What is New in PrARI® V2.0?

By Anna Abaimova

Summary of Enhancements

<table>
<thead>
<tr>
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<th>PrARI V2.0</th>
<th>PrARI V1.0</th>
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</thead>
<tbody>
<tr>
<td>Cash flows</td>
<td>Nominal</td>
<td>Real (inflation-adjusted) only</td>
</tr>
<tr>
<td>GLiB Basis Step-up Frequency</td>
<td>7 options: Never, 1,3 or 6 month; 1,3 or 5 years</td>
<td>3 years</td>
</tr>
<tr>
<td>GLiB Maximum Stock Exposure</td>
<td>User specified</td>
<td>Restricted to 75%</td>
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<tr>
<td>GLiB Maximum Stock Exposure</td>
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<tr>
<td>GLiB Maximum Stock Exposure</td>
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<tr>
<td>Maximum Desired Retirement</td>
<td>No restriction</td>
<td>7%</td>
</tr>
<tr>
<td>Income</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum number of</td>
<td>No restriction</td>
<td>8 years</td>
</tr>
<tr>
<td>Years until Retirement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-existing Pension Income</td>
<td>1) Nominal pension</td>
<td>Real income pension only</td>
</tr>
<tr>
<td></td>
<td>2) Real pension income with user specified CPI adjustment</td>
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Methodological Enhancements

While the economic philosophy underlying the PrARI algorithm remains unchanged, a number of notable enhancements have been implemented within PrARI, a module of QWeMA VIEW.

The most significant improvement within this version is the shift from a strictly real (or inflation-adjusted) cash flow system to one that allows for the analysis of nominal mixed with real (user inflation adjusted) cash flows. This enhanced methodology more accurately captures the characteristics of retirement income products that exist in today’s market and their role in an optimal retirement income product mix. Generally, the improved methodology will allow users to easily and intuitively interpret all inputs and calculations of the module.

One of the key metrics computed by the PrARI algorithm is the Retirement Sustainability Quotient (RSQ) which reflects the overall likelihood that a given product allocation and asset allocation will generate the desired level of income for the remainder of one’s life. PrARI V1.0 arrived at this quantity by computing the income and probability weighted average of cash flows from three financial/insurance products or categories. In the real cash flows system, these income streams are known and constant. However, within the nominal system employed by V2.0 these cash flows are no longer fixed quantities because of the effect of inflation and varied basis step-up frequencies. Thus, the nominal income or cash-flow gap will likely vary over time and with age. There is no unique and constant spending rate during retirement.

Instead, these fixed quantities are replaced with actuarial present values of the non-constant, nominal income streams that are expected to be generated by each retirement income category or product. It should be noted that under this expanded definition, certain combinations of client-specific input parameters result in RSQ values that exceed 100% and therefore these values should not be interpreted as probabilities per se. This is simply
an indication that income from the selected product allocation will greatly exceed the required target retirement income. Consequently, and practically speaking, the client can “afford” to increase his or her annual desired retirement income.

**Increased User Flexibility**

The nominal cash flow system also has implications for a number of program parameters and outputs. Most importantly, several parameter restrictions previously imposed within PrARI V1.0 have been eliminated within V2.0. We have also implemented a much more robust calculation engine that does not require these stability restrictions. Within the **GLiB Parameters** settings panel, which captures the characteristics of the available guaranteed living income benefit, the program now allows the user to specify the maximum underlying equity allocation. In turn, the PrARI Optimizer is bound by this constraint when determining the client’s optimal product and asset allocation.

In addition, the user can now more precisely describe the step-up mechanism of the available guaranteed living income benefit (GLiB), which is now a feature of most Guaranteed Minimum Withdrawal Benefits. Previously, the real cash flow system within V1.0 only roughly approximated the effect of a 3 year nominal basis step-up GLiB feature. A direct result of the new nominal system within V2.0 is the freedom to model market step-ups of various frequencies. The newly released version allows for the selection among seven GliB basis step-up frequency options ranging from “Never” to every 5 Years.

Similarly, the user can now describe pre-existing pension income in greater detail. Version 2.0 allows for the inclusion of pre-existing nominal pension income, as well as pre-existing real pension income (that is to be augmented annually, in nominal terms, by the user specified CPI rate). The program now allows for a personal inflation rate which can differ from the aggregate macro-economic rate.

Improved algorithm architecture has also resulted in the removal of restrictions placed on the client spending rate and the term to retirement parameters. Because PrARI V2.0
conducts the analysis in nominal terms and incorporates a wider range of product characteristics, greater spending rates and longer pre-retirement terms can now be considered and assessed as part of the overall retirement income strategy.

Finally, the user will notice minor reorganization of the user interface, aimed at improving ease-of-use. Among these changes is the inclusion of the COLA rate parameter in the Analyzer and the Optimizer panels, rather than within PrARI Settings. Within the nominal cash flow system, the desired spending rate will increase annually by this specified rate. This also enables the user to gauge the impact of personal expenditures that increase at a rate that differs from the aggregate CPI inflation rate.

**Numerical Example**

To gauge the implications of the nominal cash flow system implemented in V2.0, consider the following hypothetical scenario. Ben, a 62 year old male in excellent health, is about to retire. His retirement nest egg has grown to $1,000,000 and is currently split evenly among equities and bonds. He plans to withdraw $50,000, in today’s dollars for the remainder of his retirement. This annual amount will increase by his personal inflation rate or his cost of living adjustment (COLA) rate, which he estimates to equal 3.5%. Ben would like to assess the likelihood of the strategy’s success.

Note that in the absence of a positive inflation or COLA parameter and GLiB step ups, or in a real-cash flow system where all cash flows are adjusted for inflation, the results produced by PrARI V2.0 closely approach those of PrARI V1.0. We can illustrate this by first inputting Ben’s age, health and desired retirement income. We leave all PrARI setting parameters unchanged at their default values: equities earn an expected return of 10% with a volatility of 18% and bonds earn an expected return of 5% with a volatility of 8%. Next, we adjust the COLA rate to zero and GLiB step up frequency to “Never” (within PrARI V2.0). These modifications effectively emulate (the old) real cash flow system.
Under these parameters within both PrARI V1.0 and V2.0, Ben’s current SWiP-only allocation results in an RSQ of 98% and an Expected Discounted Bequest (EDB) value between $471,000 and $478,000.

It should also be noted that in the real cash flow system described above, a 100% allocation to SWiP equity causes the RSQ value to collapse to another quantity of interest, within both versions of the program. The RSQ in this case is equal to 94.6% or 1 minus the Retirement RisQuotient™, which is an analytic approximation for the probability that a fixed spending plan will deplete a retirement nest egg before the end of the life cycle. That is, if Ben invests his $1,000,000 retirement nest egg into equities expected to earn 10% with a volatility of 18%, and withdraws $50,000 per year (in today’s dollars), his Retirement RisQuotient -- or probability of running out of money -- is equal to 5.4%.

Now, to assess the sustainability of his spending plan under his current 50% SWiP equity and 50% SWiP bond allocation in the presence of his estimated inflation rate, we input the value of 3.5% within the COLA field of the PrARI V2.0 Analyzer. This is a personal inflation rate which may or may not be equal to the projected macro-economic rate. The panel below illustrates the result of this scenario. The RSQ of Ben’s proposed allocation and spending strategy is 81.6% and the expected discounted bequest is valued at approximately $278,500. The reductions in both the sustainability and bequest metrics are observed because his required spending increases each year by the specified COLA rate. In fact, if Ben increases his projected spending COLA to 4%, the RSQ and the EDB values are further reduced to 77.4% and $235,800, respectively. On the other hand, if we reduce the projected spending COLA rate to 2%, the RSQ of his strategy increases considerably to 91.6% and his estimated EDB is $377,700. This should be intuitive and is consistent with classic Monte Carlo simulation results.

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1 The Retirement RisQuotient is a trademark of Moshe A. Milevsky and The QWeMA Group. The methodology behind this metric is discussed within A Gentle Introduction to the Calculus of Sustainable Income: What Is Your Retirement RisQuotient? (M. Milevsky), published in the Journal of Financial Service Professionals, July, 2007.
Now let’s illustrate the power of PrARI by examining “product allocation”. To increase Ben’s likelihood of success, let’s assume that he allocates a portion of his nest egg to investment products that guarantee a lifetime of income. Again, PrARI V2.0 allows the user to see the impact of such a strategy in the presence of inflation and various GLiB step-up frequencies. For example, if Ben invests 25% of his retirement savings to lifetime payout income annuities (LPIAs) and 25% to a GLiB that allows for a basis step-up to market value every three years (selected within the GLiB parameters panel, with a COLA rate of 3.5% and all remaining PrARI inputs unchanged), an improvement in the RSQ value is observed. As illustrated in the panel below, the addition of two guaranteed retirement income products raises Ben’s RSQ to above 93.4%. Recall that this is more than ten percentage points better than the case in which 100% of the nest egg was allocated to the SWiP.
Similar to PrARI V1.0, the Optimizer panel of the new program version will allow Ben to locate an optimal product and asset allocation that also takes into consideration possible goals or criteria such as attaining a minimum EDB or RSQ value.

The following table illustrates the change in RSQ and EDB values for a generic case, as increasing percentages of wealth are allocated to GLiB and LPIA products. In addition, the table shows that delaying retirement and/or spending less increases the RSQ regardless of the product allocation.
In conclusion, PrARI V2.0 expands the functionality and the applicability of the "product allocation" concept, while remaining consistent with the results and outputs of the previous version.
Default Parameters

The default capital market parameter values within QWeMA View are NOT intended as financial forecasts or predications by The QWeMA Group but are provided for user convenience only. They can obviously be changed at anytime and we urge users to give careful thought as to which parameters to actually use as market conditions change.

The parameters themselves are inputs to the PrARI™ algorithm and are located in the settings panel of the program. They are meant to reflect forward looking asset class returns and volatility and are used to model the investment portfolio’s performance. The default equity parameters are based on statistical averages of the historical behavior of the Morgan Stanley Capital International World Index (which reflects the movement of equity indices from numerous developed world markets and is published by Bloomberg). The default bond parameters are based on statistical averages of the S&P Canadian Bond Index (published by Bloomberg).

The default conditional probabilities of death for males and females are drawn from the (static) RP-2000 mortality table for a healthy annuitant, published by the Society of Actuaries and available at www.soa.org. To capture the client’s specified health (ranging from “excellent” to “below average”) the default mortality rates are increased by approximately 10% for each degree of health status below “excellent.” This was is an assumption made by The QWeMA Group based on its estimates of anti-selection embedded in population and insurance mortality tables.

Additional economic parameters that heavily impact program results include the Consumer Price Index (CPI) rate and the Cost of Living Adjustment (COLA) rate, which appear in the input screens of the Analyzer and the Optimizer panels. The default CPI value reflects the average historical inflation rate which is the change in the CPI index (for all items) for the past 25 years, as reported by Statistics Canada and available from their website. The COLA parameter allows for the input of a personal inflation rate that differs from the reported overall CPI rate. The default value is assumed to exceed the CPI rate as research has shown that the rate of inflation experienced by retirees is likely to outpace the overall
rate of inflation. We refer the interested reader to the various white papers available on www.ifid.ca that discuss these and related issues.

The default yield curve values are based on the Government of Canada Benchmark Long Term Bond yields as estimated in mid September 2008 and published by the Bank of Canada on their website. Once again, all of the default parameter values within QWeMA View are meant to assist the user of the program and should not be viewed as macroeconomic forecasts.

**Contact and Support**

- To review research papers on the topic of retirement and product allocation, please visit: www.qwema.ca

- For technical support, please contact a QWeMA group representative at: support@qwema.ca