

# What's New!

# ProVal®

ProVal version 2.28

August 2008

ProVal version 2.28 introduces **dynamic mortality tables** and **spot rate lump sum assumptions** to make PPA valuations and forecasts easier, **stochastic trial trace**, and **gain/loss for OPEB plans**. You'll find details about these and other enhancements below.

## U.S. Pension Plans

- ◆ “Dynamic mortality” tables to value PPA funding liabilities and lump sums are now available. The tables will be automatically created based on IRS specifications. The following three new tables have been added to the Mortality Rates library.
  - IRS 2008+ Static Mortality (dynamic)
  - IRS 2008+ Combined Static Mortality (dynamic)
  - IRS 2008+ Applicable Mortality Table for 417(e) (dynamic)
- ◆ There is now an option to use the underlying liability interest rates for lump sum factors for Target and PBGC liabilities. Also, if lump sums are valued using spot rates that are variable by duration from the valuation date, now the resulting liability matches the equivalent liability if the benefit were payable as an annuity.

From	Up to	Rate
0		

- ◆ A new option to smooth “total return” in the N-Year average asset smoothing method is available to smooth assets as described by PPA.

- ◆ Credit balances can now be waived to avoid At-Risk status.
- ◆ Non-HCE annuity purchases for the prior two years can now be entered. Accordingly, the AFTAP will now be used to determine if benefit restrictions are required.

Year	Value
Year -1	264,853
Year -2	953,682

- ◆ The interest rates to use for the shortfall amortization calculation can now be overridden. This is useful to assume middle of year spot rates for liability calculations, but beginning of year spot rates for the shortfall amortization calculation.
- ◆ The “Discounted Contributions Receivable” parameter has been retired. This was previously used to determine PBGC assets (before regulations set these equal to the funding assets) and in limited cases to back into the prior year’s effective interest rate. If required, the prior year’s effective interest rate will now be entered on the Prior Year Values screen.

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- ◆ The PBGC variable rate premium can now be calculated using the target liability interest rates.

## Canadian Pension Plans

- ◆ A new option has been added to reflect the exemption of certain types of employers (typically Public Plans) from the Quebec Supplemental Pension Plans Act effective 1/1/2007. If selected, a “special contribution” will be available in the output menu for plan amendments, and this amount will be developed in the minimum required contribution exhibit.
- ◆ Future gains can now offset schedule payments based on their years remaining, if desired, rather than always on a pro-rata basis. This option applies to going concern and solvency bases.
- ◆ A new option applies grow-in rights to Solvency Transfer Value and Solvency Deferred Annuity Purchase liabilities, but not Solvency Immediate Annuity Purchase liabilities.

## OPEB Plans

- ◆ A warning was added in OPEB Plan Definitions, to prevent accidentally losing lifetime maximums by adding/omitting benefits.

## All Plans

- ◆ Lump sum components can now reference valuation assumptions COLAs. This avoids having to hardwire it in the component and allows more flexibility since valuation assumptions COLAs can vary by age and duration from commencement.

**Lump Sum Factor: Advanced**

Cost of Living Adjustments:

Use valuation assumption COLAs  
COLA rate during - payment period:   
deferral period:

Youngest/Oldest Recognized Ages:

Use age 55 lump sum factor for all ages up to age 55  
 Use age 65 lump sum factor for all ages after age 65

When used in a death benefit, base primary mortality on the deceased member's age/sex

Apply Valuation/Projection assumptions for fraction receiving J&S

OK Cancel

- ◆ Lump sum factors can now be valued using generational mortality tables.
- ◆ Individual results will now apply all data defaults, even for fields that are not used.
- ◆ Youngest/oldest recognized ages can now be entered for table benefit formula components. This will reduce the number of tables needed, primarily for plan-specified conversion factors such as joint and survivor factors.

**Benefit Formula Component Table: Advanced**

Look up table values using projected age & service, except:

Freeze age & service for pure unit credit & vested liabs.  
 Freeze service for vested liabilities  
 No exceptions

Youngest/Oldest Recognized Ages:

Use the age 55 table value for all ages up to age 55  
 Use the age 65 table value for all ages after age 65

OK Cancel

- ◆ The calculation of projected benefits in a valuation for subtotals is now optional. This can free up significant storage space hopefully helping users who were running into the 4GB ProVal file limit.

## Sample Lives

- ◆ All and None buttons have been added to facilitate selecting which reports to view.
- ◆ ProVal will now remember which benefits and components were selected when you return to sample lives.
- ◆ Sample lives will now display PUC and UC values for subformulas.

Benefit Formula Components

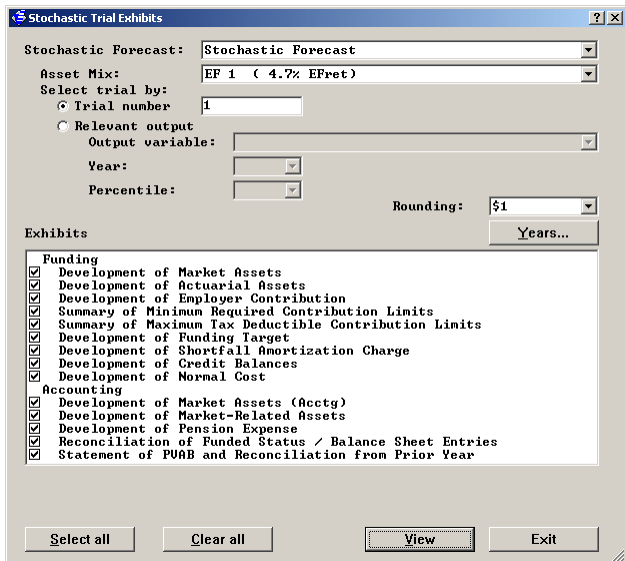
Name: FORMULA  
Type: SubFormula

RecID: 1

Year	Age	BASE Component	EXCESS Component	SubFormula Component	SubFormula Component PUC h.o.y.	SubFormula Component PUC e.o.y.	SubFormula Component UC h.o.y.	SubFormula Component UC e.o.y.
2005	21	144.86	0.000000	144.86				
2006	22	526.29	0.000000	526.29				
2007	23	935.34	0.000000	935.34				
2008	24	1,369.22	0.000000	1,369.22	1,369.22		1,369.22	
2009	25	1,829.44	0.000000	1,829.44	1,811.74	1,829.44	1,369.22	1,829.44
2010	26	2,317.59	0.000000	2,317.59	1,456.00	1,886.79	1,369.22	1,829.44
2011	27	2,915.76	0.000000	2,915.76	1,544.67	2,001.70	1,369.22	1,829.44
2012	28	3,578.19	0.000000	3,578.19	1,638.74	2,123.60	1,369.22	1,829.44
2013	29	4,310.50	0.000000	4,310.50	1,738.53	2,252.93	1,369.22	1,829.44
2014	30	5,118.73	0.000000	5,118.73	1,844.41	2,390.13	1,369.22	1,829.44
2015	31	6,009.41	0.000000	6,009.41	1,956.74	2,535.69	1,369.22	1,829.44
2016	32	6,989.59	0.000000	6,989.59	2,075.90	2,690.11	1,369.22	1,829.44

## Forecasting

- ◆ Stochastic forecast analytical tools are now available in ProVal.
  - Trial numbers for each percentiled output item are now available from Stochastic Forecast Output.
  - Deterministic Assumptions can be populated by specifying a stochastic forecast, asset mix, and a trial number.
  - A Stochastic Trial Exhibits command is available on the Execute menu. It will display exhibits to detail a single trial's results.

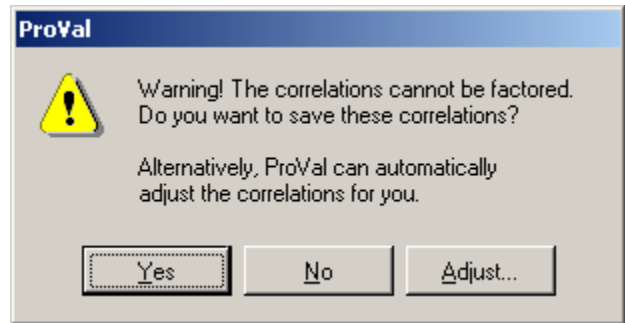


[See Stochastic Forecast Analytical Tools, page](#)

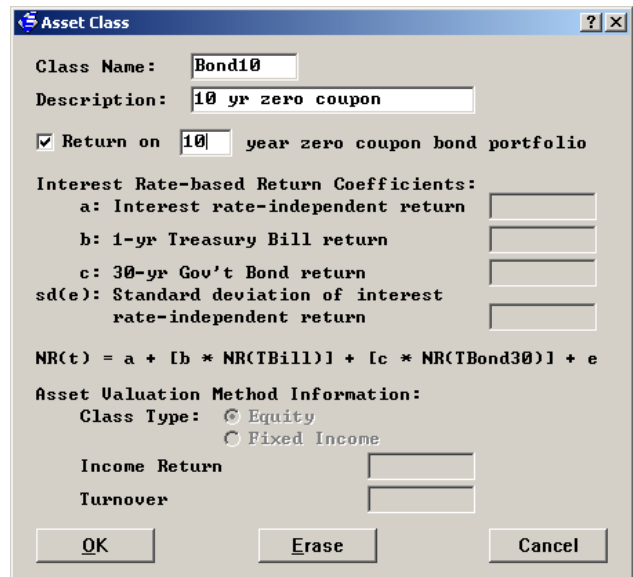
- ◆ Not-at-risk and At-risk PBGC liabilities are now available as end of year additional contribution liability targets.
- ◆ ProVal will now issue a warning if a core projection with more than 1,000 records or a new entrant database file with more than 20 new entrants are processed alerting users that grouping data or reducing the number of new entrants will speed up processing time.
- ◆ 9-pt interpolation and non-logarithmic interpolation options have been removed from the Core Projection > Sensitivities screen and Asset and Funding Policy > Forecast Analysis screens respectively.
- ◆ A new n-year average funding asset valuation method option to use a market-based rate is now available when the gain/(loss) to be spread is the excess return over the expected return. Previously this method was only available in U.S. qualified mode. With this method, the expected rate of return on the portfolio is based on the return on a portfolio of 30-year bonds.

### Capital Market Simulations

- ◆ ProVal can now automatically adjust inputted correlation coefficients in capital market simulations to make them factor.



- ◆ The multi-factor capital market simulator's valid range for the b coefficient has expanded to [-6, 20] and the c coefficients has expanded to [-3.5, 3.5] instead of [-2, 2].
- ◆ The multi-factor capital market simulator now lets you define bond asset classes of fixed known duration on the simulated treasury yield curve.



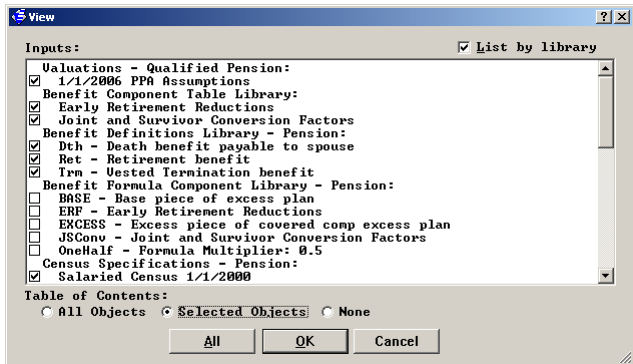
- ◆ Liability returns calculated in an excess efficient frontier can now be saved to a file to import as an asset class into a custom capital market simulation.

### Output & Reporting

- ◆ Valuation Set Exhibits can now be saved to an MS-SQL database. The MS-SQL database's structure, or schema, is identical to the structure of the Access database.
- ◆ A new table of valuation assumptions will be generated when saving valuation set exhibits to Access or MS-SQL.
- ◆ When saving to an Access database from exhibits, there is now an option to replace an existing run (as well as delete existing runs).

Previously, you could only replace the entire file or append to the file.

- ◆ When viewing inputs (either in List objects or within the Execute menu), you can now specify if the table of contents should list all objects, just the objects selected or skip the table of contents all together. Also, “list by library” is now the default viewing style within the Execute menu.



- ◆ Valuation salary and number are now available as output on accounting only runs. If funding and accounting are run, then only the funding results are calculated.

### Census Data

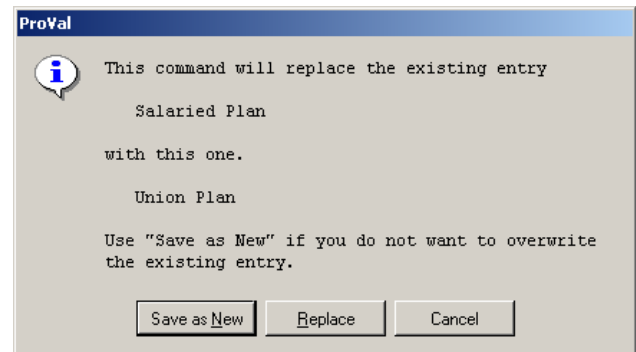
- ◆ The performance of extremely wide grids in Spreadsheet Edit (e.g., viewing 300,000 records in columns) has been enhanced.
- ◆ For coded fields, 11 digit codes can now be entered in the data dictionary. Previously, you could import 11 digit codes, but not enter them in the data dictionary.
- ◆ The Screen Data command will now skip custom screening tests during processing that do not validate. For example, if the database being screened does not contain the requisite fields. Previously, processing was halted until the errors were fixed.
- ◆ When pressing the View button to display a database’s Change History (e.g., to save it to Excel), ProVal now displays the same information (and in the same order) as shown on the screen.

### Gain/Loss Analysis

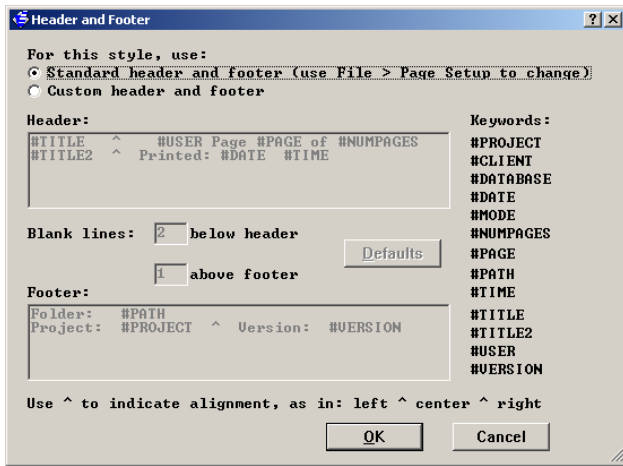
- ◆ Gain / Loss Analysis is now available in OPEB mode.
- ◆ Gain / Loss Analysis can now be run on accounting valuations.

### System

- ◆ The original name of the library entry you’re editing is now displayed in the dialog caption.
- ◆ Check marks have been added to alert users that items are selected behind a button when:
  - Writing excess return efficient frontiers to a file
  - Saving stochastic trial detail
  - Saving valuation individual results
- ◆ ProVal no longer allows the creation of new objects with names that differ only because of case.
- ◆ Component names (i.e., database fields, benefit formula components, accrual basis components, and custom operators) can now be up to 30 characters long. Previously, the limit was 20 characters.
- ◆ When replacing an object where both the name and parameters have changed, confirm that it is OK to overwrite the old version of the object and offer “save as new” as an alternative.



- ◆ In the viewer, it is now more obvious when “find” wraps around to the beginning.
- ◆ ProVal’s standard header and footer on printouts has changed to include the user name, date and time printed, client folder, project name, and ProVal version. Also, the storage of header and footer information has been moved from pvcom.sf to provalw.ini to allow system administrators to push a standardized header and footer out to all end users. Additionally, for menu options that allow the use of custom output styles, users can either use the standard header and footer or the header and footer defined in the output style.



## WinTech's Virtual Back Office

Need help bringing up new clients, converting cases, or experienced help in a ProVal area that's new to you? Why not call upon WinTech's experienced actuaries to fill in? Contact **Hank Freeman** at (203) 861-5526 for details or to request a quote.

- ◆ Date constants can now be entered and will be displayed in the format specified in your Windows Regional Settings.
- ◆ The usage log (specified in provalw.ini) will now include the software version number and date.
- ◆ When prompting users to pack files (upon closing a client), a new "Settings..." button has been added to set the thresholds. These settings are also accessible from File > System Maintenance > Customize.
- ◆ To ease confusion for beta testers
  - If a client has been updated by a newer version of ProVal, the version number and date that's needed (not just the date) will now be reported.
  - When opening an older client, ProVal will now determine if an update is necessary by looking at the version number and date (not just the date).

# WinTech

Two Greenwich Office Park  
Greenwich, CT 06831

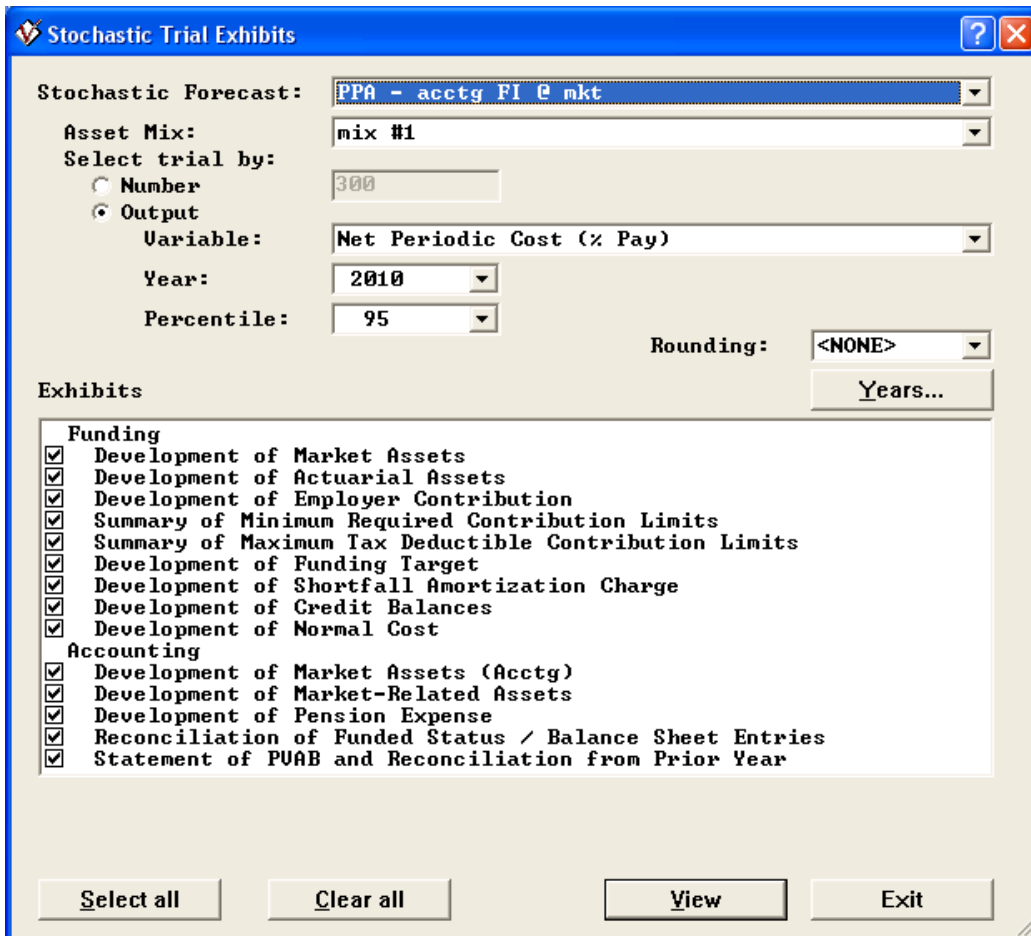
tel: (203) 861-5530  
fax: (203) 861-5531  
email: support@winklevoss.com  
website: www.winklevoss.com

# Stochastic Forecast Analytical Tools

New stochastic forecast analytical tools are now available in ProVal. A stochastic trial can easily be brought into the deterministic forecast arena where output exists in greater detail. This can be done in two ways. A deterministic assumption set can be populated with a stochastic forecast trial from which a deterministic forecast can be created. Alternatively, if the user is interested only in exhibits, Stochastic Trial Exhibits are now available. To facilitate these new features, ProVal will also now store the trial numbers associated with the stochastic forecast output. Each of these new features are discussed in more detail below.

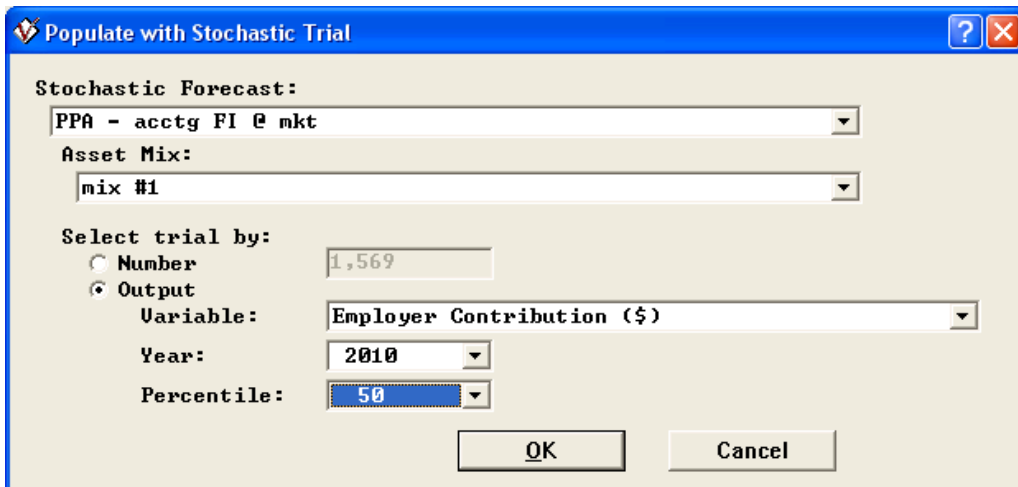
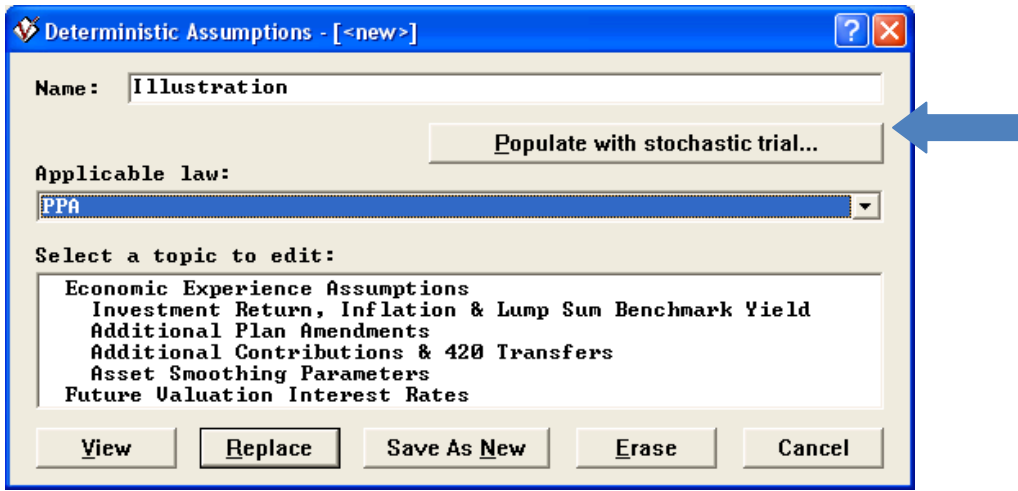
## Stochastic Trial Exhibits

Stochastic Trial Exhibits is a new item on the Output menu. It is similar to Deterministic Forecast Exhibits except that instead of a deterministic forecast, input consists of a stochastic forecast, an asset mix and a trial number. The trial number can be chosen in two ways. It can be entered directly. A user may be analyzing stochastic forecast trial detail, and want to further investigate a particular trial. Alternatively, the user might be interested in a particular stochastic output result, and want more information. In this situation, the user can define a trial by specifying an output variable, a forecast year, and a percentile.



## Populate Deterministic Assumptions

Deterministic Assumptions can now be populated by specifying a stochastic forecast, asset mix, and a trial number. If desired, ProVal will determine the trial number based on user input of the variable, year and percentile of interest.



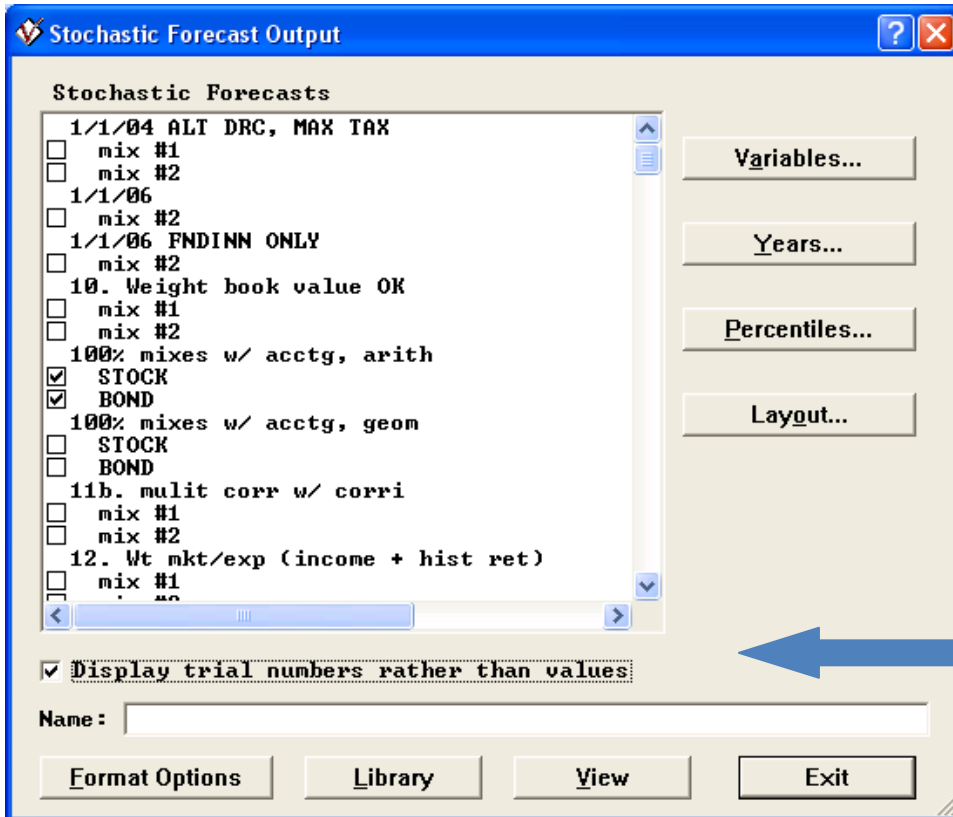
## Interpolation Methodology

There is a key difference between Deterministic Assumptions that are populated “by hand” by the user and those that are populated by reference to a Stochastic Forecast. The difference is the interpolation methodology.

In general, when ProVal executes a Deterministic Forecast, it interpolates all liabilities and normal costs by benefit for the desired economic scenario and valuation assumptions. It then sums across the benefits to get the total liabilities. To save space and time in a Stochastic Forecast (and in ProVal PS), however, ProVal sums across comparable benefits first, and then does the interpolation. This difference in methodology will generally create a very small difference in the final costs and contributions. To eliminate this “noise”, ProVal remembers if a Deterministic Assumption Set was populated by reference to a Stochastic Forecast, whether or not it is subsequently modified by the user. If it was, the interpolation methodology for the Deterministic Forecasts is set to “collapse on benefit” so that the numbers will match exactly what would have been produced by the Stochastic Forecast. If for pedagogical reasons, or due to intellectual curiosity, the user wants to see results using standard deterministic forecast interpolation methodology, the assumption set can be exported, and reestablished in a virgin assumption set.

## Stochastic Forecast Output

Stochastic Forecast Output has been expanded. In addition to displaying values, the stochastic trial number producing these values can also be displayed. Blank trial numbers will be displayed for forecasts run prior to the installation of ProVal Version 2.28. If more than one trial produces a given result, the lowest trial number will be displayed. For example, if in the year 2011, 312 out of 1,000 trials have a contribution rate of zero, and the lowest trial number with a zero contribution rate is trial 12, then the 0<sup>th</sup> through the 30<sup>th</sup> percentiles will display trial number 12. Trial number 1 will be displayed for all variables that are not actually stochastic.



# PPA Issues

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This article discusses enhancements and modifications for the following PPA items:

- ◆ Funding mortality under IRC §430
- ◆ Lump sum interest and mortality
- ◆ PPA asset valuation method
- ◆ Waiving credit balances
- ◆ PBGC Premium calculation
- ◆ Shortfall amortization interest rates

## Funding mortality under IRC §430

PPA prescribes new mortality tables to determine funding liabilities under IRC §430. There are four mortality options for 2008 funding valuations:

- 2008 Static Mortality (pre/post-commencement rates by age and sex)
- Generational Mortality (pre/post-commencement rates by age)
- 2008 Combined Static Mortality (rates by age and sex; small plans only)
- Plan-specific table (needs approval)

For subsequent valuation years (2009, 2010, etc.), the IRS expects to update “2008 Static Mortality” and “2008 Combined Static Mortality” tables with one more year of mortality improvement. ProVal Version 2.28 introduces “dynamic mortality” tables to explicitly handle this assumption. These tables will be sensitive to the valuation date, so that they act like a 2008 table for 2008 valuation dates, like a 2009 table for 2009 valuation dates, etc. This eliminates the need to update the mortality rates in your valuation assumptions each year. In a forecast, ProVal will change assumptions to use the applicable table for each future valuation date.

Version 2.28 includes 2 dynamic mortality tables to calculate funding liabilities:

- IRS 2008+ Static Mortality (dynamic)
- IRS 2008+ Combined Static Mortality (dynamic)

Note that the mortality rates in these tables can not be modified by users nor can users enter their own dynamic mortality tables.

While dynamic mortality can be a valuation assumption, it is not allowed as a projection (experience) assumption. This is because these static tables are designed to approximate a generational mortality table and yield comparable liabilities. They are not designed to be used for experience. We recommend using a generational mortality table for experience.

## Lump Sum Interest and Mortality

The proposed regulations (1.430(d)-1(f)(4)(iii)) specify that §417(e) lump sum interest rates in a funding valuation should be the same as the target liability interest rates used under §430(h)(2). You may optionally adjust these rates to reflect differences between the phase-in of the §430(h)(2) segment rates and the adjustments to the segment rates under §417(e)(3)(D)(iii). These rates are applied to the annuity payments that underpin the lump sum. In Version 2.27, to calculate present values in compliance with PPA regulations, the Lump Sum Interest & Mortality topic of Valuation Assumptions required that the spot rates be converted to forward rates and the resulting forward rates entered. In Version 2.28, spot rates can be entered directly as spot rates and the resulting liability will be equal to the liability that would be calculated if the benefit was payable as an annuity. To make this even easier, the Lump Sum Interest & Mortality topic of Valuation Assumptions (under PPA law type) has a new option to use the underlying liability interest rates for Target and PBGC liabilities.

The default mortality rates are now a dynamic mortality table (called the IRS 2008+ Applicable Mortality Table for 417(e) (dynamic)) that will be generated based on IRS specifications. Dynamic mortality tables for lump sum

purposes can be generated dynamically as of the valuation date (appropriate for PPA funding valuations) or as of the decrement date. Alternatively, a generational table can be selected.

By electing to use the underlying liability interest rate and a dynamic mortality table, this new screen eliminates the need to update the Lump Sum Interest and Mortality topic of Valuation Assumptions each year to value PPA liabilities.

**Interest Rates**

Target and PBGC Liabilities

Use underlying liability interest rates

Constant

Variable by duration from: valuation date

From	Up to	Rate
0		

Input is  forward rates  
 spot rates

Actuarial Liabilities

Use alternative interest rates

Params...

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**Mortality rates**

\* IRS 2008+ Applicable Mortality Table for 417(e) (dynamic)

\* Mortality table will be dynamically generated as the IRS table expected to be in effect as of the valuation date

Clear OK Cancel

### PPA Asset Valuation Method

Currently, PPA’s only permissible asset smoothing method is to average the fair market value at the valuation date with adjusted fair market values on earlier determination dates. In ProVal Version 2.28, there is a “total return” smoothing option in the N-Year Average method. The asset gain/(loss) that is smoothed under this method is the EOY Assets – (BOY Assets + Contributions - Benefit Payments – Expenses).

**N-Year Average**

Years in Averaging Period: 3

Asset Gain/(Loss) to be Spread: Total return

Year	Asset Gain (Loss)
-2	10,500
-1	-43,500

Expected Return Based on Prior Year

Assets: [dropdown]

Return: Valuation Rate

Current year rate: [text field]

Premium over rate: [text field]

Value fixed income assets at market

OK Cancel

We understand that many clients have chosen to use the PPA asset valuation method, but to smooth over non-annual periods. A Valuation Set can handle this by setting the “years to average period” parameter as the number

of periods to smooth. However, since ProVal only handles calculations on an “annual” basis, this is not supported in a forecast. In a forecast, an approximate annual smoothing method must be used.

### Waiving Credit Balances

PPA states (Section 436) that credit balances must be waived if the Adjusted Funding Target Attainment Percentage (AFTAP) is less than 60% (80% if lump sums are payable) or the funding ratio is less than 100% (or applicable transitional percentage). The calculation of the AFTAP is similar to the calculation of the FTAP except the AFTAP adds the non-HCE annuity purchases over the past 2 years to the numerator and denominator. Prior to this version, ProVal assumed that the AFTAP was equal to the FTAP to determine if credit balance waivers were required. In Version 2.28, we have added the ability to enter the non-HCE annuity purchases over the past 2 years to correctly calculate the AFTAP. The Development of Credit Balances exhibit will detail this calculation and the AFTAP will be available as an output item in Valuation Set and Deterministic Forecast Output. Note that since future annuity purchase values are unknown in a forecast, the annuity purchase values entered will be rolled down in a forecast and after two years, the FTAP and AFTAP will be equal.

We have also added a new option for waiving credit balances in this release of ProVal. A number of users called stating that they had such a large credit balance that they were At-Risk although the minimum required contribution was zero. To address this concern, we have added the option to waive credit balances to avoid At-Risk status. If this option is selected, the calculation will be detailed in the Development of Credit Balances exhibit.

Maintain:	Current Balance
<input checked="" type="checkbox"/> Funding Standard Carryover Balance	312,542
<input checked="" type="checkbox"/> Prefunding Balance	0
<input checked="" type="checkbox"/> Apply to Minimum Required Contribution, if eligible	
<input checked="" type="checkbox"/> Eligible to apply balances against MRC (80% funded last year)	

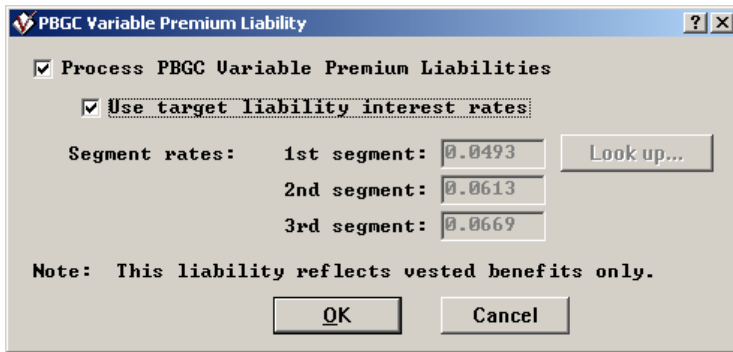
Waivers:
<input checked="" type="checkbox"/> Eligible for waive balances transition rule
<input checked="" type="checkbox"/> Waive balances to avoid At-Risk status, if possible
<input type="checkbox"/> Waive balances to meet 80% AFTAP, if possible (60% AFTAP is always maintained, if possible)

Non-HCE annuity purchases for AFTAP calculation:	
Year -1	253,976
Year -2	512,843

### PBGC Premium calculation

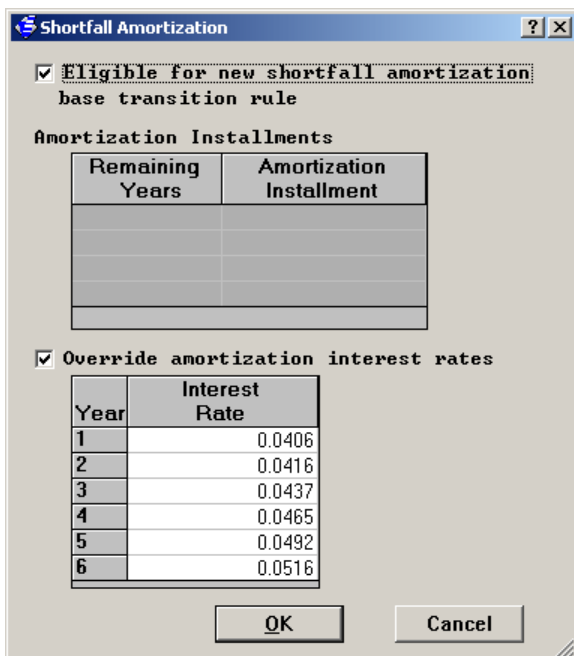
When PPA was released, the initial law stated that the PBGC premium calculation must use the fair value of assets and segment style interest rates. Since then regulations have been released which state that the funding assets should be used (released in a 2.27 UPDATE) and optionally, the PPA target liability interest rates can be used for the calculation. We have made some changes in Version 2.28 to reflect these regulations. First, in the valuation assumptions, there is a new option to use the PPA target liability interest rates for the PBGC liability calculation.



Second, we have retired the Discounted Contributions Receivable parameter from the Initial Asset Values topic of the Asset & Funding Policy. In Version 2.27, this value was subtracted from the funding market value of assets to calculate the fair value of assets for the PBGC Premium calculation. Since this calculation is no longer necessary, we have removed the parameter. However, ProVal had been using this item for more than just the PBGC premium calculation. In limited circumstances, ProVal derived a prior year effective interest rate from this parameter and the actual prior year contributions entered in a contribution schedule. ProVal Version 2.28 will now directly ask for the prior year effective interest rate in the Prior Year Values topic. This input is only required if you are using a contribution schedule or the forecast parameter to use contribution timing to calculate interest on the receivable for funding assets.

### Shortfall Amortization Interest Rates

There is a new parameter to override the shortfall amortization interest rates. It is found in the Shortfall Amortization topic of the Asset & Funding policy. For users who elect to use the full yield curve to value their PPA liabilities, this allows them to use the mid-year spot rates for the liability calculation and the beginning of year spot rates for the shortfall amortization calculation.



# Liability-Driven Investing

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Liability-Driven Investing (LDI) is an approach to pension fund management under which the plan's obligations are considered to some degree in the investment policy. It is not a well defined term or concept and can come to mean several related but different things.

Under the most strategic application of LDI, the investment policy and fund management are changed to reflect the plan's liabilities. The benchmark return is keyed to the plan's liabilities, and the portfolio is divided into two functions related to this benchmark – an allocation to meeting/matching the liability return and another to exceeding/outperforming the benchmark. The former allocation serves to reduce uncompensated returns related to interest rate risk, and the latter to shore up initial funding deficits or reduce the long term cost of the plan. ProVal is well suited to assist with LDI studies of this nature. Long duration bond asset classes, commingled LDI investment products, and diversified sources of excess return can all be established in ProVal's multi-factor term structure simulator.

A typical first step is to evaluate a fully hedged state. To do this in ProVal, establish a liability return asset class (see below) and set up a mix with a 100% allocation to it. Despite the dramatic reduction in funded status and cost volatility, the resulting plan costs can be prohibitively high, as fewer return dollars translate into higher average employer contribution levels.

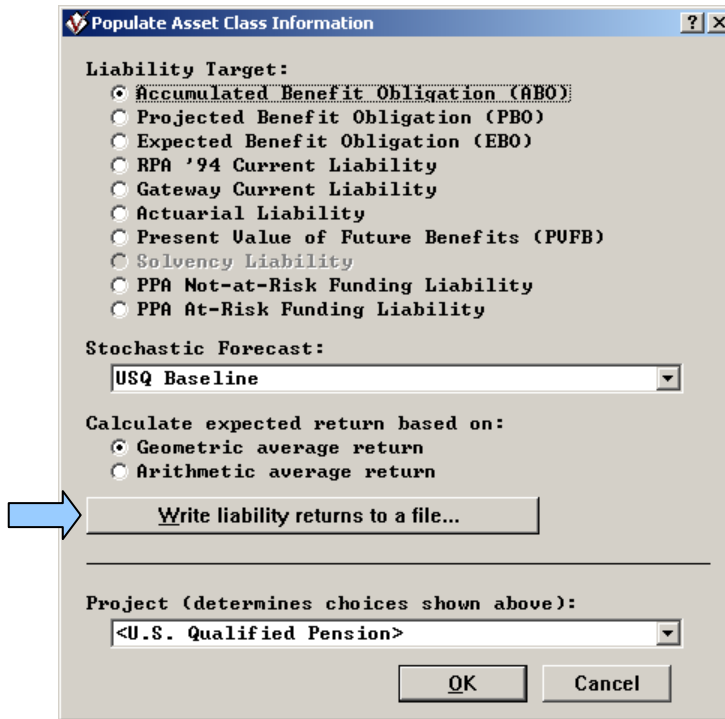
Next, incremental allocations to risky assets can be explored, e.g. 90% hedging with 10% for excess returns, 80%/20%, etc. These involve taking compensated risks as well as leaving some portion of the liabilities unhedged. Thus the overall risk will include the volatility of the risky assets plus the volatility associated with the unhedged liability. By reviewing distributions of the funded status and cost under various allocations, the sponsor can evaluate the trade offs between low cost and cost certainty and can elect how much of the overall risk budget should be spent inside the pension fund trying to lower long term costs.

Some of the key features of ProVal for doing LDI studies are discussed below.

## **1. Establish a liability return asset class.**

To simulate the performance of a commingled LDI product, or alternatively, a customized fixed income mandate tuned up with derivatives, you need to establish an asset class in your capital market simulation that represents the return on plan liabilities.

- a. Execute a (preliminary) Stochastic Forecast using the original Capital Market Simulation (CMS).
- b. Export your CMS trial data to a spreadsheet. Using Output | Capital Market Simulation, export to a spreadsheet the following trial detail from your capital market simulation: inflation, Treasury yield, Corporate yield, and all investable asset classes.
- c. Capture your liability returns to a spreadsheet. Using Input | Efficient Frontier, create a (temporary) new Excess Efficient Frontier by pointing to a previously-run Stochastic Forecast and also pointing to the liability measure desired. Save the results to a new spreadsheet.



- d. Copy & paste the liability return results to the bottom of the CMS trial detail spreadsheet created in step b. Save this spreadsheet.
- e. Using the Custom type of Capital Market Simulation, import the final spreadsheet in step d. Note that you will have to check the boxes to denote that you will be importing both a 30Y Treasury yield and a corporate bond benchmark yield. [Hint: If you make a copy of the original CMS and edit the copy, it will be faster than starting from scratch as ProVal will “know” the names of all the asset classes you wish to import (except the new one for liability returns) and you’ll be able to choose each asset class name from a list.]

Examine the return characteristics of your liability hedging asset class. As long as the returns on your liability hedging asset class are no more than 50-70 basis points higher than the returns on long bonds (T30) they are likely reasonable for this purpose.

## 2. Establish a long duration fixed income asset class.

Two primary determinants for the duration of an asset class in the multi-factor term structure simulator are the parameters for b (coefficient applied to the 1-year Treasury bill return) and c (coefficient applied to the 30-year Treasury bond return). For shorter duration investments (e.g., managed against the Lehman Brothers Aggregate Bond Index) you may find values of b in the range of (0.6, 0.8) and values of c in the range of (0.0, 0.5). To increase the duration, decrease the weight on the 1-year and increase the weight on the 30-year bonds. Note that you can enter a value for b between (-6, 6) and for c between (-3.5, 3.5).

Effective with ProVal 2.28 you have a precise method of creating an asset class of known duration. In the definition of an asset class are new parameters used to access the returns on zero coupon Treasury bonds from your CMS. Thus to create a fixed income asset class of duration 17, parameterize the asset class as shown below:

Asset Class

Class Name:

Description:

Return on  year zero coupon bond portfolio

Interest Rate-based Return Coefficients:

a: Interest rate-independent return

b: 1-yr Treasury Bill return

c: 30-yr Gov't Bond return

sd(e): Standard deviation of interest rate-independent return

$NR(t) = a + [b * NR(TBill)] + [c * NR(TBond30)] + e$

Asset Valuation Method Information:

Class Type:  Equity  Fixed Income

Income Return

Turnover

Importantly, note that ProVal will “sell” this asset class at the end of each year and “buy” a brand new 17-year bond so as to maintain a constant duration throughout the forecast period.

### 3. Find diversified sources of excess return.

The Excess (or Surplus) Efficient Frontier (EF) identifies mixes such that for any given level of excess return, the standard deviation of funded ratios is minimized. As such, the first and most conservative mix is comprised solely of the liability hedging asset class, which should have zero/negligible volatility of funded ratio. Importantly, as one moves up the efficient frontier, considering mixes with increasingly higher excess returns, the excess efficient frontier identifies the “best” source of excess returns in the context of LDI. That is, it identifies strategies to achieve liability-beating returns that minimize the volatility of funded ratios.