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A FUZZY TIME SERIES-MARKOV CHAIN MODEL WITH AN APPLICATION TO FORECAST THE EXCHANGE RATE BETWEEN THE TAIWAN AND US DOLLAR

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Abstract. *In this study, a fuzzy time series-Markov chain approach for analyzing the linguistic or a small sample time series data is proposed to further enhance the predictive accuracy. By transferring fuzzy time series data to the fuzzy logic group, and using the obtained fuzzy logic group to derive a Markov chain transition matrix, a set of adjusted enrollment forecasting values can be obtained with the smallest forecasting error of various fuzzy time series methods. Finally, an illustrated example for exchange rate forecasting is used to verify the effectiveness of the proposed model and confirms the potential benefits of the proposed approach with a very small MAPE.*
Keywords: Fuzzy time series model, Markov chain, Fuzzy logic group, Exchange rate

1. **Introduction.** Forecasting methodology is most important and relevant in the field of management, including that for financial forecasting, production demand and supply forecasting, technology forecasting, and so on. In international economics forecasting, explicating the behavior of nominal exchange rates has been a central theme in economists' work when executing the notoriously challenging task of modeling exchange rates, since the celebrated work of Meese and Rogoff [1] who found that the fundamentals-based exchange rate models systematically fail to deliver better forecasts than a simple random walk at horizons of up to one year. Subsequent studies by Engel and Hamilton [2], who modeled exchange rates alternating between appreciation and depreciation regimes in a Markovian fashion, while considering more recent data, led to a model that no longer beats the random walk. From the above analysis, it is evident that, normally, we cannot directly use the established model for forecasting because there may be some additional causes that are not considered in the collected historical data. That is, if we applied the collected data in a Group A to construct a forecasting model for extrapolation, then, because of its similar structure, and when all conditions remain the same, we could use Group A for forecasting. However, once the trend of future changes in Group B is determined, the derived model cannot be used for forecasting because we have not collected sufficient factors to be incorporated in the forecasting model. For such an insufficient factors problem, fuzzy forecasting models such as the fuzzy regression model and fuzzy time series model are considered a solution. The fuzzy time series model is applied as a valid approach for forecasting the future value in a situation where neither a trend is viewed nor a pattern in variations of time series is visualized and, moreover, the information is incomplete and ambiguous [3,4].