



Statistics Canada  
www.statcan.gc.ca



# LifePaths

## Evaluating Earnings Replacement After Retirement

Kevin D. Moore  
Statistic Canada's Modelling Division

Prepared for the Toronto Association for Business and Economics  
February 2010



Statistics  
Canada Statistique  
Canada

Canada 

# Overview of presentation

- Acknowledgements
- Project motivation
- What is LifePaths? Advantage of using LifePaths for this project?
- Key data underlying LifePaths' simulations
- Replacement rate concepts and methods
- Assumptions underlying these results
- Current limitations
  
- Results: most recent retirement cohort (2006-2010)
  - Average replacement rates – total and by source, broken out by pre-retirement earnings quintile
  - Distributions of replacement rates
  
- Results: trends for cohorts retiring 1966-2050
  - Average replacement rates – total and by source
  - Distributions of replacement rates: number of individuals falling below certain total replacement rate thresholds
  
- Sample sensitivity analysis
- Next steps

# Acknowledgements

- LifePaths has been under development for more than a decade, requiring the ongoing efforts of a small team of Statistics Canada researchers and programmers
- Critical contributions to this replacement rate project have been made by Xiaofen Lin, Laurie Plager, Geoff Rowe and Steve Gribble of Statistics Canada's Modelling Division

# Replacement rates project motivation

- Preventing “significant declines” in individuals’ standard of living after retirement is one of the primary goals of retirement income policy, yet relatively little has been known about such outcomes
- Replacement of pre-retirement earnings with other sources of income after retirement a key aspect of this
- Current concerns about the “replacement adequacy” of the retirement income system for future retirees in particular - declining RPP coverage for current workers, perceived inadequate take-up of RRSP saving
  - Provincial task forces recommending new provincial public pensions
  - Issue rising on the federal/provincial and federal policy agenda
  - Recent financial market declines and turbulence
- Project has been sponsored by and developed in collaboration with HRSDC, although HRSDC has no responsibility for the specific results presented here

# What is LifePaths ?

- LifePaths is a publicly-available microsimulation model of individuals and families, designed to aid in the analysis and development of government policies having a longitudinal dimension
- LifePaths creates detailed individual life histories from birth to death, using behavioural equations estimated from a wide variety of micro-data sources
- The resulting synthetic population is representative of Canada's population and of its historical evolution, consistent with available microdata and summing to aggregate statistics
- LifePaths incorporates rich modeling of individual-level fertility, mortality, education, employment, earnings, marital status, residence, most taxes and transfers (including public pensions), and saving in registered pension plans (RPPs) and RRSPs
- LifePaths was developed using Modgen, a general-purpose microsimulation model development language created at Statistics Canada

# Advantages of using LifePaths for this project



- Acts as a vehicle for data integration across a wealth of different household survey and administrative sources
- Facilitates projections of the likely impact of current socio-economic trends on future replacement rates
- Provides detailed distributional results at the level of individuals and families
- As complete lifetimes are observable, provides full flexibility in measuring pre-retirement earnings and retirement income, including career or lifetime measurement periods
- Allows exploration of “what-if” questions / alternate scenarios or policy options

# Key data underlying LifePaths' simulations

- For the simulation of retirement income, individuals' earnings histories are of particular importance. These earnings histories are primarily created by LifePaths' modules for employment transitions and earnings
- LifePaths' employment transitions module relies on equations estimated from a longitudinal version of the Labour Force Survey data from 1976-2004
  - These data are unusually rich, cover a long historical period, and represents a large sample (38 million person-months of data)
  - Three states (E, SE, NE), seven transition types, seasonal patterns and period effects are modeled
- LifePaths' earnings module relies uses equations estimated from the 1981, 1986, 1991, 1996 and 2001 Censuses
  - 380 equations capturing variation by gender, education, field of study, and type of earner (paid employee, self-employed, student)
  - Weekly earnings and lifetime earnings trajectories are modeled
  - Correlation between individual earnings from year to year calibrated using LAD
- Resulting earnings histories have been validated using Census, LFS, and Longitudinal Worker File (longitudinal T4 data, 1983-2004)

# Replacement rate concepts/methods, in general

- Replacement Rate
  - =  $\frac{\text{Retirement income}}{\text{Pre-retirement earnings}}$
  
- Replacement rate results are highly sensitive to the choices made in their specification, such as:
  - Pre-retirement earnings and post-retirement income measured over what periods?
  - What components of income are included?
  - Individual or family earnings/income?
  - Equivalence scales to adjust for family size?
  - Before or after tax? Gross earnings or consumption?
  - Price or wage-indexing of measures (retirement income measured relative to your own actual pre-retirement standard of living, or relative to that of current workers)

# Replacement rate methodology chosen for this analysis

- Replacement Rate = 
$$\frac{\text{After-tax retirement income}}{\text{Proxy for pre-retirement consumption}}$$
- After-tax retirement income:
  - is full-year, age 70 after-tax income from OAS, C/QPP, GIS, RPPs and RRSPs
- Proxy for pre-retirement consumption:
  - Consumption proxy = gross earnings
    - subtract (payroll and income taxes)
    - subtract (retirement saving in RPPs and RRSPs)
  - Averaged over best 25 years from age 25 to 65, price-indexed
  - Implicit target for “full replacement” of consumption is 100%  
(\*rather than rough “rule of thumb” of about 70% of gross earnings)
- Individual unit of analysis but family income – “single-adult equivalent” measures ... family income (or consumption) is divided by the square root of family size

# Assumptions and Context for Results



- The specific findings shown rely on one particular conception of replacement rates, and one illustrative projection scenario, which implements many specific assumptions about future socio-economic experience
- The specific results are quite sensitive to both the specification of replacement rates, and to these assumptions about the future
- A better sense of the robustness of these findings and their sensitivity to assumptions can only be obtained by comparing the results of different replacement rate specifications, and a broad range of projection scenarios
- Some limited sensitivity analysis is shown at the end of this presentation

# Significant assumptions used for the future in this illustrative projection scenario

- Real wage growth of 1.3%/annum (baseline assumption made by the Chief Actuary of Canada)
- The provisions of the public pension programs, payroll and income tax systems including indexing, remain as currently legislated
- For the past, these parameters are set using data on the actual historical experience, including the details of the historical evolution of the public pension programs
- Moderate future trend to lower private sector RPP coverage, and continuing movement from defined benefit to defined contribution plans in the private sector
- Future real market rates of return to the various asset classes held by RRSPs and defined contribution RPPs assumed to be their average real rate of return over the last 72 years
- RRSP wealth then roughly calibrated to 1999 and 2005 Surveys of Financial Security by applying individual annual rate of return penalties to market rates of return. Penalties imposed are 2.5% for equities and 2.0% for long bonds, in addition to annual management expense ratios of 2.16% and 1.4%, respectively
- The results are based on a simulated synthetic population of 20 million representative individuals, restricted to those who were resident in Canada from age 25 to death

# Current Limitations

- This analysis does not include some of the elements that could be considered of interest in implementing a comprehensive consumption-based approach to replacement rates. These include the flows of economic welfare associated with:
  - owner-occupied housing, including mortgages
  - financial assets other than RPPs and RRSPs
  - intra-family transfers, including inheritances
  - other debts and real assets
  - work-related expenses



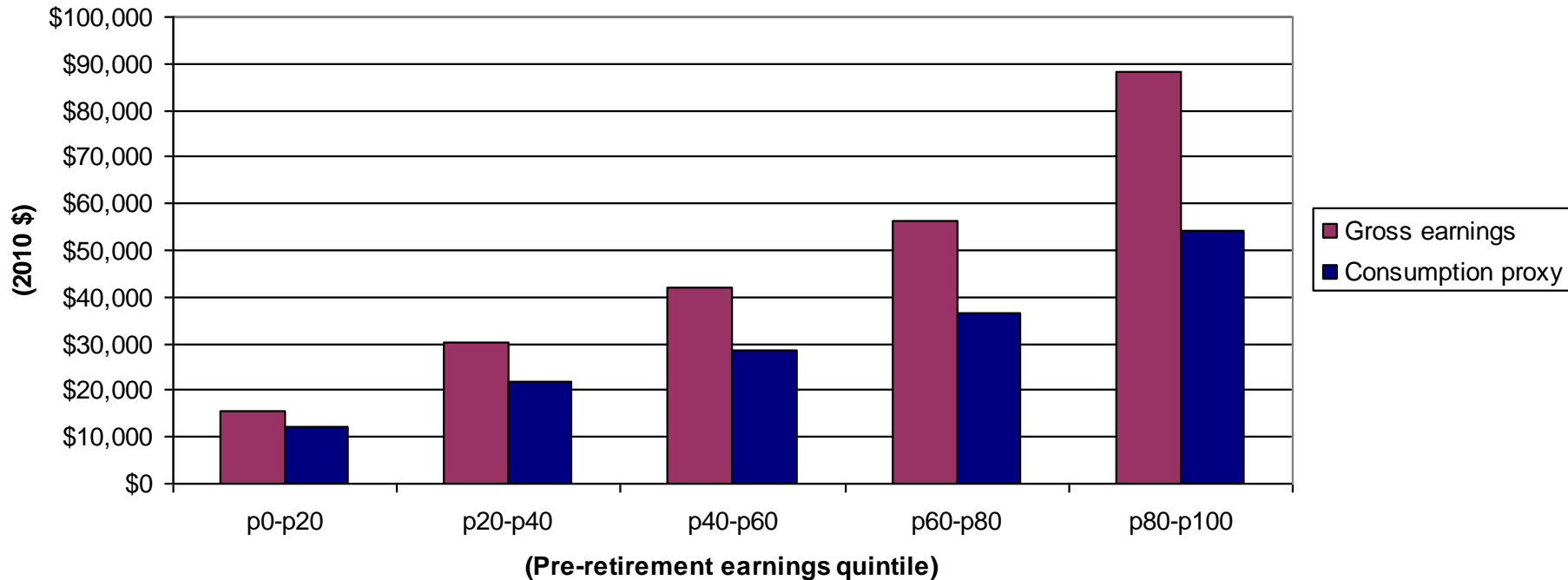
- 2006-2010 retirement cohort

- average retirement income and average replacement rates by source and pre-retirement earnings quintile

# Profiles of pre-retirement earnings groups : gross earnings and “consumption proxy”

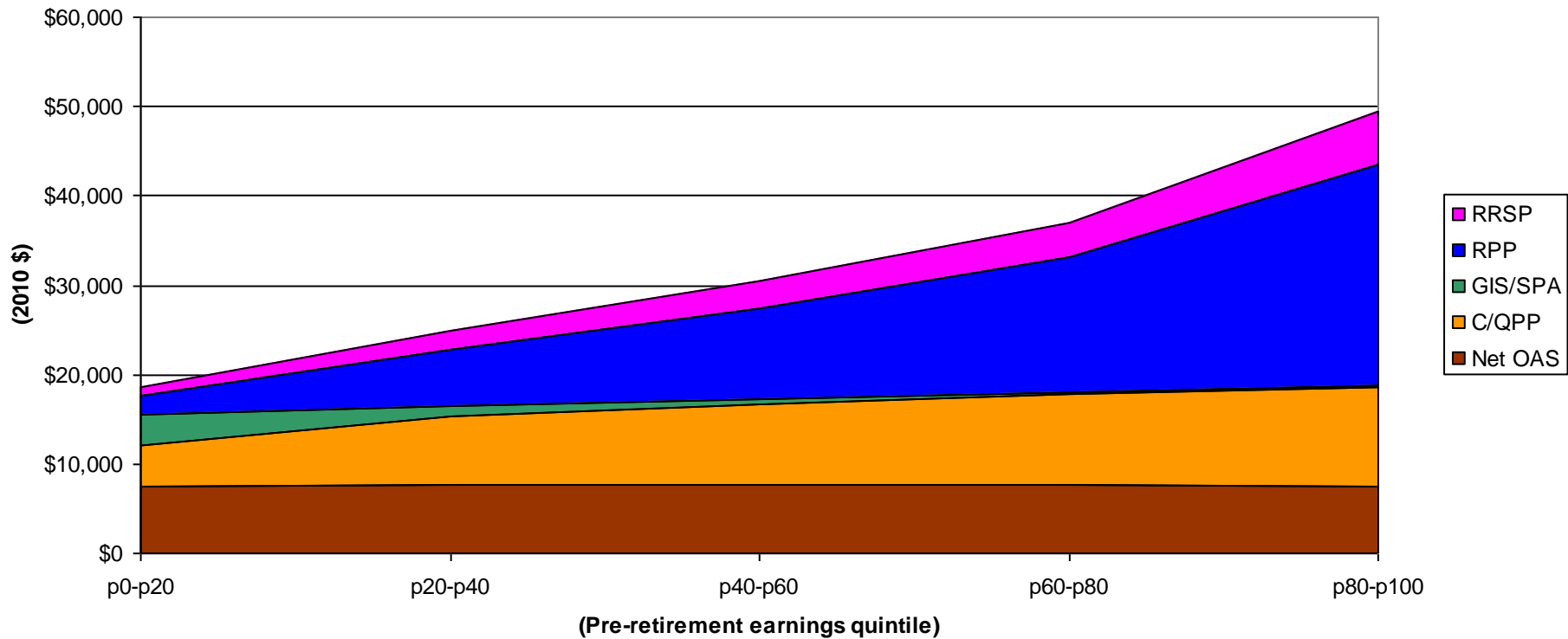
\* Best 25 years \*\* single-adult equivalent measures

Average gross pre-retirement earnings and consumption  
by quintile (2006-2010 retirement cohort)



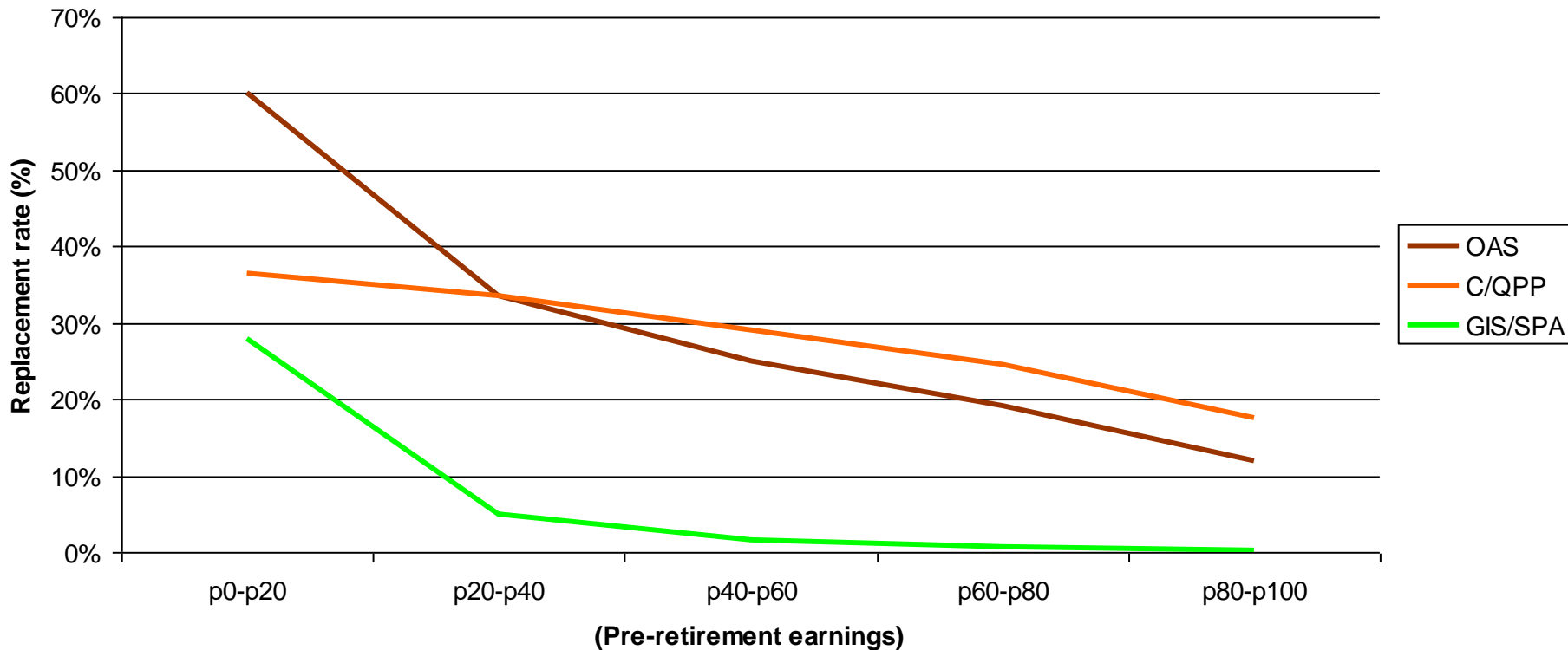
# Overview of retirement income; average public pensions increase only modestly with pre-retirement earnings; RPP and RRSP benefits more strongly linked

Stacked average single-adult equivalent retirement income by source and pre-retirement earnings (2006-2010 retirement cohort)



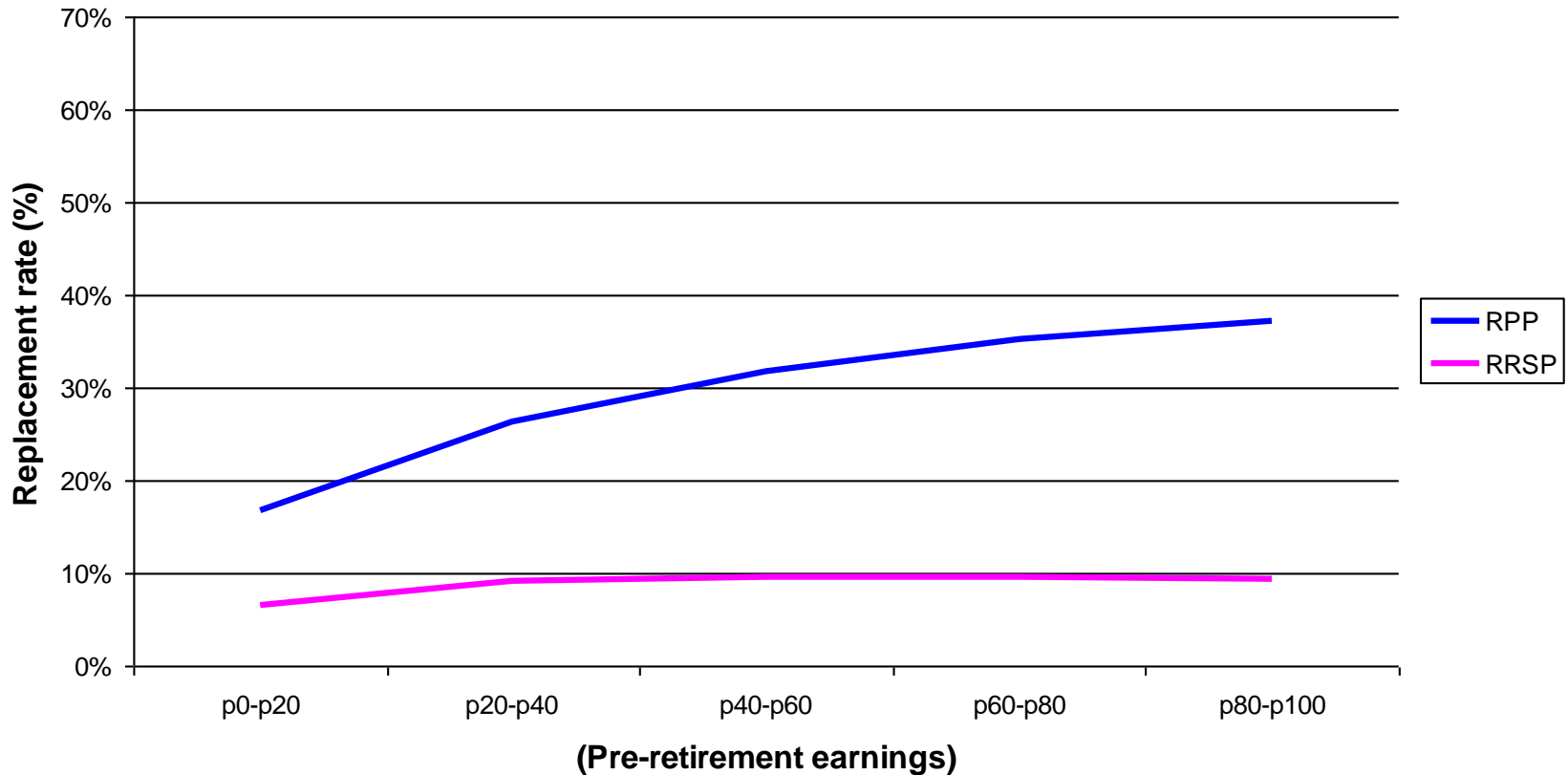
# Public pension replacement rates fall sharply with pre-retirement earnings

Average public pension replacement rates by source and pre-retirement earnings (2006-2010 retirement cohort)



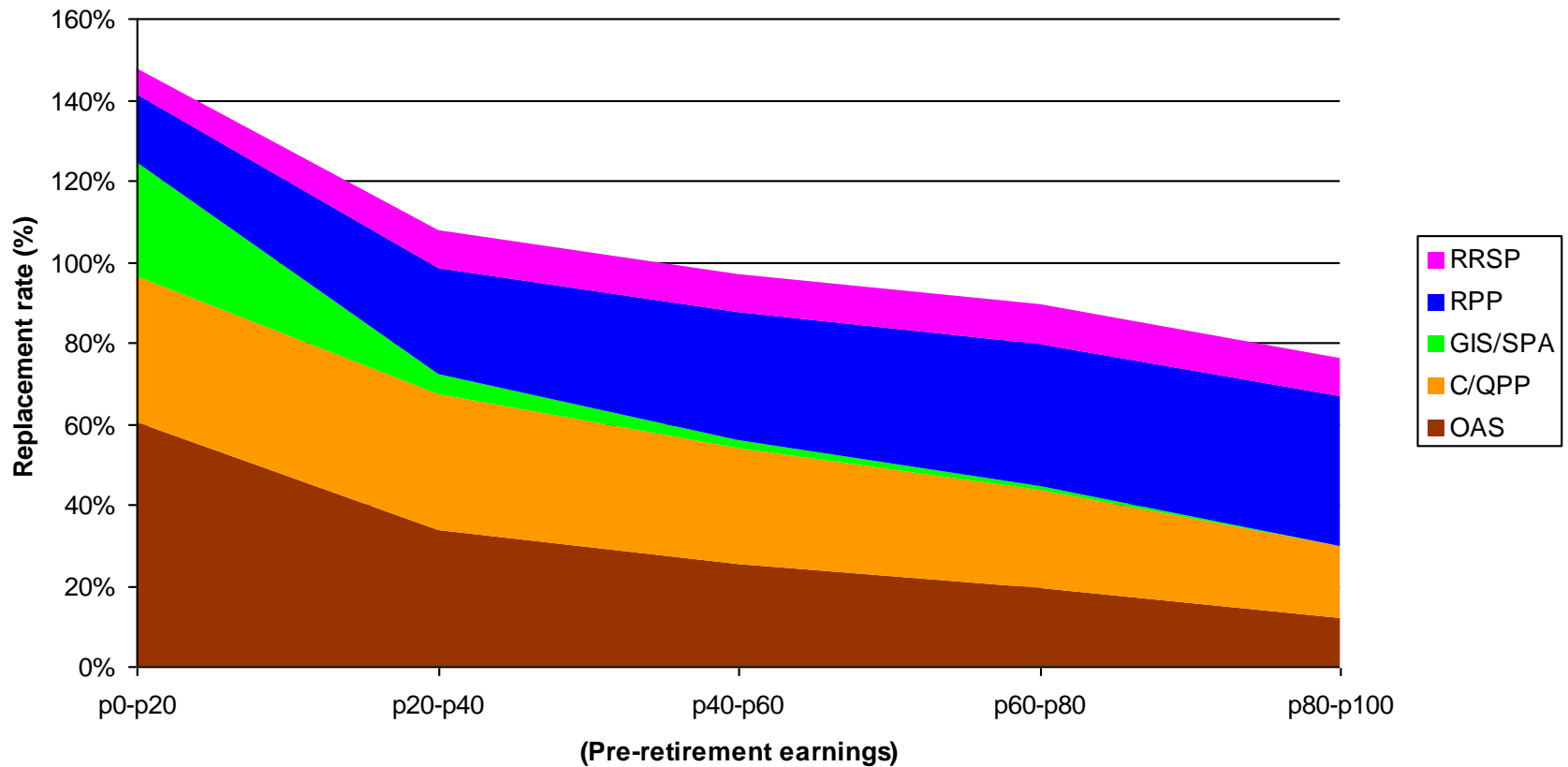
# Average RPP replacement rate rises with pre-retirement earnings; average RRSP replacement rate is flat over most of the permanent earnings distribution


Average RPP and RRSP replacement rates by source and pre-retirement earnings (2006-2010 retirement cohort)



# Average total replacement rate decreases substantially with pre-retirement earnings; it is well over 100% for the bottom quintile, falling to 76% for the top quintile

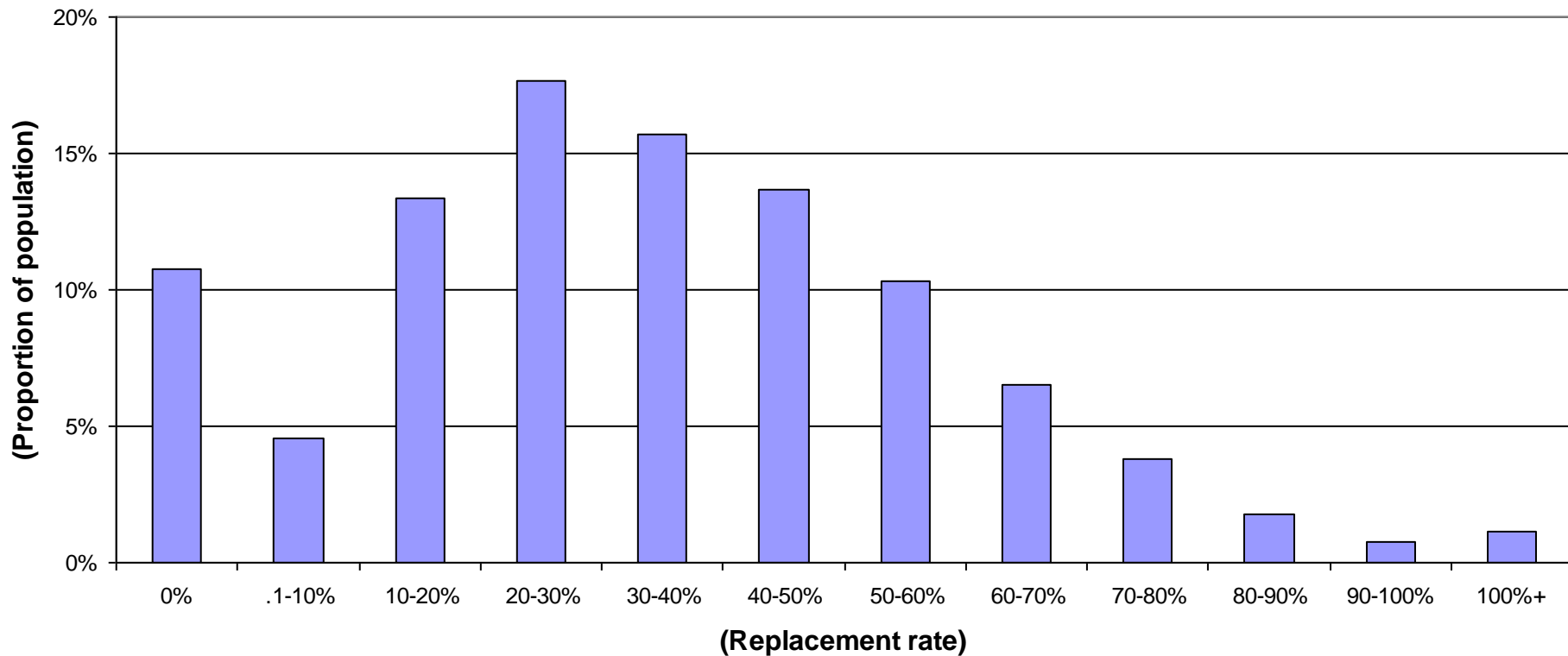
Stacked average replacement rates by source and pre-retirement earnings (2006-2010 retirement cohort)



- 
- 2006-2010 retirement cohort
    - distributions of individual replacement rates

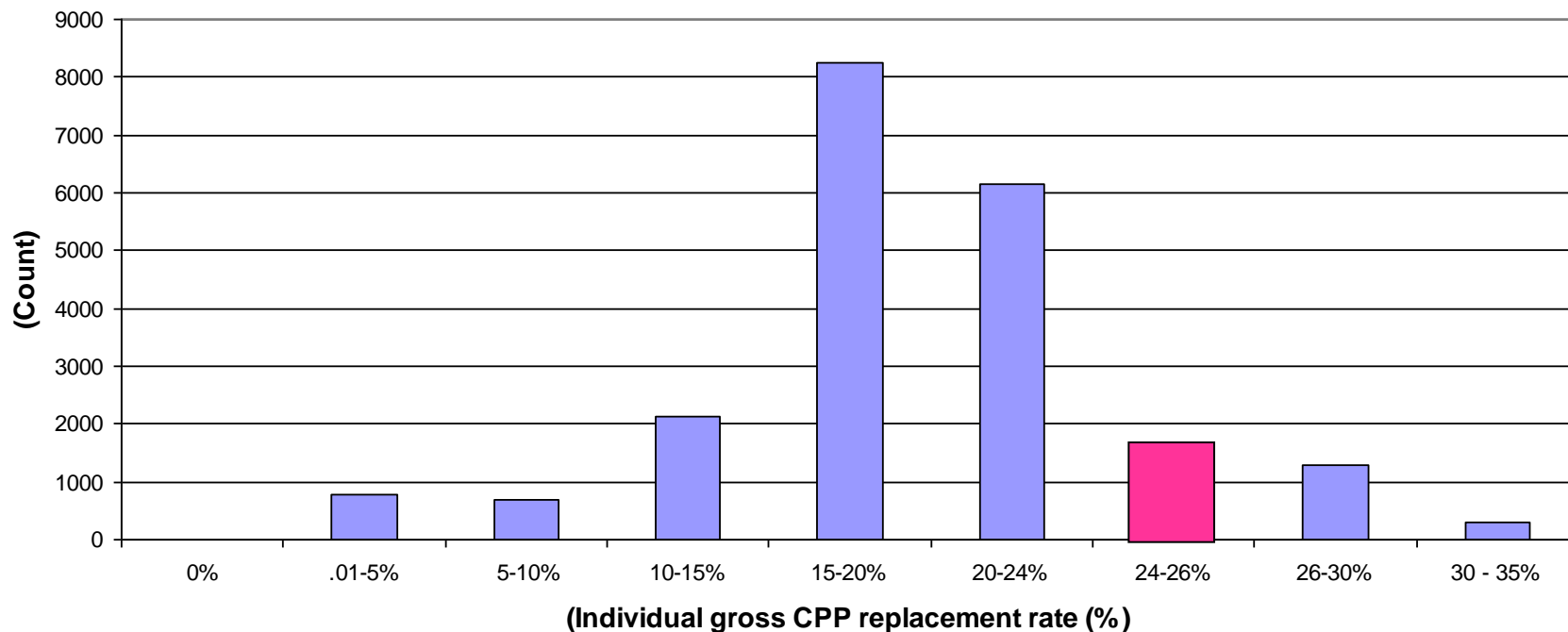
# Tremendous individual variability in replacement rates by component, even when you control for pre-retirement earnings ... example – RPP replacement rates

Distribution of RPP replacement rates by size  
(p60-p70 decile, 2006-2010 retirement cohort)



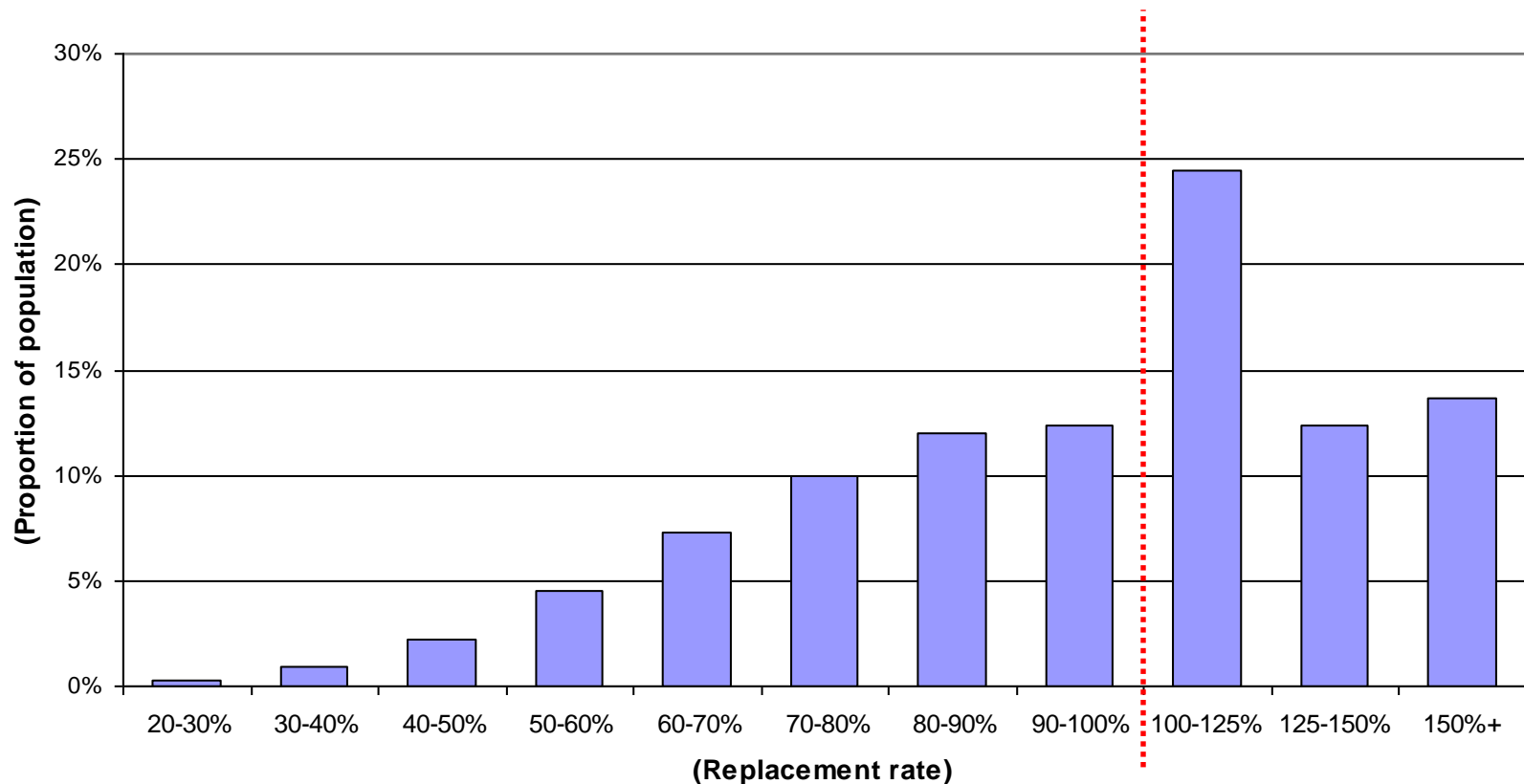
**Even in C/QPP replacement rates ... substantial variability across individuals ... rarely equal to the stylized 25% ... (individual, gross replacement rates)**

**Distribution of gross CPP replacement rates  
(Men reaching age 66 in 2005 with pre-retirement earnings near YMPE)**



# Total replacement rates: Half of the recently retired appear to be maintaining their standard of living. But a significant minority may be experiencing a large drop

Distribution of total replacement rates by size  
(2006-2010 retirement cohort)



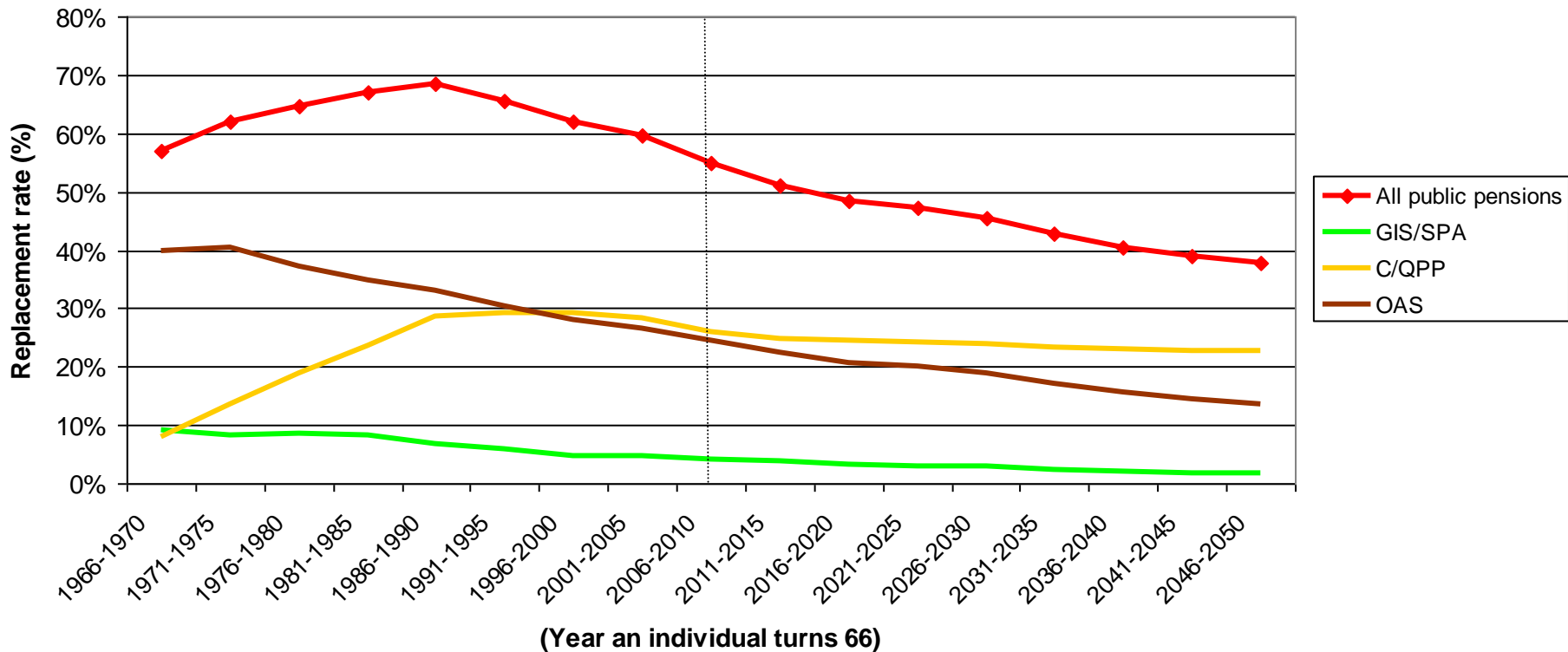


- Cohorts retiring from 1966-2050

- Trends in average replacement rates

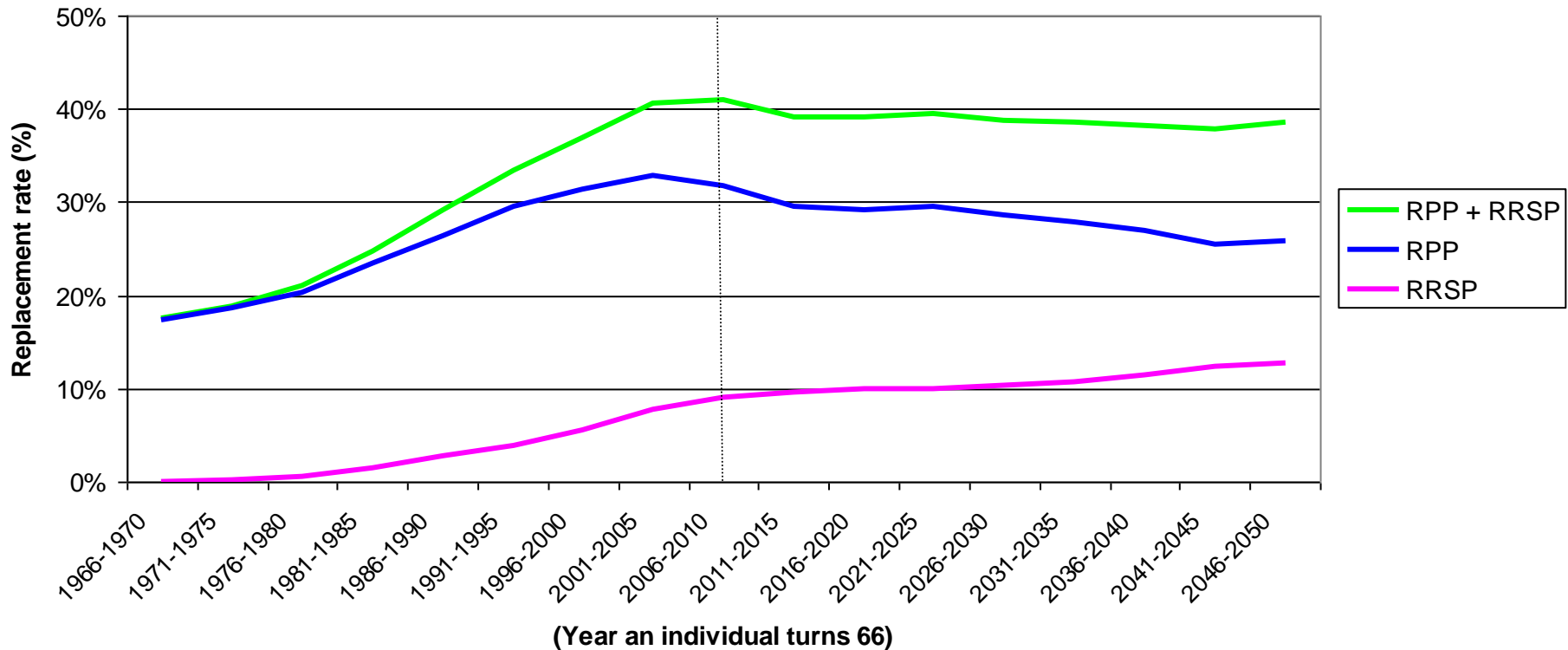
# Since 1998, steady declines in average public pension replacement rates for retiring cohorts

Average public pension replacement rates by component and retirement cohort, 1966-2050



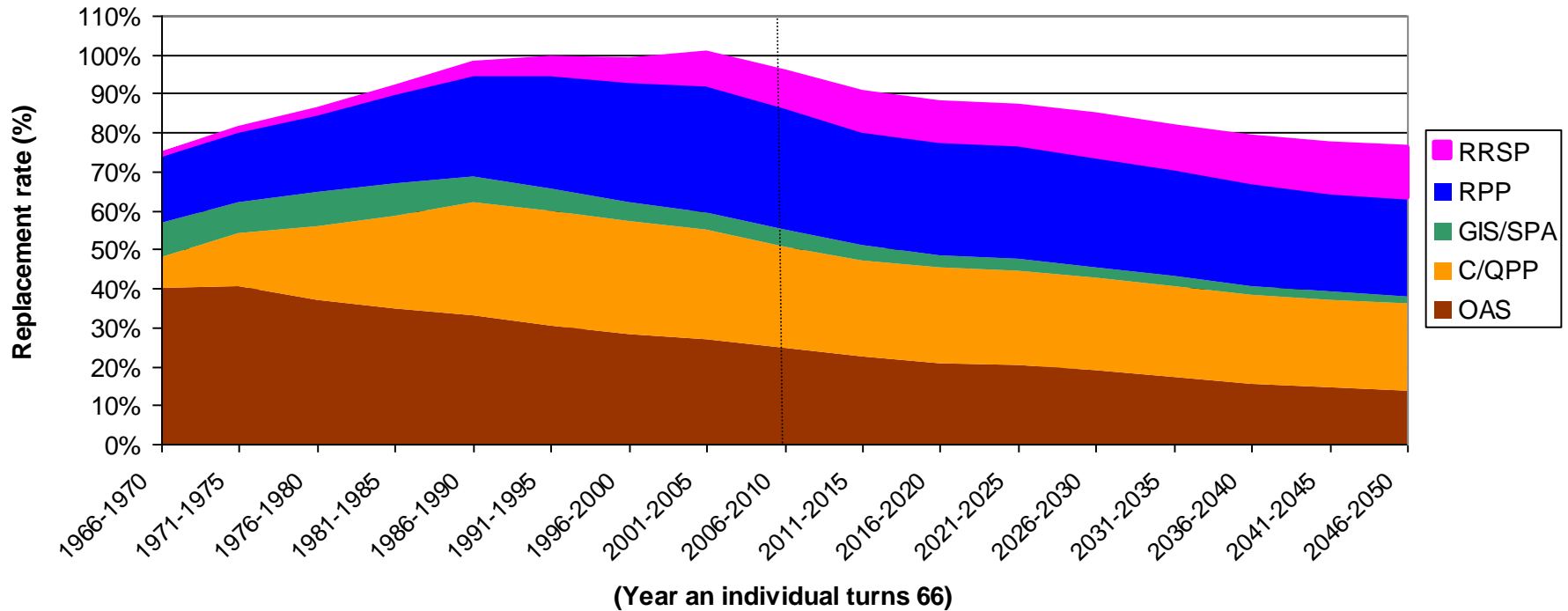
# Historical trend to increasing RPP replacement rates reverses; trend to higher RRSP replacement rates continues into projection period, but quite flat


Average RPP and RRSP replacement rates by component and retirement cohort, 1966-2050



# Average total replacement rate increases across cohorts retiring from 1966 to 1990, reaching 100%; substantial declines for recently retired or future retirement cohorts

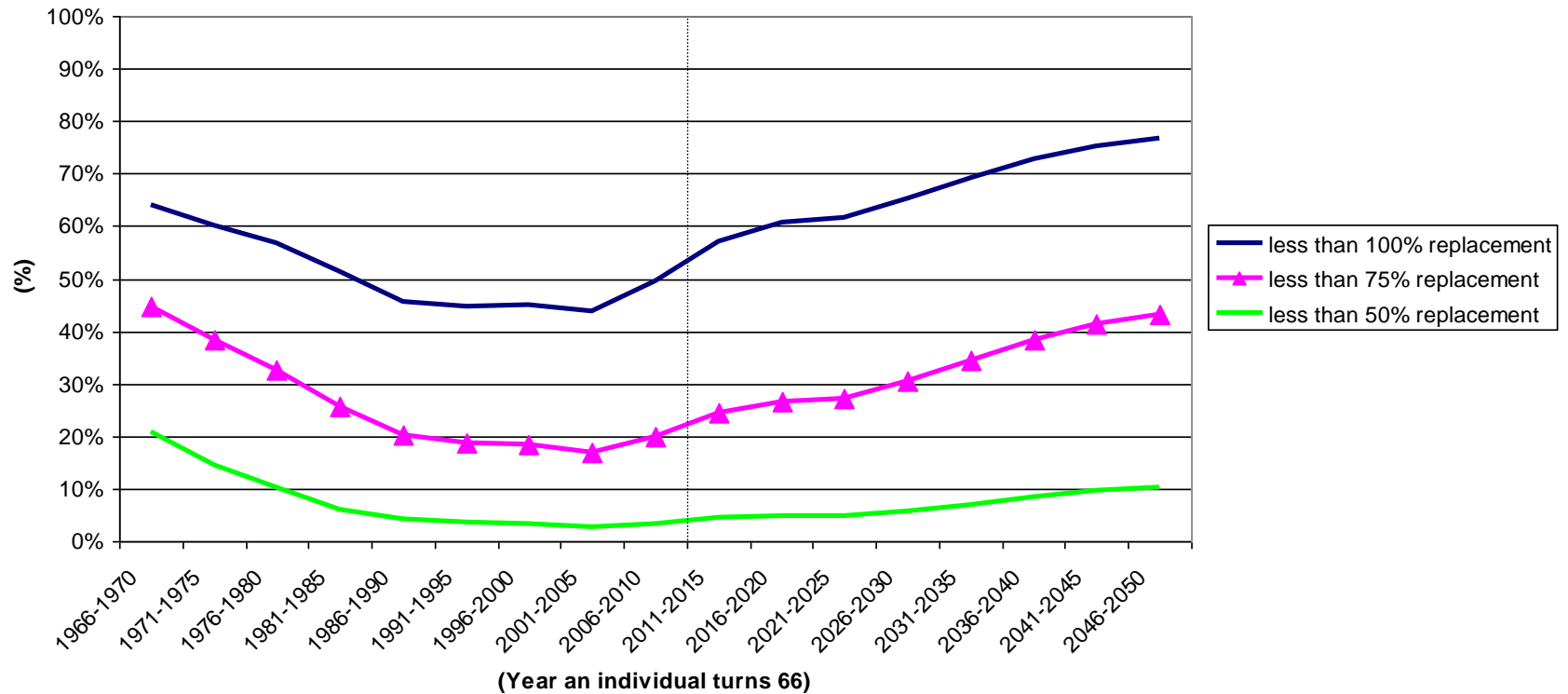
## Stacked average cohort replacement rates by component and retirement cohort, 1966-2050



- 
- Cohorts retiring from 1966-2050
    - Trends in replacement rate distributions : number of individuals with total replacement rates below selected thresholds

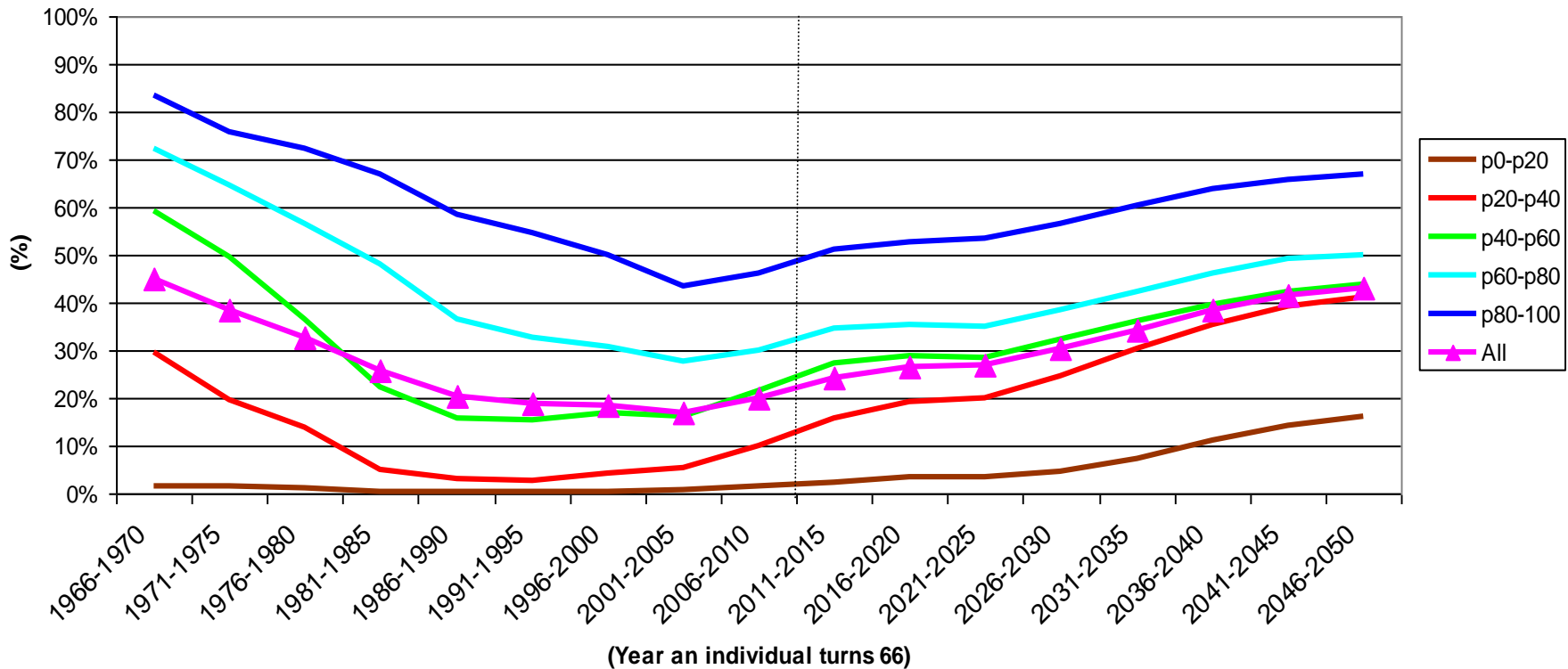
# Increasing numbers of individuals with “low” replacement rates in recently retired and future retirement cohorts

Proportion of individuals falling below different replacement rate thresholds by retirement cohort



# Increasing numbers of individuals with “low” replacement rates across entire pre-retirement earnings distribution; the proportion rises sharply with earnings

Proportion of individuals with total replacement rates <75% by pre-retirement earnings quintile and retirement cohort



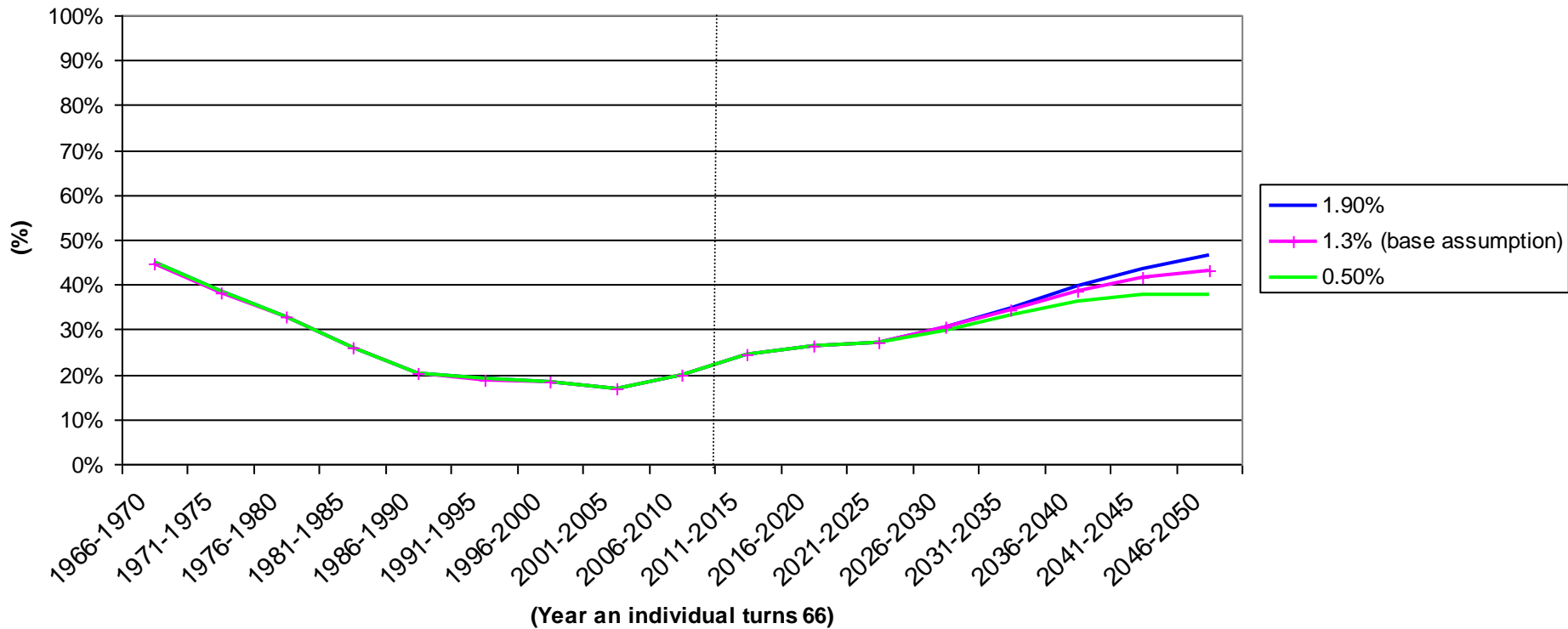


## ■ Some sample sensitivity analysis

- sensitivity of results to assumptions about future real wage growth
- sensitivity of results to assumptions about the rate of return received by individuals in their RRSPs
- sensitivity of results to the specification of pre-retirement earnings

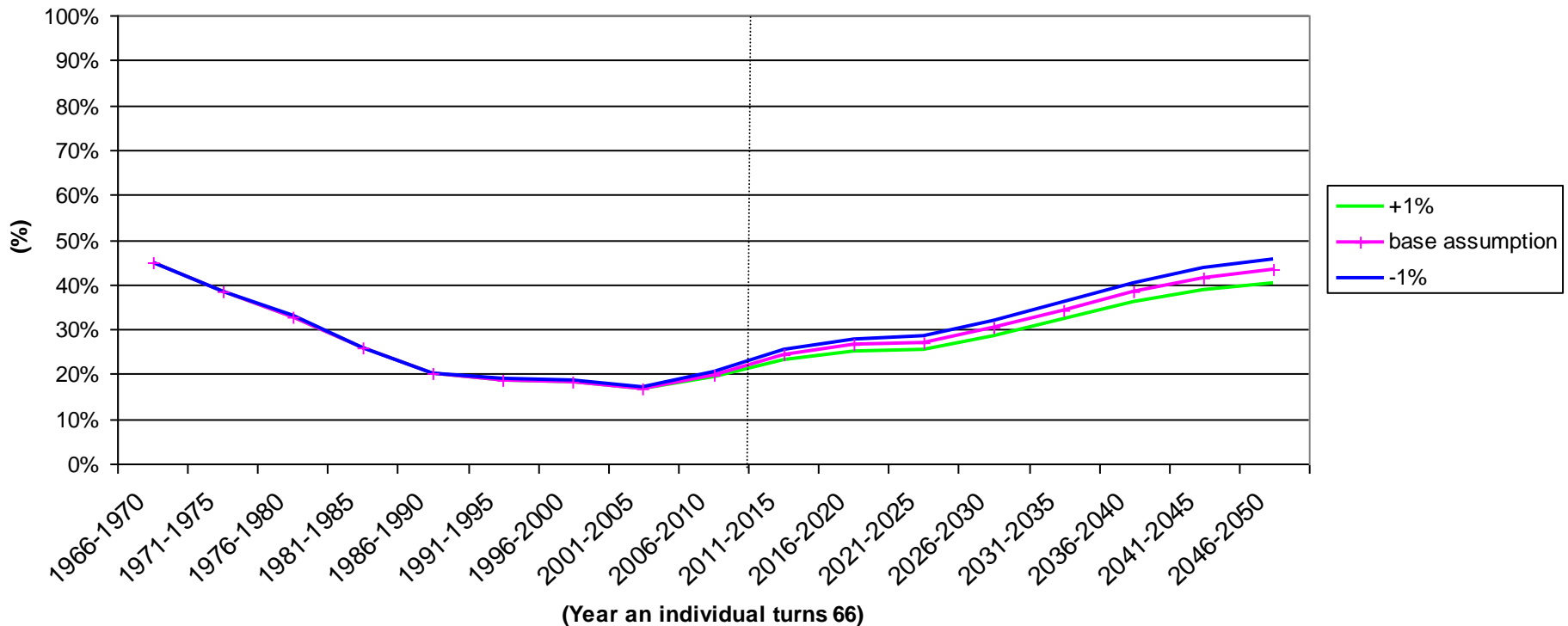
# Number of individuals with “low” replacement rates quite sensitive to assumptions about the future annual growth in average real wages (range of assumptions are those made by the Chief Actuary of Canada)

**Proportion of individuals with total replacement rates <75% by assumed future real wage growth and retirement cohort**



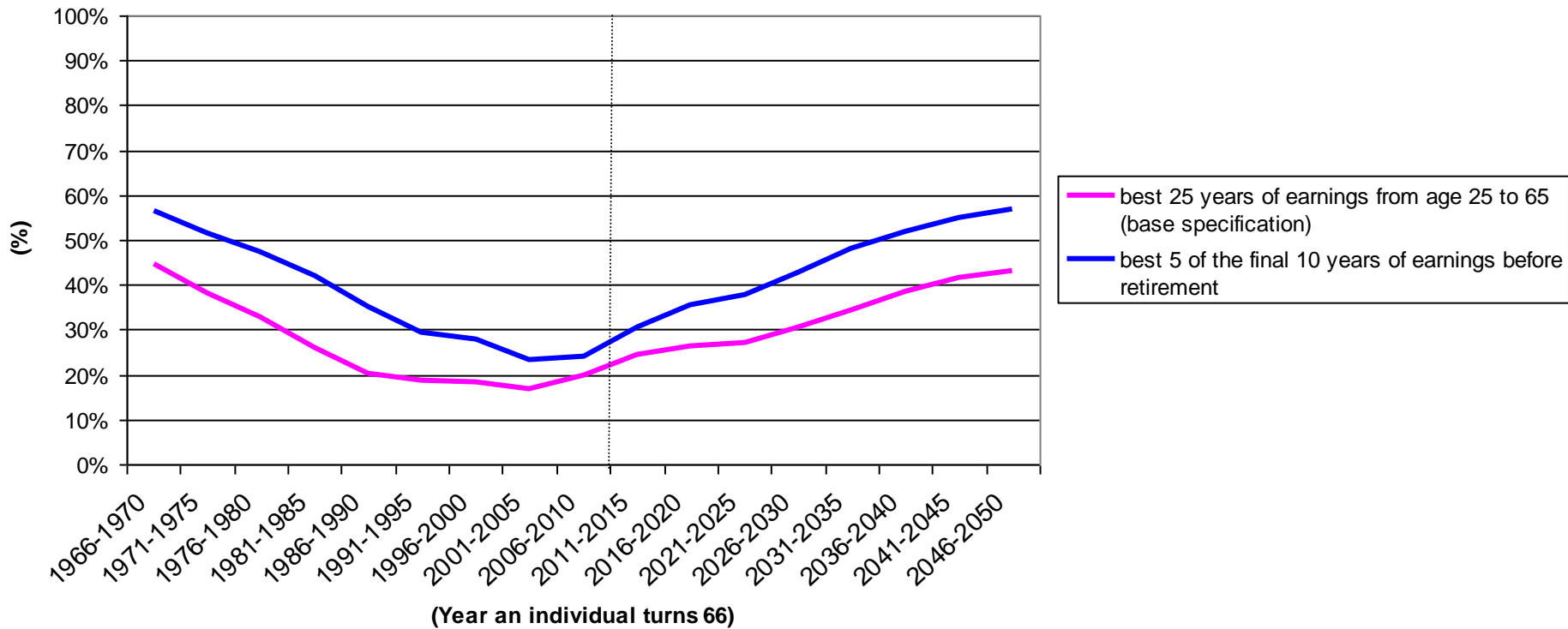
# Number of individuals with “low” replacement rates fairly sensitive to the net annual rate of return realized by RRSPs, but future trend stable

Proportion of individuals with total replacement rates <75% by assumed net rate of return in RRSPs and retirement cohort



# Number of individuals with “low” replacement rates very sensitive to definition of pre-retirement earnings, but future trend quite consistent

Proportion of individuals with total replacement rates <75% by pre-retirement denominator and retirement cohort



# Next Steps

- Add module on owner-occupied housing/housing equity
- Add additional saving flows and financial assets (RPPs and RRSPs are already modelled)
- Explore alternative replacement rate measures
- Conduct further sensitivity analysis
- Add levers to facilitate the simulation and analysis of various policy options
  - Expanded C/QPP (defined benefit)
  - Supplementary defined-contribution public pension plan
  - Other?

# Want more?

- More information about LifePaths can be found at <http://www.statcan.gc.ca/microsimulation/lifepaths/lifepaths-eng.htm>
- More information about this project can be obtained from the author at [kevin.moore@statcan.gc.ca](mailto:kevin.moore@statcan.gc.ca)