Financial markets Project

Introduction:

This thorough report is a tribute to the coordinated efforts and creative teamwork of our team, which consists of Ons Mkaouar,Oussema BelKadhi and Yassine Ben Kara Ahmed. Our goal was to conduct a quantitative investigation into the intricate field of Financial markets. Our goal at Alpha Capital was to maximize gains on the Tunis Stock Exchange (TSE) in a one month timeframe. We skillfully combined data-driven tactics, ethical concerns, and financial approaches under the direction of Dr. Eymen Errais. Our path is outlined by a painstaking process of research, optimization, and implementation, which includes negotiating lower brokerage costs to cautious stock selection.
Come along with us as we attempt to achieve financial success by navigating the TSE's intricacies.

(Addings: To be more readable we tried to compose the excel sheets on 4 major excels where we'll provide the hyperlinks of excels)

STEP1: The CFA Code of Ethics and Standards of Professional Conduct

While brokers in Tunisia do not formally adopt the Code and Standards in their entirety, their practices are significantly influenced by the principles embedded within them.

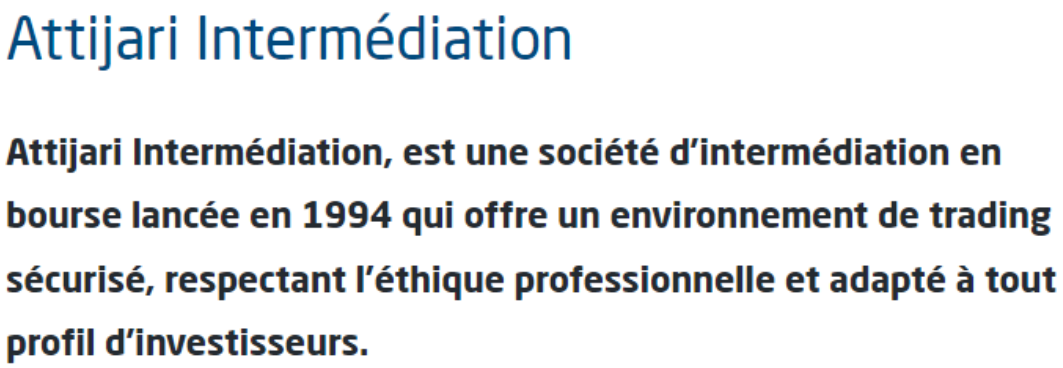
These principles, such as integrity, competence, diligence, respect, and fair dealing, act as a guiding force for ethical conduct within the Tunisian financial industry.

Attijari Intermediation have established their own internal codes of conduct, drawing heavily on the spirit and content of the CFA Code and Standards. This ensures that they strive to uphold high ethical standards and provide their clients with professional and trustworthy services and to analyze this matter we asked Mme Arwa to provide us with some back office documents to analyze their standards. This ***document*** was The base.

1) the code of ethics:

-Place the integrity of the investment profession and the interests of clients above their own personal interests.
-Attijari promote ethical practices, and strive to enhance their professional competence. This ultimately serves to protect the integrity of the financial markets and benefit society.

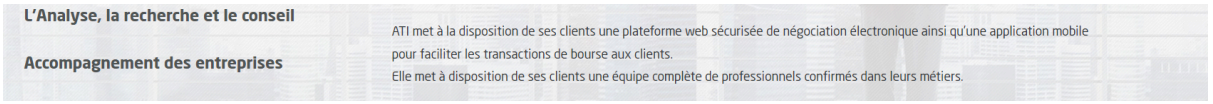
2) Standards of professional conduct:

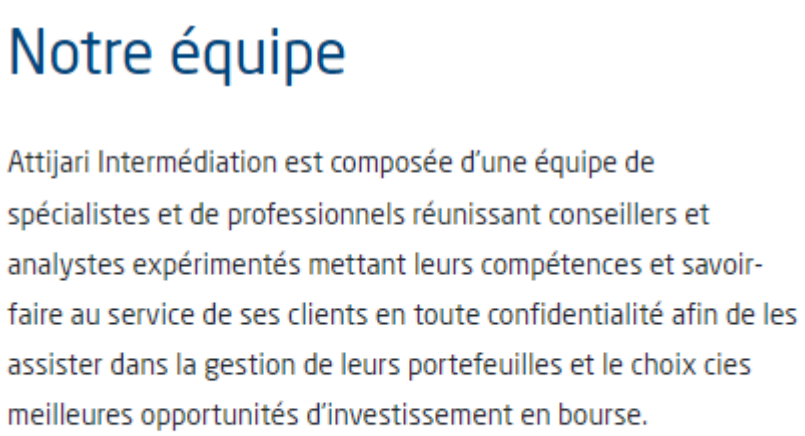


*Attijari comply with all applicable laws and regulations, maintain independence and objectivity, avoid misrepresentation, and refrain from misconduct. These standards are essential for building trust in the financial industry, promoting a healthy financial system, and ensuring its professional reputation like:

- **Professionalism**
- **Integrity of capital market**
- **Duties to clients**
- **Duties to employers**
- **conflict of interest**

- **investment analysis, recommendations, and actions**





STEP 2: How we got 0.2% brokerage fees.

At first we were thinking about how to negotiate these fees to get the first 10 points of our project. Nevertheless, the idea of bringing money was not a good option since our budget is limited. After brainstorming we tried to play a tactic to develop the intermediary some financial instruments to develop their platform and bring them opportunities to attract Tunisian or foreign investors.

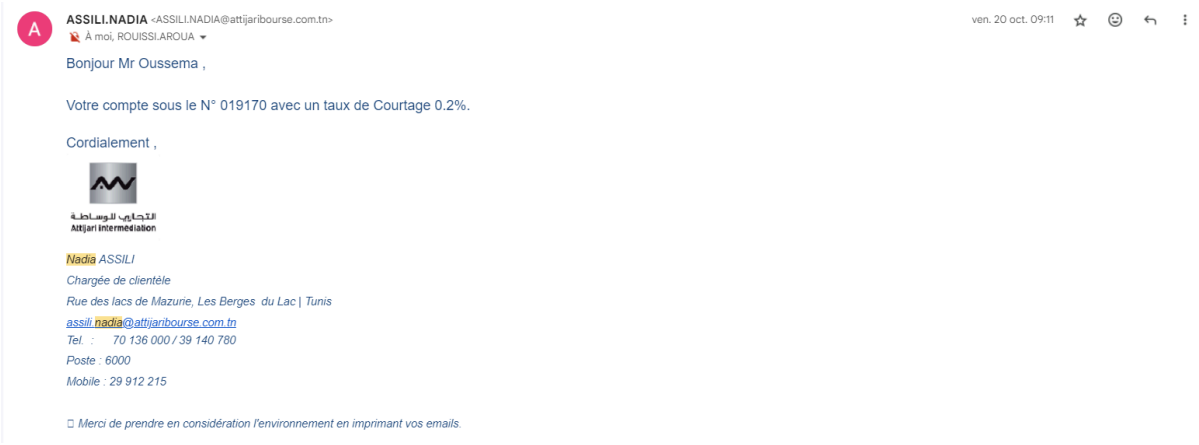
Entering the bargaining room with a PowerPoint deck in hand and a sparkle in our eyes, we were prepared to reveal our hidden weapon: **Exchange-Traded Funds (ETFs**). Yes, the

financial world's magic beans. We fervently outlined our vision of ETFs twirling around the Tunisian market, bringing happiness and—above all—cutting brokerage costs.

We started by stating how much we cherished the brokerage and compared it to a precious find in the wide desert of financial services. With the praise pouring in like a flood, we moved seamlessly into the ETF showcase. In our idealized vision of Tunisia, brokerage fees would be obsolete and ETFs would rule supreme.

We presented our work to Mme Aroua Rouissi and Mr Hichem Ben Romdhane which by the way told us he's actually a friend of yours and was amazed by the quality of students that TBS got by presenting them ***'les fonds indiciels en bourse'***. we explained their benefits and attractiveness and how can it solve some of the illiquid problem that the tunisian market faces.

3 days after we got this email:



ASSILI.NADIA <ASSILI.NADIA@attijaribourse.com.tn> ven. 20 oct. 09:11

À moi, ROUISSI.AROUA

Bonjour Mr Oussema ,

Votre compte sous le N° 019170 avec un taux de Courtage 0.2%.

Cordialement ,

التجاري للوساطة
Attijari intermédiation

Nadia ASSILI
Chargée de clientèle
Rue des lacs de Mazurie, Les Berges du Lac | Tunis
assili.nadia@attijaribourse.com.tn
Tel. : 70 136 000 / 39 140 780
Poste : 6000
Mobile : 29 912 215

Merci de prendre en considération l'environnement en imprimant vos emails.

not to lie, this was a good debut to begin the project and it gave us a smooth boost to work harder than ever.

Step 3: TOP-DOWN APPROACH

To make a better approach for the choice of the first stocks we thought that it would be more efficient and logical to find the healthy sectors by applying a TOP-DOWN approach and then using BOTTOM-UP by implementing Financial statement analysis and be more detailed in it.

1-Economic Analysis:

-Interest Rates:

The CBT held its key interest rate steady at 8% on September 7th 2023, keeping borrowing costs at their highest since at least 2006, in order to contain inflationary pressures. The bank said in a statement that the current stance of the monetary policy will support a further easing of inflation over the coming period while cautioning that the risks of a further acceleration “are significantly tilted to the upside.” The annual inflation rate rose to 9.3% in August, after decreasing for five consecutive months.

source: Central Bank of Tunisia

-Economic Growth:

Tunisia's economy advanced by 0.6% from a year earlier in the second quarter of 2023, easing from a downwardly revised 1.9% rise in the previous period. This marks the ninth consecutive quarter of growth since the contraction in Q1 2021, albeit the slowest pace in the sequence. The biggest gains were reported for hotel, restaurant & coffee shops (17.5% vs 16.3% in Q1), chemical industries (5.9% vs 2.3%) and financial & insurance activities (6.2% vs 4.3%). On the other hand, sharp declines were seen in oil refining (-61.5% vs -9%), mining (-14.1% vs -9.6%) and construction (-5.4% vs -1.6%). The agricultural sector was also down by 12.5%, following a 4.9% slump in Q1. On a quarterly basis, the GDP shrank by 1.3% in the second quarter, after a downwardly revised 0.7% gain in the first quarter of 2023. Overall, GDP growth for the first half of 2023 is estimated at 1.2%.

source: National Institute of Statistics - Tunisia

-Inflation:

The annual inflation rate in Tunisia edged up to 9.3 percent in August of 2023, after decreasing for five consecutive months. Main upward pressure came from food products (15.3 percent vs 14.2 percent in July); restaurants & hotels (11.5 percent vs 11.2 percent); miscellaneous goods & services (9.6 percent vs 9.9 percent); furnishings & household equipment (9.2 percent vs 9.5 percent); clothing & footwear (9.1 percent vs 9.4 percent) and alcoholic beverages & tobacco (4.6 percent vs 1.8 percent). Transportation prices also remained elevated (7.7 percent vs 8.8 percent). On a monthly basis, consumer prices rose by 0.6 percent following a 0.7 percent increase in the previous month.

source: National Institute of Statistics - Tunisia

2-Market Analysis:

The TUN increased 349 points or 4.30% since the beginning of 2023, according to trading on a contract for difference(CFD) that tracks this benchmark index from Tunisia.

3-Sector Analysis:

Financial sector:

At the end of the first quarter of 2022, the entire financial sector listed on the Tunis Stock Exchange, including 12 banks, 5 insurance companies, and 10 financial services and leasing companies, generated a total income of 1.9 billion Tunisian dinars (625 million dollars), an increase of 11.6% compared to the 1.7 billion dinars achieved in the same period in 2021

BANKS:

If we consider the specific case of the 12 listed banks, it is observed that only one institution, namely the Bank of Tunisia and the Emirates (BTE), reported a decrease in revenue by 17.6% at the end of the first quarter. The remaining 11 banks generated increased revenues during this period. The three highest revenue increases were achieved by Wifack International Bank (56%), Arab Tunisian Bank (30%), and the Arab International Bank of Tunisia (18.2%)

Investors are optimistic on the Tunisian Banks industry, and appear confident in long term growth rates. The industry is trading at a PE ratio of 9.1x which is higher than its 3-year average PE of 7.2x.Also The earnings for companies in the Banks industry have grown 12% per year over the last three years.

Chosen stocks example: BT,STB,Attijari bank

Diversified Financial:

Over the last period, the Diversified Financial industry has remained flat. Furthermore, the industry has been flat for the past year as well. In the next few years, earnings are forecast to decline by 7.3% annually.

Among the 10 financial services companies, including leasing companies, 4 entities showed a decrease in revenue. The three highest revenue increases were from the Industrial and Touristic Investment and Development Company (SPDIT-SICAF), BH

Leasing, and Arab Tunisian Lease.The industry is trading close to its 3-year average PS ratio of 1.1x.

Chosen stocks example: Hannibal Lease , STAR

The earnings for companies in the Diversified Financial industry have grown 79% per year over the last three years.

Industrial sector:

The industrial sector has exhibited a stagnant performance in the past 12 months. Looking ahead, there is an anticipated annual earnings growth of 9.4% for the next few years. Investor sentiment towards the Tunisian Industrials industry is currently pessimistic, suggesting an expectation of lower long-term growth rates compared to historical trends. The industry is currently valued at a PE ratio of 27.7x, which is below its three-year average PE of 31.7x. Moreover, it is trading in proximity to its three-year average PS ratio of 0.69x. Over the last three years, companies in the Industrials sector have experienced a robust annual earnings growth of 19%, while their revenues have expanded at a rate of 10% per year. This indicates a notable increase in overall sales for these companies, leading to a subsequent rise in their profits.

Chosen stocks example: TPR, Carthage Cement

Consumer Discretionary :

In the last period, the Specialty Stores industry is up 1.3%, with Ennakl Automobiles up 6.8%. This takes the industry's 12-month performance to a gain of 18%. Looking forward, earnings are forecast to grow by 2.9% annually.

-Investors are pessimistic about the Tunisian Specialty Retail industry, indicating that they anticipate long-term growth rates will be lower than they have historically.

-The industry is trading at a PE ratio of 9.0x which is lower than its 3-year average PE of 10.2x.

-The industry is trading close to its 3-year average PS ratio of 0.84x.

-The earnings for companies in the Specialty Retail industry have grown 12% per year over the last three years.

-Meanwhile, revenues for these companies have declined 4.1% per year.

Chosen stocks example: City cars, MAG,SFBT

Materials:

The industry has maintained a steady course over the last year, with anticipated earnings growth at an annual rate of 9.1 percent. However, investor sentiment towards the Tunisian Materials industry is pessimistic, indicating an expectation of a lower long-term growth rate compared to historical levels. The industry's current P/E ratio stands at 14.1x, which is below its three-year average P/E ratio of 20.2x. Interestingly, the three-year average P/E ratio, at 1.5x, is higher than the industry's current P/E ratio of 1.3x. Notably, companies within the Materials industry have experienced robust annual earnings growth of 48 percent over the past three years.

Chosen stocks example: SOTUV

Energy:

Over the past decade, the energy sector in Tunisia has faced significant challenges. Indeed, this summer, Tunisia recorded an unprecedented peak in electricity consumption, surpassing last year's by 3%.

Energy demand in Tunisia has experienced an average annual increase of over 1% from 2010 to 2022, covering electricity, natural gas, and petroleum products primarily used in transportation.

With a slight increase in demand for petroleum products in 2022 compared to 2021 by 0.8%.

According to data published by the Observatory, the total electricity production decreased by 3% in 2022, reaching 19,516 GWh (excluding consumed self-production). However, production intended for the local market increased by 5%.

Chosen stocks example:STPIL

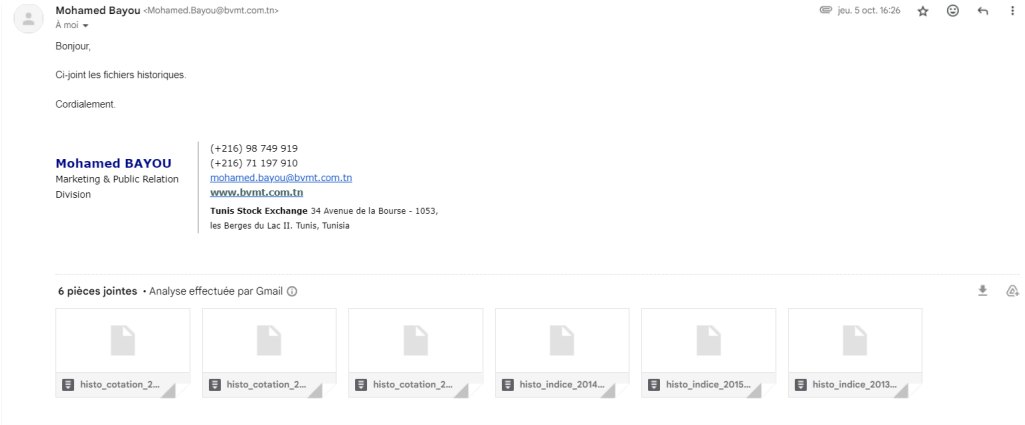
STEP 4: 10 years return raw and adjusted

After doing some market analysis and profound research. we choose from these sectors 20 stocks to analyze to We can compose thi step on major other steps:

a) Downloading data for last 10 years:

- **Data Collection and Preparation:**

Gathering historical data for the last 10 years for the 20 stocks chosen in the previous step by collecting them from the BVMT site, we found missing data (2013;2014;2015), which obliged us to contact Mr Mohamed Bayou to collect them.



Address missing data points, especially the 'Adjusted Close' prices for some stock and for the Missing Data We Applied linear interpolation for stocks with missing dates to estimate missing values and ensure consistency and accuracy in the data set especially for CAPMs and Markowitz.

b) Calculating daily Returns

We Computed the annual ,3-month returns for each stock over the 10-year period for the returns and then adjusted them for dividends, capital augmentation and stock splits. also,Determine the daily volatility (standard deviation),3-month and yearly volatility of returns for each stock. with the Value at risk at 95% confidence skewness and Kurtosis to study more the risk behavior of the stocks.

Missing Data:

We Applied linear interpolation for stocks with missing dates to estimate missing values. Ensure consistency and accuracy in the data set. The code used was the following:

```python
import pandas as pd

df=pd.read_excel("PGH.xlsx")

df['ADJUSTED RETURNS'] = df['ADJUSTED RETURNS'].interpolate()

df.to_excel("PGH.xlsx", index=False, engine='openpyxl')
```

c) Calculating Dividend Impact:

For stocks without 'Adjusted Close' data, calculate the dividend impact separately.
Adjust the stock prices to reflect the dividend payouts.

Unfortunately, Attijari intermediation didn't have the adjusted data for some stocks which made us do a little trick since it was enormous to do this kind of adjustment on 20 stocks. this pushed us to contact intermediary MACSa and pretend that we will open an account and put money with them We took the adjusted data of 10 stocks with 0 money and did the dividend impact with 10 another stocks using:

Dividend impact=(1-(Div !$D$68/$F$137))

with **$F$137= the close** at the day of dividend until another dividend comes and you multiply the dividend impacts by each other. as shown on the excel of adjusted data.

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Step 5 : Financial Statement Analysis:

	Profitability	Growth	P/E	Payout
PGH	PGH has a low operating margin (9.16%<40%) which is higher than the industry (8.32%) .	insufficient data	PGH is expensive based on its Price-To-Earnings Ratio (18.4x) compared to the peer average (15x).	PGH has been paying a dividend for less than 10 years and during this time payments have been volatile.

	Profitability	Growth	P/E	Payout
	And a low net profit margin of 4.16%(<10%) which is lower than the industry (4.6%)			
Attijari bank	Attijari bank has a high operating margin (49.05%>40%) which is higher than the industry (46.06%) . And a high net profit margin of 32.28%(>10%) which is also greater than the industry (30.91%)	Attijari bank managed to grow their EPS with 8.09% over the past 5 years which is greater than the industry (3.35%)	Attijari is expensive based on its Price-To-Earnings Ratio (9.3x) compared to the peer average (8.1x).	At its current payout ratio (83%), Attijari's payments are covered by earnings.
City cars	City cars has a relatively low operating margin (12.27%<40%) which is higher than the industry (11.32%) . And a relatively low net profit margin of 8.8%(<10%) same as the industry	City cars managed to grow their EPS with 15.55% over the past 5 years which is greater than the industry (3.89%)	CITY is good value based on its Price-To-Earnings Ratio (7.1x) compared to the peer average (10.9x)	with its reasonable payout ratio (73.7%), CITY's dividend payments are covered by earnings.
TPR	TPR has a relatively low operating margin (13.8%<40%) which is higher than the industry (11.8%) . And a slightly high net profit margin of 10.41%(>10%) which is higher than the industry	TPR managed to grow their EPS with 14.02% over the past 5 years which is greater than the industry (8.2%)	TPR is good value based on its Price-To-Earnings Ratio (8.5x) compared to the peer average (28.5x).	With its reasonable payout ratio (60.4%), TPR's dividend payments are covered by earnings.

	Profitability	Growth	P/E	Payout
	(4.93%)			
STIP	STIP has a low operating margin (4.83%<40%) which is higher than the industry (1.96%) . But a high net profit margin of 21.81%(>10%) which is higher than the industry(9.78%)	insufficient data	STIP is good value based on its Price-To-Earnings Ratio (1.6x) compared to the peer average (34.2x).	Insufficient data to calculate STIP's payout ratio to determine if its dividend payments are covered by earnings.
SOTRAPIL	STPIL has a high gross profit margin (92.54%>40%) which is the same as the industry. And a high net profit margin of 47.89%(>10%) same as the industry	STPIL managed to grow their EPS with 8.57% over the past 5 years which is same as the industry	STPIL is good value based on its Price-To-Earnings Ratio (6x) compared to the Global Oil and Gas industry average (8.2x).	With its reasonable payout ratio (55.3%), STPIL's dividend payments are covered by earnings.
SOTUVER	SOTUVER has a high gross profit margin (47.76%>40%) which is the same as the industry.. And a relatively high net profit margin of 15.62%(>10%) same as the industry	SOTUVER managed to grow their EPS with 23.63% over the past 5 years which is same as the industry	SOTUV is expensive based on its Price-To-Earnings Ratio (15.7x) compared to the estimated Fair Price-To-Earnings Ratio (14.2x).	With its reasonable payout ratio (72.2%), SOTUV's dividend payments are covered by earnings.
ONE TECH	One Tech has a low operating margin (4.94%<40%) which is also lower than the industry (5.06%) .	insufficient data	OTH is expensive based on its Price-To-Earnings Ratio (22.9x) compared to the peer average (10.9x).	OTH is not paying a notable dividend for the TN market.

	Profitability	Growth	P/E	Payout
	And a low net profit margin of 3.99%(<10%) which is slightly higher than the industry (3.63%)			
SFBT	SFBT has a low operating margin (22.6%<40%) which is the same as the industry . But a high net profit margin of 18.96%(>10%) which is same as the industry	insufficient data	SFBT is good value based on its Price-To-Earnings Ratio (11.6x) compared to the peer average (14.6x).	With its reasonable payout ratio (71.3%), SFBT's dividend payments are covered by earnings.
BT	BT has a high operating margin (63.53%>40%) which is also higher than the industry (46.06%) . And also a high net profit margin of 42.97%(>10%) which is higher than the industry (30.91%)	BT managed to grow their EPS with 4.76% over the past 5 years which is higher than the industry (3.35%)	BT is expensive based on its Price-To-Earnings Ratio (8.5x) compared to the peer average (8.3x).	With its reasonably low payout ratio (42.4%), BT's dividend payments are well covered by earnings.
Mag	Mag has a very low operating margin (0.77%<40%) which is also lower than the industry (0.67%) . And a negative net profit margin of 3.48%	insufficient data	MAG is good value based on its Price-To-Sales Ratio (0.1x) compared to the peer average (0.7x).	Insufficient data to calculate MAG's payout ratio to determine if its dividend payments are covered by earnings.
UMED	UMED has a relatively low operating margin (19.58%<40%) but it is higher than	UMED has a negative EPS growth of 9.6% over the past 5 years which is	UMED is good value based on its Price-To-Earnings Ratio (18.1x)	With its high payout ratio (114.4%), UMED's dividend payments

	Profitability	Growth	P/E	Payout
	the industry (18.92%) and a relatively high net profit margin of 12.34%(>10%) which is also higher than the industry (11.92%)	same as the industry	compared to the peer average (58.4x).	are not well covered by earnings.
Délice Holding	DH has a low operating margin (7.17%<40%) which is also lower than the industry (8.32%) . And a low net profit margin of 5.84%(<10%) which is slightly higher than the industry (4.6%)	DH managed to grow their EPS with 15.25% over the past 5 years which is higher than the industry (4.9%)	DH is good value based on its Price-To-Earnings Ratio (6.8x) compared to the peer average (32.2x).	With its low payout ratio (24%), DH's dividend payments are well covered by earnings.
Hannibal Lease	HL has a high gross profit margin (75.86%>40%) which is also higher than the industry (3.52%) . And a net profit margin of 10.14%(>10%) which is lower than the industry (30.91%)	HL has a negative EPS growth of 5.15% over the past 5 years	HL is expensive based on its Price-To-Earnings Ratio (7.2x) compared to the peer average (6.5x).	With its reasonably low payout ratio (41.1%), HL's dividend payments are well covered by earnings.
SAH	SAH has a low operating margin (9.67%<40%) which is also the same as the industry . And a low net profit margin of 4.12%(<10%) which is the same as the	insufficient data	SAH is good value based on its Price-To-Earnings Ratio (18.9x) compared to the peer average (25.2x).	Insufficient data to calculate SAH's payout ratio to determine if its dividend payments are covered by earnings.

	Profitability	Growth	P/E	Payout
	industry.			
STAR	STAR has a low operating margin (5.84%<40%) which is also lower than the industry (9.82%) . And a low net profit margin of 5.15%(<10%) which is also lower than the industry(7.53%)	STAR managed to grow their EPS with 33.01% over the past 5 years which is higher than the industry (12.77%)	STAR is good value based on its Price-To-Earnings Ratio (11.6x) compared to the peer average (14.8x).	STAR is not paying a notable dividend for the TN market.
STB	STB has a high operating margin (42.21%>40%) which is also lower than the industry (46.09%) . And a high net profit margin of 25.68%(>10%) which is also lower than the industry (30.76%)	there's no EPS growth over the past 5 years	STB is good value based on its Price-To-Earnings Ratio (5.2x) compared to the peer average (8.2x).	insufficient data to calculate MAG's payout ratio to determine if its dividend payments are covered by learnings.
carthage cement	CC has a low operating margin (14.4%<40%) which is higher than the industry (13.28%) . And a negative net profit margin of 3.94%	insufficient data	CC is good value based on its Price-To-Earnings Ratio (14.5x) compared to the peer average (18.2x).	Insufficient data to calculate MAG's payout ratio to determine if its dividend payments are covered by earnings.
SPDIT	SPDIT has a high Gross profit margin(100%>40%)	insufficient data	SPDIT is expensive based on its Price-To-Earnings Ratio (10.2x) compared to the peer average (6.5x).	Whilst dividend payments have been stable , SPDIT has been paying a dividend for less than 10 years.
	UIB has a high	UIB managed to	UIB is good value	With its reasonably

	Profitability	Growth	P/E	Payout
	operating margin (43.4%>40%) which is lower than the industry (46.09%) . And a high net profit margin of 24.66%(>10%) which is also lower than the industry (30.76%)	grow their EPS with 9% over the past 5 years which is also higher than the industry (3.45%)	based on its Price-To-Earnings Ratio (6.7x) compared to the peer average (7.4x).	low payout ratio (32.6%), UIB's dividend payments are well covered by earnings.

The methodical process of choosing 10 stocks out of 20 has been guided by a comprehensive research that included important financial indicators. Emphasizing profitability, growth potential, P/E ratio, and payout ratio, the goal has been to construct a well-balanced portfolio that aligns with our investment objectives.

Companies with robust profitability metrics indicate their ability to generate sustainable earnings . Example : Hannibal Lease,SPDIT, BT, SOTUVER, SOTRAPIL,Attijari bank.

The consideration of growth prospects ensures that the chosen stocks have the potential for future expansion . Example : **TPR,City cars,Attijari bank , SOTUVER,SOTRAPIL**.

The examination of P/E ratios helps in identifying stocks that are reasonably valued relative to their earnings, facilitating prudent investment decisions.
Lastly, the assessment of the payout ratio allows for a nuanced understanding of how companies allocate their earnings between dividends and retained earnings.

STEP 6: Markowitz and risk assessment

- **Determining Optimal Weights:**

Choosing the risk aversion:

Our main goal was to aim for a 12% yearly return while minimizing the minimal variation in the portfolio. The assumption used in this optimization was a modest level of risk aversion.

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- **Risk Profile Assessment:**

Taking into account variables like standard deviation, beta, and other pertinent risk measures, the optimized portfolio's risk profile was assessed. This evaluation gave us information about possible volatility and guarantees that the portfolio is in line with our risk moderation which can be made through diversification.

- **Covariance Matrix Computation:**

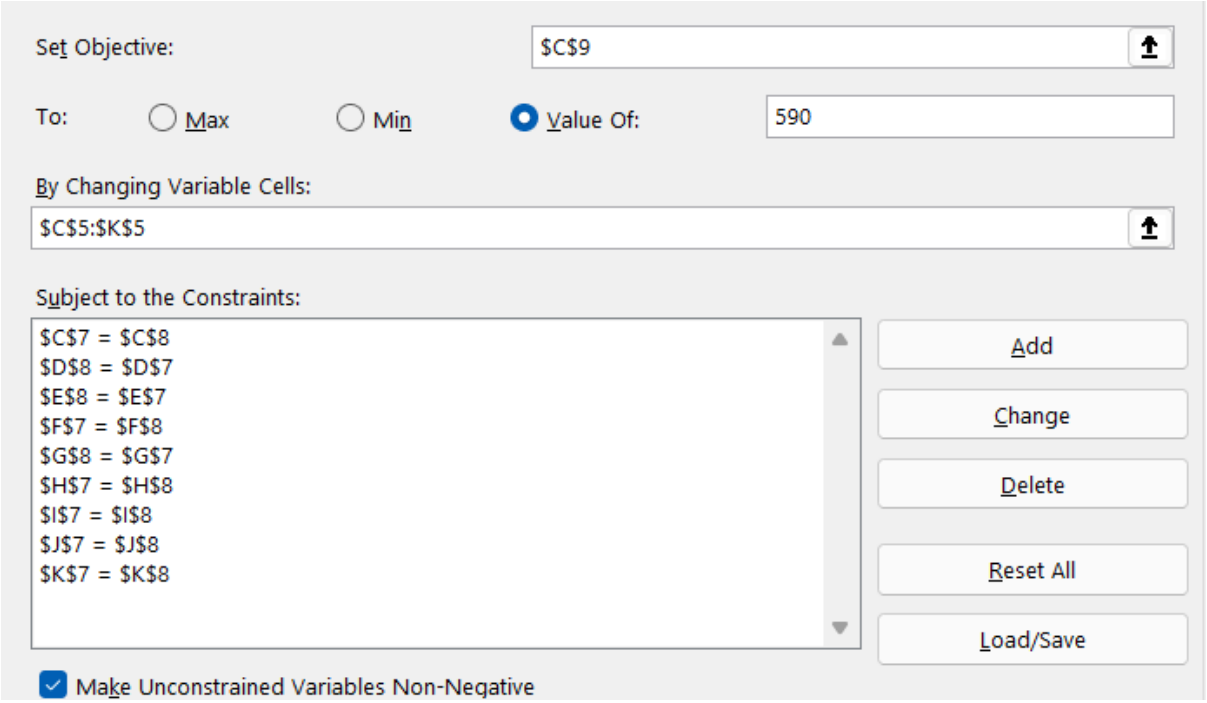
We Calculated the covariance matrix for the 9 selected stocks: **"HAN LEASE," "SPDIT," "CITY CARS," "TPR," "POULINA," "TIJARI," "BT," "STPIL," and "SOTUVER."**
This matrix is crucial for understanding the relationships between the returns of different stocks and for portfolio optimization.as we comprehended back with Pr Eymen and TA's on the excel.

	HAN LEASE	*SPDIT*	*CITY CARS*	*TPR*	*POULINA*	*TIJARI*	*BT*	*STPIL*	*SOTUVER*
HAN LEASE	0.000272021	1.408E-06	7.69026E-06	1.01746E-06	-3.31474E-06	8.26253E-06	-1.82784E-06	6.34919E-06	9.00354E-06
SPDIT	1.408E-06	0.000212962	5.18963E-06	-1.54671E-06	9.50591E-06	4.13578E-06	-4.83204E-07	-6.70307E-07	7.58699E-06
CITY CARS	7.69026E-06	5.18963E-06	0.000174925	7.60349E-06	8.52921E-07	-4.51422E-06	5.56268E-06	2.81413E-06	-9.97466E-07
TPR	1.01746E-06	-1.54671E-06	7.60349E-06	0.000164877	3.13605E-06	2.17155E-06	1.1893E-05	-3.34677E-06	1.35495E-05
POULINA	-3.31474E-06	9.50591E-06	8.52921E-07	3.13605E-06	0.000216185	2.76547E-06	1.08005E-06	-4.85196E-08	4.00472E-06
TIJARI	8.26253E-06	4.13578E-06	-4.51422E-06	2.17155E-06	2.76547E-06	0.000154014	2.75749E-07	1.26226E-06	7.85698E-06
BT	-1.82784E-06	-4.83204E-07	5.56268E-06	1.1893E-05	1.08005E-06	2.75749E-07	0.000152341	-9.79539E-07	2.56281E-06
STPIL	6.34919E-06	-6.70307E-07	2.81413E-06	-3.34677E-06	-4.85196E-08	1.26226E-06	-9.79539E-07	0.000224614	1.02863E-05
SOTUVER	9.00354E-06	7.58699E-06	-9.97466E-07	1.35495E-05	4.00472E-06	7.85698E-06	2.56281E-06	1.02863E-05	0.00023586

We deducted the relationships between different stocks based on their covariances and identified the pairs of stocks that may have high positive or negative correlations between each other.

- **Portfolio Optimization:**

We Used the covariance matrix in a Markowitz portfolio optimization model through two major steps: Minimizing the portfolio variance and setting the budget to 590 dt. We put up the optimization model to minimize the minimal portfolio variance by varying the weights allocated to each asset using Excel's Solver tool. A 12% yearly target return was established and then solved the budget constraint with the following:



which gave us the following output:

	HANN LEASE	SPDIT	CITY CARS	TPR	POULINA	ATTIJARI	BT	SOTRAPIL	SOTUVER	Portfolio
Average Return	-0.098%	0.024%	0.036%	0.019%	0.016%	0.073%	0.012%	0.040%	0.039%	0.048%
Volatility	1.653%	1.462%	1.322%	1.287%	1.468%	1.241%	1.237%	1.501%	1.537%	1.347%
Weights	0.00%	6.62%	16.71%	6.02%	3.66%	39.43%	3.22%	13.44%	10.89%	
nombre d'actions	0	4	8	7	3	5	4	5	5	
Prix	5.48	9.05	12.22	5	7.68	43.9	5.33	14.97	12.1	590
Budget*weights	0	39.08042	98.57755	35.5369	21.60767875	232.65236	18.9770942	79.31157032	64.25645704	
nbd'actions*Prix	0	39.08033	98.57761	35.5369	21.60762015	232.65245	18.9770942	79.31157032	64.25645704	
TARGET BUDGE	590		590							

In another attempt to optimize the portfolio , we used a python code that allowed us to conduct a Markowitz analysis after linking an excel sheet containing the historical returns of the stocks in the market .We were able to get a visualization using this code .

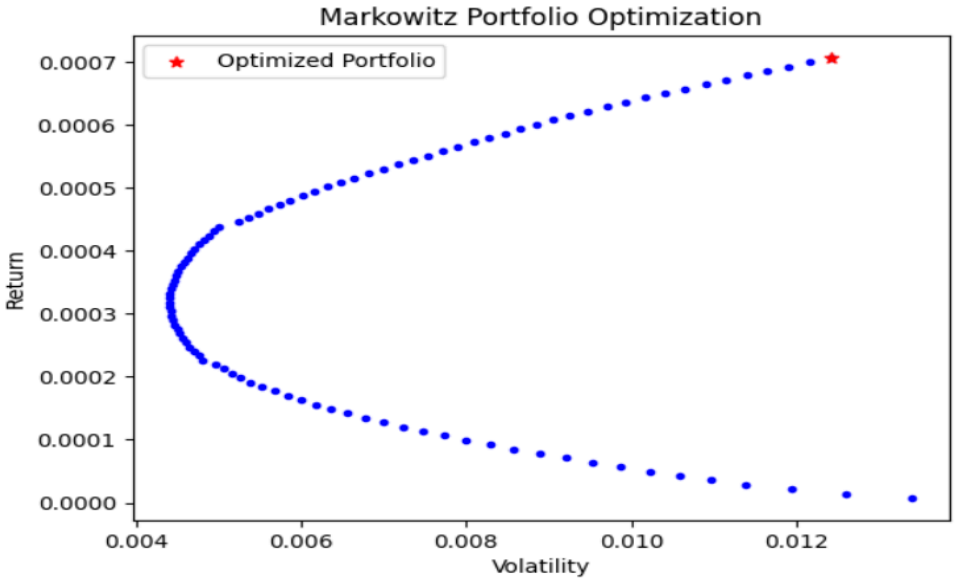
markowitz code :

```python
import pandas as pd
import numpy as np
import cvxpy as cp
import matplotlib.pyplot as plt
# Load historical stock prices from an Excel file
file_path = r'C:\Users\lenovo\Desktop\MARKOWITZ\MARKOOZ.xlsx'
df = pd.read_excel(file_path, parse_dates=True, index_col='Date')
# Calculate daily returns
returns = df.pct_change()
# Calculate mean returns and covariance matrix
mean_returns = returns.mean().values
cov_matrix = returns.cov().values
# Number of assets
num_assets = len(mean_returns)
# Risk-free rate
risk_free_rate = 0.06  # 6
# Define the optimization variable
weights = cp.Variable(num_assets)
# Define the objective (maximize the expected return)objective = cp.Maximize(mean_returns @ weights)
# Define the constraints
constraints = [cp.sum(weights) == 1, weights >= 0, cp.norm(weights, 1) <= 1]  # L1 norm constraint
# Solve the problem
problem = cp.Problem(objective, constraints)
problem.solve()
# Extract optimized weights
optimized_weights = weights.value
# Portfolio statistics for the optimized portfolio
optimized_return = mean_returns @ optimized_weights
optimized_volatility = np.sqrt(optimized_weights @ cov_matrix @ optimized_weights.T)
# Print the results
print("Optimized Weights:", optimized_weights)
print("Optimized Portfolio Return:", optimized_return)
print("Optimized Portfolio Volatility:", optimized_volatility)
# Plot the efficient frontier
target_returns = np.linspace(mean_returns.min(), mean_returns.max(), num=100)
efficient_portfolios = []
```

```python
efficient_portfolios = []
for target_return in target_returns:
    objective = cp.Maximize(target_return)
    constraints = [cp.sum(weights) == 1, weights >= 0, mean_returns @ weights == target_return]
    problem = cp.Problem(objective, constraints)
    problem.solve()
    efficient_portfolio = {
        'Return': target_return,
        'Volatility': np.sqrt(weights.value @ cov_matrix @ weights.value.T),
        'Weights': weights.value
    }

    efficient_portfolios.append(efficient_portfolio)
# Convert efficient portfolios to DataFrame
efficient_portfolios_df = pd.DataFrame(efficient_portfolios)
# Plot the efficient frontier
plt.scatter(efficient_portfolios_df['Volatility'], efficient_portfolios_df['Return'], c='blue', marker='.')
plt.title('Markowitz Portfolio Optimization')
plt.xlabel('Volatility')
plt.ylabel('Return')
# Highlight the optimized portfolio
plt.scatter(optimized_volatility, optimized_return, c='red', marker='*', label='Optimized Portfolio')
plt.legend()
plt.show()
```

this code allowed us to get this plot :



this plot gave us an idea about the volatility and return of various portfolio combination

Conclusion concerning Markowitz portfolio optimization :

After applying the model and solving for our constraints , we got the following results :

	HANN LEASE	SPDIT	CITY CARS	TPR	PGH	ATJ	BT	SOTRAPIL	SOTUVER	Portfolio
Average Return	-0,098%	0,024%	0,036 %	0,019 %	0,01 6%	0,073 %	0,012 %	0,040%	0,039%	0,048%
Volatility	1,653%	1,462%	1,322 %	1,287 %	1,46 8%	1,241 %	1,237 %	1,501%	1,537%	1,347%
Weights	0,00%	6,62%	16,71 %	6,02 %	3,66 %	39,43 %	3,22%	13,44%	10,89%	
number of shares	0	4	8	7	3	5	4	5	5	
Price per share	5,48	9,05	12,22	5	7,68	43,9	5,33	14,97	12,1	590

Capital Asset Pricing Model :

In parallel with implementing the Markowitz portfolio optimization technique, we complemented our stock selection process by utilizing the Capital Asset Pricing Model (CAPM). The CAPM model played an important role in providing insights into the nature of the stocks under consideration where we used the risk-free rate bta 10 years to determine whether the selected stocks exhibited defensive characteristics and in evaluating their

relative valuation(overvalued/undervalued). Specifically, the CAPM model enabled us to assess the expected returns of individual stocks in relation to their systematic risk, aiding us in making informed decisions about the overall composition of our portfolio. Integrating both the Markowitz optimization and CAPM analysis, led us to achieve optimal diversification and gain an understanding of the risk-return profiles of the chosen securities.

Choosing weights:

After obtaining results from both analyses, we manually adjusted the weights to better align with our vision and strategy. The following weights are the results of our efforts to tune to factor in our specific risk tolerance and investment objectives (These customized weights aim to optimize the portfolio composition and ensure balance that aligns with our moderate risk tolerance

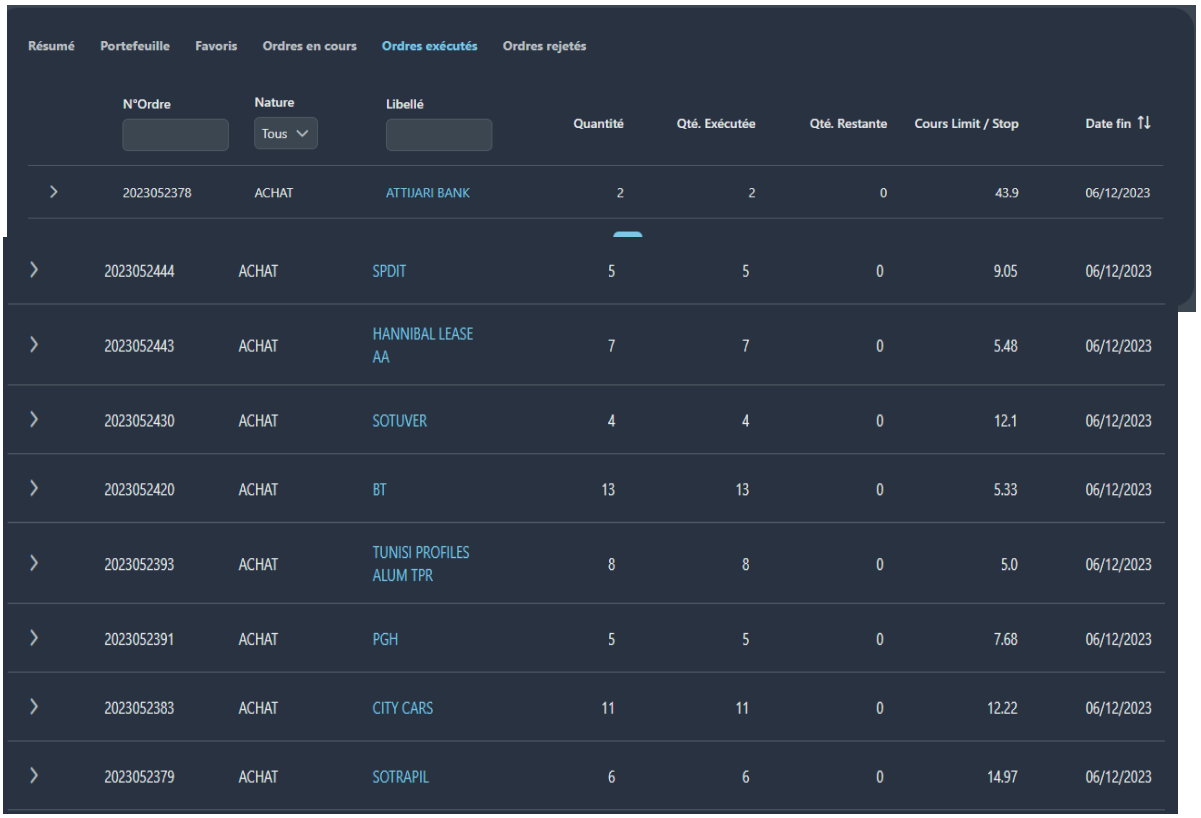
Stock name	Weight	Beta	Expected Return
Attijari Bank	15.5%	0.4257	18.33%
BT	11.8%	0.0941	2.61%
SOTUVER	8.1%	0.6013	9.98%
HANN LEASE	6.2%	0.2462	0.39%
POULINA	6.4%	0.1719	3.97%
SPDIT	7.2%	0.0065	5.71%
CITY CARS	23.1%	0.024%	9.86%
TPR	6.6%	0.1597	4.84%
SOTRAPIL	15.1%	0.1158	10.33%

Risk profile :

Knowing the bearish nature of the tunisian market in the days where we first invested our capital , we decided to go for a moderate approach to risk ; we were willing to invest in risky stocks but also included defensive and less risky stocks in our portfolio for hedging purposes.

Step 7: Strategy:

Under budget constraints , we wanted to minimize the costs of buying the initial stocks included in the portfolio , which led us to change the percentages laid out by the Markowitz portfolio optimization technique. In order to further save money on buying the initial shares , we used limit buy orders on the stocks with the maximum price we were willing to pay for them.



Résumé | Portefeuille | Favoris | Ordres en cours | Ordres exécutés | Ordres rejetés

	N°Ordre	Nature (Tous)	Libellé	Quantité	Qté. Exécutée	Qté. Restante	Cours Limit / Stop	Date fin
›	2023052378	ACHAT	ATTIJARI BANK	2	2	0	43.9	06/12/2023
›	2023052444	ACHAT	SPDIT	5	5	0	9.05	06/12/2023
›	2023052443	ACHAT	HANNIBAL LEASE AA	7	7	0	5.48	06/12/2023
›	2023052430	ACHAT	SOTUVER	4	4	0	12.1	06/12/2023
›	2023052420	ACHAT	BT	13	13	0	5.33	06/12/2023
›	2023052393	ACHAT	TUNISI PROFILES ALUM TPR	8	8	0	5.0	06/12/2023
›	2023052391	ACHAT	PGH	5	5	0	7.68	06/12/2023
›	2023052383	ACHAT	CITY CARS	11	11	0	12.22	06/12/2023
›	2023052379	ACHAT	SOTRAPIL	6	6	0	14.97	06/12/2023

Code	Désignation de la valeur	Quantité	Qte bloquée	Prix de Revient Unitaire	Estimation au Prix de Revient	Dernier Cours	Estimation au Cours Moyen	+/- Values
160015	ATTIJARI BANK	2	0	44,083	88,166	43,900	87,800	-0,366
220005	BT	13	0	5,322	69,187	5,330	69,290	0,103
755001	CITY CARS	11	0	12,271	134,980	12,200	134,200	-0,780
731013	HANNIBAL LEASE AA	7	0	5,276	36,934	5,250	36,750	-0,184
570001	PGH	5	0	7,617	38,087	7,560	37,800	-0,287
666001	SOTRAPIL	6	0	14,852	89,109	14,790	88,740	-0,369
656001	SOTUVER	4	0	12,051	48,205	11,900	47,600	-0,605
140070	SPDIT	5	0	9,020	45,099	8,800	44,000	-1,099
727001	TUNISI PROFILES ALUM TPR	8	0	5,004	40,030	4,990	39,920	-0,110
TOTAL :					**589,797**		**586,100**	**-3,697**

Total Actions	**586,100**
Total OPCVM	**0,000**
Total Obligations	**0,000**
Total Titres	**586,100**
Trésorerie Disponible	**10,203**
Trésorerie bloquée	**0,000**
Capital actuel :	**596,303**

Advantages of Limit Buy Orders:

Cost Efficiency: By specifying the maximum price, we aim to secure shares at a favorable price, preventing us from overpaying in a volatile market.
Discipline in Execution: Limit orders help us adhere to our predefined investment criteria, avoiding impulsive decisions based on short-term market fluctuations.

Choosing entry point :

We carefully considered prevailing market conditions and any imminent events that could impact stock prices. We noted important metrics such as the trading volume and the price trends for each individual stock .This proactive approach allowed us to time our market entry, taking advantage of favorable conditions and potential price dips aligning with our conservative strategy and our goal in minimizing the initial investment .

STEP 8 :REBALANCING PORTFOLIO

*Following our moderate strategy , we spent the first days not taking risks since the market had a negative revenue and the stocks were too volatile . On Friday December 15th , following the decline in the price of CITY CARS and SPDIT and their respectives technical indicators leading to a selling decision , we sold some of our shares to avoid the risk of losing too much money.
Seen as their prices were falling at a steady rate , we placed market orders to avoid unnecessary losses. On Monday December 18th we invested the capital in UIB knowing the upside of the expected growth of the banking sector a and TGH by placing market orders

since our limit buy orders were rejected .

	N°Ordre	Nature	Libellé	Quantité	Qté. Exécutée	Qté. Restante	Cours Limit / Stop	Date fin
		Tous						
>	2023052841	VENTE	CITY CARS	3	3	0		15/12/2023
>	2023052840	VENTE	SPDIT	2	2	0		15/12/2023

>	2023052960	ACHAT	TGH AA	12	12	0		18/12/2023
>	2023052959	ACHAT	UIB	2	2	0		18/12/2023

On December 19th we sold one share of SOTRAPIL and bought shares of STIP since their share price took a big a hit whilst having good technical indicators and it was an arbitrage opportunity

STIP	-4,21 %	4,10	200

>	2023053042	ACHAT	STIP	2	2	0	4.5	19/12/2023
>	2023053022	VENTE	SOTRAPIL	1	1	0		19/12/2023

On December 21st , we sold shares in SPDIT, TPR, and CITY CARS(using a stop loss order) to have the necessary capital to buy one share of BIAT following the decline in the sold share's value and the estimated growth of the financial sector as a whole and the safety of the BIAT stock in particular.

>	2023053227	ACHAT	BIAT	1	1	0		21/12/2023
>	2023053157	VENTE	SPDIT	3	3	0		21/12/2023
>	2023053155	VENTE	TUNISI PROFILES ALUM TPR	2	2	0		21/12/2023
>	2023053153	VENTE	CITY CARS	5	5	0	12.1	21/12/2023

On december 26th and 27th we decided to cut our losses with the TPR and City Cars stocks entirely and invest that capital in the rising Amen Bank stock

	N°Ordre	Nature	Libellé	Quantité	Qté. Exécutée	Qté. Restante	Cours Limit / Stop	Date fin
		Tous						
>	2023053490	ACHAT	AMEN BANK	2	2	0		27/12/2023
>	2023053487	VENTE	CITY CARS	3	3	0		27/12/2023
>	2023053392	VENTE	TUNISI PROFILES ALUM TPR	6	6	0		26/12/2023

This turned out to be a profitable investment since the following day Amen Bank was the second most voluminous stock in the market with a good increase in its price

Behavioral finance insights :

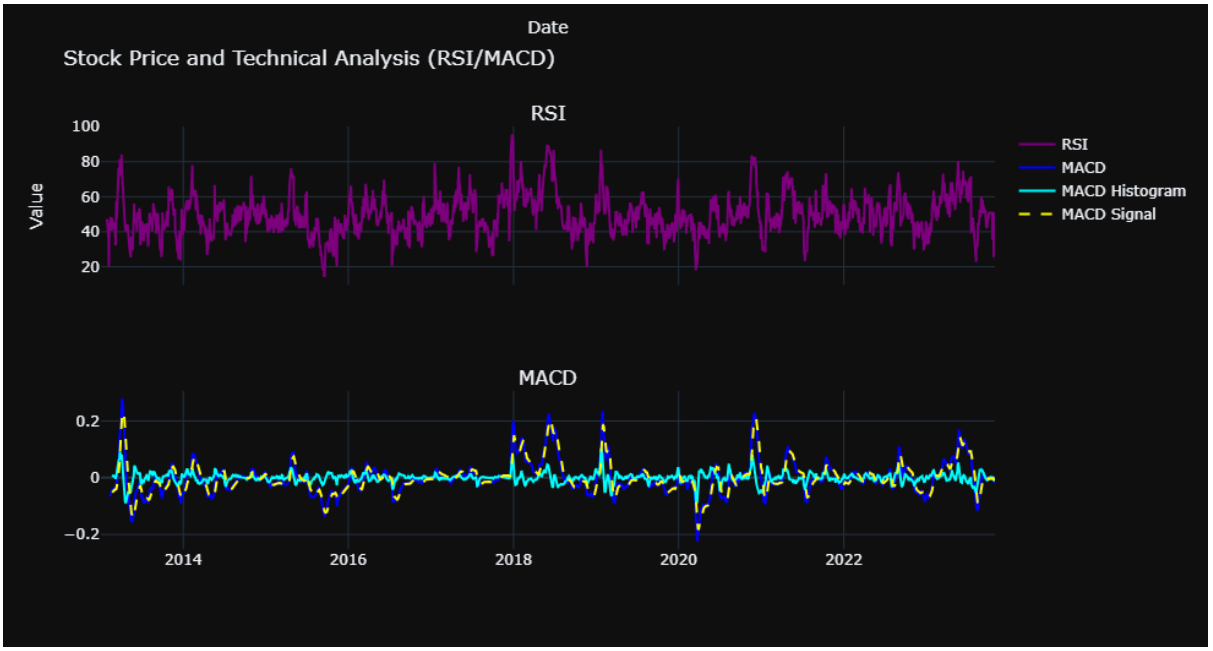
technical analysis:

We wrote a python code that allowed us to extract data from our excel sheet in which we kept our historical data ,conduct a technical analysis of the stock price and then visualize its technical chart with indicators such as the moving average , bollinger bands , RSI and MACD . Using the information we acquired in the online sessions with Mr Bechir Bouzid and the information available online we analyzed the figures to study the trends of each individual stock in order to get an idea whether the stock was oversold or overbought in order to make good investment decisions .
By including bollinger bands , we get an idea of the future trend reversal of the stock price and its volatility (when the price breaks above or below either bands , it is considered a sign of high volatility and possible trend reversal)
By analyzing the direction of the moving average (angled up or angled down) , we could get an idea about the future momentum of stock (bullish or bearish)
By analyzing the RSI (relative strength index) , we get an idea if the stock is overbought or oversold and then act accordingly (sell is overbought / buy if oversold)

Code :

```python
import pandas as pd
import matplotlib.pyplot as plt
import pandas_ta as ta
import plotly.graph_objects as go
# Read data from Excel
df = pd.read_excel(r'C:\Users\lenovo\Desktop\TA\TAFM-RETURNS.xlsx', sheet_name='TPR')
# Calculate 20-day Simple Moving Average (SMA)
df['SMA'] = ta.sma(df['close'], length=20)
df2 = ta.bbands(df['close'], length=20, std=2)
df[['bb_upper', 'bb_lower']] = ta.bbands(df['close'], length=20, std=2)[['BBL_20_2.0','BBU_20_2.0']]
macd_data = ta.macd(df['close'], fast=12, slow=26, signal=9)
df['macd'] = macd_data['MACD_12_26_9']
df['macdhist'] = macd_data['MACDh_12_26_9']
df['macdsignal'] = macd_data['MACDs_12_26_9']
# Calculate Relative Strength Index (RSI)
df['RSI'] = ta.rsi(df['close'], length=14)
from plotly.subplots import make_subplots
# Create separate figures for SMA/Bollinger Bands and RSI/MACD
fig_sma = make_subplots(rows=2, cols=1, shared_xaxes=True, subplot_titles=['Stock Price and SMA/Bollinger Bands'],row_heights=[0.7, 0.3])
fig_rsi_macd = make_subplots(rows=2, cols=1, shared_xaxes=True, subplot_titles=['RSI', 'MACD'])
# Add traces for SMA/Bollinger Bands
fig_sma.add_trace(go.Scatter(x=df['Séance de Bourse'], y=df['close'], mode='lines', name='Close Price'), row=1, col=1)
fig_sma.add_trace(go.Scatter(x=df['Séance de Bourse'], y=df['SMA'], mode='lines', name='20-Day SMA', line=dict(color='orange')), row=1, col=1)
fig_sma.add_trace(go.Scatter(x=df['Séance de Bourse'], y=df['bb_upper'], mode='lines', name='Upper Bollinger Band', line=dict(color='red', dash='dash')), row=1, col=1)
fig_sma.add_trace(go.Scatter(x=df['Séance de Bourse'], y=df['bb_lower'], mode='lines', name='Lower Bollinger Band', line=dict(color='green', dash='dash')), row=1, col=1)
# Add traces for RSI/MACD
fig_rsi_macd.add_trace(go.Scatter(x=df['Séance de Bourse'], y=df['RSI'], mode='lines', name='RSI', line=dict(color='purple')), row=1, col=1)
fig_rsi_macd.add_trace(go.Scatter(x=df['Séance de Bourse'], y=df['macd'], mode='lines', name='MACD', line=dict(color='blue')), row=2, col=1)
fig_rsi_macd.add_trace(go.Scatter(x=df['Séance de Bourse'], y=df['macdhist'], mode='lines', name='MACD Histogram', line=dict(color='cyan')), row=2, col=1)
fig_rsi_macd.add_trace(go.Scatter(x=df['Séance de Bourse'], y=df['macdsignal'], mode='lines', name='MACD Signal', line=dict(color='yellow', dash='dash')), row=2, col=1)
# Update layout for SMA/Bollinger Bands figure
fig_sma.update_layout(
    title='Stock Price and Technical Analysis (SMA/Bollinger Bands)',
    xaxis=dict(title='Date'),
    yaxis=dict(title='Value'),
    template='plotly_dark'
)
# Update layout for RSI/MACD figure
fig_rsi_macd.update_layout(
    title='Stock Price and Technical Analysis (RSI/MACD)',
    xaxis=dict(title='Date'),
    yaxis=dict(title='Value'),
    template='plotly_dark'
)
# Show the interactive plots
fig_sma.show()
fig_rsi_macd.show()
```

example of output :



Besides using our own code , we used investing.com's technical chart functionality for more flexibility regarding indicators and to be able to compare the technical analysis of two or more stocks at one time.

*In our first plans as a group , we intended to invest heavily in SFBT , a well performing stock in our market , that goes along with our strategy.
In the light of the palestinian struggle and the boycott of the SFBT after the events of the 7th of October , we decided not to invest any capital in the company as support to the resistance movement ignoring the possible upside of this investment for moral reasons.(return after 7th oct)
*Even though the return for CITY CARS and TPR was negative and their price was showing signs of declining even further , we decided not to limit our losses and sell all of our shares invested in them and decided to sell them partially whilst the right decision was to liquidate them and invest the capital elsewhere. This decision is due to us preferring to hold onto the losing position rather than to accept the pain associated with making a bad decision that cost us money.
*For Attijari Bank we got information that they are raising their capital, which made us more sure and confident that its price will rise which was the case.
*We saw that the the TGH shares were cheap and thought of as an arbitrage opportunity whilst it was just a bad investment , this decision was made due to overconfidence in that the stock price will bounce back and create profit.
*Since we as individuals have banking accounts in BIAT , we decided to buy a share in the company because we had personal ties and interest in the company aside from its profitability.
*We wanted to include a company in the diversified finances sector ,the historical data and analysis proved that the companies had quite similar prospects . Seen as Hannibal Lease

was a sponsor of our favorite football club Esperance Sportive de tunis. we leaned in its favor as a personal preference .

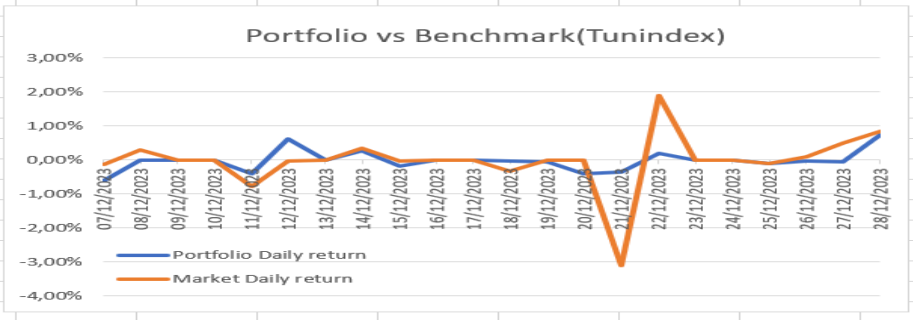
STEP 9: Performance evaluation:

On the following link 'DAY BY DAY Returns' you can find day by day returns.

Attribution analysis:

Date	Portfolio	Market	Difference
07/12/2023	-0,62%	-0,1360%	-0,4802%
08/12/2023	0,00%	0,3000%	-0,3000%
09/12/2023	0,00%	0,0000%	0,0000%
10/12/2023	0,00%	0,0000%	0,0000%
11/12/2023	-0,39%	-0,7800%	0,3859%
12/12/2023	0,61%	-0,0188%	0,6299%
13/12/2023	0,00%	-0,0102%	0,0102%
14/12/2023	0,27%	0,3470%	-0,0759%
15/12/2023	-0,19%	-0,0321%	-0,1533%
16/12/2023	0,00%	0,0000%	0,0000%
17/12/2023	0,00%	0,0000%	0,0000%
18/12/2023	-0,03%	-0,3200%	0,2912%
19/12/2023	-0,06%	0,0000%	-0,0585%
20/12/2023	-0,41%	0,0000%	-0,4058%
21/12/2023	-0,36%	-3,1000%	2,7421%
22/12/2023	0,19%	1,9000%	-1,7100%
23/12/2023	0,00%	0,0000%	0,0000%
24/12/2023	0,00%	0,0000%	0,0000%
25/12/2023	-0,12%	-0,1016%	-0,0162%
26/12/2023	-0,02%	0,1041%	-0,1272%
27/12/2023	-0,06%	0,4840%	-0,5469%
28/12/2023	0,74%	0,8530%	-0,1107%
average	-0,02%	-0,0232%	0,0747%

OUTPERFORMED THE MARKET



Sources of added value

Stock selection : 3 examples .

ATTIJARI BANK : this stock has been rock solid for us throughout the investment period , it had an increase of 4,67 % in that period and constantly had positive returns . We gained 2,057 TND per share from this stock,

STIP : we capitilized on a price dip that the stip share price suffered (-4,21%) which was then followed by an important increase of 1,57% the following day . In just one day we made 0,55 TND of profit from buying three shares at a low price.

AMEN BANK : We decided to cut our losses from losing stocks and sell them to raise capital to buy 2 shares of this stock . This trade went on to be a favourable one since we made 0,724 TND , enough to cover our losses on the previous investments in the sold stocks

Composite Analysis

Stock Name and number of days included in inventory	*Historical Return (daily*n days)*	*Return during investment period*	*weight in portfolio*	*Contribution towards portfolio*
ATTIJARI (20 days)	*1.46%*	*4.67%*	*15.79%*	*0.738%*
AMEN BANK (one day)	*0.036%*	*1.07%*	*11.47%*	*0.122%*

BIAT (6 days)	*Technical*	*0.68%*	*15.73%*	*0.1%*
PGH(20 days)	*0.32%*	*-0.0919%*	*6.54%*	*-0.006%*
STIP (8 days)	*Technical*	*2.13%*	*2.33%*	*0.05%*
SOTRAPIL(20 days)	*0.8%*	*0.1885%*	*12.79%*	*0.025%*
SOTUVER(20 days)	*0.78%*	*0.821%*	*8.21%*	*0.07%*
HAN LEASE(20 days)	*-1.96%*	*-0.138*	*6.31%*	*-0.009%*
UIB (9 days)	0.288%	*-0.577%*	*8.86%*	*-0.05%*
			Total :	1.0175%

Financial metrics interpretations and formulas we used :

Indicator Name	Formula	Explanation
Maximum Drawdown	Peak value - Trough value *(max-min)*	asses maximum loss suffered by the portfolio
Maximum Drawdown Percentage	Max Drawdown/Peak value	offers a magnitude of loss in terms of percentage
Sortino Ratio	(Portfolio return-Risk Free Rate)/Downside Deviation*(volatility of negative returns)*	focuses on downside risk
Treynor Ratio	(Portfolio return-Risk Free rate)/portfolio Beta	evaluates risk adjusted return relative to systematic risk
Portfolio Beta	stock's weight*stock's beta	measures sensitivity of the entire portfolio towards volatility of market
Total Portfolio Return	[(ending portfolio value -beginning portfolio value)/beginning portfolio value]*100	measures the capital gains made by the portfolio in a certain period.

Compounded Annual Growth rate (CAGR)	[(ending value/beginning value)"(1/number of years)] -1	geometric ratio that gives a rate of return over a specific time period.

Stock selection :.

ATTIJARI BANK :

This stock has been rock solid for us throughout the investment period , it had an increase of 4,67 % in that period and constantly had positive returns . We gained 2,057 TND per share from this stock.

STIP :
We capitilized on a price dip that the stip share price suffered (-4,21%) which was then followed by an important increase of 1,57% the following day .
In just one day we made 0,55 TND of profit from buying three shares at a low price.

AMEN BANK :
We decided to cut our losses from losing stocks and sell them to raise capital to buy 2 shares of this stock . This trade went on to be a favourable one since we made 0,724 TND , enough to cover our losses on the previous investments in the sold stocks

By structuring our report step by step , we ensure a comprehensive and organized presentation of our project, enabling the bank to gain a clear understanding of our approach and the outcomes achieved.

Thank you for taking the time to review our project.

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