Fuzzy Time Series- Markov Chain Method for Corn and Soybean Price Forecasting in North Carolina Markets

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Abstract : Among the main purposes of optimal and efficient forecasts of agricultural commodity prices is to guide the firms to advance the economic decision making process such as planning business operations and marketing decisions. Governments are also the beneficiaries and suppliers of agricultural price forecasts. They use this information to establish a proper agricultural policy, and hence, the forecasts affect social welfare and systematic errors in forecasts could lead to a misallocation of scarce resources. Various empirical approaches have been applied to forecast commodity prices that have used different methodologies. Most commonly-used approaches to forecast commodity sectors depend on classical time series models that assume values of the response variables are precise which is quite often not true in reality. Recently, this literature has mostly evolved to a consideration of fuzzy time series models that provide more flexibility in terms of the classical time series models assumptions such as stationarity, and large sample size requirement. Besides, fuzzy modeling approach allows decision making with estimated values under incomplete information or uncertainty. A number of fuzzy time series models have been developed and implemented over the last decades; however, most of them are not appropriate for forecasting repeated and nonconsecutive transitions in the data. The modeling scheme used in this paper eliminates this problem by introducing Markov modeling approach that takes into account both the repeated and nonconsecutive transitions. Also, the determination of length of interval is crucial in terms of the accuracy of forecasts. The problem of determining the length of interval arbitrarily is overcome and a methodology to determine the proper length of interval based on the distribution or mean of the first differences of series to improve forecast accuracy is proposed. The specific purpose of this paper is to propose and investigate the potential of a new forecasting model that integrates methodologies for determining the proper length of interval based on the distribution or mean of the first differences of series and Fuzzy Time Series- Markov Chain model. Moreover, the accuracy of the forecasting performance of proposed integrated model is compared to different univariate time series models and the superiority of proposed method over competing methods in respect of modelling and forecasting on the basis of forecast evaluation criteria is demonstrated. The application is to daily corn and soybean prices observed at three commercially important North Carolina markets; Candor, Cofield and Roaring River for corn and Fayetteville, Cofield and Greenville City for soybeans respectively. One main conclusion from this paper is that using fuzzy logic improves the forecast performance and accuracy; the effectiveness and potential benefits of the proposed model is confirmed with small selection criteria value such MAPE. The paper concludes with a discussion of the implications of integrating fuzzy logic and nonarbitrary determination of length of interval for the reliability and accuracy of price forecasts. The empirical results represent a significant contribution to our understanding of the applicability of fuzzy modeling in commodity price forecasts.

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