The ARIMAX Model

Full Name:

The **A**uto**r**egressive **I**ntegrated **M**oving **A**verage e**X**ogenous Model

Mathematical Notation:

$$\Delta P_t = c + \beta X + \varphi_1 \Delta P_{t-1} + \theta_1 \varepsilon_{t-1} + \varepsilon_t$$

P_t, P_{t-1}	Values in the current period and 1 period ago respectively
ε_t, ε_{t-1}	Error terms for the same two periods
c	Baseline constant factor
φ_1	What part of the value last period is relevant in explaining the current one
θ_1	What part of the error last period is relevant in explaining the current value
ΔP_t	$= P_t - P_{t-1}$
X	Exogenous variable
β	Coefficient for the exogenous variable

Description:

The ARIMA is just an integrated version of the ARMA model. What that means is, we simply integrate the data (however many times is needed) to get a stationary set.

Then, we fit a normal ARMA model like we already learned to.

An ARIMA model with 0 degrees of integration is simply an ARMA model, and so any ARIMA (p, 0, q) model is equivalent to an ARMA (p,q).

The order of Integration (d) tells us exactly how many times we need to compute the non-seasonal differences between the values to reach stationarity and including more is discouraged (due to data attrition and interpretability of the results).

The ARIMAX Model

Implementation of the Simple Model in Python:

The library the *ARIMA* method comes from

The method we are importing

```
from statsmodels.tsa.arima_model import ARIMA
```

```
model_ar_1_i_1_ma_1_X_spx = ARIMA(df.market_value, exog = df.spx, order=(1,1,1))
```

The variable storing the model characteristics that we will fit later

The time series we wish to analyse

The exogenous variable we are adding to the ARIMA model

The order of the model

*For an ARIMAX(p,d,q) model, simply change the order from (1,1,1) to (p,d,q).