

Eisenberg, Julia; Krühner, Paul

The impact of negative interest rates on optimal capital injections. (English) Zbl 1416.91172
Insur. Math. Econ. 82, 1-10 (2018).

Summary: In the present paper, we investigate the optimal capital injection behaviour of an insurance company if the interest rate is allowed to become negative. The surplus process of the considered insurance entity is assumed to follow a Brownian motion with drift. The changes in the interest rate are described via a Markov-switching process. It turns out that in times with a positive rate, it is optimal to inject capital only if the company becomes insolvent. However, if the rate is negative it might be optimal to hold a strictly positive reserve. We establish an algorithm for finding the value function and the optimal strategy, which is proved to be of barrier type. Using the iteration argument, we show that the value function solves the Hamilton-Jacobi-Bellman equation, corresponding to the problem.

MSC:

- 91B30 Risk theory, insurance (MSC2010)
- 93E20 Optimal stochastic control
- 49L20 Dynamic programming in optimal control and differential games
- 91G30 Interest rates, asset pricing, etc. (stochastic models)

Keywords:

negative interest rate; capital injections; Markov-switching; optimal stochastic control; Hamilton-Jacobi-Bellman equation

Full Text: [DOI](#)

References:

- [1] Akyildirim, E., Güney, I.E., Rochet, J., Soner, H.M., 2013. Optimal Dividend Policy with Random Interest Rates. Swiss Finance Institute Research Paper No. 13-14.
- [2] Asmussen, S., Risk theory in a Markovian environment, *Scand. Actuar. J.*, 2, 69-100, (1989) · [Zbl 0684.62073](#)
- [3] Bäuerle, N., Some results about the expected ruin time in Markov-modulated risk models, *Insurance Math. Econom.*, 18, 119-127, (1996) · [Zbl 0859.60081](#)
- [4] Borodin, A. N.; Salminen, P., Handbook of Brownian motion - facts and formulae, (2002), Birkhäuser Verlag Basel · [Zbl 1012.60003](#)
- [5] Boyarchenko, S.; Levendorskii, S., Exit problems in regime-switching models, *J. Math. Econom.*, 44, 180-206, (2008) · [Zbl 1151.91485](#)
- [6] Dickson, D. C.M.; Waters, H. R., Some optimal dividends problems, *Astin Bull.*, 34, 49-74, (2004) · [Zbl 1097.91040](#)
- [7] Duan, J. C.; Popova, I.; Ritchken, P., Option pricing under regime switching, *Quant. Finance*, 2, 1-17, (2002)
- [8] Eisenberg, J.; Schmidli, H., Optimal control of capital injections by reinsurance in a diffusion approximation, *Bl. DGVMF*, 30, 1-13, (2009) · [Zbl 1183.91069](#)
- [9] Jiang, Z.; Pistorius, M. R., On perpetual American put valuation and first passage in a regime-switching model with jumps, *Finance Stoch.*, 12, 331-355, (2008) · [Zbl 1164.60066](#)
- [10] Jiang, Z.; Pistorius, M. R., Optimal dividend distribution under Markov regime switching, *Finance Stoch.*, 16, 449-476, (2012) · [Zbl 1252.93135](#)
- [11] Ly Vath, V.; Pham, H.; Villeneuve, S., A mixed singular/switching control problem for a dividend policy with reversible technology investment, *Ann. Appl. Probab.*, 18, 1164-1200, (2008) · [Zbl 1141.60020](#)
- [12] Nie, C.; Dickson, D. C.M.; Li, S., Minimizing the ruin probability through capital injections, *Ann. Actuar. Sci.*, 5, 2, 195-209, (2011)
- [13] Pafumi, G., On the time value of ruin: discussion, *N. Am. Actuar. J.*, 2, 1, 75-76, (1998)
- [14] Pedler, P. J., Occupation times for two state Markov chains, *J. Appl. Probab.*, 8, 2, 381-390, (1971) · [Zbl 0223.60026](#)
- [15] Walter, W., Ordinary differential equations, (1998), Springer-Verlag New York
- [16] 0000. Website of the European Central Bank: <https://www.ecb.europa.eu>.

- [17] 0000. Website of The Guardian: <https://www.theguardian.com/business/2016/apr/18/the-problem-with-negative-interest-rates>.
- [18] Zhu, J.; Yang, H., Ruin theory for a Markov regime-switching model under a threshold dividend strategy, *Insurance Math. Econom.*, 42, 311-318, (2008) · [Zbl 1141.91558](#)

This reference list is based on information provided by the publisher or from digital mathematics libraries. Its items are heuristically matched to zbMATH identifiers and may contain data conversion errors. It attempts to reflect the references listed in the original paper as accurately as possible without claiming the completeness or perfect precision of the matching.