
Invesco Vision Case Study 5: Liability-driven investing

LDI solutions for US corporate defined benefit plans

The first step in any LDI exercise is to obtain a full and detailed understanding of liabilities. In particular, two basic components need to be well understood: 1) the projected cash flows and 2) the discount curve that is used to value them. Once we successfully model the liabilities, we can then use them as a benchmark and employ relative optimization to construct frontiers that will maximize return for any given level of funding ratio volatility. In this example, we will look at a hypothetical US corporate defined benefit plan.

Figure C5a shows the liability worksheet where we can create generic or highly customized liability profiles. In the upper panel we have the choice of creating a generic cash flow schedule using Russell's Standard Cash Flow Generator as well as manually defining a customized set of payments. Once we have defined the cash flow schedule, we can then select a discount curve from a list of various standard options. In this example, we use the FTSE pension discount curve which is commonly used for these types of plans. Finally, one last aspect to consider is liability specific risk. This is most relevant when discount curves have a credit component. Credit migration in these curves leads to risk that cannot be hedged. For a typical liability that is discounted with a AA curve, we will empirically set this value to 2%.

With the necessary components in place, we are then able to model the liability stream. In the right portion of the upper panel, we can see all of the factor risks and exposures. For example, this liability has meaningful interest rate risk, some credit risk and some specific risk. Drill in capabilities allow for a more detailed decomposition of the risks into sub-components such as key rates. We can also toggle between isolated risks, contribution to risk and the factor exposures themselves. Having calculated all the factor exposures, we have effectively translated the liability into a benchmark just like any other third-party benchmark that may now be used as a reference point for further asset allocation modeling exercises. The lower panel of Figure C5a provides additional details that summarize the liability characteristics. For example, the present value of the liability stream is \$235 million with only \$18 million coming from cash flows beyond 30 years. The yield of the liability is 4.08% which serves as a quick return bogey. The implied spread of the liabilities over Treasuries is 115 bps and the effective duration is 13.7 years, which is close to the highest duration we can get in the physical cash market (excluding Treasury STRIPS).

Having modeled the liabilities, we can go back to the analysis worksheet shown in Figure C5b, where we can begin to focus on asset allocation modeling. For this example, we decide to employ five asset blocks: Intermediate Corporates, Long Corporates, Intermediate Treasuries, Long Treasuries, Treasury STRIPS (15+ years) and the S&P 500. The fixed income blocks have been selected to allow us to introduce varying levels of duration and credit exposure, both of which are key ingredients of the liabilities. The S&P 500 acts as our growth asset. The frontier shown in the left portion of the upper panel indicates portfolios with the highest possible return for a given level of funding ratio volatility. In this instance, we have also chosen to focus on a relatively low risk point on the frontier that is comprised of Long Corporates, Treasuries, and some allocation to the S&P 500. Here, the S&P 500 is what drives the return higher than the liabilities while the fixed income components are reducing the funding ratio volatility by adding duration and credit exposure. In the upper right portion of the panel, we can also see the relative factor risks which are mostly skewed to equity and credit risk as we seek to outperform the liability. The lower panel of Figure C5b overlays the projected cash flows of the assets and the liabilities. As can be seen, there is a cash deficit in the short term and a cash surplus around the 25- to 30-year portion of the schedule. This is the direct result of seeking to minimize duration mismatches with only a fraction of the assets and investing the rest in equities. While appearing somewhat counterintuitive, this is the solution that best minimizes funding ratio volatility while seeking to exploit the benefits of growth assets.

Figure C5a: Liability-driven investing - US corporate defined benefit plan
Liability analytics

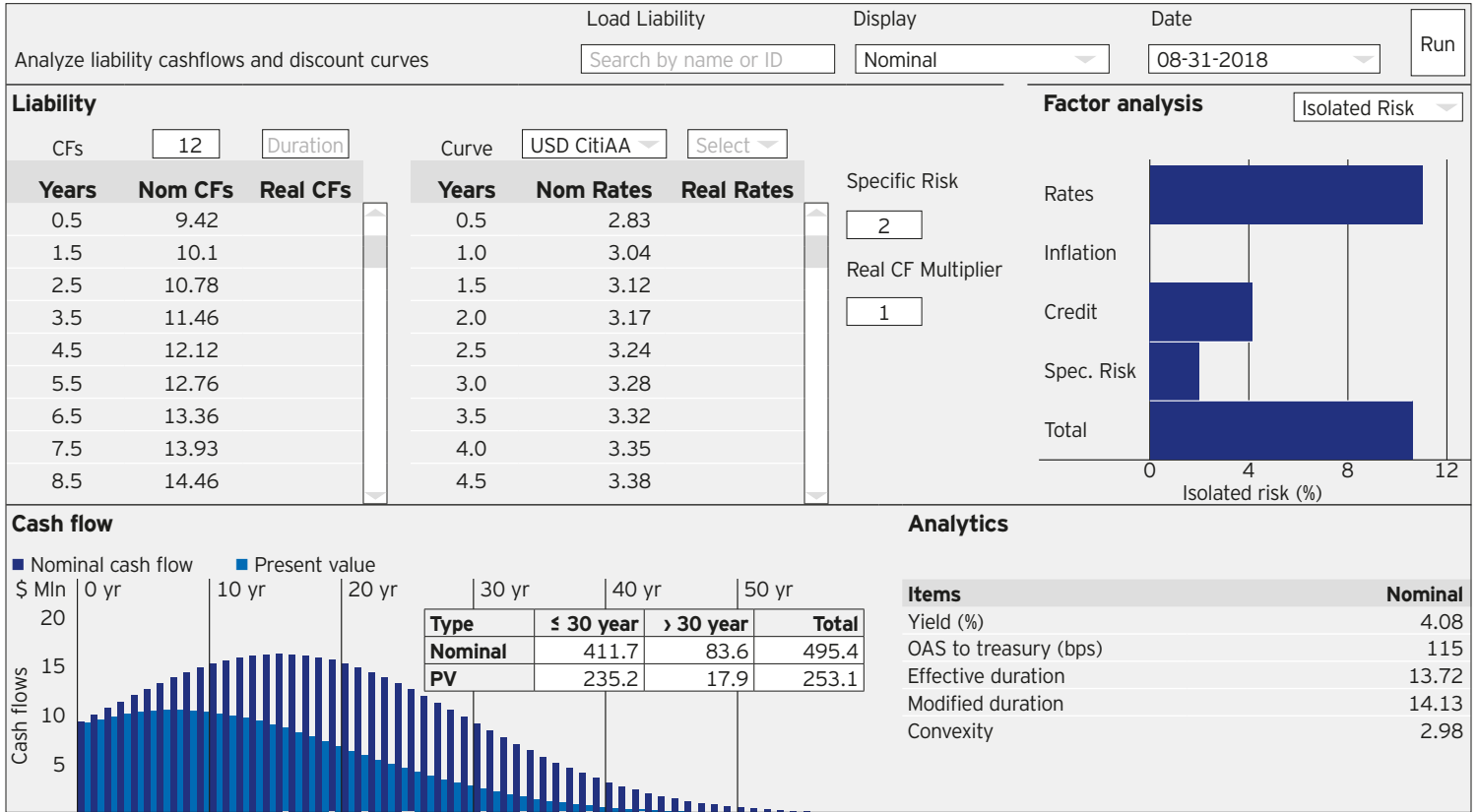
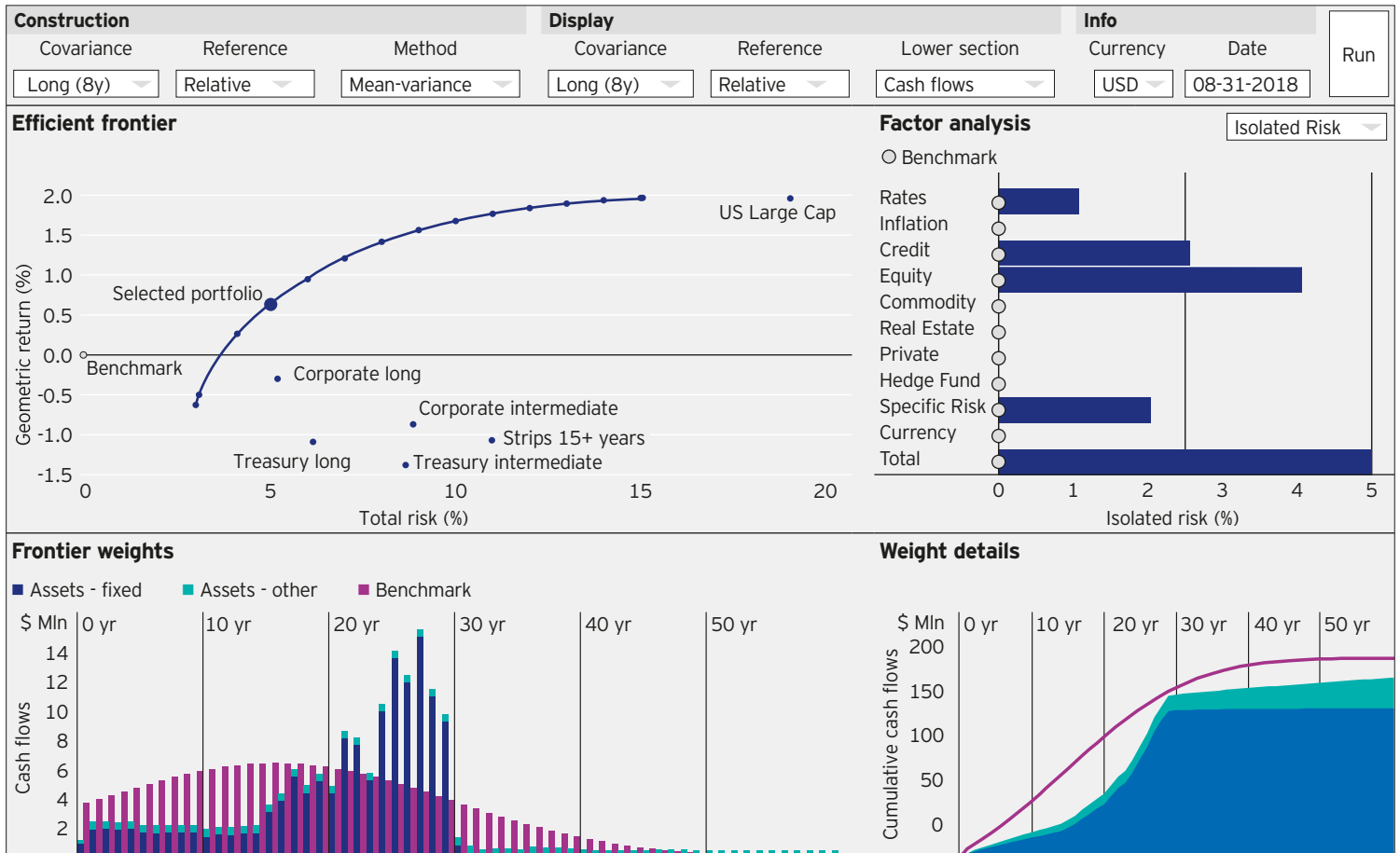


Figure C5b: Liability-driven investing - US corporate defined benefit plan
Liability relative efficient frontier



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