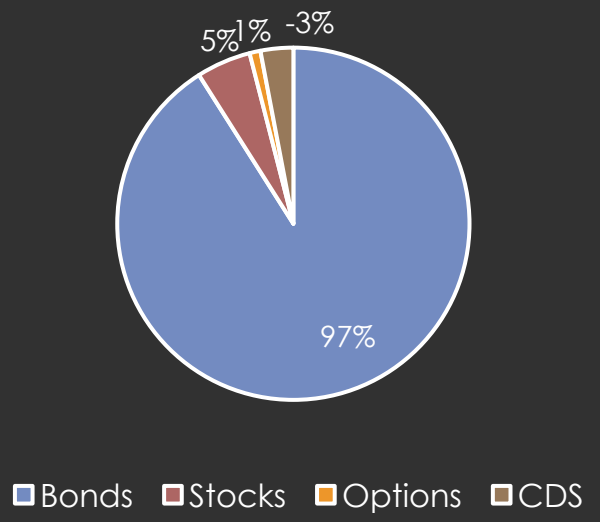
Portfolio Risk Analysis

Pantelis Isaiah
Sergio Ortiz Orendain
Jose Saad Canales
Ryan Shrott

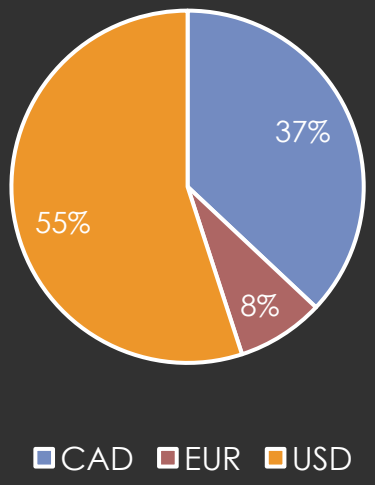
Investment Allocations

Total Portfolio Value = 248.5M

Exposure by Asset Class

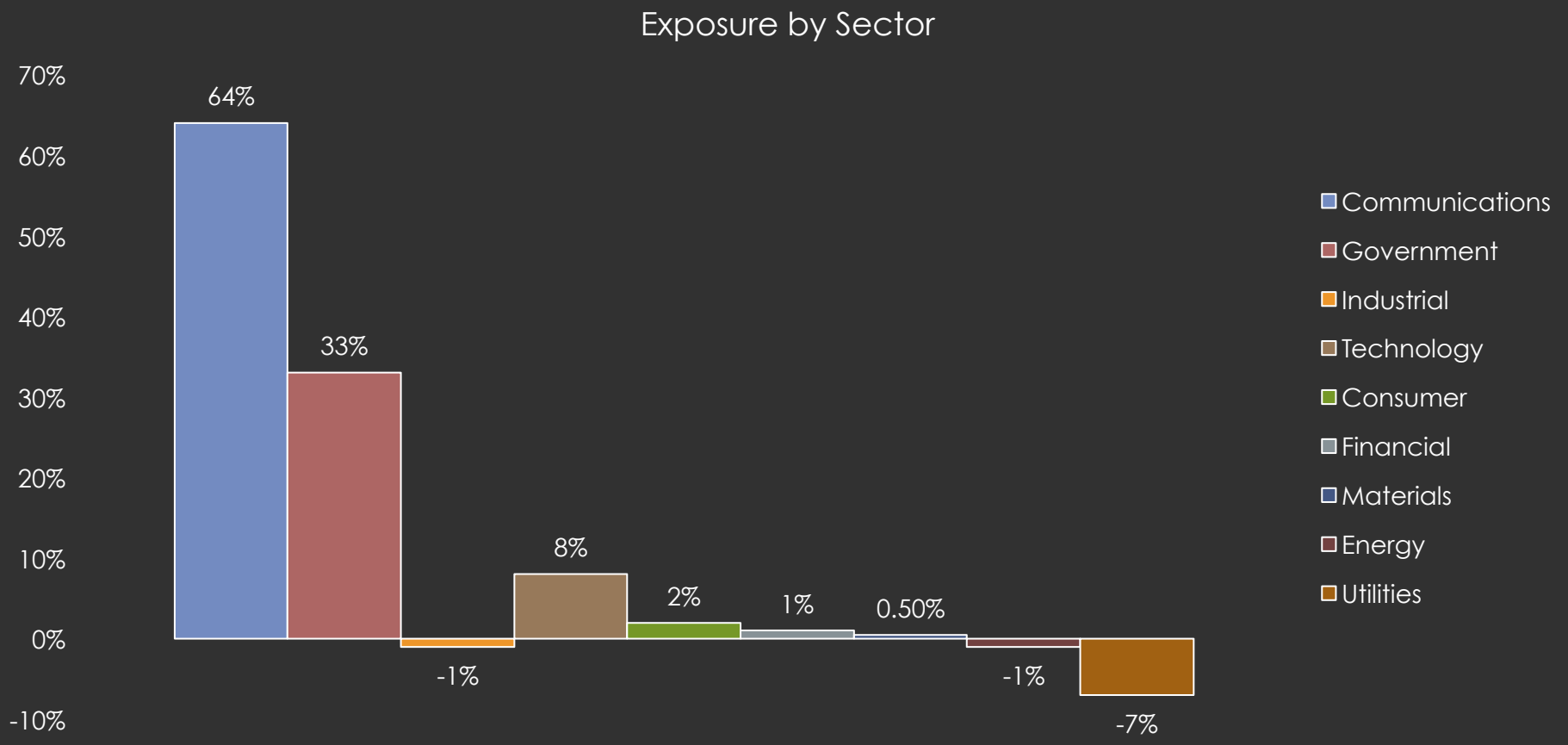


Exposure by Asset Class



The portfolio is mainly composed of fixed income instruments with the biggest currency exposure to USD.

Investment Allocations



Large exposure to Communications and Government sector while short on Utilities and Energy

Instruments

Bonds

- 25 in total
- 7 short positions
- 5 sectors
- 1 ILB
- 1 puttable bond

CDS

- 9 in total
- 2 short positions
- 6 sectors

Options

- 3 in total
- 2 European puts
- 1 American call

Stocks

- 3 in total
- 3 long positions
- 3 sectors

Pricing

Bonds

- **23 standard evaluations:** discount the cashflows using the appropriate term structure
- **1 ILB:** adjust for inflation the P.V. of each cashflow
- **1 puttable bond:** incorporate the optionality in the spread

Pricing

Options

- **1 American call:** the underlying pays dividends → binomial tree

CDS and Stocks

Standard

Implementation

- Excel and Matlab
- Started building a GUI, but turned out to be a project in itself so the idea was dropped.
- Used some basic OO techniques to have stable interfaces despite changing requirements (e.g., where the data comes from, what is constant and what is variable, etc).

Risk Factors in Portfolio

- 125 risk factors
- 3 equities
- 3 underlying spot prices for options
- 2 FX rates
- 3 interest rate curves = 45 risk factors
- 72 CDS par spreads (9 CDS's * 8 times point's)
- 25 Corporate bond spreads (1 for each of our 25 bonds)

Modeling 1 Year Value at Risk

- Geometric Brownian Motion: equities, spot prices
- Cox–Ingersoll–Ross: CDS hazard rates, FX rates, bond spreads
- Vasicek: interest rate term structures
- Cash flows were reinvested at the risk free rate
- One year computation allows us to consider the theta of the portfolio
- Square root of time rule is inaccurate over a whole year

Credit Value at Risk

- CreditMetrics Approach
- Split CDS underlying firms and bond issuers into two separate computations
- Sector correlations were used as a proxy for the correlations
- Assumed migration shock occurred instantaneously since the theta of the portfolio is already considered in the Market Value at Risk computation
- $CVaR = \sqrt{CVaR_{BONDS}^2 + CVaR_{CDS}^2 + 2\rho * CVaR_{BONDS} * CVaR_{CDS}}$

CVA and DVA

- Hazard rates for CDS's were simulated using the Ho-Lee model
- Calibration of the model was done under the risk neutral pricing measure. The drift was chosen as a function of the forward rate today. The historical volatility was used as a proxy for the risk neutral volatility.
- $CVA = \sum_{i=1}^{N} q_i \, v_i$
- $DVA = \sum_{i=1}^{N} q_i^* \, v_i^*$
- $V^{new} = V^{old} - CVA + DVA$

Model Vetting Techniques

- Compare VaR magnitude to portfolio value
- Compare pricing functions to current market prices today
- Compare historical and Monte Carlo models
- Compare 1 year VaR to scaled VaR from 1 day computation
- Backtesting: moving window compared to out of sample data
- Standard statistical tests could not reject the validity of our models

Value-at-Risk and ES

Monte Carlo Method

Time Horizon	VaR - 95%		VaR - 99%		US S&P IG Index	S&P 500	ES – 95%	ES – 99%
1-day	$2.68M	1.09%	$3.79M	1.54%	0.59%	2.28%	$3.35M (1.36%)	$4.33M (1.76%)
10-day	$8.48M	3.45%	$12M	4.88%	1.88%	7.20%		
1-year	$54.45M	22.14%	$78.39M	31.87%	9.42%	36.14%		

Historical Method

Time Horizon	VaR - 95%		VaR - 99%		US S&P IG Index	S&P 500	ES – 95%	ES – 99%
1-day	$2.97M	1.19%	$4.57M	1.84%	0.59%	2.28%	$5.40M (2.17%)	$11.33M (4.56%)
10-day	$9.38M	3.77%	$14.46M	5.82%	1.88%	7.20%		
1-year	$47.08M	18.94%	$72.61M	29.22%	9.42%	36.14%		

Marginal and Incremental VaR

Marginal VaR

1-day 99% MVaR		
Bonds	3.87M	1.58%
CDS	-0.015M	0.01%
Options	0.01M	0.005%
Stocks	0.05M	-0.02%

Incremental VaR

1-day 99% IVaR		
Bonds	3.46M	1.39%
CDS	0.46M	0.19%
Options	0.54M	0.22%
Stocks	0.68M	0.27%

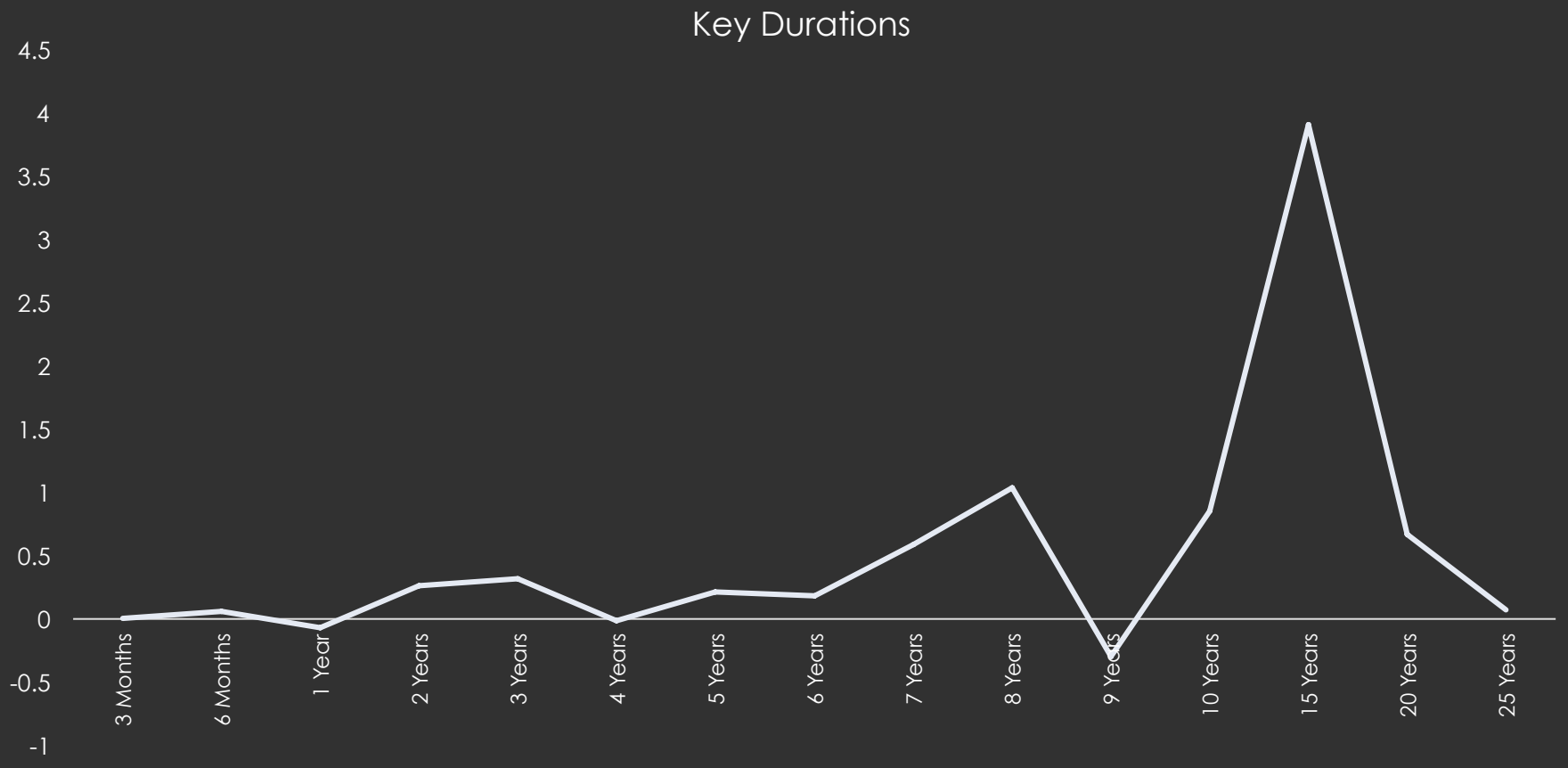
Stressed VaR and Credit Risk

Stressed VaR		
Daily (99%)	5.5M	11.09%
Ten Day (99%)	17.4M	19.62%

Credit VaR for the bond portfolio		
95%	20.04M	8.07%
99%	40.40M	16.25%
99.9%	50.64M	20.38%

Credit VaR for the CDS portfolio		
95%	2.76M	1.11%
99%	4.88M	1.96%
99.9%	5.07M	2.04%

Rates

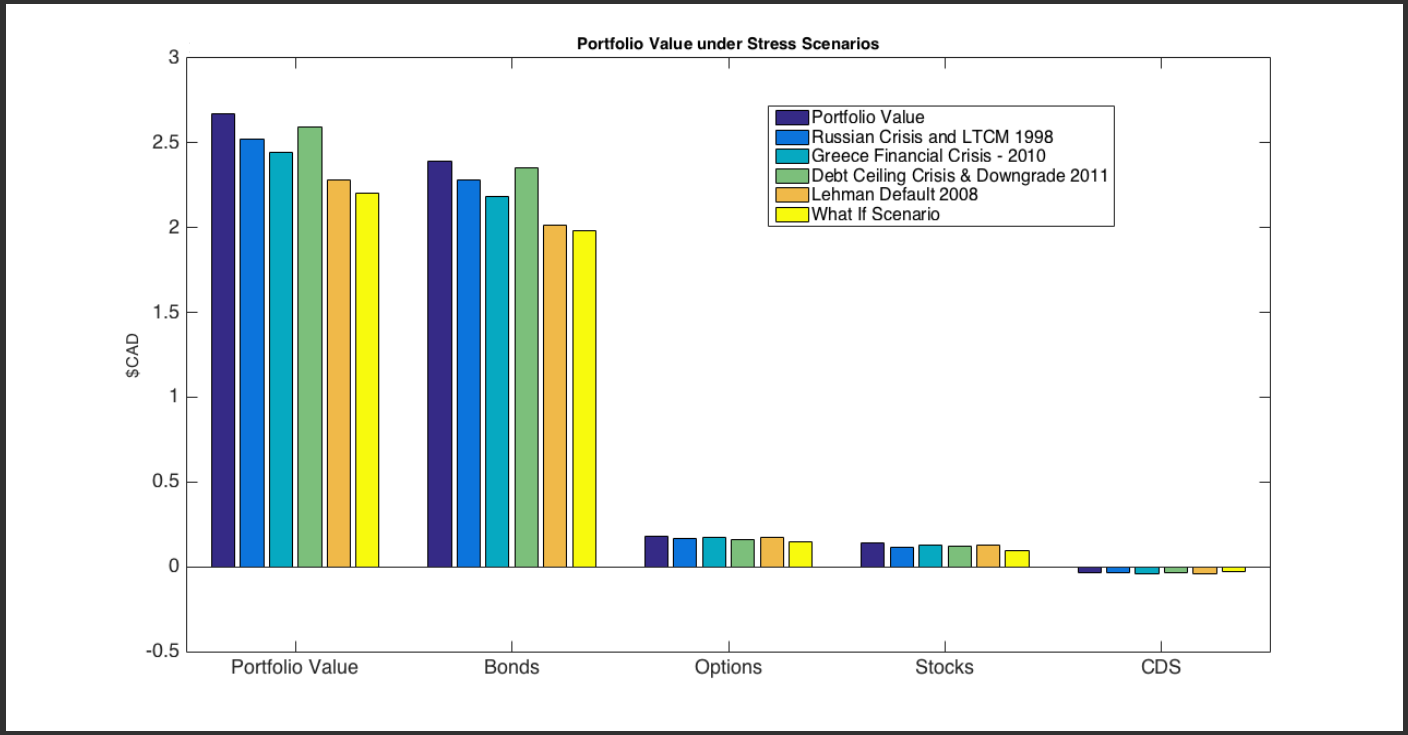


Sensitivities	
Duration	8.05
Convexity	0.96
DV01	$210,300
CR01	$-17,100

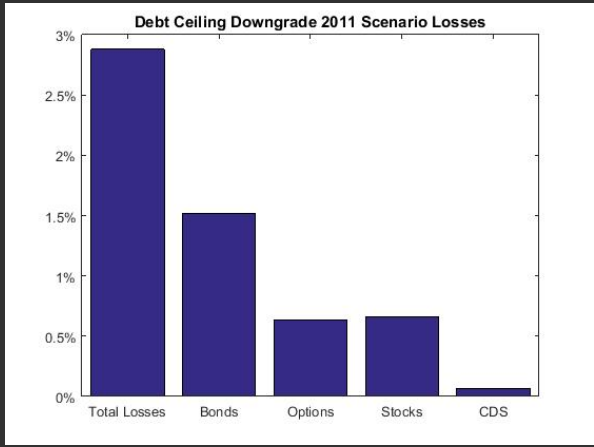
There is a large exposure to the 15 years node of the curve

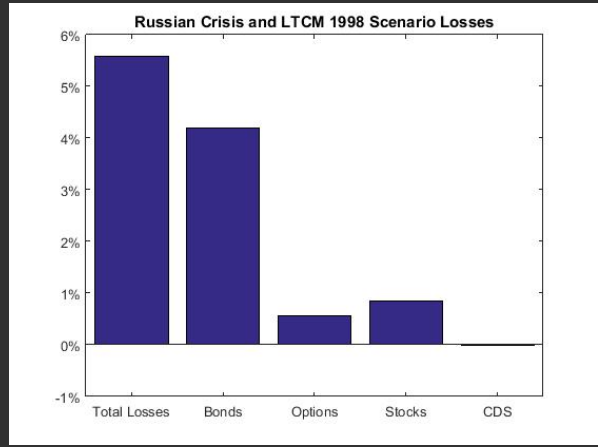
Stress Scenarios

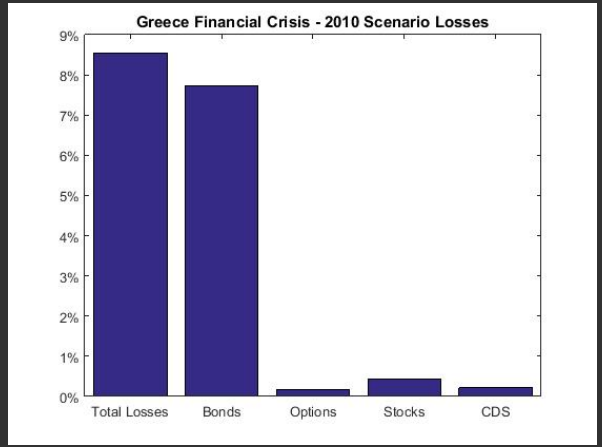
- 4 historical scenarios considered: LTCM (1998), Lehman Default (2008), Greece Financial Crisis (2010) and Debt Ceiling & Downgrade (2011)
- 1 hypothetical scenario to consider a significant raise in interest rates

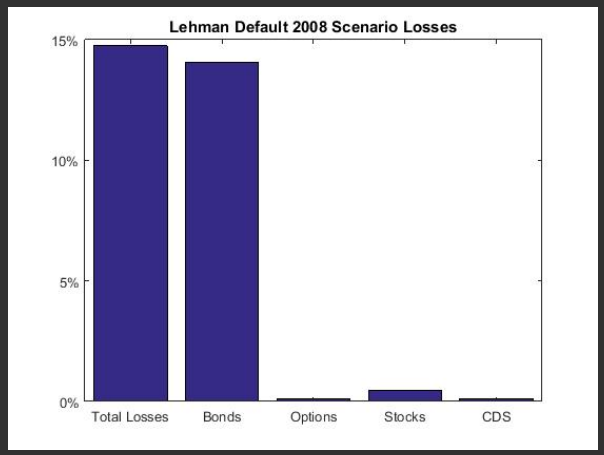


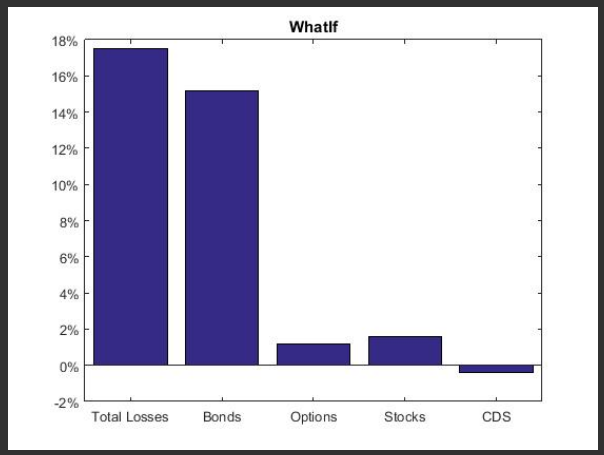
Stress Scenarios











Regulatory Capital

Capital Requirements		
Market Risk (mc = 3.1 for AA rating according to Regulatory Authority)	98.6M	39.7%
Credit Risk (IRC VaR 99.9% 1Y)	55.7M	22.4%
Total	154.3M	62.1%

Capital Requirements		
Economic Capital	13.6M	5.5%
Standardized Approach	0.27M	3.1%
Standardized CVA Capital	0.22M	2.6%

Q&A

"You can never know everything", Lan said quietly, "and part of what you know is ***always wrong****. Perhaps even the most important part. A portion of wisdom lies in knowing that. A portion of courage lies in going on anyway."*

"The Wheel of Time", R. Jordan