

# Financial Dashboard

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Master Degree Program in Data Science  
and Advanced Analytics

## Business Cases with Data Science

Github repository:

<https://github.com/andremforte/BusinessCase5>

Dashboard:

<https://share.streamlit.io/andremforte/businesscase5/main/app.py>

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## **1. Business Understanding**

Dashboards provide critical reporting and metrics information and are essential in Business Performance Management. After the first successful project, Invest4some decided to hire us again to create a dashboard for their financial analysts. They do, however, anticipate a flexible dashboard that pulls regularly updated data on any financial asset.

The dashboard will help their internal financial team and external stakeholders make better investment decisions. Due to that, the business goal is to create a dashboard that can handle information from as many assets as feasible. In this project, the Data Mining's goal is to develop a dashboard that can include financial data in real-time and display the most adequate visualizations to provide relevant information to answer the needs of the company.

## **2. Data Understanding & Data Preparation**

To develop the Dashboard, it was imported data from Yahoo Finance, which is a website with financial data. This data is related to cryptocurrencies, currencies and stocks that constitute the financial data that will be helpful to make better decisions. From every asset, we extracted "Low", "High", "Close", "Adj Close", "Open" prices and the "Volume" since January 1<sup>st</sup>, 2021.

Since the goal of this project was to provide visualizations, we only prepared the data for the Predictions' section, using the same Machine Learning algorithm from the last project. This step was only applied to Predictions' section. Here, we applied the same steps as we did in the Business Case 4: deleting missing entries, creating new important features (such as "spread", "volatility", "close of high" among others), adding external data (EURUSD change rate) that could help improve the models' performance. The Bitcoin closing price was also included as a variable in the datasets of the other cryptocurrencies due to its dominance in the market. After that, the datasets were normalized using MinMaxScaler and we selected the non-highly correlated variables, deleting those who registered values above 0.85 or below - 0.85.

## **3. Modeling**

As it was mentioned above, this phase was only applied to Predictions' section, and we used XGBoostRegressor. to calculate the prediction for the next closing price for each cryptocurrency. We used a sliding window to define the train and test datasets. In this case and to make it more interactive, we let the users decide which is the interval of days they want to consider.

## **4. Deployment**

In this section, it will be presented the structure of the final dashboard, explaining in detail what the users can do with the application. The dashboard was developed using Streamlit and it was deployed using Streamlit Share, making it public to everyone.

The final solution includes financial data divided into four main sections: “Cryptocurrencies”, “Predictions”, “Currencies”, “Other Assets”. We also have a chapter called “Menu”, where we have the general information about our application. Besides, we created another chapter called “Exploratory Space”, where it will be possible to have different analyses at the same time. The purpose of each chapter will be clarified further on. You may have access to the final dashboard through this link: <https://share.streamlit.io/andremforte/businesscase5/main/app.py> .

#### 4.1. Section “Menu”

The default page of our dashboard can be seen in Annex 1, and it corresponds to the page that the users see when they access the link. Here, it is possible to see the three main chapters of the application and some general information about them. If the users need to come back to this page, there is an option called “Menu” in the sidebar. Besides filter options, this bar contains instructions to help the users using the dashboard (E.g., notes explaining how to insert the cryptocurrency in the text input space (“BTC”)).

#### 4.2. Section “Cryptocurrencies”

Using the sidebar, the users have a radio item where they can select the chapter and, with that, the sidebar changes and includes different fields to filter and change the visualizations, allowing to make different analyses by the users. In this case (Annexes 2 to 6), the side bar contains a *text input*, where the users can write the symbol of the cryptocurrency they want to analyse, a *selection box*, which serves to choose the type of price, and start and end date spaces, to define the time interval they want to consider in the analysis. By default, the analysis is for the closing price of BTC (Bitcoin) between Jan 1<sup>st</sup>, 2021, and the current day.

The page can be divided in two horizontal subsections: “Cryptocurrency prices” and “Financial Indicators”. In the first subsection, they can analyse the distribution of the volume and price of the selected cryptocurrency between the interval time they considered. In the second column, we have the current value updated every time they refresh the dashboard, calculating the change rate considering the last closing price. The values allow the users to understand the trend of the price in real time, improving our analysis with more updated information. Finally, we have a table with data of the prices of the last 7 days for each cryptocurrency, where we can see the exact values. The column “Volume” is fixed, but the price column varies depending on the selected option.

In the second subsection, it is possible to analyse different financial indicators that will be useful to make better decisions: Moving Average Convergence Divergence, Bollinger Bands and Moving Average. The financial indicators can be selected using a *select box*, allowing the user to see, with more detail, each indicator. For every indicator, there is a box with general information in case the user needs some help. For Bollinger bands in particular, the user can select the number of days to compute the bands using a slider that appears when they select that indicator.

Below, we have a brief explanation of the financial indicators displayed in the dashboard:

A Simple Moving Average (SMA) minimizes volatility and makes identifying a pattern in security price easier. When the simple moving average line is pointing up, it means the asset's price is growing. If it's pointing down, it means the security's price is dropping. The smoother the simple moving average, the longer the time frame for the moving average. The reading of a shorter-term moving average is closer to the original data than the reading of a longer-term moving average. To obtain a simple moving average, the number of prices within a time period is divided by the total number of periods.

The Moving Average Convergence Divergence (MACD) is used to show trend of the market prices of a security. It shows the relationship between two moving averages of a cryptocurrency coin, currency, or asset. It is calculated by subtracting the long-term exponential moving average (EMA) from the short-term exponential moving average. the "signal line," is plotted on top of the MACD line, this line could be used to determine when to buy and sell. When the MACD crosses above its signal line, traders can buy the asset, and when the MACD crosses below the signal line, they can sell (or short) the security.

One of the most common issues with divergence is that it can often imply a potential reversal, but no real reversal occurs—a false positive. The other issue is that divergence does not always predict reversals. In other words, it predicts too many false reversals and too few true price reversals.

Finally, Bollinger Bands are a common trading indicator. The market is more overbought the closer it gets to the upper band, while the market is more oversold the closer it gets to the lower band. Because they are generated using a simple moving average, older price data is weighed the same as the most recent data. This means that new information may be diluted by previous data. When the middle band is designed to reflect the intermediate-term trend, Bollinger Bands perform best because trend information is paired with relative price level data.

### **4.3. Section “Predictions**

In the “Predictions” section (Annex 7), it is given the possibility of analysing the predicted closing price for the next day of the selected cryptocurrency. Here, the user can select the sliding window they want to consider in the modelling phase between 1 and 90 days. By default, it is selected the sliding window of 7 days, so the line plot presented in this subsection displays the last 7 closing prices and the predicted price. If is above the previous price, it will display a green line (positive trend). Otherwise, it will display a red line, meaning that the predicted price is below the last closing value. The exact predicted price can be seen near the line plot, and, under that, it is displayed the change rate comparing to the last closing price. There is also a box with some information in case users need some help in interpretation.

#### 4.4. Section “Currencies”

When the users select “Currencies” in the radio items (Annexes 8 and 9), the options in sidebar will adapt for this specific section. In this case, the space for Cryptocurrencies will be replaced to a space to write Currencies symbols. By default, the dashboard will present data for Euro to Dollar currency (“EURUSD”). The other filters remain the same as the Cryptocurrencies’ section.

We have also two subsections: Currencies prices and Financial Indicators. In the first subsection, the user can analyse a line chart that shows the distribution of the selected price and currency. It is also possible to see the current trading price for each currency and the change rate comparing to the price of the previous day. There is also a table where the user can analyse the prices of the last 7 days. The “Financial indicators” subsection is similar to the same subsection in “Cryptocurrencies”. There are three indicators that allow the user to analyse the trends and make better decisions.

#### 4.5. Section “Other Assets”

The users can analyse stocks data in “Other Assets” page (Annexes 10 and 11). The side bar changes for stocks symbols and the other options remain the same. Its structure is similar to “Cryptocurrencies”. There is a line plot displaying the specific price and the volume for the selected stock, having the current price and the change rate with the price of the previous day. There is also a table to see the exact values of the volume and prices of the last 7 days. The subsection “Financial Indicators” displays the same three indicators, this time to extract information about stocks.

#### 4.6. Section “Exploratory Space”

Until now, it was presented to the user different informative sections. However, since we want to make sure that the users can extract the maximum information from our application, we decided to create an Exploratory Space (Annexes 12 to 15). The last section is an open space where users can perform their personalized analyses. One of the main reasons to create this space in our dashboard is related to the lack of comparison between assets at the same time.

The exploratory space was designed to explore the three markets used in the previous chapters. Depending on the reasoning behind the user’s purposes, it’s possible to do their own comparisons between the three types of assets and extract different patterns to make better investment decisions. The Exploratory Space is composed by three horizontal *buttons* on the top of the page. Each one of them represents one type of market: cryptocurrencies, currencies and stocks markets.

Moving on to each button in specific, the first “Cryptocurrency” button is composed by four *text inputs*, meaning that the user can search and compare four cryptocurrencies at the same time by searching for its crypto symbol (for example, Bitcoin is represented by “BTC”). It is possible to visualize the cryptocurrencies’ image on the right side of the *text input*. There are also two *radio*

*items*: the first one is related to the variables that the user wants to analyse, having displayed the following options: “Close”, “Low”, “High”, “Open”, “Adjust Close” and “Volume”. The second *radio item* is related to the scale of the data and it is composed by two options “Log” and “Normal”.

The visualizations were developed using plotly due to its interactivity and customization. In the top left of the main chart, the user can change, with a *dropdown*, between two types of graphs: a line plot (through a scatter plot) and a bar plot. Also, on the upper part of the plot, six small *buttons* are displayed, corresponding to the interactivity with the date. The date options are the last seven days (7d), month (1m), semester (6m), one year from today (YTD), one complete year (1y) and all the date (all). In the bottom, it's also possible to change the date with a *range slider*. For the second and third main *buttons*, Currencies and Stocks respectively, the same reasoning from the first *button* was applied. The only difference is that Currencies' analyses don't have the variable “Volume” and both *buttons* don't have the image logo related to the currency or stocks company.

## 5. Limitations

Having our final dashboard deployed, it is possible to identify some limitations of the solution that can be faced as future work to improve the performance of the application. Firstly, regarding the content, there is a possibility of including more financial data (indicators, other types of markets, real-time updated with minutes and hours) to create a more complete and useful dashboard. Along with that, the use of more different types of visualizations/charts could make the interpretation more valuable to the users.

Secondly, regarding the design, the dashboard presents a simple configuration because the goal was to keep the focus in the information and visualization. However, the design may be developed making the application more attractive and user-friendly. Finally, we could add more external information in such as “Financial News” so the users can be always informed about the last updates in this market.

## 6. Conclusion

With the use of this dashboard, the financial specialists can analyse three different markets, extract important information and different patterns from three financial indicators and make use of the predicted value for closing price of each cryptocurrency in their decisions.

Besides the informative space and in case they haven't found the information they want, there is an exploratory space where they can make their own analyses and compare different assets, increasing their knowledge and improving their decisions. Due to that, we can conclude that our dashboard answers the needs of the company.

## Annexes

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Select which asset do you want to analyse

☐ Cryptocurrencies
 ☐ Predictions
 ☐ Currencies
 ☐ Other Assets
 ☐ Exploratory Space
 ☒ Menu

Write the crypto symbol (E.g.: BTC)

BTC

Select the price that you want to analyse

Close

Start Date

2021/01/01

End Date

2022/05/29

Source: <https://finance.yahoo.com/>

### Invest4Some Financial Dashboard

Welcome! In this dashboard, it is possible to analyse different financial assets in order to have more information to make better investment decisions. In the sidebar, it is possible to select which asset do you want to analyse, having independent analyses for each of them. Lastly, there is a section called 'Exploratory Space' where you can perform your personalized analysis, including different indicators in the same plot and extracting the information that you need.

#### Cryptocurrencies

In this chapter, there is information about Cryptocurrencies. You have access to the current price and the distribution of the prices from January 1st, 2021. Moreover, you can find information about financial indicators. Finally, using Machine Learning algorithms, it is possible to see the prediction for the next closing price for each cryptocurrency.

#### Currencies

Here you can find information about Currencies. It is possible to analyse their prices' distribution and some important financial indicators.

#### Other Assets

In "Other Assets", it is possible to analyse stocks prices. You can analyse financial indicators and extract interesting patterns from them.

### Annex 1. "Menu" Page

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Select which asset do you want to analyse

☒ Cryptocurrencies
 ☐ Predictions
 ☐ Currencies
 ☐ Other Assets
 ☐ Exploratory Space
 ☐ Menu

Write the crypto symbol (E.g.: BTC)

BTC

Select the price that you want to analyse

Close

Start Date

2021/01/01

End Date

2022/05/29

Source: <https://finance.yahoo.com/>

### Cryptocurrencies Analysis

#### BTC Prices

Distribution of the Close Price and Volume of BTC

Current Trading Price (% difference from yesterday's closing price)

30664.8 USD

↑ 7.12 %

Table with prices and volume of the last 7 days (USD)

	Close	Volume
21 May, 2022	29,432.2266	17274840442
22 May, 2022	30,323.7227	21631532270
23 May, 2022	29,098.9102	31483454557
24 May, 2022	29,655.5859	26616506245
25 May, 2022	29,562.3613	27525063551
26 May, 2022	29,267.2246	36774325352
27 May, 2022	28,627.5742	36582005748

### Annex 2. "Cryptocurrencies" Page

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Select which asset do you want to analyse

☒ Cryptocurrencies
 ☐ Predictions
 ☐ Currencies
 ☐ Other Assets
 ☐ Exploratory Space
 ☐ Menu

Write the crypto symbol (E.g.: BTC)

BTC

Select the price that you want to analyse

Close

Start Date

2021/01/01

End Date

2022/05/29

Source: <https://finance.yahoo.com/>

### Financial Indicators

Select the length of the window

Select the indicator

Bollinger Bands

Moving Average Convergence Divergence

Bollinger Bands

Moving Average

Bollinger Bands for BTC

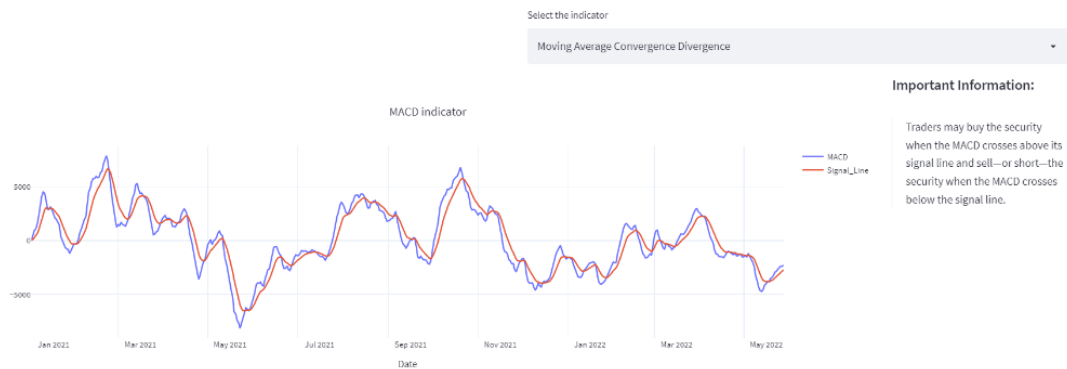
used to determine how strongly an asset is rising and when it is potentially reversing or losing strength. An uptrend that reaches the upper band indicates that the stock is pushing higher and traders can exploit the opportunity to make a buy decision. In a strong downtrend, the price will run along the lower band, and this shows that selling activity remains strong.

### Annex 3. "Cryptocurrencies" Page – Financial Indicators

7



## Financial Indicators



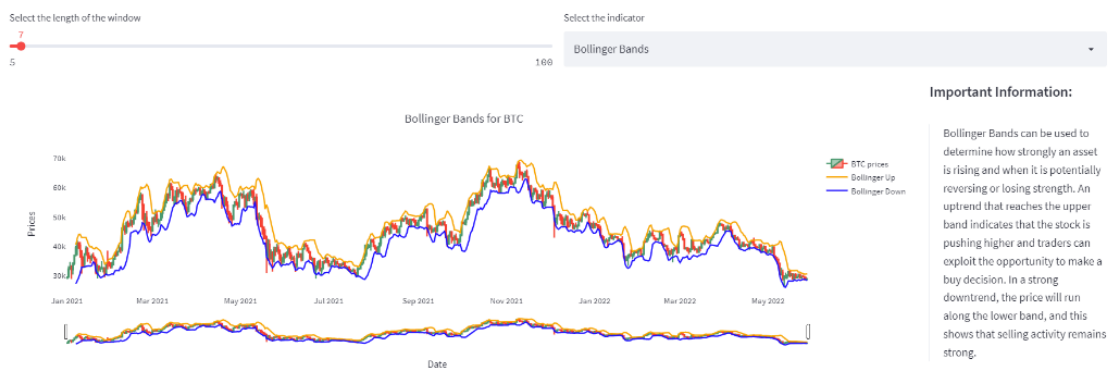
**Annex 4. "Cryptocurrencies" Page - MACD**

## Financial Indicators



**Annex 5. "Cryptocurrencies" Page - MA**

## Financial Indicators



**Annex 6. "Cryptocurrencies" Page – Bollinger Bands**

Select which asset do you want to analyse

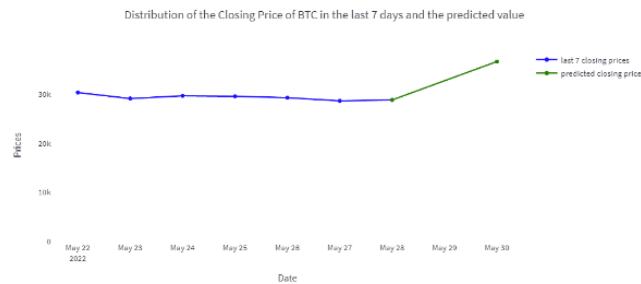
☐ Cryptocurrencies  
☒ Predictions  
☐ Currencies  
☐ Other Assets  
☐ Exploratory Space  
☐ Menu

Write the crypto symbol (E.g.: BTC)

BTC

Source: <https://finance.yahoo.com/>

## Predictions



Select the sliding window (Days) for Modeling

7

Predicted closing price of BTC on May 30, ...

**36655.33 USD**

↑ 27.21 %

**Important Information:**

Considering our prediction, the price of BTC will vary 27.21 % comparing to the last price.

Annex 7. "Predictions" Page

Select which asset do you want to analyse

☐ Cryptocurrencies  
☐ Predictions  
☒ Currencies  
☐ Other Assets  
☐ Exploratory Space  
☐ Menu

Write the currency symbol (E.g. EURUSD)

EURUSD

Select the price that you want to analyse

Close

Start Date

2021/01/01

End Date

2022/05/29

Source: <https://finance.yahoo.com/>

## Currencies Analysis

### Currencies Prices



Current Trading Price (% difference from yesterday's closing price)

**1.08 USD**

↑ 0.82 %

### Table with prices of the last 7 days (USD)

	Close
20 May, 2022	1.0579
23 May, 2022	1.0570
24 May, 2022	1.0682
25 May, 2022	1.0737
26 May, 2022	1.0687
27 May, 2022	1.0733
30 May, 2022	1.0783

Annex 8. "Currencies" Page

Select which asset do you want to analyse

☐ Cryptocurrencies  
☐ Predictions  
☒ Currencies  
☐ Other Assets  
☐ Exploratory Space  
☐ Menu

Write the currency symbol (E.g. EURUSD)

EURUSD

Select the price that you want to analyse

Close

Start Date

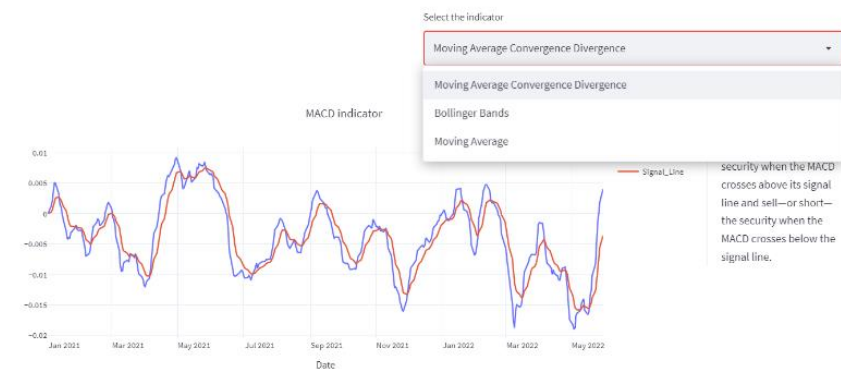
2021/01/01

End Date

2022/05/29

Source: <https://finance.yahoo.com/>

## Financial Indicators



Annex 9. "Currencies" Page – Financial Indicators

Select which asset do you want to analyse

☐ Cryptocurrencies  
☐ Predictions  
☐ Currencies  
☒ Other Assets  
☐ Exploratory Space  
☐ Menu

Write the index symbol (E.g.: AMZN for AMAZON)

AMZN

Select the price that you want to analyse

Close

Start Date

2021/01/01

End Date

2022/05/29

Source: <https://finance.yahoo.com/>

## Stocks Analysis

### Stock Prices



Current Trading Price (% difference from yesterday's closing price)

2302.93 USD

↑ 3.66 %

#### Table with prices and volume of the last 7 days (USD)

	Close	Volume
19 May, 2022	2,146.3799	4407100
20 May, 2022	2,151.8201	4968200
23 May, 2022	2,151.1399	5389900
24 May, 2022	2,082.0000	5146700
25 May, 2022	2,135.5000	4656000
26 May, 2022	2,221.5500	4650100
27 May, 2022	2,302.9299	4675800

### Annex 10. "Other Assets" Page

Select which asset do you want to analyse

☐ Cryptocurrencies  
☐ Predictions  
☐ Currencies  
☒ Other Assets  
☐ Exploratory Space  
☐ Menu

Write the index symbol (E.g.: AMZN for AMAZON)

AMZN

Select the price that you want to analyse

Close

Start Date

2021/01/01

End Date

2022/05/29

Source: <https://finance.yahoo.com/>

### Financial Indicators



### Annex 11. "Other Assets" Page – Financial Indicators

Select which asset do you want to analyse

☐ Cryptocurrencies  
☐ Predictions  
☐ Currencies  
☒ Exploratory Space  
☐ Menu

Source: <https://finance.yahoo.com/>

## Invest4Some Financial Dashboard

Welcome to Exploratory Space! In this page, it is possible to make extra analyses, comparing cryptocurrencies, currencies, and stocks. You may also select which chart do you want to analyse and which category of prices. Improve your analysis and extract useful information to make better decisions with this space!

**Cryptocurrencies** **Currencies** **Stocks**

Write your 1<sup>st</sup> cryptocurrency: BTC

Write your 2<sup>nd</sup> cryptocurrency: ETH

Write your 3<sup>rd</sup> cryptocurrency:

Write your 4<sup>th</sup> cryptocurrency:

Categories

☒ Close  
☐ Low  
☐ High  
☐ Open  
☐ Adj Close  
☐ Volume

Select scale type:

☒ Normal  
☐ Log

Variable Close Over Time

7d 1m 3m YTD 1y 2y 3y 5y 10y 20y 30y 40y 50y 60y 70y 80y 90y 100y

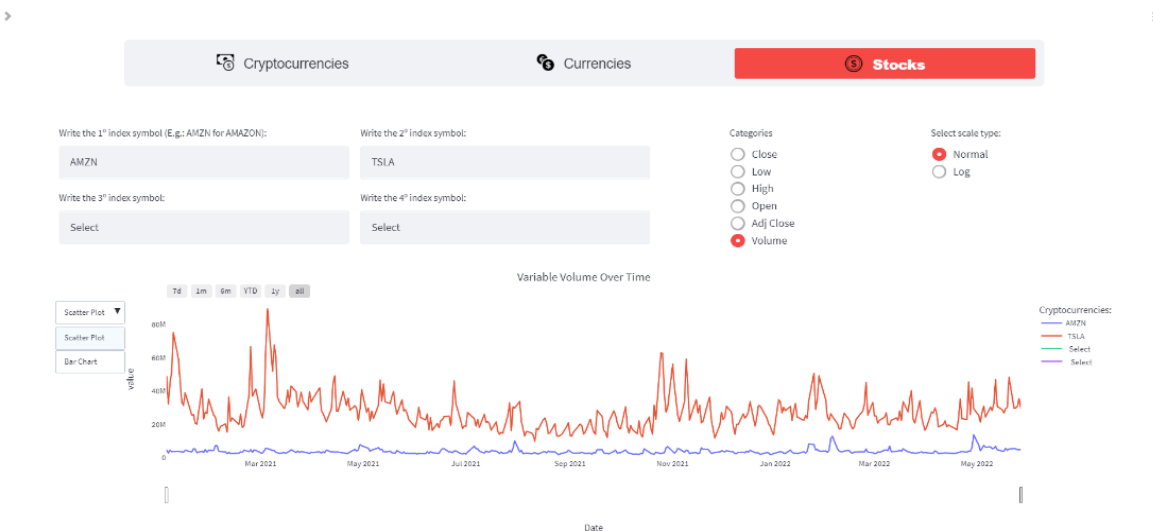
### Annex 12. "Exploratory Space"



### Annex 13. Exploratory Space - Cryptocurrencies



### Annex 14. Exploratory Space - Currencies



### Annex 15. Exploratory Space - Stocks