

## ***Effective Trading Strategies - an Autoregressive Perspective***

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## **Meeting Agenda**

- Portfolio Teams = Members
- Bryant Wang wants you!
- Mistakes Happen
- ARMA virumque cano

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## Why ARMA?

- Most Used In:
  - Econometrics
  - Time Series Analysis
  - Trading Systems
- As Effective As Research Analysts

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## Agenda

- Theory
  - ARMA = Autoregressive Moving Average Model
  - AutoRegressive, or AR
    - Implications
  - Moving Average, or MA
    - Implications
- Application for Trading Systems

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## House Cleaning

- First, take out obvious trends
- For Coke(KO), you would take out the average



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## House Cleaning

- For emerging markets(EEV), take out the linear trend



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## Error - Epsilon

- $\varepsilon$
- Distribution with mean 0
- Has no predictability
- If you had a time series of  $5 + \varepsilon$ , what is the expected value?

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## AutoRegressive

- $P_t = k * P_{t-1} + \varepsilon_t$
- Example:
- Previous close for Coke was \$50 and the k for Coke at that period with an average price of \$45. k was calculated to be 0.6.

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## Answer

- Take out average, so deviation is \$5.
- $P_t = 0.6 * \$5 + \varepsilon = \$3$
- So expected price is  $\$45 + \$3 = \$48$

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## Discussion

- How can you leverage this for a trading strategy
- Excel Spreadsheet

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## Moving Average

- Calculates the effect of ripples from errors
- If stocks drop 5% in one day, won't there be some sort of ripple effects?
  - Late traders
  - Liquidation due to margin calls
- NOT MOVING AVERAGE FROM TECHNICAL ANALYSIS

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## Moving Average Example

- $P_t = q \cdot \epsilon_{t-1} + \epsilon_t$
- Coke has average price of \$45, and jumped \$2 yesterday. It has a  $q$  of 0.4. What is the expected price tomorrow?
- $P_t = 2 \cdot .4 = .8$
- Price expected to be \$45.8

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## Discussion

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## Synergy

- AR does not take into account the effects of errors, but MA does not take into account where the stock currently stands.
- Put them together to form ARMA model.
- Now, only problem is calculating  $k$  and  $q$ .

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## Exploratory Analysis

- So, how do we find  $k$  and  $q$ ?
- ARMA Modeling
- Software Packages
  - Minitab
  - R
  - Matlab

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## Contestant #1

- Difference between XOM and Chevron Stock

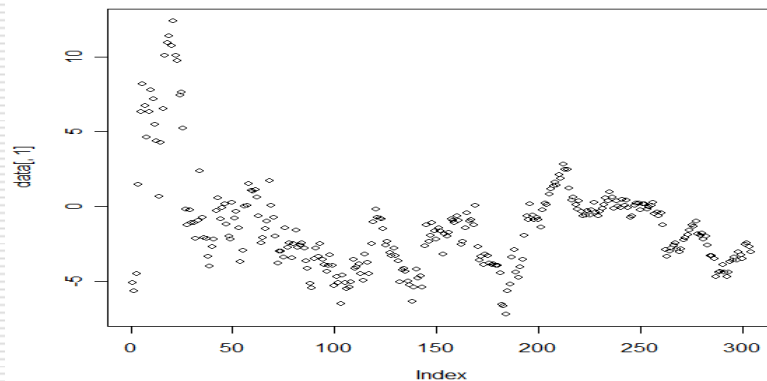


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## Exxon - Chevron Price



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## Avenue Q

- We can find the Q of the Moving Average using the ACF function (autocorrelation function).
- ACF calculates the lag-x correlation
- Note: lag-1 correlation is the correlation between time series and itself.

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## Torn ACF

- Set: {1, 3, 4, 5, 7}
- Lag-1 correlation =  
Correlation(1,3,4,5 against 3,4,5,7)
- If value is above 1

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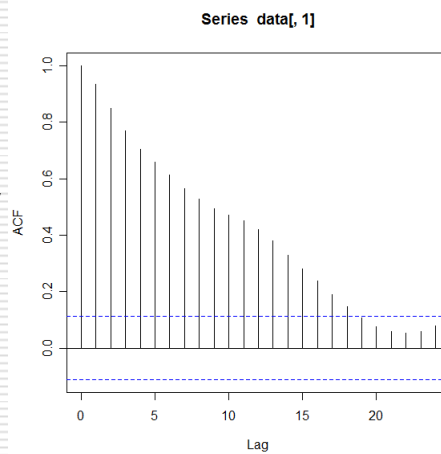
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## ACF of Data Series

- What does  
this imply?

Implies t-series may  
be AR model!



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## Link Between AR and MA

- AR(1) = MA( $\infty$ )
- Recursion
  
- Much like logic for dividend discount model



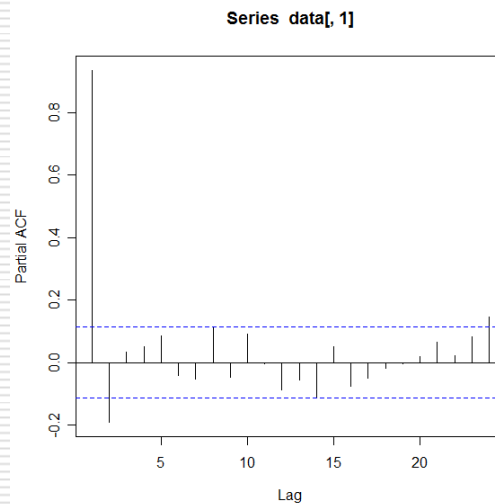
## Special K

- Use the PACF to find the Autocorrelation Coefficients
- Computes Partial ACF- takes out explanatory power of previous autocorrelations



## PACF of Data Series

- AR(1) ~ 0.9
- AR(2) ~ -0.2



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## Final Verdict

- Difference between CVX and XOM
  - $= .9P_{t-1} - 0.2P_{t-2}$
- What is the forward prediction?
  - $P_{t-1} = -3.65$
  - $P_{t-2} = -5.13$
  - $P_t = .9 * -3.65 - .2 * 5.13 = -2.259$
- What should your trade be?

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## Ending Thoughts

- Does not work for everything!
- Beware of the Random Walk model.
- Notes on how to do the analysis in R posted online on QFS website

