DRW INVESTMENT RESEARCH

Towards a Sustainable Retirement Plan IX

Saving for Retirement: Replacement rate projections

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The four variables determining how much capital will be available at retirement

- Savings rate as a percentage of gross income
- Investment portfolio returns (real = after-inflation)
- Contribution period (savings term)
- Income growth rate relatively to inflation rate

The Basic Model used to project how much retirement capital will be available

Gross annual income	250,000	
Pensionable salary	187,500	
Contribution towards retirement fund (own & employer)		22.50%
Less risk benefits premium		3.50%
Less admin charges		1.50%
Net contribution towards retirement savings		17.50%
Net savings rate as percentage of gross income …..(1)		12.50%
Growth in annual income……. (2)		5.0%
Inflation rate p.a.		5.0%
Real portfolio return p.a. ……(3)		5.00%
Standard Deviation of annual portfolio return		15.00%
Contribution term (years)…..(4)		40
Contributions over term	3,774,993	
Retirement fund value at retirement	31,979,662	
Annualised portfolio return (simulated)		10.8%
Final year's gross income	1,676,188	
Retirement value as factor of final year's gross income	19.08	
Retirement income required as percentage of final year's gross income		100%
Retirement income required	1,676,187.79	
Retirement value as factor of retirement fund value	19.08	
Implied initial withdrawal rate		5.2%
Max initial withdrawal rate “allowed”		5.00%
Implied retirement income as factor of retirement fund value	20.00	
Implied retirement income	1,598,983	
Implied replacement rate		95%

Notes:

- Contributions (own & employer) towards retirement plan typically only based on pensionable salary; non-pensionable salary, such as bonuses, travel allowances, etc., not included.

- Thus, savings rate of gross income is often not the same as the contribution rate towards retirement plan

Replacement rate…

How much of one's pre-retirement income can be replaced by post-retirement income?

- Post-retirement income…The more the better, but at least 75% of pre-retirement income, ideally 100%, but the sustainability thereof and adjustment of income with future inflation are important…

- Initial drawdown (withdrawal rate) must not be too high, otherwise jeopardizing the ability of future income generation of retirement plan

***Implied* replacement rate…**

- Allow a maximum initial drawdown (withdrawal rate) of 5% of retirement capital available, i.e. upper-boundary level.
- How much of pre-retirement income will then be replaced by post-retirement income?

Methodology

- Test assumptions and project possible *implied* replacement rates by means of Monte Carlo simulations

- 5,000 repetitions to generate a probability distribution

- Probability distribution i.t.o. percentiles

    - 10^{th} percentile = 90% of all simulations showed at least equal and better results
    - 25^{th} percentile = 75% of all simulations showed at least equal and better results
    - 40^{th} percentile = 60% of all simulations showed at least equal and better results
    - Median = midpoint, 50% of simulation results were at least equal and better
    - 60^{th} percentile = 40% of all simulations showed at least equal and better results
    - 75^{th} percentile = 25% of all simulations showed at least equal and better results
    - 90^{th} percentile = 10% of all simulations showed at least equal and better results

Possible Implied Replacement Rates at different savings rates and contribution periods

Savings rate 10% of gross income, real portfolio return = 5% p.a., income growth = inflation

Contribution period (years)	30	35	40	45
90th percentile	59%	85%	114%	156%
75th percentile	43%	59%	78%	103%
60th percentile	34%	46%	60%	78%
median	**30%**	**40%**	**51%**	**66%**
40th percentile	27%	35%	43%	57%
25% percentile	21%	27%	34%	43%
10th percentile	16%	20%	24%	29%

Possible Implied Replacement Rates at different savings rates and contribution periods

Savings rate 12.5% of gross income, real portfolio return = 5% p.a., income growth = inflation

Contribution period (years)	30	35	40	45
90th percentile	75%	108%	146%	190%
75th percentile	55%	74%	98%	125%
60th percentile	44%	58%	76%	95%
median	**38%**	**50%**	**65%**	**81%**
40th percentile	34%	43%	56%	68%
25% percentile	27%	35%	43%	53%
10th percentile	20%	25%	30%	37%

Possible Implied Replacement Rates at different savings rates and contribution periods

Savings rate 15% of gross income, real portfolio return = 5% p.a., income growth = inflation

Contribution period (years)	30	35	40	45
90th percentile	89%	125%	169%	227%
75th percentile	64%	88%	115%	150%
60th percentile	51%	70%	89%	114%
median	**45%**	**61%**	**76%**	**98%**
40th percentile	40%	53%	66%	84%
25% percentile	32%	42%	51%	65%
10th percentile	24%	30%	37%	43%

Possible Implied Replacement Rates at different real portfolio returns and contribution periods

Real portfolio return = 4% p.a., savings rate 12.5% of gross income, income growth = inflation

Contribution period (years)	30	35	40	45
90th percentile	62%	83%	113%	143%
75th percentile	46%	59%	76%	96%
60th percentile	37%	47%	59%	73%
median	**32%**	**41%**	**50%**	**62%**
40th percentile	28%	36%	43%	53%
25% percentile	23%	29%	34%	41%
10th percentile	18%	21%	25%	28%

Possible Implied Replacement Rates at different real portfolio returns and contribution periods

Real portfolio return = 5% p.a., savings rate 12.5% of gross income, income growth = inflation

Contribution period (years)	30	35	40	45
90th percentile	75%	108%	146%	190%
75th percentile	55%	74%	98%	125%
60th percentile	44%	58%	76%	95%
median	**38%**	**50%**	**65%**	**81%**
40th percentile	34%	43%	56%	68%
25% percentile	27%	35%	43%	53%
10th percentile	20%	25%	30%	37%

Possible Replacement Rates at different real portfolio returns and contribution periods

Real portfolio return = 6% p.a., savings rate 12.5% of gross income, income growth = inflation

Contribution period (years)	30	35	40	45
90th percentile	87%	126%	185%	256%
75th percentile	63%	90%	124%	165%
60th percentile	51%	70%	95%	126%
median	**45%**	**61%**	**82%**	**106%**
40th percentile	40%	53%	70%	89%
25% percentile	32%	42%	55%	66%
10th percentile	24%	30%	39%	46%

Possible Implied Replacement Rates at different income growth rates and contribution periods

Income growth = 1% < inflation, savings rate 12.5% of gross income, real portfolio return = 5% p.a.

Contribution period (years)	30	35	40	45
90th percentile	89%	131%	188%	260%
75th percentile	64%	92%	124%	170%
60th percentile	51%	72%	95%	128%
median	**45%**	**62%**	**81%**	**109%**
40th percentile	40%	54%	69%	92%
25% percentile	32%	42%	54%	69%
10th percentile	24%	30%	38%	47%

Possible Implied Replacement Rates at different income growth rates and contribution periods

Income growth = inflation, savings rate 12.5% of gross income, real portfolio return = 5% p.a.

Contribution period (years)	30	35	40	45
90th percentile	75%	108%	146%	190%
75th percentile	55%	74%	98%	125%
60th percentile	44%	58%	76%	95%
median	**38%**	**50%**	**65%**	**81%**
40th percentile	34%	43%	56%	68%
25% percentile	27%	35%	43%	53%
10th percentile	20%	25%	30%	37%

Possible Implied Replacement Rates at different income growth rates and contribution periods

Income growth = 1% > inflation, savings rate 12.5% of gross income, real portfolio return = 5% p.a.

Contribution period (years)	30	35	40	45
90th percentile	63%	85%	111%	146%
75th percentile	45%	61%	76%	97%
60th percentile	37%	48%	60%	74%
median	**32%**	**42%**	**52%**	**63%**
40th percentile	28%	36%	45%	54%
25% percentile	23%	29%	35%	42%
10th percentile	17%	21%	25%	29%

Conclusions:

- The longer the contribution period, the higher the expected replacement rate, i.e. the starting date and retirement dates are important!

- The higher the savings rate, the higher the expected replacement rate,

- The higher the real portfolio return, the higher the expected replacement rate

…but watch out for this counter-intuitive finding:

- The higher the income growth rate relatively to inflation, the lower the expected replacement rate!

i.e. if faster-than-inflation growth in income is not accompanied by an increase in savings rate, than savings won't keep pace with rise in living standards.

Sensitivity Analysis: Base-case scenario

Contribution period = 40 years
Savings rate = 12.5% p.a.
Real portfolio returns = 5% p.a.
Income growth = 5% p.a.
Inflation rate = 5% p.a.

Probability distribution	**Replacement rate**
90th percentile	146%
75th percentile	98%
60th percentile	76%
median	**65%**
40th percentile	56%
25% percentile	43%
10th percentile	30%

Sensitivity Analysis:

Deviation from base-case scenario: +10% or -10% in assumptions of variables:

Contribution period = 44 or 36 years

Savings rate = 13.75% or 11.25% p.a.

Real portfolio return = 5.5% or 4.5% p.a.

Income growth = 5.5% or 4.5% p.a. (inflation = 5% p.a.)

Which change in variable assumption will have the biggest impact on replacement rate projections?

Sensitivity Analysis:

Change in one variable only: Possible implied replacement rate (at median probability)

Variable	Base-case	+10%	-10%
Contribution period	65%	77%	52%
Real portfolio return	65%	72%	57%
Savings rate	65%	70%	58%
Income growth rate	65%	57%	72%

Thus, the most important variable assumption is the contribution period, followed by real portfolio return, income growth relative to inflation, and then savings rate.

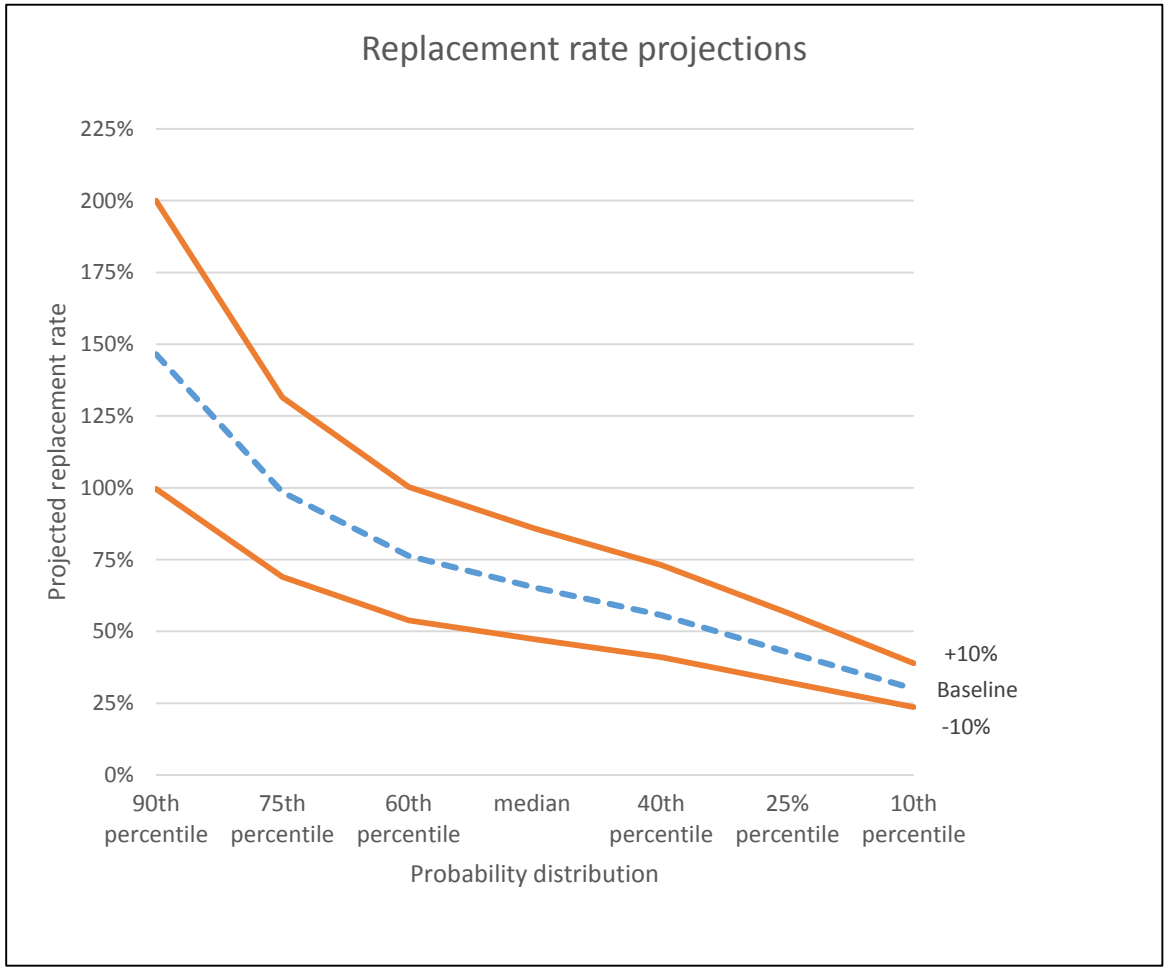
And when deviations from variable assumptions are seen together…

Possible implied replacement rates and probability distribution:

	Base-case	+10%	-10%
90th percentile	146%	200%	100%
75th percentile	98%	131%	69%
60th percentile	76%	100%	54%
Median	**65%**	**86%**	**47%**
40th percentile	56%	73%	41%
25th percentile	43%	56%	32%
10th percentile	30%	39%	24%

Possible implied replacement rate

10% Deviation in base-case assumptions



The influence of one's own behaviour and actions over the outcome of variables and overall retirement savings…

100% Control — No Control

- Contribution period
- Savings rate
- Income growth
- Real portfolio return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