



**9th Regional Pension and Social
Insurance Conference**
The Government Role &/or Control

Mitigating the risks for future generations

**Managing the uncertainties of aging:
an actuarial perspective**

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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

| Strategic | Operational | Investments |
|---|---|---|
| <ul style="list-style-type: none"> ❖ <i>Demographic changes</i> ❖ <i>Economic environment</i> ❖ <i>Inadequate plan design</i> ❖ <i>Hyperinflation</i> ❖ <i>Governance deficiencies</i> ❖ <i>Regulatory changes</i> ❖ <i>Knowledge base</i> ❖ <i>Fiduciary responsibility</i> ❖ <i>Non-Compliance</i> ❖ <i>Political risks & uncertainty</i> ❖ <i>Incompetence & mismanagement</i> ❖ <i>Fraud/Embezzlement</i> ❖ <i>Ethical/behavioral risk</i> ❖ <i>Catastrophic events</i> | <ul style="list-style-type: none"> ❖ <i>Pricing/Normal cost</i> ❖ <i>Liability estimate</i> ❖ <i>Integrity of data</i> ❖ <i>IT systems/component</i> ❖ <i>Actuarial assumptions</i> ❖ <i>Sponsor HR policy</i> ❖ <i>Improper benchmark</i> ❖ <i>Reliability of information</i> ❖ <i>External events</i> ❖ <i>Participant behavior</i> ❖ <i>Internal processes</i> ❖ <i>Benefit amount paid</i> ❖ <i>Communication</i> ❖ <i>Eligibility beneficiary</i> ❖ <i>Administrative risks</i> | <ul style="list-style-type: none"> ❖ <i>Market fluctuations</i> ❖ <i>Pricing risk</i> ❖ <i>Volatility of returns</i> ❖ <i>Concentration</i> ❖ <i>Interest spread</i> ❖ <i>Transactions</i> ❖ <i>Mismatching</i> ❖ <i>Reinvestment</i> ❖ <i>Call risk</i> ❖ <i>Direct default and Credit risk</i> ❖ <i>Liquidity Outsourcing</i> ❖ <i>Cash management</i> ❖ <i>Merger/acquisition</i> ❖ <i>Custodian</i> |



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

| Event | Hazard | Probability | Impact | Risk |
|------------------------|-------------------------|--------------------|---------------|-------------|
| Compensation | Restructure | 15% | 20% | 3% |
| Rate of return | Drop 2% | 30% | 40% | 12% |
| Life Expectancy | Increase 1yr/5yr | 50% | 10% | 5% |



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



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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**



Accuracy

- ❖ 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



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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

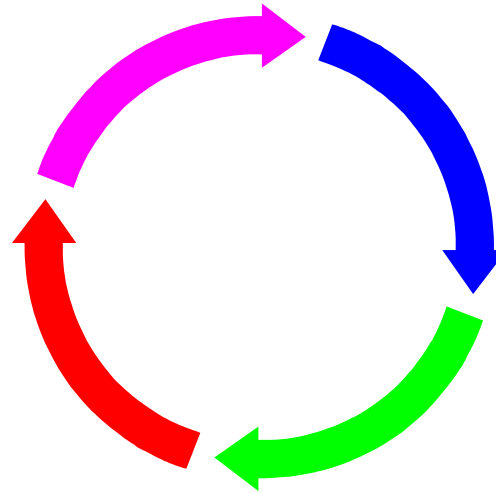


The Actuarial Control Cycle

Financial Projections

Risk analysis

**Adjust
Operation
parameters**



**Revise
design and
model
parameters**

**Monitor
Performance
Collect data**

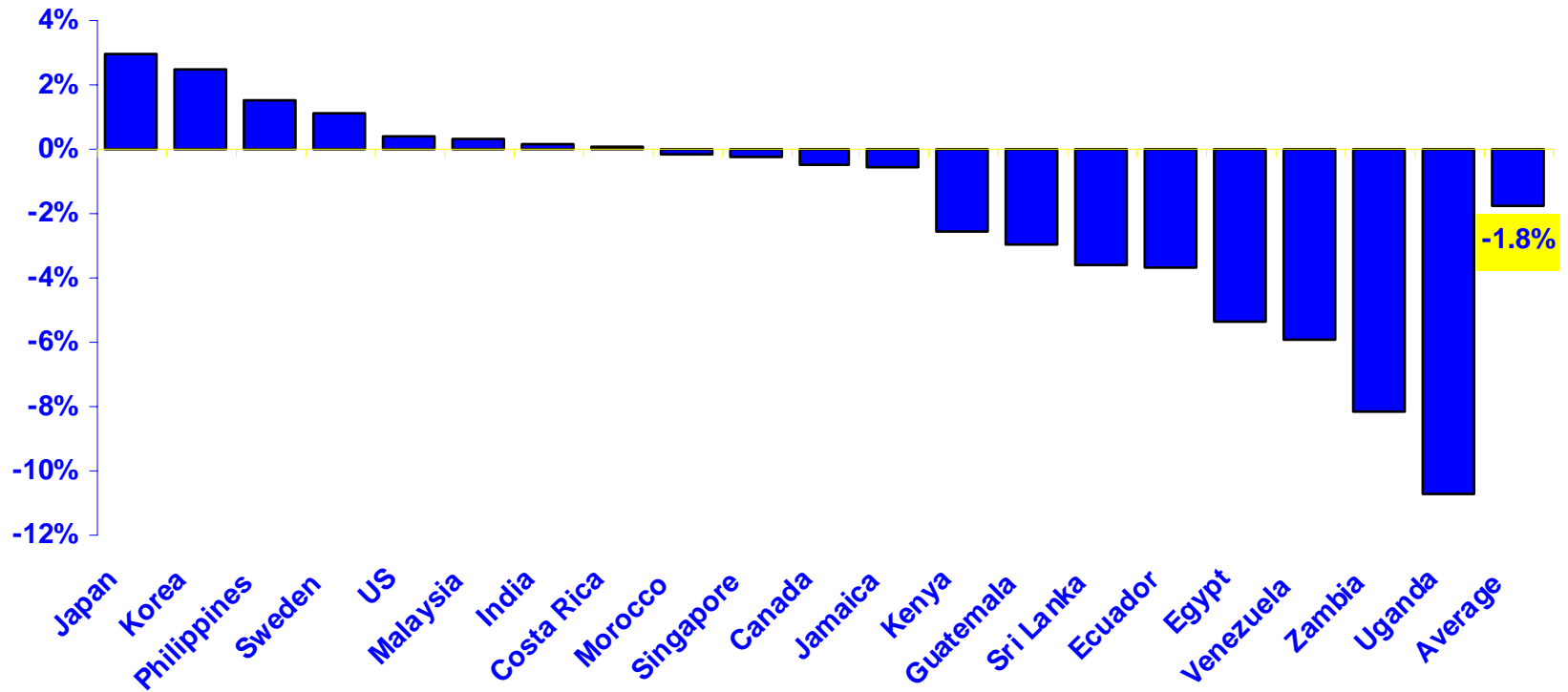
Actuarial Control Cycle

- ❖ **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**



Some direct evidence – returns (vs bank deposit rates)

**Robert Pallacios, Managing Public Pension Reserves
World Bank , September 24th 2001**



Example of risk/return benchmark

| Category | Min % | Target % | Max % | Reference Index |
|---------------------------|-------|----------|-------|-----------------|
| Domestic Shares | 0% | 20% | 30% | JSX |
| Domestic Gov't Bonds | 20% | 30% | 100% | Local Average |
| Domestic Industrial Bonds | 0% | 20% | 40% | Local Average |
| Real Estate | 0% | 10% | 15% | Local Average |
| Mortgage | 5% | 10% | 25% | Local Average |
| Money Market | 3% | 10% | 20% | SBI |
| Foreign Equity | 0% | 0% | 10% | IEFE |
| Total | n/a | 100% | n/a | N/A |

Illustration not a recommendation



Attribution of value added

- ❖ **Total expected return** = $\Sigma (W_i \times H_i)$
 - Total actual return = $\Sigma (T_i \times A_i)$
 - Benchmark return = $\Sigma (W_i \times R_i)$
- ❖ **Market fluctuation**
 - ✓ Expected returns $\Sigma (W_i \times H_i)$ minus
 - ✓ Benchmark returns $\Sigma (W_i \times R_i)$
- ❖ **Manager value added (or subtracted)**
 - ✓ Due to asset mix: $\Sigma (W_i - T_i) \times R_i$
 - ✓ Due to securities selection: $\Sigma T_i \times (R_i - A_i)$
 - ✓ A_i = series of actual returns on the invested portfolios
 - ✓ H_i = series of historical returns by category,
 - ✓ R_i = series of index market returns
 - ✓ T_i = actual asset mix achieved by the manager
 - ✓ W_i = series of benchmark percentages,



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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 depends 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 \neq Costs**
 - ✓ **Pre-funding**
 - ✓ **Target funding**



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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 an 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



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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



Life Expectancy at Birth
Selected Countries
1950 – 1998

| Countries | Male | | | Female | | |
|-------------------------------|-------------|-------------|--------------|---------------|-------------|--------------|
| | 1950 | 1998 | Diff. | 1950 | 1998 | Diff. |
| Australia | 67 | 77 | 10 | 72 | 83 | 11 |
| Egypt | 41 | 60 | 19 | 44 | 64 | 21 |
| Austria | 61 | 71 | 10 | 66 | 78 | 12 |
| Belgium | 69 | 74 | 5 | 72 | 79 | 8 |
| Czech Rep. | 64 | 75 | 11 | 69 | 83 | 13 |
| France | 63 | 76 | 12 | 67 | 81 | 14 |
| Germany | 59 | 67 | 7 | 63 | 75 | 12 |
| Greece | 64 | 75 | 12 | 67 | 82 | 15 |
| Italy | 60 | 74 | 14 | 64 | 82 | 17 |
| U. K. | 41 | 60 | 19 | 44 | 64 | 21 |
| Average | 59 | 71 | 12 | 63 | 77 | 14 |
| 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**



A Model with a Mission

Social security reforms should anticipate emerging global trends, consider country experience and structures but remain committed to protect all sectors of society

