ADEQUACY OF SINGAPORE'S CENTRAL PROVIDENT FUND PAYOUTS: INCOME REPLACEMENT RATES OF ENTRANT WORKERS

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Abstract:

The study examines whether the Central Provident Fund (CPF) can provide adequate retirement savings for a young Singaporean joining the workforce today, using the Income Replacement Rate (IRR). The paper fills gaps in previous studies on Singapore's IRR by incorporating unique institutional features of CPF. It also shows how IRRs vary with individuals' decisions on their housing consumption and use of CPF savings. Assumptions used in the model are largely based on empirical data to remove subjective elements as far as possible.

The study finds that CPF savings are able to support robust IRR outcomes comparable to OECD countries. Amongst entrants to the workforce today, the median male earner will be able to replace 70% of his wages when he retires. For the median female earner, the net IRR is slightly lower at 64%. If imputed rent on owner-occupied homes is taken into account, the net IRRs would be higher. For lower income earners, the Workfare Income Supplement boosts the IRRs significantly. The study affirms that for those who work consistently, the CPF system will be able to provide adequately for retirement, with prudent choice of housing and the wise use of withdrawn CPF savings.

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1.   INTRODUCTION

Singapore has a fully funded mandatory defined contribution (DC) social security system. The system, which is based on individual accounts, is administered and managed by the Central Provident Fund (CPF) Board. One main advantage of a DC system is that it helps avert issues relating to financial sustainability, particularly in an ageing population. Under a defined benefit social security system, for example in Japan, an ageing population which leads to a falling contributor-benefactor ratio issues has brought sustainability issues to the forefront. Although a DC system lends fiscal advantages and the assurance that payouts are funded and sustainable, the policy concern turns to whether such a system can deliver adequate retirement savings. Retirement adequacy depends on the designs of both the accumulation and the payout phases.

This paper aims to assess the retirement adequacy of young Singaporeans, i.e. those entering the workforce today. It is not easy to assess the retirement adequacy of a social security system. Pension economists commonly rely on the concept of Income Replacement Rate (IRR), which represents retirement incomes/payouts relative to pre-retirement earnings, and use the IRR to evaluate and compare the different social security systems. IRRs indicate how much of one's pre-retirement earning is replaced by payouts from his accumulated savings. Individuals can use the IRR as an indicator of their retirement preparedness.

The IRR is also commonly used to make international comparisons. There are essentially two measures of IRR internationally. One is the gross IRR, defined as gross pension entitlement divided by gross pre-retirement earnings. The other is net IRR, defined as net pension entitlement divided by net pre-retirement earnings, taking account of personal income taxes and social security contributions paid by workers and pensioners.

It is generally accepted that if retirees are able to replace roughly 70% of pre-retirement earnings, they would be able to maintain their standard of living after retirement. (Scheiber, 2004 and McGill et.al, 2005). The World Bank recommends a net IRR of between 53% and 78% for middle-income earners[1]. (The World Bank 1994, p.294).   The average net IRR amongst 34 OECD countries for median income earners is 72%. (OECD 2011, p.125).

There are some recent computations of IRRs for Singapore. In Hui (2012)'s study on the retirement adequacy of CPF, he sets gross IRR of 66% as the target for retirement adequacy. He then compares the computed IRRs for three different groups, namely the secondary educated, post-secondary educated and tertiary educated, to the target.   Using publicly available data of wage profiles by educational attainment from Report on Labour Force in 2010, , findings from his base case model (which did not include home purchase) showed that only low-income workers (secondary educated) will be able to achieve the target IRR with their CPF savings when they reached 65 years old.

Computations of IRRs for Singapore by some international agencies indicate much lower IRRs. In the annual Melbourne Mercer (2012) report on the global pension index, the net IRR for a

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[1] 53% corresponds to net final year wage and 78% corresponds to the net average lifetime wage.

median income earner in Singapore is below 20%. The OECD (2012) reports the gross IRR for Singapore to be 13%[2] for a working career of 40 years and 9.3% for a shorter career of 30 years (See OECD, p. 36). The international figures are low because the methodologies used, while appropriate for many pension systems overseas, are not designed for evaluating the CPF system, which differs in important respects from the pension systems from most OECD countries.

Amongst others, we note that the methodologies used typically consider only CPF savings that are earmarked for retirement, i.e. savings in the CPF Special Account (SA) and not other CPF savings.[3] However, CPF savings are channeled into three different accounts for different purposes. Savings in the SA and Medisave Account (MA) are earmarked for retirement and healthcare expenses, respectively. Savings in the Ordinary Account (OA) can be withdrawn for pre-retirement uses, notably to finance housing. Indeed, OECD has qualified that Singapore's IRR would be 82% if all CPF SA and OA savings are put towards retirement-income provision, without any pre-retirement withdrawals for housing.[4] Both these numbers do not adequately reflect the institutional arrangements of the CPF system. Care is thus needed if these numbers are used to assess the adequacy of the CPF system.

The above suggests that it is important for international IRR comparisons to take into account the unique features of a country's social security system. In the case of Singapore, the CPF enables the majority of Singaporeans to own their homes, which is an asset that can be tapped on to supplement retirement income should the need arises. Even if this asset is not monetized, it enables one to save on rental costs in retirement. The ability to incorporate the housing asset adds an important dimension in measuring the IRR for Singapore.

This paper recognizes that the replacement rates that the CPF system can deliver depends on many factors, such as the initial wage level, earnings growth path, length of the contribution period, the employment/contribution density and housing consumption choice. It also depends on CPF policy parameters such as the contribution rates, and returns to CPF savings. Furthermore, since CPF permits pre-retirement withdrawals to finance housing and healthcare, to assess the adequacy of the CPF system using IRR, it is necessary to model the pre-retirement withdrawal of savings for housing finance.

This paper seeks to fill the gaps in previous studies on Singapore's IRR. We construct a simulation model that incorporates the institutional details of the CPF system and implements the model based on CPF administrative data as well as data from the Labour Force Survey.

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[2] For entry age at age 20 (full career of at least 40 years) and 9.3% for entry age at age 30 shorter career of OECD. p. 36.

[3] There could possibly be other measurement and conceptual differences used in the computations that account for the lower rate. For example, in the computation of IRR for Singapore, the OECD used Gross National Income per capita to proxy average income and an annuity factor to determine payout from a price-indexed life annuity. They also made some assumptions on macroeconomic variables such as price inflation, wage growth rates and interest rates.

[4] The OECD stated that "The relatively low replacement rate for Singapore shown in Figure 1 of 13% is because the calculations only consider the earmarked retirement account. If an individual were to put the general account towards retirement-income provision as well, then the replacement rate would be 82%." Source: OECD (2009), p. 6.

The model also demonstrates that the IRRs depend on the choice of the CPF LIFE annuity plans during the payout phase, the real wage growth and employment density and also the individual worker's housing consumption choice.

The paper is organized as follows: Section 2 describes the assumptions used in the projection simulation model. Section 3 presents the baseline results on the income replacement rates. Section 4 shows the sensitivity of the baseline results to assumptions on housing consumption, single earner households, i.e. single-financing of housing mortgage. This section also presents income replacement rates when the amounts of CPF savings that are annuitized are capped to the minimum sum level. Section 5 concludes with some policy recommendations.

2. MODEL STRUCTURE AND PARAMETER ASSUMPTIONS

The model constructed is used to determine the income replacement rates at different income percentiles at age 65 for the cohort of young workers in 2012. To do so, we projected the CPF accumulations in the OA and SA. The CPF accumulations depend on the earnings profiles such as the initial wage, real wage growth, and employment density. It also depends on policy parameters set by the CPF Board, such as contribution rates, salary ceiling, and allocation of contributions into different CPF accounts and rate of returns. Given that OA savings can be withdrawn for housing purposes, the net accumulation will depend on the levels of housing consumption.

2.1 Earning Paths

The model assumes that male workers enter the workforce at age 25 and female workers at age 23. Both male and female workers work till age 65. The starting wages and starting CPF balances are based on CPF administrative data of workers at that age. Table 1 shows the starting wages of male and female workers which are used to anchor the lifetime earnings path for different income percentiles.

Table 1
Starting Wages of Male and Female Workers (2012$)

Percentiles	Male (Age 25)	Female (Age 23)
30P	$1,820	$1,650
50P	$2,500	$2,120
70P	$3,300	$2,700

In contrast to previous studies which assumed constant wage growth[5], we used data collected by the Ministry of Manpower (MOM) for the Labour Force Survey (LFS) over 2001 to 2011 to simulate real wage growth paths[6] for individuals. Wage growth is a key factor in determining how much CPF savings is accumulated.

With detailed empirical data from the LFS, we were able to map out the age-earnings profile of workers over their working life for each income percentile, thereby providing more realistic wage growth data for the model.

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[5] The OECD study assumed constant real earnings growth of 2%. Hui (2012) also assumed constant annual wage growth from age of 22 to 62.

[6] As an illustration, for each income percentile level, to calculate the real wage growth of a worker aged 30 – 34, we first rebase the wage series to the same reference year before computing the annualized real wage growth for (i) workers who moved from age 25-29 (in 2001) to age 30-34 (in 2006) and (ii) workers who moved from age 30-34 (in 2001) to age 35-39 (in 2006). The real growth rates from (i) and (ii) are then averaged so that we do not under or over-estimate the real wage growth. This is repeated using data from 2006 to 2011. To account for cyclical effects, we further took the average of the annualized real wage growths over the two 5-year periods – 2001 to 2006 and 2006 to 2011 – to obtain the real wage growth for workers aged 30 – 34. The same process is repeated to determine the real wage growth of workers in other 5-year age bands, for each income percentile studied.

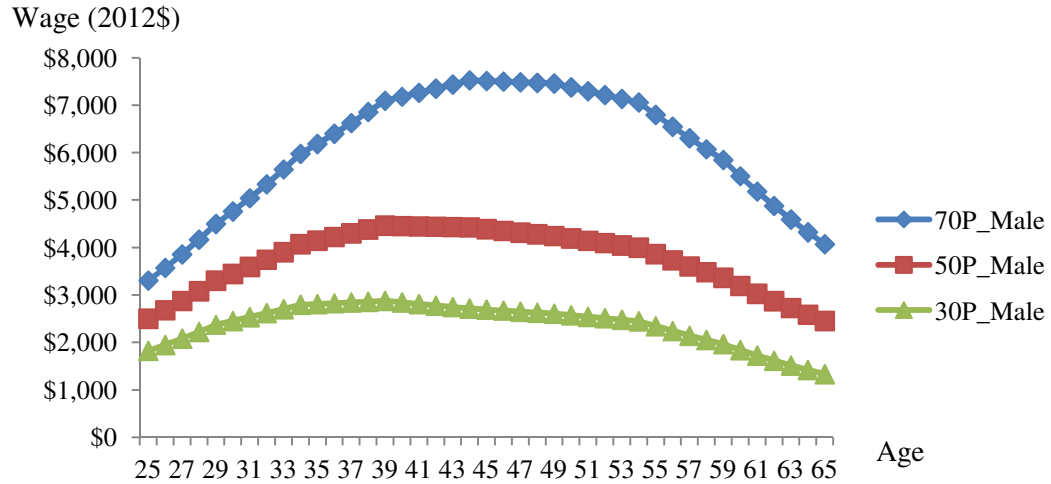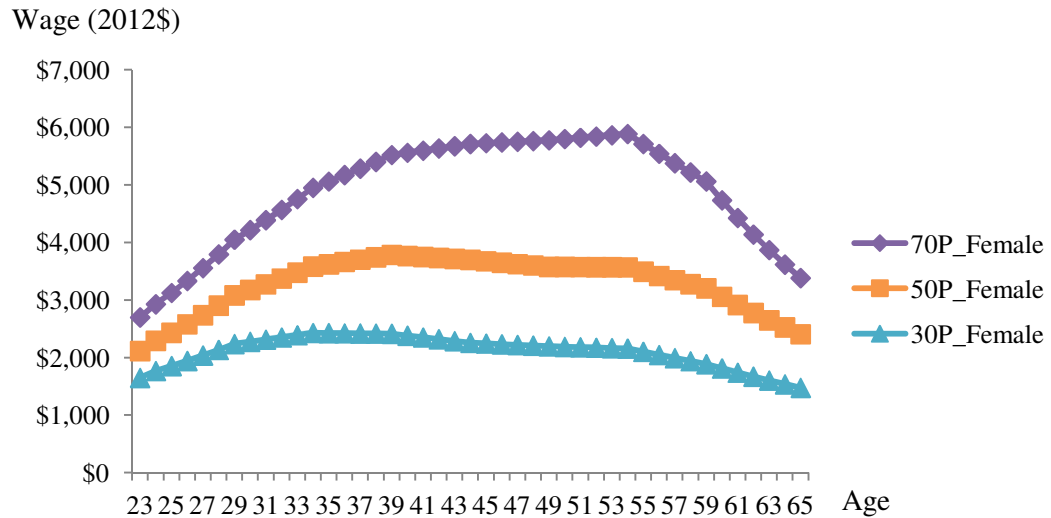**Figure 1a: Empirical Age-Earnings Profile (Male Workers)**

Wage (2012$)

Legend: 70P_Male, 50P_Male, 30P_Male. X-axis: Age (25 27 29 31 33 35 37 39 41 43 45 47 49 51 53 55 57 59 61 63 65)

Figure 1b: Empirical Age-Earnings Profile (Female Workers)

Wage (2012$)

Legend: 70P_Female, 50P_Female, 30P_Female. X-axis: Age (23 25 27 29 31 33 35 37 39 41 43 45 47 49 51 53 55 57 59 61 63 65)

Figures 1a and 1b show the resulting empirical age-earnings profile for workers at different income percentiles. It is a hump-shaped distribution of earnings by age where wage growth is faster when the worker is young and tapers off into the negative as he gets older. This profile is attributed to the human capital effect[7] and is also seen for workers in the US, UK, Germany, Netherlands, Denmark and Sweden (Bosworth et al., 1999 and Mastrobuoni. and Taddei, 2011)[8].

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[7] In the initial years of work, average earnings rise as workers accumulate human capital (skills and experience). It falls after age 45 or 50 as value of workers' skills erodes or as workers reduce their hours and enter retirement.

[8] Based on lifetime earnings records from US administrative data, Bosworth et al. (1999, p.45) documented hump-shaped age earning profiles for American men and women born between 1931 and 1960. Using data from the European Community Household Panel, Mastrobuoni and Taddei (2011) found that economies with more flexible

It is important to take this age-earnings profile into account in studies on retirement adequacy as a dollar saved when a person is younger earns more interest over time than a dollar saved later in life. Models which assume constant wage growth such that income before retirement is highest do not reflect real-world income patterns accurately, and could understate savings accumulated over a person's lifetime.

In computing earnings, we took into account the Annual Wage Supplement (AWS, or 13th month bonus as it is more commonly known), for workers in the 30th percentile and above. To be conservative, it is assumed that low income workers (bottom 20 percent) do not receive the AWS.

We assumed that workers remain in their respective income percentiles throughout their working life. In reality, workers would move across income percentiles through their working careers. Actual experience is hence likely to create results with less dispersion in incomes and IRRs between different income percentiles than found in this study.

2.2   Employment/Contribution Density

Most existing studies assume that the worker is employed 100% of the time, i.e. they earn a wage every month of every year from starting age to pension eligibility age. To mirror the real-world employment experience of workers, we allowed for episodes of unemployment or economic inactivity in our baseline estimates, and made assumptions about employment density, i.e. how much a CPF member worked over his or her life.

For workers between the ages of 25 to 54, we assumed that the worker is unemployed for 15% of his working life. The unemployment period is spread out evenly over the entire working life, so that he is not working for 15% (or works for 85%) of the time each year. From age 55 to 65, we assumed the worker works 78% of the time. The employment density for workers between age 25 to 54 is based on the median contribution density of alive active CPF members aged 55 in 2011 by tracking their contribution history from 1981 (when they were 25 years old) to 2011 (when they turned 55 years old). For workers aged 55 to 65, the employment density is based on the median contribution density of alive CPF members who were active when they were aged 55 in 2001 to age 65 in 2011.

2.3   CPF Policy Parameters

The CPF contribution rates, CPF salary ceiling and interest rates paid on the respective CPF accounts (OA, SA, MA, and RA, including the Extra Interest (EI)) are based on current policies. Table 2 shows the CPF contribution rates and how the contributions are allocated into the respective accounts, as of September 2012.

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labor markets such as the UK, Germany, Netherlands, Denmark and Sweden have wage profiles that increase at the beginning of a workers' career, up to ages 45-50 and decline as workers approach retirement.

Table 2
Rates of Contribution and Allocation as of 1 September 2012

Employee Age (years)	Contribution (% of wage)		Total Contribution (% of wage)	% of total contribution credited to:		
	Employer	Employee		Ordinary Account	Special Account	Medisave Account
35 & below	16	20	36	23	6	7
Above 35 –45	16	20	36	21	7	8
Above 45 –50	16	20	36	19	8	9
Above 50 – 55	14	18.5	32.5	13.5	9.5	9.5
Above 55 - 60	10.5	13	23.5	12	2	9.5
Above 60 – 65	7	7.5	14.5	3.5	1.5	9.5
Above 65	6.5	5	11.5	1	1	9.5

Source: CPF website at http://www.cpf.gov.sg
Notes: All figures are in percent of wage. Figures above are for monthly wages of $1,500 and above.

The current interest rate for OA is at the statutory minimum of 2.5% while that for SA, MA and RA (SMRA) is at the floor rate of 4%. For simplicity, we keep the CPF interest rates at these minimum levels throughout the model. The first $60,000 of CPF savings including up to $20,000 in the OA, would also earn an Extra Interest of 1%.
These assumed long-run rates are equivalent to a real interest rate of 0.7% for the OA and 2.2% for the SA/RA, if we factor in a long-run inflation rate of 1.8%, which is the 20-year annualized inflation rate using the Consumer Price Index (CPI) for the period 1991-2011. These assumed rates are lower than the historical real rate of return for the OA and SA/RA[9]. Since CPF interest rates should trend upwards towards historical averages over the long-run, the assumed rates are relatively low and conservative.

Currently, CPF contributions are payable up to a salary ceiling of $5,000. The Economic Review Committee (ERC) had recommended in 2003 that the CPF salary ceiling should be pegged to the 80th percentile income[10]. In the projection model, we assumed that the CPF salary ceiling would grow at the same rate of wage growth at the 80th income percentile, i.e. it grows at a constant real rate of 1.6%. This is derived based on the compounded annual growth rate of the 80th percentile wages measured using gross monthly income from work among full-time workers from 2001 to 2011, as provided by the Ministry of Manpower.

The Minimum Sum (MS) started out at $30,000 in 1987, and has increased steadily over the years to preserve its real value and to meet Singaporeans' rising expectations of their standard of living in retirement. To date, there were two major reviews that set the path of the MS. In 1994, the MS was set to increase progressively from $40,000, by $5,000 each year to reach $80,000 in 2003. The next revision was almost a decade later in 2003, where the ERC

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[9] The real rates of returns on the OA and SA/RA (without factoring in Extra Interest) are 1.1% and 2.5% over the 15-year period from 1996 to 2011 and 1.1% and 2.2% over the 20-year period from 1991 to 2011 respectively. Prior to 1 July 1995, the same interest rate was paid on all the CPF accounts. From 1 July 1995 onwards, a higher interest rate was paid on SA and RA in view of the longer tenure of these savings.
[10] For households with incomes above the 80th percentile, there is no need to impose on them the same level of mandatory savings as they have a greater ability to look after their own financial affairs.

recommended a target MS of $120,000 (in 2003 dollars), to be reached in 2013. This involved a $4,000 real (2003 dollars) increase each year beginning in 2004 over 10 years. However, to avoid higher than normal inflation resulting in large annual increases in MS, the government announced in 2012 that it would smoothen out the remaining increases in the MS to reach the $120,000 (2003 dollars) target in 2015 instead. In the model, we assumed that the MS is at $120,000 (in 2003 dollars) or $147,400 (in 2012 dollars).

2.4   Housing Consumption

As CPF members utilize CPF savings to finance housing, the model computes the accumulated savings net of withdrawals for housing finance. To do so, it is necessary to compute both the amount of OA savings used for down-payment as well as for monthly mortgage installments. The assumptions used to generate these are discussed below.

The model assumed that, the male member who marries a female member from the same income percentile will upon marriage purchase a flat directly from the HDB when they are aged 30 and 28 respectively. 30 is the median age of male residents when they purchase their first Build-to-Order (BTO) flat, and 28, the equivalent age for females[11]. We assume that the flat is directly purchased from the HDB because the HDB has been ramping up the BTO flat supply to meet the housing needs of first-time buyers and young couples looking to set up their first homes are advised to consider applying for BTO flats.

We assume that the couple fully utilizes their accumulated CPF OA savings for the down-payments (as is required by the HDB). The remaining outstanding amount, net of housing grants, is financed using HDB loans, up to a maximum of 90% of the purchase price. The HDB mortgage financing rate is set at 2.6% and mortgage duration is 30 years. The Monthly Installment (MI) is shared equally with the spouse and paid out from their OAs. Furthermore, we assumed that households buy a flat type which is within their financial means. Table 3 summarizes the housing characteristics and the computed monthly mortgage payments for the different percentiles. As seen from the table, the MI can be fully paid out of their OAs.

Table 3
Housing Consumption and Financing

Percentiles	Housing Types	Monthly Household MI (2017$)	MI as % of Household Monthly Salary at Marriage
30P	3R	$612	12
50P	4R	$1,079	15
70P	5R	$1,388	15

It is assumed that the member does not upgrade to a larger home. The HDB flat prices are based on the BTO selling price by flat types in 2011. Since the entrant male worker at age 25

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[11] The median ages used here are based on the average of the median age of purchase for males and females across the years from 2006 to 2011.

will buy a BTO flat when he turns 30, the housing prices are adjusted for housing appreciation over the five-year period. We assumed the housing appreciation for new flats to be at 2% per annum (real). Using a sample of BTO prices published by HDB in their annual report, we derived[12] that the real housing appreciation rate for new flats were closely aligned to that of resale flats using the HDB Resale Price Index (RPI) from 2004 to 2009 and range between 6%-9%. However, the real rate of appreciation in the prices of new flats have slowed down and diverged from the RPI in recent few years. For the sampled estates with comparable data in both periods, the real rate of housing appreciation for a new flat from 2008/09 to 2010/11 is about 3.0%. Considering the various Government measures to moderate price increases, including increasing the supply of BTO flats, the real rate of housing appreciation could slow down especially over the next five years.

The model factors in housing grants given by the HDB[13]. First-time home buyers in Singapore with a monthly household income of $5,000 and below can apply [14] for a subsidy under the Additional CPF Housing Grant (AHG) scheme. The AHG amount ranges from $5,000 to $40,000 depending on the buyers' average gross monthly household income. As can be gleaned from Table 4, low-income households with $1,500 or less can get to an AHG of $40,000. AHG are to be used as capital payment for the flat purchase and the balance, if any, must be used to reduce the mortgage loan.

Table 4
Additional CPF Housing Grant

Average Gross Monthly Household Income (assessed over the past one year)	Enhanced Additional CPF Housing Grant Quanta (Feb 2009)
$1,500 or less	$40,000
$1,501 - $2,000	$35,000
$2,001 - $2,500	$30,000
$2,501 - $3,000	$25,000
$3,001 - $3,500	$20,000
$3,501 - $4,000	$15,000
$4,001 - $4,500	$10,000
$4,501 - $5,000	$5,000

Source: HDB website

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[12] For HDB Towns with continuous new flat launches over the past 5 years, a simple average of the lower bound and upper bound of the price range by Town and flat type published in HDB's Annual Report was taken to derive the average price for each estate by flat type. The averages are then aggregated to give rise to overall housing appreciation rates.
[13] As the model assumes the purchase of an HDB BTO flat, grants that apply when HDB resale flats are purchased are not included. For information, households who purchase HDB resale flats for the first time and had not previously enjoyed a housing subsidy can apply for CPF Housing Grant for family of $20,000 to $40,000 if average gross monthly household income does not exceed $10,000. This is on top of the AHG and SHG.
[14] Housing grants are disbursed if the buyer(s) meet the prevailing eligibility conditions (e.g. citizenship requirement, continuous employment in a year etc).

Besides the AHG, the model also incorporates the Special CPF Housing Grant (SHG), which was introduced in Budget 2011 to help low-income families making a first-time purchase of a flat directly from the HDB. SHG, which ranges from $5,000 to $20,000 is given on top of the existing AHG and are available to first-timer households with average monthly incomes of up to $2,250 who are buying 2- or 3- room standard flats in non-mature estates.

2.5 Retirement Income

CPF members turning 55 from 1 Jan 2013 onwards will draw down their monthly payouts through CPF LIFE (or CPF Lifelong Income Scheme), which is a national annuity scheme. It has been announced that the CPF LIFE scheme will be simplified from the existing four plans [15] to two plans, namely the LIFE Standard Plan and LIFE Basic Plan, from 1 Jan 2013. The Standard plan provides higher monthly payouts but leaves less as bequest, while the Basic plan gives smaller monthly payouts in return for higher bequest. The LIFE Standard Plan is the default plan.[16] We assume that members receive payouts under the CPF LIFE Standard Plan or Basic Plan.[17]

The model assumes full annuitization of the accumulated CPF savings in the SA and OA (i.e. balances remaining after withdrawals for mortgage payments). We assumed that premiums for CPF LIFE will be paid in two tranches. The first tranche is paid at age 55, where the accumulated savings in OA and SA up to the full MS will be committed to CPF LIFE. Amounts above the MS, if any, will be kept in OA and SA. This amount with interest accrued, together with new working contributions into the OA and SA from age 55 to age 64, will be used to pay the second tranche of CPF LIFE premiums at 65.

The first monthly payout begins at the drawdown age of 65. Payouts under the Standard and Basic plans used in this study are generated by the CPF Board, based on the simulated CPF balances from the model. The payouts are estimates based on prevailing interest rate and mortality assumptions, and will vary over time according to interest rate and mortality experiences.

2.6 Workfare Income Supplement Scheme (WIS)

With globalization and technological change, the incomes of less-skilled workers have come under pressure all over the world. In the last ten years, the real incomes of Singaporean workers at the 20th income percentile were roughly flat, whereas the median Singaporean saw significant income growth.

The government introduced the Workfare Income Supplement (WIS) Scheme[18], in 2007, as a permanent scheme to mitigate the widening income spread and help older low wage workers aged 35 and above. Unlike the European- or Western-style unemployment benefits, Workfare

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[15] The four plans are Basic, Balanced, Plus and Standard plans.

[16] The Standard Plan also allows flexibility for members to use their RA balances before their draw down age for housing needs, if required.

[17] The OECD used an annuity factor to determine payouts. Hui (2012) assumed members purchase a 20-year term annuity payouts which pays out till age 85, earning a return of 4%.

[18] The WIS was preceded by a one-off "Workfare Bonus" in 2006.

rewards regular and productive work. It supplements CPF savings, provides immediate financial assistance as well as encourages low-wage workers to work regularly in order to maintain the "work ethic which was the bedrock of Singapore's success."[19] The WIS is considered the fourth pillar of Singapore's social security system.

WIS was enhanced in 2010, where the income eligibility threshold was extended from $1,500 per month to $1700 per month. There was also an increase in the maximum WIS quantum from $2,400 to $2,800 per year. Table 5 shows the maximum payouts that may be received by workers at different age tiers. WIS is accounted for in the model, and its quantum and income eligibility requirements are assumed to grow in pace with the income growth of the WIS target group.

Table 5
Maximum WIS Payout for Different Age Tiers

Age tiers	Max WIS
35 to 44	$1,050
45 to 54	$1,400
55 to 59	$2,100
60 and above	$2,800

Source: CPF website

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[19] See Ng (2007).

3.   RESULTS FROM BASELINE MODEL

We use IRR to assess retirement adequacy provided by the CPF system. IRR compares the retirement income (numerator) with pre-retirement earnings (denominator). Calculations are performed for different concepts of the IRR.

3.1   Computation of Income Replacement Rate

a.   Gross and Net IRR

The retirement income used in the numerator of the IRR calculations reflects the monthly payout from CPF LIFE as described in Section 2.5.

Most IRR calculations use the earnings just prior to retirement in the denominator. As mentioned earlier, we modeled earnings using empirical wage growth for different age bands as described in Section 2.1, where earnings generally decline in later life. Earning just prior to retirement at age 65 is therefore too low a proxy for pre-retirement earning. In this study, we have therefore used earning at age 55 rather than at age 65. Table 6 compares the gross earnings at age 55 and 65. Earning at age 55 is closer to the peak earning a person might earn over his career and is thus a better gauge of post-retirement expectations.[20] Since earning at age 55 is higher than earning at age 65, using the former as the denominator also means that the IRR calculated will be a conservative one.

Table 6
Gross Earnings of Male and Female Workers at Age 55 and Age 65 (2012$)

Percentiles	Male		Female	
	Age 55	**Age 65**	**Age 55**	**Age 65**
30P	$2,340	$1,330	$2,100	$1,480
50P	$3,860	$2,450	$3,490	$2,410
70P	$6,800	$4,070	$5,710	$3,380

To calculate net IRR, the denominator is the after-tax pre-retirement earnings with the assumption of 85% employment density factored in. The after-tax pre-retirement earnings are computed by deducting personal income taxes and employee CPF contributions from the gross pre-retirement earning of workers at age 55. The model also assumes that the current tax provisions in assessing the chargeable income[21] and personal income tax schedule remains unchanged.

Several authors, examples Brady (2010), MacDonald and Moore (2011) and Purcell (2012) opined that in assessing what is an adequate ratio, one ought to be mindful that retirement

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[20] However, Purcell (2012) is of the view that if workers save a substantial amount of their peak earnings or spend it on their children, peak year earnings may overstate the income they will need in retirement to maintain their accustomed standard of living.

[21] The chargeable incomes are imputed based on tax deductibles of $6,000 personal income tax relief and employee's contributions to CPF. We then applied the 2012 personal tax structure to the chargeable incomes.

income need not replace the entire pre-retirement earnings since retirees no longer need to save for retirement or for their children's education. As in the OECD practice, we also deduct the workers' contribution to social security from earnings since workers would be more concerned about replacing pre-retirement disposable income in retirement, rather than pre-retirement earnings per se. The denominator term thus excludes personal income tax and the workers' contribution to CPF.

Gross IRR, as mentioned earlier is the ratio of retirement incomes to pre-tax pre-retirement earnings before any deduction for CPF contributions with the assumption of 85% employment density factored in.

b.   Adjusted Net IRR with Imputed Rent

Most households in Singapore own their homes. In fact, our home ownership rate, at 88.6%[22], is one of the highest in the world. Housing wealth can potentially be unlocked to supplement retirement income. Although few Singaporeans monetize their housing asset because they do not need to, or due to strong bequest motive or desire to age in place, home-owner retirees enjoy significant savings in rental costs and thus have more cash income available for consumption. Rental cost would otherwise have been the largest expenditure item for most healthy retirees.

Measures of IRRs conventionally used to compare Singapore's IRR with that of other countries where home ownership is low would therefore understate the relative state of retirement adequacy in Singapore, where home ownership is high. This is because retirement payouts in Singapore generally do not need to be used for rental, while retirement payouts in these other countries do.

For international comparison, it is therefore also useful to assess the adequacy of the CPF system in a way that factors in the fact that retirees are able to consume not just their CPF payout in retirement but also the imputed rent of the home they own. We have hence performed a separate set of IRR calculations that factored in imputed rent (i.e. the flow of housing services that homeowners receive from their homes). Following the methodology by Munnell and Soto (2005), the definition of retirement income in the numerator is expanded to include the imputed rent. For consistency, imputed rent is also included in the denominator since household also receives imputed rent as part of his income before retirement.

Imputed rent figures for the different HDB flat-types are estimated using the average of the median subletting rents across all estates for the various flat types from HDB InfoWEB, after deducting a proportion of rent that is estimated to be furniture and furnishing. The component of a flat rental that is paid to furniture and furnishing should not be included because it does not reflect consumption arising from home ownership per se, and a home owner still has to incur it. Table 7 below shows the computed imputed rent figures for the various flat types.

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[22] Singapore, Department of Statistics (2012).

Table 7
Imputed Rent per Household Member by Flat Type

Flat Types	Average subletting rental rate[*]	% of household expenditure on furniture and furnishing[**]	Imputed rental figure per household	Imputed rental figure per household member[***]
3R	$1,713	5%	$1,627	$814
4R	$2,086	5%	$1,982	$991
5R	$2,310	5%	$2,194	$1,097

Notes:
[*]   Based on average of median subletting rates across all estates from 3Q2007 to 2Q2012, rebased to 2012 dollars before averaging across the periods from 2007 to 2012 to adjust for fluctuations in the rental market.
[**]   Based on data collected by the Department of Statistics for the Household Expenditure Survey (2007/2008).
[***]   Two household members per household, based on the assumption that a member and spouse co-share a flat.

3.2   Retirement Adequacy of Workers in the 30th, 50th and 70th Income Percentiles

a.   Gross and Net IRR

We examine the retirement adequacy of lower-middle, median and upper-middle income male workers at age 65, which are proxied by workers at the 30th, 50th and 70th income percentiles respectively. Our modelling results show that workers who are in the 30th income percentiles and above have accumulated savings beyond the MS in their CPF by the time they reach age 55, i.e. they are able to attain the MS at that point. Table 8 shows the replacement rates from retirement income from the CPF LIFE Standard and Basic plans respectively. All replacement rates are in percentage terms.

Table 8
Replacement Rates for Men

	CPF-LIFE Standard Plan			CPF-LIFE Basic Plan		
	30P	50P	70P	30P	50P	70P
Gross IRR	71.3	56.9	49.9	65.0	51.9	45.6
Net IRR	87.5	70.2	62.9	79.7	64.0	57.4

For the median-income worker, under the CPF-LIFE Standard plan, net replacement rate is about 13 percentage points higher than one computed on pre-tax earnings (Gross IRR). This reflects the high defined contribution rate (at 18.5%) that workers have to contribute to the CPF when they are working. [23]

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[23] For median earners, the net replacement rate across OECD averages 72% which is 12 percentage points higher than the gross replacement rate. This reflects the higher taxes and social security contributions that workers paid when they were working. (OECD, 2012, p.119 and p.125).

In the base case scenario under the Standard Plan, lower-middle, median and upper-middle income male workers can expect net income replacement rates comparable to the World Bank recommendations and the OECD figures. The average net IRR amongst OECD countries for the lower middle (income is 50% of average earners), median and upper-middle income (income is 150% of average earners) workers are 82.8%, 72.0% and 63.4% respectively.

Table 9
Replacement Rates for Women

	CPF-LIFE Standard Plan			CPF-LIFE Basic Plan		
	30P	50P	70P	30P	50P	70P
Gross IRR	65.2	51.9	47.0	62.2	49.5	44.9
Net IRR	80.0	63.9	58.8	76.3	60.9	56.1

As can be gleaned from Table 9, the replacement rates for women are below those for men. For the median income earners, the net replacement rate for women under the Standard Plan is 6.3 percentage points lower than that of men. The lower replacement rate for women is due to lower wage growth found in the empirical LFS data used and lower LIFE payouts compared to males as females have a longer life expectancy.

b.   Adjusted Net IRR with Imputed Rent

Table 10
Net Replacement Rates with Imputed Rent

Percentiles	Net IRR for Men		Net IRR for Women	
	Standard Plan	Basic Plan	Standard Plan	Basic Plan
30P	91.5	86.1	86.8	84.4
50P	77.8	73.2	73.8	71.7
70P	69.6	65.1	67.3	65.1

Including imputed rent in the calculation lifts the net replacement rate by an additional 4 to 9 percentage points for men and additional 7 to 11 percentage points for women. When comparing Singapore's IRR with those of countries with low home ownership such as Germany[24], where rental is the norm, it would be more appropriate to use IRR with imputed rent.

3.3   Income Adequacy of Low Wage Workers

Low wage workers are not able to attain the MS at age 55 and also need higher replacement rates as they have lower pre-retirement earnings. Table 11 presents the net IRRs for low wage workers using payouts under the Standard plan. We have assumed that the 10th percentile worker buys a 2-room flat, and that the 20th percentile worker buys a 3-room flat.

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[24] See Palmer (2011).

WIS gives a significant boost to the retirement balances and net IRRs for low wage workers. WIS increases IRRs by 36.8 percentage points and 12.0 percentage points for the males in the 10th and 20th percentiles respectively. For female workers, the IRRs increase by 36.2 percentage points for the 10P and 22.8 percentage points for the 20P.

Table 11
Net Replacement Rates for Low Wage Workers (Standard Plan)

Percentiles	Net IRR for Men			Net IRR for Women		
	No WIS	WIS	Change	No WIS	WIS	Change
10P	91.9	128.7	36.8	75.6	111.8	36.2
20P	80.3	92.3	12.0	68.6	91.4	22.8

With WIS, low wage workers at the 10th income percentile would receive a replacement rate of more than 100%. While this may appear unusual at first glance, it is less surprising when one considers that this group is likely to receive financial assistance even while they are working, such that their pre-retirement expenditure could be higher than their pre-retirement income.
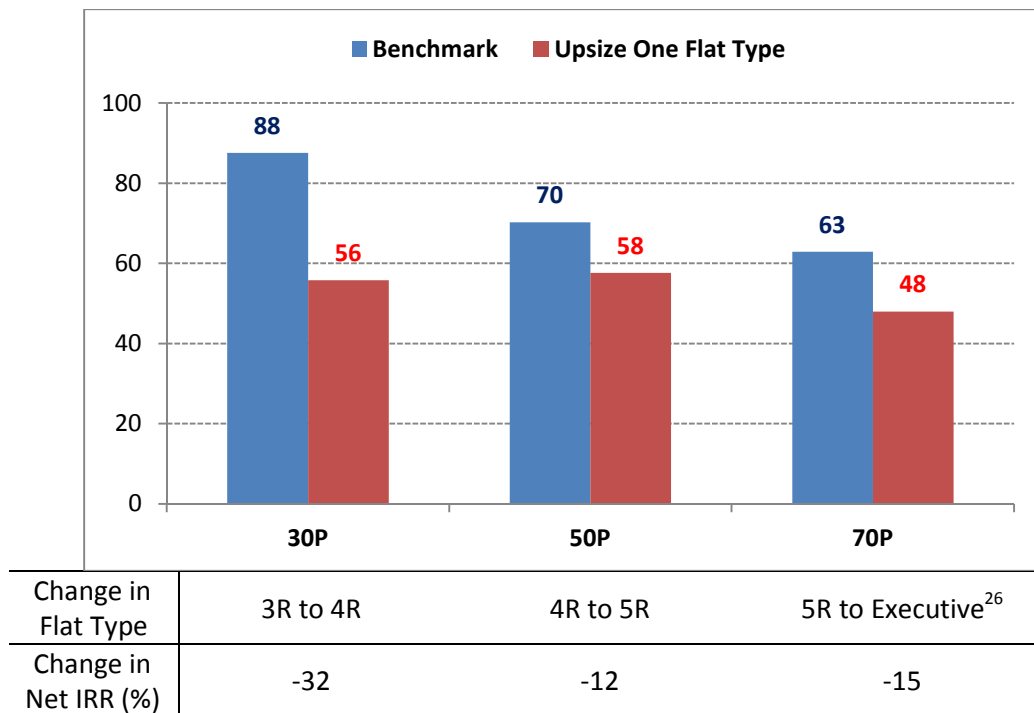
4.   SENSITIVITY ANALYSIS

4.1   Bigger Housing Consumption

One key feature of the Singapore's CPF system is that the accumulated savings can be withdrawn to finance housing.   Larger CPF withdrawals to finance bigger housing loans mean that lesser savings will be available for retirement. In the base case model, we assumed that the flat types purchased are within the financial means of the households.   Sensitivity analysis is conducted to assess the effect on retirement adequacy when workers upsize their housing consumption and buy a flat type one size larger than in the base case. Figure 2 shows the net replacement rates using payouts from the Standard plan for the male worker[25].

There is a tradeoff between housing consumption and retirement adequacy. By buying a flat one size larger, the net IRR falls. The fall in replacement rates are more pronounced for lower income groups compared to the higher income groups. This analysis shows that CPF members who wish to purchase a flat size somewhat larger than what we assume in this paper should be prepared to accept a lower IRR in retirement.   Alternatively, since they own a relatively larger home, they should be prepared to monetize their housing asset in retirement, so as to increase their IRRs. Members who choose to downgrade to a 3-room flat or smaller will qualify for a Silver Housing Bonus of $20,000, which would give an additional boost to their IRRs.

Figure 2
Net Replacement Rates (Standard Plan) when Male Workers Upsize HDB Flats

	30P	50P	70P
Change in Flat Type	3R to 4R	4R to 5R	5R to Executive[26]
Change in Net IRR (%)	-32	-12	-15

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[25] The net IRRs when a female worker buys a flat type one size larger will be similar to that of the male worker.
[26] In the simulation, we assume 70P upgrades to a relatively more expensive BTO flat which costs $550,000 (in 2012 dollars).

4.2   Single Income Earners and Sole Financing of Housing Mortgage

In the base case model, households are dual-income earners and jointly finance the HDB purchase. The accumulated CPF savings of both husband and wife are used for down-payment of the flat and monthly mortgage payments are shared equally between the spouses and are paid out from their respective CPF ordinary accounts.

For sensitivity analysis, we examine the retirement adequacy of a single-income male worker who has a non-working spouse and uses just his CPF savings for the down-payment as well as for the monthly mortgage installment. This also means that the income of this male worker now represents the total household income.   As a result, the type of flat that such a single-income household can afford is smaller, and we assume that such a male worker buys a HDB flat which is one size smaller than in the base case, i.e. than a similar member whose wife is also working and earning.

As can be gleaned from Figure 3, the replacement rate will fall for the 50P and 70P male members but increase for the 30P male member. The unexpected result for the 30P male member arises because his household income (recall that in this case, his wife is not working) is low enough to qualify for a larger housing grant. The larger grant, together with the assumption that this 30P male member purchases a 2-room flat instead of a 3-room flat, results in a smaller monthly mortgage payment for the member, even though he is no longer sharing the payment with his spouse. The small monthly mortgage payment results in the single-earner 30P male member being able to achieve a higher IRR than in the base case.

While unexpected, this result is not inappropriate. As only the single-earner 30P male member's income is being replaced here, this higher IRR still translates to a lower household income in retirement compared to a similar 30P member whose wife works (since both husband and wife receive payouts in retirement, albeit each at a lower replacement rate).

Single-earners across all income groups will experience a lower household income in retirement, even with the assumption that they purchase a home than is one flat size smaller. They may wish to consider monetizing their homes, for instance, by subletting a room or downgrading to a studio apartment to boost their retirement payouts. It will also help if their spouses work for at least some period in their lives to contribute to the financing of the mortgage, and to accumulate some savings in their CPF for their own retirement.

Figure 3
Net Replacement Rates (Standard Plan), Male Workers
Sole financing versus Joint-financing

Change in Flat Type	3R to 2R	4R to 3R	5R to 4R
Change in Net IRR (%)	+4*	-8	-20
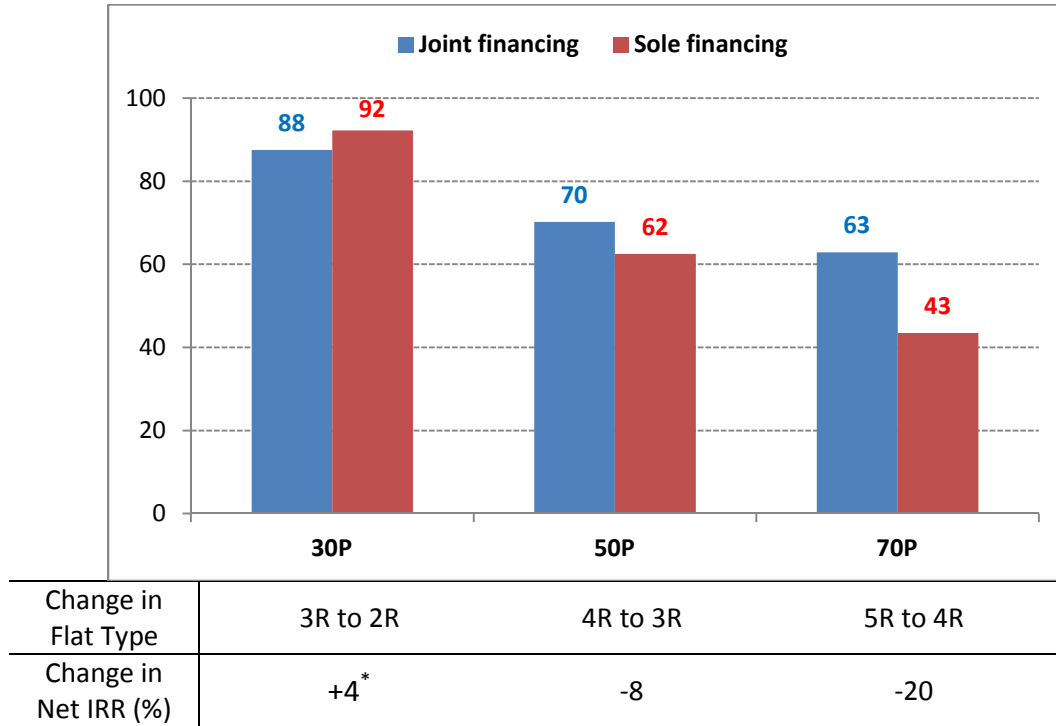
Note:
*The IRR rises with sole financing because (i) a smaller flat type is assumed, and (ii) household income is lower (since spouse does not work) resulting in a larger housing grant.

4.3   Retirement Adequacy when up to the Maximum of MS is Annuitized

In the base case model, we do not put a cap on the maximum amount that can be annuitized. At age 55, members can use the accumulated CPF savings to buy CPF LIFE products up to the maximum of MS. CPF savings in excess of the MS are left in their respective CPF accounts and accrue interest at the CPF interest rates. Subsequently, at age 65, this money together with further CPF contributions from work after age 55 is used to buy an additional life annuity that is similar to CPF LIFE. We assume the existence of a private annuity market which will give payouts comparable to CPF LIFE.

For sensitivity analysis, we examine the impact on retirement adequacy if the MS cap of $147,400 in 2012 dollars is placed on the amount of CPF savings that can be used to buy a life annuity. The remaining CPF savings are therefore assumed to be withdrawn and used for other non-retirement purposes. Table 12 reports on the replacement rates under the Standard and Basic Plans when only savings up to the MS are annuitized. Compared to the base case, the rates are lower when only savings up to the maximum of MS are annuitized.

Table 12
Replacement Rates when up to the Minimum Sum is Annuitized

	CPF-LIFE Standard Plan		CPF-LIFE Basic Plan	
	Gross IRR	Net IRR	Gross IRR	Net IRR
Men				
30P	47.4	58.1	43.0	52.8
50P	28.7	35.4	26.1	32.2
70P	16.3	20.6	14.8	18.7
Women				
30P	48.1	59.0	45.8	56.2
50P	28.9	35.6	27.6	33.9
70P	17.7	22.1	16.9	21.1

Figures 4a and 4b compare the replacement rates when the accumulated savings are fully annuitized and when up to the MS is annuitized, using the Standard and Basic plans respectively. As expected, replacement rates will fall more for the higher income groups compared to the lower income groups when only up to MS is annuitized, since the same MS cap is applied across all income groups, even though higher income members have a larger pre-retirement income to replace. This pattern is consistent for both men and women[27].

This analysis shows that CPF members with CPF savings above the MS should not assume that they can withdraw this lump sum and spend extravagantly. If they rely purely on the CPF LIFE payouts from their MS (assuming that the MS remains unchanged in real terms), the payouts are designed to only support a basic standard of living. If CPF members wish to achieve the high IRRs that saving through the CPF system allows, they must invest their CPF savings above the MS wisely so as to generate a stream of retirement income to supplement CPF LIFE payouts.

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[27] The net IRRs for women are higher because the same amount of CPF savings (the MS) is annuitized at age 55 for men and women and the incomes at age 55 for women are lower than men.

Figure 4a
Net Replacement Rates (Standard Plan),
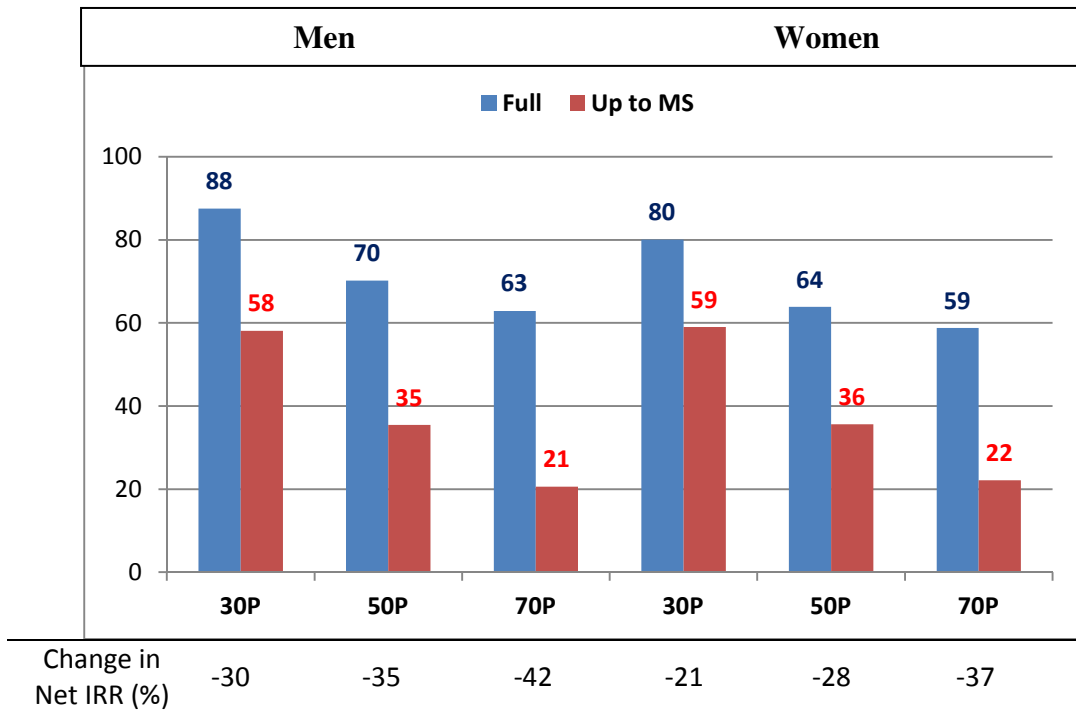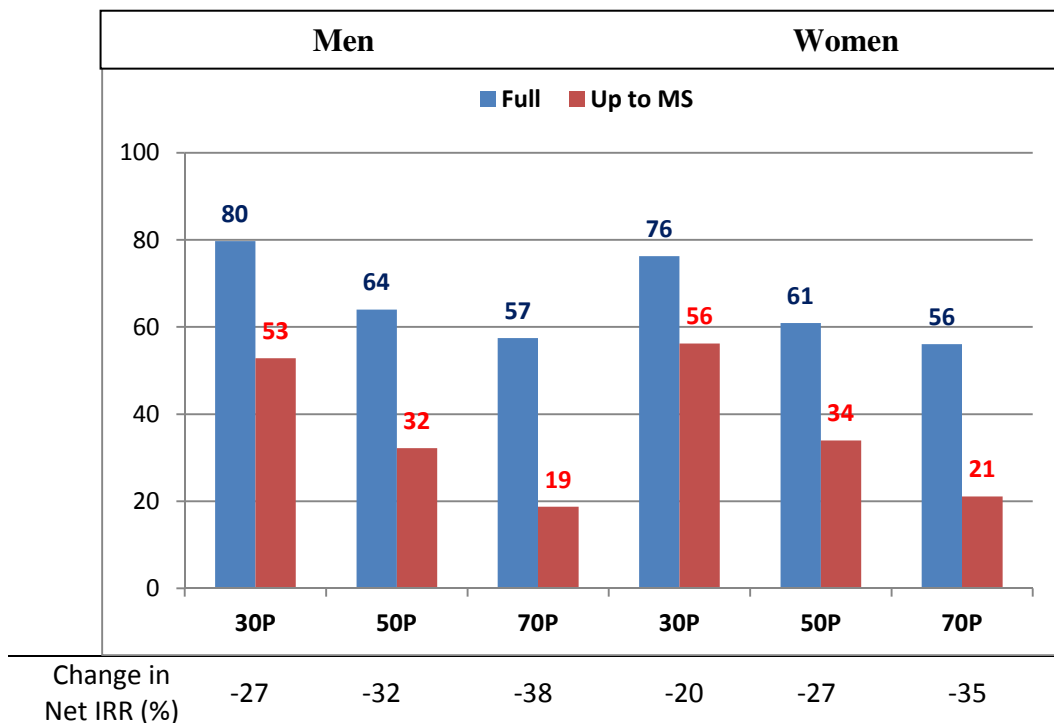**Annuitization up to MS versus Full Annuitization**

	Men			Women		
	30P	**50P**	**70P**	**30P**	**50P**	**70P**
Full	88	70	63	80	64	59
Up to MS	58	35	21	59	36	22
Change in Net IRR (%)	-30	-35	-42	-21	-28	-37

Figure 4b
Net Replacement Rates (Basic Plan),
Annuitization up to MS versus Full Annuitization

	Men			Women		
	30P	**50P**	**70P**	**30P**	**50P**	**70P**
Full	80	64	57	76	61	56
Up to MS	53	32	19	56	34	21
Change in Net IRR (%)	-27	-32	-38	-20	-27	-35

5.   CONCLUSION

We have employed a simulation model to assess the retirement adequacy of the current cohort of young entrant workers, in terms of their income replacement rates upon retirement. Our study incorporates institutional features which are unique in Singapore. They include the high ownership of HDB housing, the government's housing grant schemes, WIS and the CPF defined contribution system which allows pre-retirement withdrawal of savings from CPF-OA to finance housing.

Findings from the base case model indicate that the CPF system is able to deliver adequate retirement savings for the current cohort of young workers within the broad middle band of the 30th to 70th income percentiles. The simulated net income replacement rates for median workers are 70% for males and 64% for females. These rates are comparable to the OECD average for median earners, even after taking into account pre-retirement withdrawals.

Given Singapore's high home ownership, which is financed from CPF savings, we have also done additional estimates that include imputed rent on owner-occupiued homes in the computations of replacement rates. This enables a more objective international comparison with countries where fewer retiring workers own their homes. With imputed rents taken into account, the net IRRs will be higher, at 78% for the median male worker and 74% for the median female worker.

For low wage workers, the net IRR is higher. Further, the Workfare Income Supplement (WIS) provides a significant boost to their retirement savings and net IRRs. At the 20th income percentile, WIS lifts the net IRR from 80% to 92% for males and from 69% to 91% for females. The impact of WIS at the 10th income percentile is even more significant.

Findings from the sensitivity analyses demonstrate that retirement adequacy as measured by the replacement rates depend on the housing consumption choice of workers. When a worker consumes a flat type that is one size larger than in the base case scenario, the replacement rate becomes lower. The fall in the replacement rate is more pronounced for lower income groups compared to higher income groups. Furthermore, the trade-off between retirement adequacy and housing consumption depends on whether the flat is financed by dual-income earners or single-income earners.

Sensitivity analysis is also conducted by capping the amount of CPF savings that are annuitized to the MS. Our findings show that capping annuitization at the MS impacts retirement adequacy. The replacement rates for higher income group fall more compared to lower income group. This pattern is consistent for both men and women.

Our findings bear some policy implications. They are highlighted as follows:

[1] CPF members should balance their housing consumption choice with retirement planning by consuming a flat type within their financial means.

[2] To ensure retirement adequacy, CPF members should annuitize beyond the stipulated MS quantum. The CPF LIFE scheme currently does not provide for annuitization beyond the full MS as the CPF system focuses on providing members with a basic standard of living in retirement. Members who want higher annuity payouts beyond what is provided by their MS have to buy annuities from commercial providers.   Other payout mechanisms can be introduced to help members who wish to annuitize beyond the MS. For example, additional rider or term annuity may be provided to help these retirees to drawdown on their CPF savings above the MS. The private annuity market needs to be further developed.

One policy implication is that the Government could consider allowing the CPF LIFE to accept funds beyond the MS. CPF Board can also consider revising the MS quantum beyond just providing basic retirement.

[3] Members should be given more incentives to keep the savings beyond the MS with the CPF Board.

In conclusion, whether the CPF system can ensure retirement adequacy depends on the interactions of CPF members' earnings profiles, individual's housing consumption choice and CPF policy parameters.   Our findings show that even after allowing for pre-retirement withdrawals for housing finance, the current CPF system is able to provide entrants to the workforce today with adequate retirement savings, as long as members work consistently and choose a housing type that is within the financial means.   To retire comfortably, young Singaporeans should consider their housing consumption choices as part of their retirement planning. The government should continue to ensure adequacy of social support schemes such as the housing grants schemes and the WIS to help lower income workers accumulate a housing asset while securing basic retirement adequacy. As housing is the most important non-financial assets for most Singaporeans, there is a need to strengthen policies that will facilitate the monetization of these assets in retirement for those who need it.

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/1994/09/01/000009265_3970311123336/Rendered/PDF/multi_page.pdf

Appendix 1

The formulae for computing IRRs at age 65 are as follows:

D0 = Pre-retirement earnings at age 55 based on the simulated earnings profile

D1 = D0 – personal income tax - employee's contribution to CPF

D2 = D1 + imputed rent

NS = Annuity payouts under the LIFE Standard Plan at drawdown age 65 based on the entire OA and SA accumulation net of housing withdrawal

NB = Annuity payouts under the LIFE Basic Plan at drawdown age 65 based on the entire OA and SA accumulation net of housing withdrawal

NB1 = NB + imputed rent

NS1 = NS + imputed rent

Various IRRs computed using monthly payouts under the LIFE Standard Plan are as follows:

Gross IRR = NS/D0;
Net IRR   = NS/D1; and
Net IRR (imputed rent) = NS1/D2

Various IRRs computed using monthly payouts under the LIFE Basic Plan are as follows:

Gross IRR = NB/D0;
Net IRR   = NB/D1; and
Net IRR (imputed rent) = NB1/D2