WHY IS FINANCIAL MARKET VOLATILITY SO HIGH?

Robert Engle

Stern School of Business

RISK

- A Risk is a bad future event that could occur and possibly could be avoided.

- Some risks are worth taking because the possible benefit exceeds the possible costs.
- Finance investigates which risks are worth taking.

NOBEL ANSWERS

- Markowitz (1952) and Sharpe(1964) and Tobin (1958) received Nobel awards in 1990 and 1981 for associating risk with the variance of financial returns.
- Capital Asset Pricing Model or CAPM answer: Only variances that could not be diversified would be rewarded.

BLACK-SCHOLES AND MERTON

- Options can be used as insurance policies. For a fee we can eliminate financial risk for a period.
- What is the right fee?
- Black and Scholes(1972) and Merton(1973) developed an option pricing formula from a dynamic hedging argument. Their answer also satisfies the CAPM.
- They received the Nobel prize in 1997

IMPLEMENTING THESE MODELS

- Practitioners required estimates of variances and covariances or equivalently volatilities and correlations.

ESTIMATES DIFFER FOR DIFFERENT TIME PERIODS

- Volatility is apparently varying over time

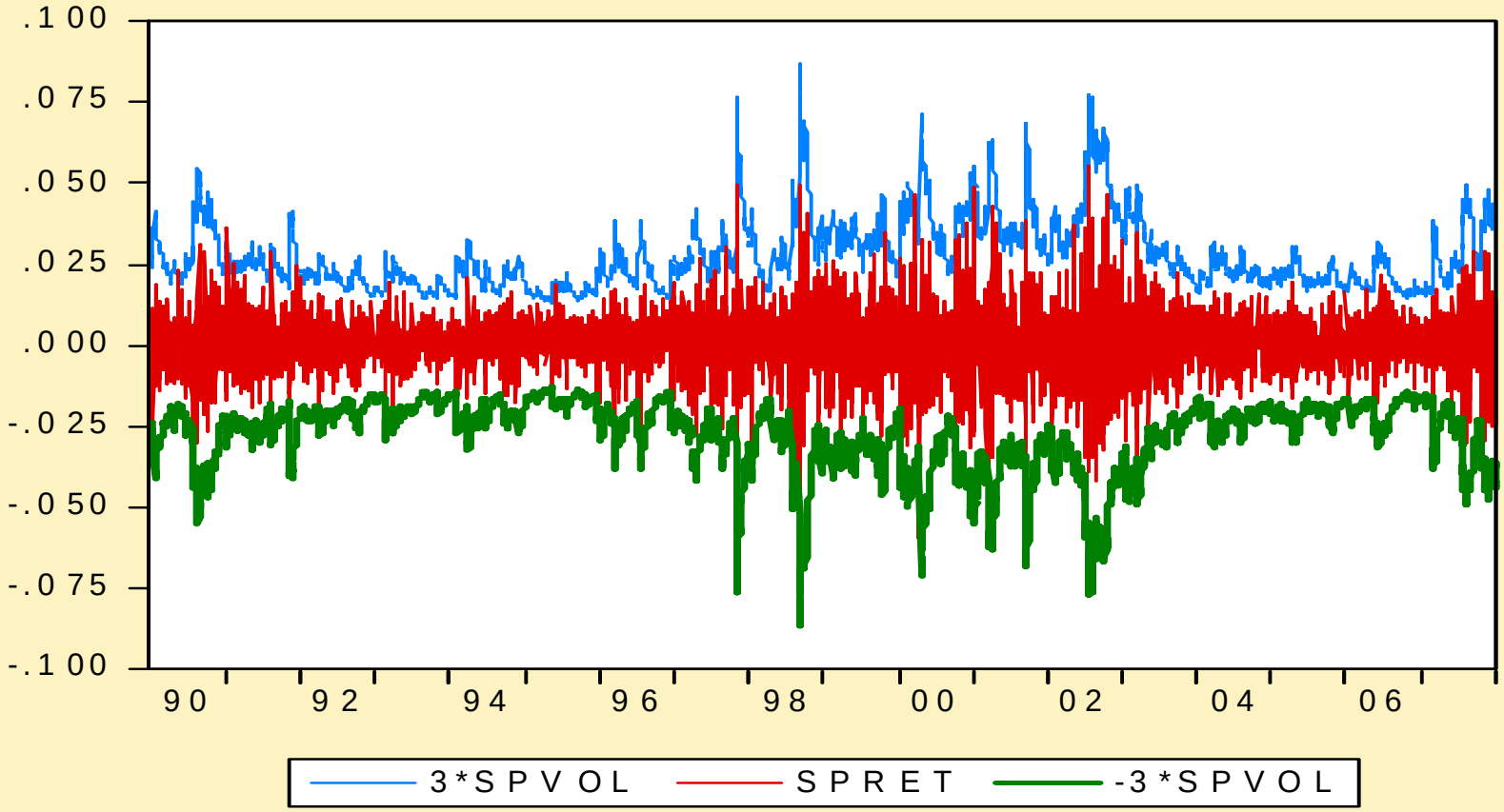
- What is the volatility now?
- What is it likely to be in the future?

- How can we forecast something we never observe?

ARCH MODEL

- The ARCH model predicts the variance of returns on the next day.
- It relies on two features of returns
  - Volatility Clustering
  - Mean Reversion of Volatility
- Econometric Methods fit this model to data

Plus and Minus three Sigma



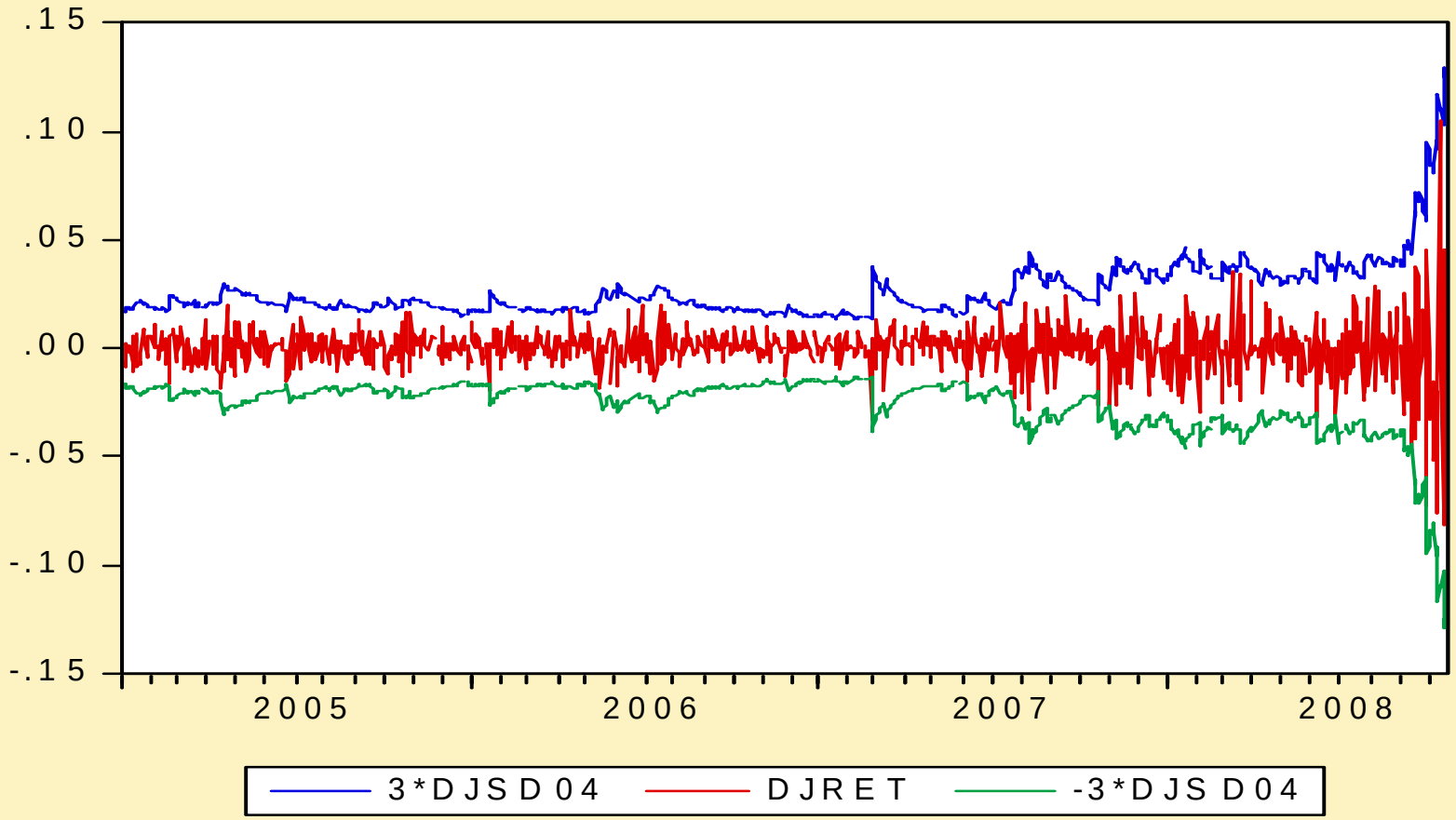
OBSERVATIONS

- CONFIDENCE INTERVAL IS CHANGING
- GREEN CURVE IS APPROXIMATELY VAR
- .6% RETURNS EXCEED INTERVAL
- LARGEST IS -6.8 SIGMA! (oct 27 1997)
- MORE EXTREMES THAN EXPECTED FOR A NORMAL BUT NOT FOR A STUDENT-T

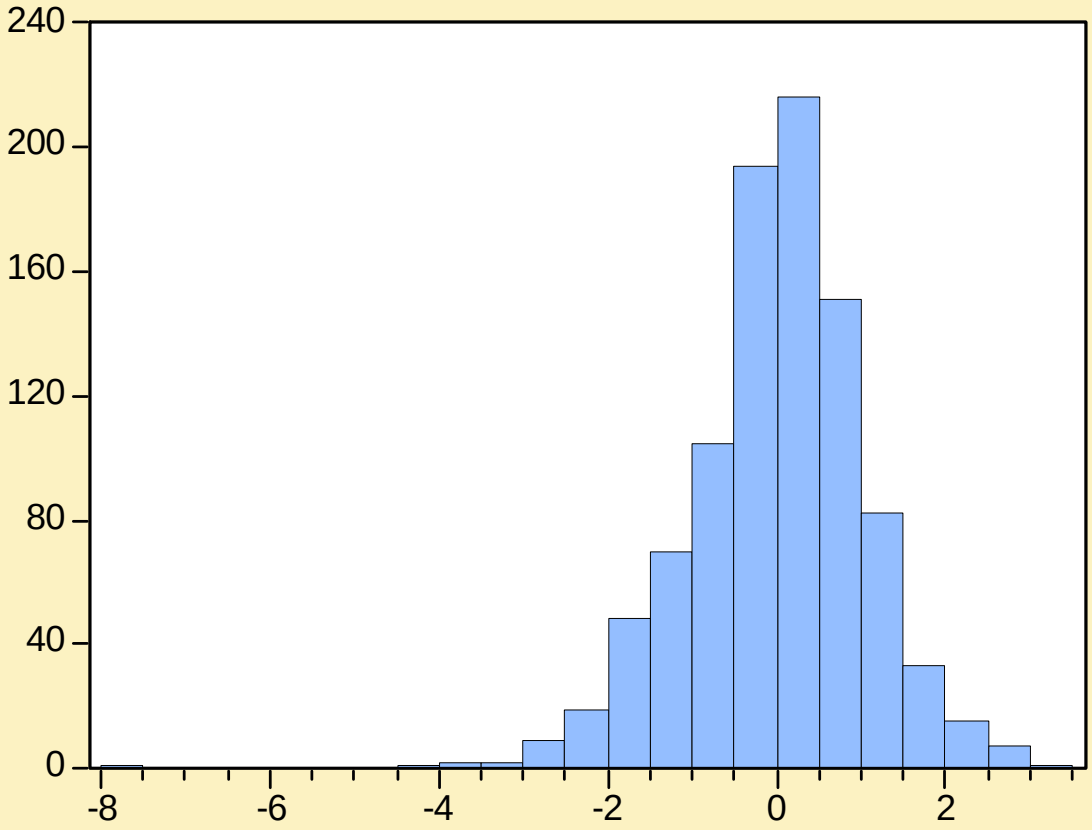
DOES THIS WORK IN TURBULENT TIMES?

- ESTIMATE THROUGH 2004
- KEEPING SAME PARAMETERS, FORECAST TO END OF SAMPLE ONE DAY AT A TIME.
- DO WE SEE MULTI-SIGMA MOVES?

Plus and Minus 3 x sigma using 2004 model



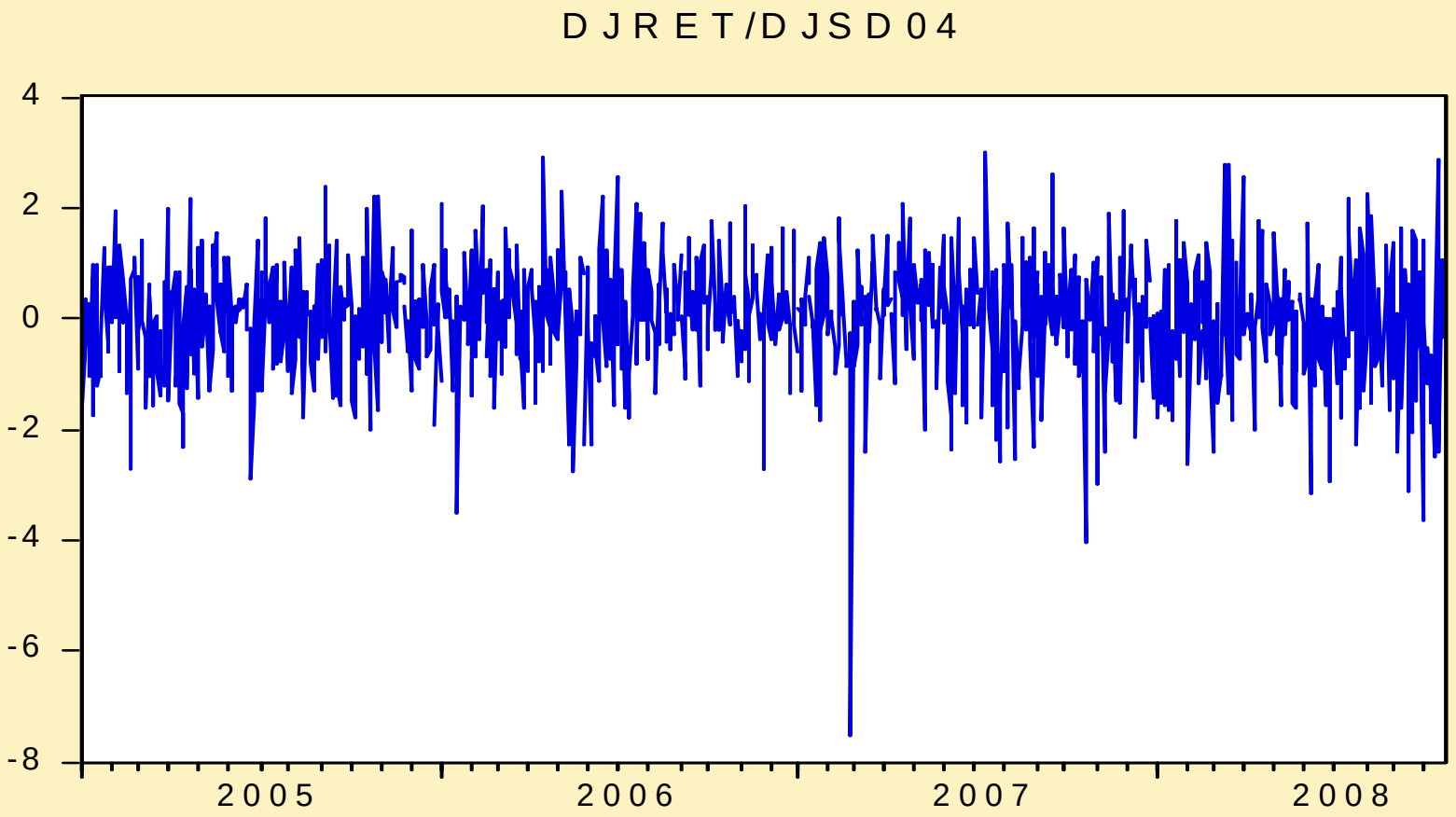
STANDARDIZED RETURNS SINCE 2004 USING 2004 ESTIMATED MODEL



Series: DJRET/DJSD04
Sample 1/03/2005 10/20/2008
Observations 956

Mean	-0.001066
Median	0.063605
Maximum	3.004820
Minimum	-7.536694
Std. Dev.	1.053278
Skewness	-0.665960
Kurtosis	5.993653
Jarque-Bera	427.6494
Probability	0.000000

WHAT WAS -7 SIGMA EVENT?



SURPRISING SUCCESS

- Although the original application of ARCH was macroeconomic, the big success was for financial data.
- Why does it work?
- What makes volatility high?

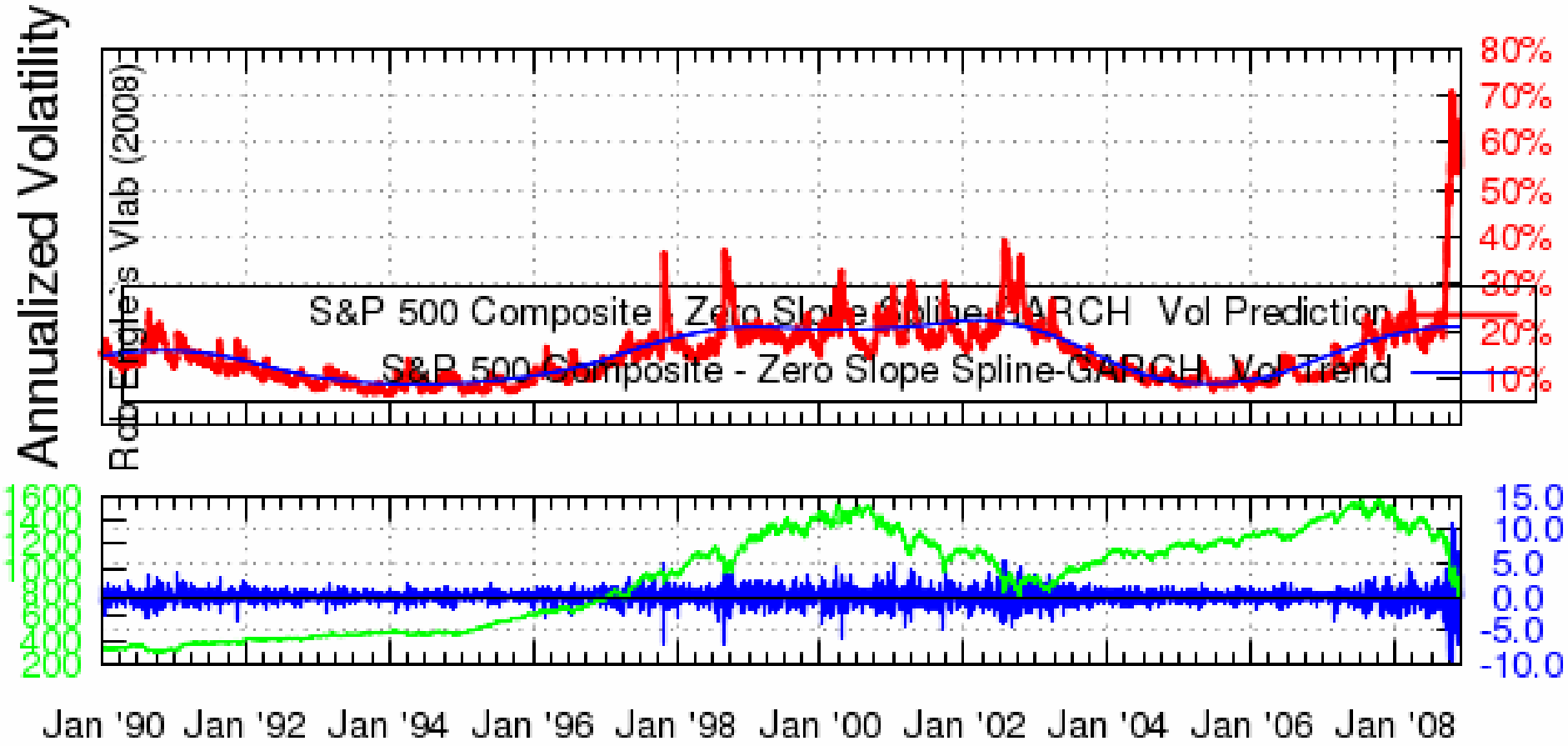
BETTER ANSWER

- Economic news on future values and risks moves prices
- Volatility is the natural response of a financial market to new information.
- News arrives in clusters.
- *High volatility means a cluster of important news!*

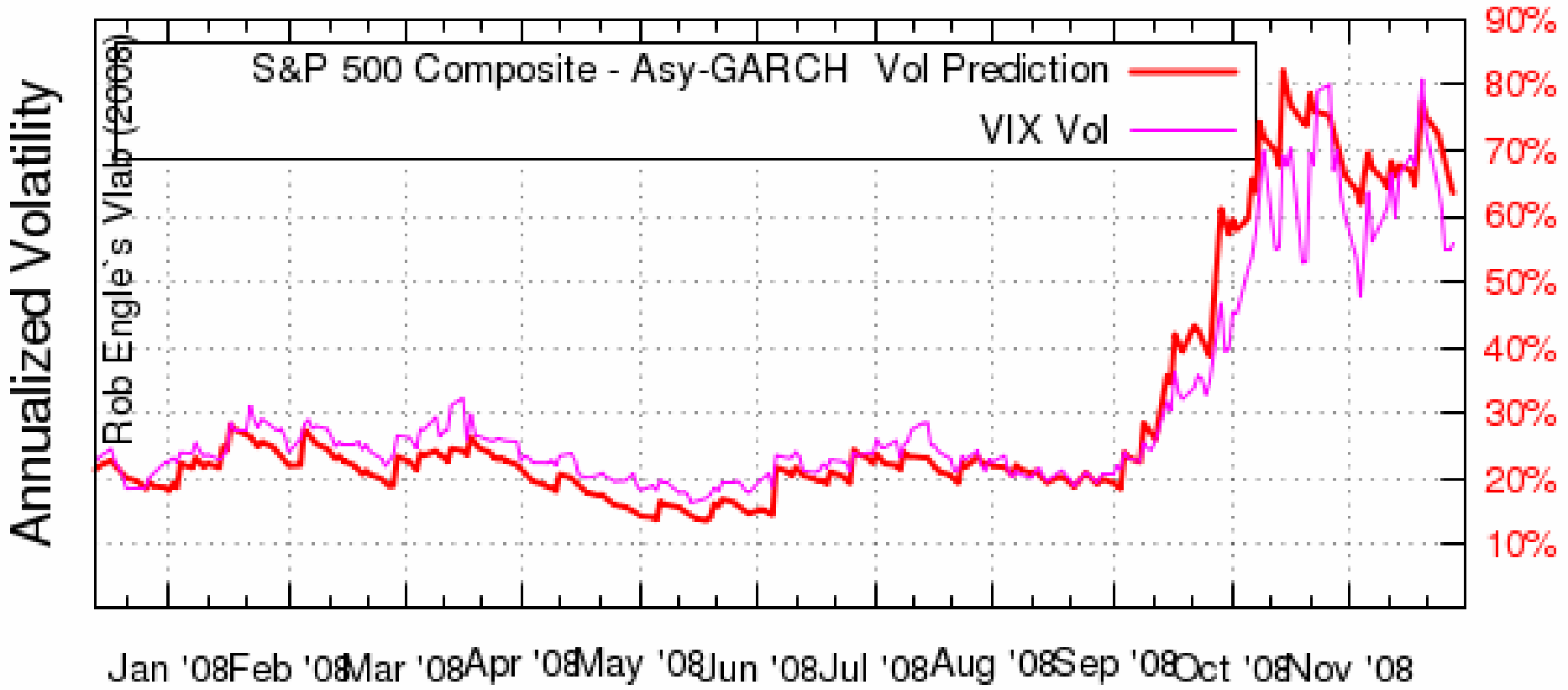
VOLATILITY

Through November 30,2008
VLAB

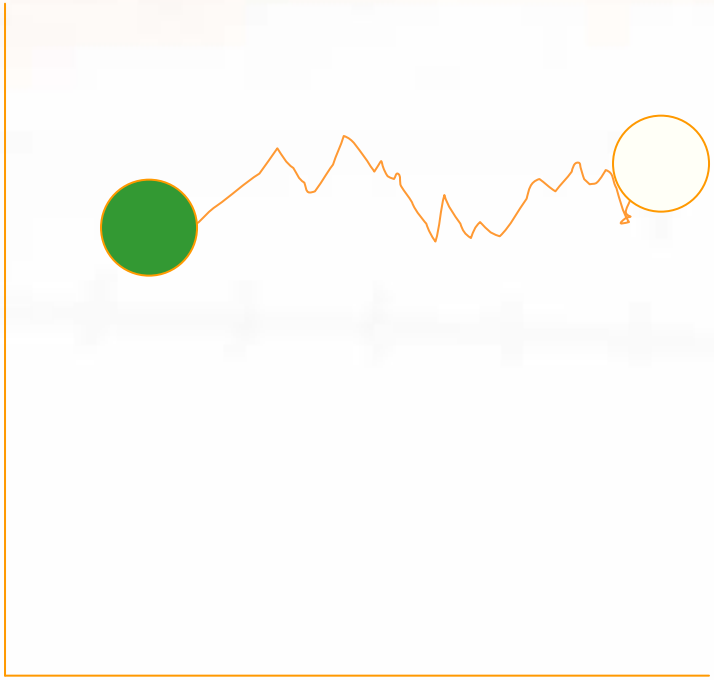
S&P 500 Spline GARCH- 11/30/08

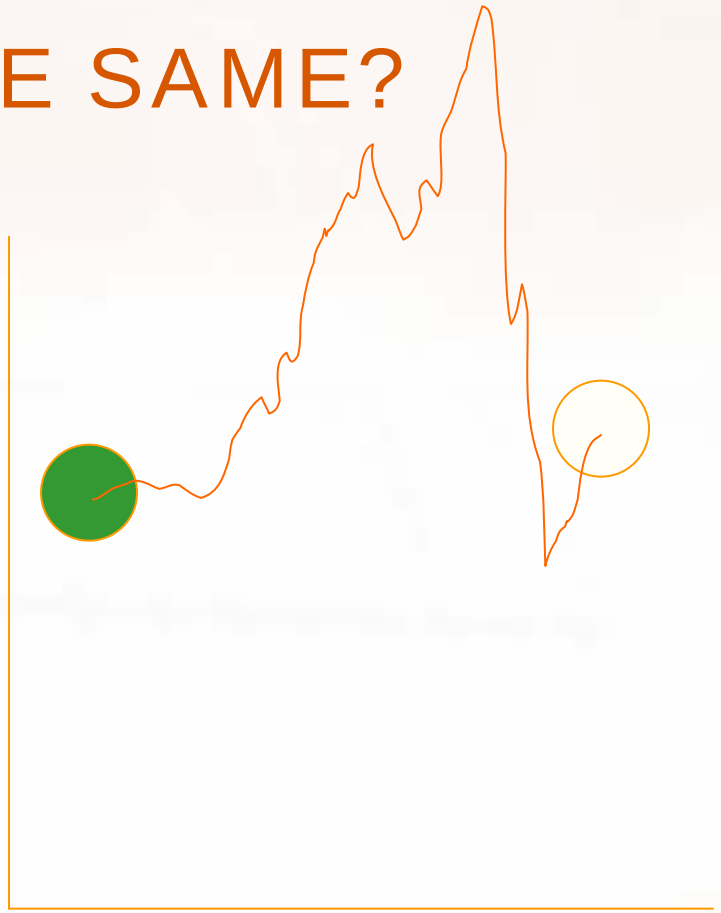


Six Months TARCH and VIX



ARE THESE DAYS THE SAME?

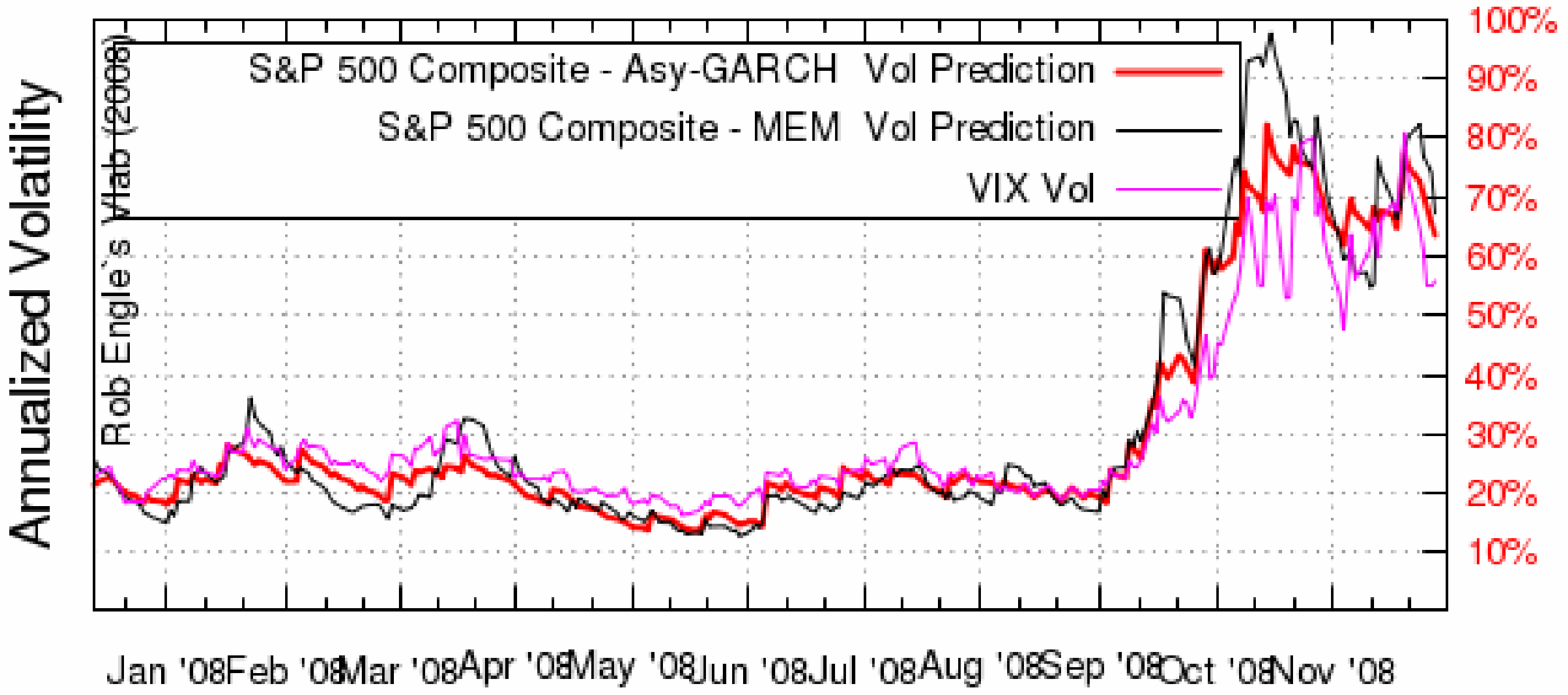




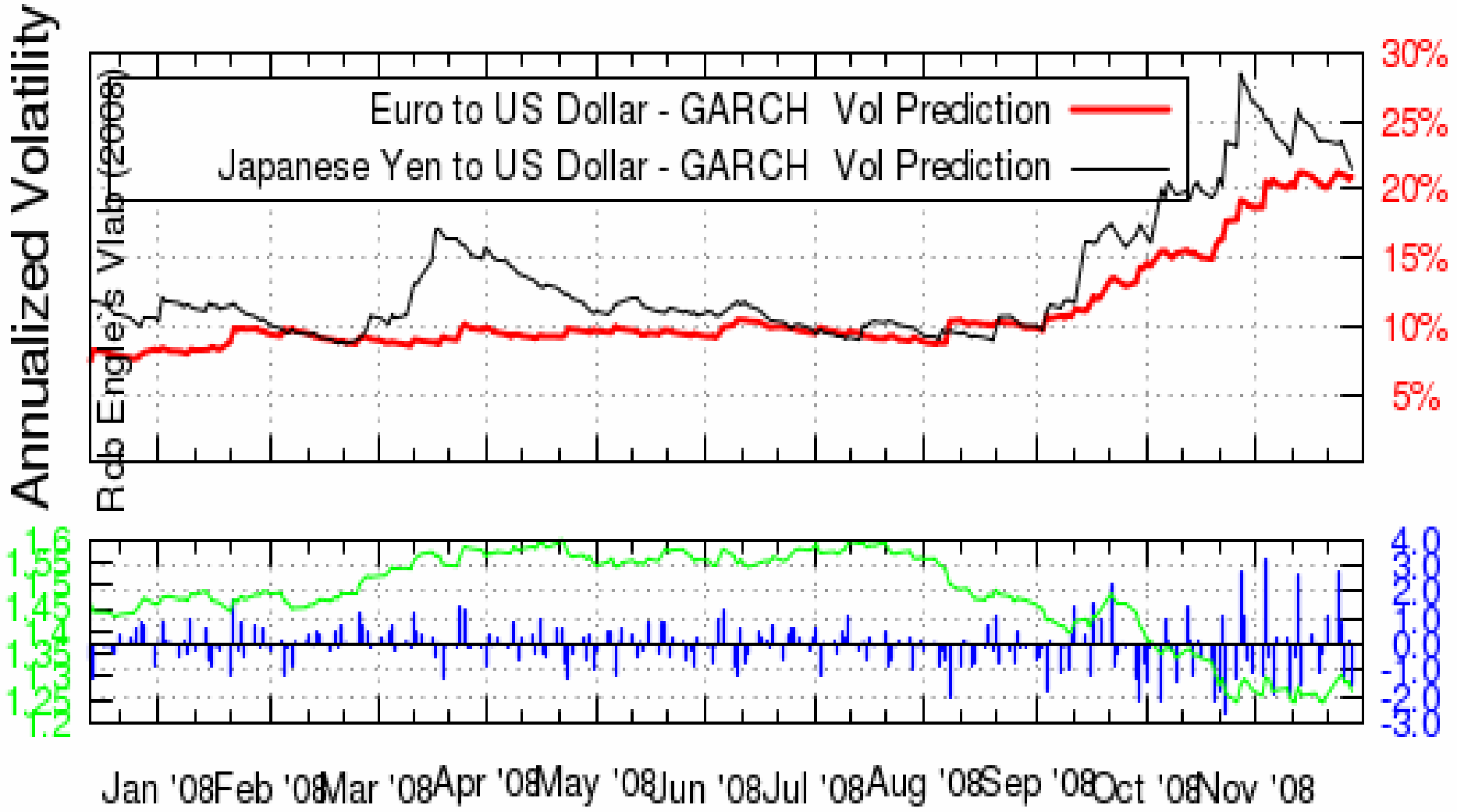
What is RANGE BASED GARCH?

- Model daily $[\log(high/low)]^2$ rather than squared close to close returns.
- Model is Multiplicative Error Model that is closely related to GARCH but applies to non-negative time series.
- Correct for overnight and non-normality
- See Engle and Gallo(2006), Engle(2002)

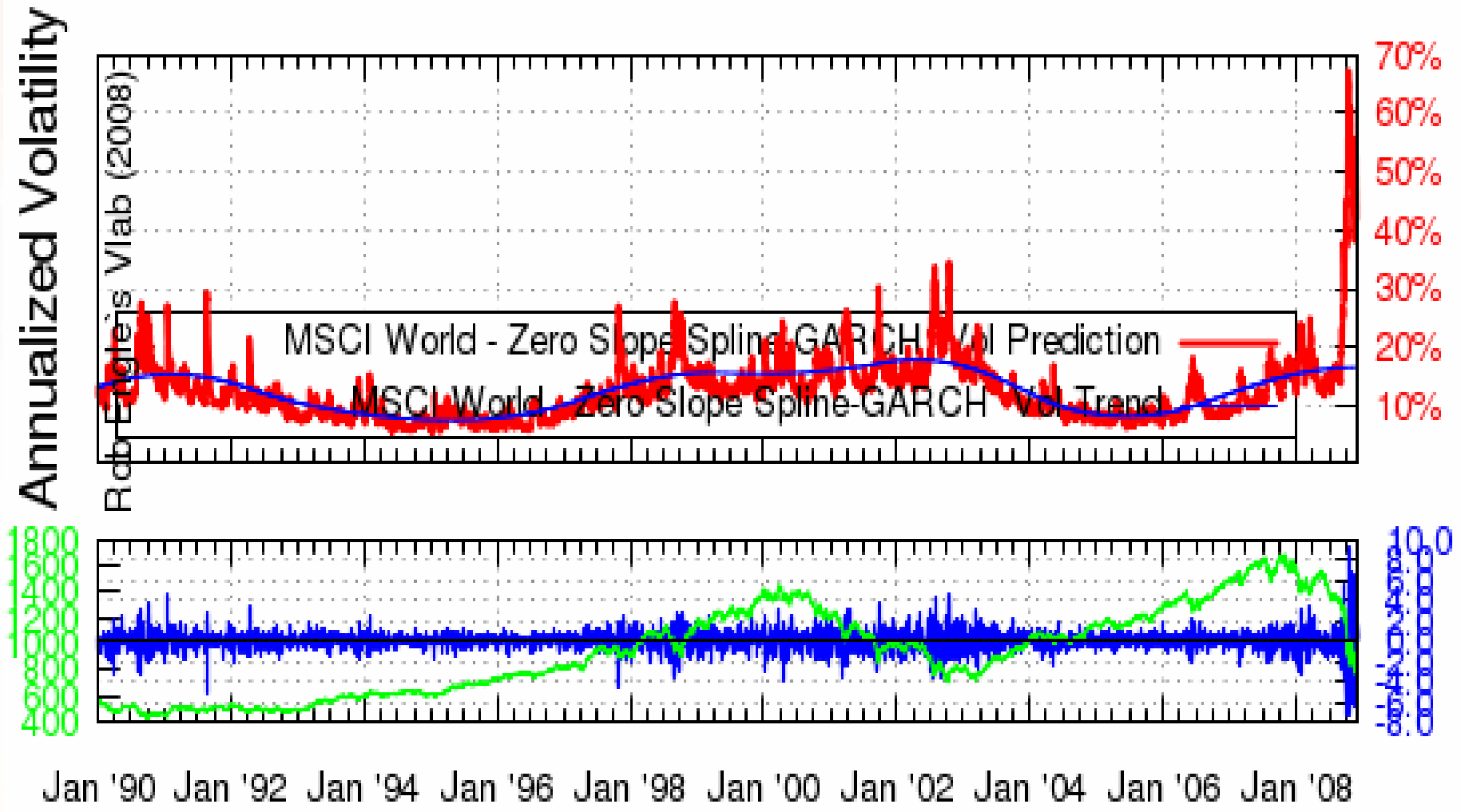
RANGE BASED GARCH



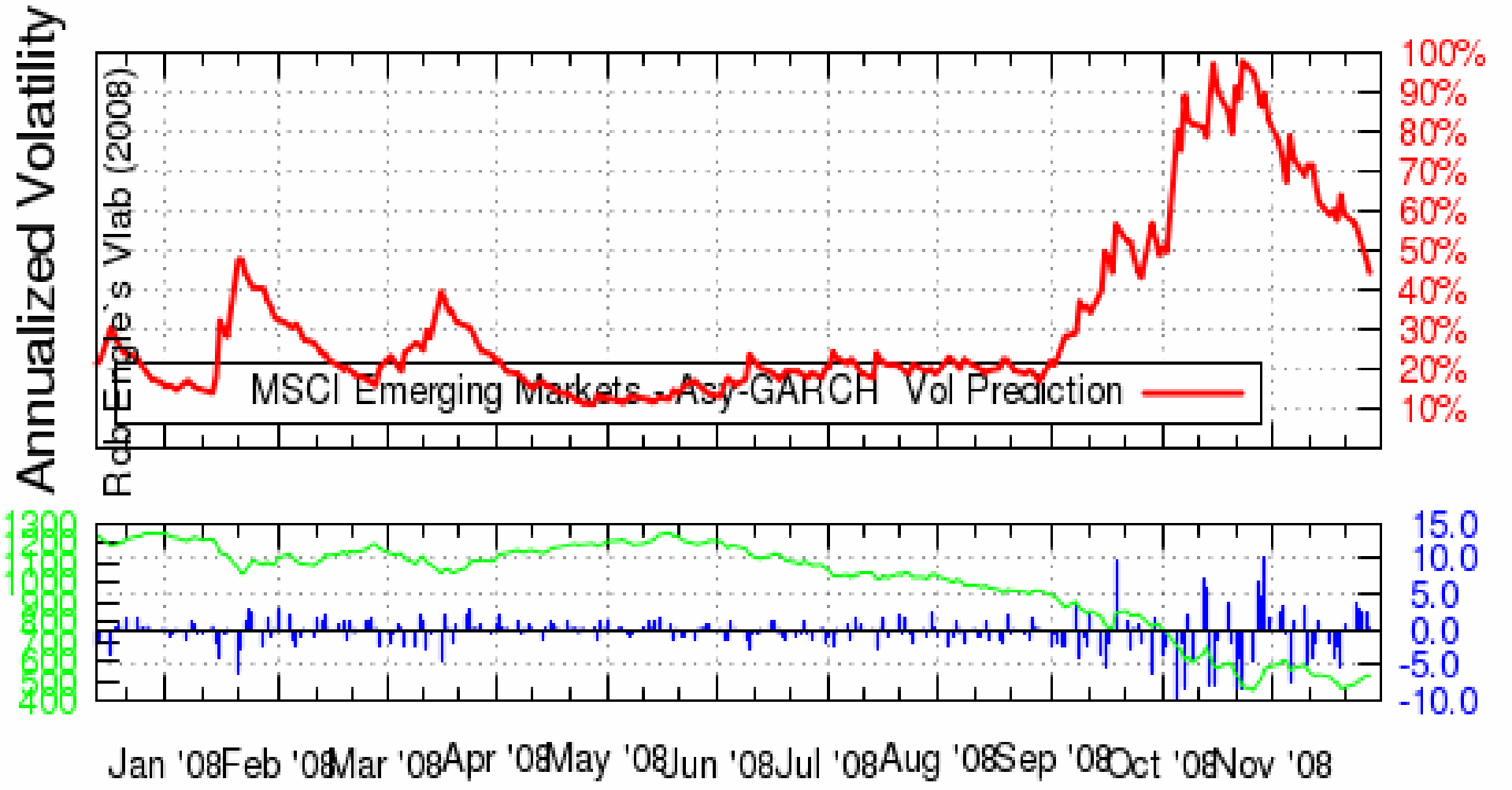
EURO/DOLLAR AND YEN/DOLLAR RATES



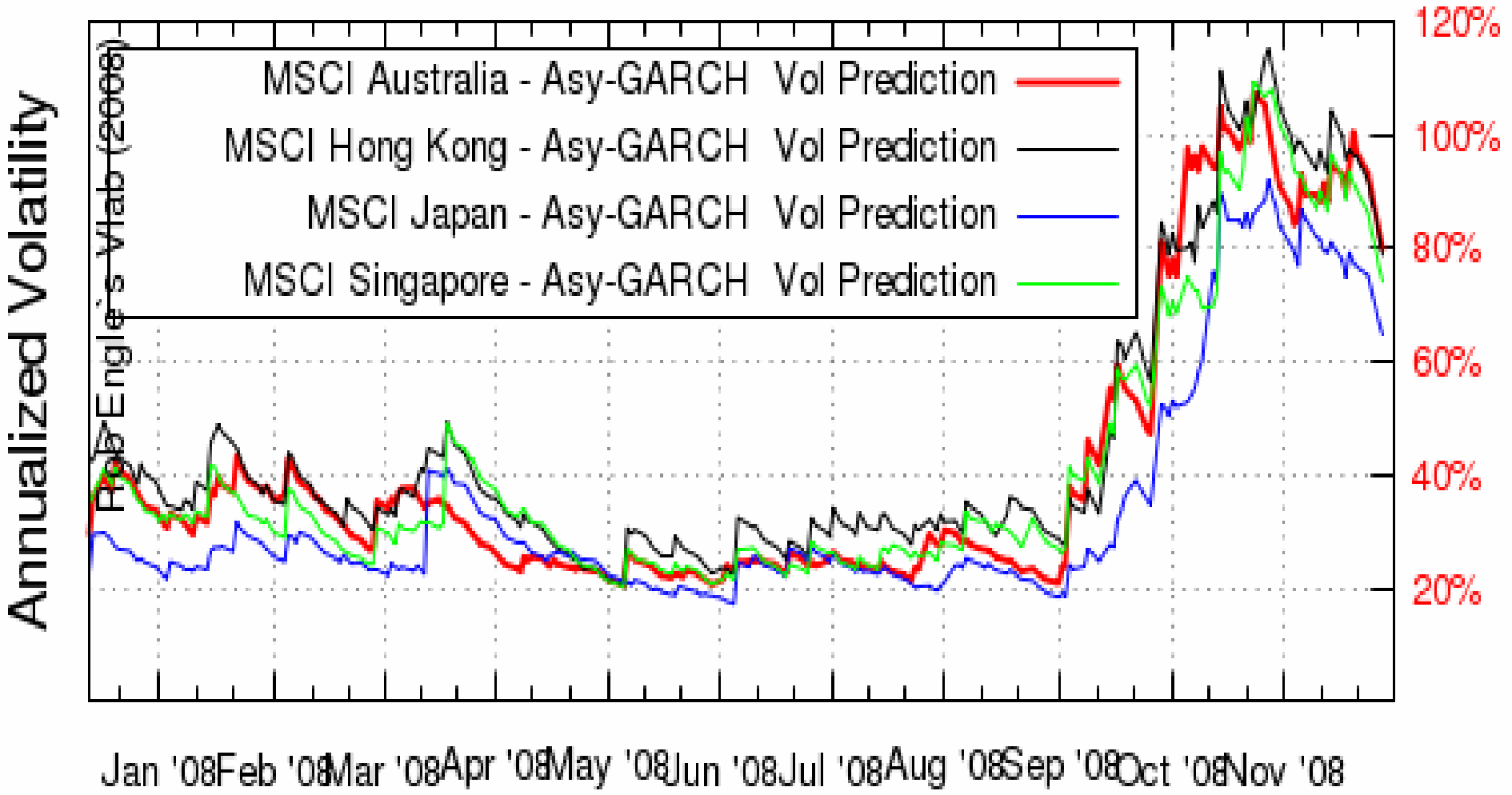
MSCI WORLD INDEX



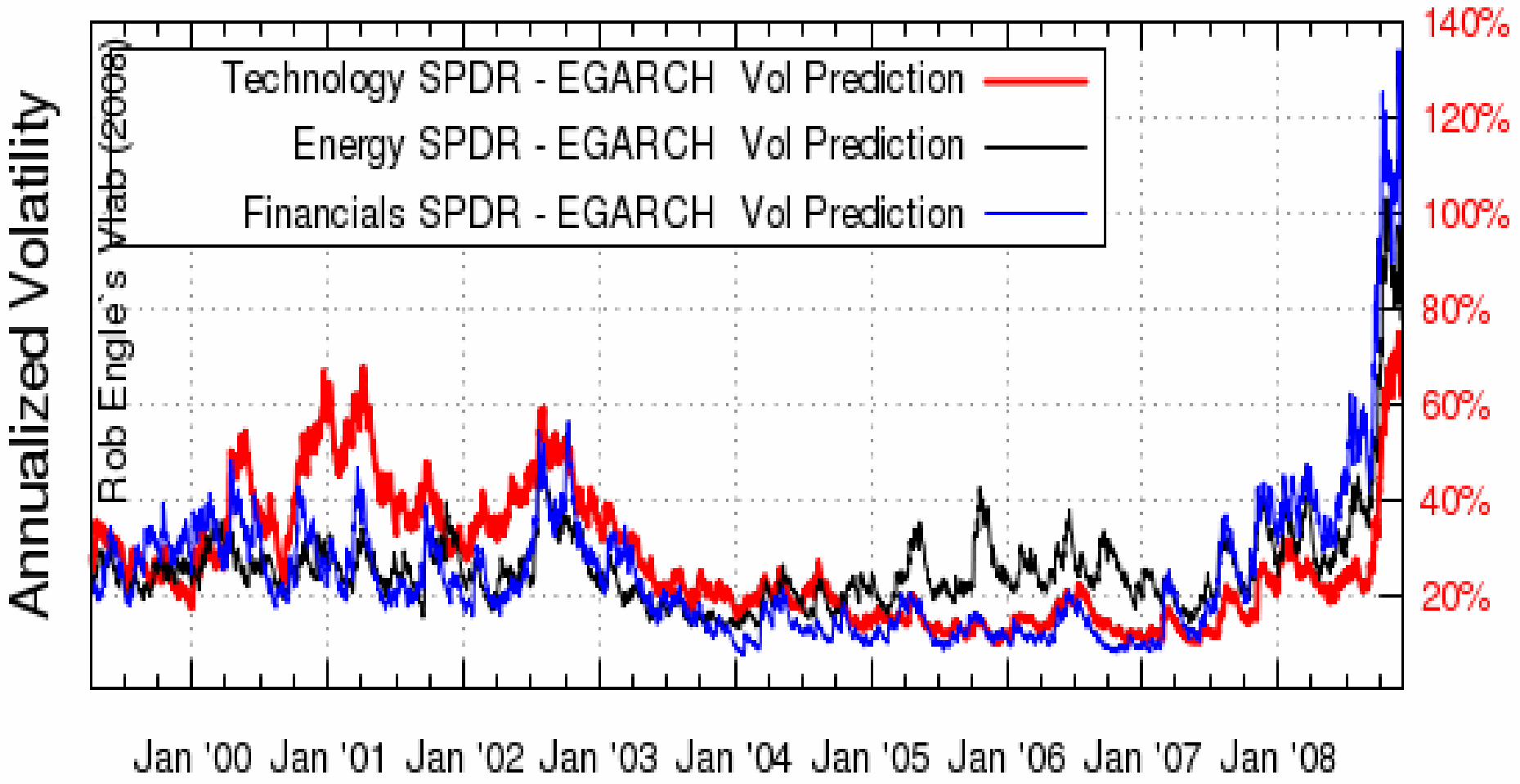
MSCI EMERGING MARKET INDEX



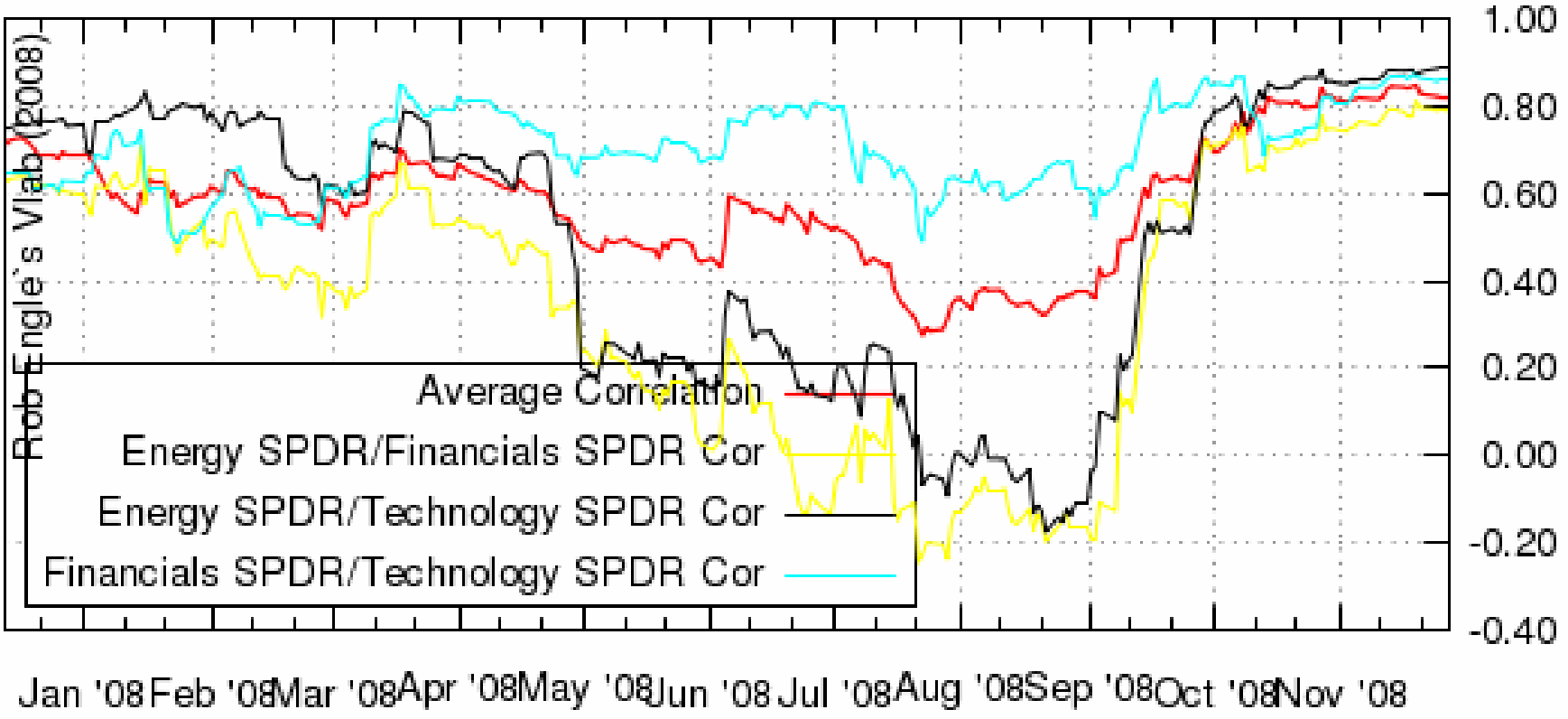
ASIAN MARKETS



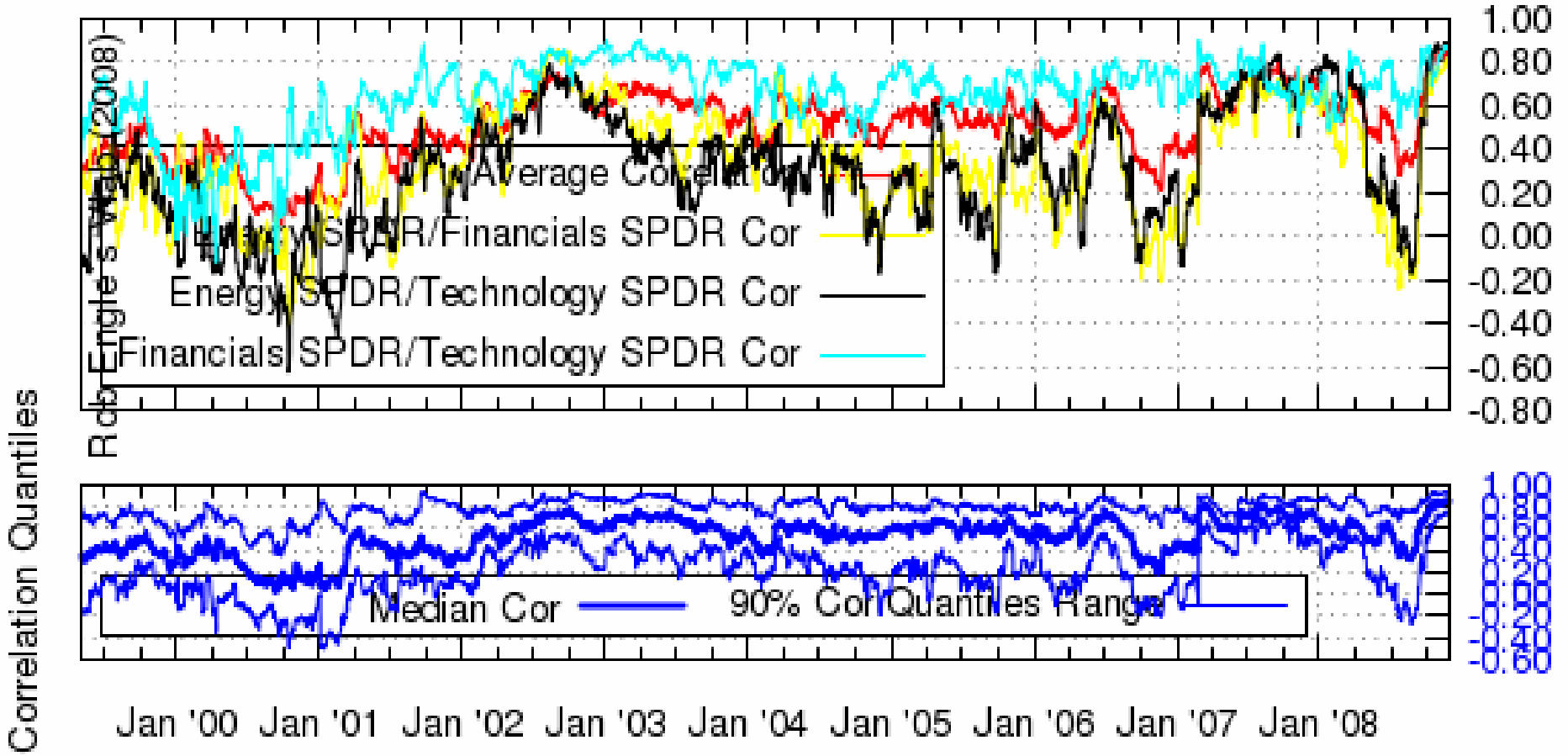
ENERGY, FINANCE, TECHNOLOGY



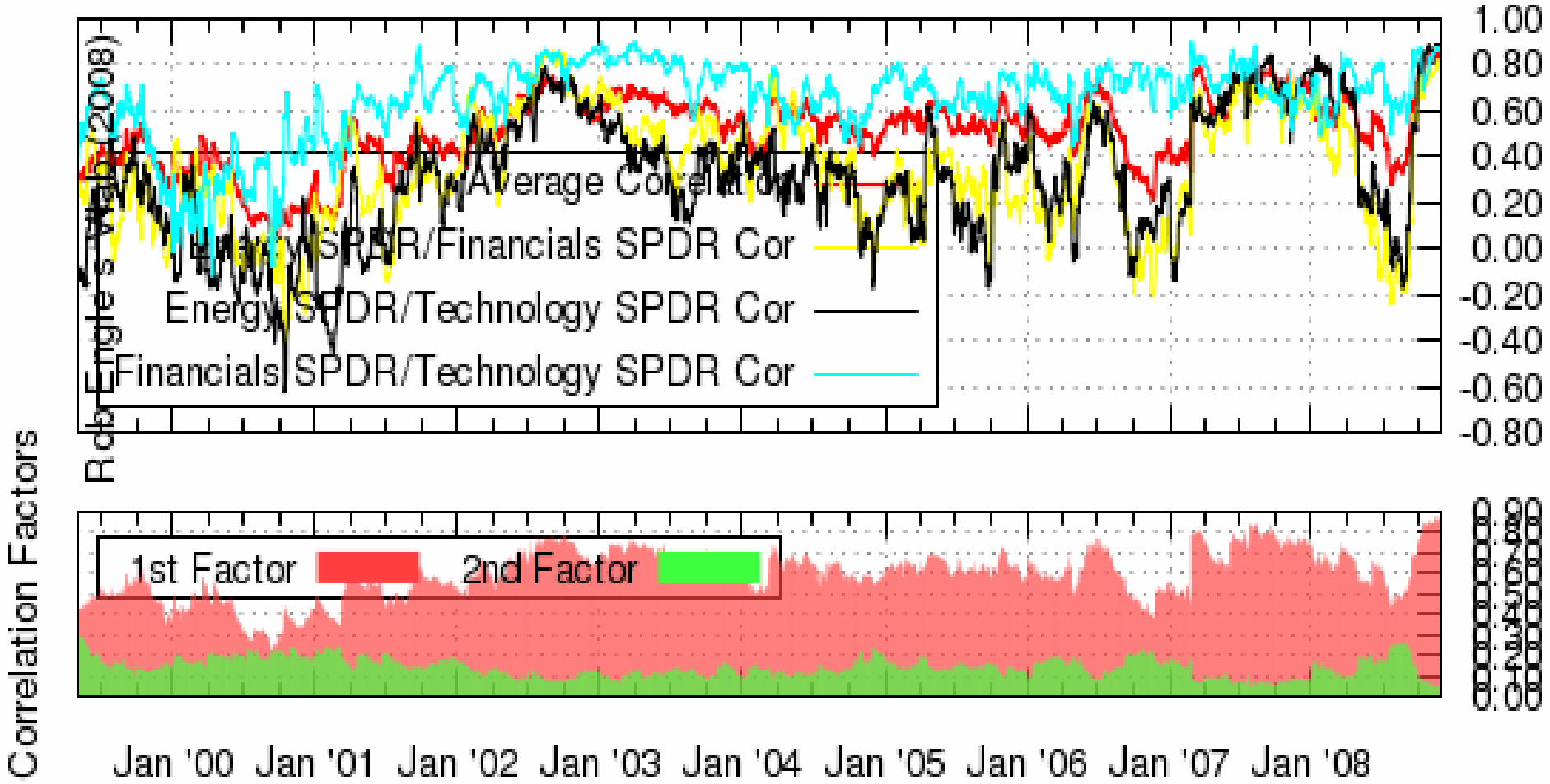
SECTOR CORRELATIONS



SECTOR CORRELATIONS



PRINCIPAL COMPONENTS



WHERE IS VOLATILITY TODAY?

- For most assets, volatility is now dramatically above levels since 1990.
- In the US, I think this is due
  - A) Macroeconomic uncertainty
  - B) Credit problems particularly associated with securitized debt.

THE SPLINE GARCH MODEL OF LOW FREQUENCY VOLATILITY AND ITS MACROECONOMIC CAUSES

Robert Engle and Jose Gonzalo Rangel
Review of Financial Studies 2008

MODEL LOW FREQUENCY VOLATILITY

- Low frequency Volatility is regressed against explanatory variables with observations for countries and years.
- Within a country residuals are auto-correlated due to spline smoothing. Hence use SUR.
- Volatility responds to global news so there is a time dummy for each year.
- Unbalanced panel

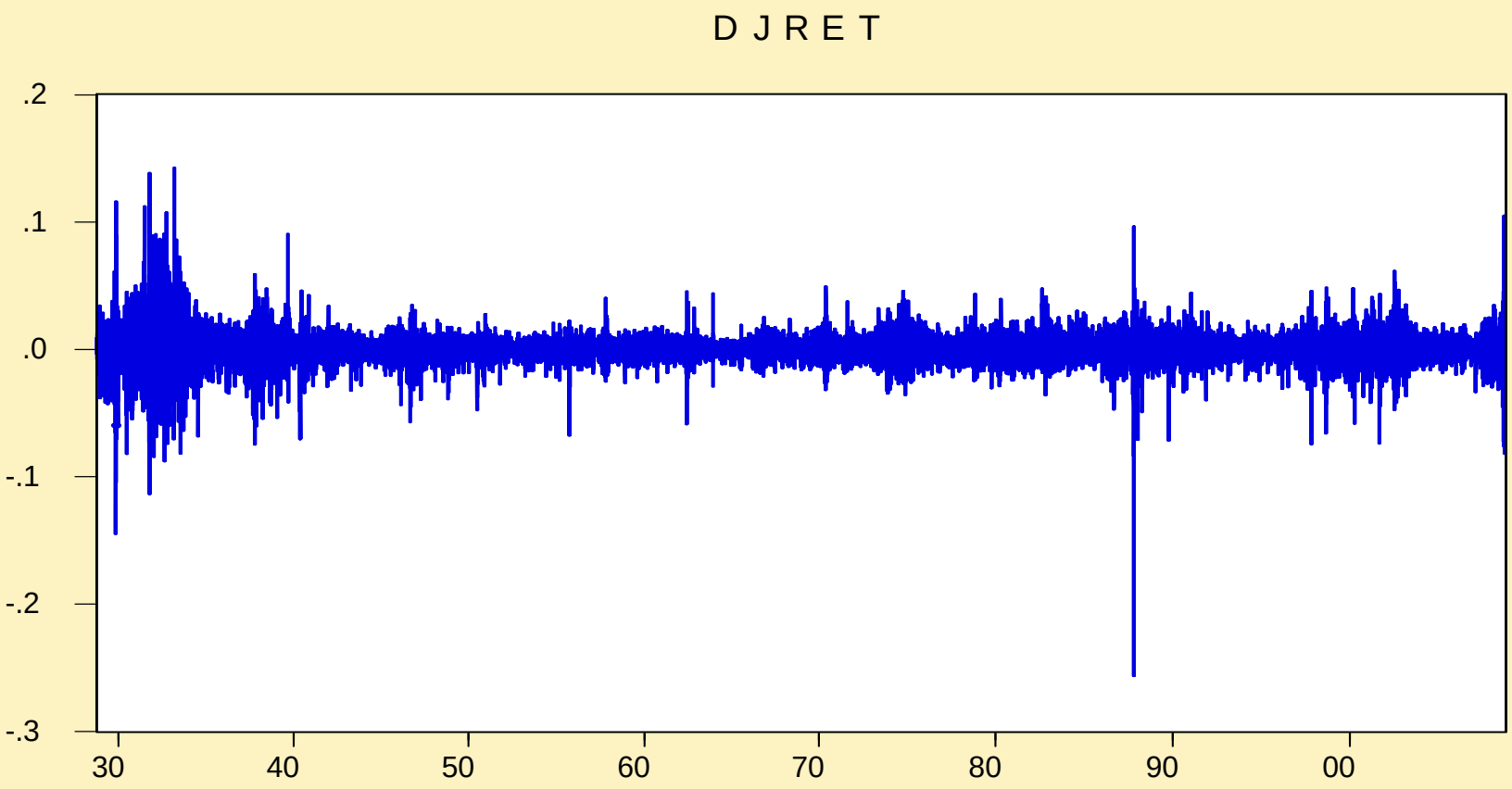
WHAT MAKES FINANCIAL MARKET VOLATILITY HIGH?

- High Inflation
- Slow output growth and recession
- High volatility of short term interest rates
- High volatility of output growth
- High volatility of inflation

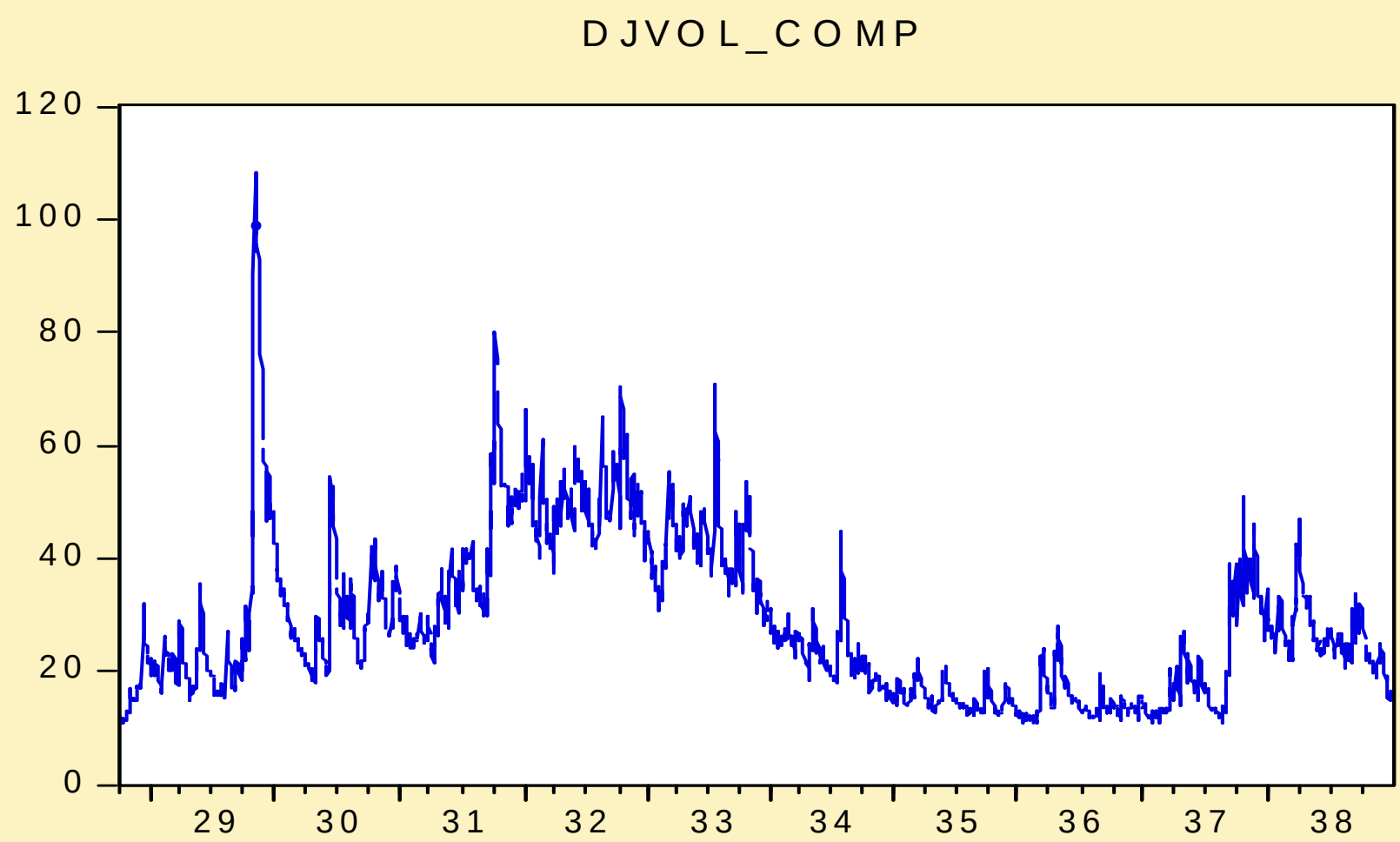
- Small or undeveloped financial markets
- Large countries


THREE VOLATILITY
EPISODES

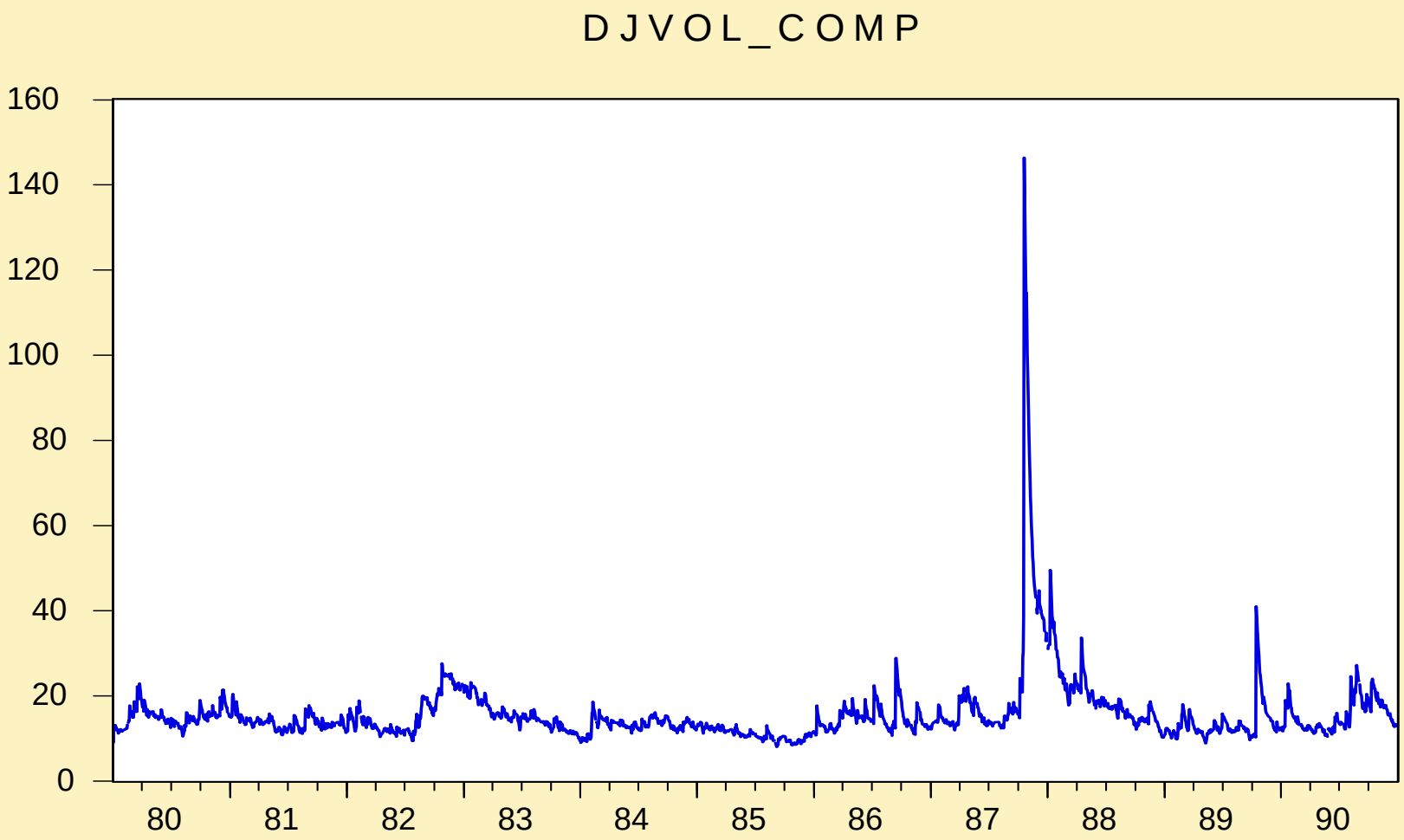
DOW JONES 1928-2008



DJ VOLATILITY 1928-1938

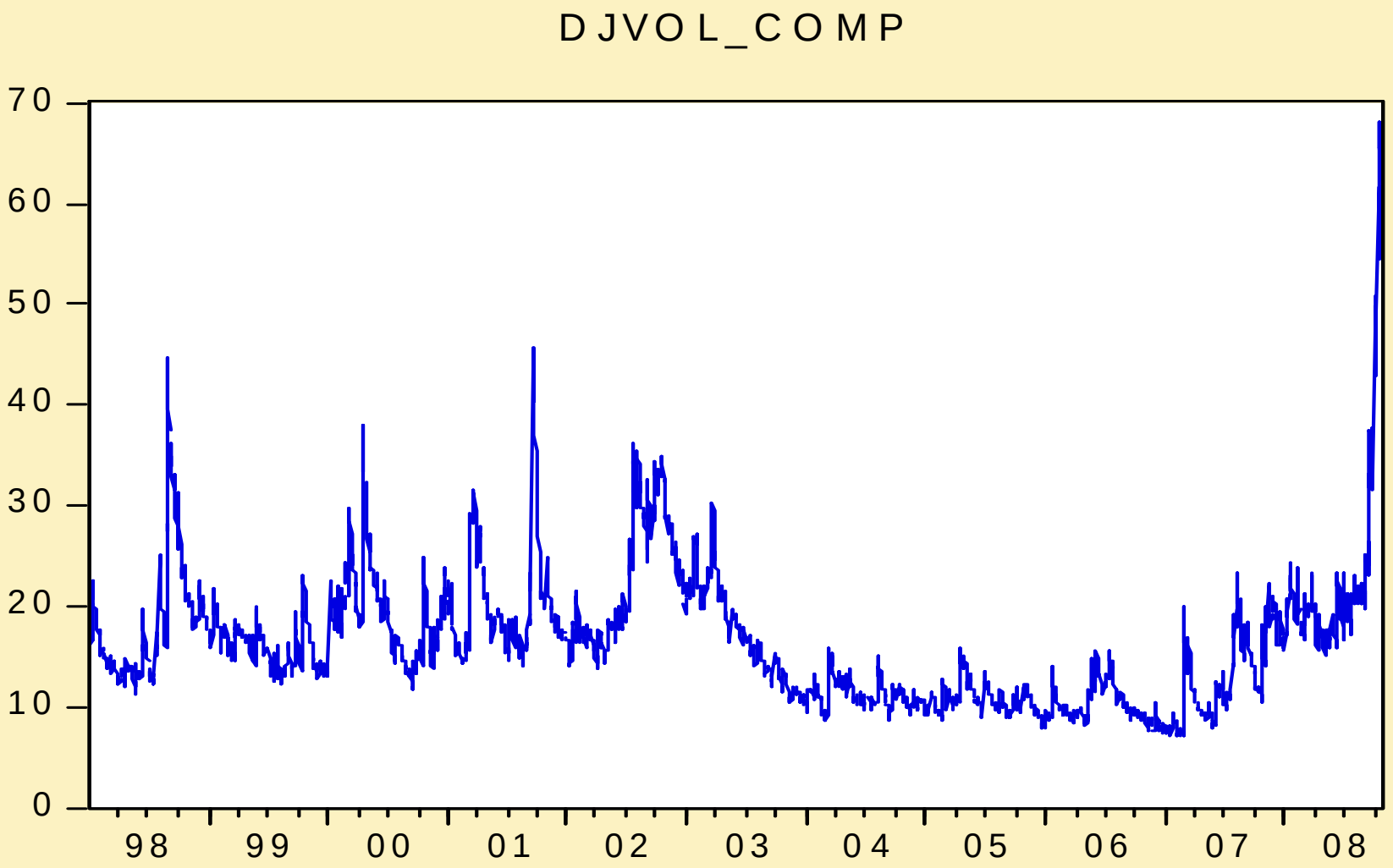


DJ VOLATILITY 1980-1990



AND FOR 1998-2008? WHAT CAN WE EXPECT?

DJ VOLATILITY 1998-2008 10/20/08



THE RISK OF WAR and TERRORISM

A LONG RUN RISK

- Deteriorating Global Economy
- Increasing income differential between rich and poor countries
- Rising fundamentalism

- Increase the risk of War and Terrorism

DEPRESSED ASSET PRICES

- Long run risks lower asset prices as investors are more cautious.
- This raises the cost of doing business and raising capital
- This reduces income of entrepreneurs
- And costs jobs

WHAT TO DO?

PROMOTE PEACE

- MANY, MANY APPROACHES THROUGH POLITICS, SCIENCE, MEDICINE, CULTURE, EDUCATION, LAW
- SOME ECONOMIC PROPOSALS:
  - TRADE
  - CAPITAL FLOWS
  - BUILD ECONOMIC INTERDEPENDENCES
  - FIGHT POVERTY
  - REFORM EDUCATION to show value in cooperation

PEACE PERMITS PROSPERITY

BENEFITS

- Reducing future risk of war
- Yields benefits today by
- Improving business and stock market valuations and
- Creating jobs

VERY LONG RUN RISKS!
ARE WE READY FOR THESE?

THREE *VERY* LONG RUN RISKS

- CLIMATE CHANGE
- UNFUNDED PUBLIC PENSIONS
  - BOTH OF THESE ISSUES WILL REQUIRE MAJOR TAXES AND EXPENDITURES AT SOME TIME IN THE FUTURE.
  - PRESUMABLY BOTH RISKS ARE RESPONSIBLE FOR SOME REDUCTION IN ASSET PRICES AND INVESTOR CAUTION TODAY.

A SOLUTION

- Most Economists believe the best solution to climate change is a comprehensive tax on carbon emissions and other greenhouse gases.
  - Only if it is comprehensive will it encourage alternative energy solutions
  - Only if it is comprehensive will efforts to avoid the tax be socially beneficial.

WHAT TO DO WITH THE MONEY?

- Initially send proceeds on a per capita basis to all residents possibly even in advance of receipt of revenues to stimulate the economy.
- Eventually establish a sovereign fund to support long run social costs such as retirement
- Invest the fund passively managed by an independent agency similar to the FED.

- Both risks are reduced as they offset each other.
- Tax a “bad” rather than a “good”.

High Oil Prices are a Good Thing!

- These now encourage consumers and industry to use less oil
  - Driving in the US is down
  - Hybrid Cars are selling and SUV's are not
  - House prices in the suburbs are declining more than in the central city
  - Ridership on public transportation is up

But this is Not Enough.

- Oil prices have fallen dramatically
- Coal is still a cheap and dirty alternative.
- Oil expenditures are leaving the country rather than accumulating as a wealth fund.
- Entrepreneurs with ideas for alternative energy sources face big risks.

CONCLUSION

- Make sure you take only the risks you intend to take
- Keep an eye on long run risks
- Policy makers remember: reducing long run risks gives benefits today