# Correlation between stock market and GDP: empirical evidence from Switzerland

## DTFF-HS22 Final Project

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December 19, 2022

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# Introduction

The industrial structure of GDP has changed significantly over the past few decades. In the same time span, the stock index has also undergone large changes.

However, changes in stock indices are sometimes out of sync with changes in GDP. A more obvious example is the creation and bursting of stock market bubbles. Exploring the relationship between the stock market and GDP is a breakthrough in the study of such issues.

# Purpose

We study the long run equilibrium relationship between stock prices and domestic GDP for the OECD countries. We expect to find higher stock price growth in countries high GDP growth than in countries with low GDP growth.

# Data and Model

This study uses quarterly GDP growth rates and stock price from the OECD. The stock price is standardized with 2015=100. This study period is from 1960Q2 to 2022Q3. Also, we removed rows with missing values to keep the data frame tidy.
The original data can be downloaded from here:

    https://github.com/Zion-W9/Digital-Tools-for-Finance

Processed data is here:

https://github.com/Zion-W9/Digital-Tools-for-Finance/tree/
                    main/project/data

# Model

Based on the topics we explored, we constructed the following model:

$$R_{Index} = \alpha + \beta * R_{GDP,t-3} + \varepsilon$$

Among them, $R_{Index}$ is the quarterly growth rate of the stock index, and $R_{GDP,t+3}$ is the quarterly growth rate of GDP. Since the share price may respond to GDP changes in advance, we choose GDP data for three periods in advance.
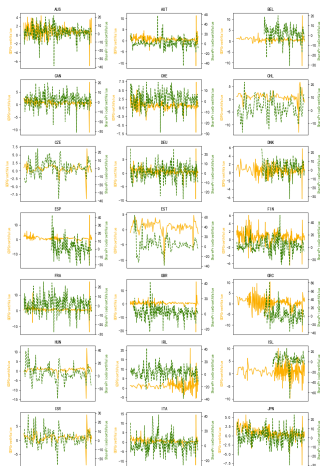
# Relationship between GDP and stock market



Figure: Relationship between GDP and stock market

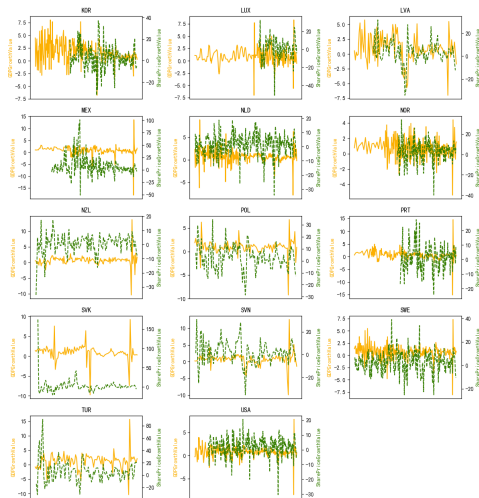# Relationship between GDP and stock market (Cont.)



Figure: Relationship between GDP and stock market Continued
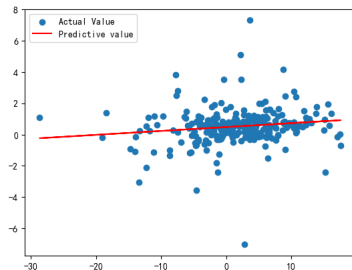
# Regression Results



Figure: Regression Results

Switzerland is one of the most important financial markets in the world, with relatively open and transparent market information, making it a reasonable and typical research sample. Therefore, we used Switzerland as an example to perform regression.

# Regression Results Analysis
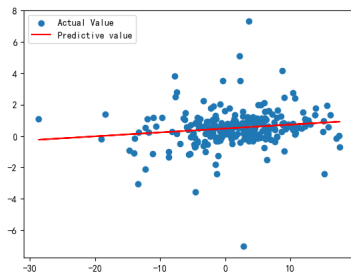


Figure: Regression Results

The following Table 1 [link] is the descriptive statistics of the sample. As far as Switzerland is concerned, GDP fluctuates around -7% to 7%, with an average of 0.55% and a standard deviation of 1.23, indicating that Switzerland's GDP growth is relatively stable. In Switzerland, the change in the stock market is greater than GDP, with an average of 1.59%, which is more consistent with the previous conclusion drawn from the chart, that is, the change in the stock market is greater than GDP.

# Regression Results

In order to further explore the relationship between the two, we regressed the model and obtained the Figure <span>link</span>, from which it can be observed that there is indeed a certain correlation between the two.

# Regression Results Table

```
                        OLS Regression Results
==============================================================================
Dep. Variable:         GDPGrowthValue   R-squared:                     0.022
Model:                            OLS   Adj. R-squared:                0.018
Method:                 Least Squares   F-statistic:                   5.361
Date:                Sat, 17 Dec 2022   Prob (F-statistic):           0.0214
Time:                        17:35:11   Log-Likelihood:              -391.29
No. Observations:                 245   AIC:                           786.6
Df Residuals:                     243   BIC:                           793.6
Df Model:                           1
Covariance Type:            nonrobust
==============================================================================
                        coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const                 0.4824      0.079      6.132      0.000       0.327       0.637
SharePriceGrowthValue 0.0250      0.011      2.315      0.021       0.004       0.046
==============================================================================
Omnibus:                       59.621   Durbin-Watson:                 1.989
Prob(Omnibus):                  0.000   Jarque-Bera (JB):           1307.480
Skew:                          -0.102   Prob(JB):                   1.21e-284
Kurtosis:                      14.315   Cond. No.                       7.50
==============================================================================
```

Figure: Regression Results Table

# Regression Results

Regarding to the results or regression $\boxed{link}$, the coefficient of $R_{GDP, t+3}$ is 0.0250, which is significant within the 95% confidence interval, which means that according to our model, for every 1% increase of GDP in t+3 period, the stock index will increase by 0.0250% in t period. This result is in line with our expectation. The stock index is positively correlated with the growth of GDP, but the growth rate is much smaller than that of GDP.

# Conclusion

Using share price data in the OECD group, we studied the long-horizon relationship between share price growth and GDP growth. Generally, the stock price increases when GDP grows in T+3 period and decreases when GDP declines in T+3 period. It may indicate the perfect capital market where the share price incorporates the future market information. However, the relationship and magnitude is **not consistent** across all sample countries.

In Switzerland, there is significantly positive between stock price growth and GDP growth. 1% increase of GDP in T+3 periods will cause 0.025% rise of share price in T period.

# Source

Get the source of this project from

https://github.com/Zion-W9/Digital-Tools-for-Finance

# Table 1: Statistical Summary

Table: Statistical Summary

| Location | GDPGrowthRate | | | | SharePriceGrowthRate | | | |
|---|---|---|---|---|---|---|---|---|
| | max | min | mean | std | max | min | mean | std |
| AUS | 4.418806 | -7.020018 | 0.837857 | 1.181453 | 21.642014 | -38.676460 | 1.704898 | 7.538439 |
| AUT | 11.232721 | -11.243786 | 0.673663 | 1.447553 | 57.487021 | -45.421095 | 1.539374 | 9.111118 |
| BEL | 11.731267 | -11.397832 | 0.645568 | 1.271786 | 20.089567 | -30.939630 | 1.654958 | 7.582937 |
| CAN | 8.983958 | -11.042537 | 0.759495 | 1.262450 | 20.383706 | -31.094573 | 1.672189 | 6.875763 |
| CHE | 7.315925 | -7.047209 | 0.551725 | 1.234857 | 17.589432 | -28.668096 | 1.593233 | 7.103834 |
| CHL | 6.665278 | -12.951959 | 0.905039 | 1.927714 | 21.824056 | -17.105582 | 1.756754 | 7.070759 |
| CZE | 6.953209 | -8.848739 | 0.627159 | 1.416782 | 24.297158 | -37.608644 | 0.918629 | 9.607779 |
| DEU | 9.004695 | -9.481134 | 0.578807 | 1.366080 | 25.897645 | -27.259745 | 1.248174 | 7.810234 |
| DNK | 5.776993 | -6.312451 | 0.578683 | 1.173001 | 24.147734 | -32.588907 | 2.724747 | 7.863246 |
| ESP | 16.637934 | -17.826256 | 0.802796 | 1.908249 | 42.641475 | -20.891714 | 2.022089 | 9.644056 |
| EST | 4.775670 | -11.798107 | 0.972202 | 2.038534 | 63.787282 | -38.600189 | 3.964411 | 15.021136 |
| FIN | 6.094493 | -6.477614 | 0.681190 | 1.510952 | 51.582402 | -29.403193 | 2.596351 | 10.345035 |

# Table 1: Statistical Summary (Cont.1)

Table: Statistical Summary (Cont.1)

| Location | GDPGrowthRate | | | | SharePriceGrowthRate | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | max | min | mean | std | max | min | mean | std |
| FRA | 18.351564 | -13.523350 | 0.654490 | 1.862877 | 25.503985 | -27.777780 | 1.642906 | 8.156255 |
| GBR | 16.608614 | -20.991373 | 0.583703 | 1.944663 | 42.213488 | -23.731214 | 1.974376 | 7.642617 |
| GRC | 10.427888 | -13.317789 | 0.664010 | 2.683935 | 82.429455 | -38.075847 | 3.418555 | 17.401837 |
| HUN | 11.900000 | -14.400000 | 0.647653 | 2.032294 | 43.123207 | -35.489609 | 3.880780 | 12.070427 |
| IRL | 21.018326 | -5.529750 | 1.254536 | 2.358158 | 41.199881 | -38.845606 | 2.351390 | 9.342773 |
| ISL | 10.067048 | -9.839834 | 0.916751 | 2.333316 | 26.033609 | -71.236371 | 2.704795 | 12.284945 |
| ISR | 9.039196 | -8.797409 | 0.991620 | 1.574280 | 28.047522 | -26.934116 | 2.442914 | 8.484191 |
| ITA | 14.476293 | -12.101330 | 0.572454 | 1.614337 | 41.689458 | -26.205626 | 1.489691 | 10.221810 |
| JPN | 5.697546 | -7.938036 | 0.866606 | 1.439967 | 25.163725 | -29.888141 | 1.600391 | 8.079274 |
| KOR | 8.061462 | -6.818022 | 1.732345 | 1.976849 | 37.779478 | -32.305365 | 2.579035 | 11.191628 |
| LUX | 8.319050 | -7.017609 | 0.875735 | 1.531374 | 32.698002 | -51.003169 | 0.648093 | 11.797765 |
| LVA | 5.748584 | -6.995186 | 0.885956 | 2.286839 | 31.419969 | -33.997673 | 3.032875 | 9.713881 |

# Table 1: Statistical Summary (Cont.2)

Table: Statistical Summary (Cont.2)

| Location | GDPGrowthRate | | | | SharePriceGrowthRate | | | |
|---|---|---|---|---|---|---|---|---|
| | max | min | mean | std | max | min | mean | std |
| MEX | 13.653575 | -17.959204 | 0.887413 | 1.890981 | 100.788728 | -51.124216 | 7.691543 | 18.606206 |
| NLD | 8.940364 | -7.904426 | 0.678117 | 1.530104 | 18.927776 | -34.219933 | 1.407653 | 7.523131 |
| NOR | 4.434557 | -5.414676 | 0.761621 | 1.214504 | 33.991223 | -39.924935 | 3.005149 | 10.131584 |
| NZL | 13.675110 | -10.393865 | 0.653112 | 1.704997 | 17.646552 | -35.670873 | 0.519457 | 6.737128 |
| POL | 6.764794 | -9.206071 | 1.013821 | 1.584297 | 34.294900 | -28.498625 | 2.329534 | 10.107595 |
| PRT | 14.588001 | -15.119497 | 0.765960 | 1.823479 | 27.409212 | -24.367060 | 1.531018 | 9.085552 |
| SVK | 9.207307 | -9.739807 | 0.914681 | 1.955863 | 174.737950 | -20.295488 | 2.147537 | 18.652152 |
| SVN | 12.617891 | -9.888565 | 0.677273 | 2.027889 | 30.793790 | -35.311504 | 1.928949 | 10.093353 |
| SWE | 7.325353 | -8.058830 | 0.639892 | 1.406531 | 39.093618 | -25.190601 | 2.683303 | 8.703745 |
| TUR | 15.649318 | -10.371753 | 1.161359 | 2.806978 | 90.295744 | -31.817736 | 5.707367 | 17.528920 |
| USA | 7.854483 | -8.484336 | 0.766620 | 1.149958 | 20.519865 | -30.435154 | 1.764790 | 6.110438 |

# References I

[4, 2, 3, 1]

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