

# **Longevity Risk and Annuities in Singapore**

Joelle H.Y. Fong, Olivia S. Mitchell, and Benedict S. K. Koh

October 2009

**IRM WP2009-23**

**Insurance and Risk Management Working Paper**

**Insurance and Risk Management**

The Wharton School, University of Pennsylvania

3620 Locust Walk, 3000 SH-DH

Philadelphia PA 19104-6302

Tel: 215-898-7761; Fax: 215-898-0310

Email: [insurance@wharton.upenn.edu](mailto:insurance@wharton.upenn.edu)

<http://irm.wharton.upenn.edu/>

Opinions and conclusions are solely those of the author(s) and do not reflect views of the institutions supporting the research, with whom the authors are affiliated, or the Pension Research Council. ©2009 Insurance and Risk Management of the Wharton School of the University of Pennsylvania. All rights reserved

# **Longevity Risk and Annuities in Singapore**

Joelle H.Y. Fong, Olivia S. Mitchell, and Benedict S. K. Koh

## **Abstract**

This chapter explores the current annuity market in Singapore and discusses the pros and cons of a proposal to mandate annuitization under the Singaporean Central Provident Fund (CPF). We evaluate the pricing of various annuity policies in order to assess whether plan participants might benefit from higher annuity returns per dollar premium and lower adverse selection costs under the new annuitization mandate. Our results indicate that private annuity providers currently offer good value-for-money annuities, with money's worth values in line with those found for other developed countries. This has implications for proposals to mandate annuitization.

## **Longevity Risk and Annuities in Singapore**

Joelle H.Y. Fong, Olivia S. Mitchell, and Benedict S. K. Koh

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 defined contribution 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 Central Provident Fund 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 defined contribution 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).<sup>1</sup>

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 2009a]). 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 healthcare 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 two decades, the proportion of members age 55+ experienced a four-fold increase from 5.5 percent in 1985 to 22.9 percent in 2005; at the same time, the proportion of those younger than age 24 fell from 25.1 percent to 9.2 percent (CPF 2007a). 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).<sup>2</sup> These facts combined 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 (MS) Scheme. This includes three main components: the value of the Minimum Sum, the age at which draw-down 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;<sup>3</sup> this amount is then preserved and may be paid out only as of the official draw-down age. In July 2007, for instance, the required MS was set at \$99,600 and the official draw-down 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 2007b).

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 1 summarizes the evolution of the MS Scheme and projected changes to 2013. Here we see that the stipulated MS rises progressively until it reaches \$120,000 by 2013.<sup>4</sup> Concurrently, the draw-down age is rising gradually from 62 to 65 by 2018.

*Table 1 here*

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, about which we discuss below. Under the present rules, most retirees take drawdowns from their MS 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 Minimum Sum Scheme annuities were offered; these involve a life annuity where the lump-sum premium is the stipulated MS.<sup>5</sup> These private insurers tend to be well-known players in the

Singapore and international insurance markets including AIA, Prudential, and HSBC Insurance, as well as some local insurance providers.

Table 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 \$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 boosting an additional participating bonus feature; these latter are not guaranteed and depend on the profits of the insurer each year. Non-participating annuities payouts average \$526 per month for males and \$478 for females, while participating payouts (minus the bonus) average \$499 for males and \$474 for females. Participating payouts are slightly lower since the consumer may receive bonus payouts on top of the specified base rate. Overall, Table 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 beneficiary receives at least the premium paid (at least a premium of \$99,600<sup>6</sup>) less annuity payouts already made. In effect, this means that the protection has an element of capital-protection on the premium remaining.

*Table 2 here*

Despite the assortment of annuities available on the market, most CPF retirees to date have elected phased withdrawal rather than life annuities. Table 3 shows that only four to five percent of the retiring cohorts in recent years have voluntarily purchased MS annuities. Yet 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.<sup>7</sup>

*Table 3 here*

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 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 defined benefit 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 \$790, compared to the average annuity payout of about \$520.<sup>8</sup> 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 lives, which insures the annuitant against the risk of outliving accumulated resources, in exchange for a premium. By so doing, the purchaser transfers his 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 ( $K$ ):

$$\text{MWR} = [\text{EPDV}(\text{benefits})]/K \quad (1)$$

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

$$\text{EPDV} = \sum_{t=1}^{\infty} \frac{{}_t p_a \cdot A_a}{(1 + i_t)^t} \quad (2)$$

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  ${}_t p_a$  is the probability of an individual of age  $a$  still surviving after  $t$  months. The expression runs over the maximum lifespan 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 MS Scheme annuities offered under the Singaporean system; both use data available in the year 2000.<sup>9</sup> 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 which more accurately discounts future cashflows. 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 defined benefit 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<sup>10</sup> 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.<sup>11</sup> 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 lifespan 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 the time) which 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 seven-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:

$$\text{EPDV} = \sum_{t=1}^{15 \times 12} \frac{A_a}{(1+i_t)^t} + \sum_{t=181}^{\infty} \frac{{}_t P_a \cdot A_a}{(1+i_t)^t} \quad (3)$$

But Equation (3) does not capture the value of the refund if death occurs prior to age 62,<sup>12</sup> 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.<sup>13</sup>

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:

$$EPDV = \sum_{t=1}^{83} \frac{{}_{(t-1)}p_a \cdot q_{a+(t-1)} \cdot G_t}{(1+i_t)^t} + \sum_{t=84}^{\infty} \frac{{}_t p_a \cdot A_a + {}_{(t-1)}p_a \cdot q_{a+(t-1)} \cdot \max[0, G_t - \sum_{s=0}^{t-84} A_{a,s}]}{(1+i_t)^t} \quad (4)$$

Here  $a$ ,  $t$ ,  $A_a$ ,  $i_t$ , and  ${}_t p_a$  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 one month. Taken together,  ${}_{(t-1)}p_a \cdot q_{a+(t-1)}$  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 beneficiaries.<sup>14</sup>

In implementing this valuation, we are also fortunate to have access to new population mortality tables recently published by Singapore Statistics (SDOS 2008b) 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:

$$\hat{q}_x(2007 + t) = q_x(2007) \times (1 - \alpha_x)^t \quad (4)$$

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  $\alpha_x$  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 five years for reserves and liability valuations pertaining to annuities sold (MAS 2008).<sup>15</sup> Accordingly, we use the a(1990) tables with a five-year setback to estimate the annuitant experience for our valuation year, and then we cohortize the resulting annuitant tables.<sup>16</sup>

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

$${}_t p_a = \prod_{j=0}^{t-1} (1 - q_{a+j}) \quad (5)$$

where  ${}_t p_a$  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 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).

*Figure 1 here*

### **Annuity Quotes and Interest Rates**

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

*Table 2 here*

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 (MAS 2008) as at end 2007, we compute the riskless spot rates to proxy the yields on hypothetical zero coupon bonds.<sup>17</sup> Table 3 summarizes the key inputs and compares them to assumptions used in prior studies on Singaporean annuities.

*Table 3 here*

### **Money's Worth Ratios for MSS Annuities**

We next provide money's worth results using population mortality tables, focusing on MS Scheme life annuities offered by private insurers in the voluntary annuity purchase scheme in 2007. Results in Table 4 show that, on average, \$1 of premium spent on a nominal MS annuity by a 55-year-old male drawn from the general population would generate nearly \$0.854 in expected annuity income (in net present value terms). Likewise, a female in the general population could anticipate receiving \$0.854. 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 \$0.944 (males) and \$0.965 (females) exceeded the average MWR by almost 10.5 percent and 13.0 percent respectively. This could be explained by the fact that NTUC Income operates as a co-operative 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).<sup>18</sup> Perhaps not surprisingly, this firm has the largest market share of annuities in Singapore.

*Table 4 here*

The MWR values may be used to estimate total loadings, which average about 14.6 percent. These estimates are similar to 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 MS Scheme 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 \$555 for males; Doyle, Mitchell, and Piggott 2004). By 2007, the premium had risen to \$99,600 but the average annuity payouts were lower (\$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 4 shows the results. On average, adverse selection costs account for approximately one-fifth of the total loadings for MS Scheme annuities. These results are lower than empirical findings in the UK where adverse selection costs amount to about 4.6 percentage points (Finkelstein and Poterba 2002) and below the six percentage points reported for Australian annuities (Doyle, Mitchell, and Piggott 2004). They are much lower than the 10 percentage points reported for the US (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 age 65 in 2007, two-thirds would expect to still be alive at age 80, and 48 percent at age 85 (CPF 2007a). This means that about half of all age-65 CPF members



alive today might outlive their CPF savings under the 20-year phased withdrawal program (CPF 2009c). 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 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 Minimum Sum Scheme. 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 age 51 and younger from 2009 forward, who have at least \$40,000 cash saving in the Retirement Account at age 55. The entity which 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 Minimum Sum; in 2013, this is expected to be about \$134,000 (CPF 2008b). 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 lives; he can also bequeath the Term amount plus interest minus payouts. One other decision to be made is whether the participant wishes to have his remaining annuity premium (N minus payouts) provided to his heirs on his 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 re-price 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 Minimum Sum which will rise over time. Very wealthy individuals seeking a higher monthly annuity payout would still turn to commercial annuities. It is also worth noting that the plan will exempt CPF members who hold alternative lifelong pensions or receive annuities from the government-run annuity scheme.

## **Conclusions**

This chapter offers new evidence on the annuity market in Singapore focusing on products offered by private insurers, and it discusses 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 0.854, using population tables; this is similar to figures in other countries. But the costs of adverse selection in Singapore are much smaller than elsewhere, on the order of three to four percent. For instance, Brown et al. (2001) find that roughly half of the cost of purchasing a voluntary annuity in the US annuity market could be attributed to adverse selection, whereas we find the proportion is less than one-fifth in Singapore. What this means is that – given the most best available data – annuitization costs in Singapore are more shaped by insurance company loadings than by 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.

### **Acknowledgements**

The authors acknowledge research support from by the Wharton-SMU Research Center at Singapore Management University, and the Pension Research Council/Boettner Center at The Wharton School of the University of Pennsylvania. They also acknowledge helpful assistance and advice from Desmond Chew, Lee Ee Jia, Jean Lemaire, and Libby Sang.

## Endnotes

---

<sup>1</sup> For workers age 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 10–16 percent. For those older than age 50 and up to age 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 6–12 percent (SPMO 2003).

<sup>2</sup> Figures are from year end 2007 and obtained from the Singapore Department of Statistics (SDOS 2008a).

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

<sup>4</sup> This change was announced in 2003. The other two changes on the draw-down age and payout structure were announced in 2007 in Prime Minister Lee's National Day Rally speech (SPMO 2007).

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

---

<sup>6</sup> 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 2. The results in Table 4 account for the different specifications of guaranteed amount for each product.

<sup>7</sup> This is consistent with Doyle, Mitchell, and Piggott (2004).

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

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

<sup>10</sup> 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.

<sup>11</sup> 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.

<sup>12</sup> 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).

---

<sup>13</sup> 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).

<sup>14</sup> 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.

<sup>15</sup> The Sixth Schedule of the Insurance Regulations 2004 stipulates that insurers may employ the rates in the UK a(90) tables with a five-year setback to value their annuity liabilities. Previously, the Insurance Regulations 1992 regulations required insurers to employ the a(1990) tables with a two-year setback. These a(1990) tables are constructed based on UK annuitants' mortality experience from 1967 – 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.

<sup>16</sup> 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.

---

<sup>17</sup> The first year rate is derived from the 1-year Treasury bill. 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 percent 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.

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



## References

- Brown, Jeffrey, Olivia S. Mitchell, James Poterba, and Mark Warshawsky (2001). *The Role of Annuity Markets in Financing Retirement*. MIT Press.
- Central Provident Fund Board (CPF) (2009a). *Interest Earned by Members*.  
[mycpf.cpf.gov.sg/Members/Gen-Info/Int-Rates/Int-Rates.htm](http://mycpf.cpf.gov.sg/Members/Gen-Info/Int-Rates/Int-Rates.htm). Viewed 3/16/09.
- Central Provident Fund Board (CPF) (2009b). *CPF Withdrawal Calculator*.  
[cpf.gov.sg/cpf\\_trans/ssl/financial\\_model/wdl\\_assumption.asp?prof](http://cpf.gov.sg/cpf_trans/ssl/financial_model/wdl_assumption.asp?prof). Viewed 3/16/09.
- Central Provident Fund Board (CPF) (2009c). *Frequently Asked Questions on CPF LIFE*.  
[mycpf.cpf.gov.sg/Members/Gen-Info/CPF\\_LIFE/CPF\\_LIFE.htm](http://mycpf.cpf.gov.sg/Members/Gen-Info/CPF_LIFE/CPF_LIFE.htm). Viewed 3/16/09.
- Central Provident Fund Board (CPF) (2008a). *CPF Minimum Sum Scheme: Table of Monthly Payment Rates for the Minimum Sum Of \$99,600 placed with a Participating Insurance Company*. [mycpf.cpf.gov.sg/NR/rdonlyres/883DD6D3-D1EC-48DD-8B09-811C0D24ECE8/0/AnnuityComparison.pdf](http://mycpf.cpf.gov.sg/NR/rdonlyres/883DD6D3-D1EC-48DD-8B09-811C0D24ECE8/0/AnnuityComparison.pdf). Viewed 3/20/08.
- Central Provident Fund Board (CPF) (2008b). *Report by the National Longevity Insurance Committee (NLIC)*, February. [mycpf.cpf.gov.sg/Members/Gen-Info/CPF\\_LIFE/NLIC.htm](http://mycpf.cpf.gov.sg/Members/Gen-Info/CPF_LIFE/NLIC.htm). Viewed 3/16/09.
- Central Provident Fund Board (CPF) (2007a). *CPF Trends: Changing Age Structure of CPF members: Membership in Brief*. [mycpf.cpf.gov.sg/NR/rdonlyres/1103E583-19A4-4B62-A38D-8D06B5C0E071/0/ChangingAgeStructureofCPFMembers.pdf](http://mycpf.cpf.gov.sg/NR/rdonlyres/1103E583-19A4-4B62-A38D-8D06B5C0E071/0/ChangingAgeStructureofCPFMembers.pdf). Viewed 12/31/08.
- Central Provident Fund Board (CPF) (2007b). *CPF Trends: Minimum Sum Scheme*.  
[mycpf.cpf.gov.sg/NR/rdonlyres/27ACA8E5-7D0D-431F-B74B-D8D3A3E43463/0/CPFTrends\\_MSS.pdf](http://mycpf.cpf.gov.sg/NR/rdonlyres/27ACA8E5-7D0D-431F-B74B-D8D3A3E43463/0/CPFTrends_MSS.pdf). Viewed 12/31/08.

- Doyle, Suzanne, Olivia S. Mitchell, and John Piggott (2004). 'Annuity Values in Defined Contribution Retirement Systems: Australia and Singapore Compared,' *Australian Economic Review*, Vol. 37, No. 4, December: 402-416.
- Finkelstein, Amy, and James M. Poterba (2004). 'Adverse Selection in Insurance Markets: Policyholder Evidence from the U.K. Annuity Market,' *Journal of Political Economy*, 112, 1, February: 183-208.
- Finkelstein, Amy, and James M. Poterba (2002). 'Selection Effects in the United Kingdom Individual Annuities Market,' *The Economic Journal*, Vol. 112, Issue 476, January: 28-50.
- Fong, Wai M. (2002). 'On the Cost of Adverse Selection in Individual Annuity Markets: Evidence from Singapore,' *Journal of Risk and Insurance*, Vol. 69, No. 2, June: 193-207.
- Koh, Benedict S. K., Olivia S. Mitchell, Toto Tanuwidjaja, and Joelle H.Y. Fong (2008). 'Investment patterns in Singapore's Central Provident Fund System,' *Journal of Pension Economics and Finance*, Vol. 7, Issue 01, March: 37-65.
- Mitchell, Olivia S., James Poterba, Mark Warshawsky, and Jeffrey Brown (1999). 'New Evidence on the Money's Worth of Individual Annuities,' *American Economic Review*. December: 1299-1318.
- Mitchell, Olivia S. and Jose Ruiz (2009). 'Pension Payments in Chile: Past, Present, and Future Prospects,' This volume.
- Monetary Authority of Singapore (MAS) (2008). ([www.mas.gov.sg](http://www.mas.gov.sg)).
- NTUC Income (2009). *Annuity Plans*. [income.com.sg/insurance/annuity](http://income.com.sg/insurance/annuity). Viewed 3/16/09.
- Singapore Department of Statistics (SDOS) (2008a). *Statistics: Demography (Themes)*. [singstat.gov.sg/stats/themes/people/demo.html](http://singstat.gov.sg/stats/themes/people/demo.html). Viewed 3/16/09.

Singapore Department of Statistics (SDOS) (2008b). *Complete life tables for 2006 – 2007 for the Singapore Resident Population*, Information Paper, Singapore, May.

Singapore Prime Minister's Office (SPMO) (2007). *Transcript of Prime Minister Lee Hsien Loong's National Day Rally English Speech: City of Possibilities; Home for All*, Singapore, 19 August.

Singapore Prime Minister's Office (SPMO) (2003). *Ministerial Statement by Prime Minister Goh Chok Tong in Parliament: Retuning the CPF*, Singapore, 28 August.

Thorburn, Craig, Roberto Rocha, and Marco Morales (2005). 'An analysis of Money's Worth Ratios in Chile,' *Journal of Pension Economics and Finance*, Vol. 6, Issue 03. November: 287-312.

World Health Organization. (Various years.) *Life Tables for WHO Member States*. [who.int/whosis/database/life\\_tables/life\\_tables.cfm](http://who.int/whosis/database/life_tables/life_tables.cfm). Viewed 3/16/09.

**Table 1: The Minimum Sum Scheme (MSS) Schedule, 2003 – 2013**

Period	Required Minimum Sum (2003 Dollars)	Required Minimum Sum (Real Dollars)	Draw-down Age	MSS Payout Structure
2003	\$80,000	\$80,000	62	• <i>Default</i> : Phased withdrawal (administered by CPF).
2004	\$84,000	\$84,500	62	
2005	\$88,000	\$90,000	63	• <i>Alternative</i> : Voluntary purchase of annuities. { Choose from MSS annuities offered by private insurers.
2006	\$92,000	\$94,600	63	
2007	\$96,000	\$99,600	64	
2008	\$100,000	\$106,000	64	Starting from 2009, participants may also choose from LIFE annuities }.
2009	\$104,000	-	65	
2010	\$108,000	-	65	
2011	\$112,000	-	65	
2012	\$116,000	-	65	• <i>Default</i> : Compulsory annuitization. { Choose from MSS annuities offered by private insurers or LIFE annuities offered by CPF }.
2013	\$120,000	-	65	
				• <i>Alternative</i> : nil.

Source: Authors' compilations; see text.

Notes: As of 2003, the Minimum Sum will be raised from S\$80,000 to \$120,000 by 2013 (in 2003 dollars) and adjusted for inflation. The Draw-Down Age refers to the official age at which the member may start drawing down the Minimum Sum plus interest. For example, a member who turns 55 as at 1 Jul 2007 must set aside \$99,600 as the Minimum Sum in his Retirement Account at age 55 and may start draw down only when he reaches age 64. If he dies before draw-down starts, the balance in the Retirement Account will be fully refunded to his beneficiary. From 2003-12, CPF is operating a voluntary annuity purchase scheme; life annuities may be purchased with the Minimum Sum 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 Minimum Sum; annuities will be offered by CPF-LIFE and private insurers.

**Table 2: Monthly Nominal Payouts for Life Annuities purchased at the Minimum Sum of \$99,600 (2007; S\$ per month)**

Company & Product	Monthly Annuity payout for entry age of 55		Guaranteed amount upon death
	Male (S\$)	Female (S\$)	
<i>Non-participating Annuities</i>			
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.
<b>Sub-average</b>	<b>525.53</b>	<b>477.80</b>	
<i>Participating Annuities</i>			
NTUC Income Co-op	523.50 (591.08 <sup>#</sup> )	490.25 (557.83 <sup>#</sup> )	Premium + interest accumulated at 2.5% p.a. and bonuses to age 62 - total annuity payments.
HSBC Insurance	474.00 (541.58 <sup>#</sup> )	458.00 (525.58 <sup>#</sup> )	Premium + interest accumulated at 2% p.a. to age 62 - total annuity payments.
<b>Sub-average</b>	<b>498.75</b>	<b>474.13</b>	
<b>Average without bonus adjustment</b>	<b>519.58</b>	<b>476.98</b>	
<b>Average with bonus adjustment</b>	<b>534.60</b>	<b>492.00</b>	

Source: Authors computations; derived from CPF (2008a).

Notes: Monthly payouts for a nominal deferred annuity purchased at age 55 with payments starting at age 62. The lump-sum premium is the Minimum Sum of S\$99,600 for members age 55 (July 07-June 08). Annuities under the MS Scheme currently guaranteed for 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. # 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 brackets; figures in brackets incorporate bonus component assuming an annual projected bonus rate of 2 percent and a projected annual investment rate of return of 5 percent.

**Table 3: Money's Worth Ratios Computed for MSS Life Annuities**

Study	Valuation Date & Sample chosen	Mortality Assumption		Interest Rate Assumption	MWR for 55-year-old Male		Adverse selection (%)
		Annuitant	Population		Ann.	Pop.	
Fong W.M. (2002)	2000; subset of 8 non-participating annuities & 1 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 Piggot (2004)	2000; subset of 5 non-participating annuities with a 15-yr 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: 7 non-participating & 2 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%).	0.883	0.854	2.89

Source: Authors' computations; see text.

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 UK a(1990) period life table for annuitants. It is based on UK annuitants' experience from 1967 – 70, with mortality improvements projected to 1990. Because of lack of annuitant experience in Singapore, previous studies used the a(90) and with a two-year setback to account for lower mortality among annuitants. A two-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.

**Table 4: Money's Worth Ratios and Adverse Selection Cost of MSS Annuities** (nominal life annuities offered by private insurers under CPF plan; 2007)

Company & Product	Male			Female		
	Population MWR	Annuitant MWR	Adverse Selection (%)	Population MWR	Annuitant MWR	Adverse Selection (%)
<i>Non-participating Annuity</i>						
Asia Life Assurance	0.808	0.835	2.72	0.792	0.830	3.79
Prudential Assurance	0.824	0.853	2.85	0.785	0.822	3.72
AIA	0.851	0.879	2.83	0.887	0.932	4.48
GE Life I	0.853	0.883	2.91	0.842	0.882	4.09
OAC	0.851	0.880	2.95	0.854	0.897	4.29
Aviva	0.883	0.915	3.15	0.875	0.919	4.43
GE Life II	0.794	0.820	2.60	0.772	0.807	3.58
<i>Participating Annuity</i>						
NTUC Income Co-op	0.944	0.976	3.21	0.965	1.013	4.82
HSBC Insurance	0.877	0.904	2.77	0.913	0.957	4.44
<b>Mean</b>	<b>0.854</b>	<b>0.883</b>	<b>2.89</b>	<b>0.854</b>	<b>0.896</b>	<b>4.18</b>

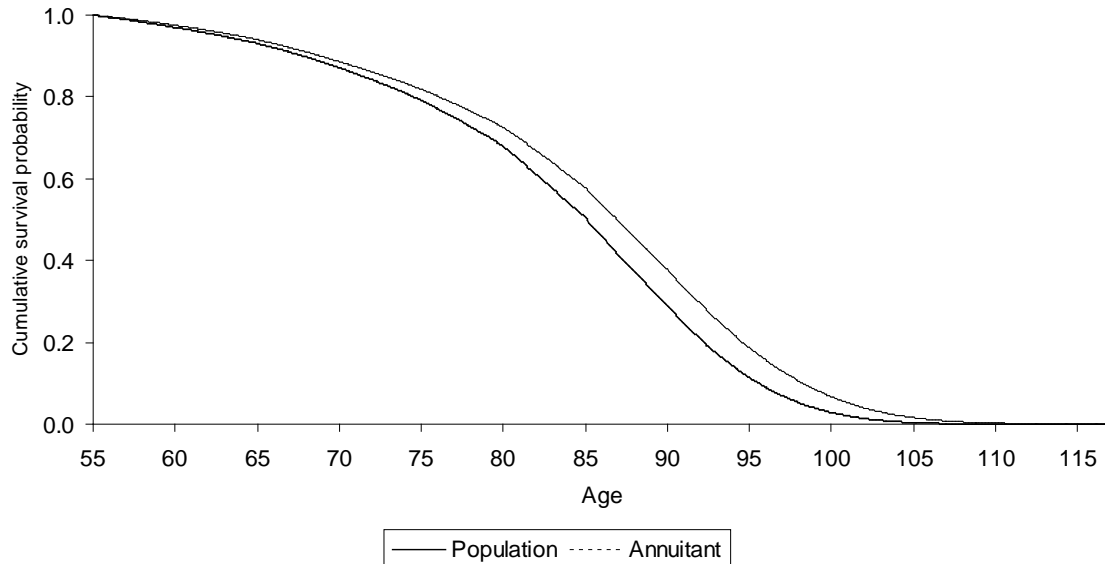
Source: Author's computations, see text.

Notes: Money's worth ratios 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 \$99,600, and starts receiving payouts at age 62.

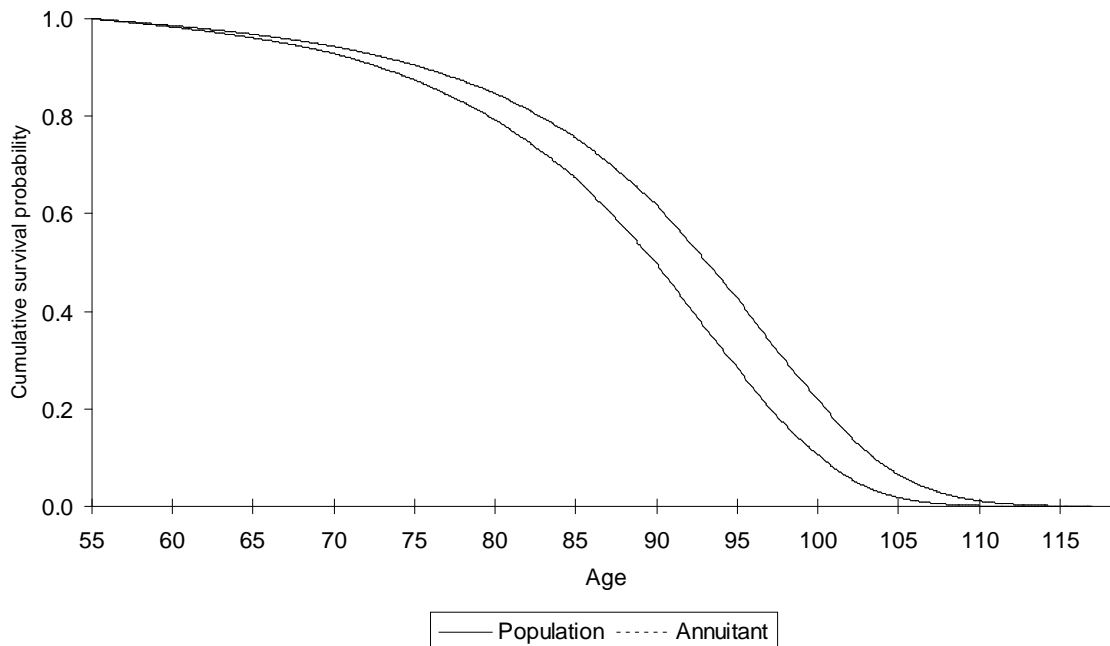


**Figure 1: Cumulative Cohort Survival Probability: General Population and Annuitant groups (conditional on attaining age 55 and limiting age of 117; 2007)**

**A. Singaporean Males**



**B. Singaporean Females**



Source: Authors' computations; see text.