COOLSTATSBLOG

Economics and statistics in plain English

HOW TO USE THE AUTOCORREATION FUNCTION (ACF)?

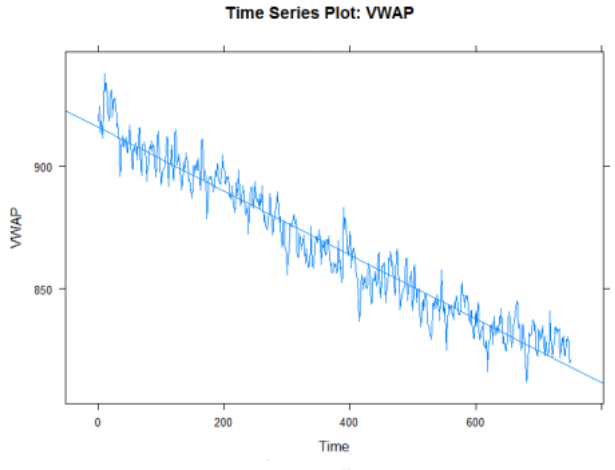
Posted on August 7, 2013 by Abbas Keshvani under Time Series

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

Stationarity:

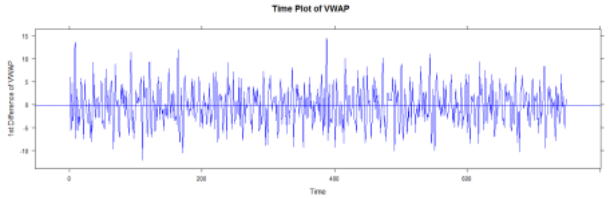
This refers to whether the series is "going anywhere" over time. Stationary series have a constant value *over time*.

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



Time series plot of non-stationary series

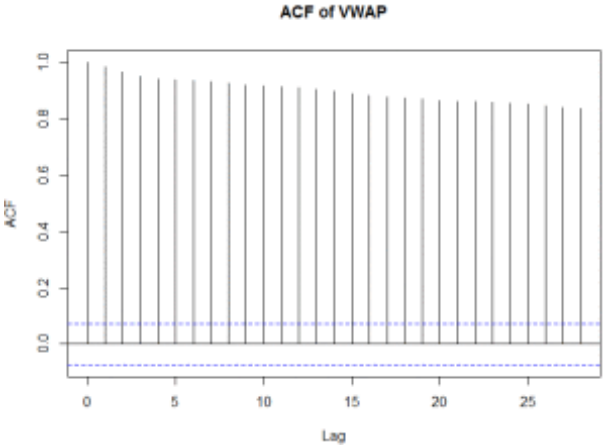
And below is what a stationary series looks like. This is the first difference of the above series, FYI. Note the constant mean (long term).



Stationary series: First difference of VWAP

The above time series provide strong indications of (non) stationary, but the ACF helps us ascertain this indication.

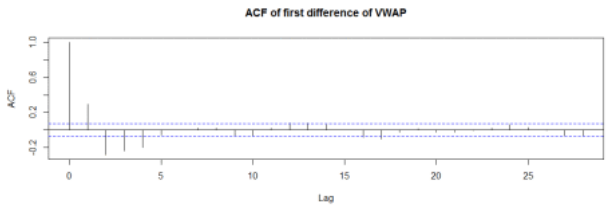
If a series is non-stationary (moving), its ACF may look a little like this:



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 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 an moving average MA(1) 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 MA(1) 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: ACF for **Seasonality**

Abbas Keshvani

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This entry was tagged Autocorrelation, MA(1), Moving average, Stationary process, Time series, Time Series Analysis. Bookmark the permalink.

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

amin ahsan

August 20, 2014 at 3:51 am

thank you very much…..

Reply

Bahaa

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

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

March 20, 2015 at 12:47 pm

You're welcome Amin🙂

Reply

gefüllte paprika zucchini

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

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

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

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

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

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

June 4, 2016 at 4:57 am

Thanks!

Reply

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