**SERT Scenario Methodology**

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If you use a simple discretization, like the one employed by the AIRG, then your expectation would be met: SERT #9 would trend towards the target Yield curve.  However, that approach would also produce discrepancies in the simulated results because that is not an accurate representation of the integral of these stochastic equations.  Those issues would be particularly problematic over the type of long runs (i.e. 100 years) that we are doing for the NAIC.

Instead, we use our knowledge of the Kernel function to map the underlying unit normals that we start the simulation process with to the true distribution for each stochastic equation.  This process, which is similar to how we convert to any other distribution (e.g. lognormal, Poisson), means that the 0 shock will actually get mapped to the conditional median.  That is, the value for each State variable for month T+1 will be the median of their expected values based on the projected value for month T.  You can see that in the chart below for the first State variable.  (Note: The solid line reflects the values for SERT #9.  The slightly jagged line reflects the median value across the full 10k.)



That leads us to the final difference: medians don't add.  Specifically, while each step will go to the conditional median, that doesn't mean that the final answer will match the median of the stochastic distribution.  A simple example would be the equity model: the median result for each month is no jumps, but the median result for our 100 year simulation will include several of them.  In particular, this difference is likely to be more pronounced when the reference variable is more volatile.  In the current Treasury model's calibration, those are the other two State variables.  The chart below shows the same comparison for the third State variable.  In the early periods, we don't have a ton of variability, so SERT #9 aligns with the median.  However, over time, the slow mean reversion leads to larger and larger cross-sectional volatility which, ultimately, leads to a gap between the two.



One final note: these same items are present in the current AIRG.  The graph below compares the 20-Year Yield for the December 2020 to the Average and Median a full 10k scenario simulation.  As you can see, the SERT scenario is below both measures.  The reason the gap seems much bigger with the GEMS scenarios are more volatile.  The associated percentiles are fairly close: around 45% for the AIRG and a little above 40% for GEMS.

