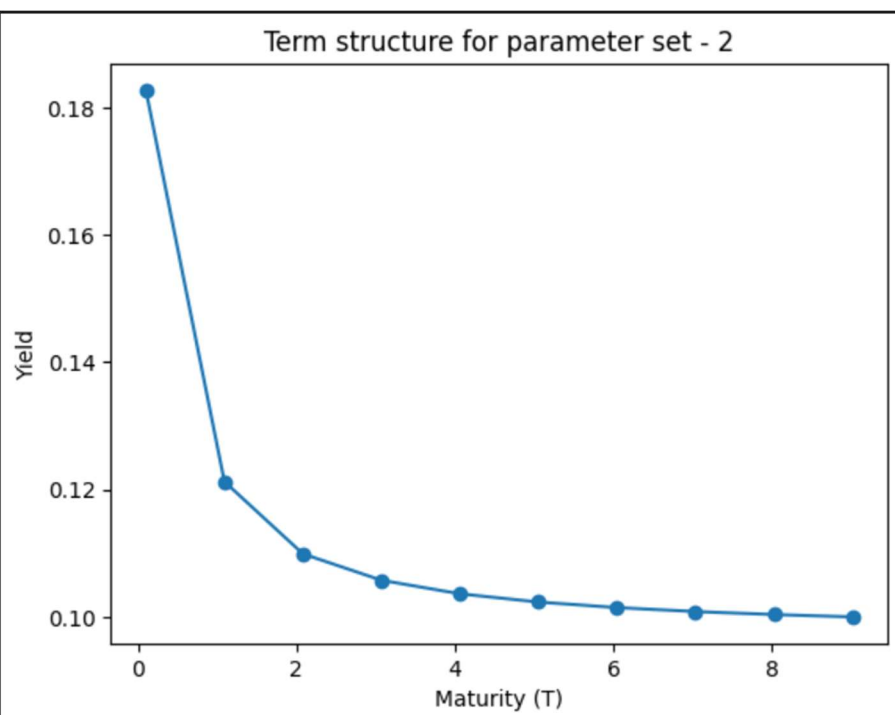
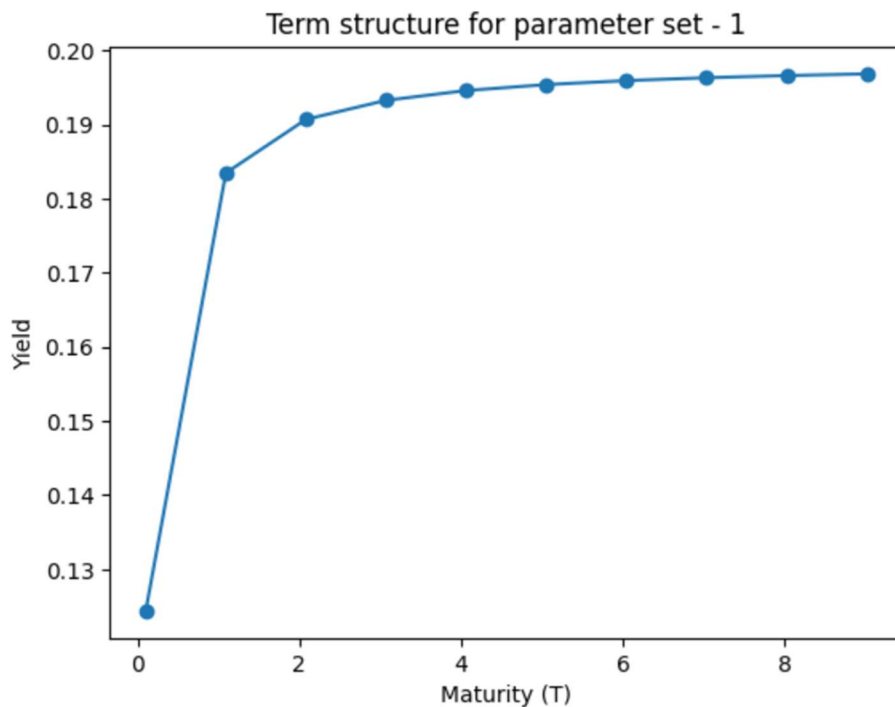


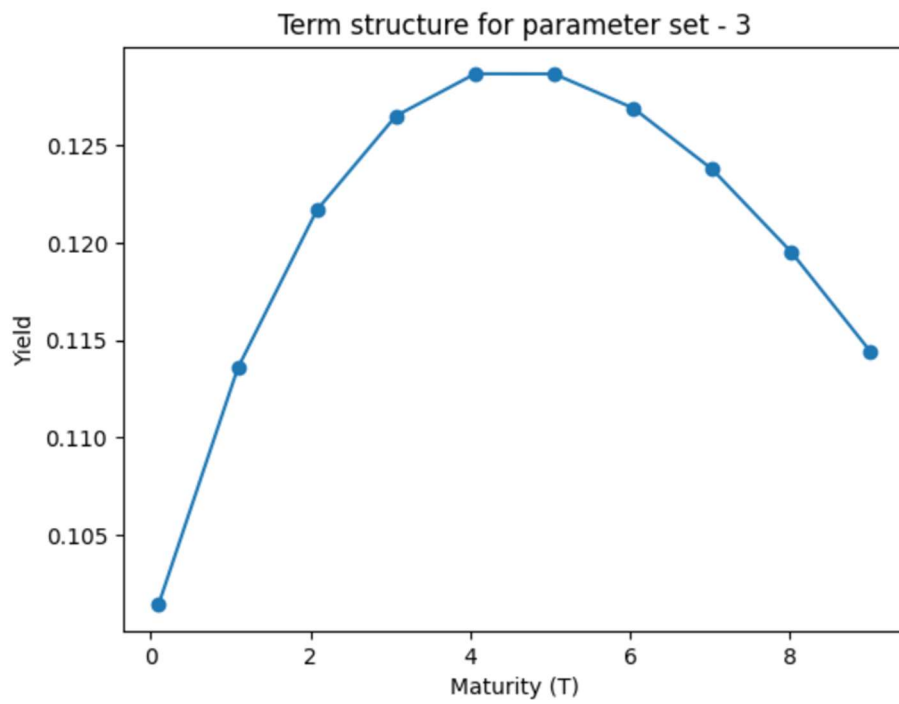
Karan Garg - 210123076

1. Consider the Vasicek model

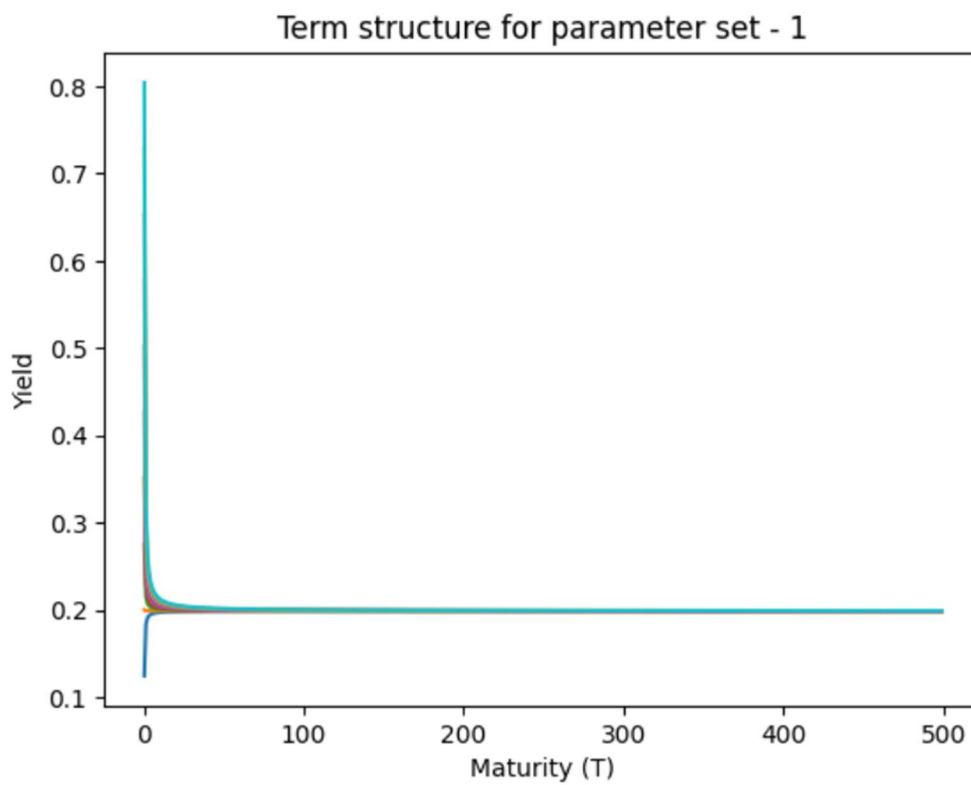
$$dr = \beta(\mu - r)dt + \sigma dW^Q.$$

For the three parameter sets $[\beta, \mu, \sigma, r(0)]$ given by $[5.9, 0.2, 0.3, 0.1]$, $[3.9, 0.1, 0.3, 0.2]$ and $[0.1, 0.4, 0.11, 0.1]$, plot the term structure up to 10 time units. Now for each of the three parameter sets, plot yield curves versus maturity up to 500 time units for ten different values of $r(0)$.

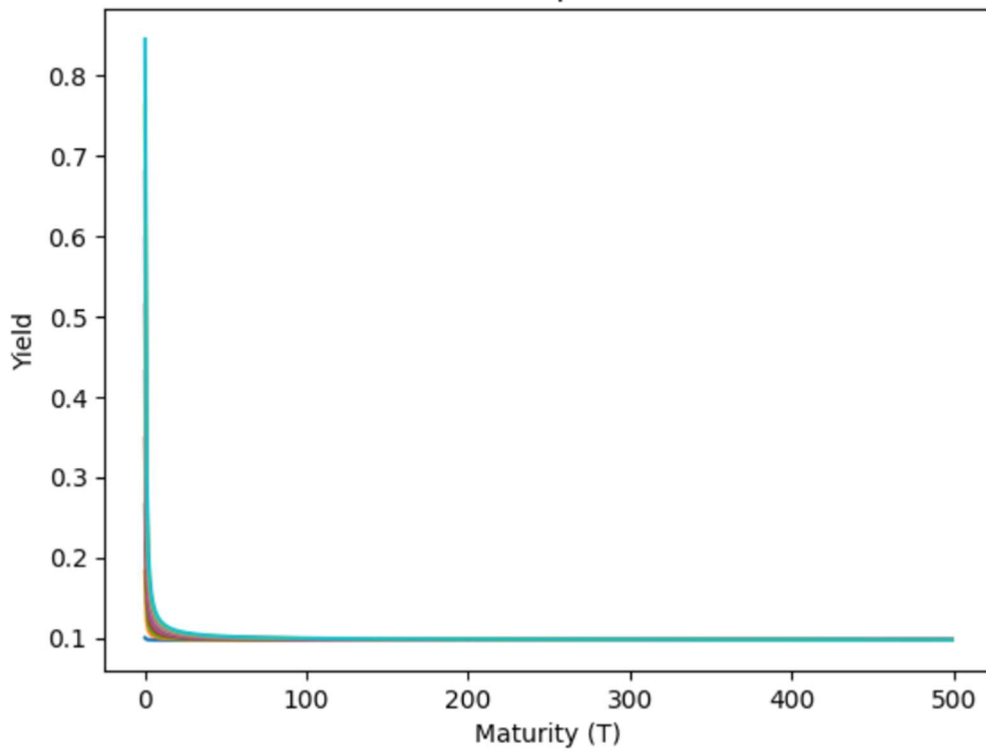
Term Structure for respective parameters:



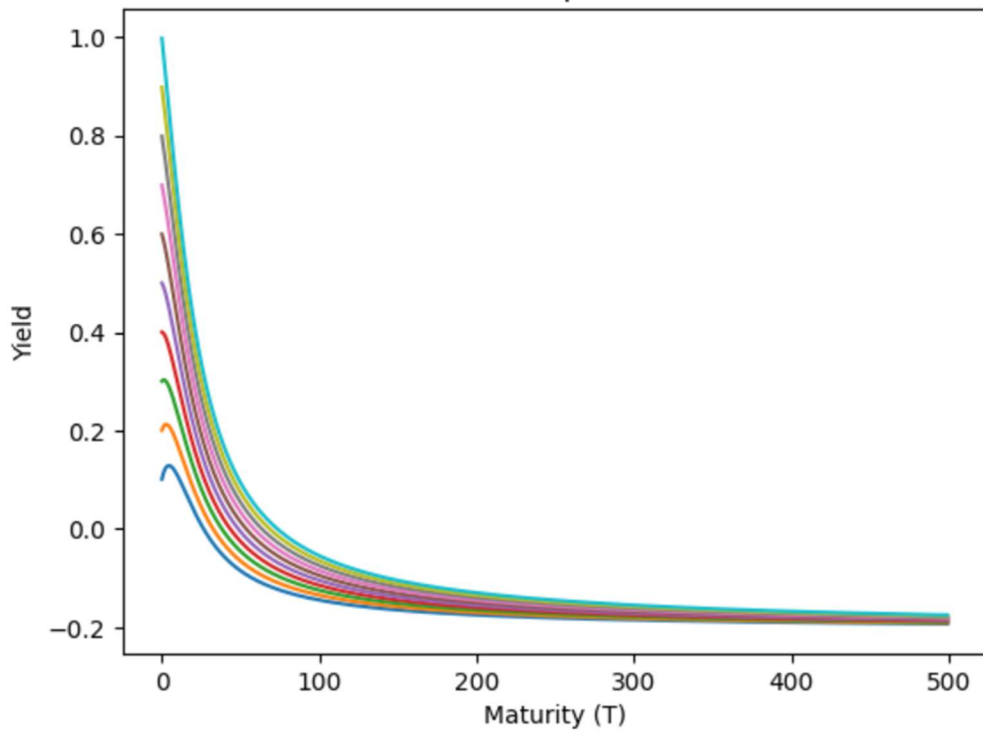
2) Plots for 500 time steps and 10 value of $r(0)$:



Term structure for parameter set - 2



Term structure for parameter set - 3



Observations:

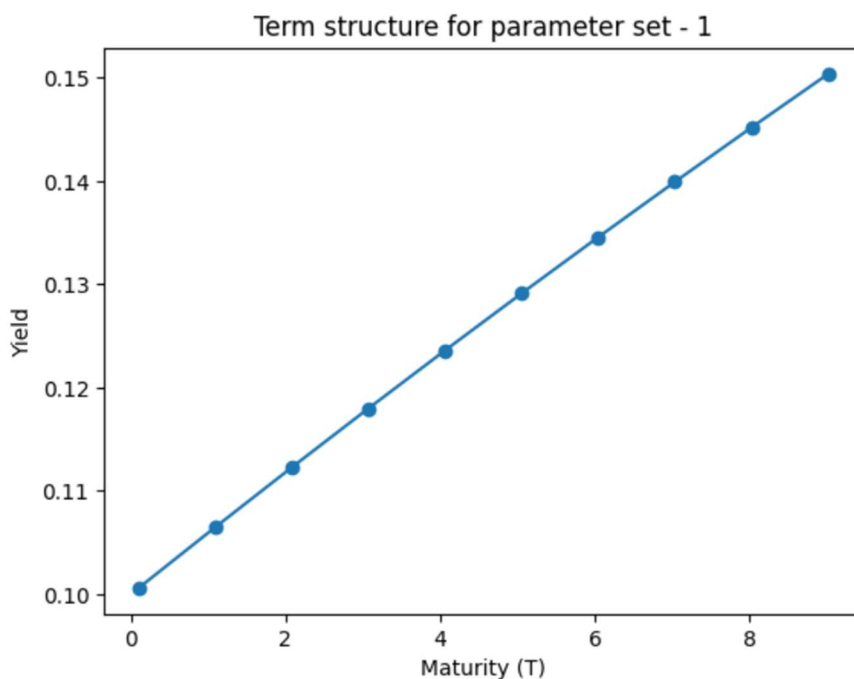
1. The yield of the bond price converges to a particular value as the maturity period is increased to sufficiently high value, irrespective of the value of $r(0)$ taken.
2. The term structure of parameters set for 10 time units show strikingly different behaviour. For the first parameter set, the yield increases and then converges. For the second one, the yield decreases and then converges, while for the last one, the yield curve has a “hump” in it.
3. The phenomenon of mean reversion is observed since high interest rate has negative trend while the low interest rate has a positive trend to the reversion level. This is due to the fact that the Vasicek Model incorporates mean reversion.
4. In the third set of parameters, yield gradually becomes zero in long term, which is highly undesirable scenario.

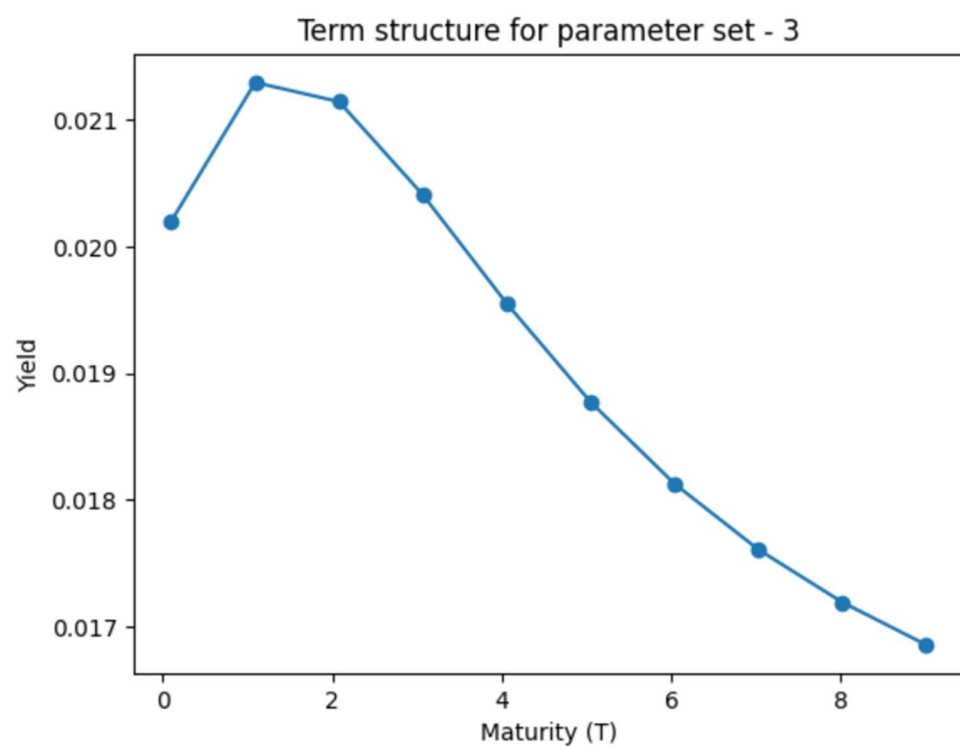
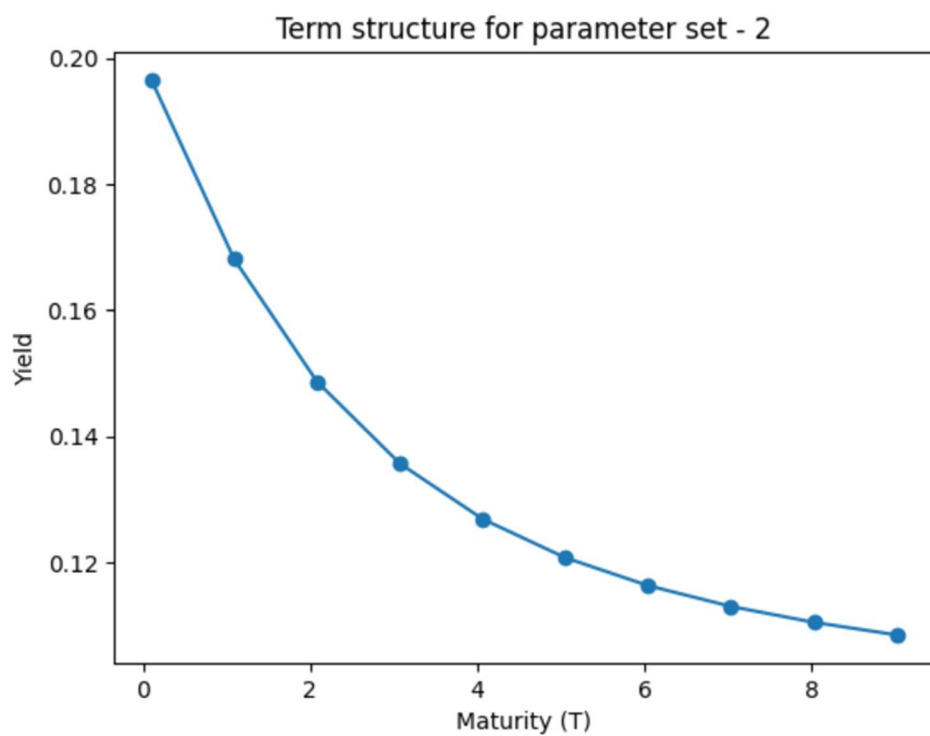
2. Consider the CIR model

$$dr = \beta(\mu - r)dt + \sigma\sqrt{r}dW^Q.$$

For the three parameter sets $[\beta, \mu, \sigma, r(0)]$ given by $[0.02, 0.7, 0.02, 0.1]$, $[0.7, 0.1, 0.3, 0.2]$ and $[0.06, 0.09, 0.5, 0.02]$, plot the term structure up to 10 time units. For the parameter set $[\beta, \mu, \sigma]$ given by $[0.02, 0.7, 0.02]$ and with $r(0) = 0.1 : 0.1 : 1$, plot yield curves versus maturity for 600 time units.

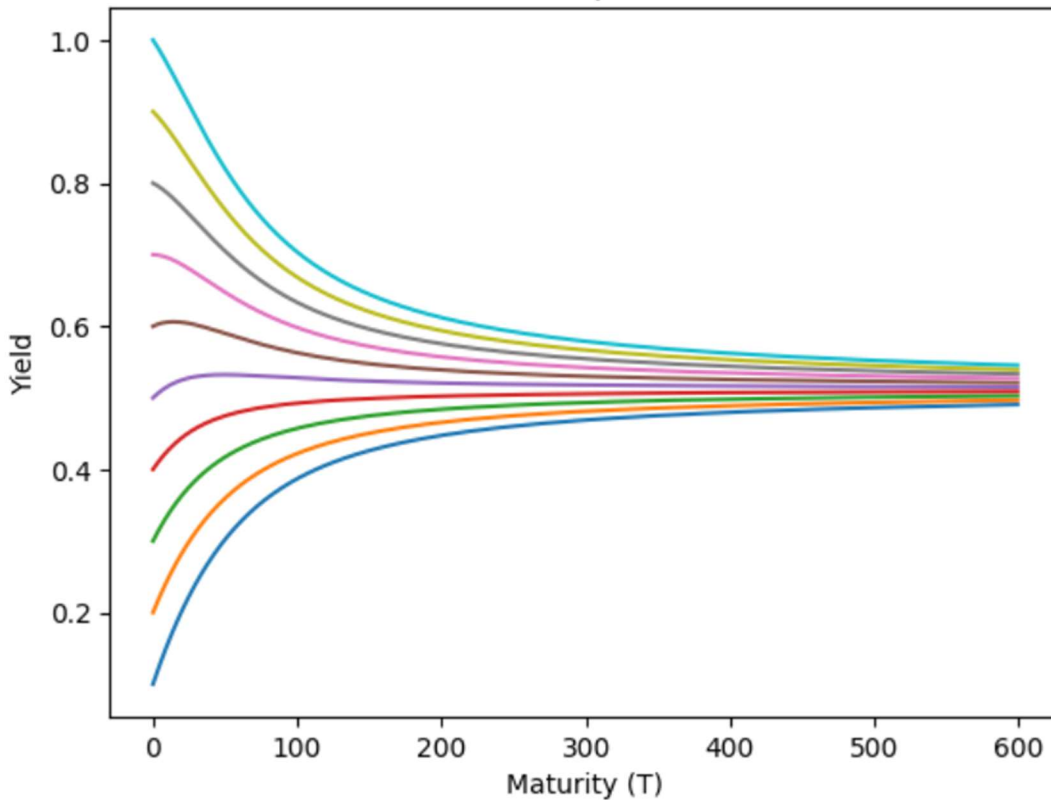
The plots with given parameters:





2)

Term structure for parameter set - 1



Observations:

- The yield of the bond price converges to a particular value as the maturity period is increased to sufficiently high value, irrespective of the value of $r(0)$ taken.
- The term structure of parameters set for 10 time units show strikingly different behaviour. For the first parameter set, the yield increases and then converges. For the second one, the yield decreases and then converges, while for the last one, the yield curve has a “hump” in it.
- The phenomenon of mean reversion from the plots is observed. This is due to the fact that the model assumes mean reversion towards a long-term normal interest rate level.