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## CRISES FACE TO FACE: 2020 vs 2008

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## OVERVIEW

During the last few weeks, many analysts and economists compared the actual downturns of the market due to the COVID-19 to the one of the 2008 caused by the speculative bubble in the American real estate market. For instance, in a recent article of Forbes, the macro analyst Patrick W. Watson states that the lockdowns imposed by countries around the world will have a heavier impact on the US economy than the previous ones because:

- The Fed can't cut rates much unless it wants to go negative
- Any fiscal stimulus will add to an already-gargantuan federal deficit
- Everyone may be dealing with a giant healthcare crisis, on top of a recession
- People of all political persuasions dislike bank bailouts and won't want to do it again

All these factors may lead to worse outcomes in the near future.

## INTRODUCTION

The aim of this article is to analyze and compare the riskiness of the markets during the two crises (for the data available up to now). The analysis has been conducted on the S&P500 and on the EUROSTOXX50 by firstly comparing the trends of the VAR and the Expected Shortfall and then looking at the two indexes representative of the fear in the markets: the VIX for the US and the VSTOXX for Europe. All the analysis has been conducted through Python by:

- Importing the historical prices through the library *pandas-datareader*, one of the most used for analyzing time-series, having Yahoo Finance as data provider

- Computing the VAR and ES with a quarterly frequency for the market indexes
- Estimating their variance with bootstrap methods
- Providing a graphical analysis for the trends of the volatility indexes

In the Appendix a snippet of the main functions used has been left for the most interested in coding with Python.

## OVERVIEW OF THE METRICS

The Value at Risk (VAR) is the maximum portfolio loss that occurs with  $\alpha\%$  of probability over a certain time horizon. For instance, if the VAR95 for a quarter (implying an  $\alpha=5\%$ ) is -3.00%, it means that in the next quarters there is a 5% probability of encountering a loss in the interval [-100%, -3.00%] potentially.

The Expected Shortfall (ES) is the expected return on the portfolio in the worst  $\alpha\%$  of cases. So, it is just a weighted average of the returns lower than the VAR.

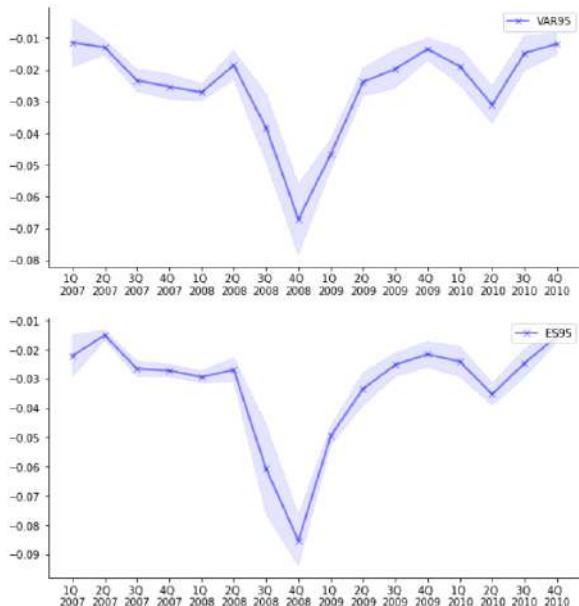
The VIX is the ticker symbol for the Chicago Board Options Exchange's CBOE Volatility Index, a popular measure of the stock market's expectation of volatility based on S&P 500 index options. It is calculated and disseminated on a real-time basis by the CBOE and is often referred to as the fear index.

The VSTOXX has the same functions and interpretability as the VIX, but it is constructed with the EUROSTOXX50 index options as an underlying.

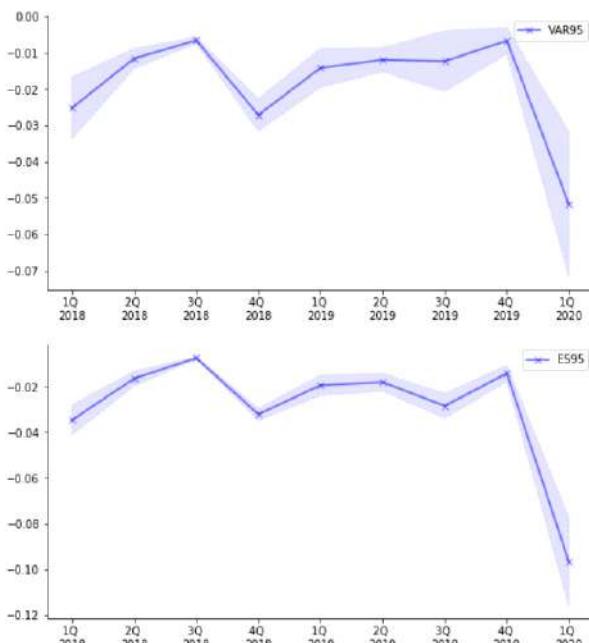
## QUANTITATIVE ANALYSIS

### American market

The following graphs show the trends of the VAR and of the ES (with an  $\alpha=5\%$  having as time horizon a quarter of year) during the financial crisis of 2008 and the actual one. The bands around the trend-line are bootstrapped standard errors.



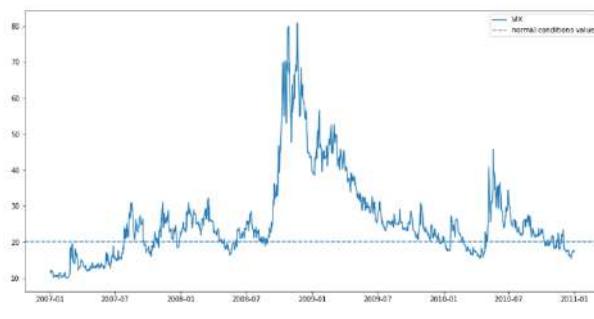
*VAR95 and ES95 trends of the S&P500 between 1Q 2007 – 4Q 2010*



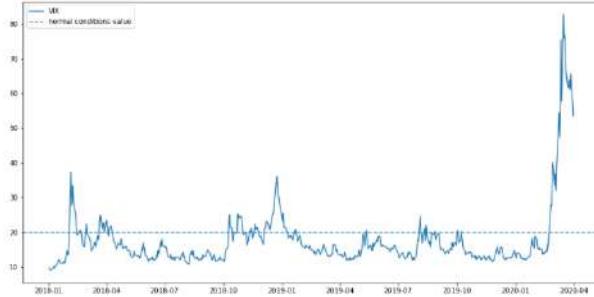
*VAR95 and ES95 trends of the S&P500 between 1Q 2018 – 1Q 2020*

By just looking at the VARs we would have wrongly stated that the crisis of 2008 had a worse impact on the economy comparing the  $-7\%$  reached on the last quarter of 2008 and the  $-5\%$  on the first quarter of this year. However, the Expected Shortfall reveals that the worst 5% of the returns had almost the same average in both periods. This “mismatch” means that the volatility in the first quarter of 2020 has been high (look at the standard error band of the VAR95) and we have encountered losses even higher than the ones of 2008.

Even by looking at the trend of the VIX we reach similar findings. In the graphs it has been plotted also a dashed line at the level of 20, which is considered the mean reverse value for this index.



*VIX trend between 01-01-2007 and 31-12-2010*

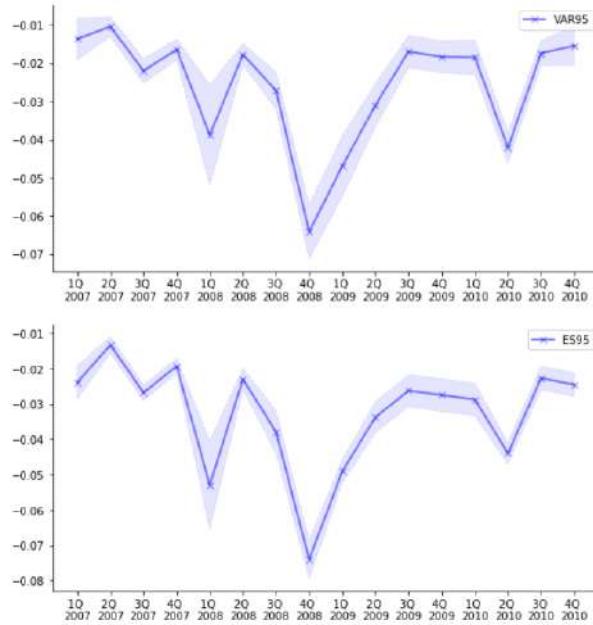


*VIX trend between 01-01-2018 and 31-03-2020*

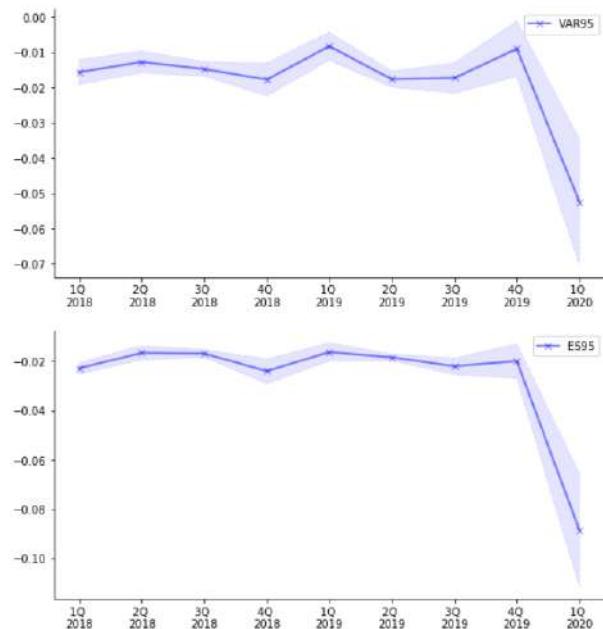
The VIX reached almost the same value in both periods (a little higher for the current crisis), that is coherent with having the same Expected Shortfall, but, in the case of the last quarter, this peak came after a period of relatively low volatility (the VIX was for a long time below the level of 20) and justifies the high variance in the VAR95 estimation.

## European market

Performing the same analysis on the European market with the EUROSTOXX50 as the underlying we can reach similar conclusions.



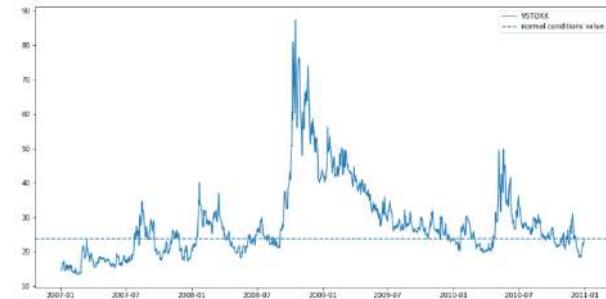
*VAR95 and ES95 trends of the EUROSTOXX50 between 1Q 2007 – 4Q 2010*



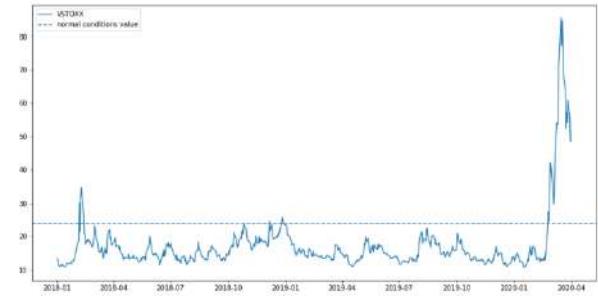
*VAR95 and ES95 trends of the EUROSTOXX50 between 1Q 2018 – 1Q 2020*

Even in the European market the VAR95 was worse in 2008 compared to now but, for the same previous reasons, the Expected Shortfall reached a lower level in the current quarter.

Similarly, we can also look at the trend of the VSTOXX during both crises. This time the dashed line corresponds to the average value in the last 20 years of the index.



*VSTOXX trend between 01-01-2007 and 31-12-2010*



*VSTOXX trend between 01-01-2018 and 31-03-2020*

Also in the European market the volatility was very low before the outbreak of the COVID-19, even lower than the American one if we look at the trend around the mean. This could explain why in Europe the Expected Shortfall is heavier than the one of 2008.

## CONCLUSIONS

The effects of the current outbreak could be compared to the one of the previous financial crisis and, if we consider the unpredictability of the epidemic, they seem even worse from a strictly quantitative point of view. However, it is important to highlight that the roots are different: in 2008 the crisis started from a bubble in the US housing market and then extended to the other sectors and countries; the current downturn is instead due to an epidemic that has had from the beginning a global impact.

## APPENDIX

```

quarters(ticker,start,end):
    l=[]
    for i in range(start,end+1):
        l.append(data.DataReader(ticker, 'yahoo', start=str(i)+-
31')[['Adj Close']])
        l.append(data.DataReader(ticker, 'yahoo', start=str(i)+-
30')[['Adj Close']])
        l.append(data.DataReader(ticker, 'yahoo', start=str(i)+-
30')[['Adj Close']])
        l.append(data.DataReader(ticker, 'yahoo', start=str(i)+-
31')[['Adj Close']])
    return l

def returns(prices):
    return np.array([(prices[i+1]-prices[i])/prices[i] for i in r
31:-1])

def find_VAR95(series):
    return np.quantile(series,0.05,interpolation='lower')

def find_ES95(series):
    return np.mean(sorted(series)[0:round(0.05*len(series))])

def bootstrap_std(f,x,iterations=1000):
    bootstrapping_estimates=[f(x[(np.random.randint(0,len(x),size=-
for i in range(iterations)])
    return np.std(bootstrapping_estimates)

```

## REFERENCES

<https://www.forbes.com/sites/patrickwwatson/2020/03/16/how-covid-19-leads-to-2008-style-bank-crisis/#7b2b5e425b77>

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