$\vec{w} = \vec{m} + t\,E(r_p)\,\vec{n}$

$\vec{w}$: $(w_1, w_2, \cdots, w_{11})$ 表示这个组合里每个债券的权重

$E(r_p)$: 整个组合的期望收益 $\begin{pmatrix}\vdots\end{pmatrix}$ 11个1

$$\vec{m} = \frac{1}{D}\left[B\cdot(U^{-1}\vec{1}) - A(U^{-1}\vec{r})\right]$$

$$\vec{n} = \frac{1}{D}\left[C\cdot(U^{-1}\vec{r}) - A(U^{-1}\vec{1})\right]$$

$$E(r_p) = \begin{pmatrix} w_1 \\ w_2 \\ \vdots \\ w_{11}\end{pmatrix}(\text{yield}_1, \text{yield}_2 \cdots \text{yield}_{11}) = \vec{w}\cdot\vec{r}^{\,T}$$

$A = \vec{r}^{\,T}U^{-1}\vec{1}$

$B = \vec{r}^{\,T}U^{-1}\vec{r} \Rightarrow \vec{r} = \begin{pmatrix}\text{yield}_1 \\ \text{yield}_2 \\ \vdots \\ \text{yield}_{11}\end{pmatrix}$

$C = \vec{1}^{\,T}U^{-1}\vec{1}$

$D = BC - A^2$

$\vec{1}^{\,T} = (1, 1, \cdots 1)$ 11个1

$\vec{r}^{\,T} = (\text{yield}_1, \text{yield}_2, \cdots \text{yield}_{11})$

$$U^{-1} = \begin{pmatrix} cov_{1,1} & cov_{1,2} & \cdots & cov_{1,11} \\ cov_{2,1} & cov_{2,2} & \cdots & cov_{2,11} \\ \vdots & \vdots & & \vdots \\ cov_{11,1} & cov_{11,2} & \cdots & cov_{11,11}\end{pmatrix}^{-1}$$

$$\Rightarrow \therefore \vec{w} = \vec{m} + \vec{w}\cdot\vec{r}^{\,T}\cdot\vec{n}$$

$$\vec{w} - \vec{w}\cdot\vec{r}^{\,T}\cdot\vec{n} = \vec{m}$$

$$\vec{w}\left(E_{11} - \vec{r}^{\,T}\cdot\vec{n}\right) = \vec{m} \Rightarrow \vec{w} = \boxed{\vec{m}\cdot\left(E_{11} - \vec{r}^{\,T}\cdot\vec{n}\right)^{-1}}$$

$$E_{11} = \begin{pmatrix} 1 & & & \\ & 1 & & \\ & & \ddots & \\ & & & 1\end{pmatrix}$$

主对角为11个1，其余全为0.