Invesco Vision Case Study 15: Multi-period optimization

Creating portfolios to meet multi-period goals

The goal planning module allows users to create multi-period solutions. Unlike other analyses that entail a constant asset allocation over time, the goal planning module allows for time varying allocations. This is particularly important in the presence of expected inflows or outflows. Once the user has identified the investible universe, they can then define their investment horizon, along with any expected cash inflows and outflows, and select their risk measure of interest. It is important to note that in these types of problems, the distribution of terminal wealth outcomes may be meaningfully different from that of a normal or lognormal distribution, which makes the choice of risk measure particularly important.

Figure C15 presents a specific example where we assume starting capital of $1,000,000 with annual inflows of $300,000 per year for 10 years followed by $300,000 per year outflows for 10 years. The objective in this example is to maximize the expected wealth at the end of 20 years subject to the specified cash flows for various levels of terminal wealth uncertainty. On the asset side, our investment opportunity set includes US large cap equites, non-US developed market equities, US aggregate bonds and cash.

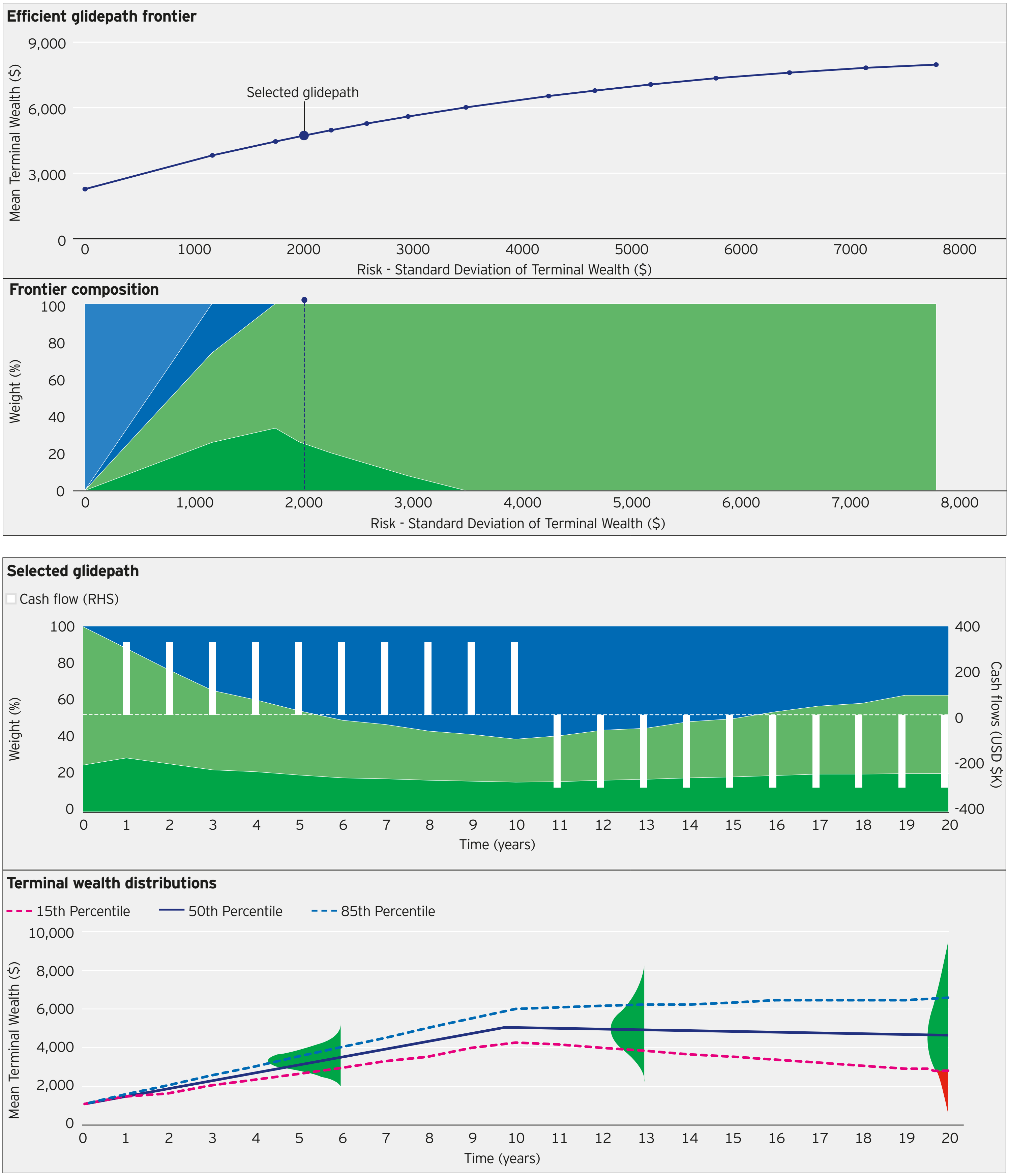
The top panel of Figure C15 demonstrates the resulting frontier in terms of expected terminal wealth and the accompanying volatility in terminal wealth. As we would expect, higher terminal wealth values are associated with more risky outcomes. The second panel shows the composition of the frontier at inception. This is the allocation that would be pursued at the start of the exercise. The third panel goes on to depict the glidepath associated with the selected point on the efficient frontier. This glidepath depicts how the asset allocation should evolve over time to best achieve the desired outcome.

As we examine the glidepath in more detail, there are several things to notice. First, at inception, the glidepath entails an allocation which is identical to the one shown in the second panel. The glidepath can effectively be thought of as a third dimension to the second panel. Second, and most importantly, we notice that the glidepath entails a period of de-risking prior to the cash outflows. This is very much in line with what we recommend as practitioners to an individual approaching retirement. The logic behind this gradual transition is that as we approach retirement and invested capital is increasing, risk needs to be reduced before outflows begin. The optimizer seeks to mitigate the impact of an instance where the retirement period begins with a significant market downturn. Something like this would prove very costly from a terminal wealth perspective. It is preferable to accept greater risk earlier in the investment horizon than at this critical point.

It is also important to notice that while the glidepath illustrates how the allocation is expected to evolve, the realized glidepath may evolve quite differently. Namely, the optimal asset allocations shown represent the average allocations to implement at any particular point in time. Optimal investment weights may follow another glidepath that is a function of actual portfolio value and market conditions through time.

Finally, in the bottom panel of Figure C15, we show the expected wealth distributions through time. The distributions graphically represent the likelihood of the portfolio's value as a function of time and provide intuition on the evolutionary nature of the investment problem.

Figure C15: Multi-period optimization



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