Given $\theta - \hat{\theta} \approx \hat{\theta} - \hat{\theta}^b$

$\Rightarrow \theta \approx 2\hat{\theta} - \hat{\theta}^b$ with some simple algebra

From percentile bootstrap, $\hat{\theta}^b$ with a 1-a confidence level has a CI of $\left(q_{\frac{\alpha}{2}}, q_{1-\frac{\alpha}{2}}\right)$.

In the 2nd line, $\hat{\theta}$ from the initial sample is fixed, and variation in $\hat{\theta}^b$ can be represented by the CI. Ensuring LB and UB are the min and max elements of the CI, $2\hat{\theta} - \hat{\theta}^b$ has a CI of $\left(2\hat{\theta} - q_{1-\frac{\alpha}{2}}, 2\hat{\theta} - q_{\frac{\alpha}{2}}\right)$.