# The Shared Appreciation Mortgage (SAM) in Korea: Evidences on Pricing Adequacy and Consumer Choice*

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**Abstract**

This study investigates the recent experience of Korea with Shared Appreciation Mortgage (SAM) in two analytical ways: first, by performing a pricing simulation to assess if the contract rate of the SAM product in Korea is adequate; and, second, by estimating a discrete choice model to examine consumer preference toward SAM over other affordable mortgage products. Our results indicate that the SAM product in Korea serves its social function of enhancing housing affordability for wealth-constrained borrowers. Among others, the LTV effect is shown to be strong in that, the higher the LTV bucket, the more likely consumers choose SAM over other mortgage products. Nonetheless, we also find an evidence of adverse selection in that those consumers residing in areas of weak housing price appreciation tend to choose SAM. In terms of pricing, our simulation results indicate that the current contract rate of SAM is adequate overall but slightly underpriced. We discuss policy implications of our findings along with several future research issues as to risk-return profiles of the SAM products.

Key words: Shared Appreciation Mortgage, mortgage pricing, consumer choice

## 1. Introduction

There has been a reasonably long history in the literature on the social value of Shared Appreciation Mortgage (SAM). As the writers claim, SAM can work as a vehicle to enhance social welfare in two ways: by promoting homeownership for borrowing-constrained households (Garnett/Guttentag, 1983; Caplin et al., 1997; Sanders/Slawson, 2005; Tiwari, 2013), and, by stabilizing housing market from a price or quantity boom-bust (Caplin et al., 2008; Cassidy et al., 2008; Yang et al., 2013). Under a SAM contract, borrower shares a fraction of housing price appreciation with mortgage lender or public (or quasi-public) entity, in return for which s/he benefits from a low financing cost with a below-market (or even zero) mortgage interest rate. SAM can also work as a counter-cyclical measure, especially in a down market, by offering an affordable mortgage instrument that, at least in theory, can beef up housing transactions.

However, the literature identifies various incentive and valuation problems associated with the instrument, such as adverse selection with a stronger demand from price declining area, moral hazard in the form of underinvestment in housing structure by homeowner (Shiller/Weiss, 2000; Sanders/Slawson, 2005), and appraisal bias in collateral valuation both at origination (for inflated values) and at maturity (for deflated values) (Cassidy et al., 2008). The U.S. and UK experiences with SAM indicate that these issues are in fact challenging. For example, the disgruntled SAM borrowers in UK, who regarded themselves as "victims" of the instrument by being deprived of the strong housing price appreciation in the 1990s, were up in arm by forming SAMAG (SAM Action Group) to pursue legal remedies on what was perceived to be excessive sharing of realized capital gains. In recent years, however, academic studies put forth various new and innovative versions of SAM as improvement in product feature: in addition to the conventional appreciation or equity sharing products (e.g., SAM, Equity Sharing Mortgage, Housing Partnerships, Home Equity Insurance), such new versions are introduced, including SAMANTHA (a SAM with A New Treatment of Housing Appreciation by Caplin et al. (2008)) and HAPN (Home Appreciation Participation Note, as an insurance vehicle that transfers price depreciation risk to investor, by Cassidy et al. (2008)).

This study shares the recent experience in Korea, first, by performing a pricing simulation to assess if the contract rates of the SAM products in Korea are adequate and, second, by investigating empirically consumer choice patterns on SAM over other affordable mortgage products in Korea. The Korean experience is fairly new in that one government-backed housing finance agency, the National Housing Fund, initiated a pilot program with two SAM products in October 2013 targeting first-time home buyers. The product is a long-term (20 years' maturity) fixed-rate (the contract rate set at 1.5%) fully-amortizing mortgage with various features related to sharing housing price appreciation or depreciation. In the first part of our empirical test, we employ an AR-GARCH model to simulate forward-looking housing price paths to assess adequacy of the pricing (or SAM's charged mortgage interest rate). Next, by using a micro loan-level data set, we advance and test several hypotheses on consumer choice patterns of SAM. Based on the empirical evidences obtained, we discuss policy implications of the Korean experience.

Our results indicate that the SAM product in Korea serves its social function by enhancing housing affordability for by wealth-constrained borrowers. Among others, the LTV effect is shown to be strong in that, the higher the LTV bucket, the more likely consumers choose SAM over other mortgage products. In particular, in the highest LTV range of 60~70, the marginal probability to choose SAM, ceteris paribus, is 24%p higher than the lower LTV ranges. Nonetheless, we find an evidence of adverse selection in that those consumers residing in areas of weak housing price appreciation tend to prefer SAM. In terms of pricing, our simulation results indicate that the current contract rate of SAM is adequate overall but slightly underpriced. We discuss policy implications of our findings along with several future research issues as to risk-return profiles of the SAM products so that international best practice is emerged in instituting this affordability enhancement vehicle with minimal side effects.

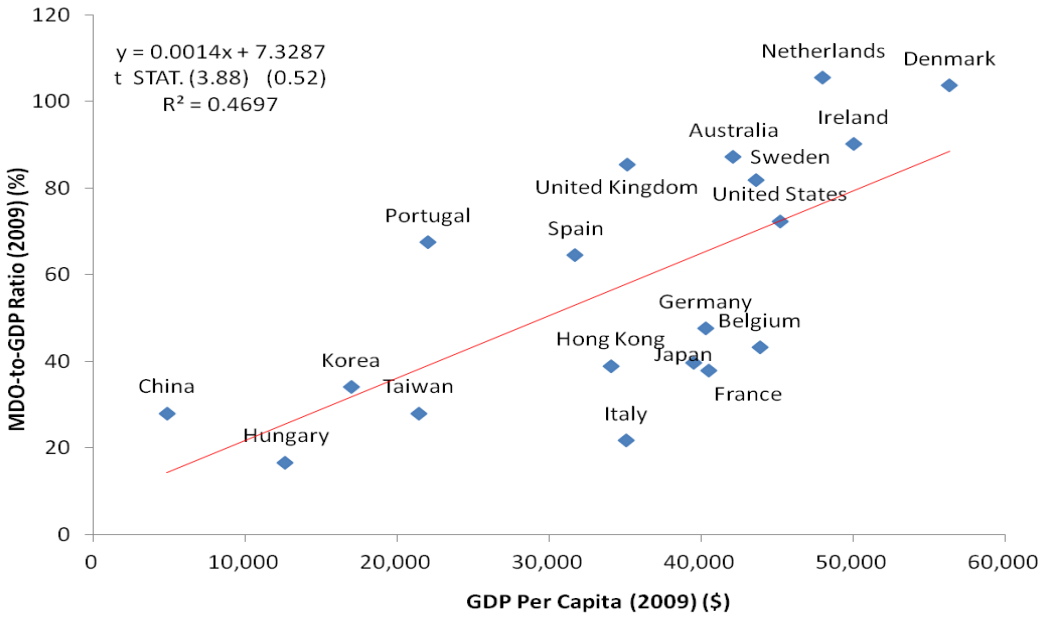
The rest of the paper consists of the following five sections: an introduction on the affordable mortgage products in Korea (Section 2), the features of SAM in Korea and the pricing simulation to assess adequacy of its contract rate (Section 3), empirical test on consumer choice patterns (Section 4), and concluding remarks and policy implications (Section 5).

## 2. Affordable Mortgage Products in Korea

*Recent trends in the housing finance sector*

The Asian Financial Crisis (AFC) in the late 1990s was a catalyst in advancing and expanding the residential mortgage lending in Korea. In particular, thanks to the two financial deregulations after AFC – lifting the restriction on real estate lending by the commercial banks and liberalizing both deposit and lending interest rates - the (residential) mortgage debt outstanding (MDO) has risen greatly in the 2000s, currently about 35% relative to GDP, which was hovering in the low teens in the 1990s. Given that the MDO-to-GDP ratio tends to be positively correlated with personal income (see Figure 1, showing an $1,000 increase in per capita GDP leading to an 1.4%p increase in the ratio), Korea appears to be on track. However, the fact that almost all outstanding mortgage contracts are adjustable rate mortgages (ARM) with a significant portion of them having short maturities (e.g., three years) is viewed as an element of structural instability. In response, the Korean government has been attempting to expand long-term fixed rate mortgages (FRM) through two government backed housing finance agencies – the Korea Housing Finance Corporation (KHFC) and the National Housing Fund (NHF). The underwriting criteria are fairly conservative with the maximum loan-to-value (LTV) ratio being set at 60% for commercial banks (who take more than 80% market share) and at 70% for some of the government-sponsored loan programs run by the two organizations. Funding is still predominantly through bank deposits, although the market share for MBS issued by KHFC has recently been on the rise.[1]

[1] KHFC is a sole securitizer of residential mortgage loans in Korea, established in 2003 by modeling after to GSEs (Government Sponsored Enterprises) in the U.S. As the major lenders in Korea are reluctant to issue FRMs and sell them to KHFC (due in large part to the size competition among big banks), KHFC runs its own




Data source: European Mortgage Federation, Lea (2010);
Re-quoted from Cho/Kim/Renaud (2013)

As a part of the housing market stabilization policies (which has been under a recession after 2011 as a fallout of the Global Financial Crisis (GFC)), NHF introduced two SAM products for first-time buyers in October 2013 – one that shares appreciation only (henceforth, to be referred to as SAM) and another that shares both appreciation and depreciation (to be referred to SAADM, Shared Appreciation And Depreciation Mortgage). Both types assume lower contract rates compared to the conventional FRM products, in return for which borrowers will have to share either housing price appreciation (SAM) or both appreciation and depreciation (SAADM). On the viewpoint of the lender, they obviously take a higher lending risk for the latter and, accordingly, charge higher mortgage interest rates for the second product. Since the inception, these products have been popular among consumers, evidenced by the fact that the initial pilot with 3,000 loans were sold out quickly. Between the two, SAM appears to be more popular, due possibly to the lower lending rate or to an inadequate pricing, which will be a topic of our investigation.

*Payment structures and underwriting conditions*

As described in Table 1, the maturity of SAM is 20 years with the lending set at the fixed rate of 1.5%. The payment structure is level (or constant) paying throughout loan life, with the option of interest-only in the first three years. The maximum LTV is 70%, and the loan amount cannot exceed 4.5 times of the household income (the combined income in the case of spouse). For SAADM, the maturity is

FRM lending program. NHF, on the other hand, utilizes various sources to fund affordable mortgage programs, via Housing Bonds (sold to developers and home buyers with low interest rates when issuing permits or registering properties), contract savings by prospective home buyers, government funding, and the lottery revenue.

also 20 years but the maximum LTV is much lower with 40%. The lending rate is step-wise varying in that it is 1% in the first five years and 2% from sixth year, and the principal is non-amortized during loan life (i.e., a bullet loan). For both types, borrowers' combined income should not exceed 70 million Korean Won (roughly 70,000 USD), the maximum house price and property size are set at 600 million KRW (about 600,000 USD) and 85$m^2$ (condominium), respectively. The lending is also limited to the condominiums (the predominant property type in Korea usually with high-rise structures) located in the capital region (Seoul, Gyeonggi-do, Incheon) and five other metropolitan areas (Busan, Daegu, Daejeon, Kwangju, Ulsan).

At maturity, the lender (NHF) receives a share of price appreciation (or depreciation) based on the ratio of the average loan balance during loan life to the property value at origination. As SAM has the principal amortization feature, the average loan balance declines over time and, accordingly, so does the gain from appreciation to the lender. But that is not the case for SAADM. For example, a SAM with 70% LTV at origination will have the appreciation share ratio of 38.5% at maturity, whereas a SAADM with 40% LTV will have a constant share ratio of 40% due to its bullet payment structure. For SAM, there is the maximum share on appreciation that the lender can claim, a 3.5% yield on the average loan balance in loan life. No such cap exists for SAADM.

**Table 1. Comparison of the Affordable Mortgage Products**

| | | Loan Products by the Korea Housing Finance Corporation (KHFC) | First-Time Home Buyers' Mortgage Products by National Housing Fund (NHF) | | |
|---|---|---|---|---|---|
| | | | Basic mortgage loan type | Profit-sharing (SAM) | Profit- & loss-sharing (SAADM) |
| Maturity | | 10, 15, 20, 30 YR | 10, 15, 20, 30 YR | 20 YR | 20 YR |
| Contract Interest Rates | | FRM 4.35% | FRM 3.0% | FRM 1.5% | Hybrid: 1% for initial 5 years, 2% for remaining years |
| Payment Structure | | Constant & Level-Paying | Constant & Level-Paying | Constant & Level-Paying | Interest Only (Bullet Payment) |
| Loan amount =min(A, B, C) | LTV(A) | 70% | 70% | 70% | 40% |
| | Ability of payment(B) | Maximum Payment-to-Income ratio=40% | 4.5 times combined annual income | 4.5 times combined annual income | 4.5 times combined annual income |
| | Loan limit(C) | 500 million KRW | 200 million KRW | 200 million KRW | 200 million KRW |
| Borrower Conditions | | - | Combined annual income less than 70 million KRW | Combined annual income less than 70 million KRW | Combined annual income less than 70 million KRW |
| Property Conditions | | Maximum property value less than 900 million KRW | Maximum property value less than 600 million KRW; Size smaller than 85 ㎡ | Maximum property value less than 600 million KRW; Size smaller than 85 ㎡ | Maximum property value less than 600 million KRW; Size smaller than 85 ㎡ |
| Geographical Areas | | - | - | Capital region and 5 other metropolitan areas | Capital region and 5 other metropolitan areas |

| | | | | |
|---|---|---|---|---|
| Profit or Loss Distribution Ratio | - | - | Increased value of house × average loan balance ratio | Increased/decreased value of house × average loan balance ratio |
| Limit on the Profit Sharing | - | - | Average loan balance ×loan period× 3.5% a year | - |

* Average loan balance ratio = average balance of mortgage loan / property value at the start of the loan

As mentioned earlier, there is a series of the incentive and valuation issues involved with SAM in general, in the forms of adverse selection (preferred by those in depreciating areas), moral hazard (putting inadequate effort and investment for maintenance), and collateral value conclusions with inflated values at origination but deflated ones at maturity (or at liquidation). In order to overcome these problems, the Korean government limits sales of SAM and SAADM only to the condominiums (which represent a more standardized and liquid property type in Korea) located in the capital region and five other metropolitan areas. In Korea, the maintenance of the condominiums is generally done in the building (not unit) level, implying that individual owner's effort matters less in forming fair market value of property. Furthermore, the condominiums of all sizes are reasonably frequently traded, and the real estate information companies weekly announce fair market prices of condominiums by size and by complex (i.e., a collection of condominium buildings), which are generally regarded as accurate.

As a problem of different sort, the borrowing cost can become excessive under a rapidly appreciating market environment, which can also cause a problem in repaying the principal at maturity. As a solution, a cap is instituted in the case of SAM at the maximum of 3.5% yield on the average loan balance. That limit does not exist for SAADM, due to the concern on the possibility of excessive cost on the part of the lender in case of a deep downturn. See Table 1 for an illustration of the return to investors, separately for SAM and SAADM, and Table 2 for the strategies to overcome various anticipated problems in running the sharing products. In the subsequent sections, we will focus on SAM as our sample predominantly represents that over the other type.

**Table 2. Strategies to Avoid the Incentive or Valuation Problems of SAM in Korea**

| | Expected Problem | Avoidance Strategy |
|---|---|---|
| Excessive Borrowing Cost | When housing price rapidly appreciates, the borrowing cost can be excessive | Put a limit on the amount of appreciation sharing (for SAM) |
| Moral Hazard | Putting inadequate effort and investment to maintain property | Limit to condominiums, with builing-(not unit-)level maintenance |
| Adverse Selection | Being preferred by borrowers facing risk of falling of housing prices | Limit eligible geographical areas |
| Price Distortion | Distortion in property valuation both at origination and at re-selling | Limit to condominiums whose fair market values are easily attainable |

## 3. Valuation of SAM: A Simulation Analysis

*Fair market yield on SAM*

On the viewpoint of lender, SAM represents an option-embedded mortgage instrument as its effective yield varies depending on state of housing price at maturity. As such, ceteris paribus, the effective rate of SAM should be higher than that of a comparable FRM with no such optionality. Conceptually, the fair return to holding SAM (or an effective interest thereof), r, should satisfy the following loan amount, L, equation:

$$(1)\quad L = \left[ MonthlyPayment \cdot \frac{1-(1+r/12)^{-(20\cdot 12)}}{r/12} \right] + \left[ SharedAppreciation \cdot \frac{1}{(1+r)^{20}} \right]$$

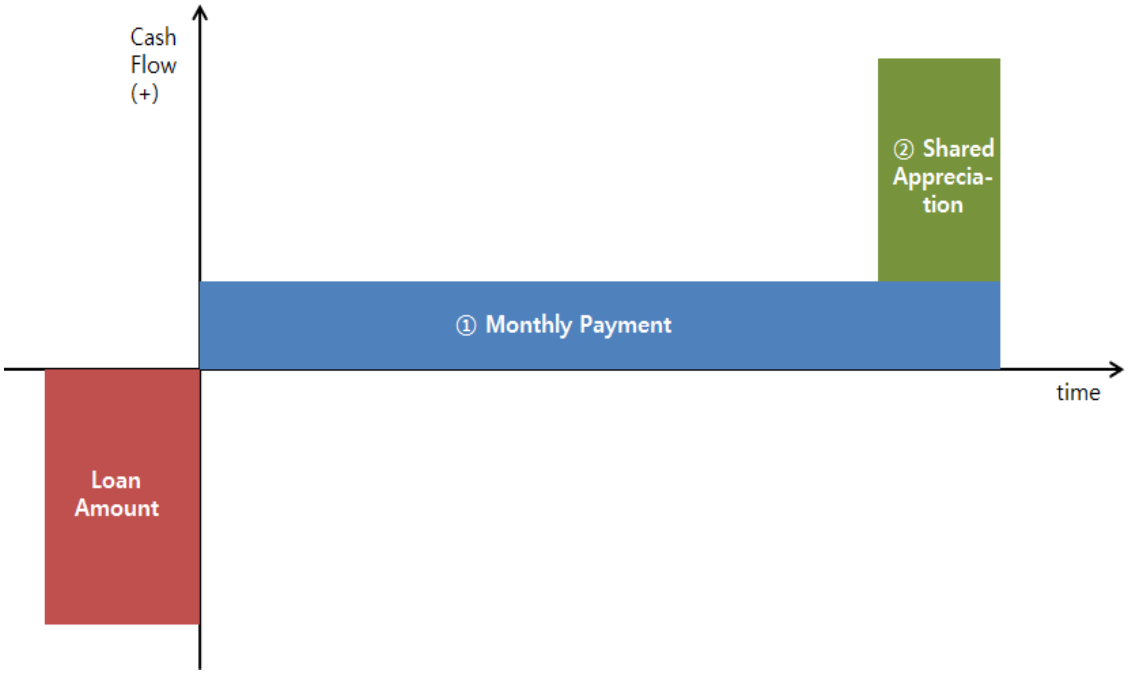
In the above, the term next to MonthlyPayment, $\frac{1-(1+r/12)^{-(20\cdot 12)}}{r/12}$, is the present value interest factor for an annuity (PVIFA) used to compute the present value of the interest and principal payments during the loan life (20 years), and $1/(1+r)^{20}$ is the present value interest factor (PVIF) for the shared appreciation amount (assuming the discount rate to be constant). Under the fully amortized principal with constant monthly payment, Monthly Payment is obtained by multiplying the mortgage constant, $\frac{i/12}{1-(1+i/12)^{-(20\cdot 12)}}$, with loan amount, L, where i represents the contract mortgage interest rate.

$$(2)\quad MonthlyPayment = L \cdot \frac{i/12}{1-(1+i/12)^{-(20\cdot 12)}}$$

As shown in Figure 1, there are three cash flow items to be assessed – the initial lending amount (L), the repayment stream of principal and interest, (1) in Figure 1, and the payment of the shared price appreciation, (2). Equation (1) simply states that, in the present value sense, L should be equal to sum of (1) and (2), and the fair (or effective) mortgage interest rate, r, is obtained with the condition of the two sides being equated.[2]

[2] For a more precise pricing, prepayment and default options should be reflected. As real loan performance data on SAM is not yet available, we omit that factor in our analysis.

**Figure 1. Cash Flow Structure of SAM**




To illustrate (in Table 3), suppose that a borrower purchases a residence worth of 200 million Korean Won (KRW, roughly 1000 KRW = 1 USD) by issuing SAM with 70% LTV, meaning that 140 million KRW is the loan amount. The average loan balance under this SAM contract is 73.78 million KRW, under the level payment of principal and interest, and the ratio of this to the property value at origination is 0.3689. This implies that the lender will receive 36.89% of capital gain. The cap on the amount of capital gain that the lender can receive is set at 3.5% yield per year on the average loan balance in loan life, generating 51.65m KRW(=73.78m x 20 x 0.035) as the maximum amount the lender can get under this contract. Hence, the actual amounts of SharedAppreciation under the two scenarios (100m KRW vs. 200m KRW capital gain) are 36.89m KWR under the first scenario and 51.65m KWR under the second one. Finally, the effective yields can be computed based on equation (1), 3.15% for Scenario 1 and 3.66% for Scenario 2.

If housing price depreciates, then there is no appreciation to share and, hence, the effective yield is same as the contract rate, currently 1.5%. Considering the maximum amount set by the cap, the possible range of effective interest rates for SAM in Korea is currently 1.5% to 3.66%. As stated earlier, SAADM has no such cap, hence no bound for the amount of capital gain in both price directions, and the gap between the contract and fair interest rates is determined by amount of housing price change between origination and maturity.

Table 3. Payment Scenarios of SAM

| | ①. 100 million KRW Capital Gain | ②. 100 million KRW Capital Gain |
|---|---|---|
| HP at origination | 200 million KRW | 200 million KRW |
| L (LTV=70%) | 140 million KRW | 140 million KRW |
| HP at maturity(20 yrs) | 300 million KRW | 400 million KRW |
| Capital gain (A) | 100 million KRW | 200 million KRW |
| Average loan balance (ALB)<br>(Ratio to HP at orig.) | 73.78 million KRW<br>(73.78/200=0.3689) | 73.78 million KRW<br>(73.78/200=0.3689) |
| Lender's share (B=A×ALB) | 36.89m =100m×0.3689 | 73.78m=200m×0.3689 |
| Limit on lender's share (B) | 51.65m=73.78m×20×0.035 | 51.65m=73.78m×20×0.035 |
| SA=Min(A, B) | 36.89 million KRW | 51.65 million KRW |
| Effective yield | 0.0315(3.15%) | 0.0366(3.66%) |

*Distribution of the effective yields*

In our data set, there are 2,257 cases of SAM and 582 cases of SAADM, all issued between October and December 2013. As we have a lot more SAMs in the DB, we will focus on the first type in the subsequent analyses.

In this section, we simulate forward-looking housing price changes by using an AR-GARCH model, to form a distribution of the effective yields as specified in equation (1). For simplicity, we do not reflect default and prepayment in the computation, and mainly gauges expected and extreme values of r derived from the cash flow identity. The simulation follows a bootstapping method by applying each of 3,000 housing price paths with 240 monthly repayments of interest and principal of a SAM contract. The housing price simulation takes the following five steps:

①. Using the log housing price growth rate (log difference of housing price index), we fit the following AR-GARCH model (To illustrate, assume AR(1)-GARCH(1, 1)):

Mean equation: $\Delta p_t = \beta \cdot \Delta p_{t-1} + \varepsilon_t$

Variance equation: $\sigma_t^2 = c + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 \sigma_{t-1}^2 + \upsilon_t$

where the lower case $p_t = \ln(P_t)$ (P being housing price level), and $\Delta p_t$ is a log difference.

②. From the above model, we capture the estimated residuals as unpredicted shocks, and form S as a group thereof:

$S = \{\hat{\varepsilon}_1, \hat{\varepsilon}_2, \ldots\ldots, \hat{\varepsilon}_n\}$

③. After imposing the initial value of $\Delta p_t$ as zero, we extract a random draw of the residual from S, to be referred to as $\hat{\varepsilon}_{s1}$, use that to compute $\Delta\hat{p}_1$ from the AR-GARCH model, and repeat that to compute $\Delta\hat{p}_2$ through $\Delta\hat{p}_{240}$ as the monthly housing price changes during the 20 years' loan life:

$$\Delta\hat{\rho}_1 = \hat{\beta}\cdot\Delta\rho_0 + \hat{\varepsilon}_{s1}$$
$$\Delta\hat{\rho}_2 = \hat{\beta}\cdot\Delta\rho_1 + \hat{\varepsilon}_{s2}$$
....
$$\Delta\hat{\rho}_{240} = \hat{\beta}\cdot\Delta\rho_{239} + \hat{\varepsilon}_{s240}$$

④. Putting 100 as the initial value for P, we compute a path of housing prices over 240 months as:

$$\hat{P}_1 = 100\cdot\exp(\Delta\hat{\rho}_1)$$
$$\hat{P}_2 = \hat{P}_1\cdot\exp(\Delta\hat{\rho}_2)$$
---
$$\hat{P}_{240} = \hat{P}_{239}\cdot\exp(\Delta\hat{\rho}_{240})$$

⑤. We repeat the third to fourth steps 3,000 times to form a forward-looking distribution of the housing price paths.

Next, we compute the effective yield for each of the 3,000 housing price paths based on equation (1), to form a distribution of r along with its expected and tail values. In our simulation analysis, we use the condominium price indices published each month by the Korean Appraisal Board for the last ten years. Table 4 shows average (monthly) nominal housing changes in different geographical areas, which demonstrates a drastic shift in the growth rate over time between the capital vs. non-capital regions. That is, in the first five years (2003~08), the capital region handsomely surpasses the other in the average price growth, but the trend inverts itself in the next five years with a much faster price growth in the non-capital region. To be conservative in our simulation analysis, we use the capital region housing price indices, which record a lower average growth rate than its counterpart during the last ten years.

Table 4. Patterns of Housing Price Changes (Capital vs. Non-capital Regions)

| Period | Korea | Capital Region | 5 Other Cities |
|---|---|---|---|
| 2003.12-2013.12 | 0.31% | 0.26% | 0.34% |
| 2003.12-2008.12 | 0.46% | 0.68% | 0.15% |
| 2008.12-2013.12 | 0.16% | -0.15% | 0.53% |

The specification test with the condominium price indices from the capital region indicates AR(2)-GARCH(1,0) to be the best model, whose results for the mean and variance equations are shown in Table 5.

Table 5. AR(2)-GARCH(1,0) Model Estimation

(a) Mean Equation

| Variable | Coefficient | Std. Error | z-Statistic |
|---|---|---|---|
| AR(1) | 1.2094 | 0.1021 | 11.8482 |
| AR(2) | -0.4040 | 0.0799 | -5.0545 |

(b) Variance Equation

| Variable | Coefficient | Std. Error | z-Statistic |
|---|---|---|---|
| C | 6.93E-06 | 6.96E-07 | 9.9623 |
| RESID(-1)^2 | 0.7068 | 0.1576 | 4.4855 |

Following the 5-step simulation procedure, a distribution of the average annual price growth rates out of the 3,000 housing price paths computed (for 20 years) is shown in Figure 2. The expected price growth rate is 2.77% with the maximum and the minimum being 10.44% and -5.66%, respectively.

As a next step, we estimate a distribution of the effective yields based on equation (1). The result (Figure 2) shows that, as expected, the minimum and the maximum are 1.5% (representing no price appreciation) and 3.66% (the maximum given the cap), and that the outcomes are concentrated close to those bounds as the product is structured such that the yields cannot go beyond each bound. The expected value of the yields is 3.08%, which is slightly higher than the conventional FRM product for first-time home buyers (which is currently 3%). The spread, 8 bps, represents compensation to the lender for the uncertainty caused by the home price movement during the loan life. Treating the standard deviation of the yields as a proxy of lending risk, the excess yield per unit of risk is 0.1, which is fairly small compared to the general risk spread used in the capital market. However, given that SAM is supposed to provide the social objective of promoting housing affordability for first-time home buyers and that is first offered fairly recently as a pilot program, it appears to be pre-mature to conclude whether or not its pricing is adequate.

When facing the 1% stress home price path, the yield for SAM is still 1.5%, which is about 1.5% lower than the conventional FRM product. That represents a stress loss to NHF, by roughly 1.3% given its average cost of capital being 2.8%. The outcome is same under 5% stress scenario as well.

**Figure 2. Distributions of Forward-Looking HP and Effective Yields**

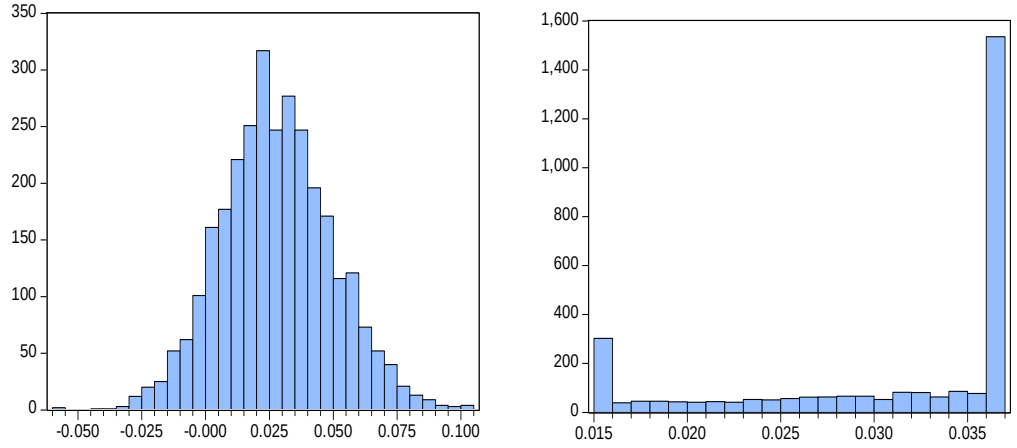



Table 6. Summary Statistics of HP and Effective Yields

| | Average annual HP growth rate (20 years) | Effective interest rate |
|---|---|---|
| mean | 2.77% | 3.08% |
| median | 2.67% | 3.65% |
| max | 10.44% | 3.66% |
| min | -5.66% | 1.50% |
| Bottom 1% | -2.54% | 1.50% |
| Bottom 5% | -0.66% | 1.50% |
| Bottom 10% | 0.14% | 1.59% |
| Standard Deviation | 2.18% | 0.77% |

## 4. Consumer Choice Patters

To identify determinants of consumer choice for SAM over the conventional FRM, we estimate a logistic regression model by using loan-level data for the SAM contracts and other NHF loans for first-time buyers. The data set includes loans originated in October through December 2013 with variables on loan amount, appraised value of collateral, age (of borrower), family size, gender, marital status, location of collateral, and other loan characteristics.

The sample encompasses 2,257 cases of SAM and 7,522 cases of the conventional FRMs. As shown in Table 7, both average loan amount and average housing price are higher for SAM borrowers, while they are younger on the average than FRM borrowers. As to the other demographic characteristics,

SAM borrowers tend to have a bigger family size (on the average), more likely to be male and married, and to be more concentrated in the capital region.

The LTV variables show interesting patterns in that, while the average LTV is about 7%p higher for SAM borrowers, they tend to be concentrated a lot more in the highest LTV bucket: that is, 37% of the SAM borrowers are in the LTV level between 60~70, whereas that figure is only 13% for the FRM borrowers. The outcome implies that the SAM product is well utilized by wealth-constrained borrowers in Korea, much more so than by the FRM borrowers. As to the housing price changes, the SAM contracts are issued more frequently in the areas of price decline (or of weak price appreciation): the average condominium price growth rates in the locations where collaterals reside are 2.9% for FRMs and -0.9% for SAMs, supporting the adverse selection issue discussed earlier. This outcome is related to the fact that SAM borrowers are also more concentrated in the capital region, where the property values are depressed during the last three years (a total depreciation of 6.3% in the capital region vs. a strong appreciation of 22.84% in the non-capital region).

Table 7. Summary Statistics of the Testing Sample

| | FRM | | | SAM | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Obs. | Mean | S.D | Obs. | Mean | S.D | Obs. | Mean | S.D |
| Loan amount(m KRW) | 7522 | 103 | 48.39 | 2257 | 137 | 38.95 | 9779 | 111 | 48.51 |
| Housing price(m KRW) | 7522 | 219 | 87.64 | 2257 | 252 | 74.62 | 9779 | 226 | 85.93 |
| Age(of borrower) | 7522 | 38.57 | 7.87 | 2257 | 36.76 | 5.62 | 9779 | 38.15 | 7.45 |
| Family size | 7522 | 2.72 | 1.22 | 2257 | 3.10 | 1.05 | 9779 | 2.81 | 1.19 |
| Gender(male=1) | 7522 | 0.70 | 0.46 | 2257 | 0.83 | 0.38 | 9779 | 0.73 | 0.44 |
| Married(married=1) | 7522 | 0.70 | 0.46 | 2257 | 0.88 | 0.32 | 9779 | 0.75 | 0.44 |
| Capital(capital region=1) | 7522 | 0.68 | 0.47 | 2257 | 0.81 | 0.39 | 9779 | 0.71 | 0.45 |
| Size(㎡) | 7522 | 67.15 | 15.02 | 2257 | 71.03 | 13.09 | 9779 | 68.04 | 14.69 |
| LTV(L/HP) | 7522 | 0.48 | 0.13 | 2257 | 0.55 | 0.09 | 9779 | 0.49 | 0.13 |
| LTV < 30(dummy) | 7522 | 0.14 | 0.34 | 2257 | 0.02 | 0.14 | 9779 | 0.11 | 0.31 |
| LTV 30_40(dummy) | 7522 | 0.13 | 0.34 | 2257 | 0.06 | 0.23 | 9779 | 0.11 | 0.32 |
| LTV 40_50(dummy) | 7522 | 0.17 | 0.38 | 2257 | 0.15 | 0.35 | 9779 | 0.17 | 0.37 |
| LTV 50_60(dummy) | 7522 | 0.44 | 0.50 | 2257 | 0.41 | 0.49 | 9779 | 0.43 | 0.50 |
| LTV 60_70(dummy) | 7522 | 0.13 | 0.33 | 2257 | 0.37 | 0.48 | 9779 | 0.18 | 0.38 |
| HP Growth Rate(Last 3 years) | 7522 | 0.03 | 0.14 | 2257 | -0.01 | 0.11 | 9779 | 0.02 | 0.14 |

Table 8. Average HP Growth Rates (for December 2010 – December 2013)

| | Growth Rate |
|---|---|
| Capital region | -6.30% |
| Seoul | -8.19% |
| Gyeonggi-do | -4.68% |
| Incheon | -7.36% |
| 5 Other cities | 22.84% |
| Busan | 16.72% |
| Daegu | 35.03% |
| Daejeon | 12.85% |
| Kwangju | 28.60% |
| Ulsan | 21.88% |

It is likely that income-constrained borrowers prefer SAM as payment burden is lower due to the lower contract rates, and that residents where property values are depressed more frequently choose SAM over FRM as expected capital gain therein would be lower. As shown in Table 7, wealth-constrained borrowers also prefer to choose SAM (as demonstrated by the high concentrations in the higher LTV buckets). In the following, we empirically test effects of various loan, borrower, and collateral characteristics on consumer choice between SAM and FRM by estimating the binary logistic regression models. The results are in Tables 9 and 10.

Model 1 in Table 9 shows that the probability of choosing SAM goes up as housing value gets higher, possibly due to increased payment burden with more expensive property and consumer's strategy to reduce that with SAM. The probability of choosing SAM also goes up (given other included factors being constant) as borrowers' age go down and as they are married. These results may be caused by the likelihood that, as living expenditure as a ratio to disposable income increases, consumers tend to resort to SAM. Male borrowers prefer SAM over FRM, which may imply that male is more pessimistic about future housing price path. At this point, however, there is no hard evidence to support that. Those borrowers who reside in the capital region tend to choose SAM more than those in the non-capital region, possibly due to the declining housing prices therein in recent years.

The most striking result out of our analyses is the LTV effect. As shown in Models 1 of Table 9, the higher the LTV variable, the higher the probability to choose SAM. When replacing the continuous LTV variable with the categorical ones, it is clearly shown that the probability rises monotonically with the LTV buckets, and that, in the highest LTV bucket of 60-70, the probability is far greater than those in the lower ranges. As computed in Table 10, the marginal effects of the LTV bucket dummies are highly non-linear: that is, ceteris paribus, the probability increases by 2.51%p for LTV 30~40 (with LTV less than 30 as reference group), 6.58%p for LTV 40~50, 8.27%p for 50~60, and 24.02% p for 60~70. The result indicates that there exists a strong demand for affordable mortgage products (SAM and others) in the high-LTV ranges by wealth-constrained borrowers in Korea.

Table 9. Results of the Logistic Regression Analyses

| Variable | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
|---|---|---|---|---|---|---|---|---|
| | Coeff. | S.E. | Coeff. | S.E. | Coeff. | S.E. | Coeff. | S.E. |
| C | -6.590* | 0.283 | -4.817* | 0.274 | -4.450* | 0.305 | -4.242* | 0.256 |
| Housing price | 0.004* | 0.000 | 0.004* | 0.000 | 0.004* | 0.000 | 0.004* | 0.000 |
| Age | -0.031* | 0.005 | -0.030* | 0.005 | -0.030* | 0.005 | -0.030* | 0.005 |
| Family size | 0.110* | 0.031 | 0.102* | 0.031 | 0.100* | 0.031 | 0.101* | 0.030 |
| Gender | 0.419* | 0.066 | 0.424* | 0.067 | 0.426* | 0.067 | 0.427* | 0.067 |
| Married | 0.704* | 0.092 | 0.708* | 0.093 | 0.713* | 0.093 | 0.714* | 0.093 |
| Capital | 0.725* | 0.067 | 0.753* | 0.068 | 0.265 | 0.190 | - | - |
| Size | 0.000 | 0.002 | -0.001 | 0.002 | 0.000 | 0.002 | - | - |
| LTV | 7.204* | 0.308 | - | - | - | - | - | - |
| LTV 30_40 | - | - | 1.054* | 0.183 | 1.057* | 0.183 | 1.058* | 0.183 |
| LTV 40_50 | - | - | 1.819* | 0.168 | 1.817* | 0.168 | 1.816* | 0.168 |
| LTV 50_60 | - | - | 2.026* | 0.160 | 2.027* | 0.160 | 2.027* | 0.160 |
| LTV 60_70 | - | - | 3.183* | 0.165 | 3.185* | 0.165 | 3.186* | 0.164 |
| Growth rate | - | - | - | - | -1.831* | 0.673 | -2.707* | 0.234 |

* Statistically significant at 1% significance level

In Model 3, we replace the location dummy with the realized housing price changes by city during the last three years. The result shows that, the higher the price appreciation, the lower the probability to choose SAM, which is robust in both Model 3 and Model 4. With the location-specific price variable included, the dummy variable for the capital region is no longer statistically significant, supporting that those in the capital region choose SAM due primarily to the state of housing price changes.

The marginal effects computed in Table 10 shows extent of change in the probability of choosing SAM as the local housing price grows by 1% (given other factors as constant), as borrower age goes up by one year, as family size increases by one person, and the local housing price growth rate rises by 1%p. For dummy variables, the effects represent changes in the probability when each variable takes value of zero vs. unity. As discussed earlier, the effects of the higher LTV buckets are by far greater than others, although one should be careful when interpreting the results as the units of measurement differ across the variables.

Table 10. Marginal Effects

| | Base | Change | ΔProbability |
|---|---|---|---|
| Housing price | 226.0 | 1% up | 0.01% point up |
| Age | 38.2 | 1 year up | -0.04% point down |
| Family size | 2.8 | 1 person up | 0.15% point up |
| Gender | 0 | 1 | 0.72% point up |
| Married | 0 | 1 | 1.41% point up |
| LTV 30_40 | 0 | 1 | 2.51% point up |
| LTV 40_50 | 0 | 1 | 6.58% point up |
| LTV 50_60 | 0 | 1 | 8.27% point up |
| LTV 60_70 | 0 | 1 | 24.02% point up |
| Growth rate | 2.02% | 1% point up | -0.04% point down |

## 5. Concluding Remarks

Our results indicate that the SAM product in Korea serves its social function of enhancing affordability in home acquisition by wealth-constrained borrowers. More than anything else, the LTV effect is shown to be strong in that, the higher the LTV bucket, the more likely consumers choose SAM over other mortgage products. In particular, in the highest LTV range of 60~70, the marginal probability to choose SAM, ceteris paribus, 24%p, far higher than the lower LTV ranges. The outcome implies that there is a strong demand for affordable mortgage products in the LTV ceiling and SAM appears to serve them properly.

Nonetheless, we find an evidence of adverse selection in that those consumers residing in areas of weak housing price appreciation tend to prefer SAM. This outcome implies that actual loss to SAM investor would be higher than originally anticipated. In terms of pricing, our simulation results indicate that the current contract rate of SAM is adequate overall but slightly underpriced, which would be justified as it is a new product and NHF may prefer an advantage in attracting credit-constrained borrowers. Further investigation is warranted as to risk-return profiles of the SAM products by reflecting a more diverse set of stress scenarios.

As the Korean experience matures, a more diverse set of SAM products can be explored. As mentioned at the outset, the new and innovative SAM products are being introduced in the literature, and some of them may even be traded in market place. As one illustration, the SAM products in the U.S., usually issued by local public entities, takes a second mortgage. As described by Guttentag (2001), the city of Burbank's Mortgage Assistance Program offers home buyers a 30-year second mortgage loan, with zero interest and no payments for the first 5 years, after which the principal must be repaid over 25 years at 5%. In exchange, the city receives a share of the appreciation in the house

when it is sold.[3] We hope that more research and sharing (of findings) are done internationally as to performance and product features of SAM so that international best practices emerge in instituting this affordability enhancement loan product with minimal side effects. Furthermore, whether a private market solution is feasible or not is another area that interested analysts must put heads together as a future research issue.

[3] The share is equal to the amount of the second mortgage as a percent of the sale price. For example, if the house is purchased for $250,000 (the maximum allowed) and the buyer takes the maximum second mortgage of $35,000, the city would take 14% of the difference between $250,000 and the price at which the house is sold. The buyer must put 3% down. Is this a good deal for home buyers?"; The Burbank program is similar to programs offered by a number of other cities in California and Oregon (Guttentag, 2001)

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