RET RPIRM Model Solutions
Spring 2025

1. Learning Objectives:

2. The candidate will recognize and appropriately reflect the role of plan investments in managing plan sponsor risk and make recommendations.

Learning Outcomes:

(2d) Apply and evaluate strategies and techniques for asset/liability management.

(2e) Provide advice and analysis to plan sponsors regarding the mitigation of investment risks.

Sources:

RPIRM-112-13: Asset/Liability Modeling and Asset Allocation for Pension Plans, Fundamentals of Private Pensions, McGill, Dan, 9th Edition, 2010, Ch. 27

RPIRM-147-17: Charting the Course: a framework to evaluate pension de-risking strategies

RPIRM-152-18: Pension Plan Immunization Strategies: How Close Can You Get?

RPIRM-163-21: Liability Driven Investment Explained

RPIRM-148-17: Key Rate Durations: Measures of Interest Rate Risk

Commentary on Question:

Candidates generally performed very well on this question. Most of them demonstrated a solid understanding of the material.

Solution:

(a) Describe why Company ABC should consider asset/liability management as opposed to asset-only management.

Commentary on Question:

Candidates had to provide enough explanation to earn full credit.

Some assets classes perform similar to liabilities (fixed income), some different (equities). The co-movement of assets and liabilities determines the volatility of surplus.

1. Continued

Financial forecasting expresses results relative to funded level targets or risk levels providing more pertinent information than asset only analysis.
Output of ALM study includes distributions of contributions, pension expense, funded levels etc.

Asset that covaries positively with pension liability hedges it and plays an important role in optimal portfolio.

To protect the plan's funding status, Company ABC should invest in assets that mirror changes in plan liabilities as interest rates change. Indeed, as plan sponsors become more interested in reducing risk versus boosting return, they are interested in matching assets with pension liabilities (i.e., reducing interest rate and possibly equity risk), especially in this case, since Company ABC's pension is currently in a surplus position.

When investing in an LDI strategy, assets move in line with value of liabilities, reducing funding ratio volatility.

(b) Calculate the key rate durations and the total effective duration for the plan liabilities.

Commentary on Question:
The response for this part is to be provided in the Excel spreadsheet.

(c) Calculate the key rate durations and the total effective duration of the asset portfolio.

Commentary on Question:
The response for this part is to be provided in the Excel spreadsheet.

(d) Calculate the dollar change in liabilities and assets if all of the following were to occur simultaneously:

- Short-term rates remain constant
- Medium-term rates increase by 40 basis points
- Long-term rates increase by 90 basis points

Commentary on Question:
The response for this part is to be provided in the Excel spreadsheet.

(e) Calculate the dollar change in liabilities and assets for an upward parallel shift in the yield curve of 65 basis points.

Commentary on Question:
The response for this part is to be provided in the Excel spreadsheet.

2. Learning Objectives:

1. The candidate will understand the issues facing retirement plan sponsors regarding investment of fund assets.

Learning Outcomes:

(1a) Assess the different types and combinations of investment vehicles for providing retirement benefits given the particulars of the stakeholders' financial circumstances, philosophy, industry, work force and benefit package.

(1b) Distinguish the various strategies, approaches and techniques used to manage retirement fund assets.

(1d) Assess the potential effects of various investments and investment policies on all of the stakeholders, including tax implications.

(1f) Identify and assess the sources of investment risk applicable to retirement fund assets.

Sources:

RPIRM-144-17: Patient Capital, Private Opportunity: The Benefits and Challenges of Illiquid Alternatives

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Explain why investing in illiquid alternatives over the long term is expected to outperform investing in publicly traded asset classes.

Commentary on Question:

Candidates generally performed relatively well on this question. The solution below is not exhaustive, points were given for any acceptable answer.

- **Asymmetric information** – Private markets do not have to publish public disclosure information, which may yield some managers who are better suited to yield additional returns relative to public markets.
- **Illiquidity premium or infrequent transactions** – Private markets do not trade on an exchange, and thus take longer when an investor is looking to buy or sell. As a result, investors demand additional returns over the long term to compensate for this.
- **Longer holding periods** – Private markets generally have longer holding or lock up periods compared to public market investments

2. Continued

(b) Explain why private market investment performance may be negative for the first few years after initially investing in the asset class.

Commentary on Question:
Many candidates did not respond with enough information to earn full points

- As a result of the 'J Curve' effect
- Negative initial cash flows may occur while committed capital is called before the investment is able to yield any returns
- Investors make an upfront commitment to invest a specific dollar amount into a limited partnership
- Commitment is then "called down" incrementally by the fund manager over the investment period to fund investments in portfolio companies and to pay fees and expenses
- Invested capital is returned in the form of distributions generated by company sales or IPOs which may then offset the initial negative cash flow

(c) The CFO has made the following two statements about the new allocation to private market alternative investments.

I. It is appropriate to have one investment manager for ABC Company's private equity investments given its smaller allocation.

II. ABC Company needs a narrow range of allowable allocation around the target to private market alternative asset classes.

Critique each of the CFO's statements.

Commentary on Question:
Many candidates did not respond with enough information to earn full points. The solution below is not exhaustive, points were given for any acceptable answer.

Statement I

- Superior manager skill (alpha) influences the return of illiquid alternatives more so than public market returns (driven by beta)
- Manager dispersion increases as illiquidity grows. The more illiquid the asset, the greater the dispersion of the best and worst performing managers.
- Introducing multiple managers will help diversify the portfolio, and avoid reliance on one single manager performance.

2. Continued

- A 15% allocation to private equity is a $75 million total commitment. $75 million may only warrant one manager as some fund managers may not accept commitments smaller than $75 million.

Statement II

- ABC Company may not gain immediate exposure to private equity. The allocation may need to be built up over a period of several years. Until such a point, it is inappropriate to assume that the target allocation is permitted. A wider range may be advisable for private equity.
- Significant movements in public or private markets may put the private equity market allocation in breach of the permitted range. Once the minimum/maximum allocation is met, ABC Company would be required to buy/sell private equity in order to be in line with the permissible allocations. The timing of such transactions may not be reasonable due to market volatility, illiquidity/lock up periods, etc.

3. Learning Objectives:

2. The candidate will recognize and appropriately reflect the role of plan investments in managing plan sponsor risk and make recommendations.

Learning Outcomes:

(2d) Apply and evaluate strategies and techniques for asset/liability management.

Sources:

Study Note: RPIRM-136-15: Longevity Risk Management: New Tools for Defined Benefit Pension Plans

Study Note: RPIRM-140-16: OSFI's Policy Advisory #2014-002- Longevity Insurance and Longevity Swaps

Commentary on Question:

There was a dispersion across candidates in their knowledge of longevity risk management tools. Many candidates provided responses linking index-based contracts to inflation instead of a mortality index. Points were not awarded in these cases.

Solution:

(a) Compare and contrast the following types of longevity contracts:

(i) Indemnity-based longevity contracts

(ii) Index-based longevity contracts

Commentary on Question:

Several candidates knew what indemnity-based and index-based longevity contracts were but did not provide sufficient detail or only described them without comparing and contrasting. The solution below is not exhaustive, points were given for any acceptable answer.

Compare

- With both indemnity-based and index-based longevity risk hedging contacts, the pension plan administrator agrees to provide a counterparty with regular pre-determined, or "fixed" payments based on agreed upon mortality assumptions. In return, the counterparty provides the pension plan with regular floating payments.
- The pension plan has more predictable outflows over the period of the longevity risk hedging contact, as the counterparty to the contract assumes the longevity risk over the period covered by the contract.
- As they are both legal contracts, they will both carry legal and counterparty risks.

3. Continued

Contrast

- Indemnity-based longevity contracts insulate pension plans both from increases and decreases in costs arising from unanticipated changes in the longevity of the plan's beneficiaries (i.e., the pension plan's actual mortality experience). In the case of index-based longevity contracts, the actual mortality experience of the pension plan does not affect the amount of the payments from the counterparty to the pension plan.
- For indemnity-based, if the pension plan's beneficiaries live longer than was assumed for the purposes of setting the plan's fixed payments, higher payments from the counterparty to the pension plan serve to offset the plan's higher pension costs. If, on the other hand, beneficiaries don't live as long as assumed, lower payments from the counterparty to the pension plan mean that the overall cost to the pension plan of paying beneficiaries' pension will effectively be held constant.
- For index-based, if there is an increase in longevity as measured by the mortality index used to set the counterparty's payments to the pension plan, this will result in higher payments from the counterparty to the plan for index-based longevity contracts, and vice versa.

(b) Describe four risks that should be considered before entering into an index-based longevity contract.

Commentary on Question:
Most candidates were able to identify one or two relevant risks but were not able to provide four. Candidates who described the risks were given higher points than those who only named them. The solution below is not exhaustive, points were given for any acceptable answer.

- Counterparty risk: the risk to the pension plan that the counterparty to the longevity risk hedging contact will not live up to its contractual obligations. The underlying expected pension payments are not at risk, it's only the ability of the counterparty to pay the additional payments resulting from changes in the underlying index is subject to the risk.

- Rollover risk: although the index-based longevity contract protects the plan against changes in mortality index over the period of the contract, it does not cover the risk of having to enter into a new contract once the contract expires. Rollover risk is the risk that entering into this new contract will be more expensive, as may result from changes in mortality expectations.

3. Continued

- Basis risk: the risk stemming from the possibility that the mortality experience of the pension plan can differ from that of the index on which the contract is based (i.e., the mortality table or index upon which the floating payments are based). The more similar the composition of the index to the plan members covered, the better the index hedge. The basis risk could result in a significant reduction in the effectiveness of a longevity risk hedging contract.

- Legal risk: index-based longevity contracts are legal agreements and are not traded on an exchange. Plan administrators should fully understand the terms and risks of the transaction and seek legal advice before entering into a longevity risk hedging contract.

4. Learning Objectives:

1. The candidate will understand the issues facing retirement plan sponsors regarding investment of fund assets.

3. The candidate will understand how to evaluate the stakeholders' financial goals and risk management with respect to their plan.

Learning Outcomes:

(1b) Distinguish the various strategies, approaches and techniques used to manage retirement fund assets.

(1f) Identify and assess the sources of investment risk applicable to retirement fund assets.

(3f) Provide advice and analysis to plan sponsors and other stakeholders regarding the mitigation of pension plan risks.

Sources:

RPRIM-151-18 (target date funds)

Solution:

(a) Describe the following risks faced by defined contribution plan members who invest in target date funds:

(i) Growth risk

(ii) Market risk

(iii) Inflation risk

(iv) Longevity risk

(i)

Growth risk is the risk that a plan member fails to grow their assets enough in the accumulation phase, especially at younger ages. Failing to grow their assets at an appropriate rate will lead to inadequate or lower-than-expected replacement ratio at retirement.

4. Continued

(ii)
Market risk is the risk that plan members face, mostly (but not only) in their equity investments, that the market will experience severe downturn at an inopportune time. Even though asset classes may perform well over long periods of time, market risk in a target date fund is mainly that the market drops right before retirement or right before a rebalancing into less equity. When this happens, there may not be sufficient time for the market to recover, which will lead to a lower replacement ratio in retirement.

(iii)
When inflation rises, the benefits of traditional diversification can break down, exposing participants to potential larger-than-expected downside risks. In addition, high inflation may lead to higher interest rates, which would decrease some equity and bond valuations. Finally, the retiree's spending power declines over time as inflation leads to increased annual expenses while portfolio values are declining.

(iv) Longevity risk is the risk that the participant will outlive their assets. An individual's assets at retirement may be projected to be sufficient for their retirement, but if the individual lives significantly longer than average, the assets could still run out while the member is still alive.

(b) List four tools not used in traditional target date funds that can be used to mitigate market risk.

- Hedge funds
- Fixed-Income Diversifiers
- Global bond strategies
- Defensive equities such as low volatility equities

(c) Explain how the four tools listed in (b) mitigate market risk.

- Hedge funds mitigate market risk by vying to be market neutral. Hedge funds usually aim to exploit market inefficiencies and mispricing, while avoiding exposure to the market. One strategy that hedge funds use to do this is the Long-Short Equity strategy in which they will, for two stocks generally competing in the same industry, be long the one that is undervalued and short the one that is overvalued relative to the other. This way, the impact of market movements is generally not a factor.
- Fixed-Income Diversifiers – include non-traditional bonds such as high-yield, securitized loans, and corporate debt in the portfolio. These investment vehicles will generally be less sensitive to interest rate movements than traditional fixed income instruments, which means that in cases of a severe downturn due to a rise in interest rates, these vehicles will be less impacted than the market.

4. Continued

- Global bond strategies – hedges against rise in local interest rates, since interest rates in different countries can behave differently than in the local market due to the number of different factors influencing them.
- Defensive equities such as low volatility equities are less correlated with the market and therefore serve as a mitigation against market risk. This means they are less impacted by market movements (when compared to non-defensive equities) which reduces the impact of large swings in the market.

5. Learning Objectives:

3. The candidate will understand how to evaluate the stakeholders' financial goals and risk management with respect to their plan.

Learning Outcomes:

(3d) Understand and apply the principles of financial economics with respect to pension plan investing.

Sources:

Pension actuaries guide to financial economics

Commentary on Question:

Successful candidates needed to understand the financial economics point of view on pension investments for individual investors and how to maximize the tax effectiveness for the individual investor. The question tested how well candidates knew the concept and how to apply it to a particular individual investor situation.

Solution:

(a) List the key factors that create pension arbitrage from a financial economics asset allocation perspective.

Commentary on Question:

The question asked candidates to list the factors. An explanation of the financial economics viewpoint and how it works was not being asked and no credit was given for the explanation. Full credit was given when candidates stated the formula for pension arbitrage as it has four of the factors.

Solution:

1. Return on bonds
2. Corporate tax rate
3. Personal tax rate differential (equities/bonds or capital gains/income)
4. Size of the pension plan asset holdings
5. Initial pension plan target asset mix

(b) Using the above and taking a financial economics viewpoint, calculate:

(i) the current portfolio after-tax income for an individual investor; and

(ii) the optimal portfolio after-tax income for an individual investor.

5. Continued

Commentary on Question:
Candidates needed to correctly assess how much of the personal and pension holdings were initially invested in equities versus bonds and demonstrate how the pension assets should be altered between equities and bonds in order to receive full credit. Common errors were not including both corporate tax and personal (equity) tax rates to the pension plan holdings, incorrectly applying corporate taxes to the personal holdings, not reflecting the correct tax rates in formulas, incorrectly splitting personal holdings into equities and bonds, and not offsetting holdings with the after-tax corporate pension holdings.

(i) Determine after tax profit using existing pension plan target asset mix and adjusting personal allocation to achieve desired equity / bond allocation for total net holdings:

	(A) Gross Investor Holdings	(B) Corporate Tax (A) x (1-CTR)	(C) Net Investor Holdings (A) – (B)	(D) Pre-tax Income (C) x Return	(E) Personal Tax (D) x (1-PTR)	(F) After-tax Income (D) – (E)
Pension Plan						
Equities	1,200.00	420.00	780.00	62.40	15.60 (equity tax rate)	46.80
Bonds	800.00	280.00	520.00	31.20	7.80 (equity tax rate)	23.40
Sub-Total	2,000.00	700.00	1,300.00	93.60	23.40	70.20
Personal						
Equities	3,740.00	Nil	3,740.00	299.20	74.80 (equity tax rate)	224.40
Bonds	6,260.00	Nil	6,260.00	375.60	187.80 (bond tax rate)	187.80
Sub-Total	10,000.00	Nil	10,000.00	674.80	262.60	412.20
Total Portfolio	12,000.00	700.00	11,300.00	768.40	286.00	482.40

(ii) Determine after tax profit using 100% bond allocation in pension plan and adjusting personal allocation to maintain desired equity / bond allocation for total net holdings:

	Gross Investor Holdings	Corporate Tax	Net Investor Holdings	Pre-tax Income	Personal Tax	After-tax Income
Pension Plan						
Equities	Nil	Nil	Nil	Nil	Nil	Nil
Bonds	2,000.00	700.00	1,300.00	78.00	19.50 (equity tax rate)	58.50
Sub-Total	2,000.00	700.00	1,300.00	78.00	19.50	58.50
Personal						
Equities	4,520.00	Nil	4,520.00	361.60	90.40 (equity tax rate)	271.20

Bonds	5,480.00	Nil	5,480.00	328.80	164.40 (bond tax rate)	164.40
Sub-Total	10,000.00	Nil	10,000.00	690.40	254.80	435.60
Total Portfolio	12,000.00	700.00	11,300.00	768.40	274.30	494.10

CTR = Corporate Tax Rate
PTR = Personal Tax Rates (equity rate for total corporate pension plan and equities in personal portfolio, bond rate for bonds in personal portfolio)

(c) Explain how the arbitrage opportunity would be maximized by adjusting the level of corporate tax rates.

Commentary on Question:
Candidates needed to correctly assess how changing the corporate tax rate directionally maximizes the arbitrage opportunity and to receive full credit needed to offer explanation of which elements are affected by the corporate tax rate.

Solution:

- Lower corporate taxes increase the amount of arbitrage. At a corporate tax rate of 0% the arbitrage would be maximized holding all else equal.
- Corporate tax rates affect the net holdings for the individual investor which impacts the amount of dollars received
- The lower the corporate tax rate the greater the indirect holdings for an individual investor in the pension plan and greater opportunity to exploit differences in tax rates for equities versus direct bond holdings, all else equal.

6. Learning Objectives:

1. The candidate will understand the issues facing retirement plan sponsors regarding investment of fund assets.

Learning Outcomes:

(1c) Given a context, analyze a Statement of Investment Policy.

(1f) Identify and assess the sources of investment risk applicable to retirement fund assets.

Sources:

Study Note: RPIRM-166-23: Fiduciary Considerations Relating to Environmental, Social & Governance Issues for Canadian Retirement Arrangements

Study Note: RPIRM-103-15: Fiduciary Liability Issues for Selection of Investment

Commentary on Question:

Candidates who performed better on the first part of the question typically were able to provide more valid recommendations in the second part. Most candidates commented on the policy as it pertains to the assets but did not provide meaningful commentary on the policy's details on the plan features and liabilities.

Solution:

You are given the following excerpt from the Investment Policy Statement (IPS) for the XYZ Company Retirement Plan:

Plan Type	Defined benefit pension plan
Plan Status	Open to new entrants
Sponsor Objectives	Invest pension fund assets taking into account ESG factors and maximize investment return
Composition of liability	Active – 40% of liability Retired – 60% of liability
Investment Manager	Different manager for each asset class
Performance Measurement	Measured in aggregate for the whole portfolio
Monitoring	Annually
Rebalancing	Rebalanced to target monthly

6. Continued

Asset Allocation

Asset class	Target	Minimum exposure	Maximum exposure
Green Bond Funds	40%	20%	60%
Global Equity Funds	25%	15%	40%
Global Direct Infrastructure	20%	10%	20%
Energy Funds	7%	5%	15%
Emerging Market Funds	5%	3%	8%
Cash	3%	0%	5%

(a) Critique the above elements of the IPS.

Commentary on Question:
Most candidates commented on rebalancing, performance measurement, and monitoring. However, many didn't pick up on the type of plan, sponsor objectives, or aspects about the asset allocation. Credit was given for noting the ranges of the allocations should be narrowed, the target allocation should not be at the maximum and the factors for ESG should be explained in the IPS. The solution below is not exhaustive, points were given for any acceptable answer.

Plan Type and Plan Status

It is helpful to know that the plan is defined benefit and has ongoing accruals, however it is not enough to understand the risk exposure to economic factors such as inflation. It would be helpful to know the type of benefits being accrued (final average, a career-average or a flat benefit) and if the benefits are indexed at retirement.

Sponsor Objectives

Integrating ESG factors may be considered in investment decisions provided any such investment is in the best financial interest of the stakeholders and the decisions are rationally based on evidence after appropriate due diligence.

The sponsor may fall short on many fiduciary responsibilities by trying to maximize investment return as opposed to invest the assets prudently so that the pensions are secure, and the pension funds deliver the promised benefits.

6. Continued

Composition of liability

The IPS should provide more information on the plan liability, including the size of the liability, the funded status, an estimated market value of assets, and how big is the plan compared to the company. Risk management requirements increase with the size of the plan.

Investment Manager

The provided information about the managers is that they use a multi-manager approach, which reduces concentration risk from any single manager and is likely the most appropriate approach given the wide array of asset classes. Depending on the size of the assets, it may be appropriate to have multiple managers within each asset class as well.

Performance Measurement

Given the multi-manager approach, each individual manager should be monitored in addition to total portfolio management.

The IPS should also specify how each manager will be evaluated and should provide a benchmark for comparison.

Monitoring

Annual reporting can be appropriate if the plan is small. Quarterly monitoring would be more appropriate and typical for pension plans. More frequent monitoring can be required if there are performance issues for any particular manager or if the plan is on a strict derisking path.

Rebalancing

Rebalancing monthly may be too frequent and generate unnecessary transaction costs. Annual rebalancing may be the right balance to harvest equity risk premium while minimizing transaction costs.

The right frequency for resetting the portfolio to its target depends on the costs to rebalance and the size of the plan.

6. Continued

Asset allocation

Green bond funds: While the objective of the sponsor is to take ESG factors into account, ESG factors should not be the only factor to determine an asset class but should be part of the process in selecting investments in a particular asset class.

Global Direct Infrastructure: This type of investment is generally not liquid. The plan may be left with assets that cannot be sold — the target allocation may be too high (and the target allocation is already at the maximum exposure limit).

Emerging Market Funds: It may be difficult to take into account ESG factors with this asset class due to less regulations and less reporting requirements (or opaque reporting) in developed countries.

Energy Funds: This asset class may contain assets that are not compatible with the sponsor ESG objective.

(b) Recommend changes to the above elements of the IPS. Justify your recommendations.

Commentary on Question:
Most candidates were able to do well on the main points, except for the asset allocation changes. The solution below is not exhaustive, points were given for any acceptable answer.

6. Continued

Plan Type: Add the type of benefits being accrued and if the benefits are indexed at retirement to allow a better assessment of the risk exposure of the plan.

Sponsor Objectives: Modify the sponsor objectives to the following: invest the assets prudently so that the pensions are secure, and the pension funds deliver the promised benefits, so the sponsor's objectives are compatible with his fiduciary responsibilities.

Composition of liability: Add in the IPS the size of the liability, the funded status, an estimated market value of assets, and the size of the plan compared to the company to allow a better assessment of what risk needs to be hedged and what level of risk is acceptable.

Investment Manager: change current IPS to "different manager for each asset class that integrate ESG factors in the investment process" in order to meet the sponsor's desire take into account ESG factors in the pension fund.

Performance Measurement: Specify how each manager will be evaluated and a benchmark for comparison for each asset class to assess manager performance.

Monitoring: Change the monitoring frequency to quarterly monitoring in order to address potential issues more quickly.

Rebalancing Decrease the rebalancing frequency to reduce rebalancing costs.

Asset allocation: Replace Green Bond Funds with Fixed income funds to avoid any breach of fiduciary duties. Just because a bond is marketed as being "Green" it does not necessarily mean it is -- these funds may not be in the best financial interest of the plan members.

Asset allocation: Global Direct Infrastructure should be replaced with a fund of global infrastructure to reduce the liquidity risk.

Asset allocation: Decrease the target allocation of the global infrastructure to 10%, recalibrate the min and max exposure to +/-5%, and increase the global equity fund target allocation to have a more balanced asset allocation.