V}_{a+1}^{1-\gamma}]$ is the continuation of an owner who, with probability ζ , receives a moving shock and solves the non-owner's problem next period and otherwise solves the owner's problem, and $R_{a+1}^H = P_{a+1}^H / P_a^H$ is the gross housing return. The buyer pays the down payment $\delta P_a^H H_a$, the purchase cost $\phi_b P_a^H H_a$, and maintenance $\chi P_a^H H_a$ out of cash on hand and finances the remaining $(1 - \delta) P_a^H H_a$ with a mortgage at R_M . Next period the house is valued at the realized price net of the selling cost ϕ , and the mortgage is repaid with interest. For tractability, the selling cost is charged regardless of the moving-shock realization; a household that stays is compensated for it.

The key difference from jeonse is the exposure to house price changes: the jeonse deposit returns at its nominal value, whereas the owner's next-period housing wealth moves with the realized housing return R_{a+1}^H .

The stayer solves the same problem, except that its housing quantity is the inherited H_{a-1} , a state variable rather than a choice, and that it does not pay the purchase cost ϕ_b again and is compensated for the selling cost ϕ . These avoided adjustment costs are the inaction benefit that generates the (S,s) region of Figure 3. Appendix D states the stayer's problem in full.

4.4 Solution Method

Because the model has a finite horizon, I solve it by backward induction. At the terminal age of 100 the household dies with certainty, and its value equals the bequest continuation, $V_{100} = \kappa_b X_{100} / (P_{100}^H)^\omega$. Given the resulting value functions, I solve the problem of the preceding

period and continue backward to the first period. I use a grid method and standard linear interpolation for next-period value functions. The household chooses its period- a policies before the stock return, the house price, and labor income of period $a + 1$ are realized. Next-period cash on hand X_{a+1} , and hence the continuation value V_{a+1} , are therefore random from the household's perspective at age a and enter the problem through the certainty equivalent CE_a . I compute these expectations by discretizing the three shocks with Gaussian quadrature. To reduce the number of state variables, I follow [Yao and Zhang \(2005\)](#) and normalize the value function by $X_a / (P_a^H)^\omega$ and the choice variables by X_a , so that the policy variables are $c_a = C_a / X_a$, $a_a = A_a / X_a$, $h_a = P_a^H H_a / X_a$, and the risky share α_a . After this normalization, a non-owner's problem depends only on age and the cash-on-hand-to-income ratio X_a / Y_a , and an owner's problem in addition on the value of the existing house relative to cash on hand, $h_s \equiv P_a^H H_{a-1} / X_a$; the policies in Section 6 are shown over these normalized states. The model is a partial-equilibrium model: prices and returns are exogenous, and solving it yields households' optimal policies given their expectations about the stochastic processes and a set of parameter values. Appendix D.3 details the grid specification and the Gaussian quadrature, and Appendix E.6 the conversion of annual data moments to the model's biennial frequency.

5 Calibration

I calibrate the model to the economic environment of Korean households over the 2000s and 2010s, the period of the KLIPS regressions in Section 3. This section explains the main calibration choices for the household's investment preferences, the housing contracts, the income, stock, and housing return processes, and the c-MIA constraint and the participation cost. Table 4 reports these parameters at annual frequency; because the model period is two years, the solver uses their biennial equivalents (Appendix E.6). The remaining parameters—the bequest motive, the moving shock, the deterministic income profile, and mortality—follow standard practice and are documented in Appendix E.1.

Investment preferences. The annual discount factor $\beta = 0.96$ is standard in the life-cycle portfolio-choice literature. Relative risk aversion is $\gamma = 5$, the standard value in [Cocco \(2005\)](#) and [Yao and Zhang \(2005\)](#), and the elasticity of intertemporal substitution is $\psi = 0.5$, between the stockholder and bondholder estimates of [Vissing-Jørgensen \(2002\)](#) (0.3–0.4 and 0.8–1).

Housing. The housing expenditure share ω is estimated from HFWPKOR. The jeonse deposit-to-price ratio $\bar{J} = 0.64$ is the national average from the Korea Real Estate Board, and the rent-to-price ratio τ is $\bar{J}$ times the Korea Real Estate Board's conversion rate between jeonse and monthly rent; the renter's security deposit is one year of rent. The down-payment ratios δ_J and δ are one minus the loan-to-value ratio of jeonse-loan users and mortgage holders in HFWPKOR, and the transaction costs and the maintenance-and-property-tax rate come from the Korean tax code and brokerage fee schedule.

Income, stock, and housing returns. The risk-free rate r_f and the mortgage rate r_M are the Bank of Korea household time-deposit and new-mortgage rates averaged over 2004–2021.

Stock returns are calibrated to KOSPI. Over the regression period 2001–2021, the annual log excess return of KOSPI is 3.8%; allowing for taxes and the low average returns that retail investors realize (Kim and Kim 2021; Kang and Kim 2026), I set the expected premium to $\mu_s = 3\%$ per year. The annual log-return volatility over 2004–2021 is $\sigma_s = 13.7\%$. Housing returns are calibrated to the national house price index of the Korea Real Estate Board over 2004–2021, which gives an annual log-return mean of $\mu_h = 2.8\%$ and a standard deviation of $\sigma_h = 3.2\%$, and the stock–housing correlation is $\rho_{sh} = 0.33$. The standard deviation of the permanent labor income shock, σ_L , is estimated from a panel income residual in KLIPS, and the labor–return correlations are set to zero because neither is statistically distinguishable from zero. Appendix E details the construction of all return and income moments.

The c-MIA constraint and the participation cost. The c-MIA parameter is $\zeta_c = 0.6$ per model period, which requires a safe-asset buffer of about 1.2 years of consumption and housing-related cash outflow. This is in line with the liquid buffers that Korean households hold: in HFWPKOR (2013–2021), the median household holds safe financial assets equal to 1.35 years of annual consumption expenditure. Section 8 reports how the results vary with ζ_c . The participation cost is $sc = 0.01$ of biennial labor income per period of participation, about one percent of annual income per year (roughly KRW 0.5 million for a household earning KRW 50 million). This is comparable to the per-period participation costs estimated in the literature, for example US\$124 per year in 1995 dollars in Brandsaas (2021).

6 Model Solution: Optimal Policies

In this section, I examine what the standard model predicts about the housing crowding-out effect of jeonse and of homeownership, and how the additional constraints—the c-MIA constraint and the stock-market participation cost—interact with jeonse to generate the crowding-out patterns documented in Section 3.

6.1 First Stage: Tenure Choice

I begin with the first-stage solution, the housing tenure choice. Figure 3a shows which tenure a non-owner chooses in the standard model, by age and the cash-on-hand-to-income ratio X/Y , and Figure 3b shows whether an owner at age 50 stays in the current house or sells it, by X/Y and the value of the existing house relative to cash on hand, $h_s \equiv P_a^H H_{a-1} / X_a$.

Figure 3a shows a housing ladder. At low values of X/Y , the non-owner rents; at intermediate values, it chooses jeonse; at high values, it buys. Because the flow cost of housing services under jeonse is lower than under renting,⁷ jeonse is preferred whenever a household has enough liquid wealth to finance the deposit. At very low X/Y , however, jeonse ties up a large share of liquid wealth in the deposit and hurts consumption smoothing, so renting is preferred. At very high X/Y , homeownership dominates jeonse because owners earn the

⁷Under rent, the household pays $\tau P_a^H H \approx 0.090 P_a^H H$ per two-year period. Under jeonse, the present cost at the start of the contract consists of the interest on the jeonse loan, the forgone return on its own funds in the deposit, and the contract cost, $[(1 - \delta_J)(R_M - 1) + \delta_J(R_f - 1)] P_a^H H / R_f + \phi_J P_a^H H \approx 0.047 P_a^H H$ at the calibrated values.

Table 4: Calibrated Parameters

Parameter	Symbol	Value	Source
<i>Investment preferences</i>			
Discount factor	β	0.96	Literature standard
Relative risk aversion	γ	5	Cocco (2005), Yao and Zhang (2005)
Elasticity of intertemporal substitution	ψ	0.5	Vissing-Jørgensen (2002)
<i>Housing</i>			
Housing expenditure share	ω	0.150	HFWPKOR
Jeonse deposit-to-price ratio	$\bar{J}$	0.640	REB
Rent-to-price ratio	τ	0.045	REB conversion rate $\times \bar{J}$
Renter security-deposit ratio	τ_{dep}	0.045	One year of rent
Jeonse down-payment ratio	δ_J	0.534	HFWPKOR
Owner down-payment ratio	δ	0.654	HFWPKOR
Owner purchase cost	ϕ_b	0.0165	Korean tax code
Jeonse transaction cost	ϕ_J	0.003	Brokerage fee schedule
Owner selling cost	ϕ	0.004	Brokerage fee schedule
Maintenance and property tax	χ	0.003	Korean tax code
<i>Income, stock, and housing returns</i>			
Risk-free rate	r_f	0.030	BOK time deposits (2004–2021)
Mortgage rate	r_M	0.044	BOK new mortgages (2004–2021)
Expected log excess stock premium	μ_s	0.030	KOSPI (2001–2021), adj. for taxes, retail returns
Stock log-return std.	σ_s	0.137	KOSPI (2004–2021)
Housing log-return mean	μ_h	0.028	REB national index (2004–2021)
Housing log-return std.	σ_h	0.032	REB national index (2004–2021)
Stock–housing return correlation	ρ_{sh}	0.333	KOSPI and REB index (2004–2021)
Permanent labor-income shock std.	σ_L	0.197	KLIPS
Labor–return correlations	ρ_{sl}, ρ_{hl}	0	Not significant
<i>Constraints</i>			
c-MIA constraint (per model period)	ζ_c	0.6	HFWPKOR liquid buffer (1.35 years)
Participation cost (share of biennial income)	sc	0.01	Brandsaas (2021)

Notes: All values are annual; the solver converts them to the two-year model period (Appendix E.6). ζ_c and sc are defined per model period. Table 8 lists the remaining parameters and data windows. Sources: KLIPS; HFWPKOR; Korea Real Estate Board; Bank of Korea; Investing.com (KOSPI).

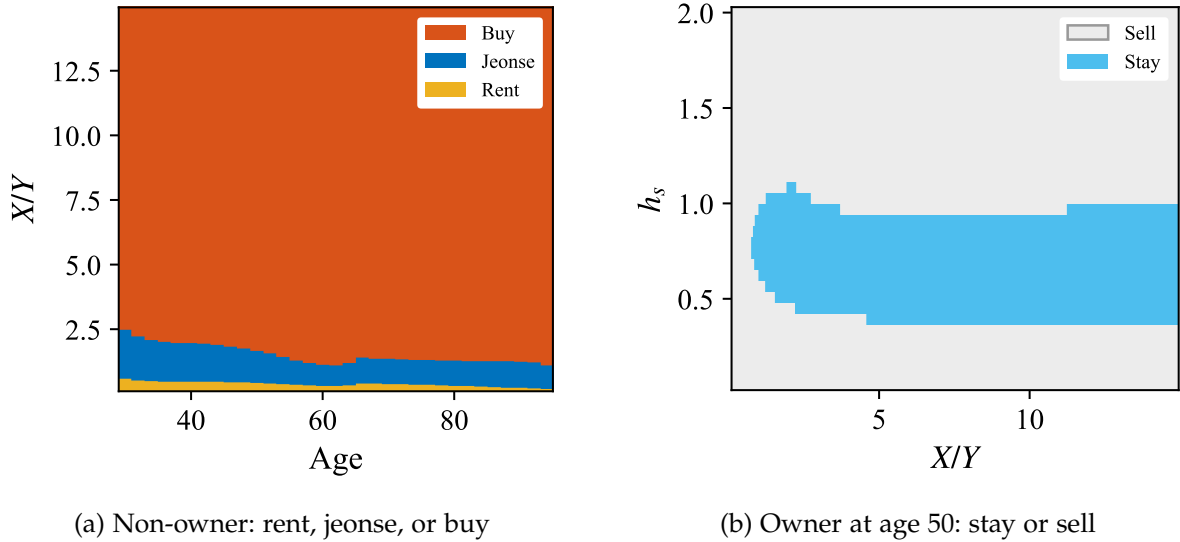


Figure 3: First-Stage Tenure Choice in the Standard Model

Notes: Standard model ($\zeta_c = 0$, $sc = 0$); X/Y is cash on hand relative to two-year income. Panel (a): tenure choice of a non-owner by age and X/Y . Panel (b): stay-or-sell choice of an owner at age 50 by X/Y and h_s , the existing house's value relative to cash on hand; other working ages look similar.

housing return on their equity and avoid the transaction cost that jeonse tenants pay at every two-year contract. As households accumulate wealth over the life cycle, they therefore move from renting to jeonse and then to ownership, a pattern similar to the Korean tenure distribution by age and W/Y in Figure 1.

Figure 3b shows the owner's decision. As in Grossman and Laroque (1990) and Yao and Zhang (2005), the optimal policy follows an (S,s)-style rule: for a given X/Y , there is a band of existing housing sizes over which the owner keeps the house, and the owner sells only if the existing house is sufficiently far from the optimal size. The transaction costs $\phi + \phi_b$ generate this inaction region.

The first-stage solution thus reproduces the main features of observed tenure behavior. The value functions and optimal portfolio policies in the rest of this section are solutions in which the household takes its current and future tenure choices over the life cycle into account.

6.2 Portfolio Policies in the Standard Model

Conditional on tenure choice, households solve the second-stage problem for consumption, housing quantity (if non-owner), savings, and risky-asset share. Figure 4 plots the four portfolio measures used throughout the empirical analysis—the financial asset ratio FAR , the risky share α , their product $RFAR$, and stock-market participation SMP —for each tenure at age 42, across X/Y (the age cross-sections are similar and omitted).

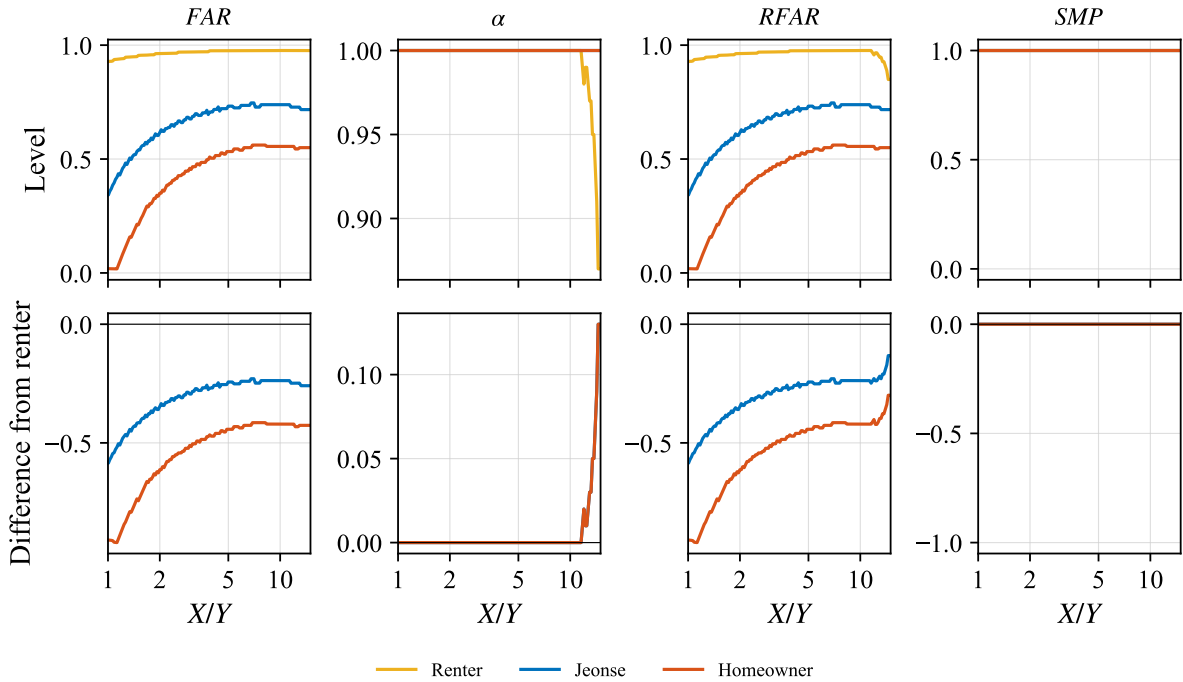


Figure 4: Standard Model: Portfolio Policies by X/Y at Age 42

Notes: Standard model, age 42. Top row: FAR , α , $RFAR$, and SMP of renters, jeonse tenants, and homeowners (new buyers) by X/Y (log scale); bottom row: differences from renters. In terms of the annual W/Y of the data, $X/Y = (W/Y)/2 + 1$, so the range shown covers W/Y from 0 to 28.

Three observations are worth emphasizing. First, the financial asset ratio FAR is largest for renters (who hold all their wealth in financial assets), intermediate for jeonse tenants (who

hold the jeonse deposit as housing-related wealth), and smallest for homeowners. This is the mechanical *substitution effect*: jeonse and homeownership both move wealth out of financial assets and into housing-related claims. The standard model produces it without any friction; the *FAR* coefficients in Figure 2 measure this effect in the data.

Second, over the entire wealth range of the KLIPS households ($W/Y \lesssim 10$ for the overwhelming majority), the optimal risky share is pinned at the $\alpha = 1$ corner *for every tenure*. This is the human-capital tilt of Cocco (2005): with labor–return correlations calibrated to their (statistically zero) Korean estimates, future labor income is an implicit bond. The household’s lifetime wealth therefore already holds more safe assets than risky ones, which leads it to invest all of its financial wealth in risky assets while working. The renter’s α becomes interior only above $X/Y \approx 12$ (0.87 at $X/Y = 15$, 0.46 at $X/Y = 25$ at age 42), where financial wealth finally becomes large relative to human capital. There—and only there—housing tenure raises the risky share of financial assets. The jeonse deposit is a riskless claim that, like human capital, already serves as a safe asset, so the jeonse tenant holds a higher risky share than the renter (0.72 against 0.46 at $X/Y = 25$). Owners also hold more (0.71), through the diversification effect of Yao and Zhang (2005): with a low correlation between house and stock returns, home equity lets the owner take a riskier financial portfolio. In the frictionless model, both effects operate only at wealth levels above the support of the data.

Third, the composite *RFAR* inherits its behavior almost entirely from *FAR*, because α does not vary over the range of the data. The *RFAR* gaps of both tenures therefore shrink with X/Y through the substitution channel: the jeonse gap from -58 percentage points at $X/Y = 1$ to -24 at $X/Y = 10$, and the homeowner gap from -91 to -42 . House price risk plays no role here, since the owner’s risky share is also at the $\alpha = 1$ corner. Participation does not differ either: every tenure holds stocks at all X/Y shown, so the standard model produces no *SMP* gap.

Compared with the crowding-out patterns in Figure 2, the standard model falls short on every margin except the sign of the *FAR* effect. For *FAR*, it produces the right ordering—homeowners hold fewer financial assets than jeonse tenants—but its gaps are much larger at low wealth and narrow mostly within the lowest W/Y bin of the data, whereas the empirical *FAR* coefficients are flat across W/Y . For α , it produces no tenure differences within the data’s wealth range, whereas the data show a jeonse coefficient that turns from negative to positive across W/Y and a negative homeowner coefficient. For *RFAR*, the gaps of both tenures shrink with wealth, so the model cannot generate the contrast between the fading jeonse coefficient and the persistent homeowner coefficient. For *SMP*, it produces no participation gap, whereas in the data participation crowding-out is largest at low W/Y . Section 6.3 shows how the two frictions address these gaps.

6.3 The c-MIA Constraint and the Participation Cost

Figure 5 shows how each friction changes the gap between each tenure and renters at age 42 in the four portfolio measures. The c-MIA constraint acts mainly on the composition of financial assets, and the participation cost on the participation decision.

The c-MIA constraint lowers the risky share of jeonse tenants and owners relative to renters.

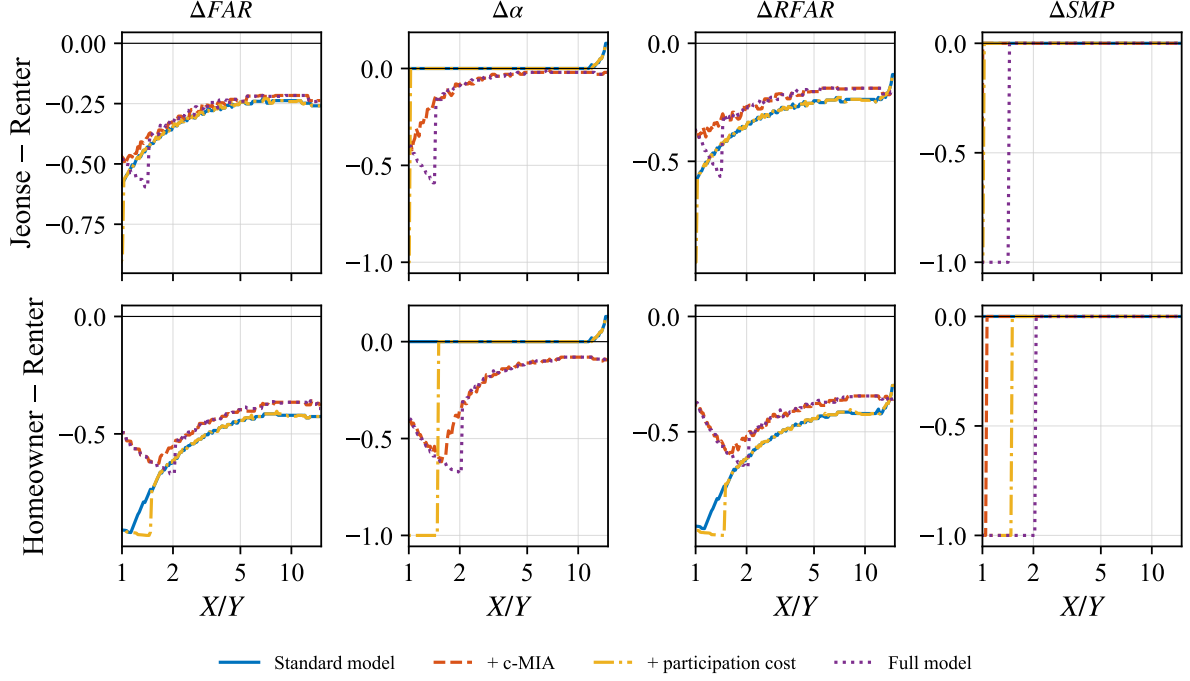


Figure 5: Tenure Differences in Portfolio Policies at Age 42: The Effect of Each Friction

Notes: Differences from renters at age 42 by X/Y (log scale; $X/Y \geq 1$ corresponds to $W/Y \geq 0$ in the data). Top row: jeonse tenant; bottom row: homeowner (new buyer). SMP : participation ($\alpha > 0$). Lines: standard model, c-MIA only ($\zeta_c = 0.6$), participation cost only ($sc = 0.01$), and both (full model).

Because the required safe buffer scales with consumption and the housing cash demand, the constraint binds hardest when cash on hand is low relative to the housing commitment. The jeonse tenant's risky share is 40 percentage points below the renter's at $X/Y = 1$, and the gap closes to 2 percentage points above $X/Y = 5$. The homeowner's gap remains about 10 percentage points even at high X/Y (11 at $X/Y = 5$, 8 at $X/Y = 10$). Because every household must keep a liquid buffer that rises with its housing cash demand, the constraint also narrows the financial asset ratio gaps at low cash on hand: at $X/Y = 1$, the jeonse gap shrinks from -58 to -47 percentage points and the homeowner gap from -91 to -50 . Together with a lower renter risky share at low cash on hand, this narrows the $RFAR$ gap between jeonse tenants and renters (-38 instead of -58 percentage points at $X/Y = 1$).

The participation cost operates on the extensive margin. On its own, it keeps households out of the stock market only at the lowest cash on hand (owners up to $X/Y = 1.5$). Combined with the c-MIA constraint, it creates a wider range in which renters hold stocks but jeonse tenants (up to $X/Y = 1.4$) and owners (up to $X/Y = 2.0$) do not: the housing commitment pushes these households below the participation threshold.

Together, the two frictions change how the crowding-out varies with wealth. In the full model, the jeonse tenant's $RFAR$ gap halves from -37 percentage points at $X/Y = 1$ to -19 at $X/Y = 10$, while the homeowner's is -37 at $X/Y = 1$ and -35 at $X/Y = 10$, deeper in between (-66 at $X/Y = 2$) where owners stay out of the stock market. Unlike in the standard model, the homeowner's crowding-out therefore does not shrink with cash on hand. These policies are closer to the empirical crowding-out in Figure 2 than the standard model on

every margin: the *FAR* gaps vary less with wealth; the jeonse tenant’s risky-share gap rises with wealth to near zero, while the homeowner’s stays negative; the jeonse *RFAR* gap fades while the homeowner’s does not; and participation gaps appear at low wealth. Section 7 compares the model with the data through the same regressions.

7 Model vs. Data: Simulated Cross-Sections

Section 6 compared the model’s optimal policies with the crowding-out patterns of Section 3. That comparison is only qualitative. The policies describe a household at a given age and cash on hand, whereas the regression coefficients average over households of all ages and wealth levels, include households that do not hold stocks, and are identified from within-household variation conditional on the controls. In this section, I therefore simulate the model at the KLIPS household-years and estimate on the simulated panel the same regressions as in Section 3.

7.1 Simulation Design

The simulated economy must match the low level of stock-market participation in Korea. If every household expected the premium of Section 5, simulating the full model at the KLIPS household-years would put 89% of households in the stock market (99% without frictions), against 5.5% in KLIPS. Following Vestman (2019), I therefore populate the simulated economy with two types of households in fixed shares: a small share p_S of sophisticated (Type S) households, who expect the premium of Section 5 ($\mu_s^{(S)} = 0.06$ per two-year period, 3% per year), and the remaining $1 - p_S$ of naive (Type N) households. The two types differ only in the excess return they expect to earn on their own stock investments. Because the model is partial equilibrium, the two types do not interact: each solves the problem of Section 4 with its own expected premium $\mu_s^{(t)}$, $t \in \{S, N\}$, so the heterogeneity is an assumption about the composition of the population. The Type S share $p_S = 0.05$ is chosen to bring the simulated aggregate participation rate close to the KLIPS rate of 5.5%; the calibrated mix participates at 4.4% when evaluated at the KLIPS household-years.

I implement the heterogeneity through the expected premium rather than through preference or cost heterogeneity because Korean retail investors’ documented underperformance disciplines the naive type’s expected return directly. Korean retail investors realize low returns on their stock investments: after trading costs, 42% of individual investors lost money over March–October 2020, and 60% of those who opened accounts after March 2020 did (Kim and Kim 2021); over 2020–2022, only 28% of investors in domestic stocks earned a positive net return, and the median investor’s annualized net return was -12% (Kang and Kim 2026). This experience is a natural source of the low expected return of Type N households: a household that expects to fare like the typical retail investor has little reason to hold stocks, in line with evidence that experienced returns shape expected returns and participation (Malmendier and Nagel 2011). The low expectation may reflect information frictions, behavioral biases, frequent trading and high turnover costs, or genuine subjective beliefs. I set $\mu_s^{(N)} = -0.05$, an annual expected log premium of -2.5% , a conservative value relative to these realized returns. The

exact value is immaterial: Type N holds no stocks at any KLIPS state for any $\mu_s^{(N)} \leq -0.03$.

Given these two types, I simulate the model at the KLIPS household-years to compare it with the regression evidence. The simulation proceeds in three steps. First, each KLIPS household is assigned a type once—Type S with probability p_S and Type N otherwise—and keeps it in every wave in which it is observed. Second, for each household-year I take the state observed in KLIPS—the household’s age, its tenure, its cash on hand relative to income, $X/Y = (W/Y)/2 + 1$ in the model’s two-year units, and, for owners, the value of the house relative to cash on hand, h_s —and evaluate at that state the optimal policy of the household’s type for its observed tenure. Owners keep their observed house and follow the stayer policy. This gives each household-year a model savings rate and risky share, and hence model values of FAR , α , $RFAR$, and SMP . Third, I estimate on this simulated panel *exactly* the two-way fixed-effects specification of Section 3.2, for four configurations: the standard model, the c-MIA constraint only ($\zeta_c = 0.6$, $sc = 0$), the participation cost only ($\zeta_c = 0$, $sc = 0.01$), and the full model.

7.2 Simulated Coefficients

Figures 6 and 7 compare the W/Y -bin crowding-out coefficients estimated on KLIPS in Section 3.2 with the same coefficients estimated on the simulated panels, for each of the four configurations: the standard model, the c-MIA constraint only, the participation cost only, and the full model. Figure 6 reports the coefficients for jeonse tenants and Figure 7 those for homeowners.

For jeonse tenants, the standard model matches the sign of the FAR effect but not its shape: its coefficient fades from -53.6 to -22.7 percentage points across the W/Y bins, whereas the KLIPS coefficient stays near -20 in every bin. It produces essentially no α or SMP effect (between -0.05 and $+0.08$), and its $RFAR$ coefficient changes little with wealth (-1.88 to -1.28), against a KLIPS profile that fades from -0.91 to -0.16 . The c-MIA constraint generates the sign flip in the α coefficient, from -0.68 in the lowest bin to $+0.82$ in the highest (KLIPS: -0.69 to $+0.46$), and makes the $RFAR$ coefficient fade, from -1.49 to -0.20 . The mechanism is the one in Section 6.3. A jeonse tenant with little wealth has put most of it into the deposit, so its remaining financial assets are small, yet the c-MIA constraint still requires it to keep a safe buffer against its consumption and housing expenditure. The buffer then absorbs a large share of its financial assets and pushes its risky share far below the renter’s. As wealth grows, the buffer becomes a small share of financial assets and the gap disappears, which produces a coefficient that is strongly negative in the lowest bin and rises across the bins. The participation cost alone produces neither the sign flip nor the fade. With both frictions, the full model gives an α coefficient from -1.01 to $+0.81$ and an $RFAR$ coefficient from -1.66 to -0.21 , and its SMP coefficient in the lowest bin (-1.12) is close to KLIPS (-1.19).

For homeowners, the standard model’s FAR coefficient is flat near -56 , just as the KLIPS coefficient is flat near -30 , and its $RFAR$ coefficient is flat near -2.7 (KLIPS: -1.08 to -1.36). Its α and SMP coefficients are small (α : -0.20 to $+0.03$; SMP : -0.24 to -0.10), whereas KLIPS shows negative coefficients in every bin (α : -0.86 to -0.60 ; SMP : -1.46 to -0.73). The c-MIA constraint makes the owner α coefficient negative in every bin (-1.62 to -0.49), because the

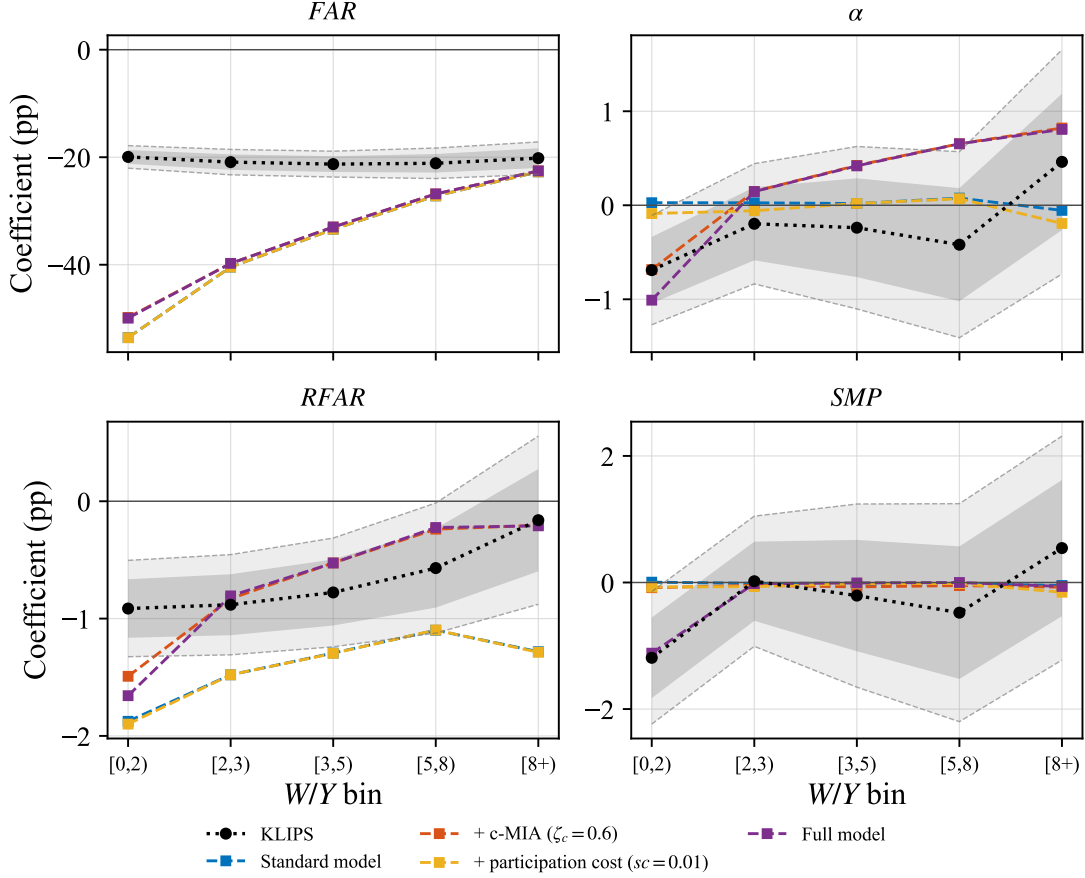


Figure 6: Friction Decomposition: Jeonse Coefficients Across W/Y Bins, Model vs. KLIPS

Notes: Coefficients on the jeonse (homeowner) indicator interacted with W/Y bins in the two-way fixed-effects specification of Section 3.2, in percentage points, estimated on KLIPS (black dotted line; darker band: ± 1 standard error; lighter band: 90% confidence interval) and on simulated panels of four model configurations: the standard model without frictions, c-MIA only ($\zeta_c = 0.6$), participation cost only ($sc = 0.01$), and the full model. Simulated panels evaluate each type's optimal policies at the KLIPS household-years (owners keep their observed house) and mix the types with $p_S = 0.05$; the model regressions control for W/Y and age.

owner's housing cash demand keeps the constraint binding at all wealth levels, and lowers the $RFAR$ coefficient to between -2.16 and -1.74 . The participation cost alone generates SMP crowding-out (-1.10 to -0.41), which also makes the α coefficient negative (-1.14 to -0.36), since owners who stay out of the stock market hold no risky assets. The full model combines the two: α from -1.81 to -0.55 , $RFAR$ from -2.21 to -1.75 , and SMP from -2.26 to -0.70 .

The better fit with the c-MIA constraint and the participation cost suggests that the housing crowding-out effect is more than a reallocation of wealth from stocks to housing. Households choose their housing commitment and their stock investment jointly under a liquidity constraint, and this joint choice shapes both the composition of their financial assets and their decision to participate in the stock market.

8 Mechanisms: Comparative Statics

This section examines the role of each model component in the crowding-out patterns. I vary one component at a time around the main calibration—the strength of the c-MIA constraint

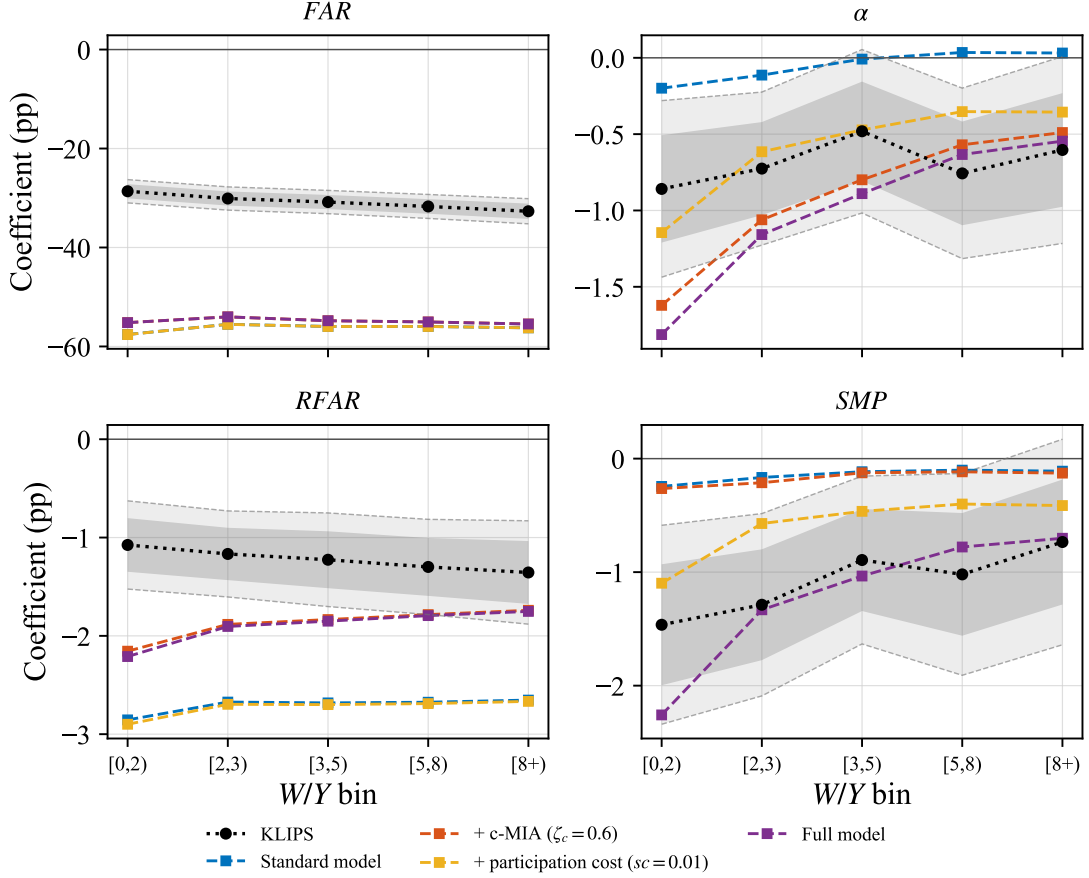


Figure 7: Friction Decomposition: Homeowner Coefficients Across W/Y Bins, Model vs. KLIPS

Notes: See Figure 6. Homeowner-interaction coefficients.

ζ_c , the participation cost sc , the housing-return volatility σ_h , and the return on the jeonse deposit—and report how the simulated coefficients respond.

8.1 The Liquidity Channel Scales with ζ_c

Figure 8 varies the c-MIA strength ζ_c with the participation cost off. Without the constraint, the jeonse and homeowner α coefficients are close to zero, so the crowding-out of risky financial assets operates only through the financial asset ratio. The c-MIA constraint adds a wealth gradient to the risky share: the jeonse α coefficient turns from negative at low W/Y to positive at high W/Y , and the homeowner α coefficient becomes negative and rises with W/Y , both closer to the data than in the standard model. Through the risky share, the jeonse $RFAR$ coefficient fades toward zero as in the data, and the homeowner $RFAR$ coefficients move toward their empirical level, while the FAR coefficients barely change. The c-MIA constraint thus shapes the W/Y profile of the crowding-out and determines how much of it operates through the risky share rather than the financial asset ratio. The pattern is present from $\zeta_c = 0.4$ onward.

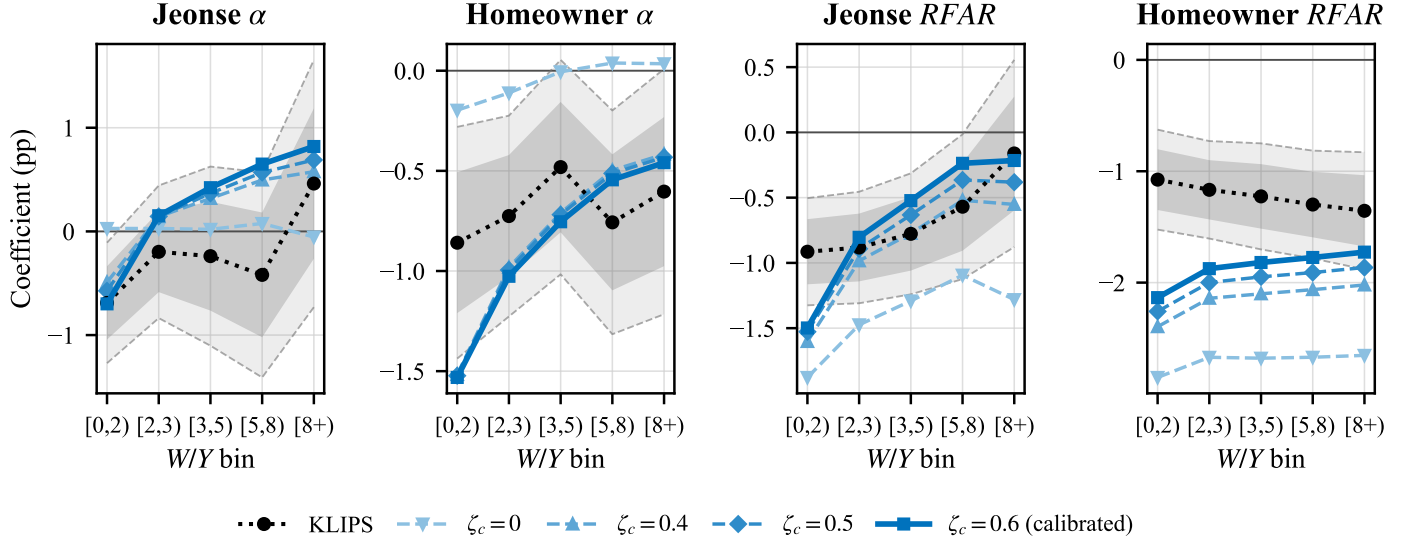


Figure 8: Comparative Statics in ζ_c : Coefficients Across W/Y Bins ($sc = 0$)

Notes: W/Y -bin coefficients of the specification of Section 3.2, in percentage points: KLIPS (black dotted line; bands: ± 1 standard error and 90% confidence interval) and simulated panels (each type's policies at the KLIPS household-years; $p_S = 0.05$) as ζ_c varies with $sc = 0$. Darker lines: larger values; solid line: calibrated value; all other parameters at the main calibration.

8.2 The Participation Cost Acts Through the c-MIA Constraint

Figure 9 varies the participation cost $sc \in \{0, 0.005, 0.01, 0.015\}$ without ($\zeta_c = 0$) and with ($\zeta_c = 0.6$) the c-MIA constraint. The results show that the participation cost generates the jeonse participation crowding-out only together with the c-MIA constraint, the regression counterpart of the policy pattern in Figure 5. Without the constraint, the jeonse SMP coefficients stay close to zero at every cost, while the homeowner coefficients become negative at low W/Y . With the constraint, a small cost suffices: at the calibrated $sc = 0.01$, the jeonse coefficient is negative in the lowest bin and close to zero above it, and the homeowner coefficient rises with W/Y , both close to KLIPS. The c-MIA constraint limits the risky position that a household with a housing commitment can hold, so at low wealth the gain from participating no longer covers the cost. For a jeonse commitment to crowd out participation, the liquid-asset need captured by the c-MIA constraint is necessary; a participation cost alone cannot generate it.

8.3 House Price Risk

The empirical contrast at the heart of the paper is that jeonse crowding-out fades with wealth while homeowner crowding-out persists. Ownership differs from jeonse in its exposure to house prices, which has two parts: the volatility of housing returns and the expected capital gain. This section examines the volatility; Section 8.4 gives the jeonse deposit the exposure as a whole.

An aggregate index smooths away the region- and unit-level variation that constitutes the risk an individual owner actually bears, so Figure 10 re-solves the full model with the

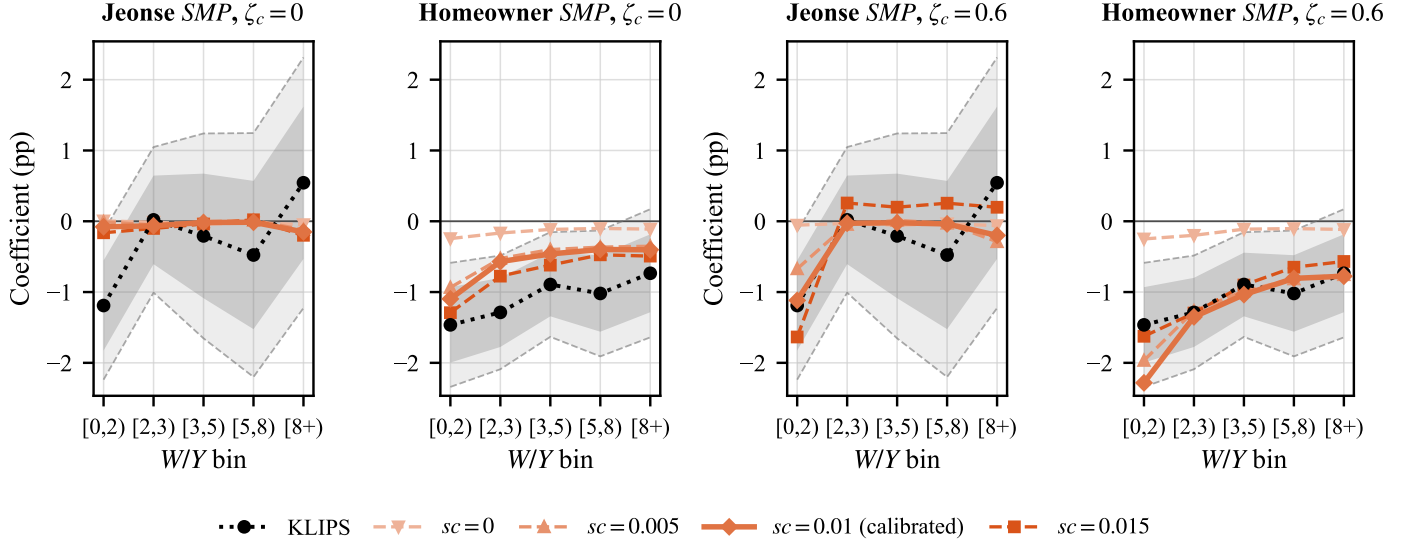


Figure 9: Participation Cost With and Without the c-MIA Constraint: *SMP* Coefficients

Notes: As in Figure 8, for the participation cost sc (share of biennial income) without ($\zeta_c = 0$, left) and with ($\zeta_c = 0.6$, right) the c-MIA constraint.

housing-return volatility raised from the index value ($\sigma_h^{\text{bi}} = 0.045$) to 0.08, 0.11, and 0.149, the last a scenario informed by the individual-apartment panel of Min (2022) (Appendix E.4).⁸

The homeowner α and *RFAR* coefficients do not change; across the spreads, the α , *RFAR*, and *SMP* coefficients of both tenures move by at most 0.09 percentage points. Once a household keeps its house, higher price risk does not lower its risky share, given that the size of the house it holds does not change.⁹

Homeowner *RFAR* persistence is therefore not a price-risk phenomenon. Price risk instead changes the tenure choice. The right panels of Figure 10 show the first-stage choice of Type S non-owners: a modest increase in volatility to $\sigma_h^{\text{bi}} = 0.065$ already widens the range of X/Y over which they choose jeonse instead of buying, and at 0.149 jeonse replaces buying entirely.¹⁰ In the model, at least under the Korean calibration, house price risk therefore operates through the extensive margin of housing—the tenure choice—rather than through the portfolios of households that own. Its effect on aggregate portfolios requires a forward simulation in which tenure responds to price risk, which I leave for future research.

8.4 Jeonse With House Price Exposure

Section 8.3 varies the volatility of house prices alone. To examine the house price exposure channel as a whole from the jeonse tenant's perspective, I ask what would happen if jeonse carried ownership's exposure to house prices. I consider a hypothetical jeonse contract whose deposit earns the housing return: the tenant finances the deposit exactly as before, but at the

⁸Each step is a mean-preserving spread: μ_h is lowered so that the expected housing return $E[R_h] = \exp(\mu_h + \sigma_h^2/2)$ is unchanged, so the experiment changes risk and nothing else.

⁹The simulated panels evaluate homeowners with the policy of a household that keeps its current house. For such a household, holding its current amount of stocks remains optimal even when housing returns become more volatile.

¹⁰The owner's stay-or-sell choice also shifts toward selling.

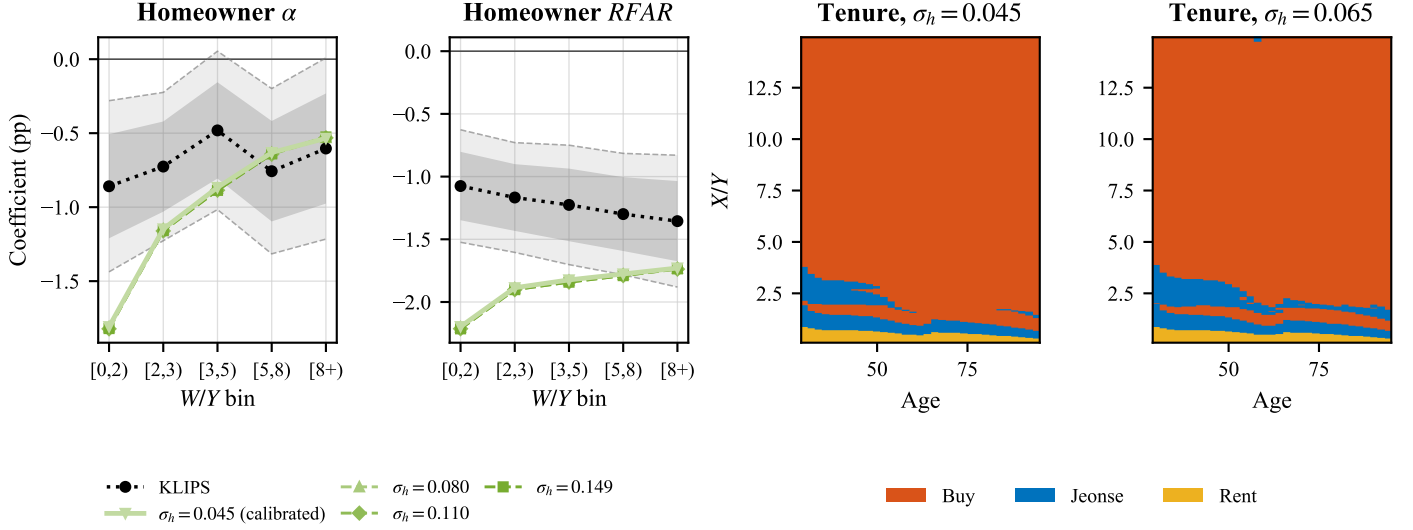


Figure 10: Housing-Return Risk: Homeowner Coefficients and the Tenure Choice

Notes: Left: as in Figure 8, for mean-preserving increases in the biennial housing-return volatility σ_h from the index value 0.045 ($E[R_h]$ unchanged). Right: tenure choice of a Type S non-owner by age and X/Y at $\sigma_h = 0.045$ and 0.065.

end of the contract receives it indexed to the house price rather than at its nominal value. Everything else, including the c-MIA constraint and the participation cost, is unchanged, and jeonse tenants are evaluated, as in the full model, at their KLIPS household-years with the housing the model chooses.

Figure 11 compares the jeonse coefficients in the two economies. With house price exposure, the deposit becomes an investment with an expected return, and tenants hold more of their wealth in housing. The crowding-out deepens and no longer fades with wealth: the *FAR* coefficient lies between -62 and -69 in every bin instead of rising from -50 to -22 , and the top-bin *RFAR* coefficient is -0.84 instead of -0.21 . The top-bin α coefficient is unchanged, so the persistence works through the amount of wealth held in housing rather than through the composition of financial assets. From the jeonse tenant's perspective, exposure to house prices turns a fading crowding-out into a persistent one: it raises the housing position, and with it the share of wealth that is not held in stocks.

9 Conclusion

Housing is the dominant asset for most households, and it crowds out risky financial asset holdings through economically distinct channels: a *liquidity constraint channel*, which operates because housing-related commitments tie up wealth that constrained households need to keep liquid, and a *house price exposure channel*, which arises because ownership ties the household's wealth to the return on its house—its risk as well as its expected capital gain. This paper provides an empirical decomposition of these channels, exploiting a unique feature of the Korean housing market—the jeonse contract—that carries a housing commitment without ownership's exposure to house prices.

Using two independent Korean household panel datasets, KLIPS and HFWPKOR, I first

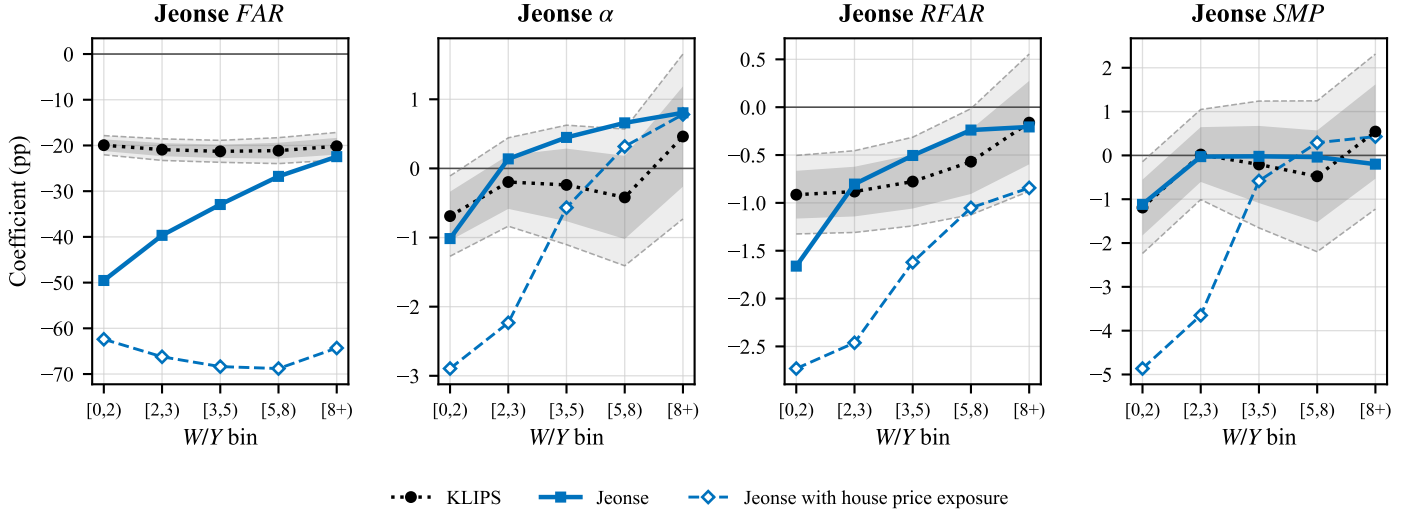


Figure 11: Jeonse With House Price Exposure: Jeonse Coefficients

Notes: As in Figure 8. Solid: full model (deposit returned at its nominal value); dashed: hypothetical jeonse whose deposit is indexed to the house price, all else unchanged.

show that jeonse and homeownership both crowd out risky financial asset holdings on average, mainly by lowering the share of net wealth held in financial assets. The crowding-out varies systematically with wealth, and the two margins behave differently. The financial asset ratio is crowded out by a roughly constant amount at every wealth-to-income level. The risky share, by contrast, is crowded out at low wealth-to-income ratios, and this crowding-out weakens as the ratio rises. Combined in the risky financial asset ratio, these patterns make the crowding-out effect of jeonse fade as the wealth-to-income ratio rises—statistically indistinguishable from zero for wealthy households—while the crowding-out effect of homeownership persists across all wealth levels. The full sample and the subsample of households that ever hold risky assets show the same patterns, and I find no comparable gradient along the age dimension. These facts provide new evidence on the mechanism through which housing crowds out risky asset holdings.

A life-cycle model with three tenures—renting, jeonse, and ownership—provides an economic explanation for these facts. The standard model matches the sign of the substitution between financial assets and housing-related assets but not its wealth structure: it produces almost no risky-share or participation effect, and its crowding-out of the risky financial asset ratio shrinks with wealth for both tenures. Adding a consumption-based money-in-advance (c-MIA) constraint, which requires households to hold a liquid buffer against their consumption and housing expenditure, generates this weakening of the risky-share crowding-out for both tenures and the fading jeonse crowding-out of the risky financial asset ratio. Together with a small per-period participation cost, it also brings the participation crowding-out of both tenures closer to the data.

Comparative statics show which elements matter. The c-MIA constraint is necessary for most of these features, and only together with the c-MIA constraint does the participation cost generate a jeonse-specific crowding-out of participation, rather than non-participation common to all tenures. House price risk, measured by the volatility of housing returns, barely

moves the crowding-out coefficients of households that already own; it shifts the tenure choice instead, toward jeonse and toward selling, through which it is likely to affect stock holdings. When the jeonse deposit is given the same exposure to house prices, tenants treat the deposit as an investment, choose larger deposits, and their crowding-out no longer fades with wealth. This indicates, indirectly, that house price exposure itself is a source of the persistent crowding-out of homeownership.

These results show that, to understand how housing crowds out stock-market participation and risky investment, modeling housing alone is not enough, and the household's need for liquid assets must interact with its housing commitment. The house price-risk experiment also points to a second-order effect: changes in the housing market move households across tenures, by selling or by returning to jeonse, and thereby change their portfolios. Quantifying this effect in a model in which tenure choice and portfolios evolve jointly is a promising direction for future research.

A Variable Construction: KLIPS and HFWPKOR

This appendix documents the raw variables used from KLIPS and HFWPKOR to construct the balance-sheet aggregates (FA , RFA , RA , LB , W) and the portfolio-choice measures (FAR , α , $RFAR$, SMP) analyzed in Section 3.

A.1 KLIPS

KLIPS variables are identified by wave-specific codes of the form $h\{ww\}\{code\}$, where $\{ww\}$ is the two-digit wave number and $\{code\}$ is the four-digit variable code (e.g., HousePrice in wave 3 is $h031412$). Table 5 lists the four-digit codes used for each balance-sheet aggregate (dropping the wave prefix).

Table 5: KLIPS: Variable Codes Used for Balance-Sheet Aggregates

Aggregate	Component	Code(s)
<i>Financial assets (FA, excludes jeonse/rent deposits)</i>		
	Bank deposit	2562
	Stock and bond (lumped)	2564
	Saving insurance	2566
	Gye (rotating savings)	2568
	Private lending	2570
	Other financial	2572
<i>Risky financial assets (RFA)</i>		
	Stock and bond (lumped)	2564
<i>Real assets (RA)</i>		
	Primary residence value	1412
	Other real estate (amount + interval proxy)	2512, 2513
	Vehicle	2653
	Other tangible	2662
<i>Liabilities (LB)</i>		
	Institutional debt	2602
	Non-institutional debt	2605
	Personal debt	2608
	Rent/jeonse deposit debt (as landlord)	2611
	Gye debt	2614
	Other debt	2617
	Auto loan	2659
<i>Housing-related</i>		
	Housing tenure	1406
	Jeonse/rent deposit	1413
	Monthly rent	1414
<i>Non-capital income (Y)</i>		
	Labor income	2102
	Social insurance (5 categories)	2134, 2136, 2138, 2140, 2142
	Public/private transfers (7 categories)	2152, 2153, 2155, 2157, 2158, 2159, 2160

Aggregates are constructed as

$$\begin{aligned}
FA &= \text{BankDeposit} + \text{StockBond} + \text{SavingInsurance} + \text{Gye} + \text{PrivateLending} + \text{OtherFin}, \\
RFA &= \text{StockBond}, \\
RA &= \text{HousePrice} + \text{OtherRealEstate} + \text{Vehicle} + \text{OtherTangible}, \\
LB &= \sum_k \text{Debt}_k, \\
W &= FA + RA + \text{Deposit} - LB, \\
Y &= \text{LaborIncome} + \text{SocialInsurance} + \text{Transfers}.
\end{aligned}$$

Because KLIPS records stocks and bonds under a single code (2564), α and $RFAR$ constructed from KLIPS include both stock and bond holdings, whereas the HFWPKOR counterparts separately identify stocks, bonds, and mutual funds. Early waves (3–9, calendar years 2000–2006) do not measure codes 2653 (vehicle), 2659 (auto loan), or 2662 (other tangible); these are treated as zero in the aggregates and do not materially affect the main tenure coefficients.

A.2 HFWPKOR

HFWPKOR variables are identified by standardized English-language names mapped to Korean column headers via a year-specific column-index lookup. Table 6 lists the variables used.

Table 6: HFWPKOR: Variables Used for Balance-Sheet Aggregates

Aggregate	Component	Variable (English / Korean)
<i>Financial assets (FA, excludes housing deposit)</i>	Total savings	Asset_Fin_Sav / 자산_금융자산_저축금액
<i>Risky financial assets (RFA)</i>	Stocks, bonds, mutual funds	Asset_Fin_Sav_Account_StockBondMutualFund
<i>Real assets (RA)</i>	Total real assets	Asset_Real / 자산_실물자산
<i>Liabilities (LB)</i>	Total debt	Debt / 부채
<i>Housing-related</i>	Housing tenure	HousingTenure / 입주형태코드
	Housing deposit (jeonse/rent)	Asset_Fin_HousingDeposit
	Primary residence value	Asset_Real_RealEstate_PrimaryResidence
<i>Net wealth</i>	Net wealth (directly reported)	NetWealth / 순자산
<i>Non-capital income (Y)</i>	Labor income	CurrentIncome_Labor
	Public transfers	CurrentIncome_PublicTransfer
	Private transfers	CurrentIncome_PrivateTransfer

Because HFWPKOR reports pre-aggregated balance-sheet totals, construction is simpler

than for KLIPS:

$$\begin{aligned}
FA &= \text{Asset\_Fin\_Sav}, \\
RFA &= \text{Asset\_Fin\_Sav\_Account\_StockBondMutualFund}, \\
RA &= \text{Asset\_Real}, \\
LB &= \text{Debt}, \\
W &= \text{NetWealth}, \\
Y &= \text{CurrentIncome\_Labor} + \text{CurrentIncome\_PublicTransfer} \\
&\quad + \text{CurrentIncome\_PrivateTransfer}.
\end{aligned}$$

Unlike KLIPS, HFWPKOR separately records stocks, bonds, and mutual funds at the household level in every wave from 2013 onward, so α and $RFAR$ are constructed more precisely in HFWPKOR.

A.3 Timing and Reference Periods

The two surveys differ in the timing of asset and income measurement:

- **KLIPS:** Fieldwork runs May–September of year t . Asset and debt variables are measured at the time of the survey (“조사당시”); income variables refer to the previous calendar year $t - 1$ (“작년한해”).
- **HFWPKOR:** Fieldwork runs late March–mid-April of year t . Asset and debt variables are measured as of 31 March t ; income variables refer to calendar year $t - 1$.

Neither survey measures net wealth at the exact end of the income-reference year. The closest available convention—pairing the survey-time net wealth W with the most recently completed calendar year’s non-capital income Y —leaves a three-to-nine month gap between the end of the income year and the wealth snapshot (three months for HFWPKOR, five-to-nine months for KLIPS). I adopt this convention throughout the paper and acknowledge the residual timing gap as a measurement limitation rather than attempt to shift one variable forward to match the other, since any such shift would introduce its own misalignment. From each (W, FA, RFA, Y) tuple I construct the four portfolio-choice measures used in Section 3: $FAR = FA/W$, $\alpha = RFA/FA$, $RFAR = RFA/W$, and $SMP = \mathbb{1}[RFA > 0]$. The wealth-to-income ratio W/Y is the main cross-sectional heterogeneity dimension.

B Timing of the 2022 Wave of Jeonse Defaults

The analysis window in the main text ends at survey year 2021. I motivate this cutoff using official HUG deposit-default statistics.

Figure 12 plots the annual HUG time series. Annual default-event counts remained below 3,000 through 2021. Defaults then doubled to 5,443 in 2022 and more than tripled to 19,350 in 2023 before stabilizing at 20,941 in 2024. The corresponding default amount rose from about 579 billion KRW in 2021 to 4.33 trillion KRW in 2023. The mid-2022 onset of widespread press

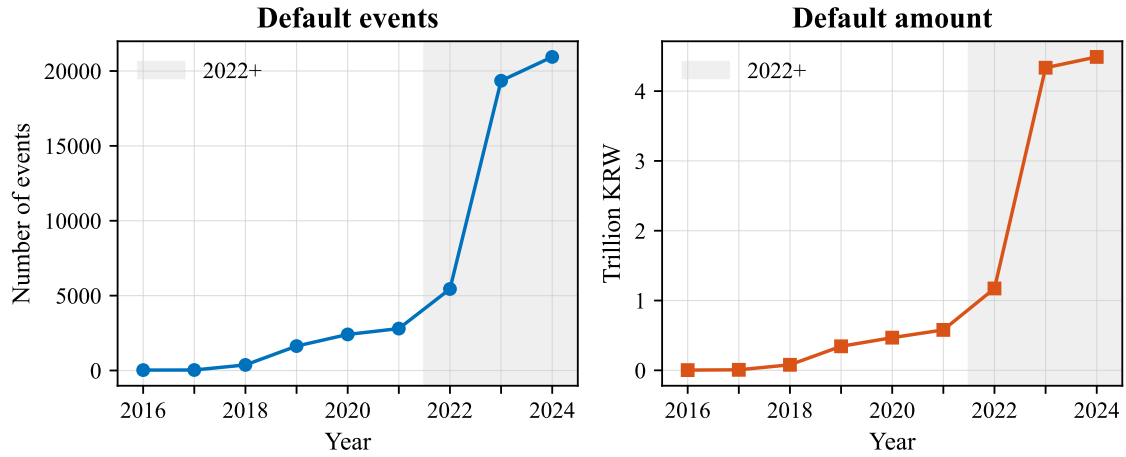


Figure 12: HUG Jeonse-Deposit Default-Event Time Series, 2016–2024

Notes: Annual number of *default events* and total *default amount* (trillion KRW) recorded under the HUG Jeonse Deposit Return Guarantee product. A “default event” arises when the landlord fails to return the jeonse deposit at contract expiration and the tenant (who had purchased the HUG guarantee) invokes the insurance. The shaded region highlights the 2022–2024 wave of jeonse defaults. Interpretation caveat: HUG statistics cover only contracts in which the tenant had purchased the insurance, so absolute default counts are a lower bound on total jeonse defaults, and year-over-year changes partly reflect enrollment growth. The 2022→2023 jump of about 3.5 times in both counts and amounts is nonetheless large relative to the earlier year-over-year changes. Source: HUG *Guarantee Default Status* dataset, Korea Public Data Portal (data.go.kr/data/15002597), 2024-12-31 release; filtered to guarantee type equal to Jeonse Deposit Return Guarantee.

coverage of high-profile landlord-default cases and the subsequent policy response align with the first visible jump in the underlying HUG statistics. From 2022 onward, jeonse tenants bear a material default-risk exposure on top of the liquidity commitment of the deposit—an exposure that homeowners and renters do not share. As a consequence, the portfolio choices of post-2022 jeonse tenants no longer cleanly isolate the liquidity constraint channel from a second, concurrent default-risk channel, and the cross-tenure coefficient comparison that underlies this paper’s decomposition is no longer valid for those years. I therefore restrict the empirical sample to survey years ≤ 2021 throughout the main text.

C Additional Empirical Exhibits

This appendix collects the HFWPKOR counterpart of Table 1 and the EverSMP-sample and age-specification counterparts of Figure 2, discussed in Section 3.

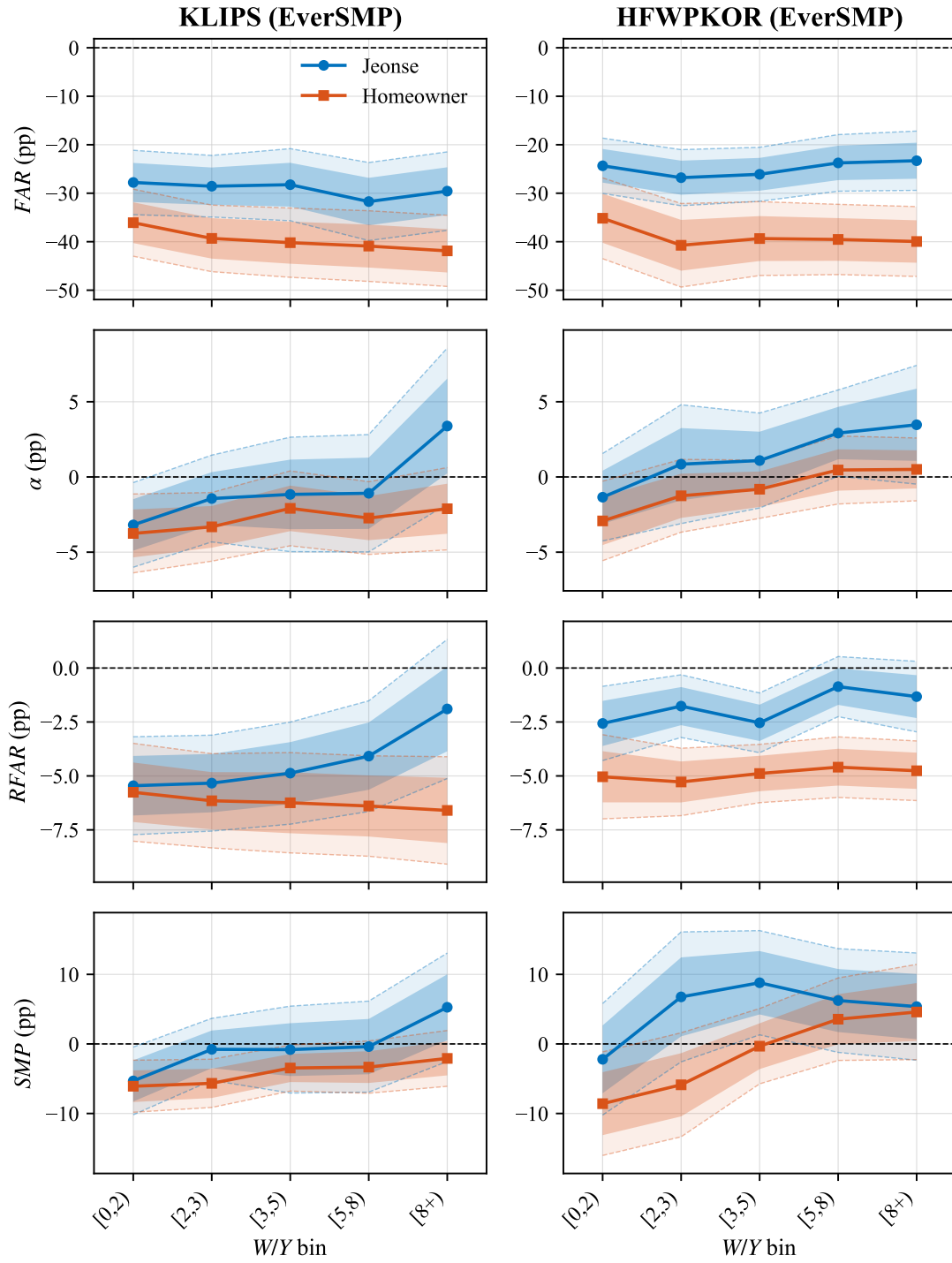


Figure 13: Crowding-Out Effects by W/Y (EverSMP Sample)

Notes: Same layout as Figure 2, but restricted to the EverSMP subsample (households holding $RFA > 0$ in at least one observed wave).

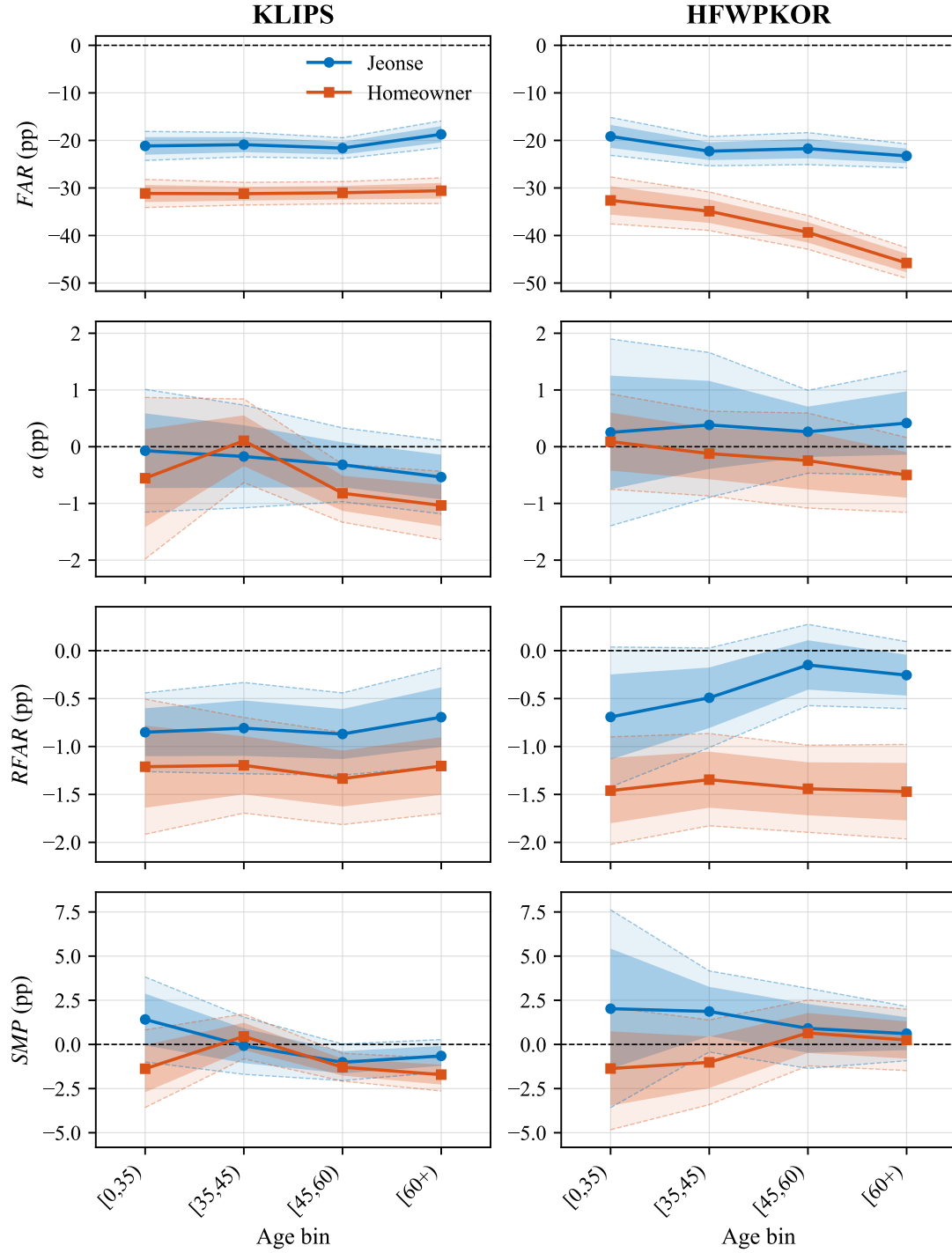


Figure 14: Crowding-Out Effects by Age (full sample)

Notes: Each point shows the estimated coefficient on the tenure $\times$ age bin interaction from Equation 3. Shaded bands show ± 1 standard error (darker) and 90% confidence intervals (lighter), both based on two-way (household $\times$ year) clustered standard errors. Rows (top to bottom): FAR, α , RFAR, SMP. Columns: KLIPS (left), HFWPKOR (right). y-axes are harmonized within each row.

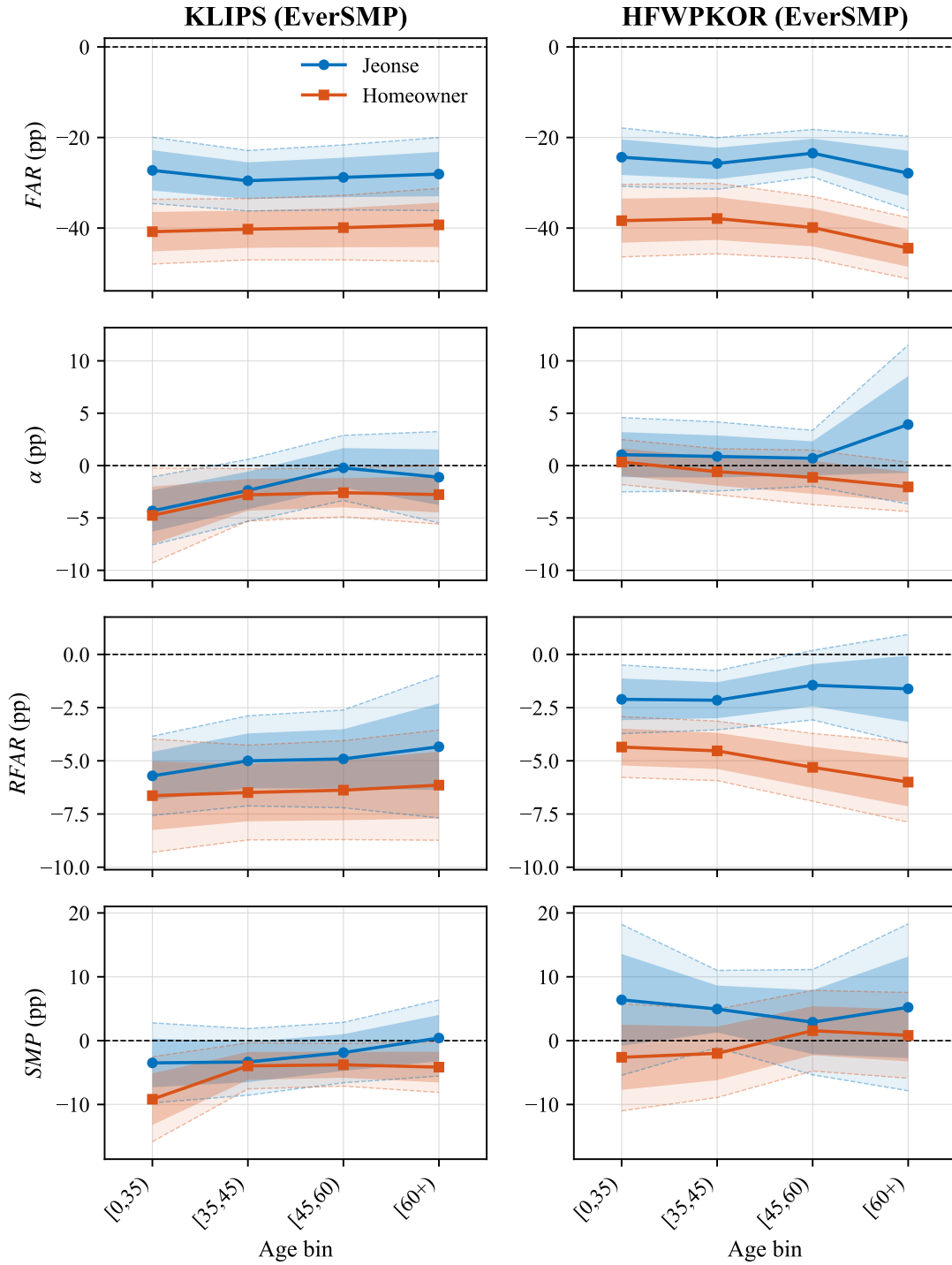


Figure 15: Crowding-Out Effects by Age (EverSMP Sample)

Notes: Same layout as Figure 14, restricted to the EverSMP subsample (households holding RFA > 0 in at least one observed wave).

Table 7: Descriptive Statistics by Housing Tenure (HFWPKOR)

	Full sample				EverSMP sample			
	All	Renter	Jeonse	Homeowner	All	Renter	Jeonse	Homeowner
Observations	133,081	27,391	15,043	90,647	40,087	3,731	4,312	32,044
Households	43,666	11,532	6,885	29,785	11,916	1,628	1,901	9,672
<i>Panel A: Demographics</i>								
Age	54.2	52.2	47.2	56.2	51.1	44.5	41.3	53.5
HH Size	2.8	2.3	2.7	3.0	3.1	2.6	2.9	3.2
<i>Panel B: Income & Wealth (USD thousands, 2020 real prices)</i>								
Y	36.2	23.5	36.4	40.1	51.1	38.0	52.9	52.5
W	248.0	44.5	140.6	330.7	378.3	107.3	222.0	437.1
FA	56.2	24.8	43.6	68.2	100.5	67.7	80.9	107.8
RFA	6.4	2.7	5.7	7.6	20.5	18.4	19.0	21.0
<i>Panel C: Portfolio</i>								
W/Y	13.6	3.0	6.5	18.1	15.4	4.5	6.3	18.2
FA/W	0.300	0.587	0.302	0.212	0.317	0.713	0.378	0.257
α	0.051	0.026	0.054	0.058	0.163	0.175	0.178	0.159
RFA/W	0.017	0.019	0.021	0.015	0.054	0.126	0.071	0.043
SMP	0.198	0.084	0.190	0.234	0.634	0.560	0.630	0.643

Notes: Survey-weighted means over household-year observations in the HFWPKOR analysis sample (survey years 2013–2021), representing the national population of Korean households. Observations and Households are un-weighted counts; because households move across tenure categories over time, tenure-specific household counts sum to more than the All column. Monetary values (Panel B) are converted from 10,000 KRW in 2020 prices (CPI-deflated) to thousands of 2020 USD at the 2020 annual average exchange rate of 1,180 KRW per USD. W is net wealth, Y non-capital income, FA financial assets excluding housing deposits, RFA risky financial assets; FA/W , $\alpha = RFA/FA$, RFA/W and $SMP = \mathbb{1}[RFA > 0]$ are fractions. The EverSMP sample keeps households observed with $RFA > 0$ in at least one wave. RFA covers stocks, bonds, and funds. Source: Statistics Korea, Bank of Korea, and Financial Supervisory Service, Survey of Household Finances and Living Conditions (HFWPKOR).

D Model Details

D.1 Bequest Motive

This appendix derives the bequest continuation $B_{a+1} = \kappa_b X_{a+1} / (P_{a+1}^H)^\omega$ of Section 4.1. The descendant inherits X_{a+1} at the start of period $a + 1$, after the period- $(a + 1)$ house price has been realized. Following Yao and Zhang (2005), the descendant buys a T_b -period annuity at the risk-free rate, rents housing at the inheritance-date price P_{a+1}^H in every post-mortem period, and splits each annuity payment between non-durable consumption and rent.

Step 1: within-period indirect utility. Given a payment a , the descendant chooses c and h to maximize $c^{1-\omega} h^\omega$ subject to $c + \tau P_{a+1}^H h = a$. The optimal split is $c^* = (1 - \omega)a$ and $h^* = \omega a / (\tau P_{a+1}^H)$, so

$$u^*(a) = \alpha_2 \frac{a}{(P_{a+1}^H)^\omega}, \quad \alpha_2 \equiv (1 - \omega)^{1-\omega} \left(\frac{\omega}{\tau} \right)^\omega.$$

Step 2: annuity factor. A constant payment a at the end of each of T_b periods costs $X_{a+1} = \sum_{t=1}^{T_b} a R_f^{-t}$ at the risk-free rate, so

$$a = \alpha_f X_{a+1}, \quad \alpha_f \equiv \frac{(R_f - 1) R_f^{T_b}}{R_f^{T_b} - 1}.$$

Step 3: the descendant's Epstein–Zin value. Each period delivers the same utility $u^* = \alpha_2 \alpha_f X_{a+1} / (P_{a+1}^H)^\omega$. The descendant values the stream with the household's aggregator, $W_t^\rho = (u^*)^\rho + \beta W_{t+1}^\rho$ with $W_{T_b+1} = 0$. Because the stream is deterministic, the certainty equivalent is the identity and the recursion sums to

$$W_1^\rho = (u^*)^\rho \sum_{k=0}^{T_b-1} \beta^k = (u^*)^\rho D, \quad D \equiv \frac{1 - \beta^{T_b}}{1 - \beta}.$$

Step 4: the bequest constant. Setting $B_{a+1} \equiv W_1 = u^* D^{1/\rho}$ gives

$$B_{a+1} = \kappa_b \frac{X_{a+1}}{(P_{a+1}^H)^\omega}, \quad \kappa_b = \alpha_2 \alpha_f D^{1/\rho} = (1 - \omega)^{1-\omega} \left(\frac{\omega}{\tau} \right)^\omega \frac{(R_f - 1) R_f^{T_b}}{R_f^{T_b} - 1} \left(\frac{1 - \beta^{T_b}}{1 - \beta} \right)^{1/\rho}. \quad (14)$$

The constant depends on the elasticity of intertemporal substitution through $\rho = 1 - 1/\psi$ and not on risk aversion γ . It is real for every $\rho \neq 0$; the case $\psi = 1$ would require a separate limit. As in the baseline of Vestman (2019), the descendant's discount factor and horizon equal the household's β and T_b .

Relation to Yao and Zhang (2005). Steps 1–2 follow Yao and Zhang (2005). With CRRA preferences, Yao and Zhang (2005) instead sum the discounted CRRA flows $\sum_{t=1}^{T_b} \beta^t u^*(a)^{1-\gamma} / (1 -$

γ), which lies on the CRRA utility scale. The Epstein–Zin aggregation above keeps the bequest on the consumption-basket scale of the recursion (9), so B_{a+1} enters the recursion in the same units as V_{a+1} . The two forms differ only in the overall strength of the bequest motive, which is governed by T_b and β .

D.2 Stayer's Problem

The renter's, jeonse tenant's, and buyer's problems appear in Section 4; the stayer's problem is

$$V_a^s(X_a, Y_a, P_a^H, H_{a-1}) = \max_{C_a, A_a, \alpha_a} \left[(C_a^{1-\omega} H_{a-1}^\omega)^\rho + \beta(1 - \pi_a) \mathcal{M}_a^{\rho/(1-\gamma)} + \beta \pi_a \text{CE}_a(B_{a+1})^\rho \right]^{1/\rho}$$

$$\text{s.t. } X_a \geq A_a + C_a + (\chi + \delta - \phi) P_a^H H_{a-1} + \mathbb{1}[\alpha_a > 0] \text{sc } Y_a$$

$$X_{a+1} = A_a R_f + \alpha_a A_a (R_{a+1} - R_f) + Y_{a+1} + P_a^H H_{a-1} (R_{a+1}^H (1 - \phi) - (1 - \delta) R_M)$$

$$\alpha_a \in [0, 1], A_a \geq 0, C_a \geq 0,$$

$$(1 - \alpha_a) A_a \geq \zeta_c \cdot \left(C_a + [\chi + (1 - \delta)(R_M - 1)] P_a^H H_{a-1} \right).$$

The stayer inherits H_{a-1} (no housing choice), is compensated for the selling cost, and avoids the purchase cost ϕ_b —the inaction benefit. Its c-MIA rate omits ϕ_b because the stayer does not pay it.

D.3 Solver Grids and Quadrature

The solver state grid uses $n_x = 300$ log-spaced cash-on-hand points and $n_{h_s} = 35$ stayer housing-state points; the choice grids are $n_a = n_h = n_\alpha = 101$ for savings rate, housing fraction, and risky share. Shocks are discretized via three-dimensional Gauss–Hermite quadrature with 3 nodes per shock (27 nodes total); re-solving the full model with 7 or 11 nodes per shock moves the mixed-model coefficients by at most 0.07 percentage points (*FAR*: 0.50). All reported coefficients are stable to the choice-grid resolution: halving it to 51 points per dimension moves every mixed-model α , *RFAR*, and *SMP* coefficient by at most 0.14 percentage points (*FAR*: 0.41), within the variability across type-assignment draws.

E Details on Model Calibration

This appendix documents the remaining parameters and the full calibration table, the life-cycle non-capital income profile, the labor income shock, the stock and housing return processes, the labor–return correlations, and the conversion to the model's biennial frequency. All moments are estimated at annual frequency and then converted to the model's biennial frequency (means $\times 2$, standard deviations $\times \sqrt{2}$; correlations are time-scale invariant).

E.1 Other Parameters and the Full Calibration Table

Table 8 lists every model parameter with its source and data window.

The annual discount factor $\beta = 0.96$ and the bequest horizon $T_b = 10$ model periods (20 years) are standard in the life-cycle portfolio-choice literature; the bequest scaling constant κ_b follows from T_b and the other primitives in closed form (Appendix D.1). The Cobb–Douglas housing expenditure share ω is estimated from HFWPKOR (2013–2021) as the survey-weighted mean of household housing expenditure over total consumption expenditure. The moving shock probability ζ is the homeowner annual move rate from KLIPS (2000–2021). The deterministic age profile $\{g_a\}$ of non-capital income is estimated from KLIPS by averaging within-year age profiles of $\log Y$ across the 22 survey years and fitting a fifth-order polynomial over working ages 30–64 (Appendix E.2). The mortality hazard $\{\pi_a\}$ comes from the 2020 Statistics Korea life table. Retirement income is not governed by a separate replacement-ratio parameter: the estimated age profile $\{g_a\}$ itself carries the retirement income drop observed in KLIPS (the profile implies $Y_{65}/Y_{64} \approx 0.83$), with the deterministic component set to zero after age 66 while the persistent stochastic component continues (Appendix E.2).

The jeonse deposit-to-price ratio $\bar{J}$ is the monthly national average from the Korea Real Estate Board (REB, January 2012 to May 2020, where the series ends). The annual rent-to-price ratio is constructed as $\tau = \bar{J} \cdot r_{\text{conv}}$, where r_{conv} is the conversion rate between jeonse and monthly rent from REB (2012–2021); the renter security deposit is set equal to one year of rent, $\tau_{\text{dep}} = \tau$. The down-payment ratios δ_J (jeonse) and δ (owner) are estimated from HFWPKOR (2013–2021) as $1 - \text{LTV}$ on the jeonse-loan-using and mortgage-using subsamples, using the clean debt breakdown between jeonse loans and home-purchase mortgages. The remaining transaction-cost parameters—the owner purchase cost ϕ_b (acquisition tax plus brokerage), the jeonse brokerage ϕ_J , the owner selling brokerage ϕ , and the maintenance-and-property-tax rate χ —come from the 2015 Korean tax code and brokerage fee schedule. At the calibrated contract parameters, the jeonse and owner c-MIA rates ϑ_{cMIA} are smaller than the renter’s τ but apply to a larger housing position.

E.2 Life-Cycle Non-Capital Income Profile

I calibrate the deterministic life-cycle non-capital income profile $\{Y_a\}_{a=30}^{70}$ from the KLIPS sample described in Section 3 (2000–2021 survey waves, $N = 80,078$ household-year observations at ages 30–64 with $Y > 0$). The estimation proceeds in four steps.

1. For each survey year t in the sample, compute the mean of $\log Y$ within each integer age bin $a \in [30, 70]$, producing a year- t age profile.
2. Average the year- t age profiles across the 22 survey years. Averaging across years controls for year fixed effects and for transitory aggregate shocks; it also averages out household-level idiosyncratic heterogeneity under the standard assumption that these shocks are orthogonal to age.
3. Fit a fifth-order polynomial in age to the averaged level profile $\bar{Y}_a$ for working ages $a \in [30, 64]$. The smoothed fit $\hat{Y}_a$ is the calibrated working-age income path.
4. For retirement (ages 65–70) I use the cross-age mean of $\bar{Y}_a$ in that range as a flat retirement-phase level. No separate replacement-ratio parameter is imposed: the re-

Table 8: Calibrated Parameters: Full List

Parameter	Symbol	Value	Source
<i>Preferences and demographics (outside)</i>			
Annual discount factor	β	0.96	Literature standard
Housing expenditure share	ω	0.150	HFWPKOR (2013–2021)
Annual moving-shock probability (owners)	ζ	0.052	KLIPS (2000–2021)
Retirement income drop, Y_{65}/Y_{64} (via $\{g_a\}$)		0.83	KLIPS age profile
Bequest horizon (model periods; 20 years)	T_b	10	Literature standard
<i>Housing contracts (outside)</i>			
Annual rent-to-price ratio	τ	0.045	REB conversion rate (2012–2021) $\times \bar{f}$
Renter security-deposit ratio	τ_{dep}	0.045	One year of rent
Jeonse deposit-to-price ratio	$\bar{f}$	0.640	REB (2012–2020)
Jeonse down-payment ratio	δ_J	0.534	HFWPKOR (2013–2021)
Owner down-payment ratio	δ	0.654	HFWPKOR (2013–2021)
Owner purchase cost	ϕ_b	0.0165	2015 Korean tax code
Jeonse transaction cost	ϕ_J	0.003	2015 brokerage fee schedule
Owner selling cost	ϕ	0.004	2015 brokerage fee schedule
Annual maintenance and property tax	χ	0.003	2015 Korean tax code
<i>Return and income processes (outside; annual unless stated)</i>			
Risk-free rate	r_f	0.030	BOK time deposits (2004–2021)
Mortgage rate	r_M	0.044	BOK new mortgages (2004–2021)
KOSPI log-return std.	$\sigma_s^{\log,a}$	0.137	KOSPI (2004–2021)
Biennial log std.	σ_s^{bi}	0.193	$\sqrt{2} \sigma_s^{\log,a}$
Housing log-return mean (national index)	$\mu_h^{\log,a}$	0.028	REB all-type index (2004–2021)
Biennial mean	μ_h^{bi}	0.055	$2\mu_h^{\log,a}$
Biennial std.	σ_h^{bi}	0.045	$\sqrt{2} \sigma_h^{\log,a}$
Labor-income shock std. (permanent)	σ_L^a	0.197	KLIPS (2000–2021)
Stock–housing return correlation	ρ_{sh}	0.333	KOSPI and REB index (2004–2021)
Stock/housing–labor correlations	ρ_{sl}, ρ_{hl}	0	Not significant (Appendix)
<i>Preferences and constraints</i>			
Relative risk aversion	γ	5	Cocco (2005), Yao and Zhang (2005)
Elasticity of intertemporal substitution	ψ	0.5	Vissing-Jørgensen (2002)
c-MIA constraint	ζ_c	0.6	HFWPKOR liquid buffer (1.35 years)
Stock-market participation cost (share of biennial income)	sc	0.01	Brandsaas (2021)
<i>Expected stock return</i>			
Expected biennial log excess premium	μ_s	+0.060	KOSPI excess (2001–2021), adj. for taxes, retail returns

Notes: Annual values unless marked biennial; Appendix E.6 gives the biennial conversion. The REB deposit-ratio series ends in May 2020. Down-payment ratios are survey-weighted means of $1 - \text{LTV}$ among jeonse-loan users and mortgage holders. The bequest horizon is in two-year model periods. The belief types of the simulated economy are calibrated in Section 7.1. Sources: Korea Labor Institute, KLIPS; Statistics Korea et al., HFWPKOR; Korea Real Estate Board (REB); Bank of Korea (BOK) ECOS; Investing.com, KOSPI history.

retirement income drop enters entirely through the growth sequence $\{g_a\}$ implied by the profile (the fitted profile delivers $Y_{65}/Y_{64} \approx 0.83$), and $g_a = 0$ after age 66 while the permanent shock ϵ^Y continues.

From the smoothed profile I compute the biennial log-growth rates $g_a = \log \hat{Y}_{a+2} - \log \hat{Y}_a$ on the two-year age grid $\{30, 32, \dots, 70\}$ used by the solver. Figure 16 plots the resulting profile alongside the underlying year-averaged raw data.

E.3 Labor Income Shock

Recall from Section 4.1 that the model’s non-capital income follows $\log Y_{a+1} - \log Y_a = g_{a+1} + \epsilon_{a+1}^Y$, where g_{a+1} is the deterministic age growth (calibrated in Appendix E.2) and ϵ_{a+1}^Y is the idiosyncratic innovation with $\text{var}(\epsilon^Y) = \sigma_L^2$. Following Yao and Zhang (2005), the specification allows only a permanent shock to log income levels—there is no separate transitory level shock. The calibrated σ_L should therefore correspond to the standard deviation of the *permanent* component of log-income innovations in the data.

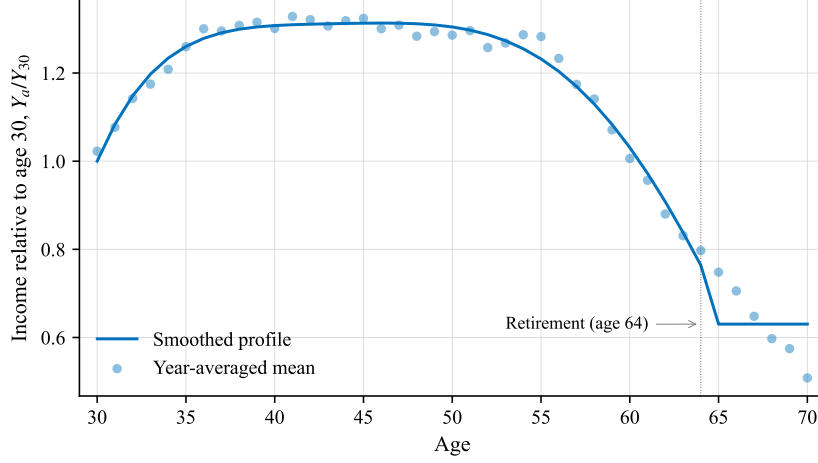


Figure 16: Calibrated Life-Cycle Non-Capital Income Profile

Notes: Line: fifth-order polynomial fit over working ages 30–64 to the year-averaged geometric-mean income by age of the household head (dots), KLIPS 2000–2021, relative to age 30; from age 65 income is held at the mean of the year-averaged levels at ages 65–70 ($Y_{65}/Y_{64} = 0.83$). The model uses the biennial log growth of the line.

Panel residual. Following Cocco (2005), on the working-age sample with a survey weight ($a \in [30, 64]$, $Y > 0$, $N = 78,041$) I run

$$\log Y_{it} = \alpha_i + \delta_t + \beta_1 \text{Age}_{it} + \beta_2 \text{Age}_{it}^2 + \beta_3 \text{Age}_{it}^3 + \beta_4 \text{NumofMember}_{it} + \epsilon_{it}, \quad (15)$$

with household fixed effects α_i and year fixed effects δ_t (panel-OLS $R^2 = 0.06$). The residual $\hat{\epsilon}_{it}$ captures household-specific deviations from the deterministic age profile and from common year effects.

Permanent/transitory decomposition. I model $\hat{\epsilon}_{it}$ as the sum of a permanent random walk P_{it} with innovation variance σ_p^2 and an i.i.d. transitory component τ_{it} with variance σ_τ^2 . Under this specification, the k -year first-difference has variance

$$\text{var}(\hat{\epsilon}_{it} - \hat{\epsilon}_{i,t-k}) = k\sigma_p^2 + 2\sigma_\tau^2, \quad k \in \{1, 2, \dots\}. \quad (16)$$

Computing the 1%/99% trimmed, survey-weight-weighted standard deviations at $k = 1$ and $k = 2$ gives 0.347 and 0.399, respectively. Solving the two-equation system for (σ_p, σ_τ) yields

$$\sigma_\tau^2 = \text{var}(\Delta_1) - \frac{1}{2} \text{var}(\Delta_2) = 0.041, \quad \sigma_p^2 = \frac{1}{2} \text{var}(\Delta_2) - \sigma_\tau^2 = 0.039. \quad (17)$$

So $\hat{\sigma}_p = 0.197$ (permanent, annual) and $\hat{\sigma}_\tau = 0.202$ (transitory, annual), of comparable magnitude. Since the model features only permanent shocks, I calibrate

$$\hat{\sigma}_L^{\text{biennial}} = \hat{\sigma}_p \cdot \sqrt{2} = 0.279, \quad (18)$$

which is the value used in the main-text calibration. Including the transitory component would correspond to $\hat{\sigma}_L^{\text{biennial}} = 0.399$ (direct 2-year first-difference of $\hat{\epsilon}$).

E.4 Stock and Housing Return Moments

For stock returns I use monthly KOSPI closing prices, aggregated to a calendar-year mean level and then to annual log returns $r_{s,t} = \log(P_t/P_{t-1})$. For housing returns I use the Korea Real Estate Board (REB) monthly price indices—the all-housing-type “(월) 매매가격지수_주택종합” and the apartment-specific “(월) 매매가격지수_아파트”—aggregated to calendar-year mean levels and converted to annual log returns. Both series overlap KOSPI over 2004–2021 (18 annual observations). The baseline calibration uses the *national all-housing-type* series: $\mu_h^{\log,a} = 0.028$, $\sigma_h^{\log,a} = 0.032$, and $\rho_{sh} = 0.333$, which at the biennial frequency become $\mu_h^{\text{bi}} = 0.055$ and $\sigma_h^{\text{bi}} = 0.045$ (Section 5, Table 4). Table 9 reports the full menu of regional and index-type alternatives.

Stock-return moments over 2004–2021 are $\mu_s^{\log,a} = 0.084$ and $\sigma_s^{\log,a} = 0.137$ at annual frequency. Because the model treats stock returns as lognormal (Equation (4)), they map to the biennial frequency by the standard time-aggregation rules,

$$\mu_s^{\text{bi,tot}} = 2\mu_s^{\log,a} = 0.168, \quad \sigma_s^{\text{bi}} = \sqrt{2}\sigma_s^{\log,a} = 0.193, \quad (19)$$

where $\mu_s^{\text{bi,tot}}$ is the biennial *total* log-return mean. The model’s stock process is specified in excess form, $R_s = R_f \exp(\mu_s + \epsilon^S)$, so the market-level excess premium over this window is $\mu_s^{\text{bi}} = \mu_s^{\text{bi,tot}} - \ln R_f^{\text{bi}} = 0.168 - 0.060 = 0.108$ (a 5.4% annual log excess premium). Over the effective KLIPS regression period 2001–2021, the same calculation gives an annual log excess premium of 3.8% (an annual log KOSPI return of 7.0% and a deposit rate of 3.3%). The model’s expected premium, $\mu_s = 0.06$ per model period (3% per year), lies below both values, reflecting taxes and the low average returns that retail investors realize (Section 5).

A natural concern with any aggregate housing index is that it understates the risk an individual owner bears: the relevant object is the variation in the value of the *specific* property, which includes idiosyncratic and unit-level variation that the index averages out. Section 8.3 therefore raises σ_h^{bi} in mean-preserving steps up to 0.149, a scenario informed by the individual-apartment panel of Min (2022), who reports a standard deviation of 27% for 3-year price changes of Korean apartments purchased in 2006–2018. Treating this statistic as an i.i.d. time-series volatility and converting it to the biennial frequency gives 0.182; since it partly reflects cross-sectional dispersion across units, I use a somewhat lower value, more than three times the index value.

E.5 Labor–Return Correlations

Aggregate labor shock series. The household-level innovation $\epsilon_{i,a+1}^Y$ in Section 4.1 can be conceptually split into an aggregate (economy-wide) component and an idiosyncratic (household-specific) component, $\epsilon_{i,a+1}^Y = \epsilon_{a+1}^{Y,A} + \epsilon_{i,a+1}^{Y,I}$. The calibrated σ_L of Appendix E.3 captures the *total* innovation standard deviation that a household faces, combining both components. For the labor–return correlations, however, only the aggregate component $\epsilon_{a+1}^{Y,A}$ can covary with the stock or housing return shocks (idiosyncratic shocks are by definition uncorrelated with macro returns). I therefore extract a proxy for $\epsilon_{i,a+1}^{Y,A}$ by taking a survey-weighted cross-sectional average of the household-level innovations, under which the

Table 9: Regional and Index Housing-Return Moments (Annual log, 2004–2021)

Region	All housing types		Apartments	
	$\mu_h^{\log,a}$	$\sigma_h^{\log,a}$	$\mu_h^{\log,a}$	$\sigma_h^{\log,a}$
National	0.028	0.032	0.033	0.037
Capital region	0.033	0.053	0.036	0.059
Seoul	0.033	0.048	0.036	0.053
Capital region excl. Seoul	0.033	0.061	0.036	0.064
Non-capital region	0.022	0.029	0.030	0.042

Notes: Mean and standard deviation of annual log returns, 2004–2021 (18 years), computed from calendar-year means of the Korea Real Estate Board monthly sales price indices for all housing types and for apartments. The capital region is the REB aggregate of Seoul, Gyeonggi and Incheon; capital region excluding Seoul is the equal-weighted mean of the Gyeonggi and Incheon returns. The model calibration uses the national all-housing-type row. Source: Korea Real Estate Board.

idiosyncratic piece averages to zero and the aggregate piece survives. I construct two such year-level aggregate series from the same panel, denoted $\bar{v}_t^{(1)}$ and $\bar{v}_t^{(2)}$, where the overbar indicates the within-year mean across households.

Method 1 (age-detrended). Following Vestman (2019), I form the age-detrended annual log-income growth at the household level,

$$\eta_{it+1}^{(1)} = \log Y_{it+1} - \log Y_{it} - g_{a+1}^{\text{ann}}, \quad (20)$$

where $g_{a+1}^{\text{ann}} = \log \hat{Y}_{a+1} - \log \hat{Y}_a$ is the annual growth of the smoothed profile of Appendix E.2, and then take the survey-weight-weighted year mean

$$\bar{v}_t^{(1)} = \frac{\sum_{i=1}^{N_t} \eta_{it}^{(1)} \cdot SW_{it}}{\sum_{i=1}^{N_t} SW_{it}}. \quad (21)$$

Method 2 (panel-FE residual). As a second method, similar to Cocco (2005), I use the panel-FE residual from Equation (15), first-differenced at the household level, and take the year-level weighted mean:

$$\eta_{it+1}^{(2)} = \hat{\epsilon}_{it+1} - \hat{\epsilon}_{it}, \quad \bar{v}_t^{(2)} = \frac{\sum_i \eta_{it}^{(2)} \cdot SW_{it}}{\sum_i SW_{it}}. \quad (22)$$

With these two aggregate labor shock series and the stock/housing annual log-return series from Appendix E.4 in hand, I compute the Pearson correlations over the common window 2004–2021. Since the cross-sectional averaging in $\bar{v}_t$ isolates the aggregate component $\epsilon^{Y,A}$ of the household income innovation, these correlations are the empirical counterparts of ρ_{sl} and ρ_{hl} in the model. Table 10 reports the labor–return correlations together with the stock–housing correlation for both housing index variants relevant to the calibration.

None of the labor–return correlations is statistically significant at conventional levels under either method; this pattern is consistent with Fagereng, Gottlieb and Guiso (2017) and Brand-saas (2021), so I set $\rho_{sl} = \rho_{hl} = 0$ in the solver calibration. The stock–housing correlation

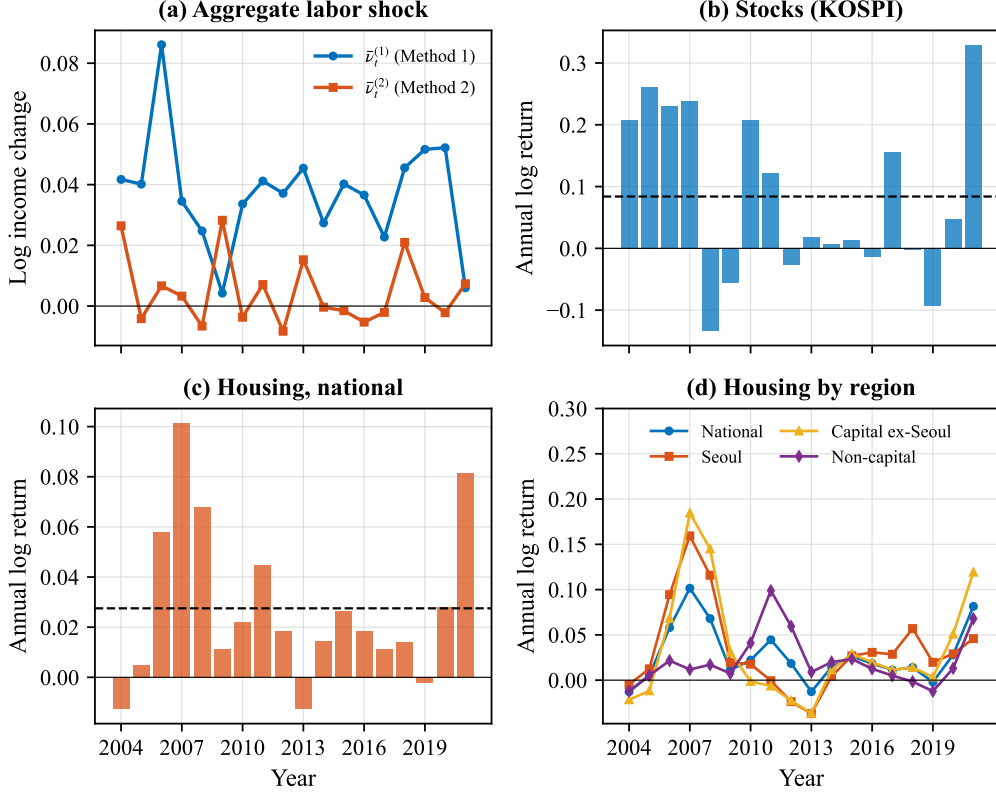


Figure 17: Aggregate Labor Shocks and Return Series, 2004–2021

Notes: (a) The two aggregate labor shock series $\tilde{v}_t^{(1)}$ (Method 1, age-detrended) and $\tilde{v}_t^{(2)}$ (Method 2, panel fixed-effects residual) described above. (b) KOSPI annual log returns. (c) Annual log returns of the national REB price index for all housing types. Dashed lines in (b) and (c) are window means (0.084 and 0.028). (d) The same housing return for the nation, Seoul, the capital region excluding Seoul (equal-weighted Gyeonggi and Incheon), and the non-capital region. Panels (a)–(c) enter the correlations in Table 10; panel (d) is descriptive.

used by the calibration is computed against the national all-housing-type index, $\rho_{sh} = 0.333$ ($p = 0.18$). For reference, the same correlation is 0.398 against the capital-region apartment index and 0.524 against the national apartment index.

E.6 Biennial Convention

Because one model period corresponds to two calendar years, the solver uses the biennial-frequency analogues of the annual rates and moments: gross returns are squared ($R_f^{\text{bi}} = (1 + r_f^{\text{ann}})^2$, $R_M^{\text{bi}} = (1 + r_M^{\text{ann}})^2$), log-return means are doubled, log-return standard deviations are scaled by $\sqrt{2}$, and correlations (being time-scale invariant) enter unchanged. Because all three processes are in lognormal form (Equations (4)–(6)), no further log-to-arithmetic conversion is applied to the stock moments.

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Table 10: Exogenous Process Correlation Structure (2004–2021)

	$\bar{v}^{(1)}, \text{stock}$	$\bar{v}^{(1)}, \text{housing}$	$\bar{v}^{(2)}, \text{stock}$	$\bar{v}^{(2)}, \text{housing}$	Stock, housing
<i>Housing return: National all-type index (calibration)</i>					
Correlation	0.057	−0.105	0.050	−0.254	0.333
<i>p</i> -value	0.822	0.679	0.843	0.308	0.178
<i>Housing return: Capital-region apartment index (reference)</i>					
Correlation	0.057	0.000	0.050	−0.163	0.398
<i>p</i> -value	0.822	0.999	0.843	0.518	0.102
<i>Housing return: National apartment index (reference)</i>					
Correlation	0.057	−0.091	0.050	−0.238	0.524
<i>p</i> -value	0.822	0.720	0.843	0.341	0.026

Notes: Pearson correlations over 2004–2021 (18 annual observations) with two-sided *p*-values. $\bar{v}_t^{(1)}$: survey-weighted yearly mean of age-detrended household log non-capital income growth (KLIPS). $\bar{v}_t^{(2)}$: yearly mean of first-differenced residuals from a household and year fixed-effects regression of log income on a cubic in age and household size. Stock and housing returns are annual log returns of calendar-year mean KOSPI and REB index levels. The calibration uses the national all-type index and sets $\rho_{sl} = \rho_{hl} = 0$; the apartment rows are for reference. Sources: KLIPS; Investing.com; Korea Real Estate Board.

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