In this paper the main question addressed is whether the Solvency Capital Requirement (SCR) of interest rate risk in Solvency II is really sufficient to protect the insurer against interest rate risk in one year from now with a 99.5% probability. There are several reasons to question the sufficiency of the SCR in Solvency II, of which two of them are treated in this paper. First, the SCR in Solvency II is derived using future interest rate shocks that are near-parallel to the current term structure of interest rates. However, non-parallel future interest rate shocks are observed in recent historical data. Therefore, it is analyzed whether non-parallel shocks lead to significant different capital requirements for different products and portfolios. Second, the SCR in Solvency II is only calculated over the best estimate liabilities. The risk margin is not taken into account. To analyze whether excluding this risk margin still leads to a sufficient SCR for interest rate risk, the impact of interest rate risk on the risk margin is also analyzed.

For both analyses a new parsimonious method is introduced that simulates future term structures that are not necessarily near-parallel to the current term structure of interest rates. The method makes use of cubic Hermite splines interpolation and Smith-Wilson extrapolation. It is able to produce a wide range of realistic term structure shapes, provides a good fit, is relatively easy and fast to implement and is user defined. The methodology is calibrated to the QIS5 technical specifications and future term structures are simulated. These simulated term structures are applied to cash flow patterns corresponding to different products and portfolios in order to derive the SCR of interest rate risk based on both the best estimate liability and the risk margin.

From this analysis it follows that the question whether the SCR of interest rate risk in Solvency II is sufficient or not to protect the insurer against interest rate risk does have an ambiguous answer. It can both be the case that Solvency II overestimates the capital required or that the SCR is insufficient. Both incorporating non-parallel shocks and incorporating interest rate risk in the risk margin can have a material impact on the SCR. The difference between the SCR in Solvency II and the simulated new SCR in this paper is mainly caused by the correlation present between the interest rates. This correlation determines the overall magnitude of the future term structure shocks and the variability in the shapes of these shocks. Based on the main conclusions of this paper an insurance company can choose to recalculate the SCR it should hold using the methodology proposed and evaluate whether it should hold more or less capital than imposed by Solvency II. Using these results the insurer can opt for an internal model. When opting for an internal model, the insurer should keep in mind that the correlation assumed the model plays a crucial role.

Keywords: Solvency II, QIS5 technical specifications, Interest rate risk, Solvency Capital Requirement, Risk margin, Cubic Hermite splines, Smith-Wilson extrapolation, Correlation Internal model