GROUP WORK PROJECT # 1
GROUP NUMBER: 3081

MScFE 560: FINANCIAL MARKETS

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Statement of integrity: By typing the names of all group members in the text boxes below, you confirm that the assignment submitted is original work produced by the group (excluding any non-contributing members identified with an "X" above).	
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Use the box below to explain any attempts to reach out to a non-contributing member. Type (N/A) if all members contributed.
Note: You may be required to provide proof of your outreach to non-contributing members upon request.

Portfolio A:
The assets for the Portfolio are:

- Income stock - Microsoft Corp
- Cryptocurrency - Binacle Coin

Step1:

Statistics	**Income stock (MSFT)**	**Cryptocurrency (BNB-USD)**
Average	0.032	0.015
Volatility	2.169	4.330
Skewness	0.108	-1.098
Kurtosis	1.027	6.199

Correlation Matrix

	Income stock (MSFT)	**Cryptocurrency (BNB-USD)**
Income stock (MSFT)	1.000	0.442
Cryptocurrency (BNB-USD)	0.442	1.000

Covariance Matrix

	Income stock (MSFT)	**Cryptocurrency (BNB-USD)**
Income stock (MSFT)	0.000472	0.000417
Cryptocurrency (BNB-USD)	0.000417	0.001883

The portfolio return and volatility are 0.042 and 3.829 respectively.

Step 2:

1.

a. Yes, this portfolio can be sold short.

b. Selling this portfolio would require one to get a broker with a portfolio that consists of these securities (stock and cryptocurrency) and is willing to lend it. He can borrow it and then sell it in the market at a high price keeping in mind that he will continue paying the borrowing fees agreed upon. Later on, one could buy the same portfolio at a price lower than what he sold it for. He then returns the portfolio to the broker. His profit would be the difference between the price he sold the portfolio and the how much it cost him to buy it back. The borrowing fees need to be deducted as well.

2.

a. No, this portfolio has no credit risk.

b.

3.

a. The weighted return of the portfolio is 0.042%
b. The portfolio variance is 10.818%

4.

a. The correlation coefficient of the two assets is 0.442442. Since diversification relates to investing in assets that have low or negative correlation with each other, then this correlation indicates that the two assets tend to move in the same direction but not always at the same rate thus a moderate diversification effect. Therefore, investing in these two assets may reduce some of the risk of the portfolio, but not like it would be for say a negative correlation coefficient.

b. A well-diversified portfolio is one that has a low or negative correlation among its assets, and that achieves the highest possible return for a given level of risk. Assuming a risk-free rate of 0.01, then Sharpe ratio of portfolio A becomes:

Sharpe ratio = (0.042 - 0.01) / 3.289 = 0.0097

This is a very low Sharpe ratio, suggesting that portfolio A has a poor risk-adjusted return and may not be well-diversified.

5.

a. In terms of risk, if we consider the portfolio's variability then portfolio A is riskier compared to portfolio C and less riskier compared to portfolio B.

b. Portfolio A has the highest portfolio return compared to both B and C.

6.

a. Let's assume there is a global cyberattack that ends up disrupting the functioning of major cryptocurrency exchanges and wallets. This could reduce confidence in the digital currency market.

This would hurt the demand for cryptocurrencies and lower their prices, affecting my cryptocurrency short position.

b. Similar scenarios would affect only cryptocurrency short position

7.

a. At the moment, some cryptocurrencies are still illegal in some countries. A scenario where more countries continue to legalize their usage would boost the demand and raise crypto's prices thus affecting my cryptocurrency short position positively.

b. Similar events would help only the cryptocurrency short position.

8.

a. The Central bank could affect my portfolio through changing interest rates. Microsoft (part of my portfolio) and its customers can borrow or save, which may change how much money Microsoft makes and keeps. For example, if interest rates go up, Microsoft stock may become less valuable because the money it will make in the future is worth less now. If interest rates go down, Microsoft stock may become more valuable because the money it will make in the future is worth more now.

b. The investment banks may write and share their opinions on Microsoft stock and crypto which constitute my portfolio. These opinions may make investors feel more or less confident about these assets, and change how much they buy or sell them. Good opinions may make investors want more of these assets and raise their prices. Bad opinions may make investors want less of these assets and lower their prices.

9.

a. No, the different investments have different skew.

b. Spearman correlation is slightly higher than pearson correlation. The following table shows the spearman correlation of the income stock and cryptocurrency.

	Income stock (MSFT)	**Cryptocurrency (BNB-USD)**
Income stock (MSFT)	1.000000	0.491767
Cryptocurrency (BNB-USD)	0.491767	1.000000

Portfolio B:

The assets for Portfolio B: (Buy any number of assets (no shorting allowed))

- NYSE: G (Genpact Ltd)
- NYSE: MNP (Western Asset Municipal Partners Fund Inc.)
- NYSE: SBI (Western Asset Intermediate Muni Fund Inc.)
- Equity ETF : VTV (Vanguard Value Index Fund)
- NasdaqGM: FTXN (First Trust Nasdaq Oil & Gas ETF)
- NYSE: T (AT&T Inc)

Number of assets = 6

The price range used for asset : 2022/04/19 to 2023/04/19

Step 1:

Statistics	G	MNP	SBI	VTV	FTXN	T
Average (%)	0.03	-0.01	-0.02	-0.02	0.03	0.02
Volatility (%)	1.52	0.97	0.70	1.18	2.56	1.569
Skewness	-0.2781	-0.0549	0.0512	-0.1051	-0.4363	0.2157
kurtosis	1.1116	1.1510	1.5196	0.4535	0.05895	4.684

correlation matrix of historical returns.

Stocks	G	MNP	SBI	VTV	FTXN	T
G	1	0.2541	0.2690	0.7245	0.3899	0.4224
MNP	0.2541	1	0.4377	0.2961	0.2117	0.1085
SBI	0.2690	0.4377	1	0.3571	0.2602	0.1646
VTV	0.7245	0.2961	0.3571	1	0.6360	0.5634
FTXN	0.3899	0.2117	0.2602	0.6360	1	0.2876
T	0.4224	0.1085	0.1646	0.5634	0.2876	1

covariance matrix of historical returns.

Stocks	G	MNP	SBI	VTV	FTXN	T
G	0.000232	0.000038	0.000029	0.000130	0.000153	0.000101
MNP	0.000038	0.000095	0.000030	0.000034	0.000053	0.000017
SBI	0.000029	0.000030	0.000049	0.000030	0.000047	0.000018
VTV	0.000130	0.000034	0.000030	0.000140	0.000193	0.000105
FTXN	0.000153	0.000053	0.000047	0.000193	0.000659	0.000116
T	0.000101	0.000017	0.000018	0.000105	0.000116	0.000247

The portfolio's average return is **0.01745%**

The portfolio volatility is **12.9273%**

Step 2:

1. Shorting

    a. Yes, we can sell this portfolio short

    b. Since most of the assets are stocks in the portfolio and stocks are very easy to short. we just need a trading account on a brokerage and it will be easily done. And a big advantage of this portfolio is all the assets are well known and are traded frequently which will make it easier to short them.

2. Credit Risk

    a.: No, this Portfolio does not have credit risk.

    b. Since most of the assets in this portfolio are stocks and stocks have market risk associated with them not credit risk. This portfolio is mainly associated with market risk.

3. Portfolio Statistics

a. Following is the weight used for different assets in the portfolio.

Assets	Weight Used In Portfolio	Weighted Return (%)
G	0.25	0.03187
MNP	0.1	-0.01167
SBI	0.05	-0.0187
VTV	0.1	-0.0160
FTXN	0.25	0.03374
T	0.25	0.01901

The weighted return of the portfolio is 0.0001745. (0.01745%)

b. Since all the 5 assets are correlated to each other we have to use following formula

$$var = \Sigma(w_i * \sigma_i)^2 + 2 * \Sigma(w_i * w_j * Cov(i,j)) \ \forall\, i > j \ , \ \forall\, i \in \{1,2,3,4,5,6\}$$

$$standard\ deviation = \sqrt{var}$$

Variance of portfolio is **0.016712**

Therefore, volatility of portfolio is **0.129273 (12.9273%)**

4. Diversification

a. We use diversification to reduce risk in our portfolio. By using different types of assets we reduce the risk of losing big. Sometimes loss in one asset affects the price of other assets in other directions which reduce the overall loss or maybe even generate profit depending upon the weight distribution of our assets.

b. Yes, our portfolio is well diversified. Our portfolio is made up of stocks and ETF funds with 6 assets in total. Following the distribution of this portfolio.

Assets	Industry/Category	Sector
G	Information Technology Services	Technology
MNP	Asset Management	Financial Services
SBI	Asset Management	Financial Services
VTV	Large Value (Exchange Traded Fund)	Industrials - 12.89% Healthcare - 19.80% Consumer Defensive - 11.66% Financial Services - 19.24%
FTXN	Equity Energy	Energy
T	Telecom Services	Communication Services

As we can see our portfolio is well diversified in Industry and Sectors.

And also as shown in the correlation matrix some assets are very weakly related to each other.

By the above argument we can say the portfolio is diversified in some sense.

5. Comparing Portfolios

a. In comparison with portfolio A, On the basis of Volatility (based on percentage return of daily close) this portfolio is more riskier since portfolio B (data shown in above statistics tables in respective sections). But as we go through individual assets in portfolio B is less riskier since portfolio A includes a Cryptocurrency with volatility way greater than assets in portfolio B.

In comparison with portfolio C, portfolio B is riskier.

b. Portfolio B has the lowest return.

6. Assessing Risk

a. We have 1 asset in the Energy sector in our portfolio, and the most recent problem for the energy sector is increasing global warming, pollution, etc which can decrease the price of this asset.

We have one asset in the Information technology sector, and one of the most important factors which can affect the asset price of this sector is company internal changes like layoffs, change in stakeholders, etc.

Lastly the telecom sector asset is mostly affected by taxes, inflation and interest rates

b.Taxes, inflation and interest rate can affect all the assets since these are the most fundamentals in the market..

7. Performance

a. The War is a very profitable scenario for the Energy sector, Healthcare and Industrial sector. War needs Fuel, Medicine and Iron to attack and defend.This will increase the price of these assets. But the condition is war must be between others so these assets may generate profit. If war took place at Genpact's headquarters then it would decrease the price of “G”.

War also needs funds but it's kind of a hot topic that the Financial sector directly or indirectly affects the War by their funding.

b. As stated above, War affects the Energy sector, Healthcare and Industrial sector directly, and Financial sector indirectly.

8. Disrupters

a. As shown in the above Industry and Sector table more than one third of our portfolio is in the Financial Sector and we know Central Banks have a lot of incidence in this sector, they increase or decrease rates based on the economic condition of their country which directly affects this sector. And also change in rates also affect the Energy sector.

b.

All the stocks and ETFs in our portfolio are big players in the Market and they have lots of investments by big investment banks. If investment banks make a move they surely affect these assets. The ICT(Information and communication Technology)sector helps the banking sector by providing their service. If banks withdraw their funds from the Industrial sector, Financial sector there will be a huge impact on this portfolio and economy.

9. Re-assessing Risk

a. No, the skewness for different investments are **not** the same.

b. Spearman correlation

Spearman correlation and Pearson correlation differ by very small amounts.

Stocks	G	MNP	SBI	VTV	FTXN	T
G	1	0.2496	0.2386	0.7083	0.3702	0.5236
MNP	0.2496	1	0.4602	0.2886	0.2049	0.1820
SBI	0.2386	0.4602	1	0.3178	0.2291	0.1863
VTV	0.7083	0.2886	0.3178	1	0.6273	0.6341
FTXN	0.3702	0.2049	0.2291	0.6273	1	0.3203
T	0.5236	0.1820	0.1863	0.6341	0.3203	1

Portfolio C:

The assets for Portfolio C are the following:

- Bond: United States Treasury Notes 1.125% 29-FEB-2028 (ISIN:US91282CBP59)
- Equity ETF: iShares S&P Small-Cap 600 Value ETF (IJS)
- Crypto ETF: Global X Blockchain ETF (BKCH)

The price range used goes from 2022/04/19 to 2023/04/19 and the source was FactSet.

Step 1:

The following table summarizes the descriptive statistics of the assets' returns:

Statistic	Bond	Equity ETF	Crypto ETF
Average	-0.0075%	-0.0273%	-0.1986%
Volatility	0.4786%	1.5511%	5.1941%
Skewness	0.4536	-0.0734	0.1364
Kurtosis	0.6942	0.2678	0.0705

These statistics are calculated on the basis of daily returns and they have not been annualized. Additionally, the kurtosis is measured as excess kurtosis. Therefore, a positive number indicates that the series show a greater kurtosis than a Normal Distribution.

The following table corresponds to the correlation matrix of historical daily returns:

	Bond	Equity ETF	Crypto ETF
Bond	1.0000	0.1224	0.1066
Equity ETF	0.1224	1.0000	0.6324
Crypto ETF	0.1066	0.6324	1.0000

The following table contains the covariance matrix of historical daily returns:

	Bond	Equity ETF	Crypto ETF
Bond	0.000023	0.000009	0.000027
Equity ETF	0.000009	0.000241	0.000510
Crypto ETF	0.000027	0.000510	0.002698

Step 2:

The Equity and Crypto ETF are the most correlated assets. Thus, one of them should be shorted. Given the higher volatility of the Crypto ETF, it is the one selected for shorting and its exposure will be the smallest. In practice, it would be really hard to short the Crypto ETF because its AUM is only USD 60MM according to its latest factsheet. Given its low liquidity, it would be hard to find a counterparty willing to lend the ETF or it would be really expensive in terms of margin and interest rate requirements.

The weights of the portfolio are: 60% Bond, 60% Equity ETF, and -20% Crypto ETF. The net exposure of the portfolio is 100%.

1. Shorting:
    a. The portfolio can be sold short.
    b. First, we need to find counterparties willing to lend the Bond and Equity ETF. Considering that the Bond is a Treasury and the ETF has over USD 6 Bn AUM according to its last factsheet, it should be relatively easy to find such counterparties. In must be noted that they will receive an interest payment based on an agreed interest rate as compensation for lending the securities. In addition, margin calls will be agreed at certain price thresholds to make sure that the borrower is still solvent and can return the lent securities. Finally, one need to buy the Crypto ETF. This operations should be carried in accordance to the negative of the weights of the portfolio.
2. Credit risk:
    a. This portfolio has credit risk.
    b. Given that the portfolio involves buying a bond, it is exposed to credit risk. However, the issuer of the bond is the Goverment of the USA. Therefore, the credit risk exposure is minimal.
3. Portfolio statistics:
    a. The weighted return of the portfolio is 0.0188%.
    b. The portfolio variance is 0.0081%.
4. Diversification:
    a. The portfolio is formed by a bond, small-cap value ETF and crypto ETF. The bond has a different risk-return profile to equities because it does not represent ownership and is affected by other risks, such as credit and interest rate risk that are not too relevant to equities. The small-cap value ETF is formed by companies of several industries with a tilt to companies that are not too expensive in terms of valuation. However, this companies are not expected to grow rapidly and are riskier than large-caps. The crypto ETF is focused in companies that are related to the blockchain technology. These companies tend to be in the technology industry and are better known for having high growth expectation and are not cheap in terms of valuation. Therefore, the risk exposures of the 3 assets are diversified. Moreover, the correlation among them is below 0.7.
    b. The portfolio is not well diversified. It does not consider other important asset classes such as large-caps or corporate bonds. It has idiosincratyc risk in the bond because it is a particular pick. Although it invests in 2 ETFs, which reduce idiosyncratic risk, these are highly specialized, small-cap value and blockchain related.
5. Comparing portfolio:
    a. The portfolio has the lowest risk of all 3. This is the result of using a bond in this portfolio. It could also be because 3 asset classes are used.
    b. The return is slightly better than the return of Portfolio B, but it is quite lower than that of Portfolio A.

6. Assessing risk:
    a. If the US Government decides to increase the issuance of bonds, it will affect the value of current bonds. The levels of debt could decrease the confidence of investor in the repayment capacity of the country and the price of the bonds will be reduced.
    b. The higher the value of rates, the more expensive the financing of businesses. Small caps would be negatively affected as well because they could face financing constraints. Higher rates would increase the willingness of consumers to save more in traditional banks. Therefore, the demand of cryptos would be reduce and the crypto ETF would also be negatively affected.
7. Performance:
    a. If expected inflation decreases, then it will reduce the interest rates and the bond price will increase.
    b. If the blockchain technology becomes more environmentally efficient, it would attract more users that are currently concerned with the energy usage in mining digital coins.
8. Disrupters:
    a. If the FED keeps increasing the reference rate, it will negatively affect the value of the bond. It will also increase the level of savings in dollars because the interest rate would become more attractive. This has a hard to predict effect on the small-cap ETF because financial would be positively affected, but the consumer discretionary sector will be negatively affected. Regarding the crypto ETF, people would spend less in digital currency and park their savings in banks, which is positive for the portfolio because it has negative exposure to the crypto ETF.
    b. Investment banks could adopt crypto as a means of payment, which would greatly increase the value of the crypto ETF because it will encourage their institutional clients to use crypto. This would negatively affect the portfolio.
9. Re-assesing risk:
    a. The bond and crypto ETF have a positive skew, whereas the equity ETF has a negative skew. Therefore, the equity ETF is more exposed to large negative returns.
    b. There are no great differences between the Pearson and Spearman correlations among assets. The following table shows the Spearman correlation matrix:

	Bond	Equity ETF	Crypto ETF
Bond	1.0000	0.0992	0.0712
Equity ETF	0.0992	1.0000	0.6398
Crypto ETF	0.0712	0.6398	1.0000

Step 5:

Email:

Our investor base should avoid Portfolio A. We believe that it is not well diversified because it invests in only 2 assets. Moreover, those assets are direct investments, not diversified vehicles such as ETFs. Therefore, it is subject to high indiosincratyc risk. This kind of risk is not rewarded.
This portfolio represents a directional bet with respect to one stock and one cryptocurrency. It shorts the cryptocurrency, so it could be margin called. Considering the high volatility of cryptos, that risk cannot be underestimated.
The correlation between assets is 0.44, which indicates a moderate correlation. In order to reduce risk, we prefer a high correlation because one of the assets is being shorted. As a consequence, the volatility is really high next to the expected return.
The portfolio could include fixed income investments in order to decrease the risk and increase portfolio diversification. Another option is use ETFs instead of particular names. Unless there is strong conviction of the growth of the stock and of the poor future returns of the crypto, one should not invest in this concentrated portfolio. There are cheaper ways of doing this bets. For instance, options could be used.
In sum, this portfolio should be avoided because its high levels of idiosyncratic risk, possible margin calls due to shorting, lack of diversification and high volatility.

In the following page, the marketing material is presented.

Portfolio B - Equity

Are you looking for an equity portfolio that offers growth potential and diversification? Portfolio B is the perfect match. Portfolio B is a carefully selected mix of assets including Genpact Ltd , Western Asset Municipal Partners Fund Inc., Western Asset Intermediate Muni Fund Inc., Vanguard Value Index Fund, First Trust Nasdaq Oil & Gas ETF, and AT&T Inc.

It does not use short positions, so no margin calls are required. The other portfolios short positions.

Since it is focused in equity, it does not have credit risk. Portfolio C uses fixed income and it’s subject to credit risk.

The volatility of the portfolio is high, as expected from an equity portfolio. Therefore, the investor must be ready to sustain high volatility.

The portfolio is diversified because it invests in several industries. Moreover, the correlation among assets is below 0.75. Portfolio A only invests in 2 assets, so it’s not well diversified. Portfolio C is diversified but it does not consider individual equities, so it’s growth potential is limited