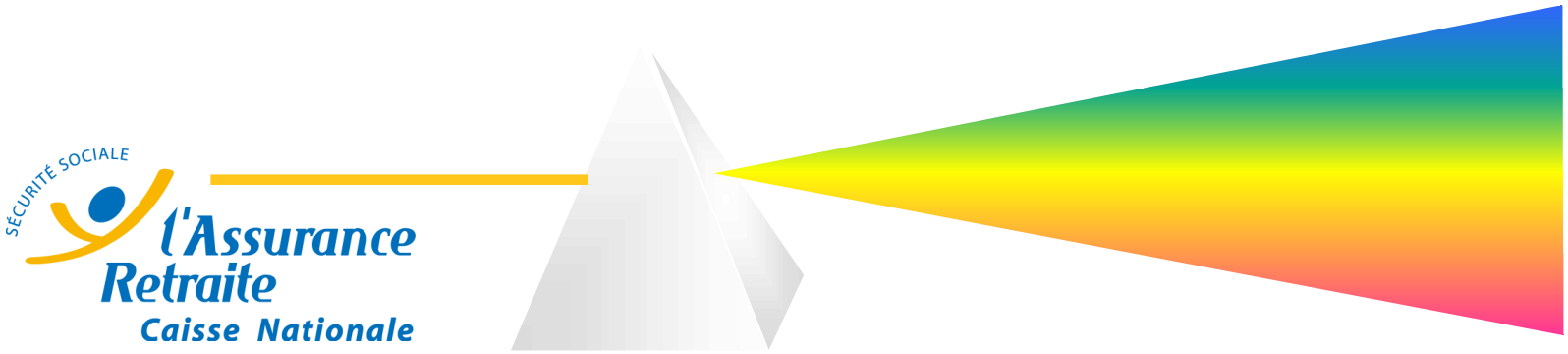


PRISME

Dynamic microsimulation model for the French pension scheme CNAV

2nd General Conference of the International Microsimulation Association
June 8th to 10th 2009 -- Ottawa

CNAV: main pension scheme in France

- **Pay-as-you-go scheme covering wage earners in french private firms (71% of active people, 97% french people once in their career).**

- **Old age pension relies on 3 terms :**
  - annual mean wage,
  - pension rate,
  - ratio representing duration of insurance in the scheme.

- **Last reforms, in order to reduce pension schemes equilibrium deterioration, induced complex cross effects**

→ old projection models based on mean representative individuals useless

Genesis of *PRISME* in 2003

Creation of the dynamic microsimulation model *PRISME* by the CNAV :

- evaluation of global and individual consequences of legislation changes,
- temporal horizon : short run (1 to 5 years), and long run (up to 2050),
- a sample of more than 4 million people (5% of people known by french welfare).

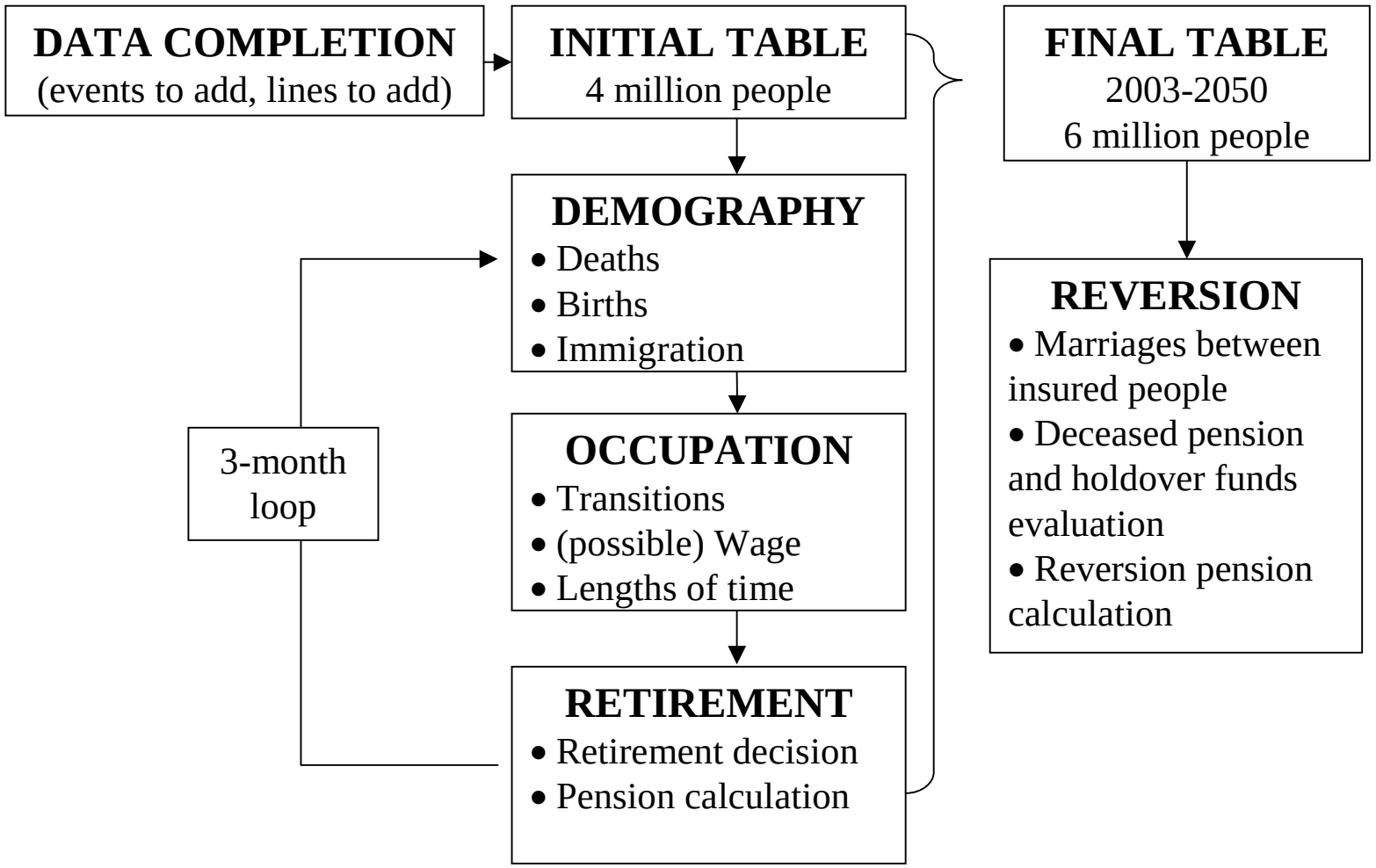
Initial data

- **Sample of one 20th.**
- **Sample renewed every 2 years, based on administrative data.**

  → same insured people between new extractions (panel).
- **Retirement data actualized every 6-months**

  → better precision of short term forecasts.
- **Wide range of available data :**
  - demographic,
  - on careers,
  - on retirement.

PRISME architecture



Preliminary stages

- **Parameters needed for projection:**
  - demographic hypothesis,
  - macroeconomic hypothesis,
  - legal environment hypothesis (for ex. before / after 2003 reform),
  - logistic equations parameters or transition matrix parameters (tested on 2001-2003 data before projection).
- **Addition of predicted future contributors (future births in France, born abroad future contributors).**

First step : completions

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- **Data completion because of :**
  - data imperfections,
  - useless data for welfare system but essential for microsimulation.
- **4 completions :**
  - deceases,
  - end of schooling age,
  - children (number and calendar),
  - careers (military and other schemes periods).

Demographic events modeling

- **Children allocation and date of death attribution.**
- **Births : 2 ways according to gender**

Women	Men
Children number and birth calendar, according to logistic equations. Central hypothesis : 1.9 child per woman	Children number according to generation and number of children distribution.

- **Deaths : use of several mortality rates**

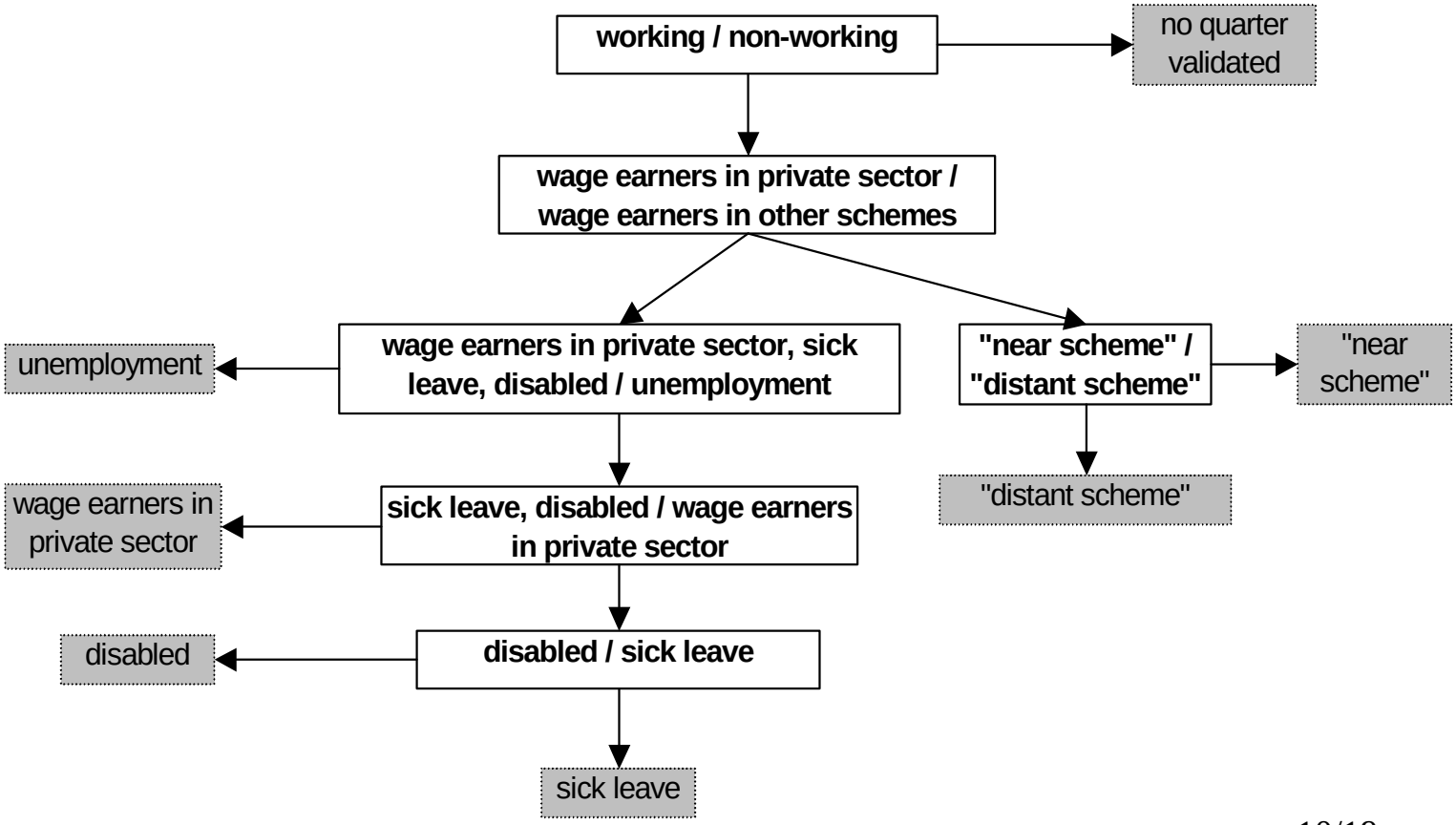
Non retired	Retired
INSEE mortality rates	CNAV mortality rates according to pension kinds (« normal », disabled, unfit to work)

Activity modeling

- **Set up activity status for each individual and each quarter in projection.**
- **For now, use of a transition matrix.**
- **Matrix based on past events given probabilities to each kind of movements between two 3-month periods according to :**
  - gender,
  - age range,
  - kind of event in previous quarter,
  - country of birth.

Activity modeling

- **Model improvement, in order to respect individual trajectories in a more precise way, thanks to a logistic equations chain.**



Wage modeling

- **Annual wages in case of employment in private firms.**

- **Use of 4 log-linearized OLS regressions depending on gender and situations before and after end of schooling.**

Independant variables depending on end of schooling age

Before	After
Current age (+ square) and a dummy for individual presence in last quarter	End of schooling age, market labor experience (+ square), dummies (unemployment, disabled, presence in t-1), country of birth, generation, number of children

Retirement decision module

- **Aim : to determine at each time step if an individual decides to retire.**

- **4 parts corresponding to :**
  - unclaimed pensions,
  - retirement before 60,
  - retirement for unfit to work,
  - retirement from 60 to 70.

- **Each of these parts is called by a sub-macro when non-retired people age is inside the corresponding brackets.**

Retirement decision module

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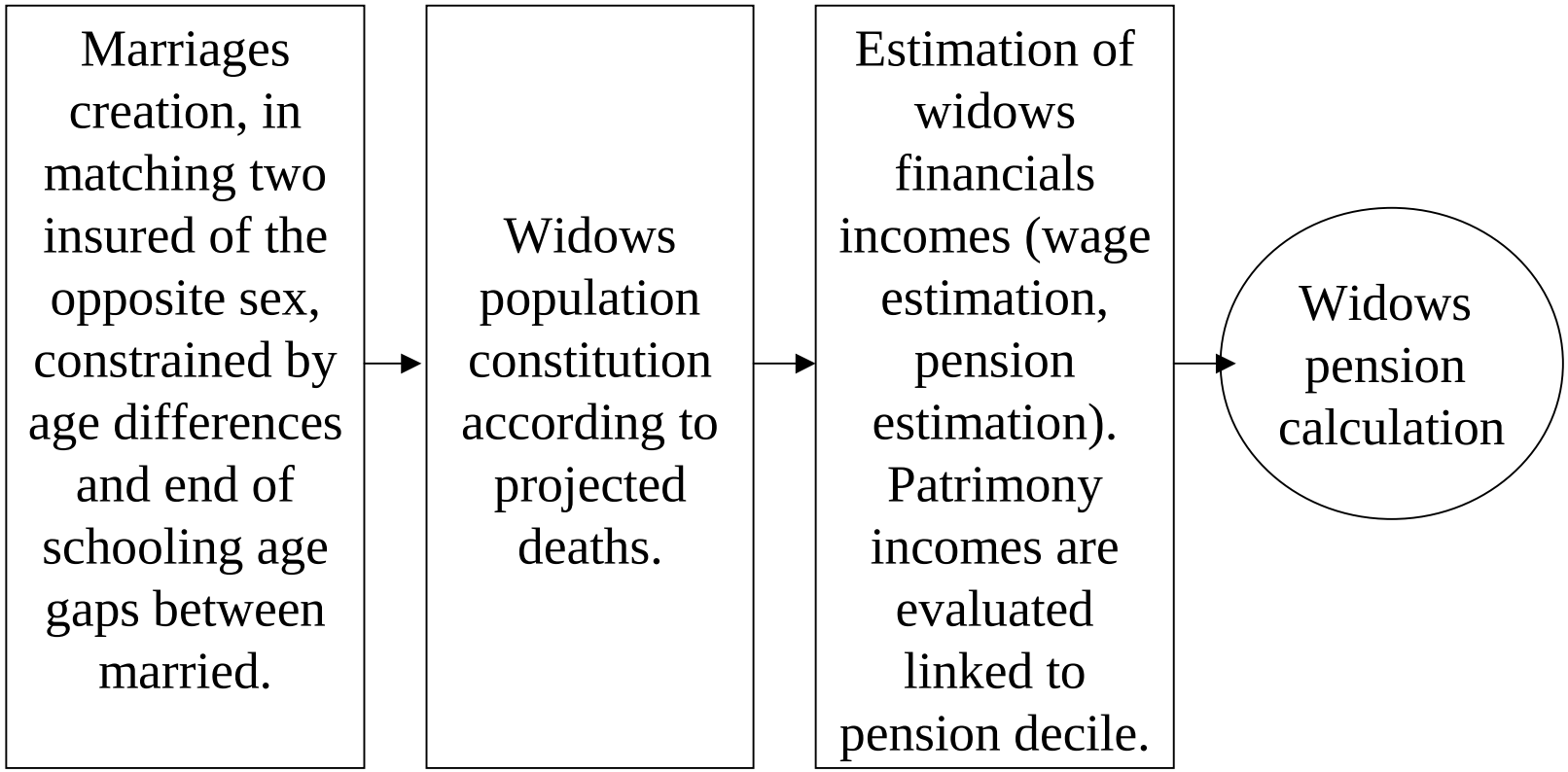
- **Retirement decision modeling relies on logistic equations.**
- **Tested on a table gathering retired and non-retired people from our sample.**
- **Retirement probability given individual characteristics.**
- **If « decision » to retire :**
  - duration and wages calculation,
  - pension estimation.

Reversion modeling

- **Determination of surviving spouses and reversion pension attribution.**

- **Several steps :**



Typical progress

- **Model executed on an Unix server, developed under SAS macrolanguage. It is composed of :**
  - 2 main macros (old age pension estimation + widow pension estimation),
  - 22 sub-macros.
- **4 optimization axes :**
  - data reading and writing control : for each year, careers data relative to t-1 are stored in a different table and matched at the end of projection.
  - creation of formats : scale data, probability and coefficients are stored in independant SAS tables. They are stored in formats and called thanks to the *input* fonction.

Typical progress

- use of random numbers : random numbers are generated with the SAS *ranuni* routine. Using of seeds linked to characteristics

  → to keep the same individual randomly distributed variable for each projection and simulation.

- MP-connect use : model running simultaneously on 2 processors (population is distributed every year between people under 50 and people over 50).

- **Computation time for more than 4 million people and 200 time steps : 5 hours.**

2007 long run projections : central scenario

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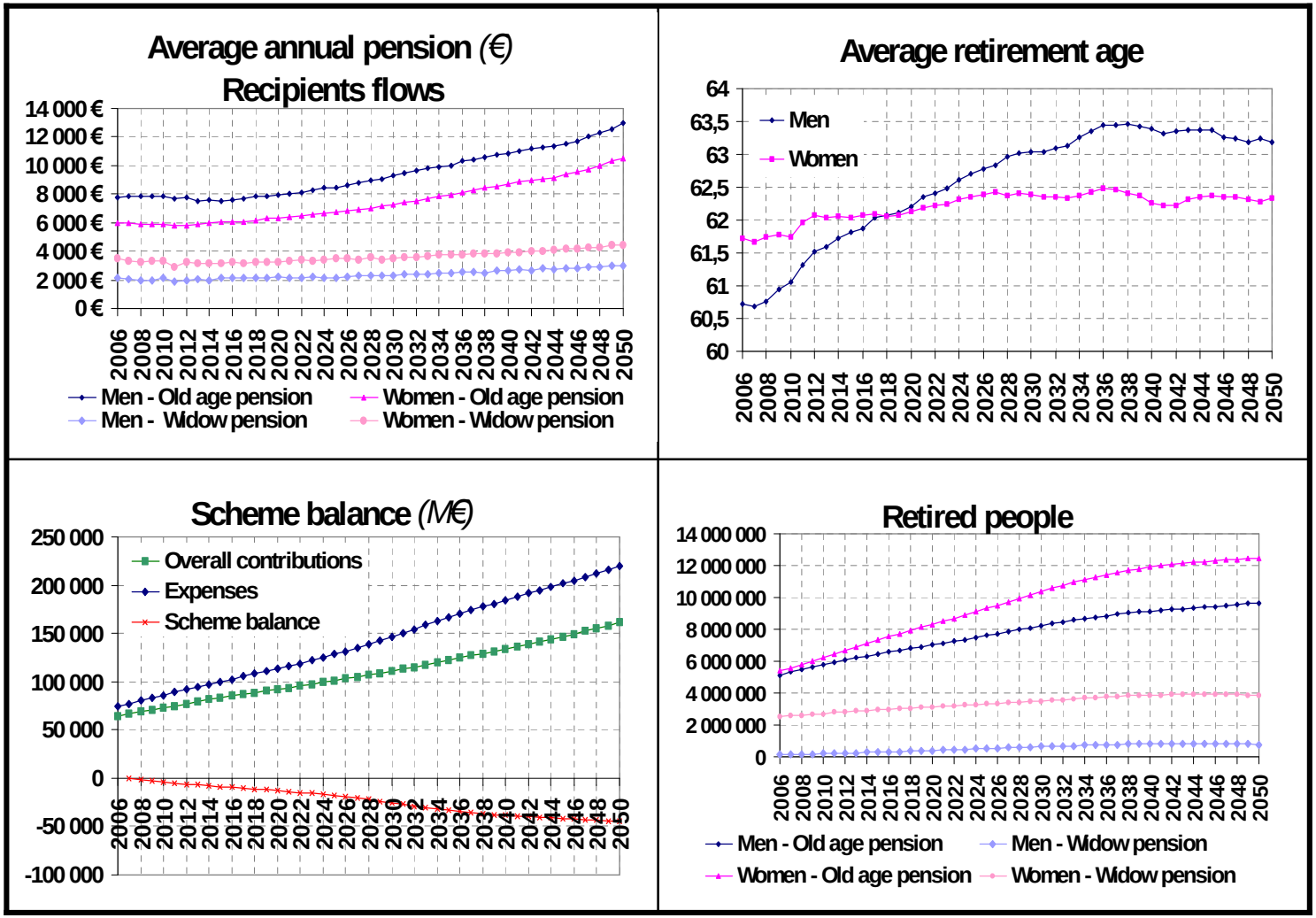
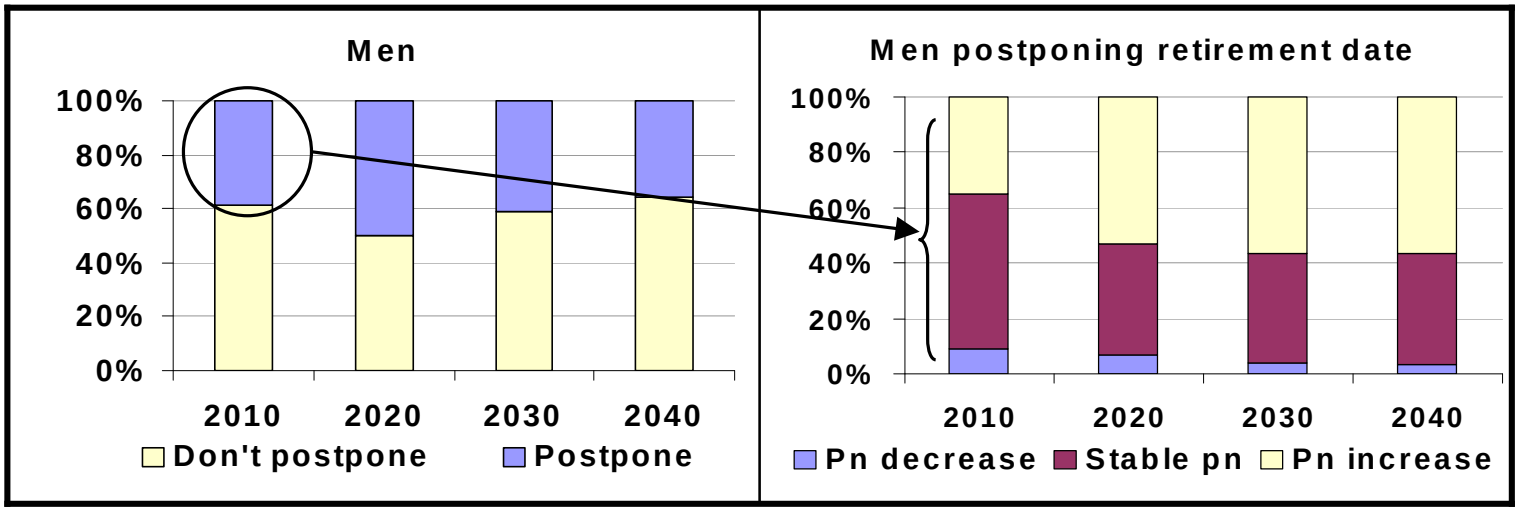


Simulation :

minimum age of retirement : 60 to 61



Conclusions

- ***PRISME*** **answers to possible pension reforms asked by different French agencies.**
- **Used as short-term prevision tool as well as long run financial projection model.**
- **Used for radical reforms evaluation (in case of transition towards a notional defined contribution scheme for instance).**
- **Became a reference in the process of continuous reform assessment.**