Modeling pension reform

The World Bank's pension reform options simulation toolkit

Today's pension policies can affect retirement incomes and the public finances for decades to come. Retirement income systems that may be affordable today will often prove unsustainable in the future, given the twin pressures of demographic aging and the maturing of pension schemes.

The World Bank's pension reform options simulation toolkit (PROST) models pension contributions, entitlements, system revenues and system expenditures over a long timeframe into the future. The model is designed to promote evidence-based policy-making, bridging the gap between quantitative and qualitative analysis of pension regimes. It is a flexible, computer-based toolkit, easily adapted to a wide range of countries' circumstances.

Policy makers and other key stakeholders have used PROST to evaluate existing schemes and reform options in more than 90 countries around the world (Figure 1).

Why model pensions?

Pay-as-you-go pension systems were often introduced with little or no analysis of the medium- and long-term effects on the elderly, on workers and on the public finances. Once schemes are introduced, there remains a need for regular scrutiny of the impact on the pension system of factors such as changing life expectancy and patterns of labor force participation.

Pensions policy-making can be dangerous without long-term projections of system finances. Pension programs can be politically popular yet the full financial impact is only realized over long periods of time, often generations. Pay-as-you-go schemes when first introduced, can generate net income for the government, because payroll tax revenues exceed (initially modest) benefit expenditures. The true costs of the pension scheme only become apparent in the medium- to long-term as the system matures. People often consider these future benefits as strict entitlements, making it politically very difficult to adjust them in line with demographic and economic pressures. Pension benefits are sometimes even protected by the constitution.
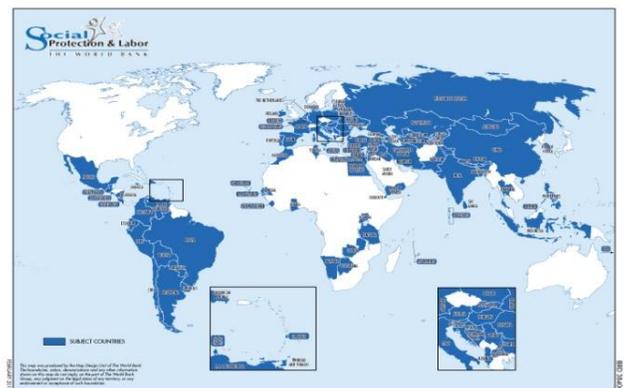
PROST used in more than 90 countries 1

Countries such as Brazil—where three-quarters of the fiscal deficit had been attributable to social security—are not isolated cases. The cost of paying for pensions crowds out spending on other deserving programs: health, education *etc.* And when payments exceed contribution revenues, cross-subsidies are required from broadly based

taxes, such as value-added taxes. Pension benefits tend to go to a privileged minority that works in the covered, formal sector so that subsidies required to support such benefits can be highly regressive.

Pension modeling assesses schemes' cash balances over the long-term and thus determines system sustainability. Modeling pensions can also rigorously evaluate different policy reforms, informing both policy-makers and the public about the financial consequences of change.

Modeling pensions with PROST

PROST is designed to answer the following kinds of question:

❏ What will be the contributions, benefits, earnings and potential need for subsidies be over the long-term? Will the system be viable and sustainable in the long-run?

❏ What kind of benefits can people expect to receive in the future? Will the pension system provide a decent retirement income to different categories of people?

❏ How large are the government's implicit pension liabilities?

❏ How would broadening coverage, changing eligibility, changing benefits, or adjusting contribution rates affect the system? How will costs, expenditures and liabilities change under various reforms?

The model utilizes country-specific data provided by the user. It generates population projections (Figure 2), which, combined with economic assumptions, are used to forecast future numbers of contributors and beneficiaries. These in turn generate flows of revenues and expenditures. The model then projects fiscal balances, taking account of any partial pre-funding of liabilities.

The model can use either a 'stock' or a 'flow' approach. In the stock concept, parameters such as retirement are expressed as total retirees as a percentage of population rather than as probabilities of retirement, since the stocks can be more stable predictors of the future. Also, projections can be based on either population or employment. The model can also be used for closed population civil servant schemes or open population national schemes.

A special section in PROST analyses the impact of pensions at an individual level. The user can explore the impact of the system and reforms on individual workers with different income levels, mortality rates, earnings profiles, job entry ages, retirement patterns *etc.*

Population pyramids 2

age

1999

age

2050

number of men   number of women
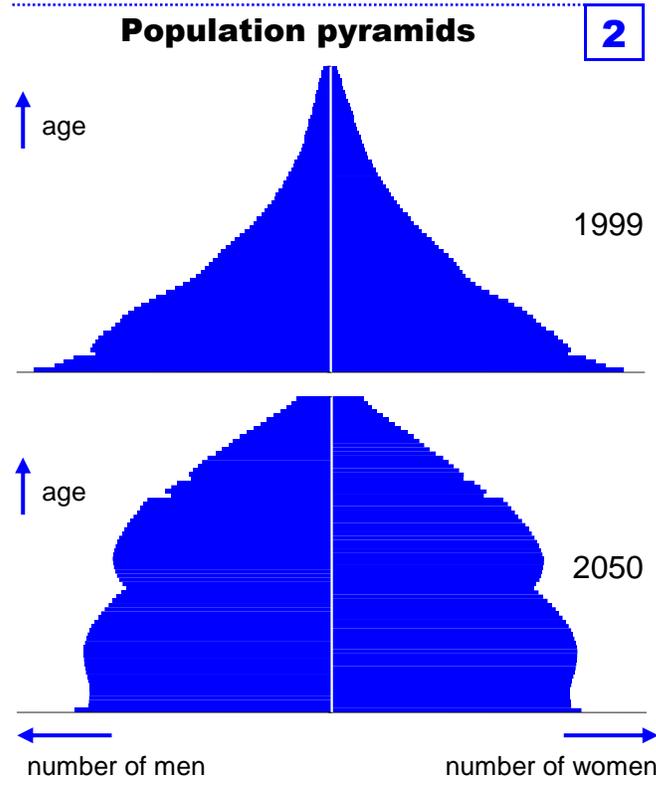
Population pyramids graphically illustrate changing demographics. In this example, the 1999 population is relatively young, with a steep decline in the number of people by age. By 2050, the projected 'pyramid' is much less steep, with fewer children and youth and many more elderly. Bulges in the 2050 pyramid also show baby 'booms' and 'busts'.

The model can accommodate a distribution of wages per cohort which allows users to determine the effects of changes in floors and ceilings of income subject to contribution and the effects of changes in the minimum and maximum pension levels.

The model can assess anything from 'parametric' reforms of initial pay-as-you-go systems—changing pensionable ages, contribution rates, benefits,

indexation *etc.*—to structural reforms, such as the introduction of individual, funded retirement savings accounts or notional accounts can also be modeled. PROST can handle provident fund schemes as well as pay-as-you-go systems as the starting point, before reform.

The model also allows for different transition paths to a new system, including the age cohorts (generations) covered by the new system (such as applying reforms only to younger workers) and the treatment of pension rights accrued before the reform. Accrued rights can be paid in multiple ways, including as recognition bonds and as proportional wages. On-going funded defined contribution schemes and notional accounts can be modeled in PROST as well.

Model output

The PROST program produces five output modules, comprising Microsoft Excel tables with graphical summaries. The modules are:

- **Population projections**, including life tables, population pyramids, population dependency ratios *etc.* (Figure 2).
- **Demographic structure**: labor force and employment, numbers of contributors and beneficiaries, system dependency ratio.
- **Financial flows**: projections of wages, benefits, revenues and expenditures of the pension system (Figure 3), pension scheme balance and the implicit pension debt. The financial flows module also calculates the adjustments—to benefit levels or contribution rates—that would 'balance' the system, *i.e.* bring revenues and expenditures into line (Figures 4 and 5).
- **Fundamental, systemic reform:** this module illustrates the effect of a shift to a 'multipillar' regim*e,* incorporating both a pay-as-you-go, defined-benefit pension and a funded, defined contribution scheme or exclusively one or the other. Again, it measures the impact both on the system finances and on individuals' pension entitlements, including measurement of transition costs. The total pension benefit and the value of each of the pillars are provided separately.

A growing pension deficit... 3
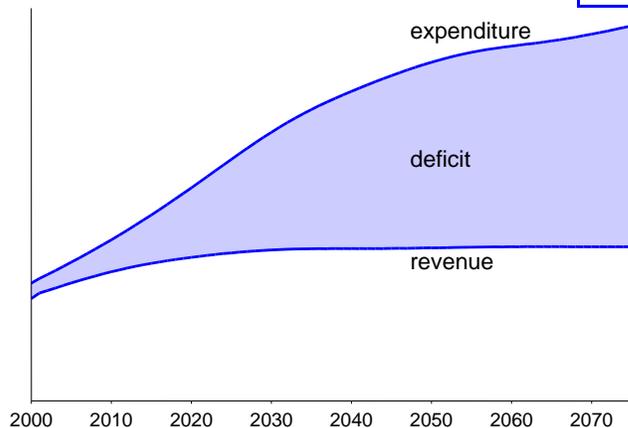
...means higher contributions... 4
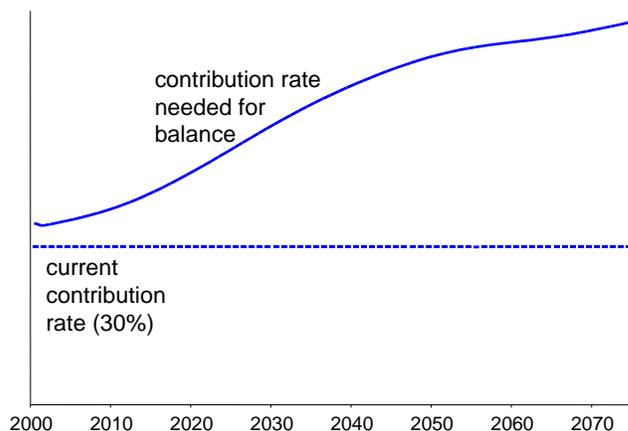
...or lower benefits 5
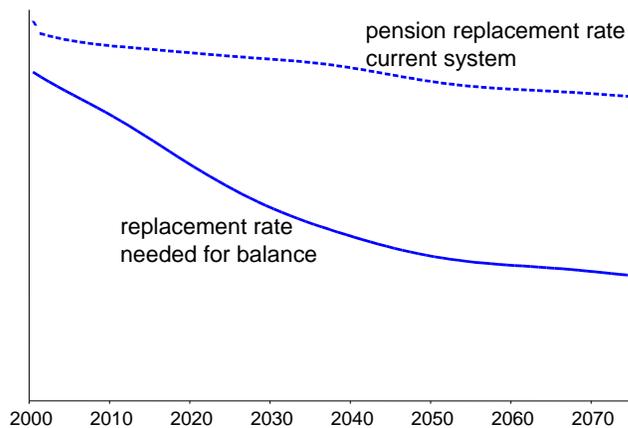
- **Effects on example individuals:** the model works out contributions and benefits for different example individuals, specified by age, sex, age of labor market entry, retirement age,

earnings profile, mortality *etc.* With results for six different example people per age cohort, the distributional effects of the current system and potential reforms can be assessed both within and between generations.

All of the modules allow for analysis of the sensitivity of results to key demographic and economic parameters, such as fertility, longevity, wage growth and interest rates.

Technical requirements

PROST is policy oriented, allowing easy operation for technical novices. Data and assumptions are easily placed into Excel input file worksheets. Outputs are similarly presented as Excel worksheets. Users require:

- Microsoft Windows Operating Systems
- Microsoft Office Excel 2003 or 2007.
- Multi-lingual input/output is possible.
- Basic knowledge of Microsoft Excel.
- User knowledge of basic economics, finance and some actuarial concepts.

Data requirements

The model is data intensive in order to support the robustness of its results. The key required data are:

- Population fertility and mortality rates by age and gender.
- Labor force participation rates, unemployment rates by age and gender.
- Numbers of contributors and beneficiaries, their contribution and retirement patterns by age and gender.
- Wages and pensions by age and gender, income distribution for contributors and pensioners.

The model also relies on informed assumptions of future patterns including:

- Wage growth
- Real returns on pensions assets
- Economic growth
- Growth in coverage of a contributory pension scheme

PROST users

PROST is used by World Bank staff, country policy makers and other counterparts and development partners.

- PROST is generally **easy to use**, with training programs, clear and concise manuals, documentation of underlying formulae, and troubleshooting, technical support. Model assumptions are transparent and sensitivity analysis is readily accessible.
- The Bank distributes the model to country counterparts engaged in a reform program and licenses its use to users attending a one week training program. The Bank carries out such training programs for client countries upon request.
- The Bank also utilizes the model in the formulation of policy options for consideration by country counterparts.
- The model's **quality** improvement is a result of worldwide exposure and constant vetting by users. The World Bank constantly evaluates user feedback and regularly updates the program to uphold its state-of-the-art features, functionality and adaptability.