GROUP WORK PROJECT # 1
GROUP NUMBER: 970

MScFE 560: FINANCIAL MARKETS

FULL LEGAL NAME	LOCATION (COUNTRY)	EMAIL ADDRESS	MARK X FOR ANY NON-CONTRIBUTING MEMBER
Lawal Nimotalai Abduganiyu	Nigeria	nabduganiyu@gmail.com	
Marin Yordanov Stoyanov	Bulgaria	azonealerts@gmx.com	
Chong Wilson	Malaysia	wilsonchong96@gmail.com	X

**Remember: Any group members who did not contribute to the project should be given all zero (0) points for the collaboration grade on the GWP submission page.*

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).	
Team member 1	Marin Yordanov Stoyanov
Team member 2	Nimotalai Abduganiyu Lawal
Team member 3	Chong Wilson

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.
Chong Wilson did not contribute to the project. He joined the discussion late and only gave excuses and promises without submitting any contributions.

PORTFOLIO A

This portfolio is a make up of two assets:

a. Financial Select Sector SPDR Fund ETF (XLF)
b. ARK Innovation ETF (ARKK)

Statistics are computed based on 1-year historical daily returns data from 01/01/2022 to 31/12/2022. Below is the summary for each asset:

Weights	0.5	0.5
	XLF ETF	ARKK
Average Return	-0.046%	-0.362%
Volatility	0.015412348	0.042719205
Skewness	0.263301632	0.409434062
Kurtosis	0.299695	-0.03112

Portfolio Statistics:

-0.204%	Expected Return
0.060%	Volatility

	Correlation Matrix	
	XLF	ARKK
XLF	1.000	0.258
ARKK	0.258	1.000
	Covariance Matrix	
	XLF	ARKK

XLF	0.00024	0.00101
ARKK	0.00101	0.00024

Q1: Can this portfolio be sold short?

Yes, this portfolio can be shorted because it can be turned into an ETF and then it would be an entire new security of its own. So, they could be executed long or short over the new security (let's call it Finance vs Tech or for short let's name it FvsT). The overall return of the portfolio consisting of ARKK and XLF will be the return that gives the newly created FvsT ETF.

The financing of the shorting part of this portfolio can be done through using OTC derivatives like CFDs. Thanks to these investment instruments and methods we can access leverage of up to 1:20 which could lower the margin capital needed for this type of trade. The cost of doing that will be that we will need as little as 5% of the capital for doing the short (let's say for precaution measures this amount to be 10%) and there will be other costs like intraday swaps (this is the amount of money the broker will take for himself for keeping our trades open during the night, this will fee will be paid every midnight)

Q2: Credit Risk

Yes, this portfolio has a credit risk like everything else in this world does, but in this case it is very small. As we know the definition of credit risk is: "Credit risk is the possibility of a loss resulting from a borrower's failure to repay a loan or meet contractual obligations." (Thomas Brock, Investopedia). There is always a chance that this new security to be hacked and the hacker to get access to the funds and somehow be able to turn them into an anonymous crypto. Then it could be sent to every place in the world and from there its traces are gone. Although this is possible, I will say that it is very improbable and also very hard to be done so the credit risk is so small that it is almost not existent but the probability for this to happen is not zero so I have to say that there is very small credit risk. There is something else that is in favor of this almost riskless new security and this that: "ETFs are usually over-collateralized and extremely safe" (ETF.com , Fidelity)

Q3: Portfolio Statistics

The statistics of this portfolios are as they follow (have in mind that the weights are the same, so weight01 = weight02 = 50%):

First let me elaborate that this portfolio is based on the combination of 2 different ETFs. We go long on XLF and we go short on ARKK with the same weights of 50%.

The calculations are over the period of the entire 2022 year and we have to take into consideration that during this year there was a war between Russia and Ukraine (still going on) and this led to prices increase of almost everything and a big inflation spike.

Expected(Portfolio return) = WaRa + WbRb

= 0.5*(-0.046) + 0.5(-0.362) = - 0.204%

Where R represents asset return and W represents asset weight in the portfolio.

This leads to an overall portfolio return of -0.204%. Which is not bad considering that for example SP500 fell down more than 15% for 2022.

The variance of the portfolio is also not bad as of the end of 2022 it is: 0.06.

Portfolio Var = Wa^2*Sa^2 + Wb^2*Sb^2 + 2*cov(a,b)*Sa*Sb = 0.06%

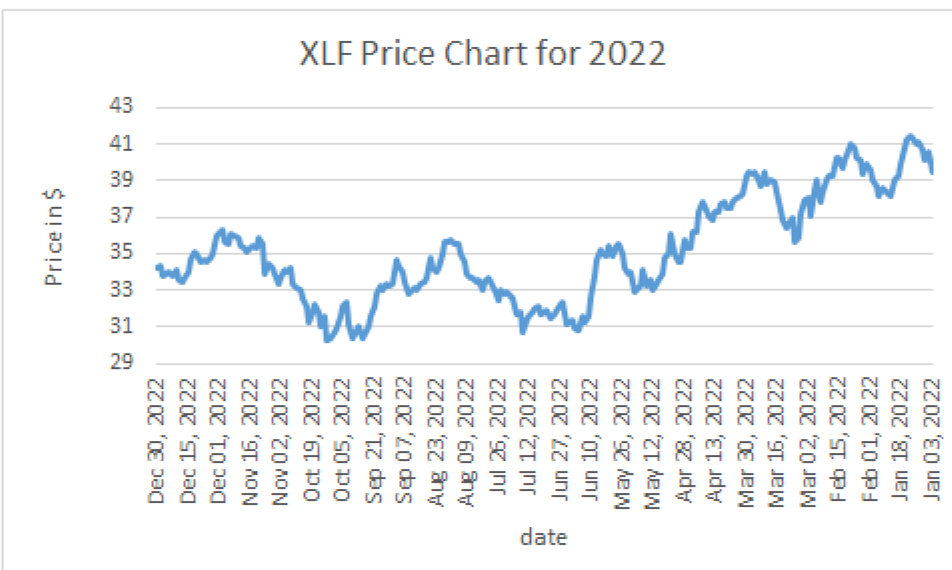

Fig.1 XLF price for 2022

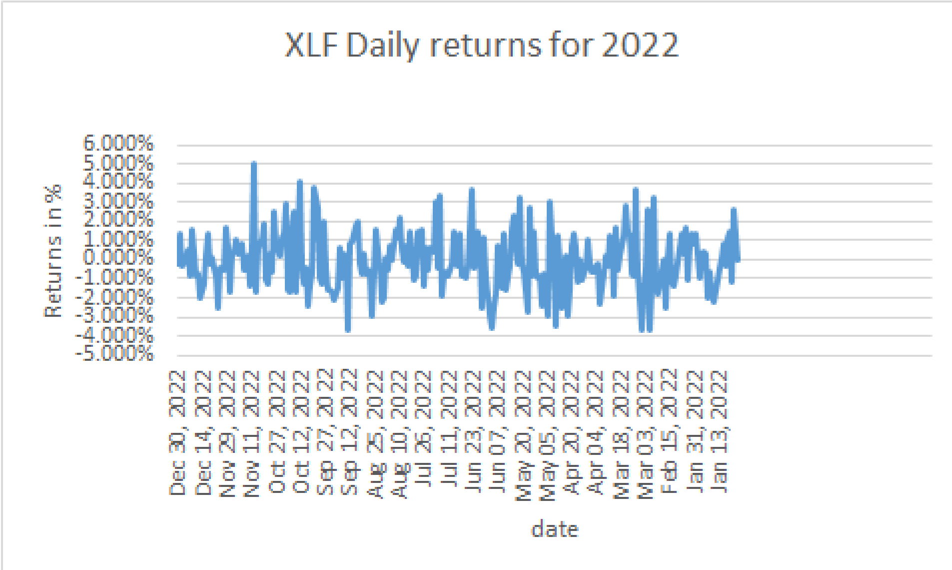

Fig.2 XLD daily returns in %

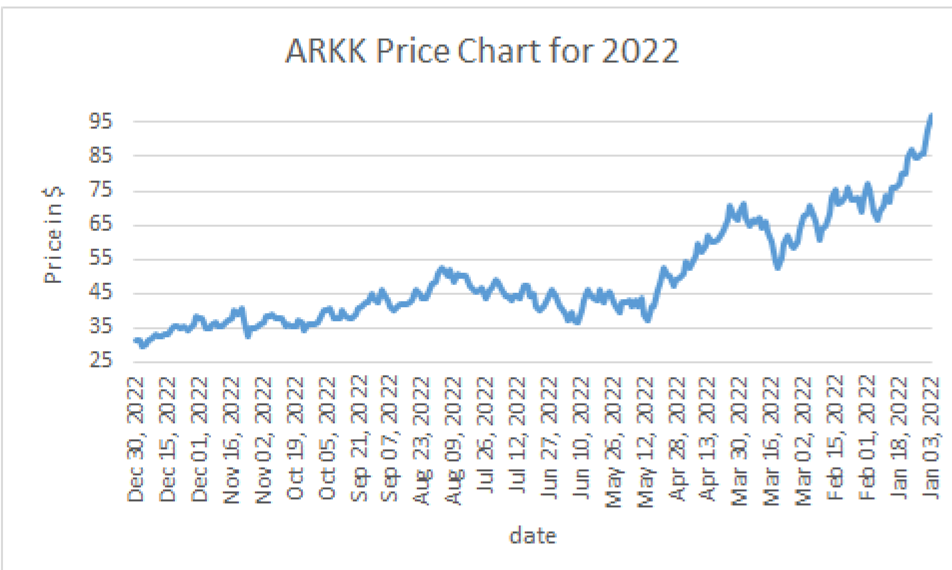

Fig.3 ARKK Price Chart for 2022

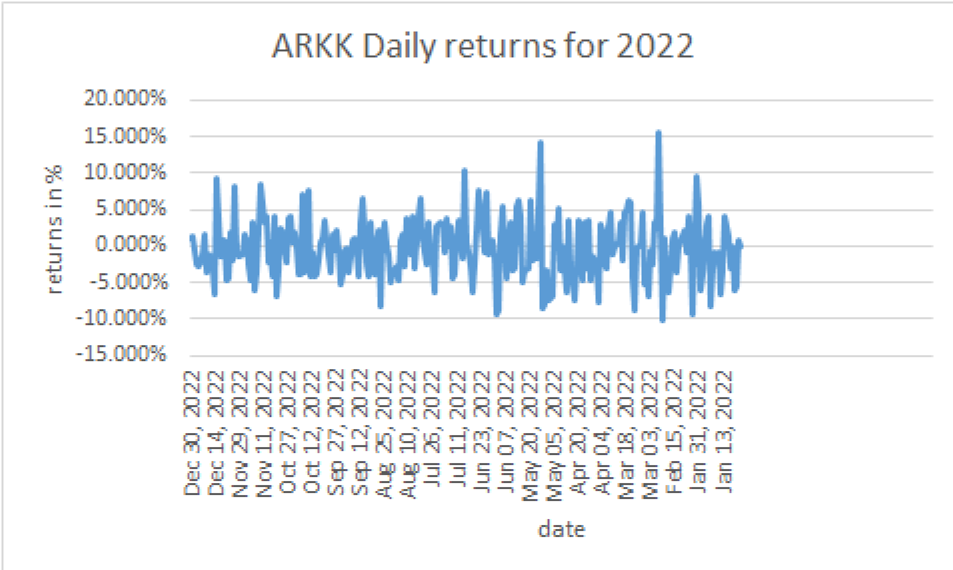

Fig.4 ARKK daily returns in %

Q4: Diversification

This portfolio is very well diversified because it consists of two ETFs which are over 2 entirely different sectors. I am talking about the financial sector and the technology sector and furthermore the financial sector XLF ETF is additionally diversified because it consists of a lot of other financial stocks like banks and more, which brings even more diversification. The same goes to the other ETF, which is the ARKK ETF. It consists of many more highly innovative companies and the fact that the ARKK ETF is very well diversified by itself, brings even more diversification toward the entire newly created ETF that we called early: FvsT.

Q5: Comparing Portfolios

This portfolio is the most diversified compared to the other because it consists of the ETF which are diversified by themselves. It is most suitable for a rate hiking period like the one we are right now.

Although its expected return is slightly negative: - 0.204% it has some future potential depending on what is going to happen in near future and if the FED is going to continue hiking rates or not.

Also the portfolio variance is quite small like: 0.06% which also is thanks to the very good diversification of the two ETFs. This is why this portfolio variance is the smallest of them all compared to the other portfolios.

Q6: Assessing Risk

The main impact that would affect the FvsT ETF is the FED rate cuts if for some reason FED decide and starts cutting rates, well this will be very negative for our FvsT ETF because lowering interest rates is considered as a bad effect on financial sector like banks and lending companies because this way their margins will be getting lower and this will affect their profits respectively. This will also affect the IT sector because the sector itself thrives in low interest rates conditions and since we are long on XLF (its profits will go down and the shares prices as well) and the IT sector will go up (but we are shorting it), so over all this will be very negative towards the entire portfolio performance.

Q7: Performance

Since we are in a period of rate hikes this will be positive towards XLF ETF and at the same time will be negative towards ARKK and this is why we decided to go long on XLF and go short on ARKK. If this narrative keeps on going the FvsT ETF will do very well. It is expected for the next couple of years this narrative to continue so the negative scenario has a lower probability

Q8: Disrupters

I have just commented on the potential influence of central bank politics so now I will talk about some other disruptors. About the financial sector they will be negatively impacted if for example Bitcoin get a lot more adoption or much more people start using cryptocurrencies (let's say for example that half of the world's population switch to using cryptocurrencies) and their properties which will drain the usual profits of the normal financial companies. They will lose half of their customers and thus their profit margins will drop significantly. This will negatively impact the XLF part of this portfolio.

About the IT sector, I think the main disruptor will be the usage of AI and for example Chat GPT which for some companies may have a positive impact because they will be able to lay off a lot of their workforce by automating it with Chat GPT. This will help lower their costs of doing business because a lot less people will be working there and a lot less salaries will be paid.

Q9: Re-assessing Risk

These two investments do have positive skewness but are a bit different because XLF's skewness is: 0.26 while ARKK's skewness is a bit more: 0.41 which is almost twice bigger than XLF. The fact that they both have positive skewness means that predominantly the returns of each ETF are positive values. So all being equal this means that most of the time prices of these ETFs go up.

PORTFOLIO B

This portfolio is a make up of three assets:

c. Vanguard Total International Stock ETF (VXUS)
d. Stocks of Apple Inc.
e. Stocks of Amazon

Statistics are computed based on 3-year historical daily returns data from 26/01/2020 to 26/01/2023. Below is the summary for each asset:

Weights	0.4	0.3	0.3
	VXUS ETF	**Apple**	**Amazon**
Av. Ret.	0.000269	0.001104	0.000389
Volatility	0.014566	0.023317	0.024851
Skewness	-1.042654	0.086752	0.104069
Kurtosis	11.940739	3.991117	3.740255

Portfolio Statistics:

0.0555%	**Expected Return**
0.065481	**Volatility**

	Covariance Matrix		
	Equity ETF	**Apple**	**Amazon**
Equity ETF	0.000212	0.000378	0.000415

Apple	0.000378	0.000543	0.000580
Amazon	0.000415	0.000580	0.000617

	Correlation Matrix		
	Equity ETF	**Apple**	**Amazon**
Equity ETF	1	0.6764883	0.529482
Apple	0.676488	1	0.659556
Amazon	0.529482	0.6595562	1

Q1: Can this portfolio be sold short?

a. Yes, the portfolio can be treated as an ETF and sold short.
b. The price on the new ETF will have its price to be the weighted average of the prices of the portfolio constituents. Since, this is not a standardized ETF, short selling it might be more complicated and may attract higher financing costs.

   We will need to create a margin account with a broker who will look for holders of the individual securities in the proportion we are willing to short sell and fund the account. This fund will be used to pay our financing costs. We can then have the securities borrowed as requested. We would then pay borrowing costs to the lenders and cover the dividend payouts for the stocks as well. When our portfolio's price drops to desired levels, we cover the short by repurchasing and returning the borrowed securities. We make profits (or losses) from the difference between our purchase price and selling price less the amount of financing costs.

Q2: Credit Risk

a. This portfolio despite being equity based is prone to credit risk. This affects the ETF less than it affects the stocks of Apple and Amazon. While a shareholder is not the company's creditor, the ability of the company to fulfill its obligations to its creditors is directly linked to losing invested capital in the shares of the company.
b. There is the risk of loss of investment as creditors are ranked above shareholders in case of bankruptcy.

Q3: Portfolio Statistics

a. E(Rp) = WaRa + WbRb + WcRc

= 0.4(0.0002686) + 0.3(0.001104) + 0.3(0.0003892) = 0.0555%

Where R represents asset return and W represents asset proportion in the portfolio.

b. Var = Wa^2*Sa^2 + Wb^2*Sb^2 + Wc^2*Sc^2 + 2*cov(a,b)*Sa*Sb + 2*cov(a,c)*Sa*Sc + 2*cov(b,c)*Sb*Sc = 0.4288%

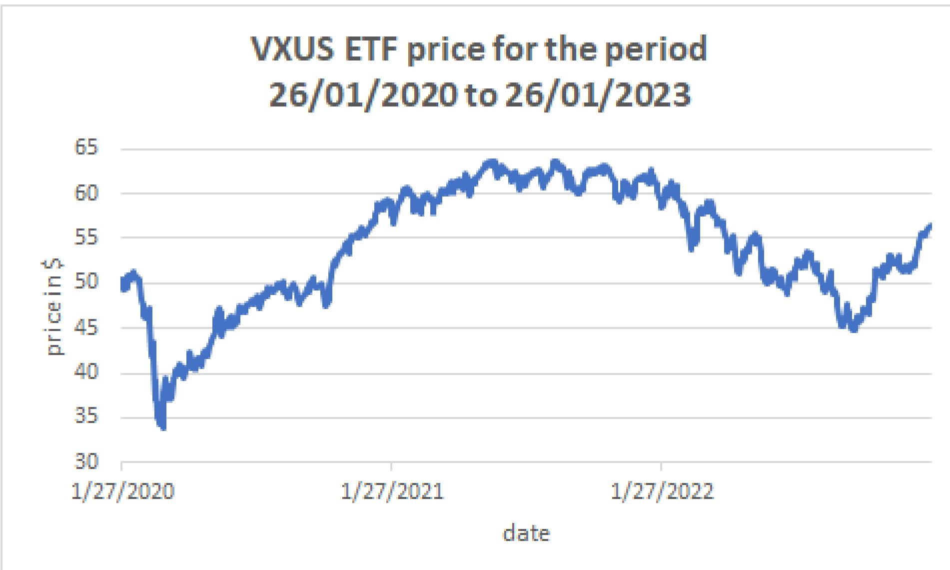

Fig.5 VXUS ETF price for the period 26/01/2020 till 26/01/2023

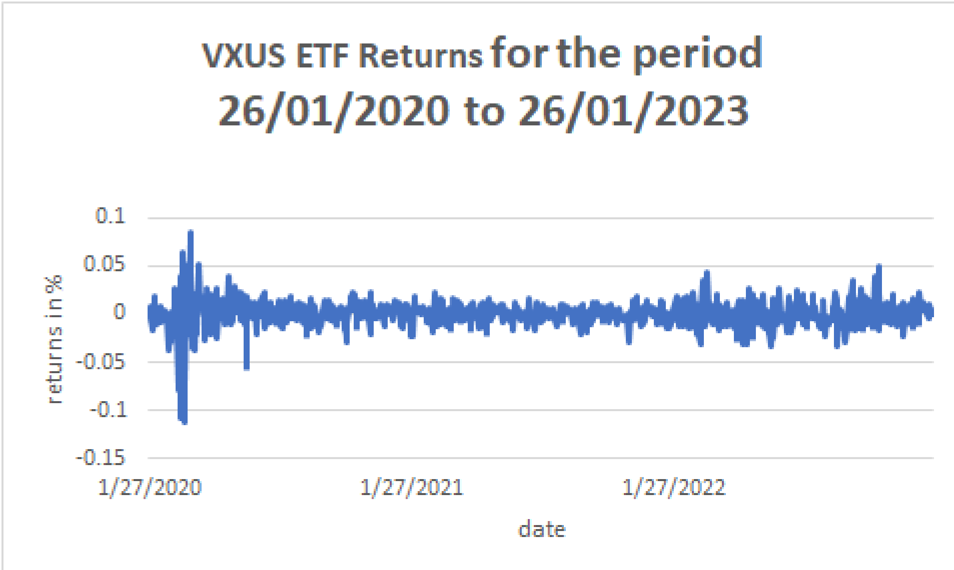

Fig. 6 VXUS ETF daily returns in %

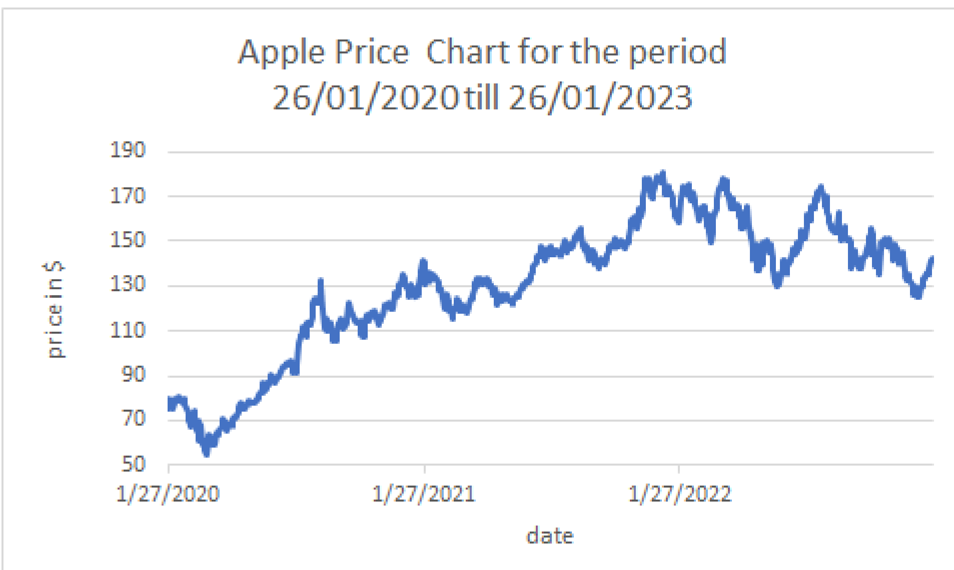

Fig.7 Apple price in $ for the period 26/01/2020 till 26/01/2023

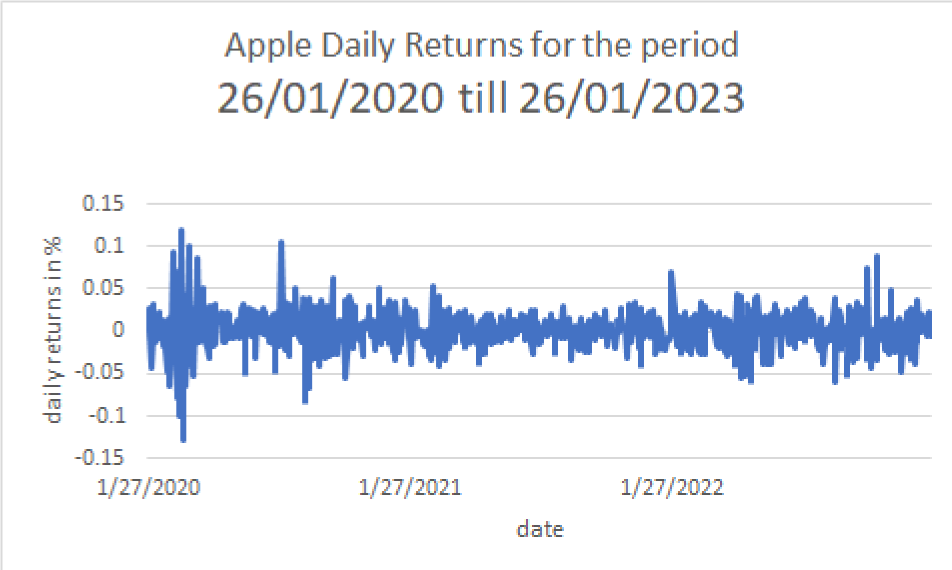

Fig. 8 Apple daily returns in % for the period 26/01/2020 till 26/01/2023

Fig.9 Amazon price chart in $ for the period 26/01/2020 till 26/01/2023

Fig. 10 Amazon daily returns in % for the period 26/01/2020 till 26/01/2023

Q4: Diversification

a. Diversification reduces overall volatility of the portfolio. The less correlated the returns of the individual assets in the portfolio, the more diversified the portfolio. There appears to be a moderate correlation of about 0.53 between the returns of the Equity ETF and Amazon's shares and a slightly higher correlation of about 0.66 between Apple's and Amazon's shares. Apple's shares have a correlation of about 0.68 with the Equity ETF.
b. Correlation between the assets in the portfolio is positive in all cases and above average. Even though this is the case, the ETF in the portfolio is in itself a tool for diversification. Apple's main business is in the technology sector and Amazon’s main business is in the e-commerce and retail sector. This also allows for an additional level of diversification. While the portfolio isn’t the best mix, it is decently diversified. Some negative correlation between the returns would have led to better diversification.

Q5: Comparing Portfolios

a. This portfolio has a higher expected daily return than the other two portfolios (0.0555%) as opposed to -0.204% and -0.78% respectively for portfolios A and C.
b. However, it has the highest volatility of the three (6.548%) compared to 0.06% for A and 1.875% for C

Q6: Assessing Risk

a. Situations of war,(the war in Ukraine, for example),pandemics and political instability are known causes of economic crises and inflation. Mass loss of income or the inability to match wages to increasing prices of goods and services leads to a decline in spending on both individual and corporate levels. Extension of such situations may aggravate the issues leading to loss of business (profits) for companies like Amazon.
b. Tech companies like Apple are also likely to get hit as consumers spend less on gadgets. In addition, political instability or frictions in relationships between countries (China-USA as example) can make sourcing for supplies difficult. The Vanguard International Stock ETF which is in itself diversified across borders will usually be better cushioned against shocks like these as long as the crisis is not on a global scale.

Q7: Performance

a. Downward trends in other markets, say Crypto market, would draw more attention to the stock market driving volumes and prices.
b. Low inflation, political stability, increased wages and general economic growth will usually boost the fundamentals of companies and make their stocks and ETFs attached to them more valuable.
c. If Apple, Amazon or Nestle S.A. (one of the major holdings of the Vanguard ETF) were to embark on acquisitions that are presumed to increase the company's economic value or see it enter a booming market; this will usually price up its stock and be a boost for our portfolio.

Q8: Disrupters

a. Central Bank Policies
    1. When central banks lower interest rates, businesses are able to borrow at a reduced cost to finance their output, translating to more earnings, higher possibilities of dividend payments and upward trend in the stock market.
    2. The U.S. Central bank has been increasing interest rates over the past year and is said to have plans to further increase rates in 2023. This is expected to generally have a negative impact on the equities market as consumers save more than they spend during this period and businesses pay more to finance their outputs affecting their profitability. Several other countries are also raising interest rates after they were lowered to nearly zero in many countries during the COVID-19 pandemic.

b. Investment banks

"Institutional investors such as pension funds, mutual funds, university endowments, as well as hedge funds use investment banks in order to trade securities." - wallstreetprep.com.

Investment banks carry out trading activities on behalf of institutional investors as well as for their own trading accounts. This is why investment banks are major market makers in the different securities markets. They trade in large volumes and are able to drive sentiments in the markets in which they are involved. If a major investment bank were to mass sell stocks of Amazon, it could give retail investors the impression that there's bad news loading and lead to more aggressive sell-offs of Amazon's stocks.

Q9: Re-assessing Risk

a. The portfolio has 3 investment options.Returns on the VXUS ETF have a negative skew, Apple and Amazon shares both have positive skew.
b. All assets in the portfolio share positive correlation with each other (between 0.53 and 0.68).

PORTFOLIO C

This portfolio is a make up of three assets:

1. Technology Select Sector SPDR® Fund (XLK) ETF (VXUS)
2. Coca-Cola (KO).
3. Domino's Pizza (DPZ)

Statistics are computed based on 3-year historical daily returns data from 01/01/2022 to 31/12/2022. Below is the summary for each asset:

Weights	0.33	0.33	0.33
	XLK ETF	**Coca Cola**	**Domino's**
Average	-0.112%	0.029%	-0.151%
Std	0.020735	0.012431	0.021687
Skewness	0.253818	-0.72495	0.494914
Kurtosis	0.409296	4.218663	1.625793

Portfolio Statistics:

-0.78%	**Expected Return**
0.000351422	**Volatility**

Q1: Can this portfolio be sold short?

Yes, it can because it could be turned into an ETF and then be traded like an individual security thus providing the possibility to be shorted. Let's say the money coming for investing in this portfolio is divided into 3 equal parts so 1/3 goes towards shorting XLK, 1/3 goes for buying Coca-Cola's shares and the rest 1/3 goes for buying Domino's Pizza shares. This will be the strategy for how the cash flow towards this new ETF (let's call it Tech and Drinks and Food so in short: TDF) will be processed.

The financing can be executed through CFDs where a leverage of something like 1:20 can be achieved. Although there will be some other costs for keeping the position open through the night, for keeping the trade open for a short period of time, these additional costs will not be a problem.

Q2: Credit Risk

The short answer is yes because there is always credit risk, ALWAYS. In this case it is limited because XLK is an ETF by itself so during its creation there were specific measures taken for lowering the credit risk, like every ETF has. Overall "counterparty risk (credit risk) is mitigated by the basket of assets (collateral) that the ETF holds". (Michael Grill, Claudia Lambert, Philipp Marquardt, Gibran Watfe, Christian Weistroffer, "Counterpart and liquidity risks in exchange-traded funds", Published as part of the Financial Stability Review November 2018).

For Coca-Cola the credit risk is so small that I could say that it is almost non-existent, because it is such a big company that has factories and operations all over the world. Being so widely exposed that even something happens to a factory like fire or earthquake and this stops the production, there will be a way to offset this event and continue doing business.

For Domino's Pizza the credit risk hides in the case if they default on got liquidated after that first they pay the creditors, the banks, the bond holders and if after all this there is no more money left to give to the investors (shares holders), well this will be a default event and could be categorized as a credit risk.

Considering all the things said above, I can conclude that the credit risk almost does not exist.

Q3: Portfolio Statistics

Taking into consideration that we are investing equal amount of money to each security, the weighted return of the portfolio is as follows:

Portfolio return = $w_1r_1 + w_2r_2 + w_3r_3$ = 1/3 * (-0.112) + 1/3 * 0.029 + 1/3 *(-0.151) = - 0.078

which is very good considering that all the major indexes have fallen between 15% and 20%.

The portfolio variance =

$= (1/3)^2 * 0.020735^2 + (1/3)^2 * 0.012431^2 + (1/3)^2 * 0.021687^2 +$

$+ 2 * 0.000292 * (1/3)^2 + 2 * 0.000449 * (1/3)^2 + 2 * 0.000313 * (1/3)^2 =$

= 0.000047771 + 0.00001717 + 0.000052258 + 0.000064889 + 0.000099778 + 0.000069556 =

= 0.000351422

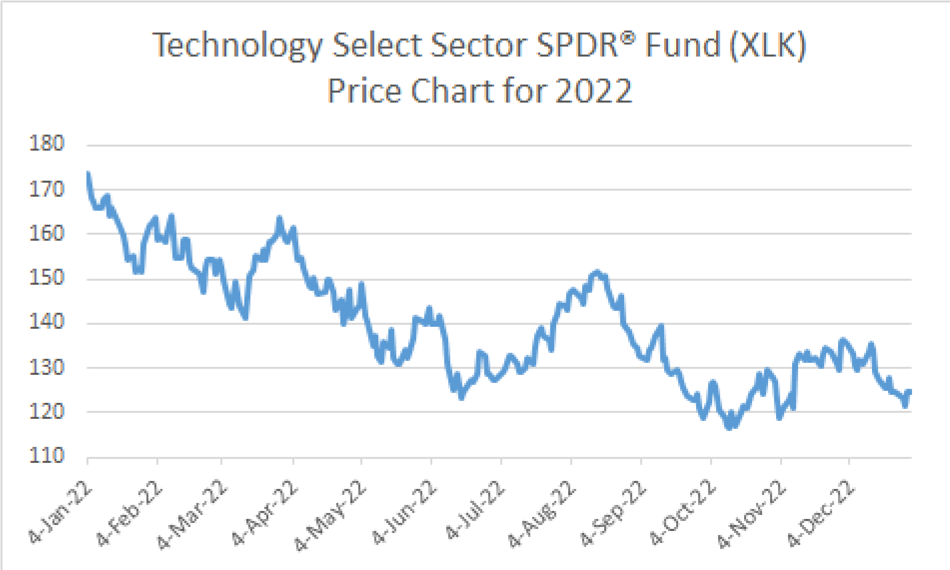

Fig. 11 XLK price chart in $ for 2022

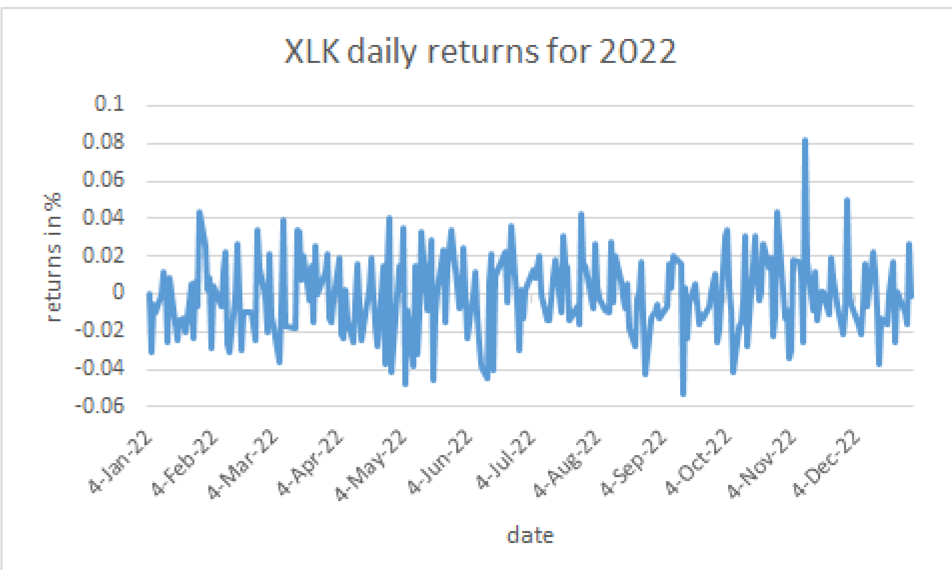

Fig. 12 XLK returns in % for 2022

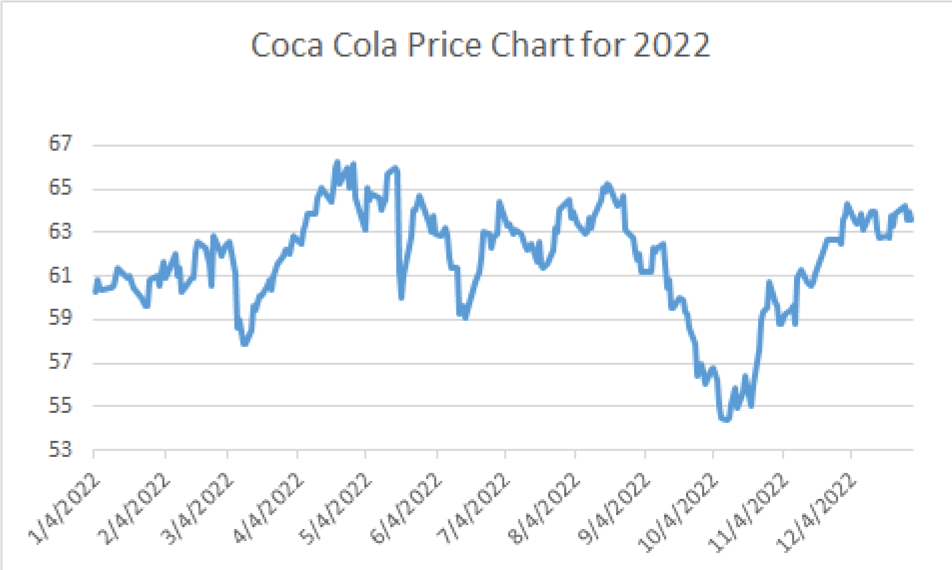

Fig. 13 Coca-Cola price chart in $ for 2022

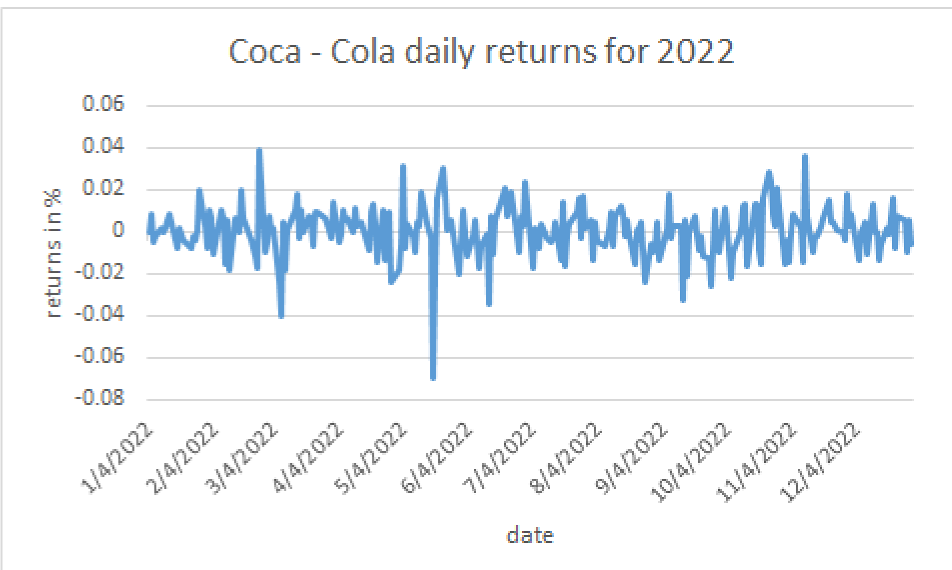

Fig 14 Coca-Cola returns in % for 2022

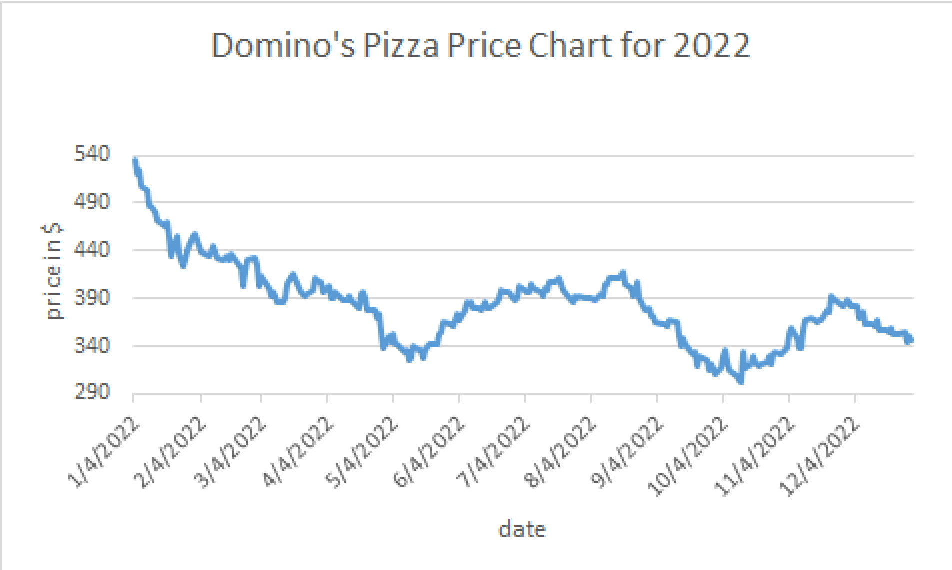

Fig. 15 Domino's Pizza Chart in $ for 2022

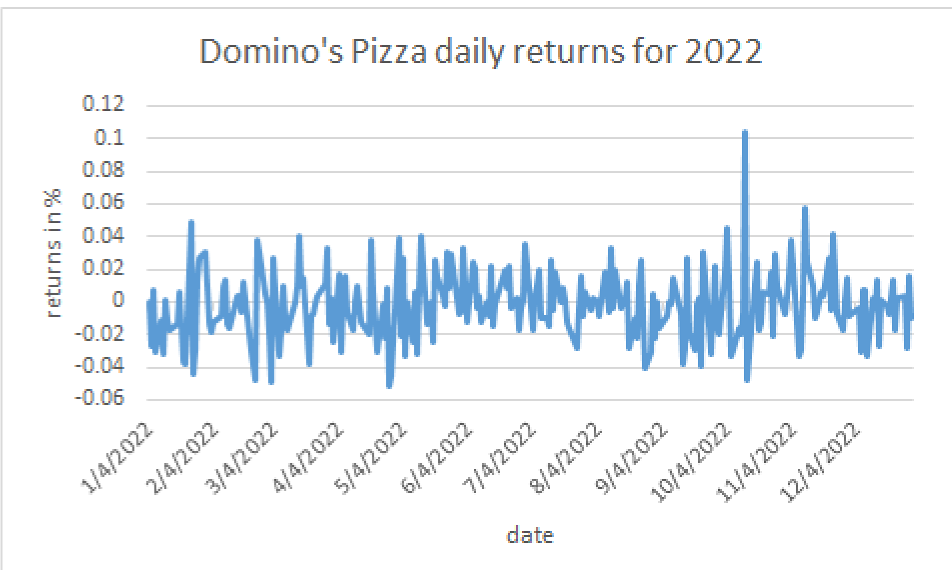

Fig.16 Domino's Pizza returns in % for 2022

Q4: Diversification

The XLK is an ETF that is diversified by design, I mean that it consists of a lot of technology companies that are situated in the tech sector in SP500 so by default it is like a portfolio of these tech companies. About Coca cola and Domino's Pizza, they are both in the Food and Drinks sector but the correlation between them is very low (0.35) so they do get a very good diversification. When combined, the three assets together, are creating a very well diversified portfolio because thanks to this portfolio we are getting exposure to different assets in different sectors and thus achieving a good diversification.

Q5: Comparing Portfolios

This portfolio has the worst result for expected return (- 7.08%) but also has the lowest variance so the risk with this portfolio is the smallest compared to the other portfolios

Q6: Assessing Risk

The main problem for XLK would be the supply-chain distortion and chips shortage, because most of the tech companies rely on chips, hardware and software and missing even one of these components will have a great impact in the production cycle which can lead to delays and other negative impacts.

For Coca-Cola, the situation is a bit different because they rely only on chemicals, sugar, water and other components that are easy to access. For this company it would be very negative if for some reason a lot of governments declare it as an unhealthy drink and forbid it with a special law. This would be devastating for its business, because suddenly the consumption of Coca-Cola will stop immediately.

For Pizza Domino's the negative impact will be if there comes a competition and let's say they offer the same pizzas but twice as cheap. This will be a stress to the company and they will have to lower their prices as well, but this measure has limitations. Also some other idiosyncratic risk is if someone gets food poisoning and then go to court and sue the company. Also, the negative advertisement and black PR will be a devastating blow towards the company's future.

Q7: Performance

For XLK and supply chain issues, the chip shortage is the main problem so if there is a way these issues can be removed, this will have a very positive impact towards the entire IT sector. Also a rate cut by the FED will also make IT companies shares go up and thus XLK's stock price as well.

This will not have an impact over Coca-Cola and Domino's Pizza because they are in a totally different sector that relies on different problem solutions. The food and drink industry will be impacted by higher inflation and higher prices for dough, sunflower oil, ingredients, electricity price and more utility prices.

These three securities are very different and almost do not have collisions, I mean that the prices that affect one does not affect the other security (I mean XLK and Coca-Cola). So, this is a very well diversified portfolio, and the small portfolio variance proves it.

Q8: Disrupters

Well, if the FED hikes the interest rates this will affect the possibility for companies (mainly the IT sector) to be able to refinance their business by taking bank credits, and this is a very common thing to do in this sector.

For the food and drinks sector the impact will be a lot less, although interest rates levels do impact salaries and business as whole. For Coca-Cola it would be easier to move its production line to a country with lower interest rates and keep on producing liquids that could be exported and sold everywhere.

For Dominos, the production cannot be moved to a different place, because they sell where they produce pizzas.

Q9: Re-assessing Risk

The skew for the portfolio investments is as follows:

1. XLK 's skewness is: 0.253818, which means it is a positive skew and there are mostly positive returns.

2. Coca-Cola's skewness is: -0.72495, which means it is a negative skew and there are mostly negative returns.

3. Domino's Pizza skewness is: 0.494914, which means it is a positive skew and there are mostly positive returns

There is a difference between Pearson and Spearman correlation types.

1. "Pearson correlation assigns a value between − 1 and 1, where 0 is no correlation, 1 is total positive correlation, and − 1 is total negative correlation." (David Nettleton, in *Commercial Data Mining*, 2014). It is used to find if there is a linear relationship between variables

2. The Spearman correlation coefficient measures the monotonicity of relationships (Pritha Bhandari, "Correlation Coefficient, Types, Formulas and Examples", 08.02.2022). It is used for non-linear relationships between the variables.

References:

Yahoo Finance - https://finance.yahoo.com/quote

Wallstreetprep.com-
https://www.wallstreetprep.com/knowledge/investment-banking-industry/

Investopedia -
https://www.investopedia.com/articles/investing/052813/how-monetary-policy-affects-your-investments.asp

Etf.com - https://www.etf.com/VXUS#overview

Schwab.com - https://www.schwab.com/learn/story/ins-and-outs-short-selling

Tradingeconomics.com -
https://tradingeconomics.com/united-states/interest-rate#:~:text=Interest%20Rate%20in%20the%20United,percent%20in%20December%20of%202008

Investing.com - https://www.investing.com/

Pritha Bhandari, "Correlation Coefficient, Types, Formulas and Examples", 08.02.2022

David Nettleton, in *Commercial Data Mining*, 2014

Michael Grill, Claudia Lambert, Philipp Marquardt, Gibran Watfe, Christian Weistroffer, "Counterpart and liquidity risks in exchange-traded funds", Published as part of the Financial Stability Review November 2018

ETF.com , Fidelity

Thomas Brock, Investopedia