

Exploring the relationship between stock prices, macroeconomic variables and gold

Group 2A

Arian, Felix, Kerstin, Robin, Maroan



Research Questions

1. Are their macroeconomic variables with a direct influence on the Dow Jones performance?
2. Pattern of weekly/monthly trends. Are there positive trends for certain years or months that can be seen?
3. Dow Jones in combination with Gold: How tight is the correlation between the U.S. stock market and the value of gold? Are there patterns of higher or lower correlations? Can there be an increase at one and fall at the other?



Sources

DowJones daily market data from George (Erste Bank):

<https://www.sparkasse.at/sgruppe/privatkunden/digitales-banking/george-kennenlernen/george-wertpapierhandel>

Gold market data: https://www.ariva.de/goldpreis-gold-kurs/historische_kurse

Inflation rate, GDP, Dow Jones yearly: <https://www.macrotrends.net/>

Unemployment rate: <https://data.bls.gov/pdq/SurveyOutputServlet>



Data sets

First: Column names of the first data set

```
[1] "Year"  
[2] "DJ Annual"  
[3] "DJ Change"  
[4] "Annual Change DJ"  
[5] "GDP per Capita US"  
[6] "Annual Growth Rate"  
[7] "Annual change Growth Rate"  
[8] "Inflation Rate"  
[9] "Annual change Inflation"  
[10] "Unemployment Rate"  
[11] "Annual change of Unemployment"  
[12] "DJ_change_factor"
```

Second: Column names of the second data set

```
[1] "Date"  
[2] "DJ"  
[3] "DJ.Change"  
[4] "Gold"  
[5] "Gold.Change"
```



Loading and processing the dataset

We began our project with the first data set. There we needed to change some variables to the correct type e.g. formatting the date correctly and removing the ‘%’ sign of the entries.

Here is the summary of our cleaned data from the macroeconomic dataset -->

Year	DJ Annual	DJ Change	Annual Change DJ
Min. :1915	Min. : 59.93	Min. : -52.670	Min. : -27.7049
1st Qu.:1941	1st Qu.: 177.22	1st Qu.: -4.085	1st Qu.: -1.7831
Median :1968	Median : 818.09	Median : 9.465	Median : -0.8598
Mean :1968	Mean : 3897.21	Mean : 7.979	Mean : -1.1647
3rd Qu.:1994	3rd Qu.: 3814.35	3rd Qu.: 20.657	3rd Qu.: 0.1216
Max. :2020	Max. :28538.44	Max. : 81.490	Max. : 14.6308
GDP per Capita US	Annual Growth Rate	Annual Change Growth Rate	Inflation Rate
Min. : 0	Min. : -2.650	Min. : -4.120000	Min. : -0.360
1st Qu.: 0	1st Qu.: 0.000	1st Qu.: 0.000000	1st Qu.: 0.000
Median : 3987	Median : 2.090	Median : 0.000000	Median : 1.270
Mean :14148	Mean : 2.961	Mean : -0.006698	Mean : 2.089
3rd Qu.:25150	3rd Qu.: 5.032	3rd Qu.: 0.085000	3rd Qu.: 3.197
Max. :62641	Max. :11.770	Max. : 1.920000	Max. :13.550
Annual Change Inflation	Unemployment Rate	Annual Change of Unemployment	
Min. : -4.200000	Min. : 0.000	Min. : -1.21000	
1st Qu.: 0.000000	1st Qu.: 0.000	1st Qu.: 0.00000	
Median : 0.000000	Median : 0.000	Median : 0.00000	
Mean : 0.009811	Mean : 1.568	Mean : -0.02698	
3rd Qu.: 0.282500	3rd Qu.: 3.975	3rd Qu.: 0.00000	
Max. : 4.880000	Max. : 9.630	Max. : 3.47000	

Question 1:

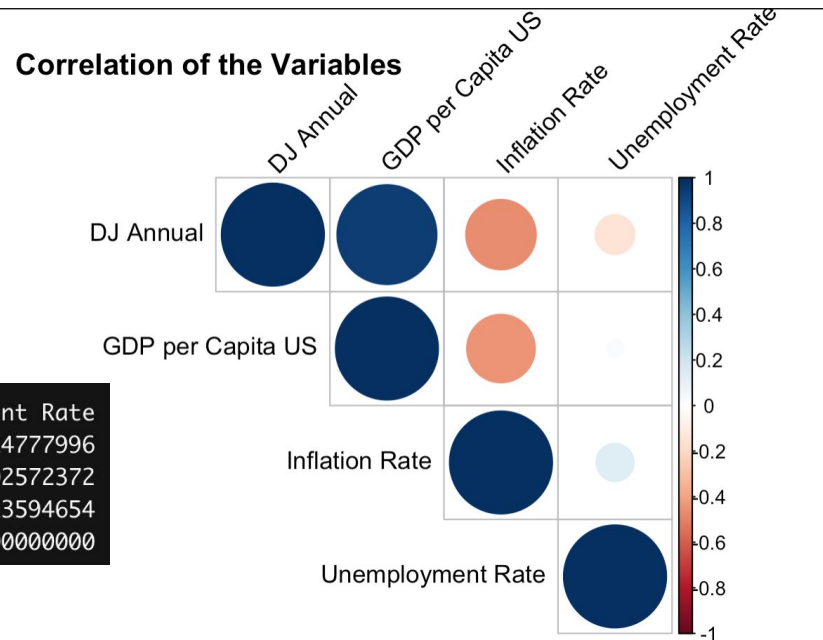
Are there macroeconomic variables with a direct influence on the Dow Jones performance?



Correlation between the numeric variables

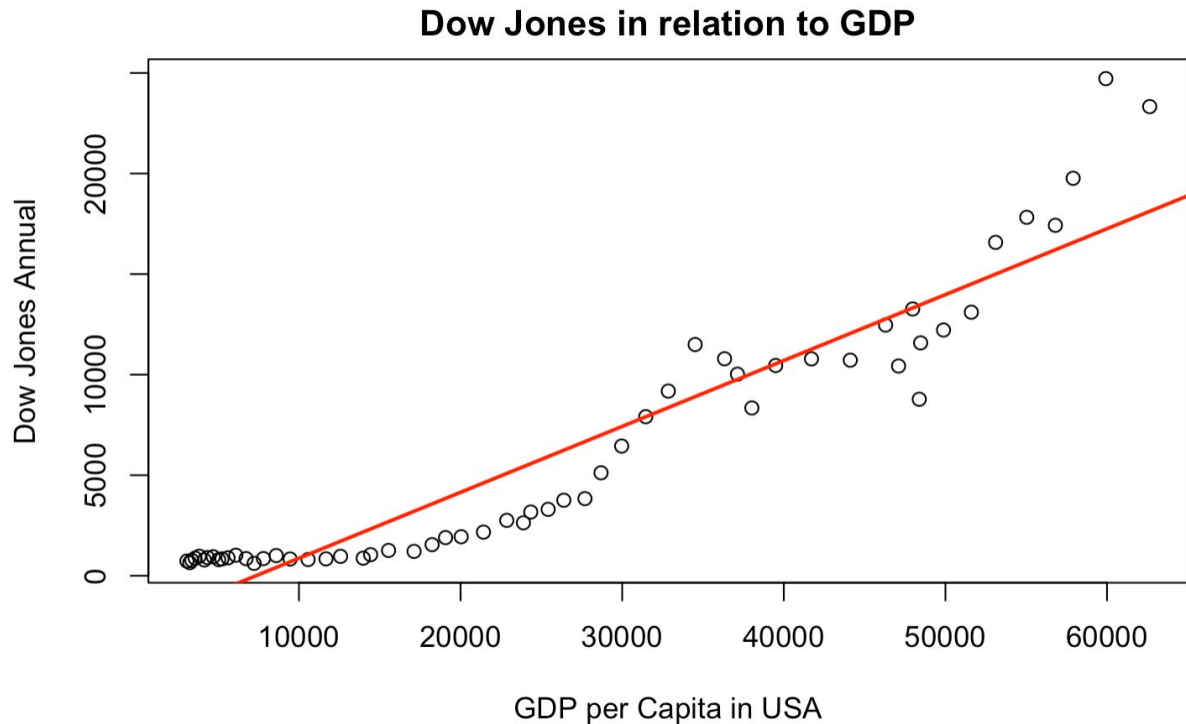
Macroeconomic variables and their correlation with the dow jones index

	DJ Annual	GDP per Capita US	Inflation Rate	Unemployment Rate
DJ Annual	1.0000000	0.94100443	-0.4666260	-0.14777996
GDP per Capita US	0.9410044	1.00000000	-0.4414481	0.02572372
Inflation Rate	-0.4666260	-0.44144805	1.0000000	0.13594654
Unemployment Rate	-0.1477800	0.02572372	0.1359465	1.00000000





Graph of the most significant variable





Linear Regression, Prediction and out of sample performance

- We formed a linear regression model to predict the annual change of the dow jones stock
- The independent variables are the gdp per capita, inflation rate and unemployment rate
- With the forward-backward selection based on AIC we get as the best model:
- -> **annual change of the dow jones ~ inflation rate + unemployment rate**
- the goodness of fit:
- This model performs best with AIC, adjusted R^2 and root mean squared error

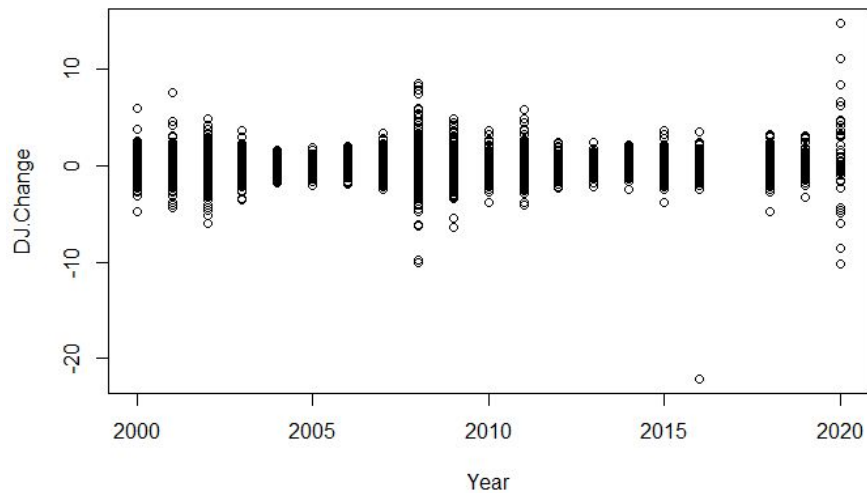
Question 2:

Pattern of weekly/monthly trends. Are there positive trends for certain years or months that can be seen?

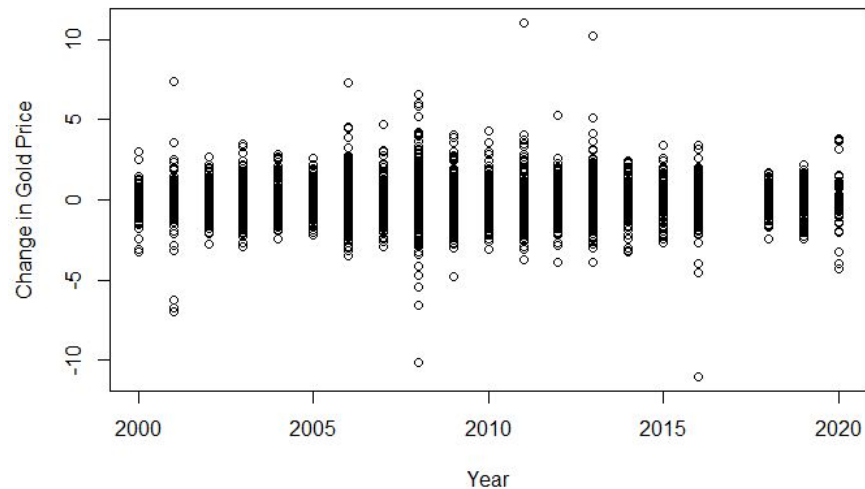


Trading strategy

Dow Jones Change per Year

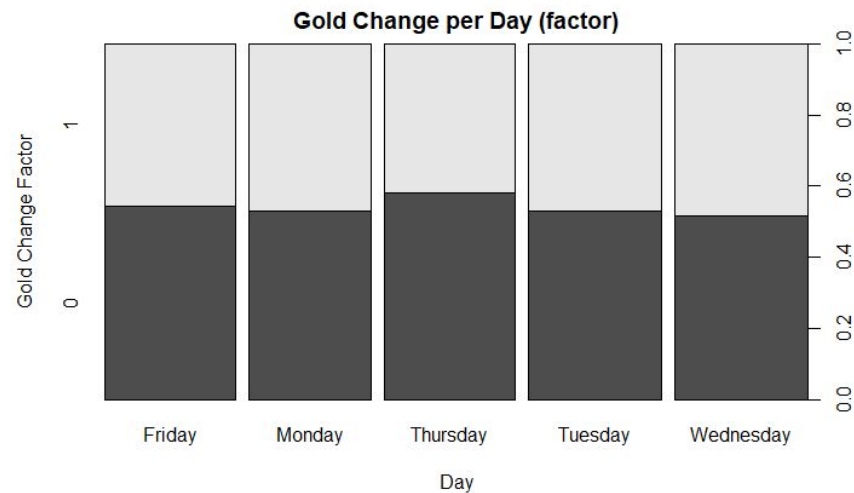
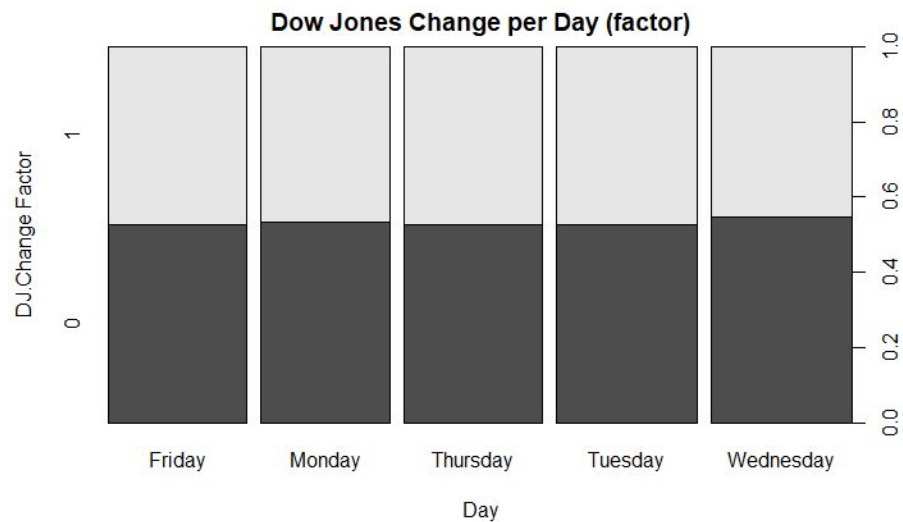


Change in Gold Price per Year





Changes per Day



Question 3:

Dow Jones in combination with Gold: How tight is the correlation between the U.S. stock market and the value of gold? Are there patterns of higher or lower correlations? Can there be an increase at one and fall at the other?



Second data set - loading and processing

Here we also needed some adjustments e.g formatting the date correctly and changing the type of some variables to numeric.

Here is the summary of our cleaned data -->

```
      Date           DJ      DJ.Change      Gold
Min.   :2000-02-28  Min.   : 6547  Min.   : -22.080000  Min.   : 255.9
1st Qu.:2004-11-18  1st Qu.:10378  1st Qu.: -0.560000  1st Qu.: 422.1
Median :2009-08-11  Median :11812  Median : -0.050000  Median : 975.1
Mean   :2009-09-27  Mean   :13727  Mean   : -0.008114  Mean   : 928.5
3rd Qu.:2014-05-01  3rd Qu.:16359  3rd Qu.:  0.480000  3rd Qu.:1305.6
Max.   :2020-03-27  Max.   :29551  Max.   : 14.850000  Max.   :1896.1

      Gold.Change
Min.   : -10.99000
1st Qu.: -0.60000
Median : -0.02000
Mean   : -0.02969
3rd Qu.:  0.49000
Max.   : 11.06000
```

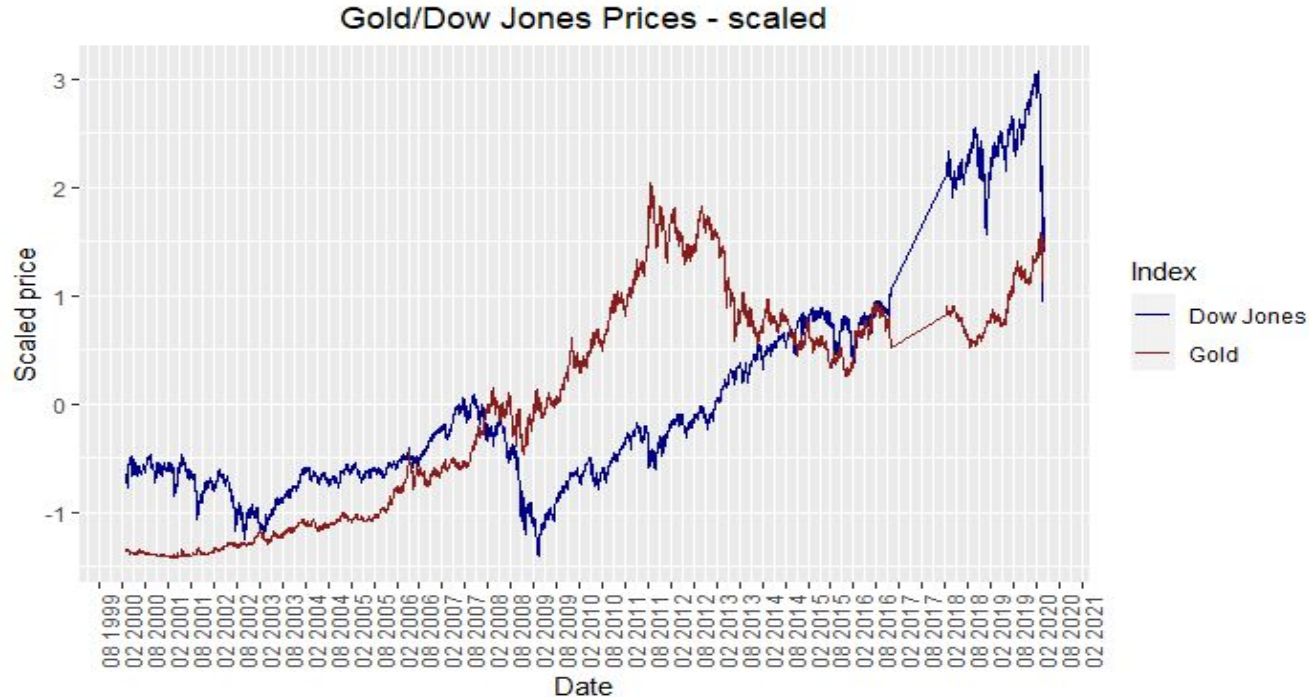


Correlation between the numeric variables

```
      DJ      Gold
DJ    1.000000 0.567707
Gold 0.567707 1.000000
```

```
      DJ.Change Gold.Change
DJ.Change 1.000000000 0.005471392
Gold.Change 0.005471392 1.000000000
```

Plotting the prices of Gold and Dow Jones (scaled)



END

Thank you ! :)