Package 'SBAGM'

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Type Package

Title Search Best ARIMA, GARCH, and MS-GARCH Model

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Description Get the most appropriate autoregressive integrated moving average, generalized autoregressive conditional heteroscedasticity and Markov switching GARCH model. For method details see Haas M, Mittnik S, Paolella MS (2004). <doi:10.1093/jjfinec/nbh020>, Bollerslev T (1986). <doi:10.1016/0304-4076(86)90063-1>.

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Contents

appgarch *Find the appropriate ARMA-GARCH model*

Description

The appgarch function computes RMSE and MAE of the all possible combinations of GARCH type model and distribution, and forecast value. Based on the lowest RMSE and MAE, we can find the best model and distribution combinations of the particular data.

Usage

```
appgarch(data, methods = c("sGARCH", "gjrGARCH"),
distributions = c("norm", "std", "snorm"), aorder = c(1, 0),
gorder = c(1, 1), algo = "gosolnp", stepahead = 5)
```

Arguments

data	Univariate time series data
methods	Volatility models. Valid models are "sGARCH", "eGARCH", "gjrGARCH and "csGARCH". Default: methods= c("sGARCH", "gjrGARCH").
distributions	The conditional density to use for the innovations. Valid choices are "norm" for the normal distibution, "snorm" for the skew-normal distribution, "std" for the student-t, "sstd" for the skew-student, "ged" for the generalized error distribution, "sged" for the skew-generalized error distribution, "nig" for the normal inverse gaussian distribution, "ghyp" for the Generalized Hyperbolic, and "jsu" for Johnson's SU distribution. Default: distributions= c("norm", "std", "snorm").
aorder	ARMA order. Default: aorder=c(1, 0)
gorder	GARCH order. Default: gorder=c(1, 1)
algo	Solver. One of either "nlminb", "solnp", "lbfgs", "gosolnp", "nloptr" or "hybrid". Default: algo = "gosolnp". (see documentation in the rugarch-package for details)
stepahead	The forecast horizon.

Details

It allows for a wide choice in univariate GARCH models, distributions, and mean equation modelling. If the user provides the model combinations like methods= c("sGARCH", "eGARCH", gjrGARCH") and distributions combination like distributions= c("norm", "std", "snorm") along with the other parameters, then get the RMSE and MAE value for all possible combinations of methods and distributions, which helps to find the best GARCH type model based on the lowest RMSE and MAE value.

Value

rmse_mean	Root Mean Square Error (RMSE) value of the mean forecast for all combinations
mae_mean	Mean Absolute Error (MAE) value of the mean forecast for all combinations
forecast_mean	Mean forecast for all combinations
forecast_sigma	Sigma value for all combinations

References

Bollerslev, T. (1986). Generalized autoregressive conditional heteroscedasticity. Journal of Econometrics, 31, 307-327.

Engle, R. (1982). Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom inflation, Econometrica, 50, 987-1008.

See Also

appmsgarch, ARIMAAIC

Examples

```
data("ReturnSeries")
appgarch(ReturnSeries)
```

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appmsgarch *Find the appropriate MS-GARCH model*

Description

The appmsgarch function computes the root mean square error (RMSE) and mean absolute error (MAE) of the different possible combinations of methods and distributions of the MS-GARCH model.

Usage

```
appmsgarch(data, methods = c("sARCH", "sGARCH"),
distributions = c("norm", "std"), stepahead = 5)
```

Arguments

data	Input time series (ts) or numerical univariate series.
methods	Combination of volatility models in two different regimes. Valid models are "sARCH", "sGARCH", "eGARCH", "gjrGARCH", and "tGARCH". Default: methods=c("sARCH", "sGARCH").
distributions	List with element distribution. distribution is a character vector (of size 2) of conditional distributions. Valid distributions are "norm", "snorm", "std", "sstd", "ged", and "sged". Default: distribution = c("norm", "std").
stepahead	The forecast horizon.

Details

Here Markov-Switching specification of the MS-GARCH model is based on the Haas et al. (2004a). For the methods, "sARCH" is the ARCH(1) model, "sGARCH" the GARCH(1,1) model, "eGARCH" the EGARCH(1,1) model, "gjrGARCH" the GJR(1,1) model (Glosten et al., 1993), and "tGARCH" the TGARCH(1,1) model (Zakoian, 1994).For the distributions, "norm" is the Normal distribution, "std" the Student-t distribution, and "ged" the GED distribution. Their skewed version, implemented via the Fernandez and & Steel (1998) transformation, are "snorm", "sstd" and "sged".

Value

`forecast_msgarch`
: Forecasted value of all possible combinations of methods and combinations.

`rmse_mat`
: Root mean square error (RMSE) value of all possible combinations of methods and combinations.

`mae_mat`
: Mean absolute error (MAE) value of all possible combinations of methods and combinations.

References

Ardia, D. Bluteau, K. Boudt, K. Catania, L. Trottier, D.-A. (2019). Markov-switching GARCH models in R: The MSGARCH package. Journal of Statistical Software, 91(4), 1-38. http://doi.org/10.18637/jss.v091.i04

Glosten, L. R. Jagannathan, R. & Runkle, D. E. (1993). On the relation between the expected value and the volatility of the nominal excess return on stocks. Journal of Finance, 48, 1779-1801. http://doi.org/10.1111/j.1540-6261.1993.tb05128.x

Fernandez, C. & Steel, M. F. (1998). On Bayesian modeling of fat tails and skewness. Journal of the American Statistical Association, 93, 359-371. http://doi.org/10.1080/01621459.1998.10474117

Haas, M. Mittnik, S. & Paolella, MS. (2004a). A new approach to Markov-switching GARCH models. Journal of Financial Econometrics, 2, 493-530. http://doi.org/10.1093/jjfinec/nbh020

Examples

```
data("ReturnSeries")
appmsgarch(ReturnSeries)
```

`ARIMAAIC` *Find the appropriate ARIMA model*

Description

Computes the AIC values of all possible ARIMA models for the given value of autoregressive and moving average parameters.

Usage

```
ARIMAAIC(data, p=3, q=3, d=0, season=list(order=c(0,0,0),period=NA),
in.mean=TRUE)
```

Arguments

data	Univariate time series data
p	Non-seasonal autoregressive order
q	Non-seasonal moving average order
d	Degree of differencing
season	A specification of the seasonal part of the ARIMA model, plus the period. This should be a list with components order and period.
in.mean	Should the ARMA model include a mean/intercept term? The default is TRUE for undifferenced series, and it is ignored for ARIMA models with differencing.

Details

Lower the AIC value better the model

Value

aic_mat	AIC values of all possible ARIMA models

References

Box, G. and Jenkins, G. (1970). Time Series Analysis: Forecasting and Control. Holden-Day, San Francisco.

Brockwell, P. J. and Davis, R. A. (1996). Introduction to Time Series and Forecasting. Springer, New York. Sections 3.3 and 8.3.

Examples

```
data("ReturnSeries")
ARIMAAIC(ReturnSeries)
```

ReturnSeries *Return Series Data*

Description

Monthly return series of International Soyabean oil starting from January 1980

Usage

```
data("ReturnSeries")
```

Format

A data frame with 86 observations on the following variable.

return a numeric vector

Details

Dataset contain 86 0bservations of monthly return series of International soyabean price. It is obtained from World Bank "Pink sheet"

Source

https://www.worldbank.org/en/research/commodity-markets

References

https://www.worldbank.org/en/research/commodity-markets

Examples

```
data(ReturnSeries)
```

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