

## statsmodels.tsa.arima.model.ARIMA

```
class statsmodels.tsa.arima.model.ARIMA(endog=None, exog=None, order=(0, 0, 0), seasonal_order=(0, 0, 0, 0), trend=None, enforce_stationarity=True, enforce_invertibility=True,
concentrate_scale=False, trend_offset=1, dates=None, freq=None, missing='none', validate_specification=True)[source]
[./_modules/statsmodels/tsa/arima/model.html#ARIMA]
```

Autoregressive Integrated Moving Average (ARIMA) model, and extensions

This model is the basic interface for ARIMA-type models, including those with exogenous regressors and those with seasonal components. The most general form of the model is SARIMAX(p, d, q)x(P, D, Q, s). It also allows all specialized cases, including

- autoregressive models: AR(p)
- moving average models: MA(q)
- mixed autoregressive moving average models: ARMA(p, q)
- integration models: ARIMA(p, d, q)
- seasonal models: SARIMA(P, D, Q, s)
- regression with errors that follow one of the above ARIMA-type models

### Parameters:

**endog** : [array\\_like](#) [[https://numpy.org/doc/stable/glossary.html#term-array\\_like](https://numpy.org/doc/stable/glossary.html#term-array_like)], [optional](#)

The observed time-series process  $\{y_t\}$ .

**exog** : [array\\_like](#) [[https://numpy.org/doc/stable/glossary.html#term-array\\_like](https://numpy.org/doc/stable/glossary.html#term-array_like)], [optional](#)

Array of exogenous regressors.

**order** : [tuple](#) [<https://docs.python.org/3/library/stdtypes.html#tuple>], [optional](#)

The (p,d,q) order of the model for the autoregressive, differences, and moving average components. d is always an integer, while p and q may either be integers or lists of integers.

**seasonal\_order** : [tuple](#) [<https://docs.python.org/3/library/stdtypes.html#tuple>], [optional](#)

The (P,D,Q,s) order of the seasonal component of the model for the AR parameters, differences, MA parameters, and periodicity. Default is (0, 0, 0, 0). D and s are always integers, while P and Q may either be integers or lists of positive integers.

**trend** : [str](#) [[{n,'c','t','ct'}](https://docs.python.org/3/library/stdtypes.html#str)] or [iterable](#) [<https://docs.python.org/3/glossary.html#term-iterable>], [optional](#)

Parameter controlling the deterministic trend. Can be specified as a string where 'c' indicates a constant term, 't' indicates a linear trend in time, and 'ct' includes both. Can also be specified as an iterable defining a polynomial, as in *numpy.poly1d*, where *[1,1,0,1]* would denote  $(a + bt + ct^3)$ . Default is 'c' for models without integration, and no trend for models with integration. Note that all trend terms are included in the model as exogenous regressors, which differs from how trends are included in SARIMAX models. See the Notes section for a precise definition of the treatment of trend terms.

**enforce\_stationarity** : [bool](#) [<https://docs.python.org/3/library/stdtypes.html#bltin-boolean-values>], [optional](#)

Whether or not to require the autoregressive parameters to correspond to a stationarity process.

**enforce\_invertibility** : [bool](#) [<https://docs.python.org/3/library/stdtypes.html#bltin-boolean-values>], [optional](#)

Whether or not to require the moving average parameters to correspond to an invertible process.

**concentrate\_scale** : [bool](#) [<https://docs.python.org/3/library/stdtypes.html#bltin-boolean-values>], [optional](#)

Whether or not to concentrate the scale (variance of the error term) out of the likelihood. This reduces the number of parameters by one. This is only applicable when considering estimation by numerical maximum likelihood.

**trend\_offset** : [int](#) [<https://docs.python.org/3/library/functions.html#int>], [optional](#)

The offset at which to start time trend values. Default is 1, so that if *trend='t'* the trend is equal to 1, 2, ..., nobs. Typically is only set when the model created by extending a previous dataset.

**dates** : [array\\_like](#) [[https://numpy.org/doc/stable/glossary.html#term-array\\_like](https://numpy.org/doc/stable/glossary.html#term-array_like)] of [datetime](#) [<https://docs.python.org/3/library/datetime.html#module-datetime>], [optional](#)

If no index is given by *endog* or *exog*, an array-like object of datetime objects can be provided.

**freq** : [str](#) [<https://docs.python.org/3/library/stdtypes.html#str>], [optional](#)

If no index is given by *endog* or *exog*, the frequency of the time-series may be specified here as a Pandas offset or offset string.

**missing** : [str](#) [<https://docs.python.org/3/library/stdtypes.html#str>]

Available options are 'none', 'drop', and 'raise'. If 'none', no nan checking is done. If 'drop', any observations with nans are dropped. If 'raise', an error is raised. Default is 'none'.

## Notes

This model incorporates both exogenous regressors and trend components through "regression with ARIMA errors". This differs from the specification estimated using `SARIMAX` which treats the trend components separately from any included exogenous regressors. The full specification of the model estimated here is:

$$\begin{pmatrix} Y_t - \delta_0 - \delta_1 t - \dots - \delta_k t^k - X_t \beta & = \epsilon_t \\ \Phi(L)Y_t & = \Theta(L)\epsilon_t \end{pmatrix}$$

where  $\epsilon_t \sim WN(0, \sigma^2)$  is a white noise process,  $L$  is the lag operator, and  $G(L)$  are lag polynomials corresponding to the autoregressive ( $\Phi(L)$ ), seasonal autoregressive ( $\Phi_s(L)$ ), moving average ( $\Theta(L)$ ), and seasonal moving average components ( $\Theta_s(L)$ ).

`enforce_stationarity` and `enforce_invertibility` are specified in the constructor because they affect loglikelihood computations, and so should not be changed on the fly. This is why they are not instead included as arguments to the `fit` method.

## Examples

```
>>> mod = sm.tsa.arima.ARIMA(endog, order=(1, 0, 0))
>>> res = mod.fit()
>>> print(res.summary())
```

## Attributes:

`endog_names` [statsmodels.tsa.arima.model.ARIMA.endog\_names.html#statsmodels.tsa.arima.model.ARIMA.endog\_names]

Names of endogenous variables

`exog_names` [statsmodels.tsa.arima.model.ARIMA.exog\_names.html#statsmodels.tsa.arima.model.ARIMA.exog\_names]

The names of the exogenous variables.

`initial_design` [statsmodels.tsa.arima.model.ARIMA.initial\_design.html#statsmodels.tsa.arima.model.ARIMA.initial\_design]

Initial design matrix

`initial_selection` [statsmodels.tsa.arima.model.ARIMA.initial\_selection.html#statsmodels.tsa.arima.model.ARIMA.initial\_selection]

Initial selection matrix

`initial_state_intercept` [statsmodels.tsa.arima.model.ARIMA.initial\_state\_intercept.html#statsmodels.tsa.arima.model.ARIMA.initial\_state\_intercept]

Initial state intercept vector

`initial_transition` [statsmodels.tsa.arima.model.ARIMA.initial\_transition.html#statsmodels.tsa.arima.model.ARIMA.initial\_transition]

Initial transition matrix

`initial_variance`

`initialization`

`loglikelihood_burn`

`model_latex_names` [statsmodels.tsa.arima.model.ARIMA.model\_latex\_names.html#statsmodels.tsa.arima.model.ARIMA.model\_latex\_names]

The latex names of all possible model parameters.

`model_names` [statsmodels.tsa.arima.model.ARIMA.model\_names.html#statsmodels.tsa.arima.model.ARIMA.model\_names]

The plain text names of all possible model parameters.

`model_orders` [statsmodels.tsa.arima.model.ARIMA.model\_orders.html#statsmodels.tsa.arima.model.ARIMA.model\_orders]

The orders of each of the polynomials in the model.

`param_names` [statsmodels.tsa.arima.model.ARIMA.param\_names.html#statsmodels.tsa.arima.model.ARIMA.param\_names]

List of human readable parameter names (for parameters actually included in the model).

`param_terms` [statsmodels.tsa.arima.model.ARIMA.param\_terms.html#statsmodels.tsa.arima.model.ARIMA.param\_terms]

List of parameters actually included in the model, in sorted order.

`start_params` [statsmodels.tsa.arima.model.ARIMA.start\_params.html#statsmodels.tsa.arima.model.ARIMA.start\_params]

Starting parameters for maximum likelihood estimation

`state_names` [statsmodels.tsa.arima.model.ARIMA.state\_names.html#statsmodels.tsa.arima.model.ARIMA.state\_names]

(list of str) List of human readable names for unobserved states.

`tolerance`

## Methods

<a href="#">clone</a> [statsmodels.tsa.arima.model.ARIMA.clone.html#statsmodels.tsa.arima.model.ARIMA.clone](endog[, exog])	Clone state space model with new data and optionally new specification
<a href="#">filter</a> [statsmodels.tsa.arima.model.ARIMA.filter.html#statsmodels.tsa.arima.model.ARIMA.filter](params[, transformed, ...])	Kalman filtering
<a href="#">fit</a> [statsmodels.tsa.arima.model.ARIMA.fit.html#statsmodels.tsa.arima.model.ARIMA.fit]([start_params, transformed, ...])	Fit (estimate) the parameters of the model.
<a href="#">fit_constrained</a> [statsmodels.tsa.arima.model.ARIMA.fit_constrained.html#statsmodels.tsa.arima.model.ARIMA.fit_constrained](constraints[, start_params])	Fit the model with some parameters subject to equality constraints.
<a href="#">fix_params</a> [statsmodels.tsa.arima.model.ARIMA.fix_params.html#statsmodels.tsa.arima.model.ARIMA.fix_params](params)	Fix parameters to specific values (context manager)
<a href="#">from_formula</a> [statsmodels.tsa.arima.model.ARIMA.from_formula.html#statsmodels.tsa.arima.model.ARIMA.from_formula](formula, data[, subset])	Not implemented for state space models
<a href="#">handle_params</a> [statsmodels.tsa.arima.model.ARIMA.handle_params.html#statsmodels.tsa.arima.model.ARIMA.handle_params](params[, transformed, ...])	Ensure model parameters satisfy shape and other requirements
<a href="#">hessian</a> [statsmodels.tsa.arima.model.ARIMA.hessian.html#statsmodels.tsa.arima.model.ARIMA.hessian](params, *args, **kwargs)	Hessian matrix of the likelihood function, evaluated at the given parameters
<a href="#">impulse_responses</a> [statsmodels.tsa.arima.model.ARIMA.impulse_responses.html#statsmodels.tsa.arima.model.ARIMA.impulse_responses](params[, steps, impulse, ...])	Impulse response function
<a href="#">information</a> [statsmodels.tsa.arima.model.ARIMA.information.html#statsmodels.tsa.arima.model.ARIMA.information](params)	Fisher information matrix of model.
<a href="#">initialize</a> [statsmodels.tsa.arima.model.ARIMA.initialize.html#statsmodels.tsa.arima.model.ARIMA.initialize]()	Initialize the SARIMAX model.
<a href="#">initialize_approximate_diffuse</a> [statsmodels.tsa.arima.model.ARIMA.initialize_approximate_diffuse.html#statsmodels.tsa.arima.model.ARIMA.initialize_approximate_diffuse]([variance])	Initialize approximate diffuse
<a href="#">initialize_default</a> [statsmodels.tsa.arima.model.ARIMA.initialize_default.html#statsmodels.tsa.arima.model.ARIMA.initialize_default]([...])	Initialize default
<a href="#">initialize_known</a> [statsmodels.tsa.arima.model.ARIMA.initialize_known.html#statsmodels.tsa.arima.model.ARIMA.initialize_known](initial_state, ...)	Initialize known
<a href="#">initialize_statespace</a> [statsmodels.tsa.arima.model.ARIMA.initialize_statespace.html#statsmodels.tsa.arima.model.ARIMA.initialize_statespace](**kwargs)	Initialize the state space representation
<a href="#">initialize_stationary</a> [statsmodels.tsa.arima.model.ARIMA.initialize_stationary.html#statsmodels.tsa.arima.model.ARIMA.initialize_stationary]()	Initialize stationary
<a href="#">loglike</a> [statsmodels.tsa.arima.model.ARIMA.loglike.html#statsmodels.tsa.arima.model.ARIMA.loglike](params, *args, **kwargs)	Loglikelihood evaluation
<a href="#">loglikeobs</a> [statsmodels.tsa.arima.model.ARIMA.loglikeobs.html#statsmodels.tsa.arima.model.ARIMA.loglikeobs](params[, transformed, ...])	Loglikelihood evaluation
<a href="#">observed_information_matrix</a> [statsmodels.tsa.arima.model.ARIMA.observed_information_matrix.html#statsmodels.tsa.arima.model.ARIMA.observed_information_matrix](params[, ...])	Observed information matrix
<a href="#">opg_information_matrix</a>	Outer product

<a href="#">[statsmodels.tsa.arima.model.ARIMA.opg_information_matrix.html#statsmodels.tsa.arima.model.ARIMA.opg_information_matrix](params[, ...])</a>	of gradients information matrix
<a href="#">predict</a> <a href="#">[statsmodels.tsa.arima.model.ARIMA.predict.html#statsmodels.tsa.arima.model.ARIMA.predict](params[, exog])</a>	After a model has been fit predict returns the fitted values.
<a href="#">prepare_data</a> <a href="#">[statsmodels.tsa.arima.model.ARIMA.prepare_data.html#statsmodels.tsa.arima.model.ARIMA.prepare_data]()</a>	Prepare data for use in the state space representation
<a href="#">score</a> <a href="#">[statsmodels.tsa.arima.model.ARIMA.score.html#statsmodels.tsa.arima.model.ARIMA.score](params, *args, **kwargs)</a>	Compute the score function at params.
<a href="#">score_obs</a> <a href="#">[statsmodels.tsa.arima.model.ARIMA.score_obs.html#statsmodels.tsa.arima.model.ARIMA.score_obs](params[, method, transformed, ...])</a>	Compute the score per observation, evaluated at params
<a href="#">set_conserve_memory</a> <a href="#">[statsmodels.tsa.arima.model.ARIMA.set_conserve_memory.html#statsmodels.tsa.arima.model.ARIMA.set_conserve_memory]([conserve_memory])</a>	Set the memory conservation method
<a href="#">set_filter_method</a> <a href="#">[statsmodels.tsa.arima.model.ARIMA.set_filter_method.html#statsmodels.tsa.arima.model.ARIMA.set_filter_method]([filter_method])</a>	Set the filtering method
<a href="#">set_inversion_method</a> <a href="#">[statsmodels.tsa.arima.model.ARIMA.set_inversion_method.html#statsmodels.tsa.arima.model.ARIMA.set_inversion_method]([inversion_method])</a>	Set the inversion method
<a href="#">set_smoother_output</a> <a href="#">[statsmodels.tsa.arima.model.ARIMA.set_smoother_output.html#statsmodels.tsa.arima.model.ARIMA.set_smoother_output]([smoother_output])</a>	Set the smoother output
<a href="#">set_stability_method</a> <a href="#">[statsmodels.tsa.arima.model.ARIMA.set_stability_method.html#statsmodels.tsa.arima.model.ARIMA.set_stability_method]([stability_method])</a>	Set the numerical stability method
<a href="#">simulate</a> <a href="#">[statsmodels.tsa.arima.model.ARIMA.simulate.html#statsmodels.tsa.arima.model.ARIMA.simulate](params, nsimulations[, ...])</a>	Simulate a new time series following the state space model
<a href="#">simulation_smoother</a> <a href="#">[statsmodels.tsa.arima.model.ARIMA.simulation_smoother.html#statsmodels.tsa.arima.model.ARIMA.simulation_smoother]([simulation_output])</a>	Retrieve a simulation smoother for the state space model.
<a href="#">smooth</a> <a href="#">[statsmodels.tsa.arima.model.ARIMA.smooth.html#statsmodels.tsa.arima.model.ARIMA.smooth](params[, transformed, ...])</a>	Kalman smoothing
<a href="#">transform_jacobian</a> <a href="#">[statsmodels.tsa.arima.model.ARIMA.transform_jacobian.html#statsmodels.tsa.arima.model.ARIMA.transform_jacobian](unconstrained[, ...])</a>	Jacobian matrix for the parameter transformation function
<a href="#">transform_params</a> <a href="#">[statsmodels.tsa.arima.model.ARIMA.transform_params.html#statsmodels.tsa.arima.model.ARIMA.transform_params](unconstrained)</a>	Transform unconstrained parameters used by the optimizer to constrained parameters used in likelihood evaluation.
<a href="#">untransform_params</a> <a href="#">[statsmodels.tsa.arima.model.ARIMA.untransform_params.html#statsmodels.tsa.arima.model.ARIMA.untransform_params](constrained)</a>	Transform constrained parameters used in likelihood

		evaluation to unconstrained parameters used by the optimizer
<b>update</b>	[statsmodels.tsa.arima.model.ARIMA.update.html#statsmodels.tsa.arima.model.ARIMA.update](params[, transformed, ...])	Update the parameters of the model

## Properties

<b>endog_names</b>	[statsmodels.tsa.arima.model.ARIMA.endog_names.html#statsmodels.tsa.arima.model.ARIMA.endog_names]	Names of endogenous variables
<b>exog_names</b>	[statsmodels.tsa.arima.model.ARIMA.exog_names.html#statsmodels.tsa.arima.model.ARIMA.exog_names]	The names of the exogenous variables.
<b>initial_design</b>	[statsmodels.tsa.arima.model.ARIMA.initial_design.html#statsmodels.tsa.arima.model.ARIMA.initial_design]	Initial design matrix
<b>initial_selection</b>	[statsmodels.tsa.arima.model.ARIMA.initial_selection.html#statsmodels.tsa.arima.model.ARIMA.initial_selection]	Initial selection matrix
<b>initial_state_intercept</b>	[statsmodels.tsa.arima.model.ARIMA.initial_state_intercept.html#statsmodels.tsa.arima.model.ARIMA.initial_state_intercept]	Initial state intercept vector
<b>initial_transition</b>	[statsmodels.tsa.arima.model.ARIMA.initial_transition.html#statsmodels.tsa.arima.model.ARIMA.initial_transition]	Initial transition matrix
<b>initial_variance</b>	[statsmodels.tsa.arima.model.ARIMA.initial_variance.html#statsmodels.tsa.arima.model.ARIMA.initial_variance]	
<b>initialization</b>	[statsmodels.tsa.arima.model.ARIMA.initialization.html#statsmodels.tsa.arima.model.ARIMA.initialization]	
<b>loglikelihood_burn</b>	[statsmodels.tsa.arima.model.ARIMA.loglikelihood_burn.html#statsmodels.tsa.arima.model.ARIMA.loglikelihood_burn]	
<b>model_latex_names</b>	[statsmodels.tsa.arima.model.ARIMA.model_latex_names.html#statsmodels.tsa.arima.model.ARIMA.model_latex_names]	The latex names of all possible model parameters.
<b>model_names</b>	[statsmodels.tsa.arima.model.ARIMA.model_names.html#statsmodels.tsa.arima.model.ARIMA.model_names]	The plain text names of all possible model parameters.
<b>model_orders</b>	[statsmodels.tsa.arima.model.ARIMA.model_orders.html#statsmodels.tsa.arima.model.ARIMA.model_orders]	The orders of each of the polynomials in the model.
<b>param_names</b>	[statsmodels.tsa.arima.model.ARIMA.param_names.html#statsmodels.tsa.arima.model.ARIMA.param_names]	List of human readable parameter names (for parameters actually included in the model).
<b>param_terms</b>	[statsmodels.tsa.arima.model.ARIMA.param_terms.html#statsmodels.tsa.arima.model.ARIMA.param_terms]	List of parameters actually included in the model, in sorted order.
<b>params_complete</b>	[statsmodels.tsa.arima.model.ARIMA.params_complete.html#statsmodels.tsa.arima.model.ARIMA.params_complete]	
<b>start_params</b>	[statsmodels.tsa.arima.model.ARIMA.start_params.html#statsmodels.tsa.arima.model.ARIMA.start_params]	Starting parameters for maximum likelihood estimation
<b>state_names</b>	[statsmodels.tsa.arima.model.ARIMA.state_names.html#statsmodels.tsa.arima.model.ARIMA.state_names]	(list of str) List of human readable names for unobserved states.
<b>tolerance</b>	[statsmodels.tsa.arima.model.ARIMA.tolerance.html#statsmodels.tsa.arima.model.ARIMA.tolerance]	

