SYMBOLS FOR TIME

\( \tau \) = time variable
\( t \) = time now,
\( T \) = target date
\( T^* \) = modeling limit (t=forever)

Cost spent to build variation point \( i \) at time \( \tau \)

\( c_i(\tau) \)

\( i \) = index over variation points
SYMBOLS FOR TIME

\( \tau \) = time variable

\( t \) = time now,

\( T \) = target date

\( T^* \) = modeling limit (\( t=\text{forever} \))

Cost spent to build variation point \( i \) at time \( \tau \)

...adjusted by a factor to account for net present value of money

\[ c_i(\tau)e^{-r(\tau-t)} \]

\( i \) = index over variation points

\( r \) = assumed interest rate
SYMBOLS FOR TIME

\( \tau \) = time variable
\( t \) = time now,
\( T \) = target date
\( T^* \) = modeling limit (t=forever)

Cost spent to build variation point \( i \) at time \( \tau \)

Expected cost summed over all relevant time intervals

\[ E \left[ \sum_{\tau=t}^{T} c_i(\tau) e^{-r(\tau-t)} \right] \]

...adjusted by a factor to account for net present value of money

\( i \) = index over variation points
\( r \) = assumed interest rate
SYMBOLS FOR TIME

\( \tau = \) time variable
\( t = \) time now,
\( T = \) target date
\( T^\star = \) modeling limit \((t=\text{forever})\)

Expected costs of building variation point \( i \) incurred from now until time \( T \)

\[
E \left[ \sum_{\tau=t}^{T} c_i(\tau) e^{-r(\tau-t)} \right]
\]

\( i = \) index over variation points
\( r = \) assumed interest rate
SYMBOLS FOR TIME

τ = time variable

\( t = \) time now,

\( T = \) target date

\( T^* = \) modeling limit (t=forever)

\( X_{i,k}(\tau) \)  
value of variation point \( i \) in product \( k \)
at time \( \tau \)

\( i = \) index over variation points

\( r = \) assumed interest rate

\( k = \) index over products
SYMBOLS FOR TIME

\( \tau \) = time variable
\( t \) = time now,
\( T \) = target date
\( T^* \) = modeling limit (\( t=\)forever)

\( i \) = index over variation points
\( r \) = assumed interest rate
\( k \) = index over products

\( X_{i,k}(\tau) \)

value of variation point \( i \) in product \( k \) at time \( \tau \) = \( VMP_{i,k}(\tau) - MC_{i,k}(\tau) \)

marginal value of the \( i^{th} \) variation point in the \( k^{th} \) product at time \( \tau \).

marginal cost of tailoring variation point \( i \) for use in product \( k \)
SYMBOLS FOR TIME

τ = time variable

\( t \) = time now,

\( T \) = target date

\( T^* \) = modeling limit (t=forever)

\[ X_{i,k}(\tau) e^{-\tau(\tau-t)} \]

value of variation point \( i \) in product \( k \) at time \( \tau \) = \( VMP_{i,k}(\tau) - MC_{i,k}(\tau) \)

marginal value of the \( i^{th} \) variation point in the \( k^{th} \) product at time \( \tau \).

\( i \) = index over variation points

\( r \) = assumed interest rate

\( k \) = index over products

marginal cost of tailoring variation point \( i \) for use in product \( k \)
SYMBOLS FOR TIME
\( \tau = \text{time variable} \)
\( t = \text{time now} \),
\( T = \text{target date} \)
\( T^* = \text{modeling limit (t=forever)} \)

\[ VMP_{i,k}(\tau) = \sum_{\tau=T}^{T^*} X_{i,k}(\tau) e^{-r(\tau-t)} \]

\( i = \text{index over variation points} \)
\( r = \text{assumed interest rate} \)
\( k = \text{index over products} \)

value of variation point \( i \) in product \( k \) at time \( \tau \) ...

summed over all time

...adjusted by a factor to account for net present value of money

marginal value of the \( i^{th} \) variation point in the \( k^{th} \) product at time \( \tau \)

marginal cost of tailoring variation point \( i \) for use in product \( k \)
SYMBOLS FOR TIME
\( \tau \) = time variable
\( t \) = time now,
\( T \) = target date
\( T^* \) = modeling limit (t=forever)

Value cannot be negative

\[
\max(0, \sum_{\tau=T}^{T^*} X_{i,k}(\tau) e^{-r(\tau-t)})
\]

marginal value of the \( i \)th variation point in the \( k \)th product at time \( \tau \).

\( i \) = index over variation points
\( r \) = assumed interest rate
\( k \) = index over products

\( \text{adjusted by a factor to account for net present value of money} \)

...summed over all time

\( \text{marginal cost of tailoring variation point \( i \) for use in product \( k \)} \)
SYMBOLS FOR TIME

\( \tau \) = time variable
\( t \) = time now,
\( T \) = target date
\( T^* \) = modeling limit (t=forever)

\( r \) = assumed interest rate

\( i \) = index over variation points

\( k \) = index over products

\[
\max (0, \sum_{\tau=T}^{T^*} X_{i,k}(\tau) e^{-r(\tau-t)})
\]

value of variation point \( i \) in product \( k \) over all time
SYMBOLS FOR TIME
\( \tau \) = time variable
\( t \) = time now, 
\( T \) = target date
\( T^* \) = modeling limit (t=forever)

\[ E \left[ \sum_k \max \left( 0, \sum_{\tau=T}^{T^*} X_{i,k}(\tau) e^{-r(\tau-t)} \right) \right] \]

value of variation point \( i \) in product \( k \) over all time...
...and over all products

\( i \) = index over variation points
\( r \) = assumed interest rate
\( k \) = index over products
SYMBOLS FOR TIME

$\tau = \text{time variable}$
$t = \text{time now,}$
$T = \text{target date}$
$T^* = \text{modeling limit (t=forever)}$

probability that variation point $i$ will be ready for use by time $T$

value of variation point $i$ in product $k$ over all time...
...and over all products

$i = \text{index over variation points}$
$r = \text{assumed interest rate}$
$k = \text{index over products}$
SYMBOLS FOR TIME

\( \tau = \) time variable  
\( t = \) time now,  
\( T = \) target date  
\( T^* = \) modeling limit (\( t = \) forever)

Expected costs of building variation point \( i \) incurred from now until time \( T \):

\[
-E \left[ \sum_{\tau=t}^{T} c_i(\tau) e^{-r(\tau-t)} \right]
\]

Probability that variation point \( i \) will be ready for use by time \( T \):

\[
+p_{i,T} E\left[ \sum_{k} \max(0, \sum_{\tau=T}^{T^*} X_{i,k}(\tau) e^{-r(\tau-t)}) \right]
\]

Value of variation point \( i \) in product \( k \) over all time...

...and over all products

\( i = \) index over variation points  
\( r = \) assumed interest rate  
\( k = \) index over products
SYMBOLS FOR TIME

\( \tau \) = time variable
\( t = \) time now,
\( T = \) target date
\( T^* = \) modeling limit (t=forever)

Expected costs of building variation point \( i \) incurred from now until time \( T \)

\[
\max \left( 0, -E \left[ \sum_{\tau=t}^{T} c_i(\tau) e^{-r(\tau-t)} \right] \right)
\]

Value cannot be negative

\[
+ p_{i,T} E \left[ \sum_{k} \max \left( 0, \sum_{\tau=T}^{T^*} X_{i,k}(\tau) e^{-r(\tau-t)} \right) \right]
\]

probability that variation point \( i \) will be ready for use by time \( T \)

value of variation point \( i \) in product \( k \) over all time...

...and over all products

\( i = \) index over variation points
\( r = \) assumed interest rate
\( k = \) index over products
**SYMBOLS FOR TIME**

- \( \tau \) = time variable
- \( t \) = time now,
- \( T \) = target date
- \( T^* \) = modeling limit (t=forever)

**Value of variation point \( i \) over the time interval \((t, T)\)**

\[
v_i(t, T) = \max(0, -E \left[ \sum_{\tau=t}^{T} c_i(\tau)e^{-r(\tau-t)} \right] + p_i,T E\left[ \sum_{k} \max(0, \sum_{\tau=T}^{T^*} X_{i,k}(\tau)e^{-r(\tau-t)}) \right])
\]

- Probability that variation point \( i \) will be ready for use by time \( T \)
- Value cannot be negative

**Expected costs of building variation point \( i \) incurred from now until time \( T \)**

- Value of variation point \( i \) in product \( k \) over all time...
- ...and over all products

\( i \) = index over variation points
\( r \) = assumed interest rate
\( k \) = index over products
SYMBOLS FOR TIME

$\tau =$ time variable
$t =$ time now,
$T =$ target date
$T^* =$ modeling limit (t=forever)

Value of variation point $i$ over the time interval $(t,T)$

\[
v_i(t,T) = \max(0, -E\left[\sum_{\tau=t}^{T} c_i(\tau) e^{-r(\tau-t)}\right])
\]

Probability that variation point $i$ will be ready for use by time $T$

Value cannot be negative

Expected value over all products

\[
V = \sum_{i=1}^{\text{num variation points}} v_i(t,T)
\]

Value of variation point $i$ in product $k$ at time $\tau$

\[
VMP_{i,k}(\tau) = \frac{\text{margin value of the } i^{th} \text{ variation point in the } k^{th} \text{ product at time } \tau}{\text{potential cost of use}}
\]

Marginal value of the $i^{th}$ variation point in the $k^{th}$ product at time $\tau$.

Marginal cost of tailoring variation point $i$ for use in product $k$

Value cannot be negative

Cost spent to build a variation point at time $\tau$

Expected cost summed over all relevant time intervals

...adjusted by a factor to account for net present value of money

Summed over all time

$i =$ index over variation points
$r =$ assumed interest rate
$k =$ index over products