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Different Approaches to Forecast Interval Time Series: A Comparison in Finance

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Abstract

An interval time series (ITS) is a time series where each period is described by an interval. In finance, ITS can describe the temporal evolution of the high and low prices of an asset throughout time. These price intervals are related to the concept of volatility and are worth considering in order to place buy or sell orders. This article reviews two approaches to forecast ITS. On the one hand, the first approach consists of using univariate or multivariate forecasting methods. The possible cointegrating relation between the high and low values is analyzed for multivariate models and the equivalence of the VAR models is shown for the minimum and the maximum time series, as well as for the center and radius time series. On the other hand, the second approach adapts classic forecasting methods to deal with ITS using interval arithmetic. These methods include exponential smoothing, the k -NN algorithm and the multilayer perceptron. The performance of these approaches is studied in two financial ITS. As a result, evidences of the

predictability of the ITS are found, especially in the interval range. This fact opens a new path in volatility forecasting.



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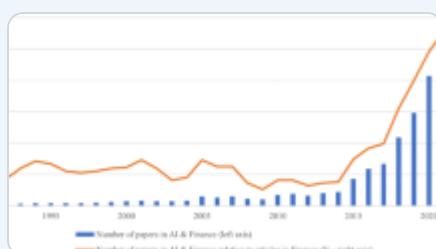
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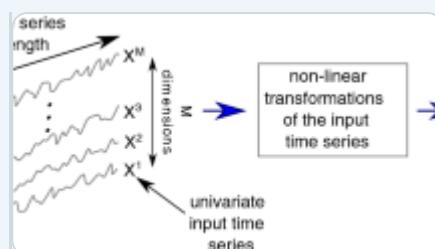
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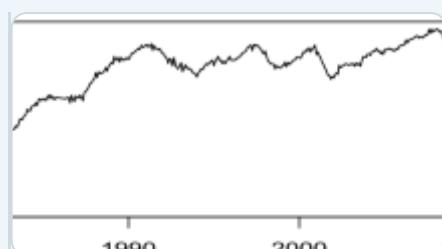
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References

Alizadeh S., Brandt M. W., Diebold F. X. (2002) Range-based estimation of stochastic volatility models. *The Journal of Finance* 57(3): 1047–1091

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Arroyo, J., González-Rivera, G., & Maté, C. (2010). Forecasting with interval and histogram data. Some financial applications. In *Handbook of empirical economics and finance*. New York: Chapman & Hall/CRC (forthcoming).

Arroyo, J., & Maté, C. (2006). Introducing interval time series: Accuracy measures. In *COMPSTAT 2006, proceedings in computational statistics* (pp. 1139–1146). Heidelberg: Physica-Verlag.

Arroyo, J., Muñoz San Roque, A., Maté, C., & Sarabia, A. (2007). Exponential smoothing methods for interval time series. In *Proceedings of the 1st European Symposium on Time Series Prediction* (pp. 231–240).

Bishop, C. M. (eds) (1995) Neural networks for pattern recognition. Oxford University Press, Oxford

[Google Scholar](#)

Box G. E., Jenkins G. M. (1970) Time series analysis: Forecasting and control. Holden Day, San Francisco

[Google Scholar](#)

Cheung Y. W. (2007) An empirical model of daily highs and lows. *International Journal of Finance & Economics* 12(1): 1–20

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Diebold F. X., Mariano R. S. (1995) Comparing predictive accuracy. *Journal of*

Engle R.F., Russell J. (2009) Analysis of high frequency data. In: Aït-Sahalia Y., Hansen L.P. (eds) Handbook of financial econometrics, Vol. 1: Tools and techniques. North Holland, Amsterdam, pp 383-426

[Google Scholar](#)

Fiess N. M., MacDonald R. (2002) Towards the fundamentals of technical analysis: Analysing the information content of high, low and close prices. Economic Modelling 19(3): 353-374

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García-Ascanio C., Maté C. (2010) Electric power demand forecasting using interval time series: A comparison between VAR and iMLP. Energy Policy 38(2): 715-725

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Gardner E. S. (2006) Exponential smoothing: The state of the art. Part 2. International Journal of Forecasting 22(4): 637-666

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Gardner E. S., McKenzie E. (1985) Forecasting trends in time series. Management Science 31: 1237-1246

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González L., Velasco F., Angulo C., Ortega J. A., Ruiz F. (2004) Sobre núcleos, distancias y similitudes entre intervalos. Inteligencia Artificial 8(23): 111-117

[Google Scholar](#)

Han A., Hong Y., Lai K., Wang S. (2008) Interval time series analysis with an application to the sterling-dollar exchange rate. Journal of Systems Science and Complexity 21(4): 550-565

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He L. T., Hu C. (2008) Impacts of interval measurement on studies of economic variability: Evidence from stock market variability forecasting. Journal of Risk Finance 8(5): 489-507

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He L. T., Hu C. (2009) Impacts of interval computing on stock market variability forecasting. Computational Economics 33(3): 263-276. doi:[10.1007/s10614-008-9159-x](https://doi.org/10.1007/s10614-008-9159-x)

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Hu C., He L. T. (2007) An application of interval methods to stock market forecasting. Reliable Computing 13(5): 423-434

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Hyndman R. J., Koehler A. B. (2006) Another look at measures of forecast accuracy. International Journal of Forecasting 22(4): 679-688

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Kilian L., Taylor M. P. (2003) Why is it so difficult to beat the random walk forecast of exchange rates?. Journal of International Economics 60(1): 85-107

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Lütkepohl H. (2005) New introduction to multiple time series analysis (1st ed.).

Maia A. L .S., de Carvalho F. A. T., Ludermir T. B. (2008) Forecasting models for interval-valued time series. Neurocomputing 71(16-18): 3344–3352

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Moore, R. E., Kearfott, R. B., Cloud, M. J. (eds) (2009) Introduction to interval analysis. SIAM Press, Philadelphia, PA

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Muñoz San Roque A., Maté C., Arroyo J., Sarabia A. (2007) iMLP: Applying multi-layer perceptrons to interval-valued data. Neural Processing Letters 25(2): 157–169

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Parkinson M. (1980) The extreme value method for estimating the variance of the rate of return. The Journal of Business 53(1): 61

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Yakowitz S. (1987) Nearest-neighbour methods for time series analysis. Journal of Time Series Analysis 8(2): 235–247

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Zhang G. P. (2003) Time series forecasting using a hybrid ARIMA and neural network model. Neurocomputing 50(1): 159–175

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