Longevity Risk and Annuities in Singapore

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

June 2009

This version: Jun 22, 2009

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Abstract

Compulsory annuitization is often proposed as a compelling solution under defined-contribution pension schemes to help plan participants manage their longevity risk. This paper 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.

Joelle H.Y. Fong
S.S. Huebner Foundation Fellow and PhD Candidate
Department of Insurance and Risk Management
The Wharton School, 3620 Locust Walk, St 3000 SHDH
Philadelphia, PA 19104-6320
Email: hfong@wharton.upenn.edu

Olivia S. Mitchell
International Professor of Employee Benefit Plans
Chair and Professor of Insurance and Risk Management
Director, Pension Research Council and Boettner Center for Pensions & Retirement Research
The Wharton School, 3620 Locust Walk, St 3000 SHDH
Philadelphia, PA 19104-6320
T: 215-898-0424 • F: 215-898-0310
Email: mitchelo@wharton.upenn.edu

Benedict S. K. Koh
Associate Professor of Finance
Singapore Management University
50 Stamford Road, #04-01
Singapore 178899
T: 65-6828-0716 • F: 65-6828-0777
Email: skkoh@smu.edu.sg

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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 paper 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, currently in development by the CPF Board.

The Retirement Framework in Singapore

Singapore's Central Provident Fund is one of Asia's oldest retirement programs, as it was established in 1955 (prior to the nation's independence in 1965). 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). [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). 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 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

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[1] 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).

years at birth[2]). 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 Scheme (MSS). 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 a Minimum Sum in their Retirement Account from their total accumulations;[3] 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 Minimum Sum was set at $99,600 and the official draw-down age at 62. The Minimum Sum is not a threshold easily met; for instance, only 36.4 percent of active members could set aside the required Minimum Sum 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 MSS and projected changes to 2013. Here we see that the stipulated Minimum Sum will rise progressively until it reaches $120,000 by 2013.[4] 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

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[2] Figures are from year end 2007 and obtained from the Singapore Department of Statistics (SDOS 2008).
[3] 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 ≤ $5,000 (withdraw everything), $5,000 < total balance ≤ $12,500 (withdraw $5,000 and set aside remainder in Retirement Account), and $12,500 < total balance ≤ $176,667 (withdraw 40 percent of total balance and set aside remainder in Retirement Account) (CPF 2009b).
[4] 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).

annuitization format, about which we say more below. Under the present rules, most retirees take drawdowns from their Minimum Sum 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 (MSS) annuities were on offer; these involve a life annuity where the lump-sum premium is the stipulated Minimum Sum.[5] 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 MSS 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 Minimum Sum of $99,600 to be paid at age 55, in exchange for annuity payments beginning at exact 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 MSS 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

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

premium of $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.

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 4-5 percent of

the retiring cohorts in recent years have voluntarily purchased an MSS annuity. 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 a MSS annuity because

they had not set aside the full Minimum Sun 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

of six – opted for annuitization.[7]

Table 3 here

This relatively high annuitization rate among the eligibles 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 MSS rules permit

bequests via refunds to beneficiaries. More plausible is a desire for liquidity, since the phased

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[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 2. The results in Table 4 accounts for the different specifications of guaranteed amount for each product.
[7] This is consistent with Doyle et al (2004).

withdrawal approach yields monthly payouts of $790, compared to the average annuity payout of about $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 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. 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):

$$MWR = [EPDV(benefits)]/K \qquad (1)$$

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:

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[8] 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.

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

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 older studies have evaluated the money's worth of MSS annuities offered under the Singaporean CPF scheme, and both use data available in the year 2000.[9] Fong (2002)

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[9] A total of 11 flat-rate (level) non-participating and participating annuities were offered in Jul 2000 (excludes two annuities with increasing payouts). Doyle et al. (2004) sampled five non-participating annuities. 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 et al. (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 their 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 et al. (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 any explanation of why this might be appropriate in Singapore's context.[11] Another data limitation in past studies is also of concern, namely that their mortality tables have different limiting ages for the population and the annuitant group. For instance, Fong's data (2002) set 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.

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sampled all eight non-participating annuities plus one participating annuity (but did not incorporate potential bonus payouts from the participation feature).

[10] The World Health Organization (WHO) has 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] There are three main actuarial assumptions that could be used for fractional ages within a year: namely, the uniform distribution of deaths assumption, the constant force of mortality assumption, and the hyperbolic assumption.

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 on offer. 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:

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

But the problem with Equation (3) is that it 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 sub-sample; 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

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[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).

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 EPDV formula is then more appropriate for a MSS nominal annuity with guaranteed amount refund:

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

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 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 et al. (2004) by explicitly including the refund upon death before age 62 to represent expected benefits due to the annuitant and his beneficiaries.[14]

In implementing the model, we are also fortunate in having access to new population mortality tables to a limiting age of 100, recently published by Singapore Statistics (DOS 2008a).

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[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. 2000). 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 et al. (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.

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 use the following formula:

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

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 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 a limiting age of 117. The rationale is to properly capture the longevity tail risk in the population group, especially for females.

Despite the improvement in population mortality data, less information is available on the annuitant mortality experience in Singapore. Standard insurance industry practice and previous research in Singapore (Fong 2002) have therefore adopted the UK annuitant mortality experience with adjustments for local conditions, as is also done in Australia. Furthermore, the Monetary Authority of Singapore (MAS) 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 2004).[15] Accordingly, we use the a(1990) tables with a five-year setback to estimate

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[15] 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(90) tables with a two-year setback. These a(90) 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 cohortise it for the MWRs.

the annuitant experience for our valuation year, and then we cohortize the resulting annuitant tables.[16]

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

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

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 plot 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 curves lie above those 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 MSS to CPF members; they provided a total of nine MSS annuities for the premium of $99,600 (the stipulated Minimum Sum that year; CPF 2008a). All of these annuities provided level payouts; two were also participating annuities, as shown in Table 2. The NTUC Income participating annuity offers an annual projected bonus rate of about 2 percent (NTUC Income 2009). Incorporating 2 percent bonus payouts for both the participating annuities, the average payout across all 2007 MSS

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[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.

annuities works out to be 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.[17] Table 3 summarizes our key inputs and compares them to prior studies on Singaporean MSS annuities.

Table 3 here

Money's Worth Ratios for MSS Annuities

We next provide money's worth results using population mortality tables, focusing on MSS life annuities offered by private insurers under the existing voluntary annuity purchase scheme as at 2007. Results in Table 4 show that, on average, $1 of premium spent on purchasing a nominal MSS annuity by a 55-year-old male drawn from the general population would generate nearly $0.862 in expected annuity income (in net present value terms). Likewise, a female in the general population can anticipate receiving $0.861. 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's annuity offers the highest money's worth

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[17] 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.

to retirees in Singapore. The MWR of $0.953 (males) and $0.973 (females) exceeds the average MWR by almost 10.5 percent and 13.0 percent respectively. This might 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. And its monthly annuity payouts are the highest among the MSS annuities (once we factor in estimated bonus).[18] Perhaps not surprisingly, this firm has the largest market share of annuities in Singapore.

Table 4 here

The MWR values generate our calculated estimates of total loadings, which stand at about 13.8 percent on average. These estimates are similar to those for the UK nominal annuities of about 14 percent (Finkelstein and Poterba 2002), and for the US of 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 et al. (2004) indicates finding a loading of about 5.5 percent for both sexes. Such small loadings follow from their very high MWR figures ranging from $0.945-1.009 using population mortality. One explanation for the difference, as acknowledged by the prior authors, is that the MWR values might be overstated due to the lack of long duration Treasury bonds at the time. Such low loadings also seem implausibly low since the products are mainly offered by private insurers who would not survive in the marketplace long, if they paid such high benefits.

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

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[18] 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).

(i)   Different products evaluated: We value MSS annuities offered in 2007, which include a guaranteed *amount* refund; earlier studies valued MSS annuities with a 15-year guaranteed *period*.

(ii)   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.

(iii)   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; see Doyle et al. 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 MSS 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 6 percentage points reported for Australian annuities (Doyle et al. 2004). They are much lower than the 10 percentage points reported for the US (Mitchell at al 1999).

Overall, our findings suggest that a retiree having the Minimum Sum in Singapore's CPF system should be able to get insurance on competitive terms, without much worry about adverse selection. Total loads could still be further reduced by introducing mandatory annuitization under the CPF scheme, a topic to which we turn next.

Mandatory Annuitization Proposed

While the existing default phased withdrawal with voluntary annuitization may have worked well in the past in Singapore, there is reason to be concerned that future retirees are increasingly 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 rose to 78.2 and 82.9 respectively. And of those age 65 in 2007, two-thirds can 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 today may 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 that will be launched in 2009, with benefits first payable in 2013. This program, dubbed the CPF-LIFE program will be integrated with the existing CPF Minimum Sum Scheme. It will automatically enroll members age 51 and younger in 2009 who have at least $40,000 cash saving in the Retirement Account at age 55. The public sector entity which supervises the current system, the CPF Board, will administer the scheme drawing on the advice of independent actuarial consultants who will determine premium and payout levels.

After the plan was announced by Prime Minister Lee in 2007, he established the National Longevity Insurance Committee (NLIC) to help design the program's elements (SPMO 2007). This group released a report in 2008 outlining preliminary details, and the plan continues to be refined by the CPF Board. Accordingly, as of this writing, only the broad outlines of the new mandatory annuitization scheme are available, so 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 most important changes in 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 (NLIC 2008). Instead of having payouts begin at age 62, as now, the Minimum Sum is to be partially annuitized by default at age 65, so there is a 10-year deferral period from age 55 to 65. The Minimum Sum is to 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, and he can bequeath the Term amount plus interest minus payouts. The only other decision to be made is whether the participant wants to have his remaining annuity premium (N minus payouts) provided to his heirs on his death, which is called the refund portion. For example, 'R80' would be a plan where the annuity component starts at age 80 and the annuity would have a refund element; 'NR65' would be a plan where the annuity component starts at age 65 and there would be no death benefit.

The rationale for making the system compulsory is to prevent adverse selection. Yet the rules will permit a member to elect either the CPF-managed annuity or a private annuity provider. The entry of the government into the provision of annuities under the new CPF plan is likely to have both positive and negative effects. On the one hand, making the program mandatory should eliminate the adverse selection measured above in the private market. On the other hand,

government provision might crowd-out private insurers, thus reducing competitiveness. There is already some support for the latter concern: in 2008, for instance, only two MSS annuities were offered by private insurers, compared to nine in the previous year. This may indicate that private insurers are scrambling to re-price their products more competitively, but it could also indicate that they have been crowded out.

It may be sensible, however, for private annuity providers to refocus their business outside the CPF scheme for those seeking to annuitize non-pension wealth. One reason is that there is a cap to the amount in the Retirement Account that CPF members can annuitize. This cap is the stipulated Minimum Sum which varies from year to year. Very wealthy individuals seeking a higher monthly annuity payout would still turn to commercial annuities. It is also worth nothing that the current plan will exempt CPF members who hold alternative lifelong pensions or annuities from the government-run annuity scheme.

Summary and Conclusion

We present new evidence on the annuity market in Singapore focusing on products offered by private insurers, and we discuss possible impact of imposing mandatory annuitization through the national CPF system. Given products provided by the private market to date, we show that a 55-year-old male in the Singapore population can currently expect to obtain a MWR value of about 0.853. These Singaporean MWRs are similar to those in other developed countries. But in Singapore, the costs of adverse selection are much smaller than elsewhere. 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 up to date data available – 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 is to 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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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
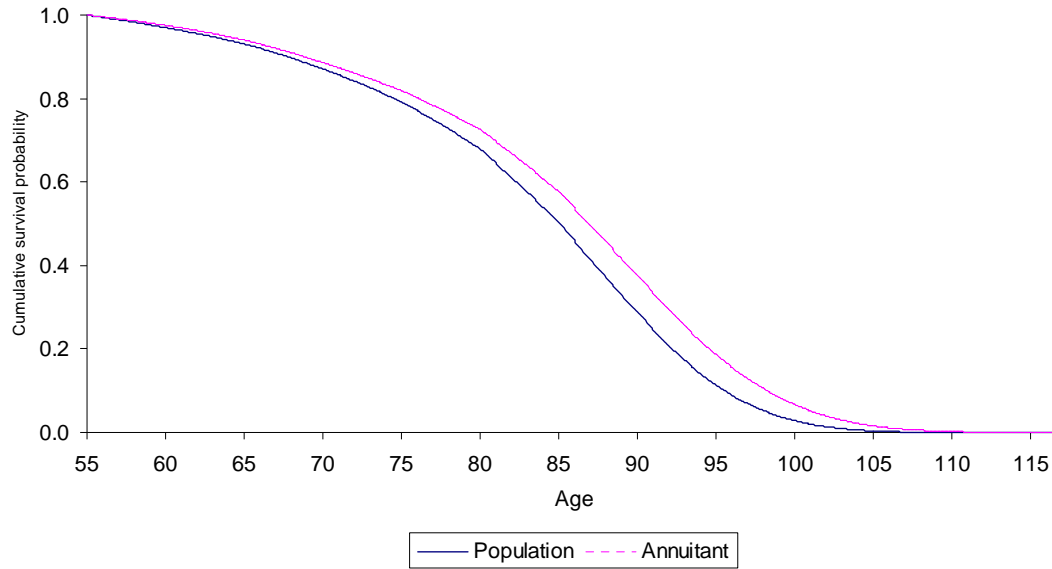
B. Singaporean Females
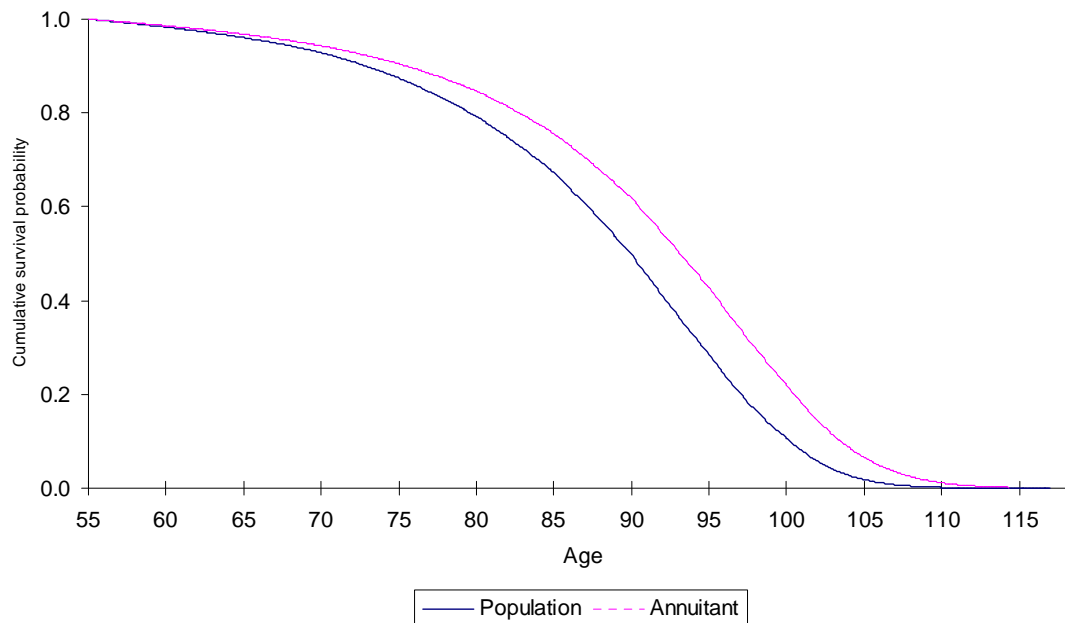
Source: Authors' computations; see text.

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

Period From 1 Jul	Required Minimum Sum (2003 Dollars[1])	Required Minimum Sum (Real Dollars[2])	Draw-down Age[3]	MSS Payout Structure
2003	$80,000	$80,000	62	• Default: Phased withdrawal (administered by CPF),
2004	$84,000	$84,500	62	
2005	$88,000	$90,000	63	or
2006	$92,000	$94,600	63	• Alternative: Voluntary purchase of annuities. {Choose from MSS annuities offered by private insurers}[4].
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}[5]. • Alternative: nil.

Source: Authors' compilation from CPF website (www.cpf.gov.sg).
Notes:
1. In the 2003, the government announced that the CPF Minimum Sum will be raised from S$80,000 to $120,000 in 2013 (expressed in 2003 dollars). This amount is to be adjusted every year for inflation (as measured by the Consumer Price Index) to compute the real (or actual) dollar Minimum Sum for that year.
2. The 2003 dollar amounts are to be adjusted every year for inflation to obtain the required Minimum Sum in real dollars. The inflation rate is measured by the Consumer Price Index (CPI) as announced by the Singapore Department of Statistics. The previous years' CPI will be used to compute the CPF Minimum Sum increase each year. So for example, the CPF Minimum Sum in real dollars is $106,000 with effect from 1 July 2008 after taking into account the inflation for the previous years.
3. 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.
4. From 2003 – 2012, CPF is operating a *voluntary annuity purchase scheme*. The purchase of life annuities using the Minimum Sum is voluntary and the basket of annuities include only MSS annuities offered by private insurers.
5. From 2013 onwards, CPF will operate a *mandatory annuitization scheme*. The purchase of life annuities using the Minimum Sum is compulsory and the basket of annuities include LIFE annuities offered by CPF and the MSS annuities offered by private insurers. However, as information on the MSS annuities available in 2013 is not yet available, we focus mainly on the LIFE annuities under this mandatory annuitization scheme.

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

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

Source: Authors' computations from CPF "*CPF Minimum Sum Scheme: Table of Monthly Payment Rates for the Minimum Sum Of $99,600 placed with a Participating Insurance Company* http://mycpf.cpf.gov.sg/NR/rdonlyres/883DD6D3-D1EC-48DD-8B09-811C0D24ECE8/0/AnnuityComparison.pdf (Viewed 16 Mar 2008)
Notes:
Bonus rates depend on company performance; NTUC Income's annual bonus rates have been 1-3.5 percent historically and a 2 percent bonus rate is used in NTUC Income benefit illustrations. Original level payouts without bonus are expressed without brackets; figures in brackets are modified payouts incorporating a bonus component assuming an annual projected bonus rate of 2 percent and a projected annual investment rate of return of 5 percent.
1. Monthly payouts are for a nominal deferred annuity purchased at age 55 with payments starting at exact age 62.
2. The lump-sum premium is the CPF-determined Minimum Sum of S$99,600 for members turning 55 between Jul 2007 and Jun 2008.

3. Annuities under the Minimum Sum Scheme (MSS) are currently guaranteed for a certain <u>amount</u> in the event of death of the annuitant. Thus, the positive difference of the guaranteed amount less annuity payments made would be paid to the annuitant's nominated beneficiaries. Previously, in Year 2000, most MSS annuities were guaranteed for a certain <u>period</u> instead. This means that if death occurs during the guaranteed period, remaining annuity payments would be converted into a lump sum to be paid to the beneficiaries.

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.**	*(in percentage points)*
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%).	0.891	0.862	2.89

Source: Authors' computations; see text.

Notes:

1. 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).

2. 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)

	Male			Female		
MSS annuity	**Population**	**Annuitant**	**Adverse Selection**	**Population**	**Annuitant**	**Adverse Selection**
Non-participating Annuity						
Asia Life Assurance	0.816	0.843	2.72	0.799	0.836	3.79
Prudential Assurance	0.832	0.860	2.85	0.792	0.829	3.72
AIA	0.859	0.887	2.83	0.895	0.940	4.48
GE Life I	0.862	0.891	2.91	0.849	0.890	4.08
OAC	0.859	0.888	2.95	0.862	0.905	4.29
Aviva	0.892	0.923	3.15	0.883	0.927	4.43
GE Life II	0.802	0.828	2.60	0.778	0.814	3.57
Participating Annuity						
NTUC Income Co-op	0.953	0.985	3.21	0.973	1.021	4.81
HSBC Insurance	0.885	0.913	2.77	0.921	0.965	4.44
Mean	**0.862**	**0.891**	**2.89**	**0.861**	**0.903**	**4.18**

Source: Author's computations, see text.
Notes:
1. Money's worth ratios are in decimals. Adverse selection costs are in percentage points.
2. The computations pertain to a CPF participant who purchased the MSS annuity at entry age 55 for a premium of $99,600, and starts receiving payouts at age 62.