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| |  |  |  |  |  | | --- | --- | --- | --- | --- | | MMF2025 – Risk Management Lab  Pantelis Isaiah – 995354593  Sergio Ortiz Orendain - 1002248533  José Saad Canales - 999048392  Ryan Shrott - 998931223 | |  | | --- | |  | |  | |  | | |
| |  |  |  | | --- | --- | --- | | July 2016 | Risk | **Report** | |

# Portfolio decompositions

## By sector

The portfolio consists of 32 Bonds, 11 government bonds and 21 corporates. Out of the Bonds, 7 have either expired or been called, which leaves the total composition of the portfolio to 25 bonds. The portfolio also consists of 3 US Stocks, 2 of them listed in the NYSE and 1 in NASDAQ, 2 European Options, 1 American Option; both on US Stocks. Finally, there are 10 Credit Default Swaps (CDS) in the portfolio out of which 1 has expired. These instruments add up to a total value of 248.5M(CAD) dollars. There are several sectors represented in the portfolio, the following table represents the total exposure of our portfolio by sector:

# It can be noted that there is a large concentration to 2 sectors, Communications and Government, however we have enough sectors to potentially rebalance the portfolio in order for it to be more diversified sector-wise.

# By asset class and by currency

In terms of asset classes, the portfolio is mainly concentrated in Fixed Income instruments, while Equities (Stocks and Options) represent around 5% of the portfolio. We are exposed to 3 different currencies: Euro, Canadian Dollar and US Dollar. All of the Equity instruments of the portfolio are in US Dollars as well as the CDS contracts. The Bond portfolio consists on 9 USD Bonds, 1 Euro Bond and 15 Canadian Bonds.

It is important to note that almost all of the Bonds in the portfolio are Investment Grades, however there are 2 Corporate Bonds with BB S&P-rating.

# Sensitivities

Market risk takes into account the losses that surge from fluctuation in the market value of our positions due to changes in interest rates, credit spreads, foreign exchange rates and values of equities. The portfolio is exposed to changes in interest rates curves through our position in fixed income (Bonds and CDS). Additionally, there’s exposure to 3 different currencies (USD, CAD and Euro) so we will assume we are an investor that manages its assets and liabilities in Canadian Dollars, therefore we are exposed to fluctuations in the value of our portfolio due to changes in the USDCAD and/or EURCAD FX rate. Finally, we are exposed to credit spreads through our corporate bond positions and also through our CDS holdings. The measures we will use for market risk will be portfolio sensitivities (such as DV01, CR01, Duration and Convexity), VaR, Stressed VaR and Stress Scenarios.

# Portfolio Sensitivities

It is important to include the dollar sensitivities of the positions in the portfolio to changes in the underlying interest rate and credit spread.

DV01: It is the dollar value of one basis point that captures the change in value of the portfolio due to a downward parallel shift of 1bp in the yield to maturity (YTM).

CR01: It is the credit risk of one basis point that captures the change in value of the portfolio due to a downward parallel shift of the credit spread.

Since our portfolio has an overall long position in bonds, we can except to benefit from a decrease in interest rate. As for our position in CDS, the portfolio has a negative impact in case of a decrease in the credit spread.

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

# Value-at-Risk calculations — Monte Carlo

## Value at Risk (VaR) and Conditional Value at Risk (CVaR)

Under Basel II.5, Regulatory Value-at-Risk (VaR) is the estimate of the potential decline in the value of a position/portfolio under normal market conditions. We will consider a 10-day time VaR at the 99th percentile for all our estimations, however in the table below we present values for different confidence level and time horizon. Our model incorporates the volatilities and correlations of 150 market factors. For the calculation of VaR we consider a time horizon that goes from December 31, 2013 to June 30, 2016. We will use 2 methods for estimating VaR: Monte Carlo and Historical. Our calculations also include the Expected Shortfall (or CVaR), which gives more information about the tail of our Profit and Losses distribution by calculating the average of the losses that exceed VaR. The following table illustrates the values obtained for these measures:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **VaR** | **95%** | | **99%** | |
| 1-day | 2.68M | 1.09% | 3.79M | 1.54% |
| 10-day | 8.48M | 3.45% | 12.00M | 4.88% |
| 1-year | 54.45M | 22.14% | 78.39M | 31.87% |
| **CVaR** | 95% | | 99% | |
| 1-day | 3.35M | 1.36% | 4.33M | 1.76% |
| 1-year | 68.52M | 27.83% | 86.84M | 35.31% |

From our results we can see that the Historical VaR is higher than the VaR calculated using Monte Carlo. We must take into account that the analytical VAR is more models dependent. To map the portfolio P&L to linear risk factors we work with the DV01 and CR01 (for bonds and CDS respectively). The mapping probably won’t be a good approximation for large movements. That’s why; the historical VAR number would be a better representation of our PNL distribution.

## Marginal Value at Risk (MVaR)

From our results we can see that the Historical VaR is higher than the VaR calculated using Monte Carlo. We must take into account that the analytical VAR is more models dependent. To map the portfolio P&L to linear risk factors we work with the DV01 and CR01 (for bonds and CDS respectively). The mapping probably won’t be a good approximation for large movements. That’s why; the historical VAR number would be a better representation of our PNL distribution.

|  |  |  |
| --- | --- | --- |
| **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 Value at Risk (IVaR)

|  |  |  |
| --- | --- | --- |
| **1-day 99% IVaR** | | |
| bonds | 3.46M | 1.39% |
| CDS | 0.46M | 0.19% |
| options | 0.54M | 0.22% |
| stocks | 0.68M | 0.27% |

# Value-at-Risk calculations — Historical

## Value at Risk (VaR) and Conditional Value at Risk (CVaR)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **VaR** | **95%** | | **99%** | |
| 1-day | 2.97M | 1.19% | 4.57 | 1.84% |
| 10-day | 9.38M | 3.77% | 14.46 | 5.82% |
| 1-year (estimate) | 47.08M | 18.94% | 72.61M | 29.22% |
| **CVaR** | 95% | | 99% | |
| 1-day | 5.40M | 2.17% | 11.33M | 4.56% |

## Incremental Value at Risk

|  |  |  |
| --- | --- | --- |
| **1-day 99% IVaR** | | |
| bonds | 4.06M | 1.63% |
| CDS | -0.33M | -0.13% |
| options | -0.32M | -0.13% |
| stocks | -0.26M | -0.10% |

# Credit VaR

## Bonds

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| --- | --- |
| **Credit VaR for the bond portfolio** | |
| 20.04M | 8.07% |
| 40.40M | 16.25% |
| 50.64M | 20.38% |

## CDS

|  |  |
| --- | --- |
| **Credit VaR for the CDS portfolio** | |
| 27.56M | 11.09% |
| 48.77M | 19.62% |
| 50.68M | 20.39% |

# Credit and Debt Value Adjustments (CVA and DVA)

In thousands CAD

|  |  |  |
| --- | --- | --- |
| **CDS #** | **CVA** | **DVA** |
| 1 | 4095 | 84570 |
| 2 | 1791 | 155832 |
| 3 | 0 | 3557 |
| 4 | 0 | 1633 |
| 5 | 7 | 1259 |
| 6 | 12229 | 5468 |
| 7 | 42515 | 1675 |
| 8 | 53922 | 572 |
| 9 | 282 | 2809 |

# Stress VaR

To compute the stressed value at risk, data was taken from the period 03/01/07 – 12/31/09. It was found that the most stressed 504-day window occurred from 03/07/07 through 03/07/09. The reported stressed value at risk during this period was

**-5.5M $CAD**

# Stress scenarios

