# SINGLE-PERIOD RORAC OPTIMIZATION IN A DYNAMIC ASSET/LIABILITY CONTEXT

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This work investigates the single-period RORAC (return on risk adjusted capital) based optimal allocation in enterprises with different business segments in a dynamic asset/liability. The investigated capital allocation model is extended by the constraint that the risk capital, which "*is an estimate of the amount of equity an enterprise needs to cover the potential losses generated by its businesses*" [1, p. 3001], has to be covered by the equity (equity constraint). Due to the dynamic asset/liability the financing of the optimal capital allocation has to be regarded. In a simulation analysis of the optimal capital allocation model in a value based portfolio framework the impact of the extension of the single-period RORAC based optimal capital allocation is shown.

## INTRODUCTION

In enterprises with different business segments a task of the general management is the capital allocation into the different business segments. Buch, Dorfleitner and Wimmer [1] use a single period RORAC optimizing problem for optimally allocating the capital into the different business segments. In this work the RORAC optimization problem is extended by the equity constraint. Buch, Dorfleitner and Wimmer [1] mention this constraint: "… the available economic capital of the firm is unlimited. In fact, however, a natural limit for the economic capital is given by the amount of equity in each period." (p. 3005). They consider this constraint by an extension of their optimization strategy with a risk limit. In this work the constraint is taken into consideration in the optimization.

Furthermore, in this work the impact of the equity constraint in the optimization problem is investigated in a dynamic asset/liability context. Due to the dynamic asset/liability context a financing strategy for the optimal capital allocations into the different business segments of the enterprise has to be regarded. In this work for simplicity a single period debt financing of the optimal capital allocations is assumed.

The model constructed in this work is addressed in a value based portfolio framework where the profits of the business segments as normally distributed random variables. In the dynamic set-up the realized profits of the business segments are simulated according to the pathwise simulation approach. In each path first the capital allocations are optimized in each period and then in the next period the information of the realized

profits of the business segments, which depend on the optimal capital allocation, is revealed.

In the model a negative equity caused by higher debts to repay than the sum of the profits of the business segments leads to a drop out caused by over indebtedness. Figure 1 shows the development of the equity in the first two simulation paths. The equity in the first simulation path presented by the black circles grows up to 551.04 in period (7; 8) and decreases to 370.66 in the last period. The cause of this development is that the realized returns of the business segments are less than the risk premium of the debts, thus the single-period debts in period (8; 9) increase more than the amounts of capital in the business segments. In the second simulation path presented by the red triangles the enterprise fails in period (3; 4) caused by over indebtedness.

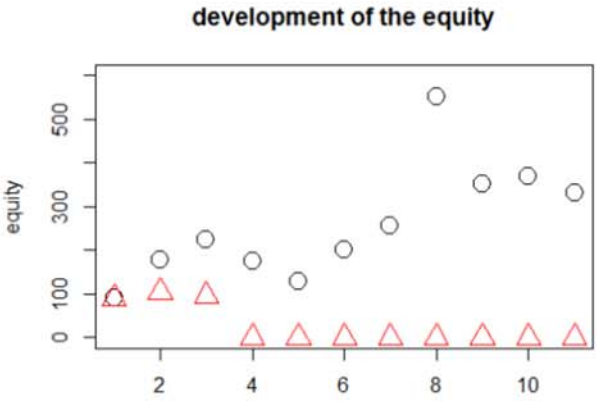


**Figure 1** development of the equity of the first path (black dots) and the second path (red triangles)

## CONCLUSION

In this work the stochastic enterprise model for RORAC based optimal capital allocation by Buch, Dorfleitner and Wimmer [1] is extended by the equity constraint. For analyzing the impact of the extension of the RORAC optimization not only the capital allocation also the financing of the capital allocation is regarded. For simplicity the financing of the optimal capital allocation is assumed single-period debt financing. The simulation analysis of the dynamic stochastic enterprise model in a value based portfolio framework shows inter alia that despite an optimal capital allocation in about a quarter of the simulation path the enterprise fails caused by over indebtedness. It is subject to further research to model intertemporal optimization strategies as well as regarding different financing strategies.

## REFERENCES

[1] A. Buch, G. Dorfleitner, M. Wimmer, *Risk capital allocation for RORAC optimization*. Journal of Banking and Finance, Vol. 35, Issue 11: 3001-3009, 2011