

## FORMULAS

**MOVING AVERAGE** (spend a fixed percentage of the average market value over a set time period)

$$\text{Spending Rate}_t \times [ (\text{Ending market value}_{t-1} + \text{Ending market value}_{t-2} + \text{Ending market value}_{t-3} \dots) / \text{Time Period} ] = \text{Spending}_t$$

**CONSTANT GROWTH** (increase spending each year by a constant growth rate or inflation)

$$\text{Spending}_{t-1} \times (1 + \text{Consumer Price Index}_{\text{YoY \% change}}) = \text{Spending}_t$$

**WITH BANDS** (spending is contained within a range of +/- a percentage of previous year's market value)

If Spending is < Floor, Spending = Floor; If Spending is > Cap, Spending = Cap

**GEOMETRIC** (weight given to inflation adjusted spending and target spending of market value)

$$\text{Smoothing Rate} \times [\text{Spending}_{t-1} \times (1 + \text{Consumer Price Index}_{\text{YoY \% change}})] + (1 - \text{Smoothing Rate}) \times (\text{Target Spending Rate} \times \text{Ending Market Value}_{t-1}) = \text{Spending}_t$$

**HYBRID** (custom combination of spending rules to meet the specific needs of an institution)

t: time; YoY: Year-over-Year

## REFERENCES

(A) 2015 Spending<sub>t-1</sub> (\$): \_\_\_\_\_ (B) Target Spending Rate: \_\_\_\_\_%

(C) 2016 Budgeted Spending: \_\_\_\_\_ (D) Smoothing Rate: 0.7 (or 70%) is common  
Weight given to inflation adjusted spending

(E) Portfolio Ending Market Value:

2015 (t-1)	2014 (t-2)	2013 (t-3)	2012 (t-4)
2011 (t-5)	2010 (t-6)	2009 (t-7)	

(F) Spending not to drop below (floor): \_\_\_\_\_ % x  $\frac{\text{Ending Market Value}_{t-1}}{\text{Line E}}$  = \_\_\_\_\_ Spending Floor (\$)

(G) Spending not to exceed (cap): \_\_\_\_\_ % x  $\frac{\text{Ending Market Value}_{t-1}}{\text{Line E}}$  = \_\_\_\_\_ Spending Cap (\$)

(H) Core Consumer Price Index (CPI)<sub>YoY % change</sub> \_\_\_\_\_ 0.021 (or 2.1%)<sup>1</sup>

<sup>1</sup> Bureau of Labor Statistics; As of December 31, 2015

## MOVING AVERAGE

(M1) Calculate the average portfolio value over specified time period:

$$\frac{\text{Sum of line E (over 3, 5, or 7 years)}}{\text{Time Period (3, 5, or 7 years)}} = \text{Average Portfolio Value}$$

(M2) Calculate spending:  $\frac{\text{Average Portfolio Value}}{\text{Line M1}} \times \frac{\text{Target Spending Rate}}{\text{Line B}} = \text{Spending}_t$

## CONSTANT GROWTH

(C1) Calculate spending:  $\frac{\text{Spending}_{t-1}}{\text{Line A}} \times (1 + \frac{\text{CPI}_{\text{YoY \% change}}}{\text{Line H}}) = \text{Spending}_t$

## WITH BANDS

(B1) Verify spending falls within bands:  $\frac{\text{Floor (\$)}}{\text{Line F}} < \frac{\text{Spending}_t}{\text{Line C1}} < \frac{\text{Cap (\$)}}{\text{Line G}}$

(B2) Adjust spending: if  $\text{Spending}_t < \text{Floor (\$)}$ ,  $\text{Spending} = \text{Floor (\$)}$   
if  $\text{Spending}_t > \text{Cap (\$)}$ ,  $\text{Spending} = \text{Cap (\$)}$   $\frac{\text{Adjusted Spending}_t (\text{Line C1 if Unadjusted})}{\text{Line C1}}$

## GEOMETRIC

(G1) Adjust for inflation:  $\frac{\text{Smoothing Rate}}{\text{Line D}} \times [ \frac{\text{Spending}_{t-1}}{\text{Line A}} (1 + \frac{\text{CPI}_{\text{YoY \% change}}}{\text{Line H}}) ] = \text{Inflation-Adjusted Spending}$

(G2) Calculate target -weighted spending:  $(1 - \frac{\text{Smoothing Rate}}{\text{Line D}}) \times ( \frac{\text{Spending Rate}}{\text{Line B}} \times \frac{\text{Ending Market Value}_{t-1}}{\text{Line E}} ) = \text{Target-Weighted Spending}$

(G3) Calculate spending:  $\frac{\text{Line G1}}{\text{Line G1}} + \frac{\text{Line G2}}{\text{Line G2}} = \text{Spending}_t$

## PROJECTED SPENDING<sub>t</sub>:

Moving Average	Constant Growth	With Bands	Geometric	2016 Budgeted Spending
Line M2	Line C1	Line B2	Line G3	Reference Line C

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