

**Kallsen, Jan; Krühner, Paul**

**On a Heath-Jarrow-Morton approach for stock options.** (English) Zbl 1390.91302  
Finance Stoch. 19, No. 3, 583-615 (2015).

Summary: This paper aims at transferring the philosophy behind Heath-Jarrow-Morton to the modelling of call options with all strikes and maturities. Contrary to the approach by *R. Carmona* and *S. Nadtochiy* [ibid. 13, No. 1, 1–48 (2009; Zbl 1199.91202)] and related to their recent contribution [ibid. 16, No. 1, 63–104 (2012; Zbl 1259.91047)], the key parameterisation of our approach involves time-inhomogeneous Lévy processes instead of local volatility models. We provide necessary and sufficient conditions for absence of arbitrage. Moreover, we discuss the construction of arbitrage-free models. Specifically, we prove their existence and uniqueness given basic building blocks.

**MSC:**

**91G20** Derivative securities (option pricing, hedging, etc.)  
**60G51** Processes with independent increments; Lévy processes  
**91G30** Interest rates, asset pricing, etc. (stochastic models)

Cited in **1** Review  
Cited in **6** Documents

**Keywords:**

Heath-Jarrow-Morton; option price surfaces; Lévy processes

**Full Text:** [DOI](#)

**References:**

- [1] Albert, A.: Regression and the Moore-Penrose Pseudoinverse. Academic Press, New York (1972) · [Zbl 0253.62030](#)
- [2] Barndorff-Nielsen, O.; Shephard, N., Non-Gaussian Ornstein-Uhlenbeck-based models and some of their uses in financial economics, J. R. Stat. Soc., Ser. B, Stat. Methodol., 63, 167-241, (2001) · [Zbl 0983.60028](#)
- [3] Belomestny, D.; Reiß, M., Spectral calibration of exponential Lévy models, Finance Stoch., 10, 449-474, (2006) · [Zbl 1126.91022](#)
- [4] Bennani, N.: The forward loss model: a dynamic term structure approach for the pricing of portfolios of credit derivatives. Technical report (2005). Available at [http://www.defaultrisk.com/pp\\_crdrv\\_95.htm](http://www.defaultrisk.com/pp_crdrv_95.htm) · [Zbl 1224.91156](#)
- [5] Bühler, H., Consistent variance curve models, Finance Stoch., 10, 178-203, (2006) · [Zbl 1101.91031](#)
- [6] Carmona, R.; Carmona, R. (ed.); et al., HJM: a unified approach to dynamic models for fixed income, credit and equity markets, 2005, Berlin
- [7] Carmona, R.; Nadtochiy, S., Local volatility dynamic models, Finance Stoch., 13, 1-48, (2009) · [Zbl 1199.91202](#)
- [8] Carmona, R.; Nadtochiy, S., Tangent models as a mathematical framework for dynamic calibration, Int. J. Theor. Appl. Finance, 14, 107-135, (2011) · [Zbl 1208.91169](#)
- [9] Carmona, R.; Nadtochiy, S., Tangent Lévy market models, Finance Stoch., 16, 63-104, (2012) · [Zbl 1259.91047](#)
- [10] Carr, P.; Geman, H.; Madan, D.; Yor, M., Stochastic volatility for Lévy processes, Math. Finance, 13, 345-382, (2003) · [Zbl 1092.91022](#)
- [11] Cont, R.; Durrleman, V.; Fonseca, I., Stochastic models of implied volatility surfaces, Econ. Notes, 31, 361-377, (2002)
- [12] Cont, R., Tankov, P.: Financial Modelling with Jump Processes. CRC Press, Boca Raton (2004) · [Zbl 1052.91043](#)
- [13] Davis, M.; Hobson, D., The range of traded option prices, Math. Finance, 17, 1-14, (2007) · [Zbl 1278.91158](#)
- [14] Ethier, S., Kurtz, T.: Markov Processes. Characterization and Convergence. Wiley, New York (1986)
- [15] Filipović, D., Time-inhomogeneous affine processes, Stoch. Process. Appl., 115, 639-659, (2005) · [Zbl 1079.60068](#)
- [16] Filipović, D.; Tappe, S.; Teichmann, J., Term structure models driven by Wiener processes and Poisson measures: existence and positivity, SIAM J. Financ. Math., 1, 523-554, (2010) · [Zbl 1207.91068](#)
- [17] Filipović, D.; Tappe, S.; Teichmann, J., Invariant manifolds with boundary for jump-diffusions, Electron. J. Probab., 51, 1-28, (2014) · [Zbl 1301.60072](#)
- [18] Heath, D.; Jarrow, R.; Morton, A., Bond pricing and the term structure of interest rates: a new methodology for contingent claims valuation, Econometrica, 60, 77-105, (1992) · [Zbl 0751.90009](#)
- [19] Jacod, J.; Protter, P., Risk neutral compatibility with option prices, Finance Stoch., 14, 285-315, (2010) · [Zbl 1224.91156](#)
- [20] Jacod, J., Shiryaev, A.: Limit Theorems for Stochastic Processes, 2nd edn. Springer, Berlin (2003) · [Zbl 1018.60002](#)

- [21] Kallsen, J.,  $\sigma$ -localization and  $\sigma$ -martingales, *Theory Probab. Appl.*, 48, 152-163, (2004) · [Zbl 1069.60042](#)
- [22] Kallsen, J.; Kabanov, Y. (ed.); Liptser, R. (ed.); Stoyanov, J. (ed.), *A didactic note on affine stochastic volatility models*, 343-368, (2006), Berlin · [Zbl 1104.60024](#)
- [23] Protter, P.: *Stochastic Integration and Differential Equations*, 2nd edn. Springer, Berlin (2004) · [Zbl 1041.60005](#)
- [24] Schönbucher, P.: *Portfolio losses and the term structure of loss transition rates: a new methodology for the pricing of portfolio credit derivatives*. Technical report (2005). Available at [http://www.econbiz.de/archiv1/2008/50106\\_portfolio\\_credit\\_derivatives.pdf](http://www.econbiz.de/archiv1/2008/50106_portfolio_credit_derivatives.pdf)
- [25] Schweizer, M.; Wissel, J., Arbitrage-free market models for option prices: the multi-strike case, *Finance Stoch.*, 12, 469-505, (2008) · [Zbl 1199.91218](#)
- [26] Schweizer, M.; Wissel, J., Term structures of implied volatilities: absence of arbitrage and existence results, *Math. Finance*, 18, 77-114, (2008) · [Zbl 1138.91481](#)
- [27] Sidenius, J.; Piterbarg, V.; Andersen, L., A new framework for dynamic credit portfolio loss modelling, *Int. J. Theor. Appl. Finance*, 11, 163-197, (2008) · [Zbl 1211.91246](#)
- [28] Wissel, J.: *Arbitrage-free market models for liquid options*. Ph.D. thesis, ETH Zürich (2008). Available at [doi:10.3929/ethz-a-005559619](https://doi.org/10.3929/ethz-a-005559619) · [Zbl 1069.60042](#)

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.