National Pension Hub

FINAL REPORT

Future Pension Plan Adequacy in a Changing World

Canadians' Preparation for Retirement — CPR

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ABOUT THIS REPORT:

The Canadians' Preparation for Retirement (CPR) project aims to shed light on the risks that may impact future pension plan adequacy of Canadians in a rapidly changing pension landscape. To answer this question, the research team developed an open-access stochastic retirement preparation simulator based on transparent and flexible assumptions. The individual online interface of the CPR simulator is now available. The calculator includes a stochastic version that models fluctuations over time for several variables such as investment returns, house prices, earnings, etc. Importantly and innovatively, this allows to compute not only retirement preparedness in a binary manner, but also the probability that a household will be adequately prepared for retirement.

Future Pension Plan Adequacy in a Changing World

(Canadians' Preparation for Retirement – CPR)

Final Report and Web Interface

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The individual online interface of the CPR calculator developed by Retirement and Savings Institute (RSI)[1], with the financial support of the Global Risk Institute is now available. This tool is intended for use by individuals born in 1957 or later and not yet retired.

Background of CPR Calculator

The Canadians' Preparation for Retirement (CPR) project consists in building an open-access stochastic retirement preparation simulator based on transparent and flexible assumptions. This project report provides background on the calculator, a brief overview of the project and information about the last stage of the project – the building of a web interface to use the CPR online for an individual household.

In 2019 and 2020, the team developed the CPR calculator code in Python. The calculator uses several "modules" developed by the team and various other contributors, including the stand-alone SRD (Simulateur de revenu disponible, or Disposable Income Simulator), a detailed Canadian tax calculator; and the SRPP (Simulateur de régimes de pension publics, or Public Pension Plans Simulator), which computes CPP/QPP contributions and retirement benefits – including the expansion taking place between 2019 and 2025. An annuity calculator is also included, based on Statistics Canada mortality tables and on annuity factors by province, birth year and sex built using projected bond rates.

The model takes as its main inputs over 80 financial and socio-demographic characteristics at one point in time, the base year. Using large number of processes and assumptions, it computes income available for spending for both spouses A) in a given year prior to retirement, usually when one of the spouses is 55 years old; and B) after retirement, usually at 65 years old, by converting all financial wealth into annuities purchased at the time of retirement. Annuity flows are then added to benefits from DB plans, CPP/QPP and OAS/GIS benefits projected by the calculator. Between the base year and retirement, debt repayments and wealth growth are projected, including savings and asset/investment returns. Finally, income available for spending in retirement is compared to the one available pre-retirement, and the resulting ratio can be compared to a pre-set criterion to determine whether a household is "prepared" for retirement. By default, this criterion is 65% of pre-retirement consumption for the top 4 income quintiles, and 80% for the bottom quintile. These values can be modified by users (see below).

[1] The project team includes RSI director Pierre-Carl Michaud and executive director David Boisclair, a senior research associate at the RSI, Pierre-Yves Yanni (Ph.D., economics), as well as an RSI fellow and former Ph.D. student in economics at UQAM, Ismaël Choinière-Crèvecoeur. An outside consultant was also used in winter 2021, for over 50 hours of programming the web interface.

Of note, the retirement ages used are those intended and provided by the household or the user.

The calculator includes a stochastic version that models fluctuations over time for several variables such as investment returns, house prices, earnings, etc. Importantly and innovatively, this allows to compute not only retirement preparedness in a binary manner, but also *the probability* that a household will be adequately prepared for retirement. Another significant innovation is that functionalities are available to account for housing and business assets and liquidate them upon retirement (accounting for the accommodation value of the primary residence) – thereby offering a more complete picture of retirement preparedness than when only financial assets are considered.

At the end of June 2020, the industry report was published by GRI/NPH and RSI that presented results obtained using the Python simulator run on confidential, proprietary 2018 data (which included a cross-section of approximately 6,600 non-retired individuals aged 25 years old or over). **Figure 1** is reproduced from that report and synthesizes the CPR's flows. The report is available from the GRI/NPH at

https://globalriskinstitute.org/publications/canadians-preparation-for-retirement/

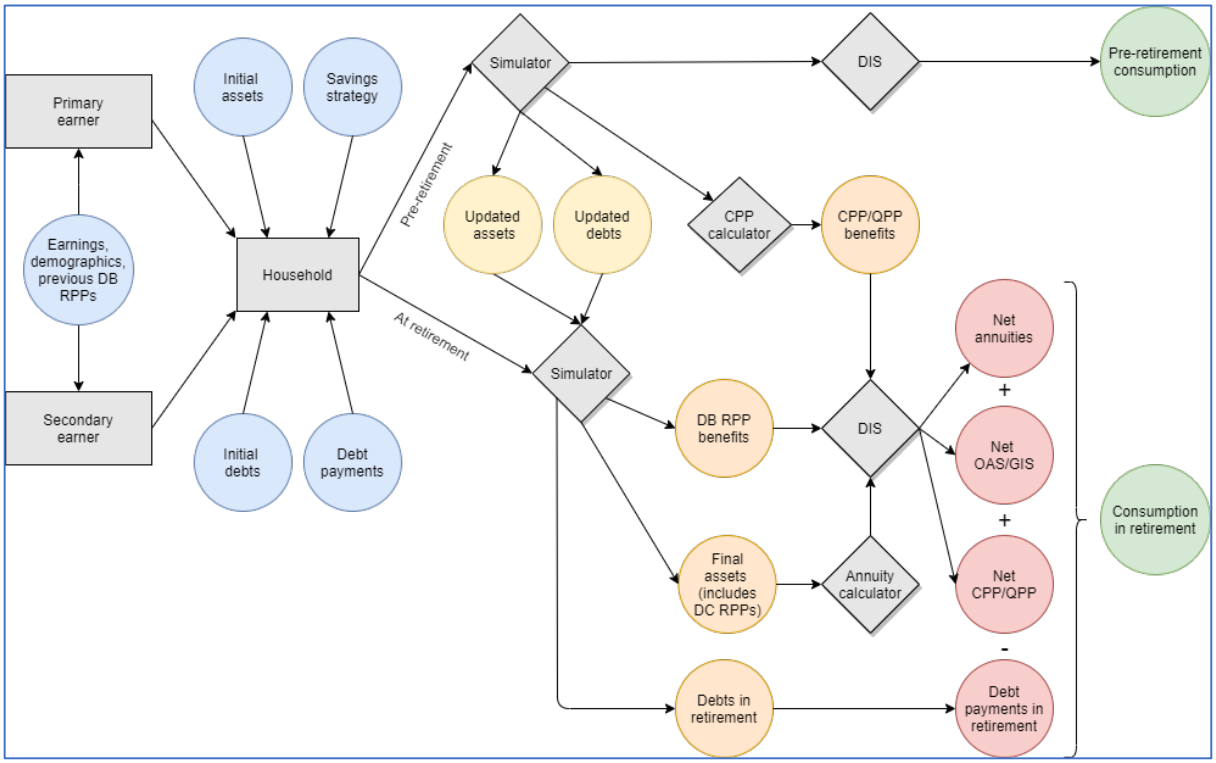

FIGURE 1. Overview of the Canadians' Preparation for Retirement (CPR) calculator.

Summary Results of Industry Report

Using the stochastic version of the innovative Canadians' Preparation for Retirement (CPR) calculator – which, for the purposes of the industry report published in June 2020, computes 25 simulations for each household and aggregates the results – the report finds the following core results, weighted using the 2016 Census.

- If retiring at their intended age of retirement and converting all their financial wealth into annuities (which excludes business and housing equity) at that moment, 84% of Canadian households were prepared for retirement; 18% had less than 4 chances out of 5 of being prepared.
- The average preparation index is 117 (which means that households would replace 117% of their pre-retirement consumption) but, as all averages do, this hides a wide variety of situations.
- Lower income households are generally very well prepared – over 90% of households with an income per person below the median are projected to be "prepared".
- Unsurprisingly, households most at risk of being "unprepared" largely fall into the sub-group with higher-than-median income, but no RPP or savings; the average wage income of the group deemed "prepared" is significantly lower than that of the "unprepared" group. Those with DB RPPs are better prepared than average.
- Probabilistically, the vast majority of households are almost certain to be "prepared"; a very small minority face dire prospects, while about 7% of households face a 35% to 65% probability of being prepared for retirement. Only 18% of households have less than an 80% chance of being prepared.

Web Interface

The ultimate aim of this project was to build and make available an open-access, flexible and transparent tool to assess retirement preparedness. The final deliverable of the project is **a freely and publicly available web interface** that allows to perform simulations for a single household, using the Python code shared with NPH members in 2020 and now available to all, and to view the simulation results graphically and numerically.

The web interface runs 25 different simulations (or "realizations") for the stochastic part of the calculations. It allows users to make their own choice of values for a number of parameters, including **age of retirement; savings rates; home or business disposition at retirement, including home downsizing; market returns for real and financial assets, and future price-rent ratio; debt repayments; and "target" replacement rates** shown in the results. It returns, in the form of figures and probabilities, information about the household's post-retirement financial situation, including the income available for spending (income minus saving, debt payments and taxes) and its decomposition. Preparedness thresholds are used for probabilities and illustrated for comparisons. A disclaimer, use instructions and a summary of assumptions are included on the interface's page.

The interface was mostly built by RSI team members, with assistance from an outside consultant knowledgeable in the tools used. It uses *streamlit*, a Python-based platform, and is hosted on *heroku*, a major provider now owned by Salesforce. It is secure, managed at HEC Montréal and accessible online immediately for GRI/NPH members at the following address (which is not yet indexed in search engines nor linked to/from any other website): https://cpr.hec.ca/

After translation into French, **the interface will be made available to the broader public and advertised – normally in May 2021** (exact date to be confirmed). It will be hosted indefinitely by the RSI, on the platform originally selected by the team or on a comparable but different one if technological advances warrant changes over time. The interface may also be updated from time to time to reflect changes to taxes and benefits.

Package, Code and Documentation

By the fall of 2020, the team had built a complete, stable and sharable version of the calculator. It now incorporates the actual 2020 tax system for Quebec and Ontario – either system can be used for other provinces, though the RSI team would advise to use the Ontario tax system. The calculator allows users to project pre- and post-retirement consumption possibilities (i.e., income available for spending) for one or more households, and to see whether the post-/pre- ratio satisfies certain preparation criteria by meeting or exceeding pre-set thresholds. All parameters can be modified by users, including the assumed levels and stochastic processes for investment returns, house prices, wages, etc. Tutorials are included in the technical documentation referenced hereafter.

A complete technical documentation of the model in English is available here: https://ire.hec.ca/en/canadians-preparation-retirement-cpr/