

W U T I S

# Insider Trading - Taking advantage of SEC filings

## Algorithmic Trading

Vienna, February 2022

01

Insiders publish their transactions on the SEC website

- Economic theory suggests above market returns for insider information
- Transactions must be announced within two days

02

Data collection is the bottleneck

- Millions of transactions need to be scraped and corresponding stock data downloaded
- SEC limits access to 10 requests per second
- Running the scraping and calculations on a cloud server significantly speeds up the process

03

Insider information gives trader an advantage

- Insider knowledge, or transaction returns, rise with the rank
- Including transaction volume as a proxy for commitment further improves returns

# Project Members



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Advanced Modeling &  
Backtesting



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Data Collection



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Data Processing



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Base Modeling



- BSc Economics



focus of this presentation



not part of this semester



## Preparation

Guided by economic theory, we asked questions and imposed assumptions:

- How fast is insider information reflected in the market price?
- Why do insiders sell / buy?
- Does information rise with the insider's position within the firm?

## Obtaining data

We built a web scraper and took advantage of Google Cloud's immense computing power. This allowed us to process millions of transactions

## Training

We looked at several statistical models with different levels of complexity

## Backtesting

To evaluate our trading strategies we benchmarked it against the S&P 500 and evaluated the most common key metrics

## Automation

Future project could potentially include:

- continuously scraping the SEC website and looking for new filings
- automatic trading based on the new information within seconds

# Insiders are obliged to file their trades SEC then publishes the information



## SEC Form 4

Statement of Changes in Beneficial Ownership must be filed by insiders (directors, officers, >10% shareholder) **within two days following the transaction**

2



3

## Information included

The insiders need to report their **relationship to the company**, the type of security, the transaction volume, the type of transaction, the price of the security\* and the nature of the ownership\*

## Independent federal agency

1

The SEC's mission is to **protect investors**, facilitate capital formation, and **maintain fair, orderly,, and efficient markets**

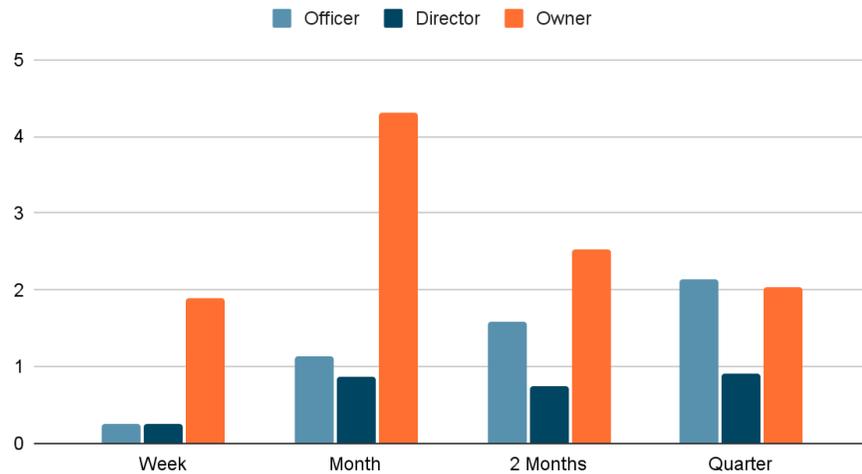
\*not included in our models

# Owners appear to make the best trades

Owners, who also may be officers or directors, outperform other ranks when looking at returns after 1 week, 1 month, and 2 months.

Not only do they outperform other ranks, they consistently beat the S&P 500 in the short term and also the long term (with the exception of 2019).

Above / below market returns - 2018



Above / below market returns - 2019



# Replicating Owner Purchases in 2020

## Performance curve

Performance 2020:  
+89.6% (14.58% SP500)



## Strategy

Each week, replicated transactions made by >10% owners<sup>1</sup>. Purchases are equally weighted.

Asset Risk metric	Strategy 1	SP500
Annual Return in %	89.6	14.58
Annual Volatility in %	35.20	31.12
Average drawdown in %	15.71	15.57
Max. drawdown in %	18.14	19.18
Sharpe ratio <sup>2</sup>	2.54	0.46

<sup>1</sup>may also be officer or director  
<sup>2</sup>4-week TB as risk free rate

# Taking Insider's Corporate Role into Account - Methodology

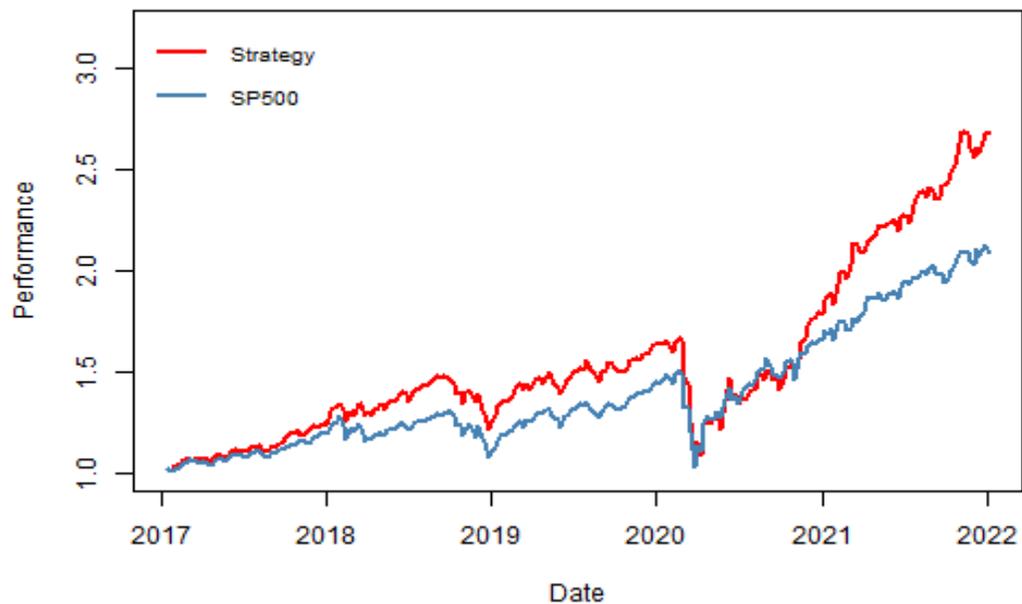
$j$ : Company;  $t$ : Week nb;  $i$ : Transaction of  $j$ 's insider during week  $t$

#	Strategy : EQUAL-WEIGHTED	Strategy : VALUE-WEIGHTED
1.	$S_i^{OWN}$ score if <i>Owner</i> = 1; $S_i^{DIR}$ score if <i>Director</i> = 1; $S_i^{CEO}$ score if <i>Title</i> = <i>CEO</i> ; $S_i^{OTH}$ score if <i>Title</i> = <i>CFO</i> or <i>Title</i> = <i>COO</i>	
2.	$S_i^{TOT} = S_i^{OWN} + S_i^{OWN} + S_i^{OWN} + S_i^{OWN}$	
3.	$S_j^{TOT} = \sum_{i,j} S_i^{TOT} / N_j$ <p>where <math>N_j</math> is the count of <math>i</math> for firm <math>j</math> in week <math>t</math></p>	$S_j^{TOT} = \sum_{i,j} S_i^{TOT} \times \log(\text{Volume}_i)$ <p>where <math>\text{Volume}_i = \text{Price}_j \times \text{Shares}_i</math></p>
4.	$\text{Weight}_{j,t} = S_j^{TOT} / \sum_{j=1}^J S_j^{TOT}$	
5.	$R_t^{STRATEGY} = X \times \sum_{j=1}^J \text{Weight}_{j,t} \times R_t^j + (1 - X) \times R_t^{S\&P\ 500}$ <p>where <math>X</math> is the % share of portfolio invested in strategy</p>	

# Taking Insider's Corporate Role into Account

## Performance curve

Performance (2017-2021):  
+166.82% (107.2% SP500)



## Strategy 2

- Additionally, adding weight to the corporate role of the Insider

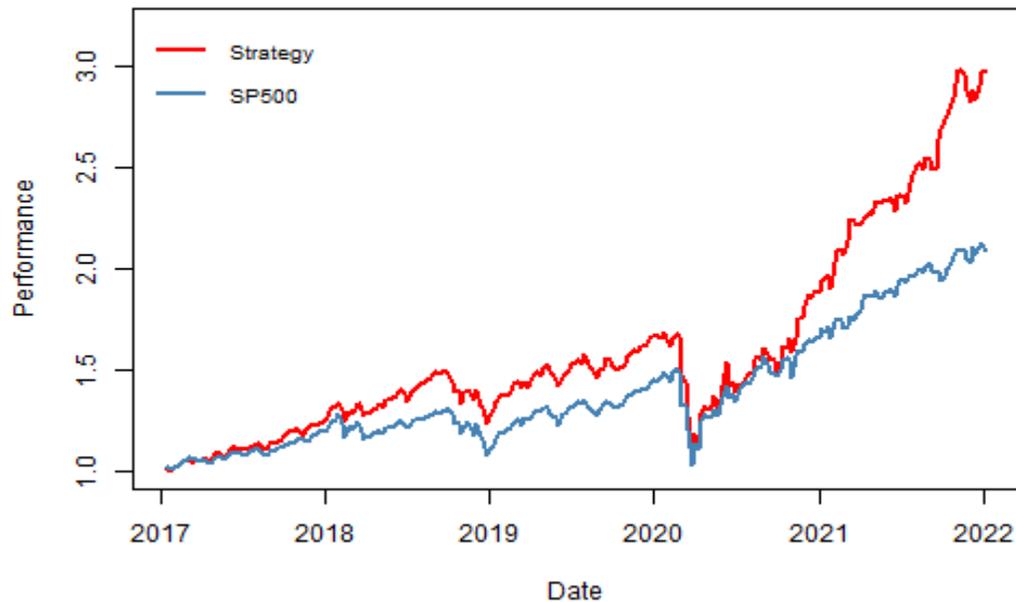
Asset Risk metric	Strategy 2	SP500
Annual Return in %	21.66	15.74
Annual Volatility in %	20.27	17.96
Average drawdown in %	19.50	17.98
Max. drawdown in %	36.99	31.81
Sharpe ratio <sup>2</sup>	1.068	0.877

<sup>2</sup>4-week TB as risk-free rate

# Taking Insider's Corporate Role and Traded Volume into Account

## Performance curve

Performance (2017-2021):  
+196.7% (107.2% SP500)



<sup>2</sup>4-week TB as risk-free rate

## Strategy 3

- Additionally, adding weight to the corporate role of the Insider & adjusting for traded volume

Asset Risk metric	Strategy 3	SP500
Annual Return in %	24.23	15.74
Annual Volatility in %	21.08	17.96
Average drawdown in %	19.24	17.98
Max. drawdown in %	36.6	31.81
Sharpe ratio <sup>2</sup>	1.149	0.877

# Regression Analysis of the Parsed Data

## Predictive Variables:

- Officer Classes:
  - CEO/President
  - Chairman
  - CFO
  - COO
  - Other Chief Officer
  - Executive Vice President
  - Senior Vice President
  - Vice President
  - Other
- times asset was traded in last 2 months
- volume traded over the last 2 months
- number of shares directly owned
- linear trend of last month

```
Call:
lm(formula = df$return_31D ~ as.factor(df$officer_class) + df$times_traded_61D *
    df$volume_traded_61D + df$past_trend_31D + df$shares_directly_owned)

Residuals:
    Min       1Q   Median       3Q      Max
-864.57  -0.07    0.00    0.06  321.16

Coefficients:
            (Intercept)                1.809e-02  2.616e-03  6.914  4.71e-12 ***
as.factor(df$officer_class)CEO/President -1.121e-02  4.650e-03  -2.411  0.0159 *
as.factor(df$officer_class)CFO          -3.118e-03  6.295e-03  -0.495  0.6203
as.factor(df$officer_class)Chairman    -2.559e-03  1.504e-02  -0.170  0.8649
as.factor(df$officer_class)COO          4.736e-03  9.759e-03  0.485  0.6275
as.factor(df$officer_class)Executive Vice President -6.073e-03  7.480e-03  -0.812  0.4169
as.factor(df$officer_class)Other        -1.202e-02  6.268e-03  -1.918  0.0551 .
as.factor(df$officer_class)Other Chief Officer -1.115e-02  5.364e-03  -2.078  0.0377 *
as.factor(df$officer_class)Senior Vice President -1.726e-02  6.956e-03  -2.481  0.0131 *
as.factor(df$officer_class)Vice President -1.014e-02  8.664e-03  -1.170  0.2419
df$times_traded_61D                    1.390e-05  1.187e-05  1.171  0.2417
df$volume_traded_61D                   -2.153e-14  7.588e-14  -0.284  0.7766
df$past_trend_31D                      -4.676e-04  2.524e-04  -1.853  0.0639 .
df$shares_directly_owned                7.247e-12  1.025e-11  0.707  0.4796
df$times_traded_61D:df$volume_traded_61D 4.346e-15  1.517e-14  0.286  0.7746
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.321 on 696738 degrees of freedom
(21044 Beobachtungen als fehlend gelöscht)
Multiple R-squared:  2.952e-05, Adjusted R-squared:  9.422e-06
F-statistic: 1.469 on 14 and 696738 DF,  p-value: 0.1133
```

# Regression Analysis of the Parsed Data

Call:

```
lm(formula = df.own$return_31D ~ df.own$times_traded_61D * df.own$volume_traded_61D +  
  df.own$past_trend_31D + df.own$shares_directly_owned)
```

Residuals:

```
   Min      1Q  Median      3Q     Max  
-1.464 -0.102 -0.019  0.058  64.233
```

Coefficients:

	Estimate	Std. Error	t value	Pr(> t )	
(Intercept)	2.614e-02	3.448e-03	7.582	3.46e-14	***
df.own\$times_traded_61D	3.584e-05	2.246e-04	0.160	0.873	
df.own\$volume_traded_61D	-6.298e-14	9.250e-14	-0.681	0.496	
df.own\$past_trend_31D	-1.772e-03	4.484e-04	-3.951	7.78e-05	***
df.own\$shares_directly_owned	8.621e-11	2.185e-11	3.946	7.96e-05	***
df.own\$times_traded_61D:df.own\$volume_traded_61D	9.195e-16	1.230e-14	0.075	0.940	

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Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.7034 on 63351 degrees of freedom

(121588 Beobachtungen als fehlend gelöscht)

Multiple R-squared: 0.0005015, Adjusted R-squared: 0.0004227

F-statistic: 6.358 on 5 and 63351 DF, p-value: 6.561e-06

**Thank you!**