

## 16.2.10 QP Example – Hedge Fund Client

Revisiting the hedge fund client problem from Section 16.2.7, now suppose that the client wished to have a bond index/equity index portfolio with the lowest risk (as measured by variance), based on the same constraints.

Thus, the client has various requirements and constraints:

- Wants a portfolio bases with minimal variability.
- Does not wish to be short equities.
- Wants a minimum investment of 5% in bonds, with a maximum of 40% in bonds.
- Wants “some” equity exposure, but not more than 80%

This is a QP problem with the objective function:

$$\text{Minimise: } Var_{port} = \sigma_1^2 x_1^2 + 2\rho_{1,2}\sigma_1\sigma_2 x_1 x_2 + \sigma_2^2 x_2^2 \quad (16.22)$$

where the  $\sigma$ 's are the bond index return's standard deviation and the equity index return's standard deviation, and  $\rho$  is correlation between the two returns, and the  $x$ 's are the relative investments (fractions) of each.

The constraints are:

$$\begin{aligned} 0.05 &\leq x_1 \leq 0.40 \\ 0.00 &\leq x_2 \leq 0.80 \end{aligned} \quad (16.23)$$

where the second constraint simultaneously incorporates both of the equity index requirements (no short selling  $>0$ , and “must have some” being  $>0$ )

Assume that the bond index and equity index returns SD's are 12% (BIRSD) and 28% (EIRSD), and assume a correlation of 70%.

A solution to this problem can be obtained by using the “Solver” Addin in MS Excel ®. Figure 16.2 – 3 illustrates a spreadsheet.

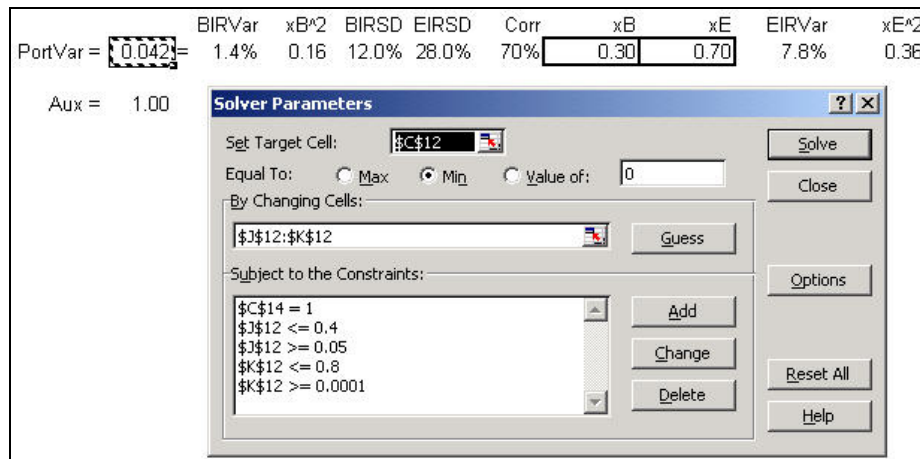


Figure 16.2 – 3. Solver set-up for “minimum risk” asset allocation problem.

The arrangement is very similar to the earlier case, except this is a different objective function, and one that is to be minimised (rather than maximised) and the (Solver) “options” have been set to general (as opposed to “linear”, which is not visible in this image)

The solution of the QP problem is shown in Figure 16.2 – 4.

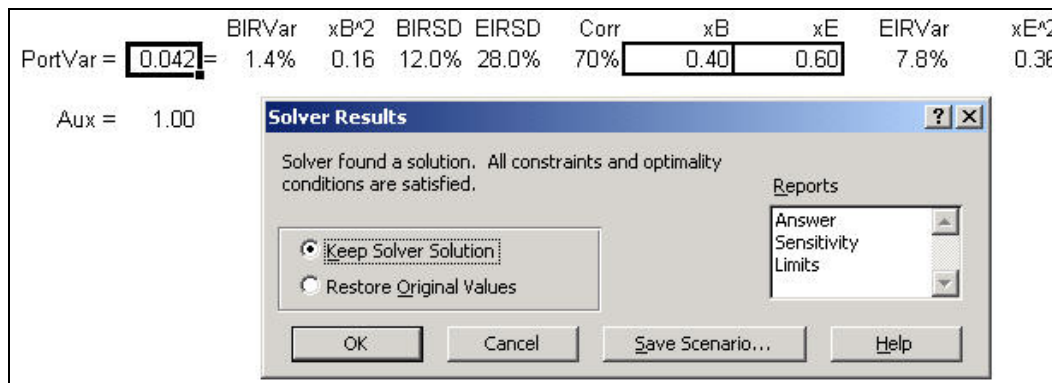


Figure 16.2 – 4. Solver results for “minimum /risk” asset allocation problem.

The “optimal” mix of bonds and equities for this circumstance is 40/60 mix. As might be expected, the optimiser is trying to minimise exposure to equities since they have very much higher variability.