

电力市场

基于加权双高斯分布的广义自回归条件异方差边际电价预测模型

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摘要:

研究电力市场系统边际电价(system marginal price, SMP)条件方差的变化规律及残差的统计分布特征, 据此引入广义自回归条件异方差(generalized auto-regressive conditional heteroskedasticity, GARCH)模型, 并建立了基于加权双高斯(weighed double Gaussian, WDG)分布假设的GARCH模型(GARCH-WDG)对系统边际电价的变化规律进行研究。美国PJM市场和澳大利亚NSW市场的实际数据表明, GARCH模型对电价的估计和预测均有良好的效果, GARCH-WDG模型则进一步改善了GARCH模型的性能。

关键词: 系统边际电价 加权双高斯分布 广义自回归条件异方差 电价预测

A Generalized Auto-Regressive Conditional Heteroskedasticity Model for System Marginal Price Forecasting Based on Weighted Double Gaussian Distribution

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Abstract:

The regularity of conditional variance variation and the statistical distribution characteristic of residual error of system marginal price (SMP) in electricity market are researched. On this basis, by means of leading in the generalized auto-regressive conditional heteroskedasticity (GARCH) model a GARCH model based on the assumption of weighted double Gaussian (WDG) distribution is proposed to research the variation regularity of SMP. Taking the actual data from PJM market in USA and NSW market in Australia as samples, both GARCH model and the proposed GARCH-WDG model are tested, the testing results show that the GARCH model can offer good estimation and forecasting results of SMP, and the performance of GARCH model can be further improved by the proposed GARCH-WDG model.

Keywords: system marginal price (SMP) weighed double Gaussian (WDG) distribution generalized auto-regressive conditional heteroskedasticity (GARCH) electricity price forecasting

收稿日期 2008-11-17 修回日期 2009-10-10 网络版发布日期 2010-02-02

DOI:

基金项目:

通讯作者: 刘西陲

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参考文献:

[1] 吴兴华, 周晖. 基于残差周期修正的灰色电价预测模型[J]. 电网技术, 2008, 32(8): 67-70. Wu Xinghua, Zhou Hui. A grey model of electricity price forecasting based on period residual modification [J]. Power System Technology, 2008, 32(8): 67-70(in Chinese). [2] 牛东晓, 刘达, 邢棉, 等. 基于自组织映射支持向量机的日前电价预测[J]. 电网技术, 2007, 31(18): 15-18,22. Niu Dongxiao, Liu Da, Xing Mian, et al. Day-ahead electricity price forecasting using support vector machines based on self-organizing map[J]. Power System Technology, 2007, 31(18): 15-18,22(in Chinese). [3] 王绵斌, 谭忠富, 李雪, 等. 供电公司实行峰谷分时电价的风险价值计算模型[J]. 电网技术, 2007, 31(9): 43-47. Wang Mianbin, Tan Zhongfu, Li Xue, et al. Value of risk calculation model for power supply company

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adopting time-of-use electricity pricing[J]. Power System Technology, 2007, 31(9): 43-47(in Chinese). [4] 曾鸣, 冯义, 刘达, 等. 基于证据理论的多模型组合电价预测[J]. 中国电机工程学报, 2008, 28(16): 84-89. Zeng Ming, Feng Yi, Liu Da, et al. Electricity price forecasting based on multi-models combined by evidential theory[J]. Proceedings of the CSEE, 2008, 28(16): 84-89(in Chinese). [5] 周明, 严正, 倪以信, 等. 含误差预测校正的ARIMA电价预测新方法[J]. 中国电机工程学报, 2004, 24(12): 63-68. Zhou Ming, Yan Zheng, Ni Yixin, et al. A novel ARIMA approach on electricity price forecasting with the improvement of predicted error[J]. Proceedings of the CSEE, 2004, 24(12): 63-68(in Chinese). [6] Niimura T. Forecasting techniques for deregulated electricity market prices[C]. Power Engineering Society General Meeting, Montreal, 2006. [7] Gonzalez A M, Roque A M S, Garcia-Gonzalez J. Modeling and forecasting electricity prices with input/output hidden Markov models [J]. IEEE Trans on Power Systems, 2005, 20(1): 13-24. [8] Zareipour H, Canizares C A, Bhattacharya K, et al. Application of public-domain market information to forecast Ontario's wholesale electricity prices[J]. IEEE Trans on Power Systems, 2006, 21(4): 1707-1717. [9] Contreras J, Espinola R, Nogales F J, et al. ARIMA models to predict next-day electricity prices[J]. IEEE Trans on Power Systems, 2003, 18(3): 1014-1020. [10] Conejo A J, Plazas M A, Espinola R, et al. Day-ahead electricity price forecasting using the wavelet transform and ARIMA models[J]. IEEE Trans on Power Systems, 2005, 20(2): 1035-1042. [11] Conejo A J, Contreras J, Espinola R, et al. Forecasting electricity prices for a day-ahead pool-based electric energy market [J]. International Journal of Forecasting, 2005, 21(3): 435-462. [12] Garcia M P, Kirschen D S. Forecasting system imbalance volumes in competitive electricity markets[J]. IEEE Trans on Power Systems, 2006, 21(1): 240-248. [13] Garcia-Martos C, Rodriguez J, Sanchez M J. Mixed models for short-run forecasting of electricity prices: application for the Spanish market[J]. IEEE Trans on Power Systems, 2007, 22(2): 544-552. [14] Xu H, Niimura T. Short-term electricity price modeling and forecasting using wavelets and multivariate time series[C]. IEEE Power Systems Conference and Exposition, New York, 2004. [15] Zheng H, Xie L, Zhang L Z. Electricity price forecasting based on GARCH model in deregulated market[C]. Power Engineering Conference, Singapore, 2005. [16] Garcia R C, Contreras J, van Akkeren M, et al. A GARCH forecasting model to predict day-ahead electricity prices [J]. IEEE Trans on Power Systems, 2005, 20(2): 867-874. [17] 余帆, 沈炯, 刘西陲. 基于不同分布假设条件的自回归条件异方差族模型在评估日前电力市场风险价值中的应用比较[J]. 电网技术, 2008, 32(17): 23-28. Yu Fan, Shen Jiong, Liu Xichui. Comparative research on application of autoregressive conditional heteroskedasticity family model based on distributional assumption conditions in evaluation of risk at value of day-ahead electricity market[J]. Power System Technology, 2008, 32(17): 23-28 (in Chinese). [18] 谢品杰, 谭忠富, 尚金成, 等. 基于小波分析与广义自回归条件异方差模型的短期电价预测[J]. 电网技术, 2008, 32(16): 96-100. Xie Pinjie, Tan Zhongfu, Shang Jincheng, et al. Short-term electricity price forecasting based on wavelet transform and generalized autoregressive conditional heteroskedasticity model[J]. Power System Technology, 2008, 32(16): 96-100(in Chinese). [19] 余帆, 沈炯, 刘西陲. 基于自回归条件异方差 - 反向传播网络模型的日前边际电价预测[J]. 电网技术, 2008, 32(8): 63-66. Yu Fan, Shen Jiong, Liu Xichui. Day-ahead marginal price forecasting based on autoregressive conditional heteroskedasticity-back propagation network model[J]. Power System Technology, 2008, 32(8): 63-66(in Chinese). [20] Ranjbar M, Soleymani S, Sadati N, et al. Electricity price forecasting using artificial neural network[C]. Power Electronics, Drives and Energy Systems, New Delhi, 2006. [21] Xu Y Y, Hsieh R, Lu Y L, et al. Forecasting electricity market prices: a neural network based approach[C]. IEEE International Joint Conference on Neural Networks, Budapest, 2004. [22] Rashidi-Nejad M, Gharaveisi A A, Khajehzadeh A, et al. Electricity price forecasting using WaveNet[C]. Large Engineering Systems Conference on Power Engineering, Halifax, 2006. [23] Mandal P, Senjyu T, Uezato K, et al. Several-hours-ahead electricity price and load forecasting using neural networks[C]. IEEE Power Engineering Society General Meeting, San Francisco, 2005. [24] Azevedo F, Vale Z A. Forecasting electricity prices with historical statistical information using neural networks and clustering techniques [C]. IEEE Power Systems Conference and Exposition, Atlanta, 2006. [25] Amjady N. Day-ahead price forecasting of electricity markets by a new fuzzy neural network[J]. IEEE Trans on Power Systems, 2006, 21(2): 887-896. [26] Gujarati D N. 计量经济学[M]. 北京: 中国人民大学出版社, 2000: 427-433. [27] Engle R F. Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom inflation [J]. Econometrica, 1982, 50(4): 987-1007. [28] Karsaz A, Mashhadi H R, Eshraghnia R. Cooperative co-evolutionary approach to electricity load and price forecasting in deregulated electricity markets[C]. IEEE Power India Conference, New Delhi, 2006. [29] PJM. PJM locational marginal pricing[EB/OL]. [2006-05-01]. <http://www.pjm.com/pub/account/lmpgen/lmpgpost.html>. [30] NEMMCO. NEM operational market data[EB/OL]. [2006-05-01]. http://www.nemmco.com.au/data/market_data.htm. [31] 刘西陲, 沈炯, 李益国. 系统边际电价概率分布检验及模型研究[J]. 中国电机工程学报, 2009, 29(4): 72-77. Liu Xichui, Shen Jiong, Li Yiguo. Study on probability distribution and model of system marginal price[J]. Proceedings of the CSEE, 2009, 29(4): 72-77(in Chinese). [32] 郑华, 张粒子, 谢莉, 等. 关于电力市场下系统边际价格概率模型的新研究 [J]. 中国电机工程学报, 2004, 24(11): 74-79. Zheng Hua, Zhang Lizi, Xie Li, et al. Study on the probability model of system marginal price in electricity market[J]. Proceedings of the CSEE, 2004,

24(11): 74-79(in Chinese). [33] 郑华, 谢莉, 张粒子, 等. 系统边际价格概率分布的实证分析[J]. 中国电机工程学报, 2006, 26(3): 43-47. Zheng Hua, Xie Li, Zhang Lizi, et al. Positivism analysis on the probability distribution of system marginal price[J]. Proceedings of the CSEE, 2006, 26(3): 43-47(in Chinese). [34] Hamilton J D. Time series analysis[M]. New Jersey: Princeton University Press, 1994: 53-59.

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1. 栗然 崔天宝 肖进永.基于云模型的短期电价预测[J]. 电网技术, 2009,33(17): 185-190
2. 谭忠富 张金良 尚金成.基于动态计量经济学模型的短期电价预测[J]. 电网技术, 2009,33(7): 71-76
3. 崔和瑞|杨丽|郭甜 .基于分形理论的改进短期电价预测模型[J]. 电网技术, 2008,32(26): 206-208
4. 吴兴华|周 晖.基于减法聚类及自适应模糊神经网络的短期电价预测[J]. 电网技术, 2007,31(19): 69-73
5. 牛东晓|刘 达|邢 棉|冯 义|陈广娟.基于自组织映射支持向量机的日前电价预测[J]. 电网技术, 2007,31(18): 15-18
6. 林其友|陈星莺|王之伟.数据挖掘技术在电价预测中的应用[J]. 电网技术, 2006,30(23): 83-87
7. 谢品杰|谭忠富|尚金成|侯建朝|王绵斌 .基于小波分析与广义自回归条件异方差模型的短期电价预测[J]. 电网技术, 2008,32(16): 96-100
8. 吴兴华 周晖.基于残差周期修正的灰色电价预测模型[J]. 电网技术, 2008,32(8): 68-71
9. 严中华|王兴元|查启平|何维来|卢 闽.基于市场因子的灰色电价预测方法[J]. 电网技术, 2007,31(Supp): 92-94
10. 牛东晓|刘 达|冯 义|李金超.考虑外生变量的广义自回归条件异方差日前电价预测模型[J]. 电网技术, 2007,31(22): 44-48
11. 刘达 王尔康 牛东晓.小波分析和考虑外生变量的广义自回归条件异方差模型在电价预测中的应用[J]. 电网技术, 2009,33(18): 99-104
12. 师彪 李郁侠 于新花 闫旺 李娜 孟欣.自适应变系数粒子群和径向基神经网络在短期电价预测中的应用[J]. 电网技术, 2010,34(1): 98-106