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How to use the Autocorreation Function (ACF)?

🗂 Time Series   🕐 August 7, 2013August 12, 2017   ≣ 1 Minute

The Autocorrelation function is one of the widest used tools in timeseries analysis. It is used to determine **stationarity** and **seasonality**.

Stationarity:

This refers to whether the series is "going anywhere" over time. Stationary series have a constant value *over time.*

Below is what a *non*-stationary series looks like. Note the changing mean.

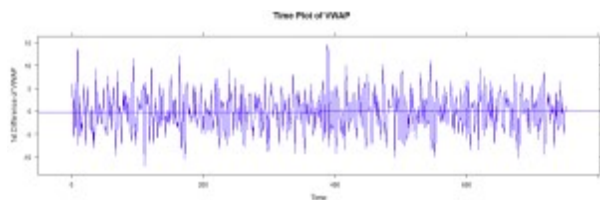(https://coolstatsblog.files.wordpress.com
/2013/08/j1.png)
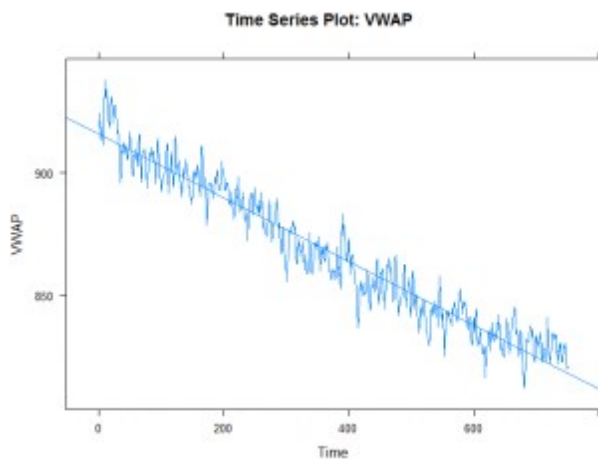
Time series plot of non-stationary series   And below is what a stationary series looks like. This is the

first difference of the above series, FYI. Note the constant mean (long term).
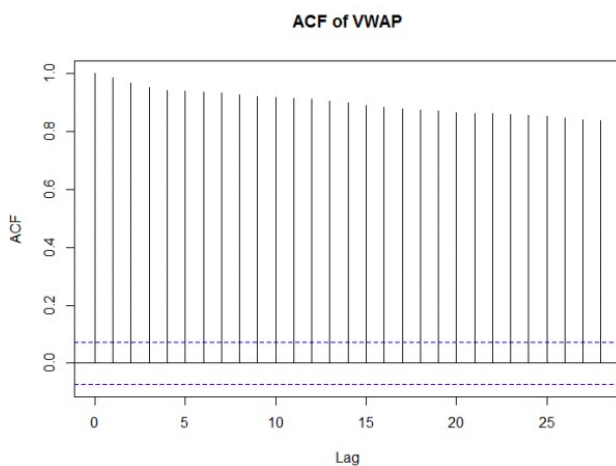
(https://coolstatsblog.files.wordpress.com
/2013/08/k.png)

Stationary series: First difference of VWAP   The above time series provide strong indications of (non)

stationary, but the ACF helps us ascertain this indication.

If a series is non-stationary (moving), its ACF may look a little like this:

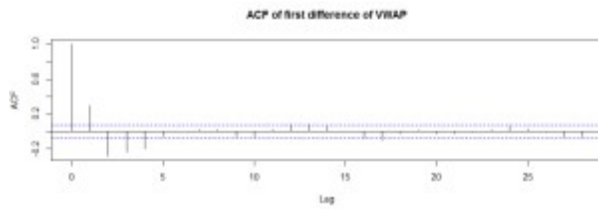(https://coolstatsblog.files.wordpress.com
/2013/08/l.png)

ACF of non-stationary series   The above ACF is "decaying", or decreasing, very slowly,

and remains well above the significance range (dotted blue lines). This is indicative of a non-stationary series.

On the other hand, observe the ACF of a stationary (not going anywhere) series:

ACF of first difference of VWAP

ACF of stationary series   Note that the ACF shows exponential decay. This is

indicative of a stationary series.

Consider the case of a simple stationary series, like the process shown below:

$$Y_t = \epsilon_t$$

We do not expect the ACF to be above the significance range for lags 1, 2, … This is intuitively satisfactory, because the above process is purely random, and therefore whether you are looking at a lag of 1 or a lag of 20, the correlation should be theoretically zero, or at least insignificant.

Next: <u>ACF for **Seasonality** (https://coolstatsblog.com/2013/08/11/how-to-use-autocorreation-function-acf-to-determine-seasonality/)</u>

Abbas Keshvani

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Time series,
Time Series Analysis

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20 thoughts on "How to use the Autocorreation Function (ACF)?"

amin ahsan says:

August 20, 2014 at 3:51 am

thank you very much…..

↳ Reply

   Bahaa says:

   February 25, 2015 at 8:28 pm

   Thank you Abbas for simple and well explained topic.

   My question is in non-stationary data how can we find auto correlation? is partial auto correlation

   is a good alternative?

   ↳ Reply

      Abbas Keshvani says:

      March 20, 2015 at 12:47 pm

      Hi Bahaa, thanks for the kind words. An autocorrelation for a non-stationary series would look

      funny, kinda of like here: https://coolstatsblog.files.wordpress.com/2013/08/berlin2.jpeg. Are

      you trying to prove that the realizations/values are correlated?

   Abbas Keshvani says:

   March 20, 2015 at 12:47 pm

   You're welcome Amin 🙂

   ↳ Reply

   Ankush Jamthikar says:

   March 24, 2017 at 1:57 pm

   Hi Can you explain relation between Auto correlation and Confidence Interval with same intuitive

   explanation

   ↳ Reply

gefüllte paprika zucchini says:

October 4, 2014 at 5:02 pm

Thanks a lot for sharing this with all people you actually realize what

you're talking about! Bookmarked. Please also talk over with my web site =).

We will have a hyperlink alternate arrangement between us

↳ Reply

kochen says:

October 21, 2014 at 1:31 pm

Woah! I'm really digging the template/theme of this website.

It's simple, yet effective. A lot of times it's

tough to get that "perfect balance" between user friendliness and visual appeal.

I must say you've done a amazing job with this. Also, the blog loads extremely quick for me

on Opera. Excellent Blog!

↳ Reply

kochgedichte says:

October 23, 2014 at 1:45 pm

I think the admin of this website is genuinely working hard in support of his website,

for the reason that here every data is quality based data.

↳ Reply

Anonymous says:

January 23, 2015 at 7:21 pm

Hi Good simple explanation – I've always believed if you can explain simply – the person has understood it thoroughly 🙂 Came across the term an hour or so ago (ACF term) and was looking for a simpler explanation

And after a few hits – here it is 🙂

Rajesh

↳ Reply

Abbas Keshvani says:

February 8, 2015 at 6:53 am

I agree, Rajesh. I think the best part about understanding something fully is that you can take control of the language around it, and therefore simplify it. Thanks for visiting!

↳ Reply

Pingback: How to Use Autocorreation Function (ACF) to Determine Seasonality | CoolStatsBlog

Anonymous says:

September 16, 2015 at 3:20 pm

Hi Abbas,

Just a non scientific comment to edit the post:
The word autocorrelation on the title is missspelled and needs a "L" 🙂

↳ Reply

Abbas Keshvani says:

June 4, 2016 at 4:57 am

Thanks!

↳ Reply

Felix Asare says:

March 10, 2017 at 11:08 am

Can the acf be used to provide at least five comments about a series? If it is possible pls give me five of them

↳ Reply

Anonymous says:

May 4, 2017 at 2:49 pm

I am interested in knowing how do we assign the blue line in stationary series data

↳ Reply

Pranjal Rawat says:

June 10, 2017 at 8:03 pm

Hello,

a slight correction needed: MA(1) process is $Y(t)=u(t)+b*u(t-1)$.

What you gave an example of above is a MA(0) process.

↳ Reply

Abbas Keshvani says:
August 12, 2017 at 1:35 am
Good spot, Pranjal! It has been corrected. Thanks.

↳ Reply

Anonymous says:
November 7, 2017 at 3:57 pm
thanx sir, how can i get a pdf paper for this subject.

↳ Reply

Martin D says:
April 24, 2018 at 6:43 am
Thanks for this clarifying post!
The criteria for a stationary time series are (1) constant mean, (2) constant variance, (3) the covariance
between today's independent variable and tomorrow's independent variable is not a function of time.
In exactly what way does autocorrelation (correlation in the error terms) violate these three criteria?

↳ Reply

inamul haq says:
January 22, 2019 at 12:36 pm
awesome explanation… Thank you sir….

↳ Reply

Blog at WordPress.com.