Mitigating the risks for future generations

Managing the uncertainties of aging: an actuarial perspective

Yves Guérard, FSA, FCIA, hFIA, PhD(hc)

Beirut, 21st February 2005
Agenda

- The challenge
- Modeling process
- Actuarial control cycle
- Stability
- Financing paths
- Target funding
Their risks, our challenge!

- Aging: global phenomenon driven by a pervasive decrease in fertility and increase in longevity.
- In most countries the resulting increase in dependency ratios is a national challenge that requires long term planning and sustained implementation.
- Health and retirement costs both driven up by aging of population.
- Escalating costs for health and retirement may squeeze out other priorities.
- Burden shifted to future generations maybe unfair: how can we be certain they will accept a level of costs that we refuse.
- The ultimate penalty is dramatic collapse.
Strategic Risks

- Programs not fulfilling their mission:
  - Inadequacy of benefits
  - Rationing of health services
  - No adequate financial security in retirement
- Mispricing
  - Costs that may become unaffordable
- Excess volatility
  - Impact on financial stability
  - May lead to insolvency
- Mismanagement
  - Poor returns, high expenses
- Evasion and leakage
  - Create distortions in the labor market
  - Maybe be due bad performance or to poor service and communications
Pension Risk Universe

- **Operations**
  - Physical assets, Process, Organizational Culture, Legal

- **Strategic**
  - Plan design, Governance, Stakeholders, Prudential framework, Taxation, Environment, Knowledge

- **Investments**
  - Markets, Liquidity & Credit, Reporting, mismanagement
# Program wide risk identification

<table>
<thead>
<tr>
<th>Strategic</th>
<th>Operational</th>
<th>Investments</th>
</tr>
</thead>
<tbody>
<tr>
<td>❖ Demographic changes</td>
<td>❖ Pricing/Normal cost</td>
<td>❖ Market fluctuations</td>
</tr>
<tr>
<td>❖ Economic environment</td>
<td>❖ Liability estimate</td>
<td>❖ Pricing risk</td>
</tr>
<tr>
<td>❖ Inadequate plan design</td>
<td>❖ Integrity of data</td>
<td>❖ Volatility of returns</td>
</tr>
<tr>
<td>❖ Hyperinflation</td>
<td>❖ IT systems/component</td>
<td>❖ Concentration</td>
</tr>
<tr>
<td>❖ Governance deficiencies</td>
<td>❖ Actuarial assumptions</td>
<td>❖ Interest spread</td>
</tr>
<tr>
<td>❖ Regulatory changes</td>
<td>❖ Sponsor HR policy</td>
<td>❖ Transactions</td>
</tr>
<tr>
<td>❖ Knowledge base</td>
<td>❖ Improper benchmark</td>
<td>❖ Mismatching</td>
</tr>
<tr>
<td>❖ Fiduciary responsibility</td>
<td>❖ Reliability of information</td>
<td>❖ Reinvestment</td>
</tr>
<tr>
<td>❖ Non-Compliance</td>
<td>❖ External events</td>
<td>❖ Call risk</td>
</tr>
<tr>
<td>❖ Political risks &amp; uncertainty</td>
<td>❖ Participant behavior</td>
<td>❖ Direct default and Credit risk</td>
</tr>
<tr>
<td>❖ Incompetence &amp; mismanagement</td>
<td>❖ Internal processes</td>
<td>❖ Liquidity</td>
</tr>
<tr>
<td>❖ Fraud/Embezzlement</td>
<td>❖ Benefit amount paid</td>
<td>❖ Outsourcing</td>
</tr>
<tr>
<td>❖ Ethical/behavioral risk</td>
<td>❖ Communication</td>
<td>❖ Cash management</td>
</tr>
<tr>
<td>❖ Catastrophic events</td>
<td>❖ Eligibility beneficiary</td>
<td>❖ Merger/acquisition</td>
</tr>
<tr>
<td></td>
<td>❖ Administrative risks</td>
<td>❖ Custodian</td>
</tr>
</tbody>
</table>
Events, Hazards and Risks

- Risk refers to the possibility of some occurrence that will adversely affect the attainment of the objectives.
- A hazard is an event that has a harmful potential if it happens. Can also be an opportunity!
- A risk measure is the probability of the hazard happening times the resulting impact.

<table>
<thead>
<tr>
<th>Event</th>
<th>Hazard</th>
<th>Probability</th>
<th>Impact</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compens- sation</td>
<td>Restructure</td>
<td>15%</td>
<td>20%</td>
<td>3%</td>
</tr>
<tr>
<td>Rate of return</td>
<td>Drop 2%</td>
<td>30%</td>
<td>40%</td>
<td>12%</td>
</tr>
<tr>
<td>Life Expectancy</td>
<td>Increase 1yr/5yr</td>
<td>50%</td>
<td>10%</td>
<td>5%</td>
</tr>
</tbody>
</table>
Resilient System Structure

Reduce risk by design through diversification:

- **Health services**
  - Mix of public and private providers
  - Financing from both premiums and taxes

- **Multi-pillar retirement benefits**
  - Pillar I: Publicly administered, basic pension, flat or earnings related, often not funded and not contributory
  - Pillar II: Occupational pension funds, earnings related DB, DC or hybrid formulas; often mandatory, generally funded with tax advantages, competitively managed
  - Pillar III: Private savings, individually oriented, some tax sheltering
Agenda

- The challenge
- Modeling process
- Actuarial control cycle
- Stability
- Financing paths
- Target funding
Need for projections

- Modeling of complex systems, a prerequisite for identifying strategic options and optimizing policy decisions
- Should be mandatory for initial design, modifications and regular reporting
- Benchmarks essential for managing the objectives
  - Adequacy: extent of coverage, level of benefits and fairness of distribution
  - Affordability: refers both to costs of system and impact on tax revenues
  - Sustainability: costs must remain affordable in the long term and benefits adequate
- In a DB plan the risks are more on the costs, in a DC, they are more on the benefits; national system are often a combination of both
- Health and insurance coverage are defined benefits entitlements
Chart the course

- Design good engine but don’t forget the brakes
- Measure, monitor and control risks
  - Modeling of the system
  - Actuarial control cycle
  - Proper risk/return benchmarks
  - Stochastic simulations
- Financing path, reserves & surplus policy
System modeling

Performing series of calculations to simulate the virtual operations of complex systems, including projections of benefits, costs, contributions and assets in accordance with various scenarios

- Multi-uses, multi-purposes, essential for managing the objectives
- Need to develop local capacity and adapt the methodology to the context
- An iterative process that need continuous monitoring
Policy Modeling

- Compare alternative designs
- Select financing paths
  - Intermediate options between Full funding and Paygo
- Analyze emerging benefits
- Arbitrage between needs: health, retirement, education, infrastructure
- Redistribution vs savings accumulation
- Diversification
Iterative process

- A Model is a major task, not a throw-away tool for initial design only
- Improves with usage especially with better data and reconciliation
- Basis for regular financial reporting on financial condition
- Needs to be institutionalized to enhance sustainability
- Maintain confidence and credibility through peer review for technical quality and compliance with professional standards
Short term vs long term

Models are long term tools

- Cover full cycle to ultimate state, usually for 75 years or more
- Show trends, check points, sensitivity, early warning signals
- Anticipate users adverse selections and responsive behaviour to adversity
- Rest on a number of assumptions
  - Even if right over medium and long term, short term deviations are normal
- Margin of error increases with time
Modeling Process Requirements

- 1. Suitable Methodology and Tools
- 2. Qualified Professional Staff
- 3. Accurate Data
- 4. Appropriate Assumptions
- 5. Review and Reporting Process
1-Suitable Methodology and Tools

- Identification of Key Issues
- Technical definitions of Metrics and Objectives
- Consistent software for projections
- Internal controls on projection software
- Consistency over successive valuations
- Adapt policy choices to changing circumstances and emerging results
2-Qualified professional Staff

- High level expert panel to provide direction
- Qualified actuaries and other professionals
- Center of Excellence for training, guidance and review
- Locally deployed production of projections
- Need for objectivity and independance from political pressures
3-Accurate Data

- Clear, consistent data format and definitions
- Internal and external audits
- Build from administration systems
- Validate from alternate resources
  - reported financial data
  - operational data
- Projection-based analytics to spot problems
- Movement Analysis to check process
4- Appropriate Assumptions

- Focus on long-term policy issues
- Consistent with high-level outlook
- Take into account tax treatment of contributions, returns and benefits
- Internal consistency of related assumptions
- Credible alternative scenarios
- Evolve from current state to long-term expectations
- Feedback loop from actual experience
5- Review and reporting Process

- Initial planning: review issues, assumptions, prior years results
- Identify and make needed methodology and assumptions changes
- Production of projections/sub-projections
- Peer review by Center of Excellence
- High level expert panel review and comments
- High level review of results: administrators, officials, appointees
- Report on results by relevant officials
- Publication of financial outlook
Interactions

- Impact of plan conditions on behaviour
  - Propensity to retire is benefit related
  - Health services responsive to availability
  - Disability determination subjective

- Enforcement of collection, wages definitions, compliance
  - Shift from formal to informal

- Impact of other social initiatives
  - Health, family planning

- Productivity of the economy

- Capacity of financial markets
Modeling

- No Model perfectly accurate but it should:
  - Enable valid relative comparisons
  - Discriminate against impossible states
  - Set a range for expected results
  - Forecast timing of check points such as reversal of cash flows
- Compare with projections from other models: demographic studies, labor studies, fiscal outlook, monetary policy studies, etc...
- Significant probability exist only over a range usually shown as:
  - low, base, high
- Relative percentages more reliable than nominal values
- Deficits/surpluses more variable than assets or liabilities:
  - $1001 - 999 = 2$
  - $99\% \text{ of } 1001 - 101\% \text{ of } 999 = -18$
- Stress testing through scenario projections
Nobody yet back from the future but best estimates are possible

People who will retire before 2065 already born if NRA= 60

Inflation factored out in favor of relationships in real terms

- Wages = inflation + productivity + merit
- Returns = inflation + real return

Uncertainty increases with time
Agenda

- The challenge
- Modeling process
- Actuarial control cycle
- Stability
- Financing paths
- Target funding
Actuaries as Risk Managers

- Actuaries traditionally seen as professional managers of the financial consequences of uncertainty
- Profession responded to the changing environment to become the leading profession in the broader area of the assessment and control of financial and other risks
- Actuaries are developing better measures and predictors of risks
Stochastic projections

- Stochastic projections better assess probability of deviations but require more resources.
- Stochastic simulations can help assess the distribution of aggregated risks and make easier for stakeholders to decide on risk control options: mitigation, prevention, transfer, acceptance, response.
- Greater transparency in risk level:
  - 70%, 95%, 99%, 99.5%
  - Confidence interval.
Contribution of Actuaries

- Actuaries offer a unique combination of mathematical, statistical, demographic, economic, financial, analytical and modeling skills
- Their contribution to decision making lies in their capacity to integrate the input of other professionals into a complex model, given their specific expertise and experience
- Some Governments have created an Office of the Actuary to achieve critical mass and enhance neutrality
The Actuarial Control Cycle

1. Financial Projections
2. Risk analysis
3. Revise design and model parameters
4. Collect data
5. Monitor Performance
6. Adjust Operation parameters
7. Revise design and model parameters
8. Collect data
9. Monitor Performance
10. Adjust Operation parameters
11. Revise design and model parameters
12. Collect data
13. Monitor Performance
14. Adjust Operation parameters
Actuarial Control Cycle

- Actuarial studies, reports and analyses can play a vital role in the control of risks
- Experiences studies, gain and loss analysis, projections can detect errors, provide a basis to quantify risks, determine sensitivity and send early warning signals
- Good communications between actuary, risk manager, administrator and sponsor essential to ensure assumptions reflect facts and best known information
- Actuaries can provide guidance on the optimization of the financing path for mitigating volatility within regulatory constraints
Robert Pallacios, Managing Public Pension Reserves
World Bank, September 24th 2001

Some direct evidence – returns
(vs bank deposit rates)

Japan
Korea
Philippines
Sweden
US
India
Costa Rica
Morocco
Singapore
Canada
Jamaica
Kenya
Guatemala
Sri Lanka
Ecuador
Egypt
Venezuela
Zambia
Uganda
Average

-1.8%
## Example of risk/return benchmark

<table>
<thead>
<tr>
<th>Category</th>
<th>Min %</th>
<th>Target %</th>
<th>Max %</th>
<th>Reference Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Shares</td>
<td>0%</td>
<td>20%</td>
<td>30%</td>
<td>JSX</td>
</tr>
<tr>
<td>Domestic Gov’t Bonds</td>
<td>20%</td>
<td>30%</td>
<td>100%</td>
<td>Local Average</td>
</tr>
<tr>
<td>Domestic Industrial Bonds</td>
<td>0%</td>
<td>20%</td>
<td>40%</td>
<td>Local Average</td>
</tr>
<tr>
<td>Real Estate</td>
<td>0%</td>
<td>10%</td>
<td>15%</td>
<td>Local Average</td>
</tr>
<tr>
<td>Mortgage</td>
<td>5%</td>
<td>10%</td>
<td>25%</td>
<td>Local Average</td>
</tr>
<tr>
<td>Money Market</td>
<td>3%</td>
<td>10%</td>
<td>20%</td>
<td>SBI</td>
</tr>
<tr>
<td>Foreign Equity</td>
<td>0%</td>
<td>0%</td>
<td>10%</td>
<td>IFE</td>
</tr>
<tr>
<td>Total</td>
<td>n/a</td>
<td>100%</td>
<td>n/a</td>
<td>N/A</td>
</tr>
</tbody>
</table>

*Illustration not a recommendation*
Attribution of value added

- Total expected return = Σ (Wi x Hi)
  - Total actual return = Σ (Ti x Ai)
  - Benchmark return = Σ (Wi x Ri)

- Market fluctuation
  - Expected returns Σ (Wi x Hi) minus
  - Benchmark returns Σ (Wi x Ri)

- Manager value added (or subtracted)
  - Due to asset mix: Σ (Wi – Ti) x Ri
  - Due to securities selection: Σ Ti x (Ri – Ai)
  - Ai = series of actual returns on the invested portfolios
  - Hi = series of historical returns by category,
  - Ri = series of index market returns
  - Ti = actual asset mix achieved by the manager
  - Wi = series of benchmark percentages,
Agenda

- The challenge
- Modeling process
- Actuarial control cycle
- Stability
- Financing paths
- Target funding
Risks for Financial Stability

- **Basic common risks**
  - Demographic: fertility, mortality
  - Labor force: participation, unemployment
  - Regulatory framework and taxation
  - Economic downturns

- **Health and insurance risks**
  - Exposure to sharp fluctuations, catastrophe and man-made disasters

- **Retirement risks greater for life pensions**
  - Major assets deficiencies
  - Excess volatility of cash flows
  - Changes in investment behavior
  - Cyclical factors: market/globalization
  - No catastrophic risks but cumulative changes
Pension Funds as NBFIs

“Pension Fund” is a proxy for all forms of capital accumulations under programs providing financial security at or after retirement: Employer Pension Plans, Provident funds, Social Security programs, retirement savings.

Many pension funds are amongst the largest financial institutions in their country.

- Even when financed on pay-as-you-go basis, public funds can mobilize large cash flows
- Some occupational pension funds have become larger than their Sponsor
Volatility risks

- Assets volatility
- Liabilities volatility
- Need for assets/ liabilities matching, diversification and no risk concentration
- Acceptable risk can be expressed as « pain » caused by adverse variation in contributions: 0,1%, 0,5%, 3%, 5% of payroll
- Risks reduced by consistent and appropriate assumptions
Assumptions

- **3 categories:**
  - **Economic:** inflation, wages, returns, initial assets if any,
  - **Demographic:** fertility, mortality, coverage, migration, …
  - **Benefit design:** benefits rules, eligibility, retirement age, indexation, death or disability benefits, …
Economic assumptions

- **Wages, by age and sex**
  - Scale by age and sex, *plus*
  - Calendar increases to reflect productivity and inflation
  - Distribution by amount if minimum or maximum

- **Return on assets, real or nominal**

- **Indexation of benefits:**
  - Prices, wages, returns

- **Expenses if charged to fund**
  - Collection, administration, investment
  - Significant for individual accounts
Contributions and Costs

- Costs are materialized by the outflows from the system for benefits or expenses.
- Contributions are the inflows which together with returns on invested assets finance the costs.
- Costs depend on benefit formula, participation, emerging experience and operational results.
- Costs are not modified by estimates or assumptions.
- Contributions are made in accordance with rules or decisions normally guided by estimates or projections.
Contributions vs. Costs

- Contributions = Costs
  - Defined contributions programs
  - Pay go financing
  - Health and insurance programs

- Contributions ≠ Costs
  - Pre-funding
  - Target funding
Agenda

- The challenge
- Modeling process
- Actuarial control cycle
- Stability
- Financing paths
- Target funding
Financing vs Funding

- Two terms often confused but not interchangeable
- Financing refers to a variety of approaches to supply a system with sufficient assets to maintain its solvency
- Main financing methods are:
  - **Paygo**: paygo cost, no assets accumulation
  - **Full funding**: maintain assets equal to full present value of benefit promises
  - **Target funding**: contribution rates selected to achieve short term or long term targets such as a given level of assets or a multiple of monthly benefit payments
- Choosing a Financing method has fiscal, monetary and labour policy implications
Paygo financing

- The contribution rate is set equal to the PAYGO rate or the estimated PAYGO rate with regular adjustments
  - In practice a small working fund will be maintained, 3 to 24 months of benefit payments
- As there are no significant assets accumulated, benefits are paid out of contributions
- Lower vulnerability to economic factors but demographic risks higher
Full funding

- Accumulated assets are maintained equal to the PV of all accrued future benefits
- The contribution is equal to the Present Value of benefit accruals during the year taking into account future returns
- Returns on assets significantly reduce the required contributions
- Vulnerable to inflation, mismanagement, political interference, embezzlement but less sensitive to demographic variations
Agenda

- The challenge
- Modeling process
- Actuarial control cycle
- Stability
- Financing paths
- Target funding
Target funding

- A long term target (40, 50, 75 years) is set such as:
  - a amount of assets defined in percentage of payroll or GDP or a multiple of annual benefits or other benchmark or a given arbitrary amount
- The rate is the level percentage contribution, by reference to a base, required to achieve the target
- This percentage is recalculated periodically, say every 3 year, moving the target forward and spreading adjustments over a long period
Level percentage funding

- The minimum constant rate that makes the program sustainable indefinitely
- In practice can select the constant rate that over say 75 or 100 years will achieve the target expressed as a multiple of benefits
- Equalizes the burden between generations
- Does not require the build up of assets as high as full funding but only a stabilisation fund
- Relative level of the fund can be stabilised by appropriate selection of program parameters
- Easy to explain and communicate


<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>67</td>
<td>77</td>
<td>10</td>
<td>72</td>
<td>83</td>
<td>11</td>
</tr>
<tr>
<td>Egypt</td>
<td>41</td>
<td>60</td>
<td>19</td>
<td>44</td>
<td>64</td>
<td>21</td>
</tr>
<tr>
<td>Austria</td>
<td>61</td>
<td>71</td>
<td>10</td>
<td>66</td>
<td>78</td>
<td>12</td>
</tr>
<tr>
<td>Belgium</td>
<td>69</td>
<td>74</td>
<td>5</td>
<td>72</td>
<td>79</td>
<td>8</td>
</tr>
<tr>
<td>Czech Rep.</td>
<td>64</td>
<td>75</td>
<td>11</td>
<td>69</td>
<td>83</td>
<td>13</td>
</tr>
<tr>
<td>France</td>
<td>63</td>
<td>76</td>
<td>12</td>
<td>67</td>
<td>81</td>
<td>14</td>
</tr>
<tr>
<td>Germany</td>
<td>59</td>
<td>67</td>
<td>7</td>
<td>63</td>
<td>75</td>
<td>12</td>
</tr>
<tr>
<td>Greece</td>
<td>64</td>
<td>75</td>
<td>12</td>
<td>67</td>
<td>82</td>
<td>15</td>
</tr>
<tr>
<td>Italy</td>
<td>60</td>
<td>74</td>
<td>14</td>
<td>64</td>
<td>82</td>
<td>17</td>
</tr>
<tr>
<td>U. K.</td>
<td>41</td>
<td>60</td>
<td>19</td>
<td>44</td>
<td>64</td>
<td>21</td>
</tr>
<tr>
<td>Average</td>
<td>59</td>
<td>71</td>
<td>12</td>
<td>63</td>
<td>77</td>
<td>14</td>
</tr>
</tbody>
</table>

| Months Gained per Year | 3.0 | 3.6 |
Cost control parameters

- To protect against increases in dependency ratio
  - Stipulate gradual increase in retirement age of 4 months per calendar year
  - Triple impact of increasing contributions, increasing compounding of returns and reducing payouts

- To protect against variations in economic differentials
  - Stipulate indexation of Scheme maximum new pension on the basis of 50% wages index + 50% price index
  - Stipulate indexation of pension in payments on a price rather than wages index

- Such stipulations act as “brakes” on potential cost increases and can be released if experience is good
  - Easier to grant an increase or postpone an increase in the NRA than the reverse

- Proper timing and fine tuning of such parameters enable to control of the level of assets under a level rate financing method
Social security reforms should anticipate emerging global trends, consider country experience and structures but remain committed to protect all sectors of society.