**Sobol QMC vs MC for valuing 30year LPI with the Jarrow Yildirim model**

The Limited Price Indexation or LPI inflation derivative market is important for hedging pension liabilities out to 30 years and beyond. LPI can be thought of as a RPI collared between 0% and 5% and compounded. In the past year there have been several deals of size greater than £500 000 per basis point.

One model for valuing inflation derivatives such as LPI is that of Jarrow and Yildirim[1]. This is essentially a multicurrency HJM type model with real and nominal Sterling viewed as two currencies and the inflation index as the exchange rate.

Consider valuing a 30y LPI zero coupon swap as a spread to an RPI swap using Jarrow Yildirim with a single factor for each of the three variables (nominal rates, real rates and the inflation index). As LPI is path dependent, we need to simulate nominal rates, real rates and inflation for at annual intervals for 30 years. This pricing problem, being of 90-dimensions, converges slowly when conventional Monte Carlo is used (in this case with the Mersenne Twister algorithm). After 50 000 iterations there is a standard deviation in the estimate of 0.05 basis points. By comparison using a 90-dimensional Sobol' sequence with a quasi Monte Carlo approach prices the liability to within 0.02 basis points after 10 000 iterations (see chart below). The computing time per iteration is approximately the same for both approaches.

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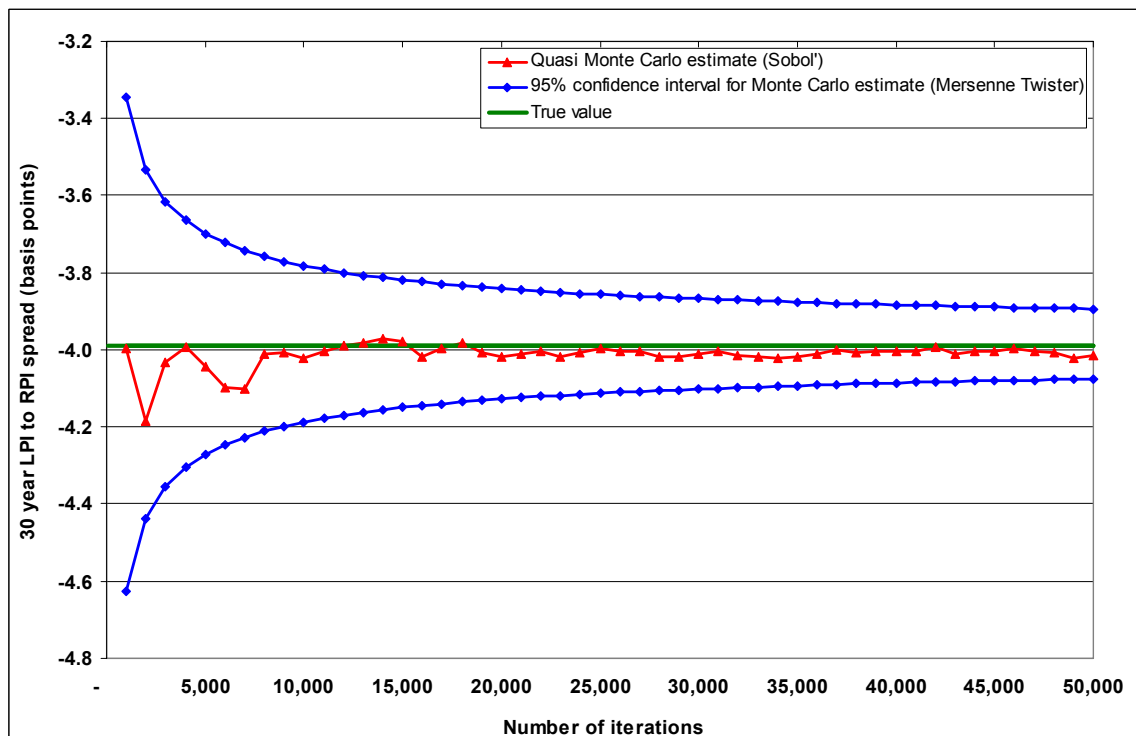
[1] R. Jarrow and Y. Yildirim. Pricing Treasury Inflation Protected Securities and related derivatives using an HJM model. Journal of Financial and Quantitative Analysis, 38(2):337–359, 2003