

 **ACTEX Learning**

RET 101

**Retirement Plan Design
Comprehensive Summary**

2nd Edition

Anna Wong, ASA, MBA



An SOA Exam



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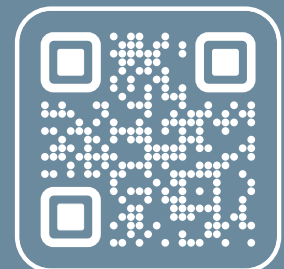
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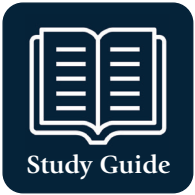


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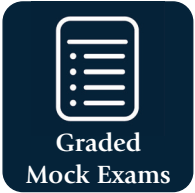
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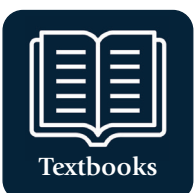
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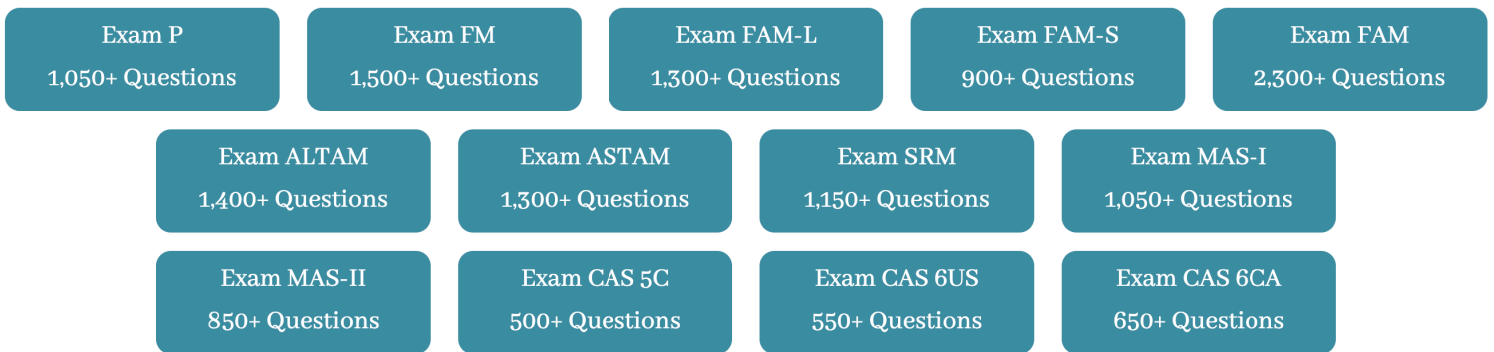
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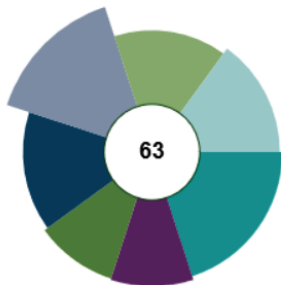
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QUESTION 19 OF 704 Question # Go! ⌂ 🚩 ✎ 🗨️ ⏪ Prev Next ⏩ ✕

Question Difficulty: Advanced ⓘ

An airport purchases an insurance policy to offset costs associated with excessive amounts of snowfall. The insurer pays the airport 300 for every full ten inches of snow in excess of 40 inches, up to a policy maximum of 700.

The following table shows the probability function for the random variable X of annual (winter season) snowfall, in inches, at the airport.

Inches	[0,20)	[20,30)	[30,40)	[40,50)	[50,60)	[60,70)	[70,80)	[80,90)	[90,inf)
Probability	0.06	0.18	0.26	0.22	0.14	0.06	0.04	0.04	0.00

Calculate the standard deviation of the amount paid under the policy.

Possible Answers

A 134 B 235 C 271 D 313 E 352

Help Me Start ⌆

Find the probabilities for the four possible payment amounts: 0, 300, 600, and 700.

Solution ⌆

With the amount of snowfall as X and the amount paid under the policy as Y , we have

y	$f_Y(y) = P(Y = y)$
0	$P(Y = 0) = P(0 \leq X < 50) = 0.72$
300	$P(Y = 300) = P(50 \leq X < 60) = 0.14$
600	$P(Y = 600) = P(60 \leq X < 70) = 0.06$
700	$P(Y = 700) = P(X \geq 70) = 0.08$

The standard deviation of Y is $\sqrt{E(Y^2) - [E(Y)]^2}$.

$$E(Y) = 0.14 \times 300 + 0.06 \times 600 + 0.08 \times 700 = 134$$

$$E(Y^2) = 0.14 \times 300^2 + 0.06 \times 600^2 + 0.08 \times 700^2 = 73400$$

$$\sqrt{E(Y^2) - [E(Y)]^2} = \sqrt{73400 - 134^2} = 235.465$$

Common Questions & Errors ⌆

Students shouldn't overthink the problem with fractional payments of 300. Also, account for probabilities in which payment cap of 700 is reached.

In these problems, we must distinguish between the REALT RV (how much snow falls) and the PAYMENT RV (when does the insurer pay)? The problem states "The insurer pays the airport 300 for every full ten inches of snow in excess of 40 inches, up to a policy maximum of 700." So the insurer will not start paying UNTIL AFTER 10 full inches in excess of 40 inches of snow is reached (say at 50+ or 51). In other words, the insurer will pay nothing if $X < 50$.

Rate this problem Excellent Needs Improvement Inadequate

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NOTES

Welcome to your preparation journey for the SOA RET101 – Retirement Plan Design / RET201 – Retirement Plan Valuation / RET301 – Actuarial Topics for Canadian Retirement Plans.

This manual follows the official syllabus and presents each topic in a clear, focused manner to help you master the material with confidence and clarity. To complement your study, a set of accompanying flashcards is available for quick reviews, reinforcing key concepts, and keeping your knowledge fresh on the go.

While every effort has been made to ensure accuracy, I warmly welcome your thoughts, suggestions, or corrections at *actuarial613@gmail.com*. Remember – steady progress, disciplined practice, and a willingness to challenge yourself are the keys to success. As a final suggestion, practice is essential. Among the most common reasons for failure, not taking past exams seriously ranks as the number one issue. Candidates are strongly encouraged to attempt the relevant past-year questions published officially by the SOA to maximize their chances of passing.

Best of luck with your studies!

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Annuities and Retirement Plans

1. Trending away from annuitization (coincides with shift to DC/ Hybrid)
2. The amount of people willing to pay for annuities depends on risk aversion and decreases with the ROR they can make
 - a. Known vs. uncertain inflation environment is not a significant factor
3. Why the low annuitization rate
 - a. Social Security (already an annuity, but alone not enough to sustain living standards)
 - b. Tapping home equity
 - i. Tend to sell when health declines (moving into a nursing home) or when widowed
 - ii. Use proceeds to pay for institutional services (e.g., nursing homes) vs. buying an annuity
 - c. Pricing of individual annuities - Expensive (various loads), timing risks
 - i. Variable immediate annuity - also state prem. tax, annual investment a/c charges
 - ii. Inflation-indexed annuity
 - iii. Life annuity with long-term care insurance - PPA (2006) gives a small tax advantage, though unavailable for qualified plans
 - d. Legal and institutional considerations for annuity pricing under pension plans
 - i. Plan must offer QJSA for annuity options
 - ii. PPA (2006) mandated the use of corporate bonds to calculate a lump sum option
 - e. Desire for felicity - most like a combination of lump sum and annuity (security and spending flexibly)
 - f. Bequest motives

- g. Self insurance and couples - higher ROR from alternative investments than annuitization

MANAGING POST-RETIREMENT RISKS

STRATEGIES FOR A SECURE RETIREMENT 2025

Economic risks

1. Inflation risk - losing purchasing power
 - a. Rising prices erode the real value of fixed nominal pensions, annuities, and bond income over long retirements.
 - b. Medical costs and retiree health premiums (Medicare, Medigap, Part D) often rise faster than general inflation, making inflation especially acute for health spending.
 - c. Even “low” annual inflation compounds and significantly reduces purchasing power over 20-30 years.
 - d. Home values may or may not keep pace with inflation; reliance on housing appreciation is risky, particularly with climate-related events and local market shocks.
 - e. Managing strategies:
 - i. Maximize inflation-protected income: delay Social Security to age 70 to lock in higher, COLA-indexed benefits; coordinate timing of pension, 401(k), and IRA withdrawals.
 - ii. Hold assets with growth potential (equities, commodities, real assets), recognizing the trade-off: shifting some inflation risk into financial-market volatility.
 - iii. Use explicit inflation-indexed securities (TIPS, I Bonds) as part of the fixed-income allocation.
 - iv. Set aside assets earmarked for later-retirement consumption when prices are likely higher.
2. Interest-rate risk - effects on income and asset values
 - a. Low rates: slower accumulation pre-retirement, lower interest income post-retirement, and lower payout rates on immediate annuities.
 - b. High/increasing rates: higher future income on new money, but price declines on existing long-duration bonds and interest-sensitive assets.
 - c. Real returns (nominal minus inflation) are critical: low real rates make retirement more expensive.

- d. Debt side: higher market rates increase payments on variable-rate mortgages and consumer debt, often without matching increases on savings yields.
 - e. Managing strategies:
 - i. Use income annuities to lock in a lifetime payout at prevailing rates, recognizing rate timing risk.
 - ii. Structure bond holdings using duration management or ladders to balance reinvestment and price risk; consider professional help for complex structures.
 - iii. Limit and prioritize repayment of high-interest consumer debt and variable-rate obligations.
 - iv. Recognize that long periods of low rates are particularly damaging for retirees relying on interest income.
3. Financial-market risk - volatility, sequence risk, product choice
- a. Equities historically outperform other assets in the long run, but volatility and drawdowns can materially reduce retirement security.
 - b. Sequence-of-returns risk: poor returns early in retirement, combined with withdrawals permanently, impair the portfolio.
 - c. Product spectrum:
 - i. Mutual funds, ETFs, target-date funds: diversified, but exposed to market swings and manager or index selection.
 - ii. Variable annuities and other packaged products: may add guarantees (floors, lifetime withdrawal benefits) but often with high fees and complexity.
 - iii. Single-stock and employer-stock concentration: combine employment and portfolio risk in one issuer.
 - iv. Private equity and specialized funds: illiquid and higher risk, suited only for wealthier, sophisticated investors.
 - d. Managing strategies:
 - i. Diversify widely across asset classes (equities, bonds, cash) and within each class across issuers and sectors.
 - ii. Reduce equity exposure gradually with age or in response to spending needs; use bonds/fixed income as the primary income stabilizer.
 - iii. Use pooled vehicles (index funds, balanced funds, target-date funds) to obtain diversification and professional management; scrutinize objectives and glidepaths.
 - iv. Control fees aggressively because they are one of the few levers retirees fully control; be wary of paying extra for active management or complex guarantees.

- v. Avoid leveraged or options-based strategies unless truly expert; these add risk beyond simple market risk.
4. Employer and insurer solvency risk
- a. Single-employer DB plans: exposure to freezes, terminations, layoffs, and sponsor bankruptcy; benefits above PBGC limits are at risk.
 - b. Multiemployer plans: underfunding can trigger benefit reductions down to PBGC-guaranteed levels.
 - c. DC plans: investment risk and any employer-stock concentration fall fully on the participant; sponsor distress often coincides with stock collapse.
 - d. Insurance companies: annuity benefits above state guaranty-fund limits may be impaired if the insurer fails.
 - e. Managing strategies:
 - i. Understand PBGC coverage and funding status of DB plans; consider sponsor credit quality when choosing lump sum vs annuity.
 - ii. Avoid heavy employer-stock concentrations in DC accounts; diversify away when possible.
 - iii. When buying annuities, spread purchases across carriers and check financial-strength ratings and state guaranty-fund limits.
 - iv. Evaluate offers to commute pensions to lump sums carefully; recognize that giving up a guaranteed lifetime benefit increases longevity and investment risk.

Personal planning considerations

1. Longevity risk - outliving resources
- a. Life expectancy is a median: about half will live longer than the projected age; couples especially face a long survivor tail.
 - b. Rising longevity plus late-life risks (health costs, cognitive decline) make misestimating horizons particularly dangerous.
 - c. Managing strategies:
 - i. Build a strong base of guaranteed lifetime income (Social Security, DB pensions, immediate annuities), often with survivor options for couples.
 - ii. Consider deferred income annuities (“longevity insurance”) that begin at very advanced ages (80-85) to cover tail risk.
 - iii. Use structured withdrawal programs and RMD schedules as guardrails rather than ad hoc withdrawals.

- iv. Integrate home equity thoughtfully: repay or refinance mortgages, or selectively deploy reverse mortgages/HELOCs with careful cost and risk assessment.
- v. Review plans regularly; adjust spending, asset mix, and annuitization decisions as experience unfolds.
- vi. Use annuities judiciously: avoid annuitizing all assets; weigh guarantees and simplicity against loss of liquidity and bequest flexibility.

2. Post-retirement employment

- a. Work after “retirement” can provide income, maintain purpose, and delay drawdown of assets.
- b. Channels include phased retirement with current employer, consulting, gig work, new careers, and self-employment.
- c. Barriers include age discrimination, skill mismatches, health, caregiving responsibilities, and local labor-market conditions.
- d. Managing strategies:
 - i. Maintain and upgrade skills, especially technical and digital; cultivate networks to sustain employability.
 - ii. Consider planned phased retirement to reduce hours rather than fully stopping work; negotiate with employers where possible.
 - iii. Recognize that planning should not over-rely on post-retirement earnings because work may end earlier than hoped due to health or job loss.
 - iv. Coordinate employment decisions with health-insurance coverage (pre-65 especially), COBRA, ACA exchange options, and Medicare timing.

3. Housing and support needs - suitability and affordability

- a. Housing is often the largest expense and major asset in retirement; design, location, and services materially affect cost and quality of life.
- b. Needs evolve with functional decline; stairs, maintenance, transportation, and isolation become key constraints.
- c. Senior housing, assisted living, and long-term care facilities can be costly and capacity-constrained; wait lists and health-entry rules matter.
- d. Managing strategies:
 - i. Test housing affordability under rising taxes, insurance, and maintenance; plan for major repairs and condo special assessments.
 - ii. Consider downsizing, relocating to lower-cost or more age-friendly communities, or shared housing when appropriate.

- iii. Evaluate reverse mortgages, HELOCs, and mortgage payoff decisions in light of rates, liquidity needs, and long-term plans.
 - iv. Choose locations with access to family, healthcare, transportation, and social networks; investigate local support services and long-term care options.
 - v. Explore senior-housing continuum options (independent living, assisted living, CCRCs) early; understand contracts, financial strength, and entry timing.
 - vi. Use long-term care insurance or linked-benefit products where appropriate to finance high-need periods; understand benefit triggers and coverage limits.
4. Change in marital/partnership status - death of spouse/partner
- a. Survivors often experience income drops disproportionate to expense reduction; Social Security and pension benefits may be reduced or cease.
 - b. Tax filing changes from joint to single can increase tax rates at lower income levels.
 - c. Loss of a caregiving spouse can create both financial and functional challenges; widows often have a greater need for help.
 - d. Managing strategies:
 - i. Use life insurance, survivor options on pensions/annuities, and savings to protect survivors' living standard.
 - ii. Coordinate Social Security claiming to maximize survivor benefit (e.g., higher earner delays to 70); be aware of spousal/survivor rules and state-law nuances for partners.
 - iii. Keep wills, beneficiary designations, titling, and powers of attorney up to date; consider trusts for complex or blended families.
 - iv. For survivors with limited financial skills, consider using annuities and simplified account structures to reduce management burden.
 - v. Recognize that dual-earner couples can see larger proportional Social Security reductions at first death than single-earner couples.
5. Change in marital/partnership status - divorce or separation in retirement
- a. Divorce generally splits assets and retirement benefits, increasing per-person costs due to two households.
 - b. Retirement-age divorce is a “shock” from which many do not fully financially recover.
 - c. Managing strategies:
 - i. Engage specialists (attorneys, actuaries, planners) to value pensions, QDRO rights, and other retirement assets.
 - ii. Weigh retaining the marital home versus liquid assets carefully; the house can be a cash-flow burden despite emotional value.

- iii. Review and revise all beneficiary designations, wills, trusts, and powers of attorney promptly post-divorce.
- iv. Understand Social Security divorce rules (10-year marriage requirement, remarriage effects) and pension survivor rights under ERISA.
- v. Consider prenuptial agreements and estate planning for later-life remarriages, especially with children from prior unions.

Unexpected/unpredictable events

1. Public policy risk

- a. Potential for higher taxes, new tax structures, or reduced tax preferences for retirement plans.
- b. Solvency concerns for Social Security and Medicare may trigger benefit cuts, eligibility changes, or higher contribution requirements.
- c. Volatile and shifting health-care policy (ACA changes, potential single-payer models, marketplace rules) complicate long-term planning.
- d. Managing strategies:
 - i. Maintain an emergency fund and flexible spending to absorb policy shocks.
 - ii. Use tax diversification: traditional and Roth accounts, municipal bonds, and tax-efficient investments.
 - iii. Consider Roth conversions with careful modeling of short- vs long-run tax impacts; note Roth IRAs avoid RMDs.
 - iv. Use QCDs from IRAs (post-70%) to satisfy RMDs while excluding amounts from taxable income and supporting charities under current law.

2. Significant health-care needs

- a. Employer retiree medical coverage is increasingly rare; Medicare has gaps (dental, vision, hearing, most long-term care).
- b. High-cost drugs and cost-sharing can create large out-of-pocket burdens even with Part D.
- c. Policy and market changes (premiums, networks, exchange offerings) add uncertainty for pre-65 retirees and supplemental coverage.
- d. Managing strategies:
 - i. Make coordinated Medicare decisions: Original Medicare + Medigap + Part D vs Medicare Advantage, considering networks, premiums, and flexibility.
 - ii. Use HSAs during working years as tax-favored funding vehicles for retirement medical costs.

- iii. Consider delaying retirement or choosing post-retirement jobs that provide health benefits until Medicare eligibility.
 - iv. Invest in health through lifestyle choices (diet, exercise, smoking cessation) to reduce risk and severity of chronic disease.
 - v. Evaluate ACA marketplace options, employer retiree coverage, and association plans for pre-65 coverage; assess affordability and volatility.
 - vi. Consider travel and international care implications; Medicare does not pay outside the U.S., and supplemental travel coverage may be needed.
3. Unforeseen needs of family members
- a. Adult children may face unemployment, disability, divorce, or education costs; retirees often feel compelled to help financially.
 - b. Grandparents increasingly act as primary caregivers for grandchildren.
 - c. Blended families expand the set of potential dependents and complicate roles.
 - d. Managing strategies:
 - i. Explicitly model potential transfers and support amounts in retirement planning; set clear limits to avoid jeopardizing retirees' own security.
 - ii. Coordinate with family on expectations, roles, and contingencies; document key understandings when appropriate.
 - iii. Use Social Security survivor and dependent benefits where applicable; consider special-needs planning (e.g., trusts) for disabled dependents.
 - iv. Recognize that nonfinancial support (time, caregiving, coordination) can be as important as financial assistance.
4. Bad advice, fraud, or theft
- a. Cognitive decline, financial illiteracy, complex products, and online exposure increase vulnerability to scams and exploitation.
 - b. Sources of harm include unqualified "helpers," conflicted brokers, family members with access, and professional con artists.
 - c. Managing strategies:
 - i. Simplify the financial structure (fewer accounts, clearer titles, standard products) to ease oversight and reduce errors.
 - ii. Use multiple, credible information sources; verify advisors via tools such as the FINRA BrokerCheck and SEC resources.
 - iii. Be skeptical of high-return/low-risk pitches and pressure tactics; seek second opinions for major decisions.

- iv. Put robust legal frameworks in place early: carefully chosen powers of attorney, health proxies, and updated beneficiary designations.
- v. Designate trusted contacts on investment accounts so institutions can reach someone if suspicious activity is observed.
- vi. Consider identity-theft monitoring services and account-monitoring technology; use bonded/insured caregivers and regulated money managers.
- vii. Educate family and caregivers to spot warning signs of exploitation (unpaid bills, unusual transactions, behavior changes) and know reporting channels.

Planning issues

- 1. Failure to plan and horizon errors
 - a. Many individuals never perform integrated retirement planning or only plan for too short a horizon.
 - b. Tools such as the Actuaries Longevity Illustrator support better horizon assumptions.
- 2. Functional decline and cognitive impairment
 - a. Loss of mobility, vision, hearing, and cognition is common and should be pre-planned for with legal documents and support structures.
- 3. Social connection and mental health
 - a. Loneliness and social isolation have health impacts comparable to major risk factors; housing and lifestyle choices should address social needs.
- 4. Fragmented and abandoned assets
 - a. Multiple small plans and IRAs increase the risk of lost accounts, escheatment, and poor coordination; periodic consolidation and record-keeping are key.
- 5. Debt at retirement and home-value dependence
 - a. Entering retirement with significant consumer or housing debt constrains flexibility; many experts advocate minimizing or eliminating high-cost debt.
 - b. Heavy reliance on uncertain home values to fund retirement creates vulnerability to housing-market and local-risk shocks.

HOW ACCURATELY DOES 70% FINAL EMPLOYMENT EARNINGS REPLACEMENT MEASURE RETIREMENT INCOME (IN) ADEQUACY? INTRODUCING THE LIVING STANDARDS REPLACEMENT RATE RET101-114-25

(Sections 3.1, 3.2, 3.4, 4, 5, and appendices background only)

Limits of 70% earnings replacement

1. The conventional metric is “final employment earnings replacement rate”: gross income in the first retirement year divided by gross earnings in the last working year, with 70% widely used as an adequacy target by planners, pension designers, and policymakers.
2. This target underlies DB plan design, official reports (e.g., Baldwin, NRRI via Palmer), and web-based planning tools in Canada and the U.S.
3. Using LifePaths micro-simulation for Canadians born 1951-1958 retiring at 61, the authors show that workers who actually hit ~70% have a wide dispersion of living standards outcomes, with about 80% seeing post-retirement living standards more than 20% higher than during working life.
4. The correlation between the conventional replacement rate and the LSRR (true living-standards continuity) is only 0.11, implying minimal predictive value.
5. Among those retiring at 61, only about 22.5% of people with a 65-75% conventional replacement rate achieve 80-120% LSRR; even among all retirees at 61 (no 70% filter), about 28.5% achieve that band, showing the 70% target adds almost no informational value.
6. Testing different targets (e.g., 60%, 80%) yields similar proportions in the “adequacy” band (20-30%), reinforcing that one-size-fits-all percentage targets are weak guides.

Why the conventional measure fails

1. A single year’s employment earnings is a poor proxy for **working-life living standards** because:
 - a. It ignores household size/composition (especially children) and economies of scale.

- b. It omits key consumption resources: home equity/imputed rent, non-registered wealth, and debt dynamics.
 - c. It ignores taxes, transfers, and savings behavior (mortgage principal, RRSP, DB/DC contributions).
 - d. It ignores earnings volatility and career patterns (humps, mobility, spells of low/high income).
2. The standard formula is gross retirement income in the first retirement year over gross final earnings, which:
 - a. Uses too short a pre-retirement measurement period (one year instead of a representative career period).
 - b. Uses too short a post-retirement period (first year, ignoring inflation erosion and later-life shocks).
 3. Ten specific omissions/problems listed include: family size, imputed rent, tax dynamics, transfers, non-traditional savings, earnings volatility, retirement-income volatility, pre/post-retirement risks, phased retirement, individual preferences, and changing expenses.
 4. Empirical literature already shows large variation in optimal replacement rates by household characteristics and risks; this paper extends that by demonstrating empirically that the 70% rule does not deliver living-standards continuity for those who actually attain it.

Living Standards Replacement Rate (LSRR)

1. Objective: directly measure **continuity of living standards** by comparing the flow of income available for **personal consumption** before and after retirement.
2. Working-life “living standards” (denominator):
 - a. Start with **family disposable income** (market income + transfers - taxes/credits - work expenses).
 - b. Subtract net saving (pension contributions, RRSP contributions, mortgage principal, other wealth accumulation).
 - c. The result is income available for **family consumption**, then adjusted to an individual level using the LIS square-root equivalence scale (divide by household size).
 - d. Average this over a representative pre-retirement period: here, 30 years before retirement, trimmed by dropping the 5 highest and 5 lowest years, and averaging the remaining 20 (in real terms).
3. Retirement “living standards” (numerator):
 - a. Family disposable income plus **drawdown from accumulated net worth** (non-housing financial assets, DC balances, RRSP/RRIFs, other real estate, business equity, minus debt), converted to a flow via a notional **inflation-indexed life annuity** at retirement.

- b. Housing: the base case includes **imputed rent** as ongoing consumption, but assumes no deliberate drawdown of home equity, consistent with observed low reverse mortgage and downsizing usage.
 - c. No post-retirement employment earnings are included in the base LSRR (conceptually, retirement is cessation of work), but the framework can incorporate them for individual planning.
 - d. Average retirement living standards from retirement to death (no trimming; retirement income is much less volatile than earnings).
4. Formula:
- a. $LSRR = (\text{average real retirement living standards}) / (\text{trimmed average real working-life living standards})$.
 - b. A band of 80-120% is used as “approximate continuity” (normal circumstances: old-age spending above ~80% of working-life spending is acceptable, per external evidence).

What drives the divergence

1. The authors stepwise refine the conventional measure to the LSRR to show how each choice alters results; three critical dimensions interact: measurement period, unit of analysis, and income concept.
2. Measurement period:
 - a. Moving from one-year pre/post (RR#1) to multi-year averages (RR#2) substantially widens the distribution because single-year incomes contain transitory shocks (terms) on top of permanent income.
3. Household vs individual and equivalence scaling:
 - a. Moving from individual measures to family-level and then equivalence-scaled measures (RR#2 → RR#3) raises average replacement and spreads outcomes, mainly by recognizing the high cost of supporting children during working life and lower equivalent consumption needs in retirement.
4. Broader income and consumption concept:
 - a. Incorporating taxes, transfers, savings and dissavings, and imputed rent (RR#3 → LSRR) both shifts the distribution right (retirement looks better when tax preferences and drawdowns are considered) and widens it (heterogeneity in taxes, savings behavior, wealth, and housing).
5. Reversing the order (first broadens income sources, then family, then period) produces similar dispersion, underscoring that the omissions are significant and interacting; you cannot “fix” the conventional rate by adjusting just one component.

Empirical findings from LifePaths

1. Sample:
 - a. Canadians born 1951-1958, resident in Canada from at least age 35, retiring at 61 (defined as working $\geq 75\%$ of the year pre-retirement and $\leq 25\%$ thereafter).
 - b. From all workers at 60, $\sim 4\%$ retire at 61; $\sim 5.4\%$ of those retirees have a 65-75% conventional replacement rate, producing a sample of 3,122 individuals.
 - c. The sample is broadly similar to the cohort, slightly more educated, and more likely to be in the public sector.
2. LSRR distribution for those with 65-75% conventional replacement:
 - a. The majority experience improved living standards; around 80% are above 120% LSRR (i.e., $>20\%$ higher consumption potential than in working life).
 - b. A non-trivial minority is below 80%, indicating under-replacement even though they “hit” 70% earnings replacement.
3. Segmentations:
 - a. Distributions by sector (public vs private), education, earnings bands at 60, and household type (single vs couple) all show wide spreads; 70% does not reliably identify adequacy for any subgroup.
 - b. Couples exhibit higher LSRRs on average than singles, driven largely by child-related equivalence effects and shared consumption.
4. Robustness:
 - a. Similar patterns when examining other targets (50, 60, 80%), and other retirement ages (65, 70).
 - b. Including realistic post-retirement risks (instead of annuitization assumptions) would likely widen dispersion further.

Practical use of the LSRR

1. For policy analysts:
 - a. Directly evaluates the standard goal: maintaining pre-retirement living standards into retirement.
 - b. Helps identify vulnerable groups (“winners/losers”) of policy changes via changes in LSRR rather than crude 70% thresholds.
 - c. Can be implemented using micro-simulation for population-level adequacy studies.
2. For plan sponsors and designers:

- a. Use LSRR to test whether plan plus public pensions maintains target employees' living standards (e.g., career employee retiring at 65) before adopting DB, DC, or hybrid formulas.
 - b. Assess whether participants are “able to retire” at a desired age under the current design; identify those needing additional support or communication.
 - c. Industry examples: Eckler’s Guided Outcomes (GO) uses LSRR-type logic for DC adequacy analysis.
3. For individual planning/tools:
- a. LSRR gives an intuitive target: aim for post-retirement consumption flow equal to (or above) your own pre-retirement consumption, not a generic 70% of earnings.
 - b. Can be tailored for preferences: higher or lower post-retirement standards, bequests, expected work after retirement, explicit home-equity use, etc.
 - c. Dynamic tools (e.g., Ruthen micro-simulation) can show LSRR distributions under alternative saving and retirement decisions.
4. Implementation considerations:
- a. Data and modeling limitations mean practitioners will approximate:
 - i. Use as many pre-retirement years as feasible (e.g., last 10-20) to estimate “representative” consumption.
 - ii. For retirement, a mid-retirement age (e.g., 75) snapshot can proxy the average if full-lifetime modeling is impractical.
 - b. Combine LSRR (relative adequacy) with absolute thresholds (e.g., poverty lines, “market-basket” measures) to handle very low- and high-income cases.
 - c. Debate around imputed rent: academics treat it as consumption
 - i. practitioners should include a housing-cost adjustment to distinguish owners vs renters, even if expressed in cash-flow terms.

RISK MANAGEMENT AND PUBLIC PLAN RETIREMENT SYSTEMS APPENDICES B AND C RET101-111-25

Society/taxpayers/service recipients

1. Dual role:
 - a. Backstop for inadequately funded pensions (via social programs, senior benefits, political pressure for higher public spending).
 - b. Direct funders of public plans through taxes; analogous to shareholders bearing DB costs in the private sector.
2. Benefits:
 - a. Large public plans can provide **efficient** benefits (scale, pooling, professional management, transparency of explicit plan costs).
 - b. DB designs can help stabilize contribution patterns and tax rates when managed prudently.
3. Key concerns and frictions:
 - a. Poor visibility into underfunding and risk; small changes in contribution rates (e.g., 10% to 8% of pay) are hard for the public to interpret.
 - b. Trade-offs between pension funding and other public services (schools, roads, social services) are politically and economically sensitive.
 - c. Growing tension as private-sector pensions decline; taxpayers may resent funding more generous/more secure public benefits than they themselves receive.
 - d. Future taxpayers are “silent stakeholders”: they bear consequences of current underpricing and excessive risk but have no current voice.

Public employees (members, beneficiaries, future hires)

1. Objectives:
 - a. Secure, predictable lifetime income as a central part of total compensation.
 - b. No adverse surprises near retirement (benefit cuts, accrual changes, unexpected contribution hikes).
 - c. For non-Social Security participants, the public pension is the primary old-age income floor.
2. Advantages of public DB participation:
 - a. Risk pooling for investment, inflation, and longevity risk; professional administration; automatic benefit formula operation.
 - b. Portability within the public sector through large multi-employer or reciprocal arrangements; reduced impact of layoffs compared with the private sector.
 - c. Early-retirement provisions tailored to specific occupations (e.g., safety workers) recognizing physical/mental job demands.
3. Behaviors and incentives:
 - a. Desire to maximize promised benefits relative to contributions and wage trade-offs.
 - b. Long tenure and strong legal protections (often constitutional) against reduction of promised benefits, sometimes including future accruals.

Unions (as institutions, not individuals)

1. Separate stakeholders from members because union leadership has its own institutional objectives.
2. Objectives:
 - a. Secure competitive or superior benefits, especially those that are “sticky” (continuing until renegotiated rather than re-won each round).
 - b. Preserve and grow membership by demonstrating bargaining success.
3. Power and tools:
 - a. Bargaining leverage over wages and benefits.
 - b. Political influence over elected officials (endorsements, campaigning) who effectively sit on the “employer” side.
4. Potential misalignments:
 - a. Unions mainly represent actives, not retirees or non-represented participants, so negotiated changes may not align with all plan stakeholders.

Public-sector employers (civil service infrastructure, non-elected)

1. Role:
 - a. Operational employers managing hiring, retention, and retirement; provide cost estimates and budget input to elected officials.
2. Objectives:
 - a. Maintain a stable, qualified workforce at minimum cost to taxpayers, using pensions and benefits to offset wage gaps with the private sector.
 - b. Avoid conflict with both elected officials (budget controllers) and unions (workforce representatives).
3. Incentives and constraints:
 - a. Managers may themselves be plan members, blending employer and member perspectives.
 - b. Limited direct authority to change taxes or broad budget priorities; depends on the legislature for funding decisions.

Retirement system governing body (boards, fiduciaries, administrators)

1. Objectives:
 - a. Ensure adequate assets to pay promised benefits when due; uphold fiduciary duties to members and beneficiaries.
 - b. Achieve benefits at the lowest possible cost without jeopardizing security; preserve contribution stability.
2. Incentives:
 - a. Desire to be seen as effective stewards; maintain stakeholder confidence and political support.
 - b. Board composition may include employer representatives, members, and sometimes political appointees, each with their own perspectives.
3. Authority and options:
 - a. Varies by jurisdiction from full authority over contributions and certain design levers to almost purely administrative, with no funding or design power.
 - b. May set investment policy, adopt funding policies, and recommend design changes, but often cannot compel employer funding or legislative action.

Legislative body/elected officials

1. Objectives:

- a. Provide desired public services at acceptable tax levels; remain electable and perceived as effective.
2. Incentives:
 - a. Political time horizon (election cycles) often shorter than pension risk horizon; temptation to understate costs or defer contributions.
 - b. May increase benefits or grant retroactive improvements without immediately raising contributions, pushing costs to future taxpayers.
3. Decisions and powers:
 - a. Control tax rates, benefit statutes, and often contribution requirements; set employer budgets.
 - b. Interact with unions and employers at bargaining tables and via legislation.

Categories of risk

1. Plan design/insurance risk: longevity, salary growth, early-retirement features, COLAs, option values, and anti-selection.
2. Management/“three levers” risk: interactions and constraints around benefits, contributions, and investment strategy.
3. Governance/principal-agent risk: diffuse authority, moral hazard among multiple principals and agents.
4. Non-actuarial risks: political risk, legal/constitutional constraints, reputational risk, operational and information-security risk.

Plan design and option risk

1. Pooled vs systemic risks:
 - a. Individual longevity risk is efficiently pooled, but cohort longevity improvement risk is borne by the system; substantial when benefits are inflation-linked.
2. Embedded options and anti-selection:
 - a. Early-retirement windows, DROP programs, generous subsidized early ages, and overtime-inflated final-earnings formulas can be exploited by members.
 - b. Short final-earnings averaging periods increase “spiking” risk (late promotion, overtime concentration, terminal leave pay) and increase plan costs beyond pricing assumptions.
3. COLAs and indexation:
 - a. Inflation-linked benefits amplify sensitivity to interest-rate and longevity shifts; mispricing these guarantees creates large tail risk.

Contribution/funding risk and maturity

1. Funding dysfunction sources:
 - a. No enforceable contribution requirement or weak legal “call on cash”; contributions can be skipped or reduced for budget relief.
 - b. Contributions not tied to actuarial methods; lack of clear adjustment mechanisms when contributions are insufficient (no automatic benefit or contribution adjustments).
 - c. Lack of rules limiting use of “surplus” for benefit increases or contribution holidays.
 - d. No quantification of risk (e.g., probability distributions of required contributions) to support limits on risk relative to sponsor capacity.
2. Plan maturity and leverage:
 - a. As plans mature, benefit payments become large relative to payroll and normal cost; the asset base grows large relative to contributions.
 - b. Mature plans are more exposed to investment shocks: a given % asset loss translates into much larger required contribution increases as a % of payroll than in young plans.
 - c. Illustrative example: a high-benefit, mature plan facing a -20% asset shock requires far larger contribution increases (over 200% relative to baseline) than a low-benefit plan to restore funding, even under identical return paths.

Investment and asset-liability risk

1. Heavy reliance on investment returns (historically 70-80% of benefit financing), with contributions a smaller share, makes return assumptions and volatility central to risk.
2. Key considerations:
 - a. Aggregate market risk (equity, credit, interest-rate) relative to liability structure and cash-flow needs.
 - b. Impact of “over-optimistic” return assumptions (e.g., assuming historical equity premia persist) on underpricing long-term guarantees.
 - c. Extreme scenarios (e.g., Japan-style stagnation, prolonged low-return environments) can make constitutionally protected benefits unaffordable without huge contribution increases.
3. Defeasance concept:
 - a. Risk-adjusted liability value (e.g., discounting at high-quality bond or risk-free rates) gives a benchmark for the cost to fully hedge or transfer obligations.
 - b. Public plans rarely fund to this level, but should understand the gap as risk borne by taxpayers and employees, and address it via governance and disclosure.

Governance, moral hazard, and multiple principals

1. Multiple principals (taxpayers, members, unions, employers, boards, legislators) with conflicting objectives and no single controlling authority create a moral hazard.
2. Examples:
 - a. Legislators raising benefits or taking funding holidays to gain short-term political advantage, shifting risk to future stakeholders.
 - b. Stakeholders “gaming” rules (benefit spiking, retroactive improvements) when design and governance allow.
3. Absence of a unified regulator (unlike ERISA/PBGC in the private sector) reduces external discipline; GASB focuses on accounting, not risk budgeting or contribution enforcement.

Risk budget and appetite

1. Explicit risk budget specifying how much variability in cost and funded status stakeholders are willing to tolerate, and who bears which consequences.
2. Practical features:
 - a. Hard limits (e.g., employer contributions cannot exceed X% of payroll, or Y% of general revenues) plus soft limits that trigger escalating responses (stress testing, design changes).
 - b. Need to consider: contribution capacity of taxpayers and employees, competing budget priorities, plan maturity, and legal constraints on benefit changes.
 - c. Recognition that some risks (systemic longevity, political underfunding) are difficult to hedge and may require structural/legal solutions.

Risk mitigation and system discipline

1. System-discipline tools:
 - a. Rules for surplus usage (e.g., priority for reserve building vs ad hoc benefit gains or contribution cuts).
 - b. Restrictions and safeguards for special programs (e.g., DROPS, early-retirement incentives).
 - c. Sunset provisions or contingent features for benefit improvements; stronger controls on retroactive enhancements.
2. Pricing discipline:
 - a. Use of both actuarial (going-concern) and market/risk-adjusted valuations, with clear explanations of purpose for each.

- b. Stress testing and stochastic modeling, including fat-tailed return distributions and long-run mean uncertainty.
 - c. Scenario analysis for extreme but plausible events (deep recessions, revenue collapses, demographic shifts).
3. Budgetary discipline:
- a. Align contribution policy with plan maturity and risk profile; for mature plans, large risk-taking is harder to support because contribution volatility becomes socially and politically untenable.

Feedback loop and disclosures

- 1. Problems in public plan feedback:
 - a. Very long time horizon; mismanagement can take decades to surface, often coinciding with market downturns when corrective actions are most costly.
 - b. Fragmented authority and no central risk owner; contributions, benefits, and investments are controlled by different bodies.
 - c. Limited risk-focused disclosure; traditional reporting emphasizes point estimates (funded ratio, ARC) rather than risk distributions and stress outcomes.
- 2. Role of risk-adjusted reporting:
 - a. Parallel disclosure of risk-free or market-based liability values can inform stakeholders about the true economic value of promises and help set/monitor the risk budget, even if contributions are set on actuarial values.
 - b. Concerns about confusion from multiple valuations need to be balanced against the benefit of transparency on risk and compensation value.