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*by*

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## **Monetizing Housing Equity to Generate Retirement Incomes\***

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### **ABSTRACT**

The public housing program and the unique way of financing housing through the mandatory savings system in Singapore have created a class of homeowners. This paper compares the instruments available to different flat owners to monetize their assets, including the Lease Buyback Scheme (LBS), subletting, downsizing and reverse mortgage. We estimate the present value of retirement incomes derived from these options by incorporating the survival probability which is forecasted using the Lee-Carter demographic model.

We compare the monthly payouts that can be unlocked and discuss the tradeoffs of adequate retirement with the elderly preference for leaving a bequest and ageing in place. Our results show that LBS is the most attractive option. It allows the elderly to age-in-place while generating a steady stream of monthly drawdown and possibility of leaving a bequest. Subletting releases housing equity while retaining the asset. This helps the elderly to fulfill their bequest motive. Reverse mortgage is the least attractive option, yielding the lowest retirement income due to high loading factors.

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## **1. Introduction**

Many developed countries finance old-age pension using PAYG-defined benefits (DB), which was introduced when populations were relatively young. With ageing population, falling contributors-benefactors ratio, the DB schemes became financially unsustainable. For example, Australia, Denmark, Germany, the Netherlands and Switzerland have introduced various forms of funded defined contribution (DC) as alternative pillar to reduce the financing burden.<sup>1</sup> The United States, once dominated by DB plans, now sees a shift towards DC plans. In 1980, roughly three quarters of retirement plans are DB plans compared to 73% DC 401(k) plans in 2005. (Porteba et.al, 2007).

Singapore relies almost exclusively on a fully funded mandatory DC system since 1955. The system, based on individual accounts, is administered and managed by the Central Provident Fund (CPF) Board. As it links benefit closely to contribution, CPF avoids the sustainability issue as in DB. However, since retirement savings under DC depends on accumulation (which hinges on employment profiles) and investment returns, retirement adequacy may be at issue.

An important policy concern is how the elderly can independently finance their retirement. Chia and Tsui (2003) showed that the CPF mandatory saving scheme is inadequate to meet the retirement needs of the elderly. Inadequacy arises because of higher medical inflation and cost of living. It is also caused by smaller accumulated

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<sup>1</sup> See Palacios and Pallares-Miralles (2000) for countries with alternative pillars.

savings balance at retirement due to pre-retirement withdrawals and investment risks. CPF allows members to withdraw their savings for housing and healthcare financing as well as for asset enhancement through investment.<sup>2</sup>

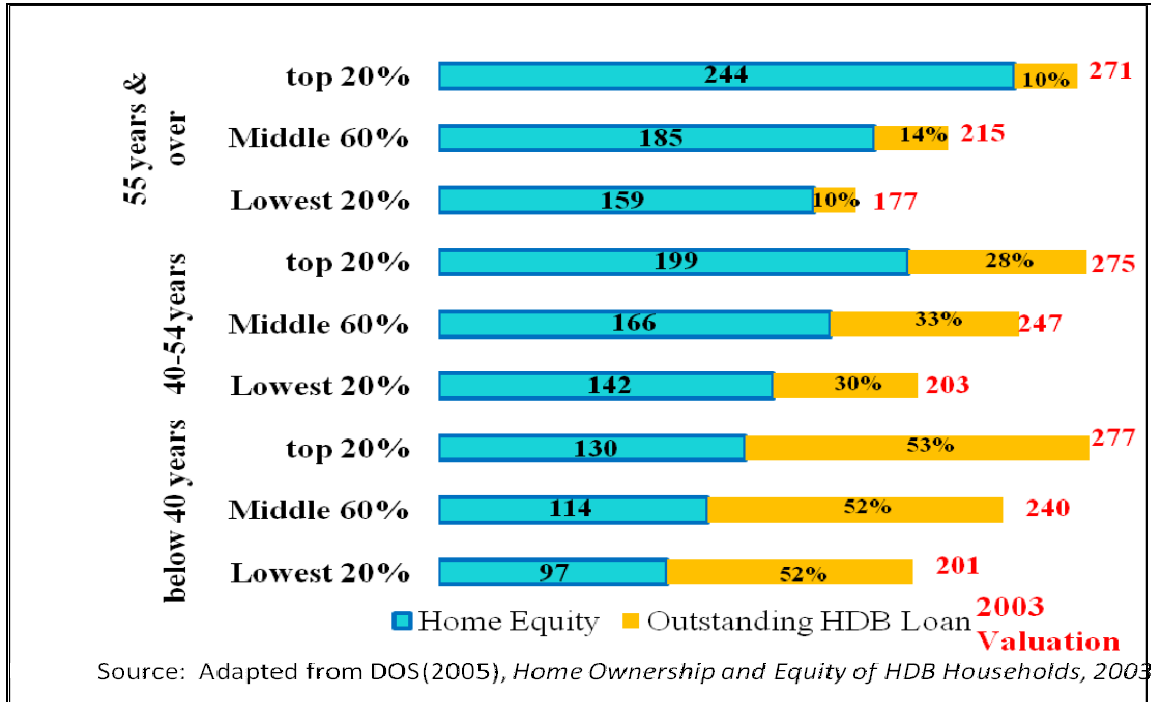
Indeed, the liberalized use of compulsory savings to help finance housing has converted retirement wealth into housing wealth and has created a class of “asset-rich and cash-poor” Singaporeans. This empirical observation is consistent with McCarthy *et al.* (2002) who demonstrate that a typical Singapore worker would have around 75% of his retirement wealth in housing asset from age 50. Such a concentration surpasses that of an American elderly household who would have 20% of their retirement wealth in housing asset. The average home equity of households staying in public housing is estimated at \$154,000, which is 3.3 times the annual household income (Department of Statistics, 2005).<sup>3</sup> Figure 1 shows the net and gross house value by age and income groups. Compared to younger home-owners, older home-owners have larger housing equity and smaller outstanding home loan. The elderly households have outstanding home loan at about 12% of the current market value; and even the lowest income elderly household has housing equity of \$159,000. The spread between gross and net value of housing for younger households is wider. They have home equity constituting slightly more than half of the market value of the flat.

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<sup>2</sup> Details on the CPF scheme are discussed in Chia and Tsui (2003).

<sup>3</sup> Home equity refers to the amount the home-owner gets when the home is sold and the outstanding mortgage is repaid. It is the difference between the estimated market valuation and the outstanding loan from the HDB.

**Figure 1:  
Asset-rich Singaporeans**



This paper examines various ways to unlock housing equity to supplement CPF savings for retirement. We calculate the present value of the unlocked housing equity and their corresponding monthly payouts. They include the reverse mortgage (RM), subletting, downsizing and lease buyback scheme (LBS). Using Singapore data, we illustrate the feasibilities of these instruments and how each option entails trade-offs (e.g. retirement adequacy, leaving a bequest and ageing in place). Except for RM, most monetization schemes involve some elements of government subsidies. Under LBS, homeowners sell the tail-end of the flat lease to HDB, and are able to age-in-place in their own flats. In addition, they receive an up-front lump sum subsidy \$5,000. The value unlocked depends on both the property value and the length of remaining lease. For both

LBS and RM, the elderly can age-in-place. Under LBS, the value is unlocked upon retirement. For RM, homeowners receive a steady stream of cash flows by borrowing against the value of their homes and repay the loans upon death. Under downsizing, elderly homeowner sells the flat to buy either a smaller HDB flat from the resale market or a studio apartment from HDB. The value unlocked from downsizing can be used to purchase annuity product. For subletting, the housing equity is retained thus making leaving a bequest possible. We compute rental incomes from subletting under different rental market environments.

The paper is organized as follows: Section 2 gives a brief overview of the housing policy in Singapore, highlighting how housing policies have led to a creation of asset-rich Singaporeans. Section 3 compares the different monetization options, and Section 4 concludes with policy recommendations.

## **2. Housing Market and Housing Finance in Singapore**

After independence from the British in 1959, the new Singapore government was resolved to tackle housing shortages which saw many living in slums. The Housing Development Board (HDB) was set up in 1960 to build “emergency” public housing on state-owned land. Initially, the focus of HDB was to provide affordable rental housing. However in February 1964, with a view that home ownership gives people a stake in the country, HDB introduced the home ownership scheme to encourage existing tenants to buy their flats by offering subsidized mortgage loans with an attractive repayment scheme.

The loan quantum was set at 80% of the price of a new flat with repayment periods of either 5, 10 or 15 years. Despite this, home ownership rate remained low. After two years into the implementation, home ownership was only 5%. This was due to affordability problems. At that time, being at the early stage of economic development, purchasing power was low. To ease financing difficulty on the demand side, a new mechanism was introduced in 1968. Mandatory individual retirement savings accounts under the Central Provident Fund (CPF) can be withdrawn to pay for down-payment, stamp duty, mortgage payments and interest incurred for the housing purchase.<sup>4</sup>

The CPF Approved Housing Scheme marked the beginning of a series of schemes in which mandatory savings were used in relation to housing finance.<sup>5</sup> CPF, which was instituted in 1955, was originally a retirement savings scheme. It is fully funded, with mandatory defined contribution for both employee and employer to contribute a proportion of the wage directly into the employees' personal accounts.<sup>6</sup>

Besides easing housing finance, to achieve a “nation of homeowners”, HDB dished out generous subsidies and supply side regulations. First, HDB set strict

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<sup>4</sup> As of today, over 70% of flat owners service housing loans solely with CPF savings. (HDB Annual Report).

<sup>5</sup> In 1981, CPF savings can be withdrawn to finance private residential private property. Over time, besides serving as a retirement vehicle, CPF becomes an important instrument to help finance merit goods such as education and health care. Chia and Tsui (2005) studied the link between the medical savings account and health care financing in Singapore.

<sup>6</sup> In 1955, the total contribution rate was only 10%. Since 1968, contribution rates have increased, reaching a peak at 1984 at 50%. The rate is now about 33% and varies according to age.

eligibility criterion to make rental unattractive or unavailable for the majority. Second, through subsidies, public housing was priced affordably below market prices. These subsidies are financed from taxes or other government revenues; and also from land rents through state ownership and acquisition since 80% of the land in Singapore are owned by the state. Under the Land Acquisition Act, the government is empowered to acquire land at its discretion from private land owners and at prices below market prices.<sup>7</sup> Compared to private sector developers who have to purchase or cost land at market rates, producer costs for public sector housing is thus lower and HDB is able to sell its flats below market prices.

HDB, as the sole public housing developer, is also exposed to risks such as interest rate risk, credit risk and liquidity risk. HDB receives subsidies in terms of government grant and loan. The grant is used to cover the HDB's deficit.<sup>8</sup> Government loans are used to finance its operations. The Housing Development Loans from the government is used to finance the development programs and operations. Interest rate for these loans is pegged at two percentage points above the floating CPF interest rate with a repayment term of 20 years. Next the Mortgage Financing Loans finance the mortgage loans granted to HDB flat buyers at concessionary loan rates. The mortgage rate is

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<sup>7</sup> For example, between 1973 and 1987, the government acquired land under the Land Acquisition Act at 1973 rates rather than at market rates of compensation.

<sup>8</sup> For example, in the fiscal year 2006/2007, HDB received \$740 million to cover the deficit. (HDB, Annual Report 2007, p.11).



pegged at 0.1% above the interest rates paid by the CPF for the compulsory savings and is about 2% below the housing mortgage interest rates of commercial banks.<sup>9</sup>

Hence demand side instruments make owning a public flat more affordable and the supply side instruments support HDB as a public housing provider. Both these have skewed the housing tenure choice towards the owner-occupied public housing. This is evidenced from the fall of HDB rental occupancy of 100% in the early 1960s to 76% at the end of 1970 and to 38% in 1981 and finally to just 7% in 2002. After almost four decades since the inception of Home Ownership Scheme in 1964, 79% of Singapore's population housed in almost 900,000 HDB flats; flats; with 93% of the public housing residents owning the units they occupied. Furthermore, HDB flats constitute 80% of the residential housing stock in Singapore.<sup>10</sup>

One consequence of the owner-occupied housing policy is that housing becomes the most important non-financial assets for Singaporeans. This can be gleaned from Table 1. Compared to France (47%), Japan (40%), US (28%) and UK (34%), Singapore has the highest ratio of household residential property assets relative to total assets (51%). This is also true for housing asset relative to personal disposable income and GDP. In the National Survey of Senior Citizens (2005), almost two-thirds of elderly aged 60 and above reported housing among their assets and half of them cited their house being the most important asset they owned.

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<sup>9</sup> The CPF interest rate on the ordinary account is pegged to the average of 12-month fixed deposit and month-end savings rates of the local banks rate.

<sup>10</sup> See Singapore, Department of Statistics (2008), *Yearbook of Statistics 2008*.

**Table 1**  
**Household residential property asset ratios in 2000**

	<b>Housing Assets/ Total Assets (%)</b>	<b>Housing Assets/ Personal Disposable Income (%)</b>	<b>Housing Assets/ GDP (%)</b>
Singapore	51	452	230
United States	28	155	113
Japan	40	294	198
France	47	271	176
United Kingdom	39	292	197

Source: Singapore, Department of Statistics (2003) *Wealth and Liabilities of Singapore Household* Occasional Paper on Economic Statistics.

### **3. Retirement Income from Monetization Options**

The HDB-CPF link has helped in housing finance but has diluted its original intent as a retirement savings scheme. The issue is how to unlock the housing wealth to finance retirement. Artle and Varaiya's (1978) housing-oriented life cycle theory predicts that households should consume most, if not all, of the housing assets to maximize consumption. For examples, Venti and Wise (2001) and Mitchell and Piggott (2004) explore how RM can be used to finance retirement consumption in the US and Japan.

Monetization options depend on flat types. Table 2 shows that 3- and 4-room flats are the predominant flat types for the elderly households. About 40% of the elderly are in 3-room flats, 33% in 4-room, less than 20% in smaller flats. (HDB, 2005). Monetization options are not available for 1-roomers. The elderly in 3-room flats can

access all options. The elderly in a 2-room flat can consider the lease buyback scheme or downsizing. Reverse mortgage is only available to 3-room and 4-room flats. The Lease buyback scheme, a subsidy program for lower income elderly, is currently not available to elderly in the larger 4-room flat. See Table 3.

**Table 2:  
Housing types of elderly households and all households (%)**

Flat Types	Elderly Households	All Households
1-Room	8	2
2 –Room	9	3
3-Room	40	26
4-Room	33	38
5-Room	8	23
Executive	2	7

Source: HDB(2005). Public Housing in Singapore: Social Aspects and the Elderly, p. 112  
Notes: HDB flat types are classified by the number of rooms (which include the living room and bedrooms). Hence a 3-room flat will have one living room and two bedrooms.

**Table 3: Monetizing options available**

	Reverse Mortgage	Lease Buyback	Downsizing	Subletting
1-Room	x	x	x	x
2-Room	x	y	y	x
3-Room	y	y	y	y
4-Room	y	x	y	y

Note: ‘x’ means not available; ‘y’ means available

We estimate the amount of housing equities unlocked and the corresponding monthly annuity payouts under the various monetization options. Calibration is done for

male and female, both age 62. As future cash flows are contingent on the survival probability of the households, appropriate mortalities are incorporated to estimate the present values of retirement incomes. We used the well-established Lee-Carter (1992) model to forecast cohort survival probability at each post-retirement age using the Singapore abridged life tables. Details on the Lee Carter method are given in Chia and Tsui (2003). For sensitivity analysis, different interest rates are also used to compute the monthly annuity payouts under the various monetization options.

Before examining the options in detail, it is necessary to highlight an innovative HDB-CPF link to unlock the housing equity under the Lease Buyback scheme (LBS). This scheme is implemented in February 2009, which allows HDB to purchase the tail-end of the flat lease. The unlocked housing value is then used to buy annuity product under the CPF Life scheme. CPF Life operates like a deferred life annuity with a refund feature. CPF Life is an added feature to the DC system to ensure lifelong incomes for retirees.

In 1987, to ensure retirement adequacy, CPF introduced a minimum sum scheme. Under minimum sum, at age 55, members are not allowed to withdraw the entire amount of savings but have to set aside a decreed sum to support a basic standard of living during retirement. There are two options to decumulate the minimum sum. It can be deposited with CPF or a bank which pays a regular retirement income from age 62 for 20 years or till the sum is exhausted. Alternatively, the minimum sum is used to buy a deferred life annuity. However, very few opt for the second choice. This means most elderly are

exposed to the risk of outliving their minimum sum. In fact, this risk increases with longer life expectancy.

Decumulation options under the minimum sum scheme are replaced by mandatory annuitization under CPF Life scheme.<sup>11</sup> The Life scheme is also designed to balance the elderly's preference for meeting retirement needs and fulfilling bequest motives. Four options are available: the LIFE Balanced Plan (default), which strikes a balance between retirement income level and amount of bequest left; the LIFE Plus Plan, which gives a higher monthly income but leaves less for the estate; the LIFE Basic Plan, which allows more bequest at the expense of lower income; and the LIFE Income Plan, which delivers the highest income but leaves no bequest. For example, by opting for a latter drawdown age and refundable premiums, the elderly will start drawing down a lower annuity level at a later date so that more can be left as bequest.

### **3.1 Lease Buyback Scheme**

The LBS targeted at lower-income households in smaller flats. Unlike the elderly in bigger flats, they do not have the option of downgrading to smaller flats or subletting the flat. An estimated 20,000 elderly or 70% of 2 and 3-room flat owners are eligible for this scheme (Source: Singapore DOS, Census of Population 2000).

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<sup>11</sup> The Life scheme is mandatory for CPF members born after 1957 who have at least \$40,000 in their Retirement Account (RA); but is optional for members born before 1957.

HDB flats are not freehold but 100-year leasehold. They are thus like depreciating assets, with decreasing values as the leases run down. On average HDB flats are about 30 years old. The average remaining tail-end lease is around 70 years. Under LBS, HDB buys back the remaining lease. The longer the remaining lease, the more housing equity can be unlocked. Besides the value unlocked, sellers also received \$10,000 as cash transfer. Of which the seller can keep \$5,000. The remaining values have to be used to buy life annuity product under the CPF Life scheme. For example, if the HDB flat is currently 30 years old with a remaining lease of 70 years. The elderly is able to age in place for 30 years, and the remaining tail-end lease of 40 years is monetized to yield monthly payouts.

How HDB calculate the value of the tail end lease was not made known. By buying out the tail-end lease and allowing sellers to age in place, the seller implicitly is enjoying full rental subsidy from HDB. Thus, from accounting point of view, the current market value of the flat reflects two components - the implicit rental subsidy/yield and the present value of the tail-end lease (PVTEL). PVTEL can be estimated by taking the difference of the current market value and the imputed rental subsidy. However, when this procedure was used, the calibrated value did not match the published figure in the HDB webpage.

We thus compute PVTEL directly by estimating the present value at the beginning of the tail-end lease of the property net of depreciation. Using the reversed sums of digits methods give a more reasonable fit to the empirical data on property depreciation, which is gentler at the beginning but accelerates quickly towards the tail-

end of the leases. See Figures A1 and A2 in the Appendix 1. Other methods, such as straight line depreciation and declining balance, are not suitable. For example, straight line depreciation calculates the salvage value of the asset at the end of period and then expense the portion of original cost in equal increments over the period. The declining balance method considers assets most useful when they are new and provides for higher depreciation charge in the first year of the asset life and gradually decreasing it.

For a 3-room flat with current market value at \$236,000 and a tail-end lease of 40 years, the estimated present value of housing value unlocked is \$109,000. The level monthly annuity generated from the unlocked home value is given in Table 4. The value unlocked for a 2-room flat with the same tail-end lease is \$79,200.

**Table 4**  
**LBS for 2-room and 3-room flats with 70 years remaining lease (S\$)**

	62	65	70
<b>2-room flat (\$79,200)</b>			
Male	508-530	550-574	606-630
Female	454-476	482-508	528-550
<b>3-room flat (\$109,000)</b>			
Male	694-724	759-790	832-864
Female	620-650	668-698	726-756

Note: The range in the monthly draw-downs corresponds to different interest rates (3.75% and 4.24%). These were the interest rates assumptions used by HDB in LBS calculations.

Figure 2 shows the monthly annuity payouts from the CPF LIFE through LBS of 2-room and 3-room flats. The longer the remaining leases, the higher the monthly payouts. The monthly payouts depend also on the interest rates assumptions and the drawdown age. Because of longevity, monthly payouts are lower for female than male.

Table 5 reports the average monthly payouts from LBS for the elderly by flat-type, age and gender. We presented the payouts without loading and with different loading assumptions. For viability and to insure against risks and uncertainties, loading factors are typically added by annuity providers. Our estimates are different from those reported by HDB. To gauge the extent of loading, we set loading factors at 5%, 10%, 15%, 20%, 25%, 30% and 35%, respectively. Regardless of gender and age, monthly payouts decrease with increases in magnitude of the loading factor. For example, when the loading factor is at 30%, the estimated monthly payout is \$545 for the male elderly at age 62 and \$489 for the female elderly at the same age. When the loading is at least 30%, the simulated figures are closer to those reported by HDB.

**Table 5:**  
**Average monthly annuity from LBS for a 3-room flat using**  
**different loading assumptions**

	Male			Female		
	62	65	68	62	65	68
HDB*	510	535	585	485	505	555
<b>Loading</b>						
0%	709	774	848	635	683	741
5%	675	737	808	605	650	706
10%	645	704	771	577	621	674
20%	591	645	707	529	569	618
25%	567	619	678	508	546	593
30%	545	595	652	489	525	570
35%	525	573	628	470	506	549

Note: \* Numbers are from the HDB infoweb.



### 3.2 Subletting

The elderly also could sublet their flat. This option was made available in October 2003 to allow homeowners who have occupied their flats for at least 15 years to sublet their entire flat. Owners with no outstanding HDB loan could sublet after staying in the flats for 10 years. HDB imposed a minimum occupancy requirement as HDB flats are heavily subsidized and primarily is for meeting housing needs. To help unlock the housing equity, HDB has relaxed the subletting rules over the years. Currently, all HDB flats can be rented out so long as the owners meet the minimum occupancy requirement.<sup>12</sup>

Subletting allows the elderly to age-in-place within their familiar neighborhood while generating rental income. They can either rent out a room or sublet the entire flats by moving in with their married children. Subletting is not available to owners of smaller flat types (1- and 2-room). 53% of the elderly in 3- or 4-room flats are eligible. The diagonal cells in Table reflect the proportion of people who are contented with their existing flat types. As gleaned from Table 6, 75% of the elderly indicated that they prefer to age-in-place, with no intention to either upgrade or downgrade. The elderly in the smallest and largest flat type have the strongest preference to age in place. These elderly who had intention of ageing in place with their married children might have opted for bigger flat type, or their married children see less need to move out as there is adequate space in the bigger flats.

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<sup>12</sup>The minimum occupancy period is 5 years for subsidized flats (flats bought directly from the HDB or from the open market using the housing grant from CPF); and 3 years for non-subsidized flats (flats bought from the open market without a housing grant).

**Table 6:  
Elderly's Housing Preference**

Housing Type Content with	1-Room	2-Room	3-Room	4-Room	5-Room	Executive
Studio Apt	0.2	0.3	1.7	1.0	0.6	0
1-Room	<b>89.3</b>	14.7	2.7	1.1	2.5	0
2 –Room	5.4	<b>70.6</b>	2.9	2.9	0	0
3-Room	3.5	7.8	<b>77.3</b>	13.1	11.7	0
4-Room	0.9	2.5	9.9	<b>71.3</b>	1.5	11.2
5-Room	0.4	2.1	3.1	0.9	<b>71.4</b>	9.0
Exec Apt/HUDC	0	0	0.1	0.8	0	<b>79.8</b>

Source: HDB(2005). Public Housing in Singapore: Social Aspects and the Elderly, Table 5.19

We calibrate the present value of retirement income derived from subletting a single room. We assume a seven-year rental cycle, with seven years of upward trend followed by seven years of downward trend. Furthermore, rents vary according to the flat location (i.e. proximity to the central business district), condition of the room being sublet, accessibility to public transport and amenities. The range of rental incomes used in the calibration is \$450 to \$650 per month. A ‘cooling period’ of one and a half month is assumed. This is to account for the period of non-occupancy when the owner has to seek for another tenant.

The present value of the rental income at age 62 is then:

$$\sum_{j=1}^{360} v^j h^j {}_j p_{62} r_j$$

where  $r_j$  is the average rent for month  $j$  and  $h$  is the percentage increase (decrease) in rent over month  $j$ .  $v^j$  is the discount factor using different interest rates of 3.75% and 4.24%;  ${}_j p_{62}$  is the probability of surviving to  $j^{\text{th}}$  month at age 62.

We obtain the mean present value of rental income that can be generated. The computation also depends on interest rate assumptions. To reflect the volatility of the rental market we also present the PV of rental income for 5<sup>th</sup>, 50<sup>th</sup> and 95<sup>th</sup> percentiles. See Table 7.

**Table 7**  
**Incomes generated from subletting one room**

	Mean	5%	50%	95%
PV of rental income	86,576	76,021	85,764	100,054
Monthly payout				
Male	551 – 576	484 - 506	546 - 571	636 – 665
Female	492 - 516	432 - 454	487 - 512	569 - 597

### 3.3 Downsizing

Elderly homeowners also have the option of selling their flats. With the capital unlocked, they can either buy a smaller flat from the secondary resale market; or buy a subsidized studio apartment from HDB. HDB studio apartments (SA) are subsidized and have a lease with 30 years. The average price of a SA is \$80,000 for a 35 square meters unit and \$115,000 for a 45 square meters unit.<sup>13</sup> The median resale price of a 3-room and 4-room flats are \$236,000 and \$315,000 respectively.

Proceeds generated from downsizing can be used to top-up the CPF Retirement Account to enhance the retirement payout under the CPF Life scheme. Or they can buy

<sup>13</sup> For more information on the Studio Apartment, visit HDB's website: <http://www.hdb.gov.sg/>.

annuity products from insurance companies to provide an additional stream of cash flows. As proceeds from downsizing is an upfront lump sum, the amount unlocked is the difference between the revenue earned from selling the flat and the cost of buying a smaller flat. Table 8 shows that by downgrading from a 4-room to a 3- or 2-room flat, \$79,000 or \$132,000 can be cashed out to finance retirement needs. Households purchasing the 35 or 45 square meters SA can thus cash out \$235,000 or \$200,000 respectively. Homeowners of 3-room flats would be able to cash out S\$53,000 if they downgrade to a 2-room flat. More can be cashed out by downgrading to HDB studio apartment - \$156,000 or \$121,000 for 45 and 35 square meters SA respectively.

**Table 8**  
**Lump sum unlocked from downsizing**

	3-Room	2-Room	1-Room	Studio Apartment	
Market Valuations	236	183	148	80	115
3-Room (\$236,000)	NA	53	88	156	121
4-Room (\$315,000)	79	132	167	235	200

Notes: All figures are in \$1000. The market valuations of flats are based on median resale prices of HDB flats from 2007 Q2 to 2008 Q2. Data are obtained from HDB annual reports and HDB websites.

The lump sum received can be used to purchase an annuity product from insurance companies or to top-up the CPF Retirement Account of the elderly to increase the monthly payouts from the CPF Life scheme. Table 9 shows the monthly drawdown from home equity unlocked through downsizing.

**Table 9**  
**Monthly drawdown from home equity unlocked through downsizing**  
**from 3-room and 4-room flats**

<b>Downsizing from 3-room (\$236,000) to:</b>					
<b>Amount</b>	3-Room	2-Room	1-Room	SA(45m <sup>2</sup> )	SA(35m <sup>2</sup> )
<b>Unlocked</b>	..	53,000	88,000	121,000	156,000
Male	..	337 - 352	560 - 586	770 - 806	992 - 1038
Female	..	302 - 316	501 - 526	688 - 723	931 - 886
<b>Downsizing from 4-room (\$325,000) to:</b>					
<b>Amount</b>	3-Room	2-Room	1-Room	SA(45m <sup>2</sup> )	SA(35m <sup>2</sup> )
<b>Unlocked</b>	79,000	132,000	167,000	200,000	235,000
Male	502 - 526	840 - 878	1062 - 1110	1272 - 1330	1494 - 1564
Female	450 - 472	751 - 788	950 - 997	1137 - 1194	1330 - 1403

Note: There is a range in the monthly draw-downs, corresponding to different interest rates (3.75% and 4.24%) used in the calculations.

### 3.4 Reverse Mortgage

A local insurance firm, NTUC Income, launches the first RM scheme for private properties in 1998. The term RM is extended to public housing in March 2006. NTUC Income offers RM product to elderly at age 70, with conditions that there is little or no outstanding loan on the property and the remaining lease at the end of the loan period should be at least 50 years. RM scheme in Singapore is a term scheme that ceases upon age 90 or death, whichever is earlier. The maximum tenure of the loan is thus 20 years. The other provider, OCBC Bank offers RM for private properties only with two different loan options – term-based and annuity linked. Under the term-based option, the monthly payout is up to 25 years or when they reach 90 years of age, whichever is earlier. Annuity-linked option gives a lower payout but is payable for life. Term-based and

annuity-based are priced at varying annual interest rates, currently at 5 percent and 4.88 percent respectively.

Typically, RMs are “non-recourse” loans. An example is the Home Equity Conversion Mortgage (HECM), a RM insured by the US government. While property tends to appreciate and exceed accumulated loan balance, during times of continued depressed property cycle and high interest charges, the RM loan can possibly exceed the property value. When this happens, being a non-recourse loan, the mortgagor’s other assets cannot be used to repay the loan. The lender can only use the accumulated property value as security for the loan. This non-recourse feature is absent in the product offered by the providers in Singapore. Indeed, the loan quantum limit is set at 70% of the property value. Once the limit is reached, the monthly payout stops and the mortgagee have to make arrangements to repay the loan. Thus the RM scheme in Singapore works more like a collateralised loan.

The RM market in Singapore has remained thin. Both NTUC-Income and OCBC have now ceased issuing RM loans. Indeed, since inception in January 1997, the NTUC income has about 350 RM policy-holders for private properties. The average loan size for private property is over \$350,000, compared to less than \$200,000 for public housing. The amount of monthly advance is determined by factors such as the age of the homeowner, the valuation of the property, the loan period and the interest rate fluctuations. Table 10 shows the draw-down per month, assuming upfront fees of S\$3,500. The low levels of monthly draw-downs reflect the high loading factor in the providers’ calculations.

**Table 10**  
**Monthly draw-downs under the NTUC Income Reverse Mortgage Scheme (S\$)**

HDB Flat types	Estimated Property Value	Monthly Payouts
3-Room	160 000	200-230
4-Room	240 000	320-360
5-Room	320 000	430-490
Executive Apartment	480 000	660-750

Source: NTUC Income website: <http://income.com.sg/>

For our purpose, we want to compare unlocking housing equities under different monetization options, housing values unlocked are used to buy life annuities. For comparability with other monetization options, we construct a 30-year term RM with 70% loan limit and 30% loading, using the Lee-Carter stochastic probability of survival. Appendix 2 summarizes the steps taken to construct the mortality table using the Lee-Carter model.

#### **4. Discussions and Conclusion**

Tapping housing equity to supplement retirement income is an option for asset-rich and cash-poor homeowners. Since property values tend to move in tandem with inflation, monetizing housing equity provide protection against general price increase. How effective and how adequate are these options? Table 11 summarizes the expected present value of income stream generated by RM, LBS, downsizing and subletting and their corresponding average monthly draw-downs. For female, LBS generates the highest monthly payout (\$635). Subletting a room yields the lowest (\$504) payouts but the elderly retains the housing asset. Monthly payouts from downsizing (\$607) and RM

(\$560) 3-room flats are smaller compared to LBS. A similar pattern is also observed for male elderly.

In terms of financing retirement, LBS generates the highest monthly payout. For a 3-Room HDB, the monthly payout from monetizing housing equity using subletting and downsizing is smaller than that generated from LBS. About 18% of the elderly in-4 Room HDB prefers to downsize. They can unlock about \$87,000 and \$157,000 through subletting and downsizing respectively.

However, the elderly also have other social considerations. The elderly in Singapore have exhibited strong preference for ageing in place. Survey results conducted on the social aspects of the elderly (HDB, 2005) indicate that about three quarter of the elderly prefers to age in place, and that alternatives such as retirement village and old folk's homes are not popular among the elderly. Besides this, they also have strong bequest motives which explain why RM is not a popular choice among the elderly.

Indeed, these options involve trade-offs. Subletting, LBS and RM are viable options as they allow the elderly to age-in-place and generate a steady stream of monthly drawdown. Both subletting and LBS allow the elderly to age in place and generate a steady stream of monthly drawdown. As subletting releases only part of the housing equity, it is possible for the elderly to leave housing wealth as bequest. However, for LBS, bequest motive can be fulfilled if sellers choose to amortize the housing value through a particular CPF Life scheme – the CPF Life basic plan with refund. Under this plan, the annuity drawdown age is deferred to a later age which may affect retirement



adequacy. Similarly, RM allows the elderly to age-in-place. Possibility of bequest depends on the property values net of the accumulated loans at time of death.

**Table11:**  
**Summary of options and average monthly drawdown**

Flat types	Monetization	Average Income	Average Monthly drawdown	
	Options	Stream	Male	Female
<b>2-Room</b> (\$1190)*	LBS	79,200	515	462
<b>3-Room</b> (\$3230)*	LBS	109,000	709	635
	Downsizing	104,500	676	607
	Subletting one room	86,576	562	504
	RM*	165,200	581	560
<b>4-Room</b> (\$5600)*	Downsizing	157,000	783	770
	Subletting one room	86,576	432	423
	RM*	227,500	804	766

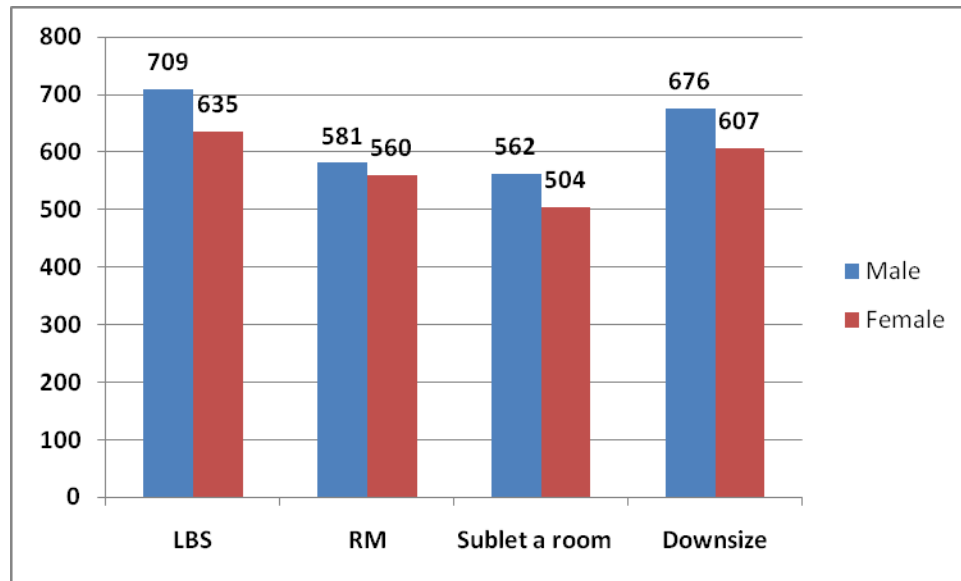
Note: \* median monthly income from work by HDB flat types (DOS, 2009).

Table 11 illustrates that LBS replaces about 45% of the employed household income for 2-room flat; and 25% for 3-room flat. To support a retirement lifestyle (using the recommended 70% earnings replacement ratio), the elderly will have to rely on other sources (such as the CPF savings and inter-generational transfers). The elderly needs also to be educated about the different methods of cashing out housing equity to generate old-age income so that they are able choose the method which best suit their retirement needs. See Figure 2.

We have demonstrated that monetizing housing asset can help to supplement retirement income in DB/DC schemes. Pre-retirement saving withdrawal converts

retirement savings to housing wealth, which allows the elderly to choose an option that balance their preference for retirement adequacy, ageing in place and leaving a bequest.

**Figure 2**



**Average monthly payouts generated from monetizing a 3 room flat**

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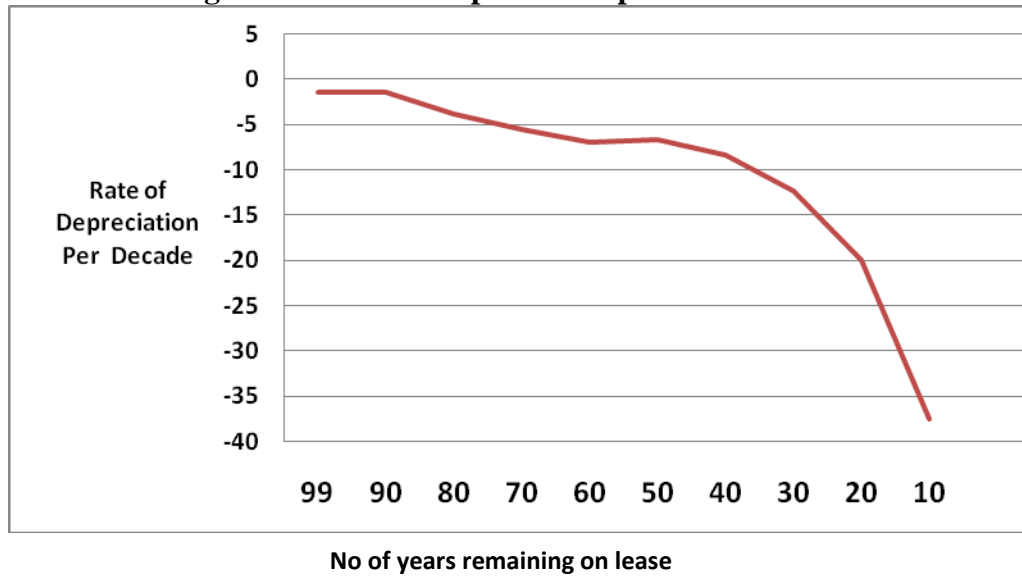
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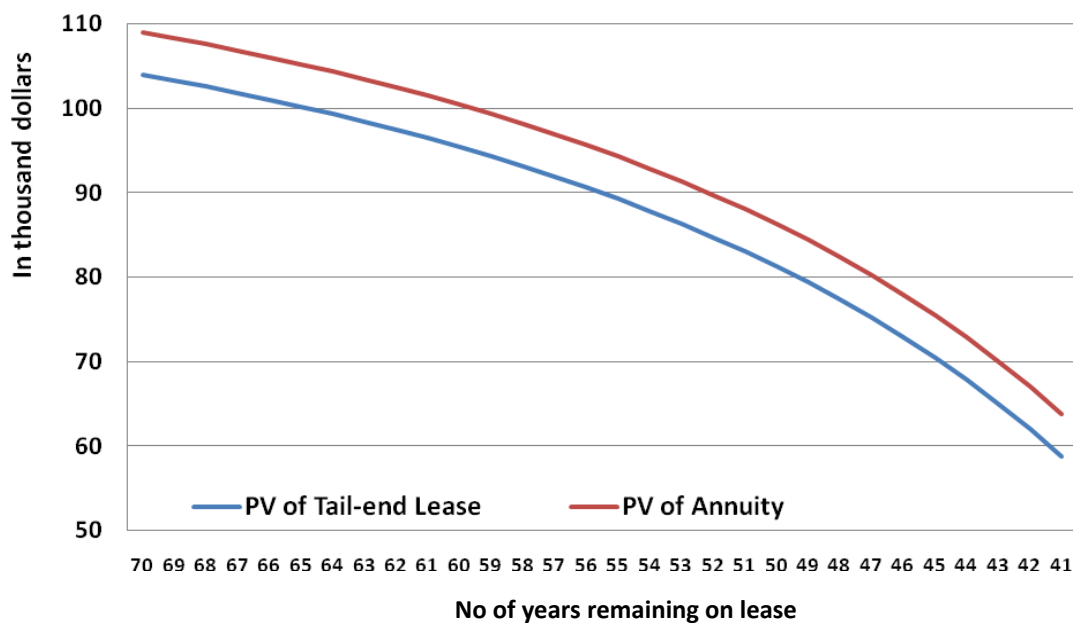
## Appendix 1

**Figure A1: Rate of depreciation per decade**



Source: Leasehold Table, Singapore Land Authority, Colliers (2005).

**Figure A2:  
Estimated Present Value of Tail-end Lease for a 3-Room HDB (\$236K)**



## Appendix 2: Construction of Mortality Tables

We predict the future mortality rates of the elderly based on the abridged life tables. We assume that the maximum lifespan of individuals in Singapore is 105 years. Individuals who are aged 62 in year 2009 will be 92 in 30 years' time; hence we need to project mortality tables from year 2009 to 2039. We use the following Lee-Carter (LC) model (1992, 2000) to fit mortality rates separately for the male and female elderly of age 60 to 85 and above:

$$\ln m_{x,t} = a_x + b_x k_t + \varepsilon_{xt} \quad (\text{A1})$$

$$k_t = \mu + \varphi k_{t-1} + \eta_t \quad (\text{A2})$$

where  $m_{x,t}$  is the central death rate in age class  $x$  in year  $t$ ;  $a_x$  is the additive age-specific constant, reflecting the general shape of the age schedule;  $b_x$  is the responsiveness of mortality at age class  $x$  to variations in the general level;  $k_t$  is a time-specific index of the general level of mortality;  $\mu$  and  $\varphi$  are parameters;  $\varepsilon_{xt}$  is the error to the actual age schedule, assuming to follow a normal distribution with zero mean and a constant variance; and  $\eta_t$  is the white noise.

There are three steps involved in the construction of the mortality tables. They are as follows:

**Step 1:** Construction of future mortality rates of the elderly based on the abridged life tables

Based on the available abridged life tables in Singapore, we first obtain estimates of the parameters  $a_x$ ,  $b_x$ , and  $k_t$  by the singular value decomposition method. The estimated values of  $k_t$  are then re-estimated either by matching the fitted total deaths with the actual deaths in year  $t$  or by matching the fitted life expectancy at birth with the actual life expectancy at birth in year  $t$ .

In their seminal paper, Lee and Carter (1992) re-estimate  $k_t$  by matching total deaths. This requires two additional pieces of information: the total deaths and the actual population by age. However, matching total deaths can introduce errors because total deaths or population counts could be inaccurate. On the other hand, matching the life expectancy at birth does not require any extra information beyond the observed mortality rates which are used to estimate the LC model. Recently, Lee and Miller (2001) re-fit the LC model on the US data and perform the second stage by matching the life expectancy at birth. This is a slight departure from the original LC approach, thereby avoiding the requirement of extra population data. While acknowledging that there may be differences in the outcome between the two second stage methods, these are generally

very small.<sup>14</sup> Owing to data limitation, we adjust  $k_t$  by matching the life expectancy at birth.

The second stage estimation is necessary because the fitted life expectancy at birth using the estimates obtained in equation (A1) from the first stage will generally not equal to the actual one reported in the abridged life tables. The adjusted  $k_t$  is used to identify a suitable time series model. By standard Box-Jenkins ARIMA modeling techniques, we find that the specification in equation (A2) is adequate. The estimates of  $\mu$  and  $\varphi$  are required to forecast  $k_t$  beyond the current calendar year. Finally we use the estimates of  $a_x$  and  $b_x$  together with the forecasted values of  $k_t$  to generate mortality rates beyond the sample calendar year according to equations (A1) and (A2), respectively.

**Step 2:** Calibration of the abridged cohort life tables based on the predicted mortality rates obtained from Step 1 using the Bourbeau and Legare approach.

Let  ${}_5\hat{q}_x[c]$  be the cohort mortality rate for a person given birth at cohort year  $c$ , now aged  $x$  and dying the next 5 years;  ${}_5\bar{q}_x[c+x]$  be the existing or reasonably forecasted mortality rate for a person aged  $x$  and dying the next 5 years for year  $(c+x)$ ; and  ${}_5\bar{q}_x[c+x+5]$  be the existing or the forecasted mortality rate for a person aged  $x$  and dying the next 5 years for year  $(c+x+5)$ , respectively. Then

$${}_5\hat{q}_x[c] = 0.5\{{}_5\bar{q}_x[c+x] + {}_5\bar{q}_x[c+x+5]\} \quad (\text{A3})$$

In applying (A.3) to the local context of Singapore, we need to obtain estimates of the future cohort mortality rates for individuals who are born in the 1949 cohort year and belong to the age class 60-65 in January 2009. We choose the Lee-Carter forecasts of mortality rates for year 2009 and those beyond on a 5-year basis as proxies for  ${}_5\bar{q}_x[c+x]$  and  ${}_5\bar{q}_x[c+x+5]$ , respectively. For example, the probability of dying between ages 60 and 65 of the 1949 birth cohort is computed by setting  $x = 60$  in (A.3) as below.

$${}_5\hat{q}_{60}[1949] = 0.5\{{}_5\bar{q}_{60}[2009] + {}_5\bar{q}_{60}[2014]\} \quad (\text{A4})$$

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<sup>14</sup> Private communications with Ronald Lee and Tim Miller.

Note that  ${}_5\hat{q}_{60}$  [1949] can be interpreted as the average of the Lee-Carter forecasts of mortality rates of a person aged 60 dying the next 5 years for calendar year 2009 and 2014, respectively. The subsequent 1949 cohort mortality rates are obtained by setting  $x = 65, 70, 75,$  and  $80$ . The interpolation procedure developed by Wilmoth (1995) is used to calibrate the level of mortality of those elderly aged above 85.

**Step 3:** Conversion of the calibrated abridged cohort mortality rates into annual mortality rates and to monthly mortality rates

We adopt Pollard (1989)'s methodology to convert the abridged life tables to complete annual life tables. The annual mortality tables are then converted to monthly tables by assuming that the mortality rates at fractional ages between age  $x$  and  $x+1$  follow a uniform distribution. We also experiment with other distribution functions such as the Balducci and exponential distributions, and find that the calibrated mortality rates are robust to these alternative distribution assumptions. The calibrated complete cohort life tables are used to produce the cumulative survival probabilities of the elderly by the following standard conversion:

$${}_j p_{62} = \prod_{t=0}^{j-1} p_{62+t} = \prod_{t=0}^{j-1} (1 - q_{62+t}) \quad (\text{A5})$$

where  $p_{62+t}$  is the probability of a person aged  $(62+t)$  surviving the next month;  $q_{62+t}$  is the probability of a person aged  $(62+t)$  dying the next month, and  ${}_j p_{62}$  is the cumulative survival probability for a person aged 62 surviving the consecutive  $j$  months. The survival probabilities are computed for each female and male elderly separately on a monthly basis. See Chapter 10 of Jordan (1975) for details.