# Scaling and Stabilizing the Brown LES Trend for Annualized Prediction

## 1. Understanding \( b\_t \) in Context

In Brown’s Double Exponential Smoothing (LES), the trend estimate \( b\_t \) represents the filtered trend over a defined smoothing window of \( MyFilterRate \) samples. This means it already includes some level of noise reduction. However, direct usage of \( b\_t \) does not provide a standardized measure across different filter rates or time periods.

## 2. Scaling \( b\_t \) to an Annualized Value

To ensure comparability across different filter rates, we need to scale the trend to a one-year period. Given that \( b\_t \) is averaged over \( MyFilterRate \) samples, the appropriate scaling factor is:

f\_{scale} = \frac{f\_s}{MyFilterRate}

where:

- \( f\_s \) = total samples per year (e.g., 252 for daily trading, 52 for weekly data).

- \( MyFilterRate \) = number of samples in the smoothing window.

Thus, the annualized trend estimate is computed as:

b\_{annual} = b\_t \times f\_{scale} = b\_t \times \frac{f\_s}{MyFilterRate}

## 3. Volatility Correction (Optional but Recommended)

Even though \( b\_t \) is smoothed, short-term fluctuations may still persist. To reduce sensitivity to these variations, a volatility-based correction is applied using an exponentially weighted standard deviation:

σ\_t = \sqrt{\alpha \sum\_{i=1}^{n} (b\_i - \bar{b})^2}

where:

- \( \bar{b} \) is the long-term average trend.

- \( \alpha \) is the smoothing factor.

To further stabilize the annualized trend, the following adjustment is used:

b\_{adjusted} = \frac{b\_{annual}}{1 + \frac{σ\_t}{\bar{b} + \epsilon}}

where \( \epsilon \) is a small constant to prevent division by zero. This correction ensures that high short-term volatility does not overly impact the long-term trend estimate.

## 4. Final Formula: Stable Annualized Trend

To further smooth out short-term noise, a rolling average is applied over the past \( N \) samples:

b\_{stable} = \frac{1}{N} \sum\_{t=T-N}^{T} \left( \frac{b\_t \times \frac{f\_s}{MyFilterRate}}{1 + \frac{σ\_t}{\bar{b} + \epsilon}} \right)

where:

- \( N \) is the number of past samples to average (e.g., 30 days).

- This ensures the final trend estimate is stable, annualized, and corrected for volatility.

## 5. Conclusion

This method provides a reliable approach for generating a stable and volatility-adjusted annualized trend from Brown’s LES. By scaling \( b\_t \) based on the filter rate and applying volatility correction, we achieve a trend estimate that is independent of the smoothing window while being resilient to short-term fluctuations.