

Home Reversion in Singapore: Preliminary Evidence of Demand and Feasibility

Education Professor KWONG Koon Shing, PhD, FSA, CERA
Practice Assistant Professor GOH Jing Rong, PhD, FIA, FSAS, CERA

Redesigning Home Reversion Products to Empower Retirement for Singapore's Public Flat Owners

by Koon Shing Kwong *  , Jing Rong Goh  , Jordan Jie Xin Lee  and Ting Lin Collin Chua 

School of Economics, Singapore Management University, Singapore 178903, Singapore

* Author to whom correspondence should be addressed.

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- Overview
 - Lease Buyback Scheme (LBS)
 - Enhanced Home Reversion (EHR)
 - Actuarial pricing model and tuning parameters
- Construction of EHR pricing model and comparisons with
 - Hong Kong Reverse Mortgage
 - LBS
- Some examples of EHR
- Conclusion



1. Singapore's CPF:

1. Inflow is Defined Contributions (by both employee and employer)
2. Outflow (aka CPF LIFE) is more similar to Defined Benefit, which pays a lifelong annuity.
 - However if u contribute more, then the monthly payout is greater



1. Singapore's HDB and LBS:
 1. About 80% of Singaporeans stay in Housing Development Board Flats.
 2. These flats are valuable, with some selling for millions of dollars.
 3. Many elderly have their equity held up in their homes.
 4. They need a way to release equity from their homes, and LBS/Home Reversion is a way to do so.



Lease Buyback Scheme's Drawbacks

1. No age-in-place
2. Lack transparency in pricing
3. Loss the flat ownership
4. Uniform pricing
- 5. More capital requirement per transaction**



Enhanced Home Reversion for HDB Flats

- Four benefits:
 1. Upfront cash payout to top up CPF Retirement Account and current financial needs (B1)
 2. Option of guaranteed staying in the flat for n months (B2)
 3. Right of age-in-place after n -months (B3)
 4. Term life-insurance protection (B4)



Advantages of Enhanced Home Reversion

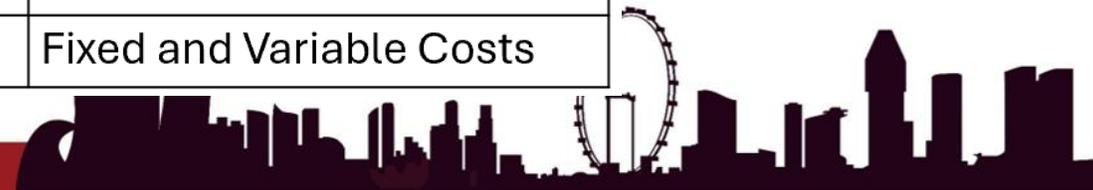
The benefits of the EHR can be summarized as follows:

1. Maintains all features of the LBS
2. Includes an age-in-place guarantee
3. Enables homeowners to keep a portion of the flat's value for inheritances or as a safety net against inflation or emergencies
4. Guarantees the return of the principal investment amount
5. Offers transparent and actuarially fair pricing
6. Requires less capital investment per transaction



Pricing Model Framework

Input Factors	Tools	Results
One or Two Owners	Survival Model	Probability of Survival
Age		
Gender		
HDB Flat Address	Property Evaluation (Accredited professional evaluation)	Flat value H_0
Remaining Lease Period		Monthly Rent R Remaining Lease RL
Total Initial Cash Outflow	CPF LIFE and owner's decision	$B1$
Guaranteed Staying Period	Owner's decision	$B2$
Monthly Discount Rate (i)	Kwong et al (2021)	$i(H_0, R, RL), \alpha(RL)$
Tuning Parameter (α)		
Operational Costs	Provider's decision	Fixed and Variable Costs



EHR Pricing Model

$$\phi H_0 = \underbrace{\theta H_0}_{\text{B1}} + \underbrace{\alpha \phi R \ddot{a}_{\overline{n}|}}_{\text{B2}} + \underbrace{\alpha \phi R A_{x:n} \frac{1}{v} \ddot{a}_{x+n}}_{\text{B3}} + \underbrace{\phi R (t-n)(v^n - A_{x:n} \frac{1}{v}) + A_{x:n} \frac{1}{v} \phi R \sum_{j=0}^{t-1} A_{x+n:t-j}^1}_{\text{B4}}$$

Total Cost

B1

B2

B3

B4

$$y_n = \left(\frac{\phi H_n - \phi R (t-n)}{\theta H_0} \right)^{\frac{1}{n}} - 1 \quad \text{for } K_x < n.$$

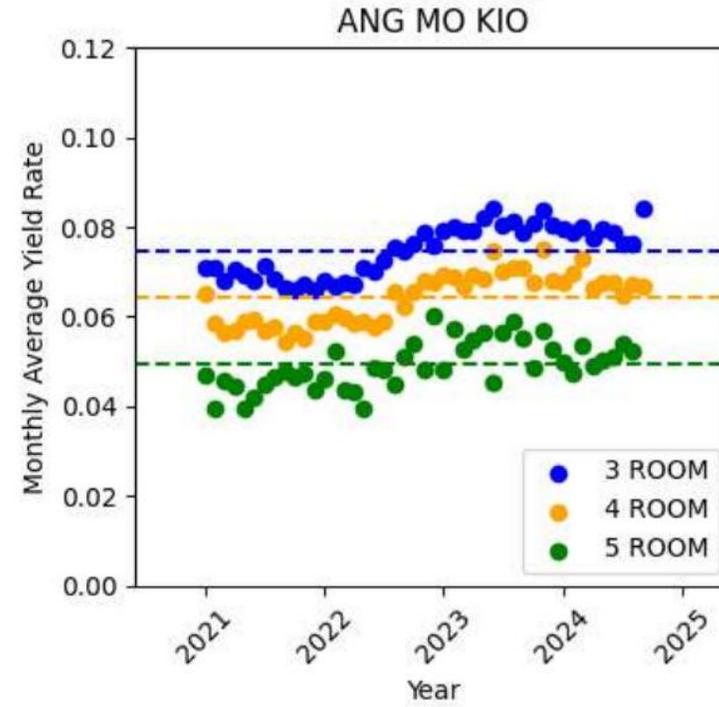
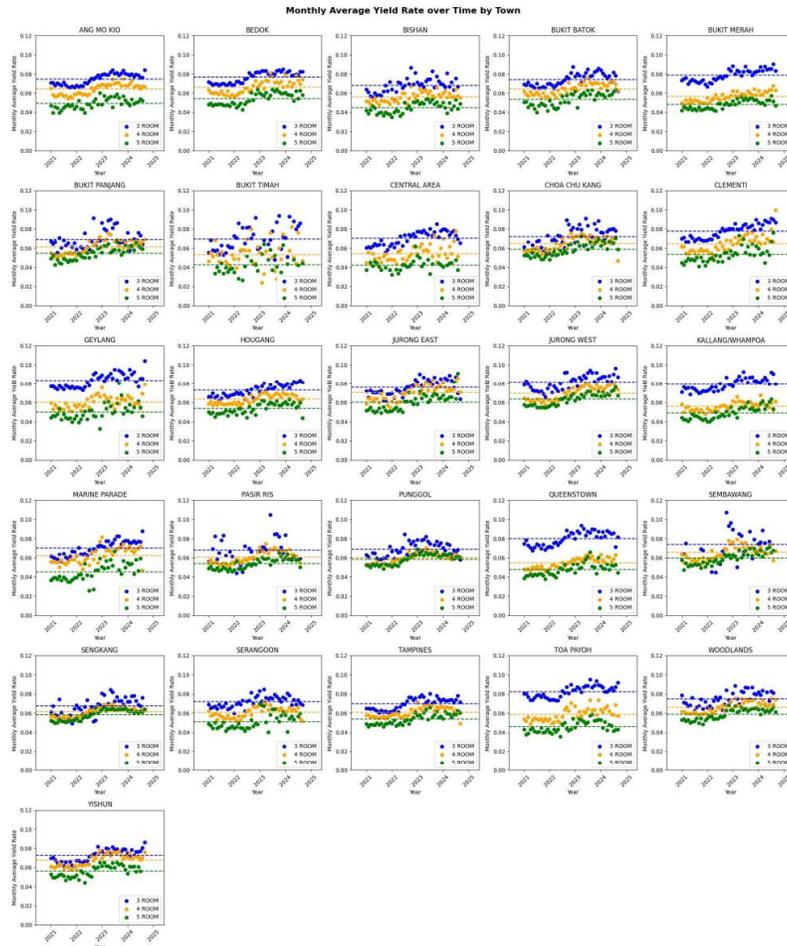
$$y_{K_x+1} = \begin{cases} \left(\frac{\phi H_{K_x+1} - \phi R (t - K_x - 1)}{\theta H_0} \right)^{\frac{1}{K_x+1}} - 1 & \text{for } K_x = n, \dots, t-1 \\ \left(\frac{\phi H_{K_x+1}}{\theta H_0} \right)^{\frac{1}{K_x+1}} - 1 & \text{for } K_x \geq t \end{cases}$$

θH_0

$\phi H_n - \phi R (t-n)$



Rental Yields



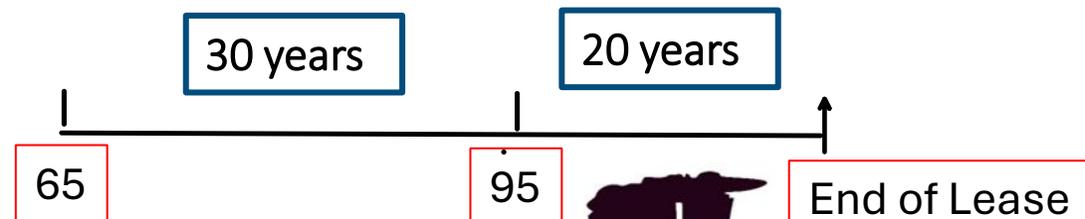
Pricing Model

Monthly Discount Rate (i)	Kwong et al (2021)	$i(H_0, R, RL), \alpha(RL)$
Tuning Parameter (α)		
Operational Costs	Provider's decision	Fixed and Variable Costs

$$R = \begin{cases} 0.07 \times H_0 \div 12 & \text{for 3 – room flats} \\ 0.06 \times H_0 \div 12 & \text{for 4 – room flats} \\ 0.05 \times H_0 \div 12 & \text{for 5 – room flats} \end{cases}$$

$$\alpha = \begin{cases} 0.75 & \text{for } \beta \geq 65 \\ 0.75 + 0.0025 \times (65 - \beta) & \text{for } 25 \leq \beta < 65 \\ 0.85 & \text{for } \beta < 25 \end{cases}$$

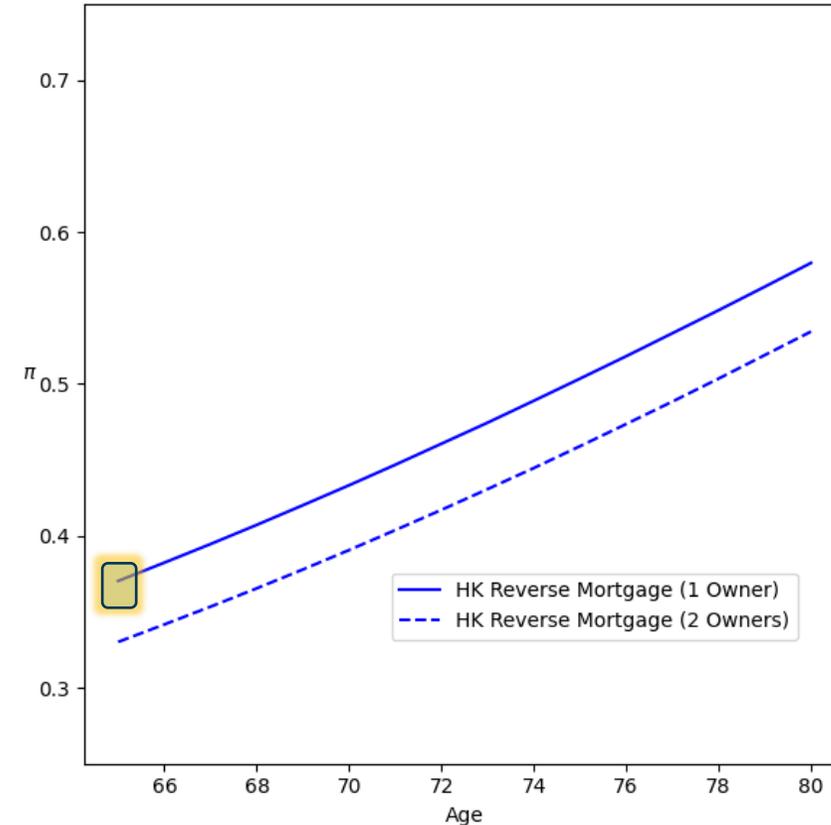
The remaining lease must be at least 20 years when the homeowner reaches 95 years old.



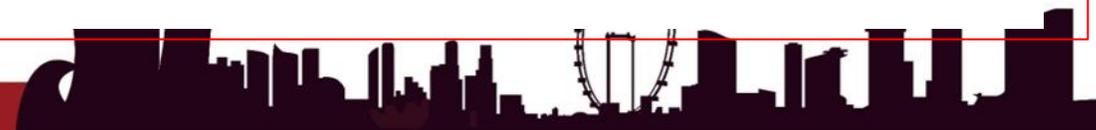
Hong Kong Reverse Mortgage

Upfront ratio π or LTV at different ages for Hong Kong Reverse Mortgage

No of Applicant(s):	<input type="text" value="1"/>
Age of Applicant(s):	65
Appraised Property Value ¹ :	HK\$ <input type="text" value="1,000,000"/>
Specified Property Value ² (for payout calculation):	HK\$ <input type="text" value="1,000,000"/>
Interest Rate Option:	Fixed Adjustable Rate First 25 years:4.5% per annum; thereafter at Hong Kong Prime Rate ³ minus 2.5% per annum
Interest:	Interest is calculated on the Outstanding Loan Balance on a monthly compound basis (Note: Hong Kong Prime Rate is quoted by The Hong Kong Mortgage Corporation Limited (HKMC) and is subject to change from time to time)
Lump-Sum Payout ⁴ :	Maximum amount ⁵ : <input type="text" value="HK\$ 388,770.00"/> Amount requested at drawdown: HK\$ <input type="text" value="0.00"/> (optional)



Upfront Ratio $\pi = \frac{\theta H_0}{\phi H_0}$, which is similar to loan-to-value (LTV) ratio in reverse mortgage



Bala's Table and HDB's LBS Pricing

TABLE SHOWING LEASEHOLD VALUES AS A PERCENTAGE OF FREEHOLD VALUE

Term of Years	Percentage (%) of Freehold Value	Term of Years	Percentage (%) of Freehold Value	Term of Years	Percentage (%) of Freehold Value
1	3.8	37	66.2	73	87.5
2	7.5	38	67.0	74	88.0
3	10.9	39	67.7	75	88.5
4	14.1	40	68.5	76	89.0
5	17.1	41	69.2	77	89.5
6	19.9	42	69.8	78	90.0
7	22.7	43	70.5	79	90.5
8	25.2	44	71.2	80	91.0
9	27.7	45	71.8	81	91.4
10	30.0	46	72.4	82	91.8
11	32.2	47	73.0	83	92.2
12	34.3	48	73.6	84	92.6
13	36.3	49	74.1	85	92.9
14	38.2	50	74.7	86	93.3
15	40.0	51	75.2	87	93.6
16	41.8	52	75.7	88	94.0
17	43.4	53	76.2	89	94.3
18	45.0	54	76.7	90	94.6
19	46.6	55	77.3	91	94.8
20	48.0	56	77.9	92	95.0
21	49.5	57	78.5	93	95.2
22	50.8	58	79.0	94	95.4
23	52.1	59	79.5	95	95.6
24	53.4	60	80.0	96	95.7
25	54.6	61	80.6	97	95.8
26	55.8	62	81.2	98	95.9
27	56.9	63	81.8	99	96.0
28	58.0	64	82.4		
29	59.0	65	83.0		
30	60.0	66	83.6		
31	61.0	67	84.2		
32	61.9	68	84.5		
33	62.8	69	85.4		
34	63.7	70	86.0		
35	64.6	71	86.5		
36	65.4	72	87.0		

- Bala's table provides the relationship between freehold properties and 99-year leasehold properties.
- Bala's table was originally an internal document of the colonial Land Office since around 1948.
- It is widely used in calculating Land Betterment Charge and Lease Renewal Premium since July 2000.

How can Mr & Mrs Lim unlock the value of their flat with the Lease Buyback Scheme?

- 1 Apply for Lease Buyback Scheme (LBS)**
 - Sell 35 years of tail-end lease to HDB worth \$190,000
 - Each owner receives \$95,000 for CPF top up
- 2 Top up CPF Retirement Account (RA)**
 - Each owner tops up their RA to the Basic Retirement Sum of \$102,900 (at age 65)
 - Couple has \$14,200 remaining and a CPF LIFE each
- 3 Receive LBS Cash Bonus**
 - As CPF RA top-up is more than \$60,000, couple qualifies for \$15,000 LBS Cash Bonus

Couple Profile
Mr & Mrs Lim, both 65 years old
Joint owners of fully paid 4-room flat

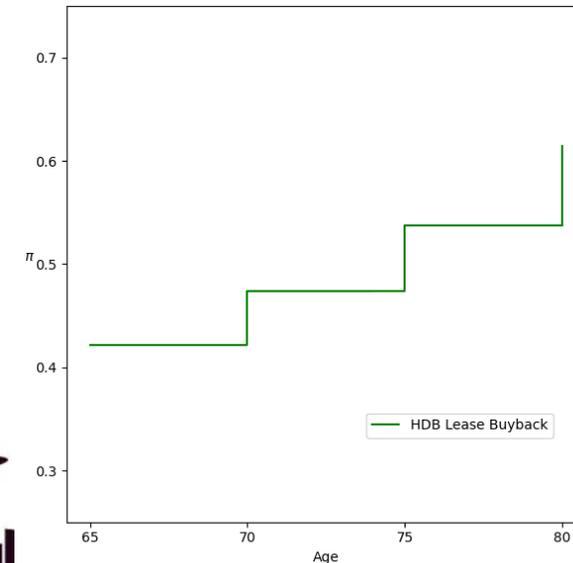
- Flat value - \$450,000
- Lease left - 65 years
- CPF RA Balance
• Mr Lim - \$20,000
- Mrs Lim - \$10,000

Total value unlocked by Mr & Mrs Lim

LBS Cash Proceeds \$14,200	CPF LIFE Payout (per month, for life) \$1,140 Based on \$175,800 top-up to couple's CPF RA and their RA balances	LBS Cash Bonus \$15,000
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Mr & Mrs Lim, both 65 years old, retains their flat with 30 years of lease remaining.

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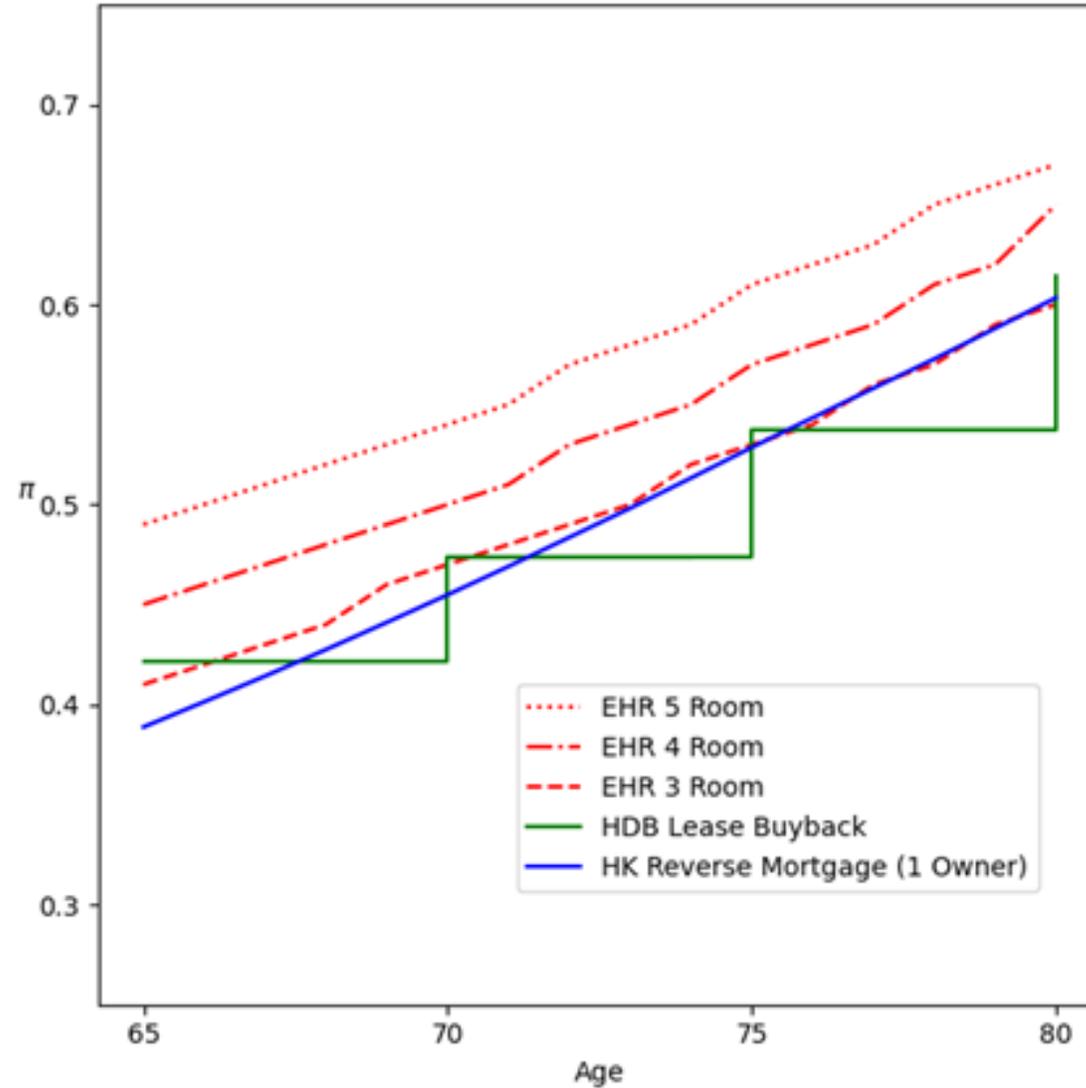
Comparison of Product Features

	EHR	LBS	Hong Kong Reverse Mortgage
Product Type	Sell-type	Sell-type	Loan-type
Upfront Ratio π	Flexible	Fixed	Flexible
Age-in-place	Yes	No	Yes
Flat Types	Public	Public	Public/Private
Ownership	Yes	No	Yes
Lease Requirements	20 years remaining at age 95	20 years remaining at age 95	Not considered



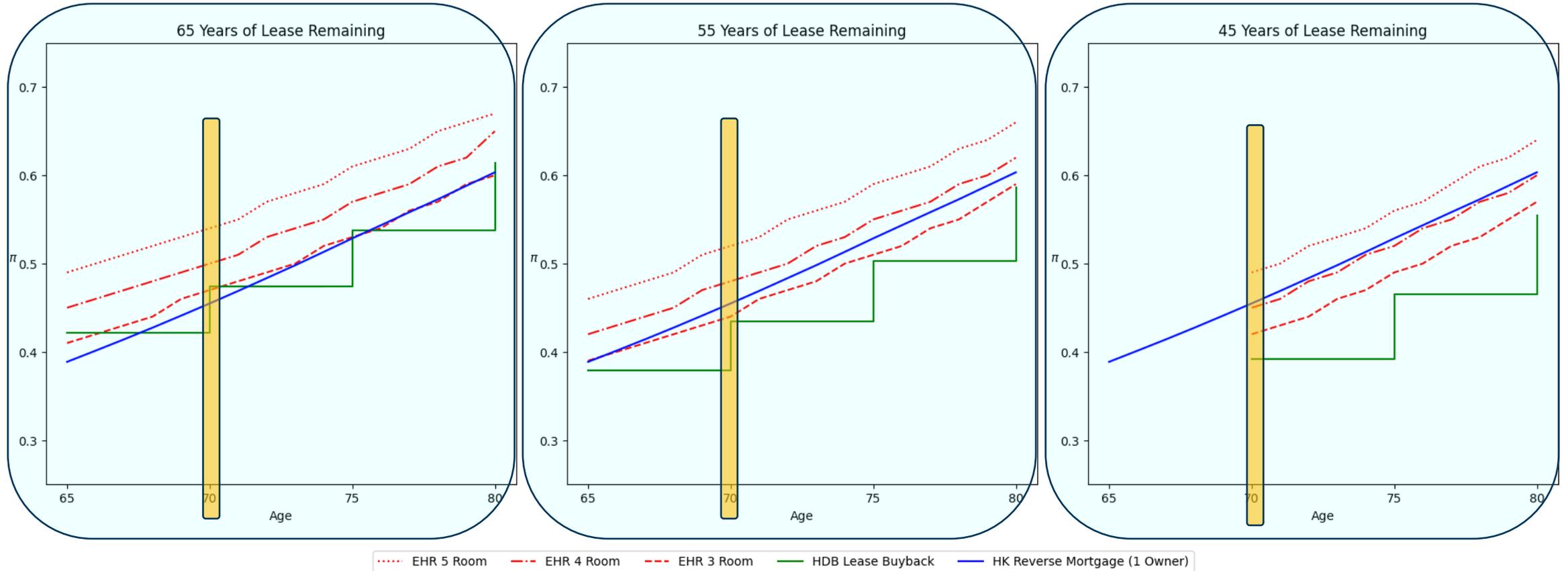
Comparisons of Upfront Ratios

Upfront ratio π by homeowner age for female flat owner with 65 years of remaining lease



Comparisons of Upfront Ratios with Different Lease Remaining

Upfront ratio π by homeowner age for female flat owner



Female Age

Housing Valuation

Rent Value

Remaining Lease

Female Homeowner CPF RA Balance

70

\$500,000

\$2,500

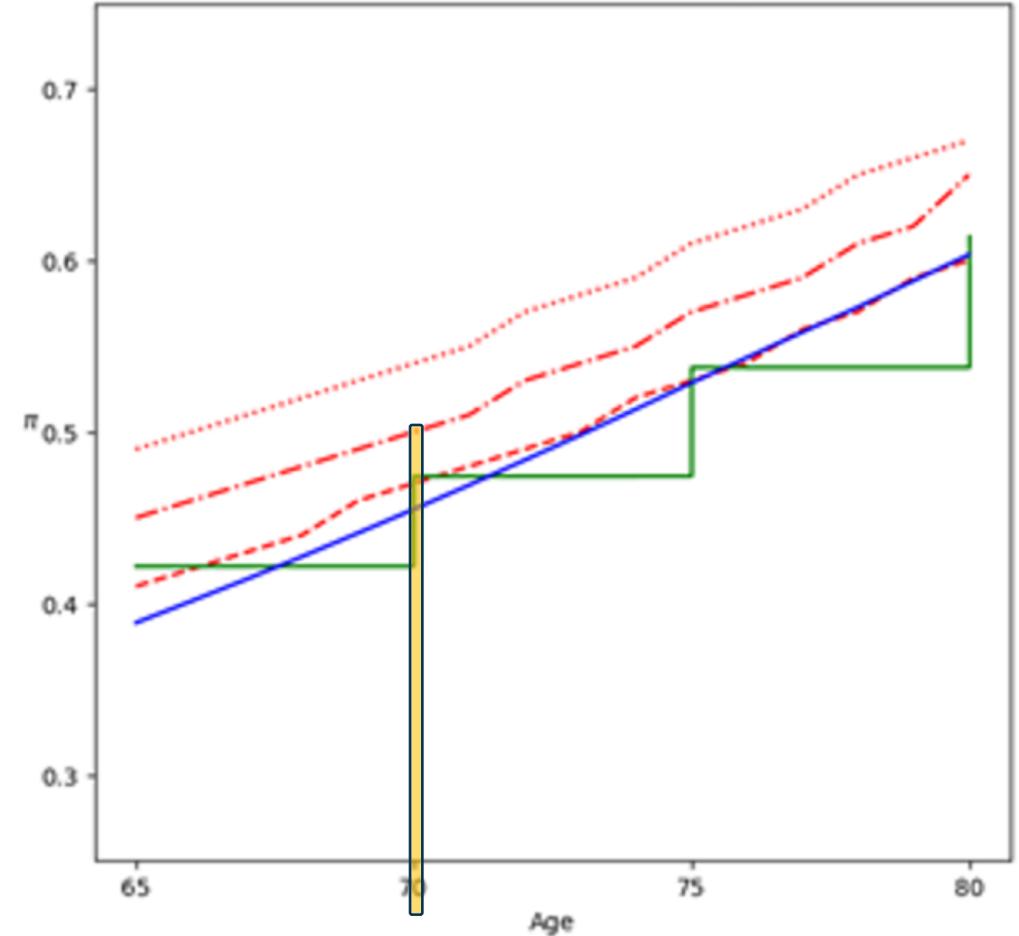
65 year(s)
0 month(s)

\$100,000

Lease Retained	LBS Cash Payout	LBS CPF Top-Up Amount	LBS Front-end Lease Value
25 Years	\$133,867 (26.8%)	\$103,000 (20.6%)	\$263,133 (52.6%)
30 Years	\$107,843 (21.6%)	\$103,000 (20.6%)	\$289,157 (57.8%)
35 Years	\$85,675 (17.1%)	\$103,000 (20.6%)	\$311,325 (62.3%)

EHR Guaranteed Stay Length	EHR Cash Payout	EHR CPF Top-up Amount	EHR Guaranteed Stay Value	EHR Rental Value	EHR Term Insurance Value	EHR House Value
0 Years	\$0 (0.0%)	\$103,000 (20.6%)	\$0 (0.0%)	\$96,311 (19.3%)	\$4,029 (0.8%)	59.3%
5 Years	\$0 (0.0%)	\$103,000 (20.6%)	\$39,449 (7.9%)	\$57,126 (11.4%)	\$2,309 (0.5%)	59.6%
0 Years	\$50,000 (10.0%)	\$103,000 (20.6%)	\$0 (0.0%)	\$143,064 (28.6%)	\$5,985 (1.2%)	39.6%
5 Years	\$50,000 (10.0%)	\$103,000 (20.6%)	\$58,599 (11.7%)	\$84,856 (17.0%)	\$3,429 (0.7%)	40.0%
0 Years	\$100,000 (20.0%)	\$103,000 (20.6%)	\$0 (0.0%)	\$189,817 (38.0%)	\$7,941 (1.6%)	19.8%
5 Years	\$100,000 (20.0%)	\$103,000 (20.6%)	\$77,749 (15.5%)	\$112,587 (22.5%)	\$4,550 (0.9%)	20.4%

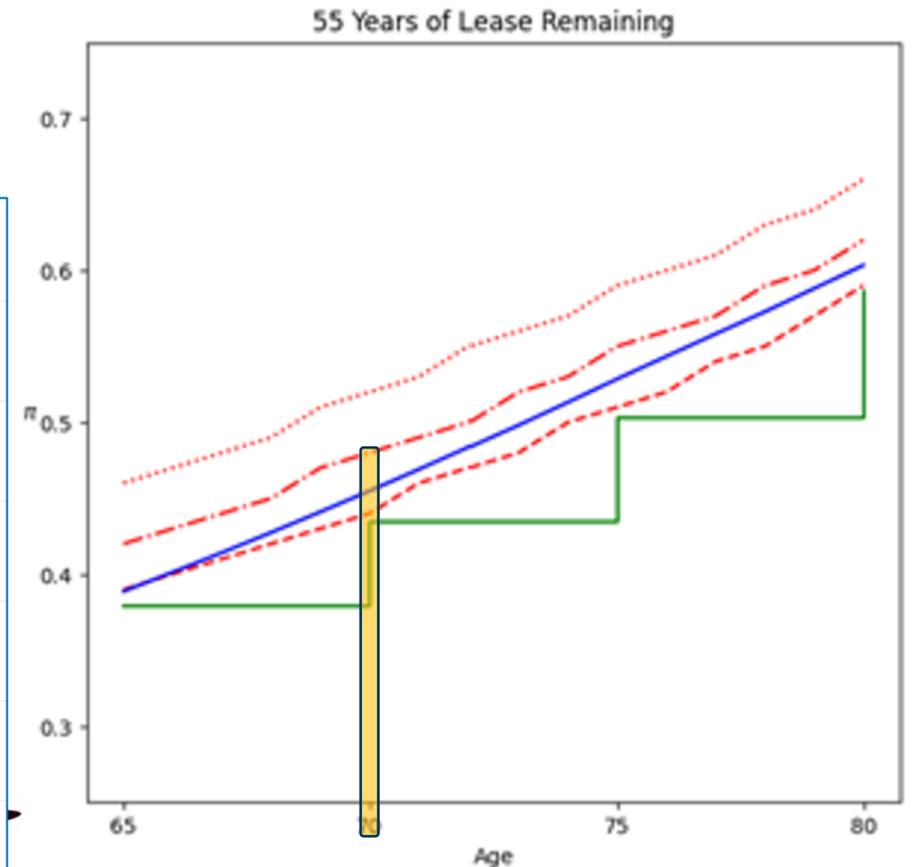
65 Years of Lease Remaining



Female Age	Housing Valuation	Rent Value	Remaining Lease	Female Homeowner CPF RA Balance
70	\$500,000	\$2,500	55 year(s) 0 month(s)	\$100,000

Lease Retained	LBS Cash Payout	LBS CPF Top-Up Amount	LBS Front-end Lease Value
25 Years	\$114,464 (22.9%)	\$103,000 (20.6%)	\$282,536 (56.5%)
30 Years	\$86,521 (17.3%)	\$103,000 (20.6%)	\$310,479 (62.1%)
35 Years	\$62,718 (12.5%)	\$103,000 (20.6%)	\$334,282 (66.9%)

EHR Guaranteed Stay Length	EHR Cash Payout	EHR CPF Top-up Amount	EHR Guaranteed Stay Value	EHR Rental Value	EHR Term Insurance Value	EHR House Value
0 Years	\$0 (0.0%)	\$103,000 (20.6%)	\$0 (0.0%)	\$105,177 (21.0%)	\$4,663 (0.9%)	57.4%
5 Years	\$0 (0.0%)	\$103,000 (20.6%)	\$42,778 (8.6%)	\$62,651 (12.5%)	\$2,826 (0.6%)	57.7%
0 Years	\$50,000 (10.0%)	\$103,000 (20.6%)	\$0 (0.0%)	\$156,234 (31.2%)	\$6,926 (1.4%)	36.8%
5 Years	\$50,000 (10.0%)	\$103,000 (20.6%)	\$63,544 (12.7%)	\$93,065 (18.6%)	\$4,198 (0.8%)	37.2%
0 Years	\$100,000 (20.0%)	\$103,000 (20.6%)	\$0 (0.0%)	\$207,291 (41.5%)	\$9,190 (1.8%)	16.1%
5 Years	\$100,000 (20.0%)	\$103,000 (20.6%)	\$84,310 (16.9%)	\$123,478 (24.7%)	\$5,570 (1.1%)	16.7%



Female Age **Housing Valuation** **Rent Value** **Remaining Lease** **Female Homeowner CPF RA Balance**

70

\$500,000

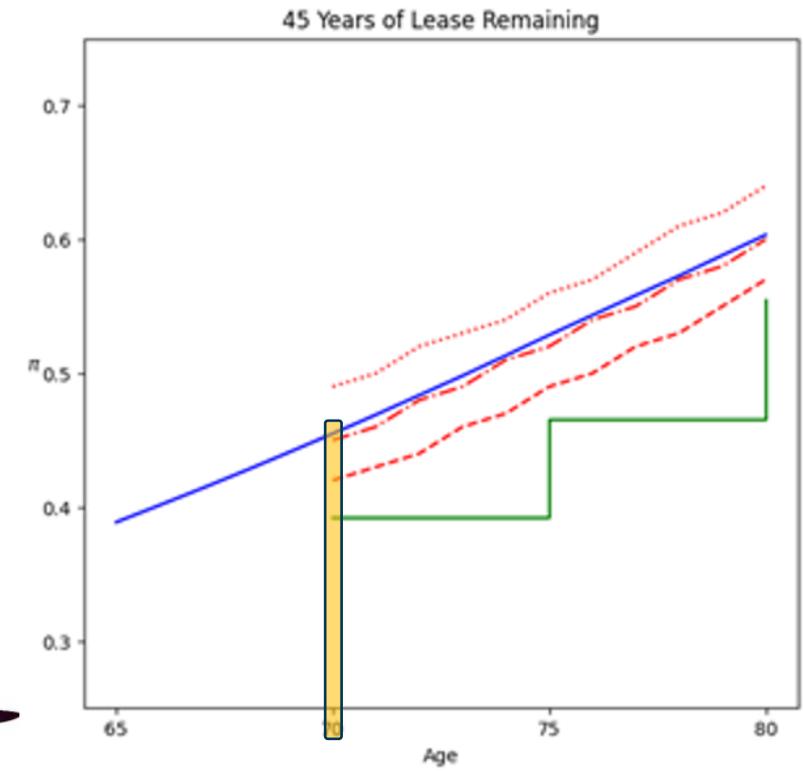
\$2,500

45 year(s)
0 month(s)

\$100,000

Lease Retained	LBS Cash Payout	LBS CPF Top-Up Amount	LBS Front-end Lease Value
25 Years	\$92,822 (18.6%)	\$103,000 (20.6%)	\$304,178 (60.8%)

EHR Guaranteed Stay Length	EHR Cash Payout	EHR CPF Top-up Amount	EHR Guaranteed Stay Value	EHR Rental Value	EHR Term Insurance Value	EHR House Value
0 Years	\$0 (0.0%)	\$103,000 (20.6%)	\$0 (0.0%)	\$117,888 (23.6%)	\$5,640 (1.1%)	54.7%
5 Years	\$0 (0.0%)	\$103,000 (20.6%)	\$47,255 (9.5%)	\$70,851 (14.2%)	\$3,637 (0.7%)	55.1%
0 Years	\$50,000 (10.0%)	\$103,000 (20.6%)	\$0 (0.0%)	\$175,116 (35.0%)	\$8,377 (1.7%)	32.7%
5 Years	\$50,000 (10.0%)	\$103,000 (20.6%)	\$70,194 (14.0%)	\$105,245 (21.0%)	\$5,403 (1.1%)	33.2%
0 Years	\$100,000 (20.0%)	\$103,000 (20.6%)	\$0 (0.0%)	\$232,343 (46.5%)	\$11,115 (2.2%)	10.7%
5 Years	\$100,000 (20.0%)	\$103,000 (20.6%)	\$93,133 (18.6%)	\$139,639 (27.9%)	\$7,169 (1.4%)	11.4%



When EHR compared to the LBS,

- The EHR product offers more benefits and options for homeowners
- The EHR pricing is more competitive, transparent and actuarially fairer
- The EHR product requires less capital per transaction and focuses on the direct benefit of homeowners

