

# Risk Analysis using ARIMA and (G)ARCH Models

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April 16, 2013

# Risk Aversion Example

- Everyone gets to "invest" in one of two assets:
  - ① A guaranteed \$51,209
  - ② A 50/50 chance of getting either \$50,000 or \$100,000.
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# Possible Explanations

- Some say it doesn't exist. The data says it does!
- Risk Aversion:
  - Stocks are risky assets so people are less willing to invest in them.
  - Very important → In 1981 Markowitz showed that investors would be willing to forgo a 1% increment between our assets from the beginning using standard risk aversion coefficients.
- Market Failures: things like transaction costs or liquidity constraints
- Volatility arguments: Risky assets are much more volatile - people don't like that.
- Tax policy

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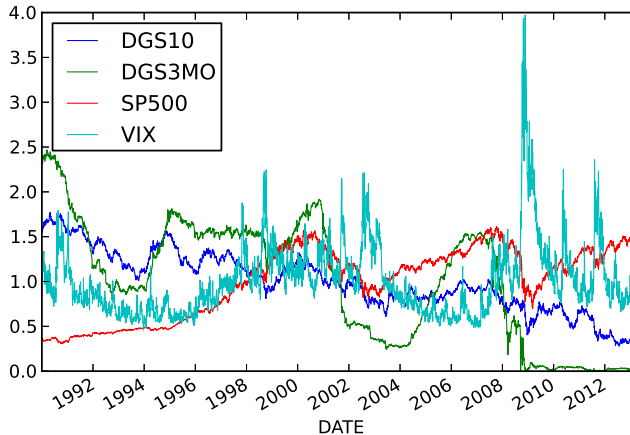
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# My Data

- Risky Assets:
  - Prices for SP500 ( $\hat{GSPC}$ )
  - Value of VIX ( $\hat{VIX}$ )
- Risk Free Assets:
  - 3-Month US T-bill (DGS3MO)
  - 10-Year US T-bill (DGS10)
- Frequency for all data is Business Day
- Collected from 1-1-1990 to 4-8-2013

# Plot Data



# Plans

- My Question: Will standard, modern time series techniques forecast data in line with the EPP or against it?
- I will use ARIMA, GARCH, and ARCH models to generate forecasts for the data
- I will then see what the implied equity premium is on my forecasted data

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# Setting up ARIMA

- Need to identify  $p$ ,  $q$ ,  $d$  for arima.
- For finding  $p$  and  $q$  see Figure on next slide ( $p=1$ ,  $q=0$  for all)
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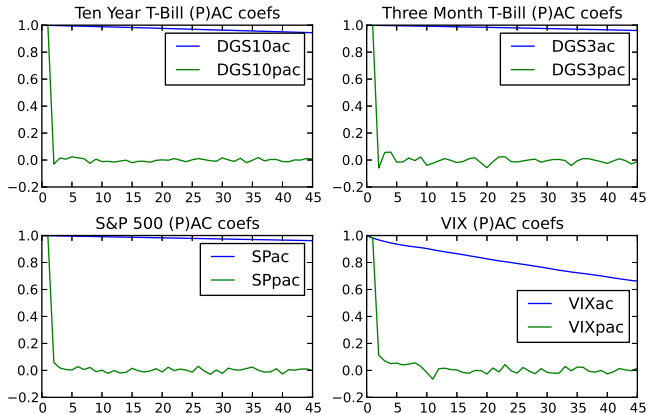
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# PAC and AC



# Moments for Differences

DataSet	Lags	Mean	Variance	DataSet	Lags	Mean	Variance
DGS10	1	-0.001425545	0.003990852	SP500	1	0.03449455	224.2908
	2	-0.002824705	0.007977331		2	0.08398426	406.3557
	3	-0.00424894	0.01156277		3	0.1329679	574.528
	4	-0.005655862	0.01518609		4	0.1779158	748.1064
DGS3MO	1	-0.001637409	0.003366346	VIX	1	-0.003483656	3.13206
	2	-0.003254617	0.007774232		2	-0.007680896	5.355797
	3	-0.00488189	0.01147704		3	-0.01181405	7.261939
	4	-0.006498031	0.01407682		4	-0.01544986	9.018458

# GARCH

I still need to do this