Reorienting Retirement Risk Management

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Chapter 9

Longevity Risk and Annuities in Singapore

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A central concern in the debate over pension reform in defined contribution (DC) systems is how plan participants should draw down their accumulated asset balances during retirement. Annuitization is often recommended as a means to help plan participants manage their longevity risk, since otherwise they may outlive their assets in retirement. Some form of annuitization in the payout phase helps ensure that plan participants have a dependable flow of income beyond the retirement date all the way to death. For instance, in the United Kingdom, retirees have been required to use at least part of the lump-sum available at retirement to purchase an annuity (Finkelstein and Poterba 2002, 2004); in Chile, the DC retirement systems give plan members the choice of taking scheduled withdrawals or buying life annuities upon retirement (Mitchell and Ruiz 2009).

This chapter reviews the nature of longevity risk and annuities in Singapore in order to draw some implications about the prospects for future annuitization under one of the world's largest DC schemes, the Central Provident Fund (CPF) of Singapore. In particular, we examine how the current life annuity market appears to be operating and assess the likely attractiveness of compulsory annuitization under proposed reforms.

In what follows, we first describe the way in which the retirement system works in Singapore. Next we assess the value for money of existing annuity products. We conclude with a brief discussion of the issues that arise when discussing the options for a mandatory annuity model such as those recently suggested in the Singaporean context.

The retirement framework in Singapore

Singapore's CPF is one of Asia's oldest retirement programs, as it was established in 1955. Built around individual accounts, the scheme is mandatory and employment-linked. The current contribution rate under the DC plan is divided between employers and employees; currently the total stands at 34.5 percent (though it has been as high as 40 percent in the past).[1]

Since inception, participants have been able to leave their contributions with the CPF to earn a guaranteed risk-free interest rate (currently at least 2.5 percent [CPF 2009*a*]). The system has also been reformed several times with the goal of enhancing the system's asset *accumulation* by stimulating more saving for retirement, housing, and health-care needs. The CPF Investment Scheme, introduced in 1986 and broadened in 1993, allowed pension contributions to be invested in mutual funds and alternative asset classes including gold. In 1993 and again in 1996, CPF members were permitted to buy shares of Singapore Telecom at a discount with their CPF contributions.

The CPF Board, responsible for managing the system, has undertaken a set of reforms focused on the asset *decumulation* process, responding in part to the rapid aging of the CPF membership base. In the last 2 decades, the proportion of members aged 55 and older experienced a fourfold increase from 5.5 percent in 1985 to 22.9 percent in 2005; at the same time, the proportion of those younger than 24 years fell from 25.1 percent to 9.2 percent (CPF 2007*a*). This trend occurred, in part, because Singapore has one of the world's lowest fertility rates (1.29 per female) and longest life expectancies (80.6 years at birth).[2] These facts imply that retirement expenses are projected to rise, as people live longer and have fewer children on which to rely.

The CPF regulates how retirees can access their money via the so-called Minimum Sum Scheme (MSS). This includes three main components: the value of the Minimum Sum (MS), the age at which drawdown can start, and the form of payouts. This scheme was introduced in 1987 to ensure that CPF members could anticipate at least a basic standard of living in retirement. At present, system participants at age 55 must set aside the MS in their Retirement Account from their total accumulations;[3] this amount is then preserved and may be paid out only as of the official drawdown age. In July 2007, for instance, the required MS was set at S$99,600 and the official drawdown age at 62. The MS is not a threshold easily met; for instance, only 36.4 percent of active members could set aside the required MS in 2006 (CPF 2007*b*).

In response to the rapid aging of the CPF membership base and the need to save more for retirement, the components have been fine-tuned. Table 9.1 summarizes the evolution of the MSS and projected changes to 2013. Here we see that the stipulated MS rises progressively until it reaches S$120,000 by 2013.[4] Concurrently, the drawdown age is rising gradually from 62 to 65 by 2018.

Retirees can currently take their payouts in the form of phased withdrawals, though as of 2013, the government has announced there will be a transition to a compulsory deferred annuitization format, which we discuss later. Under the present rules, most retirees take drawdowns from their MS

Table 9.1 Singapore's Minimum Sum Scheme (MSS) schedule: 2003–13

Period	Required minimum sum (2003 S$)	Required minimum sum (real S$)	Drawdown age	MSS payout structure
2003	80,000	80,000	62	• Default: phased withdrawal (administered by CPF).
2004	84,000	84,500	62	• Alternative: voluntary purchase of annuities
2005	88,000	90,000	63	(choose from MSS annuities offered by private insurers. Starting from 2009, participants may also choose from LIFE annuities).
2006	92,000	94,600	63	
2007	96,000	99,600	64	
2008	100,000	106,000	64	
2009	104,000	–	65	
2010	108,000	–	65	
2011	112,000	–	65	
2012	116,000	–	65	
2013	120,000	–	65	• Default: compulsory annuitization (choose from MSS annuities offered by private insurers or LIFE annuities offered by CPF). • Alternative: nil.

Notes: As of 2003, the Minimum Sum (MS) will be raised from S$80,000 to S$120,000 by 2013 (in 2003 dollars) and adjusted for inflation. The drawdown age refers to the official age at which the member may start drawing down the MS plus interest. For example, a member who turns 55 on July 1, 2007 must set aside S$99,600 as the MS in his/her Retirement Account at age 55 and may start draw down only when he/she reaches age 64. If he/she dies before drawdown starts, the balance in the Retirement Account will be fully refunded to his/her beneficiary. From 2003 to 2012, CPF is operating a voluntary annuity purchase scheme; life annuities may be purchased with the MS voluntarily from qualifying annuities offered by private insurers. Starting from 2009, participants may also choose from life annuities offered by CPF. From 2013, CPF will operate a mandatory annuitization scheme with compulsory purchase of life annuities using the MS; annuities will be offered by CPF-LIFE and private insurers.

Source: Authors' calculations; see text.

over about 20 years, or until the balance is exhausted. An alternative to this phased withdrawal approach is a life annuity sold by private insurers. In 2007, nine MSS annuities were offered; these involve a life annuity where the lump-sum premium is the stipulated MS.[5] These private insurers tend to be well known in Singapore and international insurance markets

TABLE 9.2 Monthly nominal payouts for life annuities purchased at the Minimum Sum (MS) of S$99,600 (2007; S$ per month)

Company and product	Monthly annuity payout for entry age of 55		Guaranteed amount upon death
	Male (S$)	Female (S$)	
Nonparticipating Annuities			
Asia Life Assurance	505.47	454.47	Premium − total annuity payments
Prudential Assurance	518.44	449.87	Premium − total annuity payments
American International Assurance (AIA)	530.87	513.94	Premium − total annuity payments
Great Eastern Life (GE Life I)	535.35	484.30	Premium + interest accumulated at 0.75% p.a. to age 62 − total annuity payments
Overseas Assurance Corporation (OAC)	535.35	494.26	Premium + interest accumulated at 0.75% p.a. to age 62 − total annuity payments
Aviva	559.00	507.00	Premium + accrued interest compounded at 1% p.a. to annuity commencement date − total annuity payments
Great Eastern Life (GE Life II) (Note: This product includes long-term care benefit.)	494.26	440.73	Premium + interest accumulated at 0.5% p.a. to age 62 − total annuity payments
Subaverage	525.53	477.80	
Participating Annuities			
NTUC Income Co-op	523.50 (591.08[a])	490.25 (557.83[a])	Premium + interest accumulated at 2.5% p.a. and bonuses to age 62 − total annuity payments
HSBC Insurance	474.00 (541.58[a])	458.00 (525.58[a])	Premium + interest accumulated at 2% p.a. to age 62 − total annuity payments
Subaverage	498.75	474.13	
Average without bonus adjustment	519.58	476.98	
Average with bonus adjustment	534.60	492.00	

[a] Bonus rates depend on company performance; NTUC Income's annual bonus rates were 1–3.5 percent historically; a 2 percent bonus is used in NTUC Income benefit illustrations. Original payouts without bonus expressed without parentheses; figures in parentheses incorporate bonus component assuming an annual projected bonus rate of 2 percent and a projected annual investment rate of return of 5 percent.

Notes: Monthly payouts for a nominal deferred annuity purchased at age 55 with payments starting at age 62. The lump-sum premium is the MS of S$99,600 for members age 55 (July 07–June 08). Annuities under the MSS currently guarantee a given *amount* in the event of annuitant's death; the positive difference of the guaranteed amount less annuity payments made would be paid to nominated beneficiaries. Previously (in 2000), most MS annuities were guaranteed for a certain *period* so if death occurred during the guaranteed period, remaining annuity payments would be converted into a lump sum paid to beneficiaries.

Source: Authors' calculations; derived from CPF (2008*a*).

including American International Assurance (AIA), Prudential, and HSBC Insurance, as well as some local insurance providers.

Table 9.2 summarizes attributes of the nine qualifying MS annuities offered in 2007 by private insurers. There are some differences in provisions, but the products offered are similar in that they are all single-premium, deferred, life annuities. The lump-sum premium is the entire MS amount of S$99,600 to be paid at age 55, in exchange for annuity payments beginning at exactly age 62. All have fixed (level nominal) payouts, with two annuities having an additional participating bonus feature; these latter are not guaranteed and depend on the profits of the insurer each year. Nonparticipating annuities payouts average S$526 per month for males and S$478 for females, while participating payouts (minus the bonus) average S$499 for males and S$474 for females. Participating payouts are slightly lower since the consumer may receive bonus payouts on top of the specified base rate. Overall, Table 9.2 shows that women receive lower payouts for the same premium given their longer life expectancies; it is also noteworthy that the annuity payouts are sex-specific, resulting in females obtaining a lower annual payout than males for a given premium (by contrast, the annual payouts under phased withdrawal are sex-neutral). It is also worth noting that all MS annuities on offer include a 'guaranteed amount' feature. Thus, at the annuitant's death, his/her beneficiary receives at least the premium paid (at least a premium of S$99,600)[6] less annuity payouts already made. In effect, this means that the protection has an element of capital-protection on the premium remaining.

Despite the assortment of annuities available on the market, most CPF retirees to date have elected phased withdrawal rather than life annuities. While only 4–5 percent of the retiring cohorts in recent years have voluntarily purchased MS annuities, this small percentage must be evaluated in the proper perspective. For one thing, about a quarter of the retiring cohort was exempted due to medical grounds, small balances, or other reasons. For another, almost half (48 percent) of the retirees were ineligible to buy this annuity because they had not set aside the full MS in cash; this group is, by default, channeled into the phased withdrawal payout option. In other words, of the remaining 27 percent who had a choice between phased withdrawals versus lifetime annuity payouts, a relatively high proportion – one out of six – opted for annuitization.[7]

This relatively high annuitization rate among the eligible compares to much lower annuitization rates in other countries, where it has been suggested that people may fail to annuitize because of crowd-out from public defined benefit (DB) pensions, a desire to leave bequests, the need for liquidity, and adverse selection, among other reasons (Mitchell et al. 1999). In the Singaporean context, however, we can rule out the crowd-out by a public DB pension as there is none. The bequest motive is

unlikely to be a deterrent since existing rules permit bequests via refunds to beneficiaries. More plausible is a desire for liquidity, since the phased withdrawal approach yields monthly payouts of S$790, compared to the average annuity payout of about S$520.[8] It is plausible that myopic participants as well as those expecting to live a shorter period will opt for phased withdrawal. Another factor may be inertia: pension plan participants are often found to accept whatever is the default option, which in this case is a phased withdrawal (Koh et al. 2008). The possibility of adverse selection may also be a consideration in the Singaporean annuity market, though the issue has not yet been fully evaluated. We turn to an examination of this issue next.

Money's worth valuation for Singaporean annuities

To examine the extent of adverse selection in the Singaporean voluntary annuity market, it is necessary to compare the money's worth of the life annuity benefit using population survival versus annuitant tables. Specifically, we note that a life annuity is a contract that pays the buyer a benefit as long as he/she lives, which insures the annuitant against the risk of outliving accumulated resources, in exchange for a premium. By so doing, the purchaser transfers his/her longevity risk to the insurer, who pools the survival experience of multiple buyers. Following Mitchell et al. (1999), the money's worth ratio (MWR) is therefore the ratio of the expected present discounted value (EPDV) of annuity payouts divided by the initial premium (K):

$$\text{MWR} = [\text{EPDV}(\text{benefits})]/K \tag{9.1}$$

In the Singaporean context, K reflects the S$99,600 lump-sum premium (the MS in 2007). The age of entry is age 55 when the annuity is purchased. The general expression for the EPDV is as follows:

$$\text{EPDV} = \sum_{t=1}^{\infty} \frac{{}_tp_a \cdot A_a}{(1+i_t)^t} \tag{9.2}$$

where a is the age at which the annuity is purchased, t represents the number of months beyond annuity starting date, A_a refers to the (level or fixed) monthly nominal annuity payout for the individual purchasing annuity at age a, i_t is the nominal interest rate at month t, and ${}_t\text{p}_a$ is the probability of an individual of age a still surviving after t months. The expression runs over the maximum life span in a given mortality table; for a deferred annuity, payments A_a are zero during the deferred period.

Assuming no commercial costs (loads), actuarial fairness requires that the discounted value of the annuity stream will equal the premium paid; accordingly, the MWR for an actuarially fair annuity is unity. In practice, two factors make annuities actuarially unfair for the average person. First, insurers must charge enough to cover administrative costs and earn a profit. Second, those who buy annuities tend to live longer than those who do not. Accordingly, in a market where people buy annuities voluntarily, this adverse selection raises prices for those who buy. As demonstrated by Mitchell et al. (1999), one can separately value these two sources of actuarial unfairness by comparing the difference in the MWR using the population versus the annuitant survival tables. An appeal of the MWR concept is that it is readily quantifiable and facilitates comparisons across products and countries. Nevertheless, these calculations are necessarily sensitive to underlying mortality and interest rate assumptions.

Prior studies on the Singaporean annuity market

Two studies have previously evaluated the money's worth of MSS annuities offered under the Singaporean system; both use data available in the year 2000.[9] Fong (2002) investigates nine annuity products using a fixed interest rate he proxies with the 10-year government bond yield. He reports a mean MWR of 0.997 for the male population so his implied cost of adverse selection is about 0.011. Doyle, Mitchell, and Piggott (2004) use five flat-rate annuities and employ a term structure of interest rates that more accurately discounts future cash flows. That analysis generates a slightly lower MWR of 0.947 for the male population and a much lower cost of adverse selection, 0.0026.

Both of these studies attribute the small degree of adverse selection detected to the fact that the lack of a public DB pension system makes the CPF annuitization scheme close to a 'captive market.' Yet there is reason to worry that these money's worth values could be overstated and the degree of adverse selection biased down, due to the lack of good mortality data. For instance, Doyle, Mitchell, and Piggott (2004) uses abridged life tables from the World Health Organization,[10] and Fong (2002) extrapolates mortality patterns estimated from 1960 period life tables. In addition, both studies assume a constant force of mortality for fractional ages within a year without justifying why this might be appropriate in the Singapore context.[11] Another data limitation in past studies is that their mortality tables have different limiting ages for the population and the annuitant group. For instance, Fong (2002) assumed a maximum life span of 99 years for the population but 109 years for the annuitant

group; this naturally leads to higher MWRs for the annuitants. In what follows, we seek to improve on these shortcomings.

Two other drawbacks of prior studies are worth noting. First, they use low interest rates (long-duration T-bonds were not available at that time) that may overstate the MWR results. The emergence of longer-duration bonds offers us the opportunity to improve on this issue. And second, both studies do not model the specific characteristics of the MSS annuities currently offered. Specifically, they ignore the guarantee effective during the 7-year deferral period and the lump-sum nature of the guarantee payments. That is, they assume that CPF life annuities have two terms, where the first term applies to the 15-year guarantee period, and the second term to the life payout period thereafter:

$$\text{EPDV} = \sum_{t=1}^{15\times 12} \frac{A_a}{(1+i_t)^t} + \sum_{t=181}^{\infty} \frac{{}_tp_a \cdot A_a}{(1+i_t)^t} \tag{9.3}$$

But Equation (9.3) does not capture the value of the refund if death occurs prior to age 62,[12] so it will understate the MWR. It also does not correctly capture the fact that if death occurs during the 15-year guarantee period, the refund is a lump-sum payment to the beneficiary minus payouts.

Our MWR equation extends the approach used in the past in four key ways. First, we match the limiting age of the population group with that of the annuitant group. Second, we include all the annuities currently on offer under the CPF scheme, as opposed to selecting a subsample; we also incorporate expected bonus payouts for participating annuities using historical rates to reflect the participation upside on such products. Third, we account for the guaranteed amount inherent in the 2007 MSS annuities when undertaking the valuation analysis. Fourth, we apply a uniform distribution of deaths assumption to better reflect the pattern of mortality in Singapore.[13]

Adapting the valuation model for the joint-and-contingent annuity, and using actuarial techniques to incorporate product-specific characteristics, the following formula is then suitable for valuing a MS nominal annuity with guaranteed amount refund:

$$\begin{aligned}\text{EPDV} = &\sum_{t=1}^{83} \frac{{}_{(t-1)}p_a \cdot q_{a+(t-1)} \cdot G_t}{(1+i_t)^t} \\ &+ \sum_{t=84}^{\infty} \frac{{}_tpa \cdot A_a + {}_{(t-1)}p_a \cdot q_{a+(t-1)} \cdot \max\left[0, G_t - \sum_{s=0}^{t-84} A_{a,s}\right]}{(1+i_t)^t}\end{aligned} \tag{9.4}$$

Here a, t, A_a, i_t, and ${}_tp_a$ are defined as before, G_t is the guaranteed amount (premium plus accrued interest) at time t, s is a counter for the number of annuity payments made to annuitant before death, ${}_{(t-1)}p_a$ is the probability of an annuitant age a being alive after $(t-1)$ months, $q_{a+(t-1)}$ is the probability of the annuitant age $a + (t-1)$ months dying within the following 1 month. Taken together, ${}_{(t-1)}\mathrm{p}_a \cdot \mathrm{q}_{a+(t-1)}$ is the probability of an annuitant aged a surviving to $(t-1)$ months and then dying between month $(t-1)$ and month t. Thus, this model extends Fong (2002) and Doyle, Mitchell, and Piggott (2004) by explicitly including the refund upon death before age 62 to represent expected benefits due to the annuitant and his/her beneficiaries.[14]

In implementing this valuation, we are also fortunate to have access to new population mortality tables recently published by Singapore Statistics (SDOS 2008*b*) with a limiting age of 100. Building on this base, we then must cohortize the population tables, as cohort mortality tables are not available in Singapore to date. To derive birth cohort tables using period life tables using the year 2007 period life table, we compute:

$$\hat{q}_x(2007 + t) = q_x(2007) \times (1 - \alpha_x)^t \tag{9.5}$$

where q_x (2007) is the annual mortality rate for age x in year 2007, $\hat{q}_x(2007 + t)$ is the estimated annual mortality rate for age x in year $(2007 + t)$, and α_x represents the estimated annual mortality improvements for an individual aged x extrapolated from mortality changes between 1990 and 2005. As in previous studies, mortality improvement rates are projected from the abridged period population tables for Singapore published by the World Health Organization. In addition, we match the limiting age of the population group with that of the annuitant group by extrapolating population mortality estimates to the common maximum age of 117 to properly capture the longevity tail risk in the population group; this is particularly important for females.

Little information is currently publicly available on the annuitant mortality experience in Singapore. Standard insurance industry practice and previous research (Fong 2002) adopted the UK annuitant mortality experience with adjustments for local conditions, similar to what is done in Australia. Moreover, the Monetary Authority of Singapore (MAS), in its capacity as insurance regulator, requires firms to employ the UK a(1990) Ultimate Tables rated down 5 years for reserves and liability valuations pertaining to annuities sold (MAS 2008*a*).[15] Accordingly, we use the a (1990) tables with a 5-year setback to estimate the annuitant experience for our valuation year, and then we cohortize the resulting annuitant tables.[16]

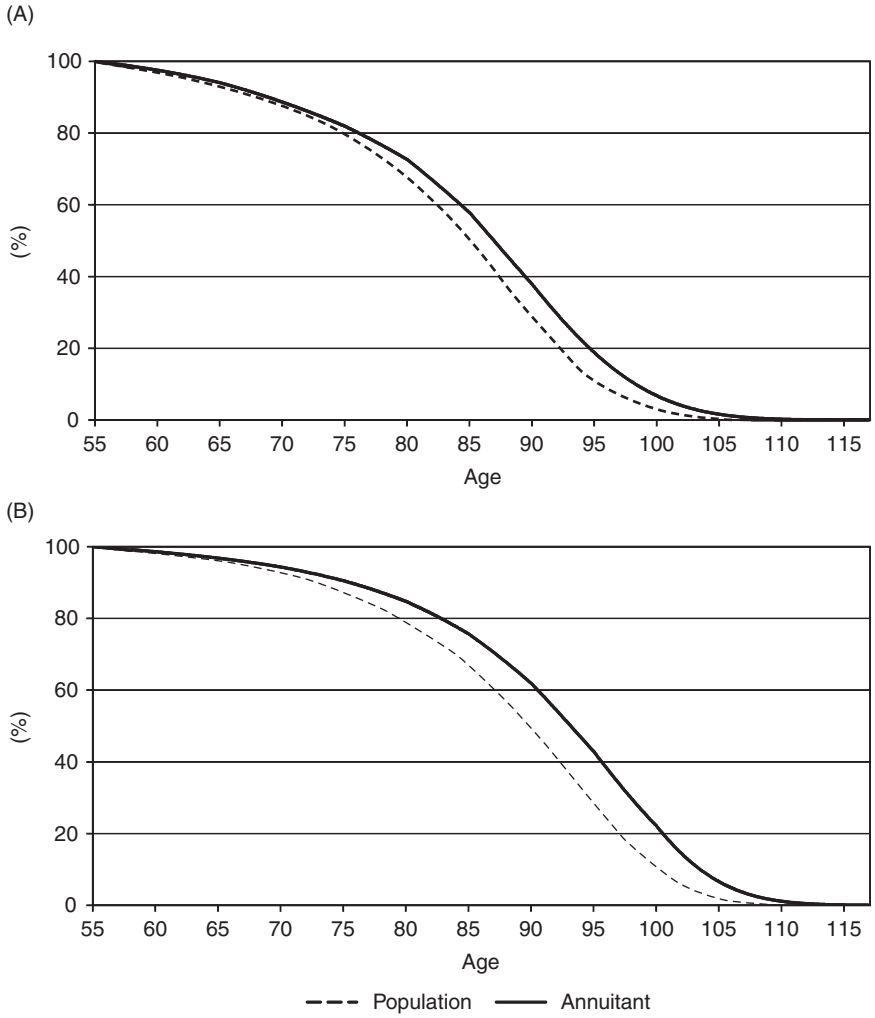

Figure 9.1 Cumulative cohort survival probability: general population and annuitant groups (conditional on attaining age 55 and limiting age of 117, 2007). Panel A: Singaporean males. Panel B: Singaporean females. *Source*: Authors' calculation; see text.

We compute cumulative survival probabilities from the cohort tables as follows:

$$ {}_tp_a = \prod_{j=0}^{t-1} (1 - q_{a+j}) \tag{9.6} $$

where ${}_tp_a$ is the cumulative probability of a person aged a surviving for t years, and q_{a+j} is the probability of a person age $(a + j)$ dying within the year. These cumulative survival probabilities are sex-specific and calculated on a monthly basis to match the frequency of the annuity payouts.

Figure 9.1 plots our estimates for the cumulative survival probabilities for 55-year-old males and females in Singapore, for the general population and also for annuitants. The key takeaway from the figure is that the annuitant survival curves lie above that of the general population, confirming that cumulative survival probabilities for annuitants are generally higher than those of the general population (or conversely, mortality for annuitants is lower since they live longer).

Annuity quotes and interest rates

In 2007, eight private insurers offered life annuities under the MSS to CPF members; they provided a total of nine qualifying annuities for the MS premium of S$99,600 (CPF 2008*a*). All annuities paid level benefits; two were also participating annuities (see Table 9.2). The NTUC Income (2009) participating annuity offers an annual projected bonus rate of about 2 percent; incorporating this rate for both participating annuities means the average payout across all 2007 MSS annuities averages about S$535 per month for a male participant and S$492 per month for a female participant.

Data on interest rates are drawn from market information. As in Mitchell et al. (1999), we use a term structure of interest rates to discount the stream of annuity payments to the present. We judge the Singaporean Treasury bond rates as appropriate here since the MSS annuities are viewed as capital-protected and thus riskless. Relying on the prices and yields of the Singapore Government Securities Treasury bonds at end 2007, we compute the riskless spot rates to proxy the yields on hypothetical zero coupon bonds.[17] Table 9.3 summarizes the key inputs and compares them to assumptions used in prior studies on Singaporean annuities.

TABLE 9.3 Money's worth ratios (MWRs) computed for Minimum Sum Scheme (MSS) life annuities

Study	Valuation date and sample	Mortality assumption		Interest rate assumption	MWR for 55-year-old male		Adverse selection
		Annuitant	Population		Ann.	Pop.	(%)
W.M. Fong (2002)	2000; subset of eight nonparticipating annuities and one participating annuity	a(90) with 2-year setback Limiting age used is 109	Derived from 1960 and 1990 ordinary male and female lives tables (Singstat) Limiting age of 99	Flat interest rate (proxy by the 10-year Government bond yield of 4.6%)	0.997	0.986	1.1
Doyle, Mitchell, and Piggott (2004)	2000; subset of five nonparticipating annuities with a 15-year guarantee period or similar	a(90) with 2-year setback Limiting age used is 109	Abridged life tables for Singapore (World Health Organization) Limiting age of 100	Term structure (yield curve with long-term rate assumption of 4.76%)	0.947	0.945	0.26
Present study (2009)	2007; all MSS annuities: seven nonparticipating and two participating annuities	a(90) with 5-year setback Limiting age used is 117	Complete life tables for Singapore resident population 2007 (Singstat), plus extrapolate from age 100 to 117 Limiting age of 117	Term structure (yield curve with long-term rate assumption of 3.44%)	0.947	0.910	3.69

Notes: A total of 13 MSS life annuities were offered in July 2000 of which 9 were flat-rate annuities, 2 were participating annuities, and 2 were increasing annuities. The increasing annuities offered by AIA were dropped after that year (*Source*: Personal communication from CPF Board). The a(90) table refers to the United Kingdom a(1990) period life table for annuitants. It is based on UK annuitants' experience from 1967 to 1970, with mortality improvements projected to 1990. Because of lack of annuitant experience in Singapore, previous studies used the a(90) and with a 2-year setback to account for lower mortality among annuitants. A 2-year setback means that a 65-year-old is treated as having the same mortality rate as a 63-year-old has in the initial table.

Source: Authors' calculations; see text.

MWRs for MSS annuities

We next provide money's worth results using population mortality tables, focusing on MSS life annuities offered by private insurers in the voluntary annuity purchase scheme in 2007. Results in Table 9.4 show that, on average, S$1 of premium spent on a nominal MS annuity by a 55-year-old male drawn from the general population would generate nearly S$0.910 in expected annuity income (in net present value terms). Likewise, a female in the general population could anticipate receiving S$0.906. Though the monthly payouts are lower for females than males, the MWR values converge for both sexes, once life expectancy is taken in account. We also note that NTUC Income annuity offered the highest money's worth to retirees in Singapore. The MWR of 1.006 (males) and 1.024 (females) exceeded the average MWR by almost 10.5 percent and 13.1 percent, respectively.

TABLE 9.4 Money's worth ratios (MWRs) and adverse selection cost of Minimum Sum Scheme (MSS) annuities (nominal life annuities offered by private insurers under Central Provident Fund (CPF) plan; 2007)

	Male			Female		
Company and product	Population MWR	Annuitant MWR	Adverse selection (%)	Population MWR	Annuitant MWR	Adverse selection (%)
Nonparticipating annuity						
Asia Life Assurance	0.861	0.896	3.47	0.840	0.885	4.44
Prudential Assurance	0.879	0.915	3.62	0.833	0.876	4.37
AIA	0.907	0.943	3.62	0.943	0.995	5.20
GE Life I	0.910	0.947	3.71	0.893	0.941	4.78
OAC	0.907	0.945	3.74	0.908	0.957	4.98
Aviva	0.943	0.982	3.98	0.930	0.981	5.14
GE Life II	0.846	0.879	3.34	0.818	0.860	4.22
Participating annuity						
NTUC Income Co-op	1.006	1.047	4.09	1.024	1.081	5.61
HSBC Insurance	0.933	0.969	3.59	0.969	1.021	5.20
Mean	0.910	0.947	3.69	0.906	0.955	4.88

Notes: MWRs are in decimals. Adverse selection costs are in percentage points. Computations pertain to a CPF participant who purchases the MSS annuity at entry age 55 for a premium of S$99,600, and starts receiving payouts at age 62.

Source: Authors' calculations; see text.

This could be explained by the fact that NTUC Income operates as a cooperative company with a mission to give back 98 percent of profits to policyholders in bonuses. Further, its monthly annuity payouts are the highest among the MSS annuities (having factored in the estimated bonus).[18] Perhaps not surprisingly, this firm has the largest market share of annuities in Singapore.

The MWR values may be used to estimate total loadings, which average about 9.2 percent. These estimates are lower than those for UK nominal annuities of about 14 percent (Finkelstein and Poterba 2002), and for US annuities where the loads amount to about 15–20 percent (Mitchell et al. 1999). But the Singaporean results for 2007 are much higher than those reported in previous studies on CPF-linked annuities using pricing from earlier years and less precise mortality tables. That is, Fong (2002) reports an average loading of only 1.4 percent for males and a negative loading for females (MWR exceeded 1), while Doyle, Mitchell, and Piggott (2004) found loadings of about 5.5 percent for both sexes. Such small loadings make sense, given their very high MWR figures (0.945–1.009 using population mortality). A possible explanation for the difference, as acknowledged by the authors, is that their MWRs might be overstated due to the lack of long duration Treasury bonds at the time. Their loading figures seem implausibly low inasmuch as the products are mainly offered by private insurers who could not survive for long if they paid such high benefits.

Our main explanations for the differences in the results are as follows:

- Different products evaluated: We value the MSS annuities offered in 2007, which include a guaranteed *amount* refund; earlier studies valued the annuities with a 15-year guaranteed *period*.
- Different mortality assumptions: Prior studies employ a constant force of mortality assumption for fractional ages within a year; by contrast, we apply a uniform distribution of deaths assumption to better reflect the pattern of mortality in Singapore.
- Higher premium and lower annuity payouts: Annuity quotes in the year 2000 were based on a lower premium (S$65,000) and paid out higher average monthly benefits (about S$555 for males; Doyle, Mitchell, and Piggott 2004). By 2007, the premium had risen to S $99,600 but the average annuity payouts were lower (S$520 for males).

Next we turn to a discussion of the cost of adverse selection. We compute this by taking the difference between a given annuity's MWR using annuitant mortality, versus the same product's MW calculated using population mortality. Table 9.4 shows that, on average, adverse selection costs are 3.69 percentage points for males and 4.88 percentage points for females. These results are comparable to empirical findings in the United Kingdom where

adverse selection costs amount to about 4.6 percentage points (Finkelstein and Poterba 2002) and below the 6 percentage points reported for Australian annuities (Doyle, Mitchell, and Piggott 2004). They are much lower than the 10 percentage points reported for the United States (Mitchell et al. 1999).

Overall, our findings suggest that a retiree in Singapore's CPF having cash of at least the MS would have been able to purchase longevity protection on competitive terms, without much concern for adverse selection. Total loads might be further reduced, of course, if annuitization were mandatory, a topic to which we turn next.

Policy proposals for mandatory annuitization

Though the existing default phased withdrawal with voluntary annuitization may have worked well in the past in Singapore, there is now concern that future retirees may be at risk of running out of money. In 1990, for instance, the average male and female life expectancy at birth was 73 and 77, respectively; by 2007, life expectancies at birth had risen to 78.2 and 82.9, respectively. And, of those aged 65 in 2007, two-thirds would expect to still be alive at 80, and 48 percent at 85 (CPF 2007*a*). This means that about half of all aged 65 CPF members alive today might outlive their CPF savings under the 20-year phased withdrawal program (CPF 2009*c*). A related concern is that the entire age structure of members has aged substantially, while membership growth has tapered off. These factors are, quite sensibly, turning policymaker's attention to the role of longevity protection.

To this end, the Singapore Government has recently announced plans to implement a mandatory annuitization scheme, slated to pay out benefits for the first time in 2013. This program, dubbed the CPF-LIFE program, is being integrated with the existing CPF MSS. At the time the plan was announced in 2007, a National Longevity Insurance Committee (NLIC) was formed to help design the program's elements (SPMO 2007). This group released a report in 2008 outlining preliminary details and the design continues to be refined. Accordingly, as of this writing, since only the broad outlines of the new mandatory annuitization scheme are available, we do not offer MWR computations; these must await more information of the product and pricing structure of products to be offered. Nevertheless, the key elements of the new proposal are usefully summarized.

The new scheme will automatically enroll members aged 51 and younger from 2009 forward, who have at least S$40,000 cash saving in the Retirement Account at age 55. The entity that supervises the current system, the CPF Board, is to administer the scheme drawing on the advice of independent actuarial consultants to determine premium and payout

levels. Members may purchase their annuities either from a government-administered entity, or from qualifying private insurers.

Key changes to be implemented under the LIFE scheme are later payouts and a different default payout structure. Specifically, at age 55, a participant must set aside a MS; in 2013, this is expected to be about S $134,000 (CPF 2008*b*). Instead of having payouts begin at age 62, as now, the MS is to be partially annuitized by default at age 65, so there is a 10-year deferral period from age 55 to 65. The MS will be split into a term component and an annuity component, with the split depending on which plan the participant chooses. The term investment amount (T) plus interest earned on T is intended to finance payouts from age 65 to some older age (Y), where Y may be elected by the participant within some bounds (e.g., Y might be either age 65, 75, or 85). The annuity component (N) is intended to finance payouts from age Y to death. In any case, however, the requirement is that the member must receive a fixed dollar payout every month from age 65 to death as long as he/she lives; they can also bequeath the term amount plus interest minus payouts. One other decision to be made is whether the participant wishes to have his/her remaining annuity premium (N minus payouts) provided to his/her heirs on their death, which is called the 'refund portion.' For example, the R80 plan starts the annuity payout at age 80, and the annuity would have a refund element; the NR65 plan starts the annuity payment at age 65 and has no death benefit.

The rationale for making the system compulsory is to prevent adverse selection, and it is logical to assume that making the program mandatory will mitigate this problem. On the other hand, while the rules permit members to elect either the CPF-managed annuity or a private annuity provider, it is unclear whether private firms will be able to compete. There is already some suggestion of a market response: in 2008, for instance, only two MSS annuities were offered by private insurers, compared to nine the previous year. The shrinkage of private annuity offerings could indicate that private insurers are scrambling to reprice their products more competitively, but it could also indicate that they have been crowded out more permanently.

In the future, private annuity providers might instead refocus their business outside the CPF scheme for those seeking to annuitize non-pension wealth. There is a cap to the amount in the Retirement Account that CPF members can annuitize, namely, the stipulated MS that will rise over time. Very wealthy individuals seeking a higher monthly annuity payout would still turn to commercial annuities. It is also worth nothing that the plan will exempt CPF members who hold alternative lifelong pensions or receive annuities from the government-run annuity scheme.

Conclusion

This chapter offers new evidence on the annuity market in Singapore focusing on products offered by private insurers, and it discusses the possible impact of imposing mandatory annuitization through the national CPF system. We show that an average 55-year-old male could purchase annuities providing a MWR value of about 0.910, using population tables; this is similar to figures in other countries. But the costs of adverse selection in Singapore are smaller than elsewhere, on the order of 0.3–5 percentage points. Adverse selection accounts for 47 percent of total loadings; Brown et al. (2001) by comparison found that roughly half of the cost of purchasing a voluntary annuity in the US annuity market could be attributed to adverse selection. What this means is that – given the best available data – annuitization costs in Singapore are equally influenced by insurance company loadings and adverse selection.

For these reasons, we would expect that requiring mandatory annuitization in Singapore is likely to have little impact on the money's worth valuations of lifetime annuity payouts due to the elimination of adverse selection. Instead, what will enhance the value for money of annuity payouts is the fact that the government will provide them, presumably without the need to make a profit. To the extent that taking the CPF-provided annuity is the default, this will likely hold down advertising, marketing, and distribution costs as well. Accordingly, the entry of the CPF Board into the market is expected to narrow the traditional gap between premiums and anticipated benefits, and it will likely make the new payout products quite attractive.

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Notes

[1] For workers aged 50 and younger, the government has set the long-term target CPF contribution rates at 30–36 percent, with an employee contribution of 20 percent and an employer contribution varying between 10 and 16 percent. For those older than age 50 and up to 55, the long-term target range is set at

24–30 percent, with the employee contribution at 18 percent and the employer contribution varying between 6 and 12 percent (SPMO 2003).

[2] Figures are from year-end 2007 and obtained from the Singapore Department of Statistics (SDOS 2008*a*).

[3] If a member's total balance is higher than the MS, any remaining balance can be withdrawn as a lump sum. If the total balance is less than the MS, the following withdrawal rules currently apply for members who reach 55 between January 1, 2009 and June 30, 2009: total balance $\leq$ S$5,000 (withdraw everything), S$5,000 < total balance $\leq$ S$12,500 (withdraw S$5,000 and set aside remainder in Retirement Account), and S$12,500 < total balance $\leq$ S$176,667 (withdraw 40 percent of total balance and set aside remainder in Retirement Account; see CPF 2009*b*).

[4] This change was announced in 2003. The other two changes on the drawdown age and payout structure were announced in 2007 in Prime Minister Lee's National Day Rally speech (SPMO 2007).

[5] It must be noted that the CPF Board does not endorse any specific life annuity product offered under the MSS nor does it screen private insurers (although any life insurer exhibiting poor conduct or unacceptable behavior may have its contract suspended).

[6] In some products, the guaranteed amount is the premium plus annual interest accrued from age 55 when the annuity is purchased up to age 62 when payouts start; see Table 9.2. The results in Table 9.4 account for the different specifications of guaranteed amount for each product.

[7] This is consistent with Doyle, Mitchell, and Piggott (2004).

[8] This is for the case of a member who has set aside the full MS of S$99,600 at age 55 as of 2007. Under phased withdrawal, he/she can draw down this amount plus interest via monthly payouts of S$790; of course, this will last for only about 20 years at which point the balance is likely to be exhausted.

[9] A total of 11 flat-rate (level) nonparticipating and participating annuities were offered in July 2000 (excludes two annuities with increasing payouts). Doyle, Mitchell, and Piggott (2004) sampled five nonparticipating annuities. Fong (2002) included all eight nonparticipating annuities plus one participating annuity but did not incorporate potential bonus payouts from the participation feature.

[10] The World Health Organization (various years) offers abridged life tables that provide mortality estimates in 5-year age intervals; they are less detailed than complete life tables providing mortality rates for every individual age.

[11] Three actuarial assumptions could be used for fractional ages within a year, namely, a uniform distribution of deaths assumption, a constant force of mortality assumption, and a hyperbolic assumption.

[12] In results not reported here, we find that 3–5 percent of EPDV is attributable to refunds to the beneficiary upon the annuitant's death (hence failure to capture this understates the MWR by 3–5 percent).

[13] The uniform distribution of deaths assumption for fractional ages within a year is appropriate given the lack of variation in Singapore's weather (so death rates are unlikely to vary seasonally).

[14] This formula is appropriate for money's worth values when the annuity has a guaranteed amount or 'capital-protection' feature. Previous studies using US data have focused on simpler products, mainly single-premium, immediate, nominal annuities, and they differentiate between the single-life versus joint-life annuities (see Mitchell et al. 1999; Brown et al. 2001). Studies on the UK compulsory and voluntary annuity markets (Finkelstein and Poterba 2002) have compared the money's worth of nominal, real, and escalating annuities, some with guarantee periods of 0, 5, and 10 years; these report that MWRs rise with the length of the guarantee period. Thorburn, Rocha, and Morales (2005) report that the MWRs of guaranteed annuities in Chile are smaller than those of non-guaranteed annuities, possibly due to the fact that long periods of guarantee tend to increase duration, thus reinvestment risk, forcing premiums up for a given value of benefits.

[15] The Sixth Schedule of the Insurance Regulations 2004 stipulates that insurers may employ the rates in the UK a(90) tables with a 5-year setback to value their annuity liabilities. Previously, the Insurance Regulations 1992 regulations required insurers to employ the a(1990) tables with a 2-year setback. These a(1990) tables are constructed based on UK annuitants' mortality experience from 1967 to 1970 with mortality improvements projected to 1990. By applying the 5-year setback, we effectively age the tables to year 2007 and then cohortize it for the MWRs.

[16] As a robustness check, we verify that our calculations yield a lower mortality for annuitant cohort than the population cohort; for instance, a 65-year-old male in the general population has a mortality of 0.01133 compared to 0.01027 for an annuitant, which seems reasonable.

[17] The first-year rate is derived from the 1-year Treasury bill (MAS 2008*b*). Thereafter, the 2-, 5-, 7-, 10-, 15- and 20-year Treasury bond rates as of 2007 are used to estimate the riskless spot rates. Our annual spot rate ranges from 1.4 to 3.44 percent. Since maximum duration available is only 20 years, we then extrapolate the last spot rate into the future, yielding a nominal riskless term structure of interest rates on Singapore's Treasury bonds.

[18] Historically, NTUC Income's average bonus participation rate has ranged between 1 and 3.5 percent, and a 2 percent future bonus rate is typically used to value its annuity (NTUC Income 2009).

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