

## **Stat 222: Research Proposal**

Christian Carmona | SID: 24978477

Risk measurement for portfolios in Fixed-income and Currency markets

### **1) Dataset**

- Historical treasury Yield Curve  
<http://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/TextView.aspx?data=yieldYear&year=2013>
- Historical foreign exchange rates for several currencies  
<http://www.federalreserve.gov/releases/h10/hist/>

### **2) Research question**

Given a portfolio comprised with bonds and spot position in different currencies, what are the possible losses that my portfolio could face for variations in market prices.

The main purpose of this work is to implement a methodology for calculating Market risk indicators for investment portfolios containing a variety of fixed-income securities, spot position in several currencies and gold. The main indicators to be calculated are: Value at Risk (VaR): 95% quantile of the profit and losses distribution, and Conditional Value at Risk (CVaR) expected value of losses exceeding the VaR.

In order to satisfy the above-mentioned goals, It is necessary to implement one of the existing methodologies in a computational language (R / python). There are different approaches for calculating market risk, and one of the most used in practice is JPMorgan's RiskMetrics.

The processes for calculating this measures include the following steps: Define a portfolio; identify market variables that affect the price of assets in the portfolio, namely risk factors, obtain historical data, calculate the covariance matrix, simulate market scenarios, evaluate portfolio market value under simulated scenarios, and estimate the probability distribution function of profit and losses.

### **3) List of figures and tables**

*Figures:*

- Estimated probability distribution function of profit and losses.
- Graphical representation of simulated market scenarios for yield curves and exchange rates
- Back testing evaluation by comparing actual losses against Value at Risk levels

*Tables:*

- Covariance estimation between risk factors
- Estimated VaR and CVaR for different levels of confidence
- Effectiveness of VaR assessed through back testing, i.e. observed percentage of actual losses above the estimated VaR.