RET RPIRM Model Solutions
Spring 2016

1. Learning Objectives:

2. The candidate will recognize and appropriately reflect the role of plan investments in retirement plan design and valuation.

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

Learning Outcomes:

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

3b. Describe how the retirement plan financial and design risks integrate with the sponsor's risk management strategy.

Sources:

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

RPIRM-119-13 Accounting for Pension Buy-In Arrangements

Commentary on Question:

Candidates generally did fairly well on this question. It required that candidates know the factors that generate longevity risk and be able to explain the main solutions available to mitigate this risk.

Solution:

(a) List the factors that generate longevity risk in a defined benefit pension plan.

Commentary on Question:

Many candidates did well on this part of the question. Note that not all factors were required to receive full credit for this part of the question.

- Number of members
- Age profile of the population
- Gender profile of the population
- Socio-economic profile
- Aggregate health profile
- Profile of spouses and dependents
- Willingness of members to take lump sums (if available)
- Utilization of other optional benefits

1. Continued

- Fixed benefits versus inflation- or COLA-linked benefits
- Nature of lump sum options
- Nature of spouse and dependent benefits
- Nature of other optional benefits and payment adjustments

(b) Describe four solutions used to mitigate longevity risk in a defined benefit pension plan.

Commentary on Question:
Most candidates were able to describe four solutions. Some candidates provided more detail than necessary while others needed to provide additional details to demonstrate their understanding of the solutions. Some candidates also provided more than four solutions, but only four solutions were needed for full credit. Candidates were also provided credit if they mentioned one of the more obscure methods in the syllabus such as synthetic buy-ins or out-of-the-money longevity swaps.

Longevity swaps
- Exchanges actual pension benefit payments (based on realized longevity) for a fixed set of payments
- The hedger of the longevity risk (e.g. pension plan) receives from the longevity swap provider (Bank ABC) the actual payments that it must make to pensioners. In return, the hedger makes a series of fixed payments to the hedge provider.
- If pensioners live longer than expected, the higher pension amounts that the pension plan must pay are offset by the higher payments received from Bank ABC.

Buy-out or plan termination
- Removes liability from the plan sponsor's balance sheet by transferring assets and liabilities to an insurer
- Will include additional payment (higher than liability) to reflect insurer assumptions such as lower interest rates and compensation for taking on the risk
- Often involves settlement accounting

Buy-in
- Annuities become pension plan assets and the plan remains on the sponsor's balance sheet
- Avoids large one-time payment for plans that are underfunded
- Does not involve settlement accounting

1. Continued

Lump-sum offer

- Removes liability from the plan sponsor's balance sheet for those who elect
- May involve settlement accounting

q-forward

- Locks in a fixed mortality rate at a future time
- Involves the exchange of an amount proportional to the actual, realized mortality rate of a given population, in return for an amount proportional to a fixed mortality rate at a future date

2. Learning Objectives:

1. The candidate will understand how to analyze the issues facing retirement plan sponsors regarding investment of fund assets and make recommendations.

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.

Sources:

RP-IRM 130-14

RP-IRM 100-14

Commentary on Question:

This question sought to test candidates' ability to evaluate a sample plan in light of fiduciary responsibilities – particularly, how to reduce fiduciary liability risks that were apparent in the plan. Also, it sought to test candidates' recall of the process and broad thematic considerations involved in selecting an investment manager.

Candidates generally did well on the second part of this question, recalling the list of procedures for selecting an investment manager, as well as general considerations related to the process. Candidates did fairly well on part a, but more points were available for those that evaluated the plan, identified risk exposures, and cited ways in which fiduciary liability could be reduced.

Solution:

(a) Critique the investment options in the context of ABC's fiduciary responsibilities.

The plan sponsor can limit its fiduciary liabilities by:

- offering funds that have been delegated to outside professionals
- allow employees to allocate their investments among choices
- offer at least three diversified investment options that are materially different in terms of risk and return
- offer a wide range of investment options

The plan sponsor may wish to reconsider:

- offering company stock as an option
- making the default investment the U.S. large cap equity fund, because it may be too risky for some participants that are near retirement

2. Continued

The plan sponsor should consider:

- offering a more diverse equity fund, such as global equity, total stock market index, etc.
- offering a target date fund

Additional notes:

- the plan sponsor is only relieved of liability for investment losses to the extent that the losses are the result of the affirmative elections / investment decisions of plan participants
- company stock may be offered as an investment option under safe harbor of section 404(c) as long as the plan offers at least the three diversified investment options mentioned above

(b) Describe the process ABC should follow when choosing fund managers for the DC investment options.

ABC should establish appropriate investment objectives and risk/return expectations for each asset class.

Next, they should review the investment firms available, possibly with the help of a consultant.

Once the field is narrowed, say after filtering for investment style (such as active vs. passive management), they should send a detailed questionnaire to prospective firms, asking them to provide or explain:

- their investment decision-making process
- client references
- clients gained/lost in recent years
- their investment decision-making process
- historical performance, and how it was measured

After the questionnaires are received, ABC should narrow the field of candidates and conduct interviews. In the interviews, they should verify the questionnaire responses, and ask about:

- key personnel and corporate governance
- control disciplines
- transaction guidelines

Once interviews are conducted, a final choice is made and transition plans are formed.

3. Learning Objectives:

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

Learning Outcomes:

(3a) Compare the interests of plan sponsors, employees, shareholders, taxpayers and other stakeholders related to the financial management of a retirement plan.

Sources:

RPIRM 122-13: Guaranteed Trouble

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Critique the proposed PBGP design.

Commentary on Question:

Most candidates did well at identifying items with regards to Benefit protection. However, many candidates did not sufficiently address other items concerning Cost fairness and Government financial involvement.

Benefit protection

Benefits are protected up to a high monthly amount. However, the dollar limit does not vary for early or late retirements and is not indexed in the future, which decreases over time.

Benefits are protected only to the extent that PBGP is well funded. It is funded by plan sponsors only, by fixed amount per plan member, therefore it doesn't take into account the financial health of pension plan, asset/liability matching, financial health of plan sponsor and sponsor/industry financial risk, which increases risk of underfunding.

No protection for DC plan members in the event of market crashes or for hybrid plan members.

Cost fairness

Cost is the same per member so fair based on plan size, however financial health of company/plan and industry risk is not taken into account in setting the premiums, therefore financially stronger companies essentially subsidize less healthy companies.

Companies are not rewarded for funding their plans or reducing risk by better matching assets to liabilities.

3. Continued

Only DB plans would be covered by the PBGP, so financially stronger companies paying too much for the insurance may decide to move to a defined contribution plan and weaker companies would be left in the PBGP creating the need for increasing premiums.

No government financial involvement
Currently no formal government financial involvement in PBGP design. To mitigate political risk, important to ensure PGBP is well funded and reduce likeliness of plan underfunding when financial distress.

There aren't rules to ensure companies don't take advantage of the program, for example, limit benefits arising from plan improvements right after a short period of time before the claim.

(b) Evaluate the following two alternatives to the proposed PBGP from the perspective of the government's objectives:

(i) stricter funding rules; and

(ii) private insurance.

Commentary on Question:
To do well on this part of the question, candidates needed to evaluate the alternatives and link the items to the different government objectives.

(i) **Implement strict funding rules**
Stricter funding rules would improve benefit security, cost fairness and limit government involvement. For stricter funding rules to be efficient, the following could be considered:
- No option to smooth assets or liabilities
- Short timeframe to report actual financial position (timely reporting)
- Fund to at least 100% or reduce risk of unfunded plans in the event of sponsor insolvency
- Limited discretion in method to value liability
- No option to use accounting credits to reduce contributions
- No amortization of cost of plan improvements
- Limit plan improvements when plan is underfunded

Stricter funding rules would put stress on poorly funded plans which could cause them to close or change plan design

3. Continued

(ii) **Private insurance**

Private insurers would risk-adjust the premiums and could risk-pool the highest risk plans and/or use re-insurance to limit PBGP liability.

It is more difficult for private insurers to insure systematic risk than non-systematic risk, potentially exposing insurers to financial distress, but insurers have access to a wide variety of financial instruments, and insurers can mitigate pension risk by imposing strict funding rules.

It may however be difficult for poorly funded plans to get affordable insurance.

4. **Learning Objectives:**

2. The candidate will recognize and appropriately reflect the role of plan investments in retirement plan design and valuation.

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

Learning Outcomes:

(3d) Compare the financial economics perspective to the traditional perspective on funding and accounting for retirement plans.

Sources:

Pension Actuary's Guide to Financial Economics

RPIRM -118-13 Reinventing Pension Actuarial Science

Commentary on Question:

As we have seen in recent years, large company-sponsored and public pension plans have become significantly underfunded due to lower interest rates and equity market volatility. Part of the reason for the underfunding is use of discount rates tied to expected pension asset returns rather than discount rates tied to settlement costs. As a consultant, there may be occasion to explain to plan sponsors the difference between various plan liability measurements. In addition, this question will also help the candidates gain a more holistic view of how investors integrate the presence of a pension plan into their investment strategies.

Solution:

(a) Describe three different types of pension liability measures from a financial economics perspective.

Commentary on Question:

Most candidates correctly listed the three different types of liability and a description of each liability and the differences between the three measures

1) Market Liability (PAG p. 25)
   a. Determined as market value of a reference portfolio comprised of traded securities
      i. Reference portfolio matches the benefit stream in amount, timing and probability of payment.
      ii. Akin to ABO under FASB
   b. Market liability of pension plan should be determined by looking at how financial markets price similar cash flows

4. Continued

2) Solvency Liability
   a. Determined as the market value of defeasance portfolio comprised of risk-free traded securities
      i. Matches benefit stream in amount and timing BUT payment is assumed to be certain
      ii. Equivalent to an annuity quote, PBGC vested liability or ABO at riskless rate
   b. Difference between market liability and solvency liability is default risk

3) Budget Liability
   a. Traditional actuarial accrued liability
      i. Used to budget cash contributions over a period of years
   b. Uses discount rate based on long-term expected return on assets
      i. Reflects a "risk charge" (anticipated equity premium)
   c. Can lead plan sponsors to under-appreciate or be unaware of the risk they carry

(b) Describe the following risks to a defined benefit pension plan from a financial economics perspective:

(i) interest rate risk;

(ii) credit risk; and

(iii) alpha risk.

Commentary on Question:
Most candidates provided the basic definition of each risk; however, this only provided minimal points. This question was intended to dive deeper into each risk and provide a holistic overview how each risk is related to the other risk in the sponsoring corporation from a financial economics perspective. Most candidates did not include the necessary level of detail.

(i) Interest Rate Risk
   a. Duration mismatch
      - If pension plan is large relative to the company, interest sensitivity of plan may add considerably to overall interest sensivity of the corporation.
        1. Overall sensitivity of corporation comes from three sources
           a. Business operations
           b. Outstanding balance sheet debt
           c. Pension/OPEB plans

4. Continued

2. Company can manage this risk by:
   a. Shortening the duration of outstanding corporate debt
   b. Lengthening the duration of pension plan assets

3. Strategies can be executed:
   a. In the Cash market
   b. Using swaps and/or other derivatives

(ii) Credit risk

a. Is costly to shareholders since lenders demand higher coupons for riskier debt
b. Unlike equities that are taxed at low personal tax rates, high yield bonds are heavily taxed
c. Consequently tax considerations point to taking credit risk inside the pension plan

(iii) Alpha risk

a. May be argument for pursuing investments that have lower cost and are better managed than securities for individual investors.
b. Alpha is not correlated to pension plan liabilities, so funded status can vary significantly

5. Learning Objectives:

1. The candidate will understand how to analyze the issues facing retirement plan sponsors regarding investment of fund assets and make recommendations.

2. The candidate will recognize and appropriately reflect the role of plan investments in retirement plan design and valuation.

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.

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

(2a) Evaluate the interaction of plan investments with plan design, valuation, accounting and funding.

Sources:

RPIRM-111-13: Mind the gap: Using derivatives overlays to hedge pension duration

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Explain how interest rate swaps work.

Commentary on Question:

Almost all candidates identified correctly how swaps work

An interest rate swap is a periodic exchange of cash flows. One party pays cashflows based on a fixed interest rate while the counterparty pays a floating interest rate

(b) Compare and contrast the two strategies in the context of the pension committee's objectives.

Commentary on Question:

Most candidates did well at identifying the duration impact of the two strategies, but only a smaller numbers of candidates identified correctly the impact on the expected return.

5. Continued

(i) Considerations regarding the interest swap overlay strategy:

1) An interest rate swap overlay would allow XYZ to achieve a better asset/liability duration match which provides a more effective approach to minimize interest rate risk
2) The underlying asset portfolio allocations may remain unchanged, while the overlaying swap can increase the duration of the portfolio. By doing so, the plan is able to maximize the expected return in the portfolio while still minimizing interest rate risk

(ii) Considerations regarding the 100% fixed-income asset allocation strategy:

1) Investing 100% in fixed income securities will not necessarily minimize the interest rate risk. Although fixed income securities do have longer durations than equities and shifting to a full fixed-income portfolio reduces the duration gap between assets and liabilities, generally the duration of fixed income portfolios is not as long as pension liabilities in general. This results from the long term nature of pension obligations
2) Investing 100% in fixed income securities may not be the best option to maximize return on asset. There is a decrease in expected return associated with shifting away entirely from equity to fixed-income

(c) Calculate the notional principal of the swap required to minimize the interest rate risk of the funded status of the plan.

Show all work.

Commentary on Question:
Almost all candidates calculated correctly the amount of notional principal. Full credit was also given for a calculation based on the actual funded status of the pension plan.

Portfolio Duration = Sum (% Allocated to Asset Class x Class Duration)
Portfolio Duration = 0.4 x 5 years
Portfolio Duration = 2.0 years

Notional Principal = MV of Portfolio x (Target Duration – Portfolio Duration) / Swap Duration
Notional Principal = 500 million x (14 – 2.0) / 16
Notional Principal = 375 million

6. Learning Objectives:

1. The candidate will understand how to analyze the issues facing retirement plan sponsors regarding investment of fund assets and make recommendations

Learning Outcomes:

(1g) Solve for a measure of investment performance relevant to a given benchmark.

Sources:

PRIRM-104-15: Maginn and Tuttle, Managing Investment Portfolios, Third Edition Chapter 12

Commentary on Question:

This question was to test if the candidate understands the qualities of a good benchmark and the criteria for measuring benchmark quality.
Some candidates did not seem to understand the question and went into discussions about performance measures and benchmarks in general without reference to "quality", which received little credit.

Solution:

(a) Describe two statistical tests that can be performed using the periodic returns to measure systematic biases in the benchmark.

Commentary on Question:
Many candidates discussed performance appraisal measures instead of measures for benchmark qualities, therefore receiving little credit.
Full credit is given if the candidate mentioned any 2 out of the 3 tests below.

(Only 2 out of the 3 tests are needed)

- Test 1: Measure the portfolio's beta relative to benchmark (or Jensen's Alpha or the Treynor measure, as both use Beta)

- Test 2: Calculate the active return A = P – B. Calculate the return attributable to style S = B – M. Calculate the correlation of A and S.

- Test 3: Calculate the return attributable to style S = B – M. Calculate the portfolio's excess return over market E = P – M. Calculate the correlation of A and S.

(b) List the outcomes that validate and would indicate no systematic biases in the benchmark for the statistical tests identified in (a).

Commentary on Question:
Most candidates who were able to identify the tests correctly in part (a) did well in part (b).

6. Continued

(Only 2 out of the 3 tests are needed)

- Test 1: Beta should be close to 1.
- Test 2: The result should be close to 0 (uncorrelated).
- Test 3: The result should be a statistically significant positive correlation.

(c) Explain how tracking error is used to demonstrate that a benchmark is capturing a manager's investment style.

Commentary on Question:
Many candidates only explained what tracking error is and mentioned it should be small, which only received partial credit. A comparison between tracking error relative to benchmark and tracking error relative to market index needs to be used to assess if the benchmarking is capturing a manager's style.

The tracking error of the portfolio relative to an appropriate benchmark should be less than the tracking error of the portfolio relative to a market index.

(d) Describe two additional criteria that can be used to evaluate the quality of a benchmark.

Commentary on Question:
Many candidates listed the basic properties of a valid benchmark such as "investible" or "measureable", which is not what this question is asking. The key words in the question are "evaluate the quality" and candidates who understood that generally did well on this question.

(only need 2 out of the 4 criteria below to receive full credit)

- A benchmark's risk characteristics should be similar to that of the portfolio. A good benchmark will exhibit risk exposures at times greater than those of the managed portfolio and at times smaller.
- A benchmark should have high coverage, which is the proportion of a portfolio's market value that is contained in the benchmark.
- Benchmark turnover (the proportion of the benchmark's market value allocated to purchases during a period rebalancing of the benchmark) should not be excessively high.
- A good benchmark will consist of largely positive active positions. Active positions are the portfolio's allocation to a security minus the corresponding allocation of the same security in the benchmark. If a high number of negative active positions exist, this indicates a poorly-constructed benchmark.