Topics in International Economic History I: Historical Financial Research

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Outline

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Size Effect

Definition:

- The Size Effect theory posits that smaller firms with lower market capitalization on average tend to outperform larger companies
- the prevalent theory explaining this phenomenon is that firm size is a proxy for risk, smaller firms tend to have greater risk than larger firms [2]
- First observed in 1981 by Banz [1]
- since 1980's no effect measurable in several empirical Studies [4, 3]

Baten Paper

Data

- Three Subperiods: pre-WWI, WWI and aftermath & post-WWII
- 775 companies from five different German stock exchanges
- challenges:
  - survivor bias
  - limited availability of data

Methodology

- Sharpe-Lintner Capital Asset Pricing Model (CAPM)

$$R_{pt} - R_{ft} = \alpha_p + \beta_p \cdot (R_{mt} - R_{ft}) + \varepsilon_{pt}$$

Results

- during times of uncertainty (wars, crises), investors favor large established companies

Outline

Idea

No Regression-Analysis

Regression analysis **not suitable**, since almost no information besides price and number of shares.

- compare development of average prices for Large-Cap vs Micro- & Small-Cap
  1. identify quarters where Large-Cap Companies outperform Market (+10%)
  2. compare average Micro- & Small-Cap for explicit quarters
- mean growth of Micro- & Small-Cap $>$ Large-Cap $\rightarrow$ Size Effect

only short time spans

Entirety of duration neglected, because than comes down to decisions in single companies and thus not suited for generalisation.

Statistical Methods

1. Cluster Analysis
   - investigate if certain companies share growth characteristics
   - explain solely those groups
   - otherwise no obvious similarity in growth patterns
2. perform Size Effect Analysis across all companies
   - identify significant quarters
   - calculate mean & variance for each capitalisation category
   - compare growth rates
   - repeat for extreme losses

Data

Data (from API using python library *bf4py* [5]) includes:

- stock prices from **boerse-frankfurt.de**
- 320 publicly traded German companies
- end-of-day prices for last 13 years
- number of shares $\rightarrow$ market capitalisation

separation into four categories (in €):

- **Micro-Cap**: $<$ €30 M
- **Medium-Cap**: €200 - 1.000 M
- **Small-Cap**: €30 - 200 M
- **Large-Cap**: $>$ €1 B

Data Engineering

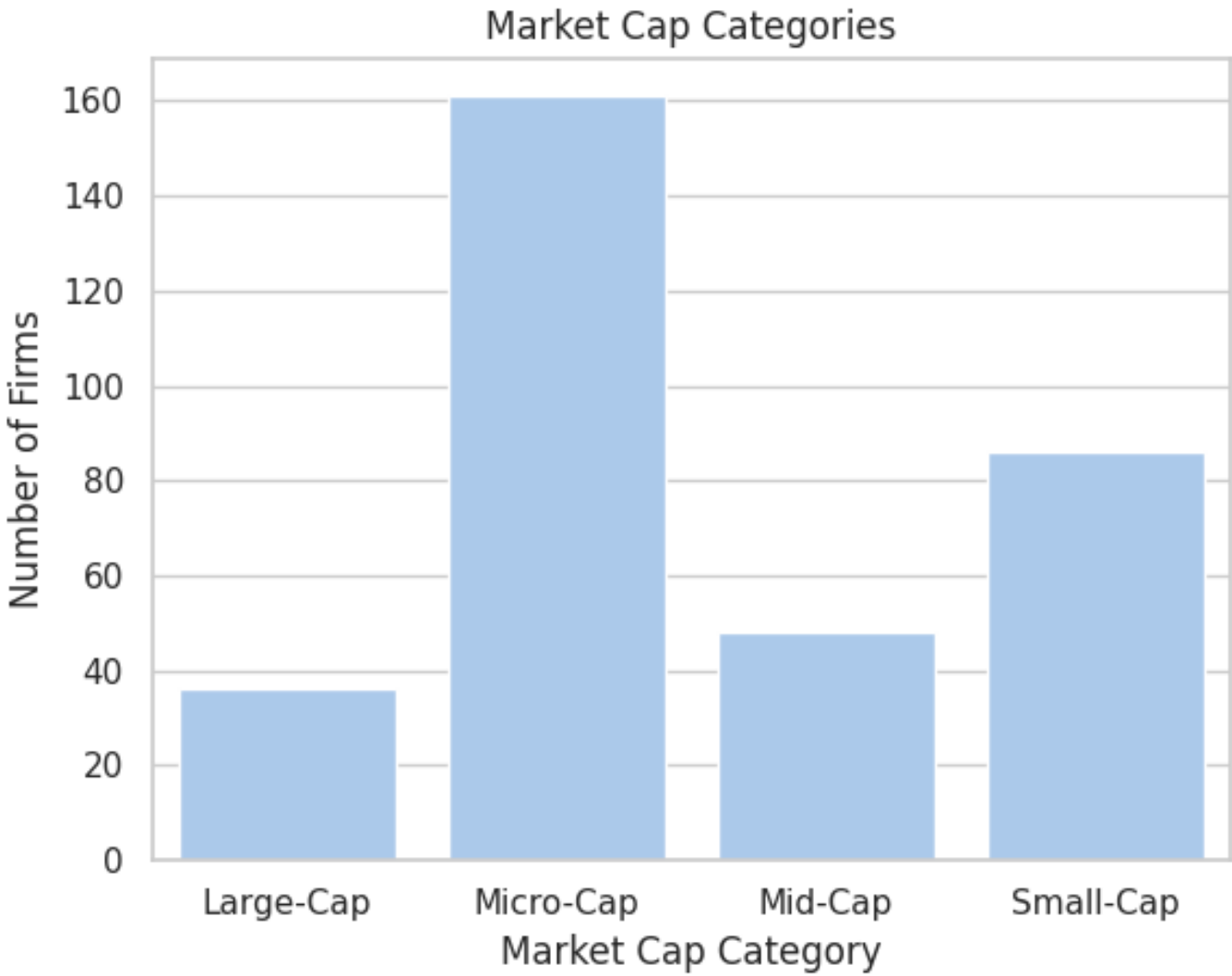
Problem stock splits

Only relative price changes are used. If a stock split occurs, the "growth" rate is exponential. Therefor the values are interpolated.

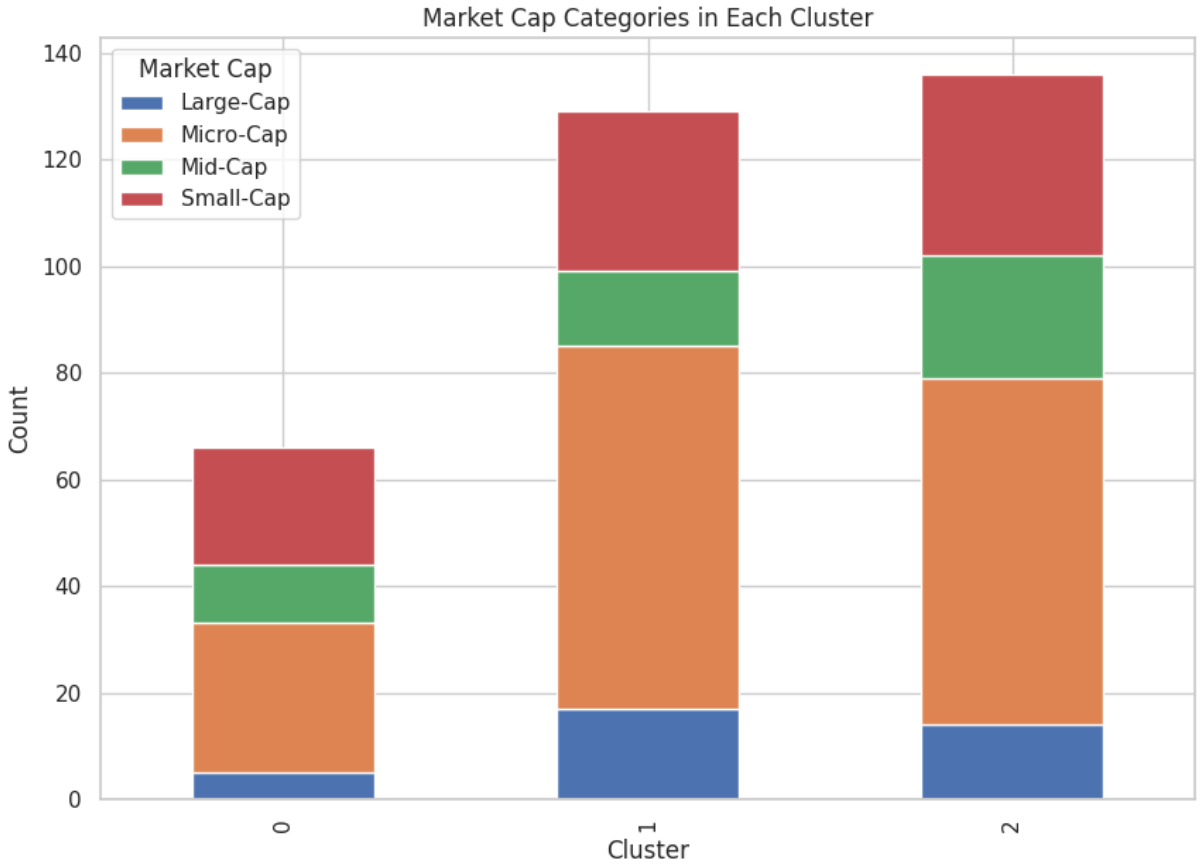
After interpolation, the quarterly changes are almost normally distributed:

Outline

Descriptive Analysis

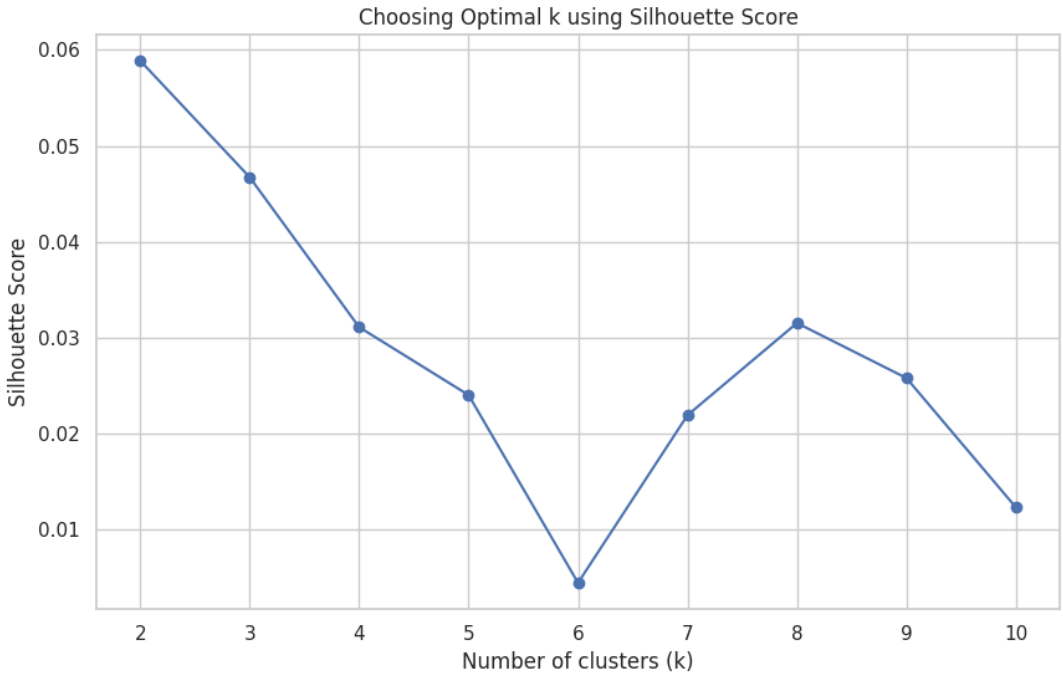


Cluster



Interesting observation, one cluster almost without Large-Cap

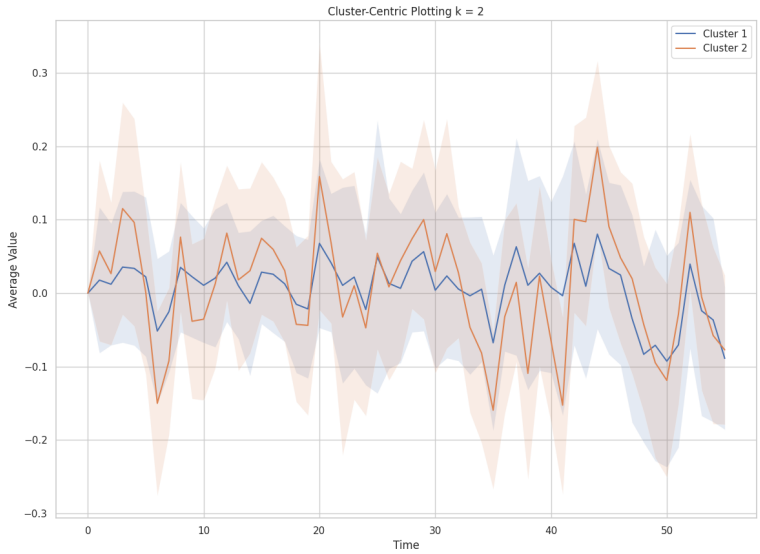
Cluster II

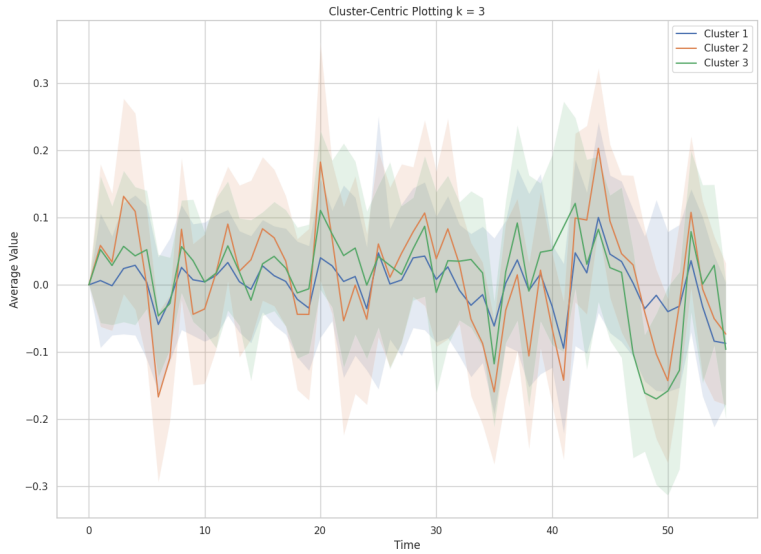


- focusing on $k = [2, 3]$ since they have the highest score

- **2 groups**: Large-Cap vs Micro- & Small-Cap
- **3 groups**: Large-Caps vs Micro-Cap vs Small-Cap

Cluster III





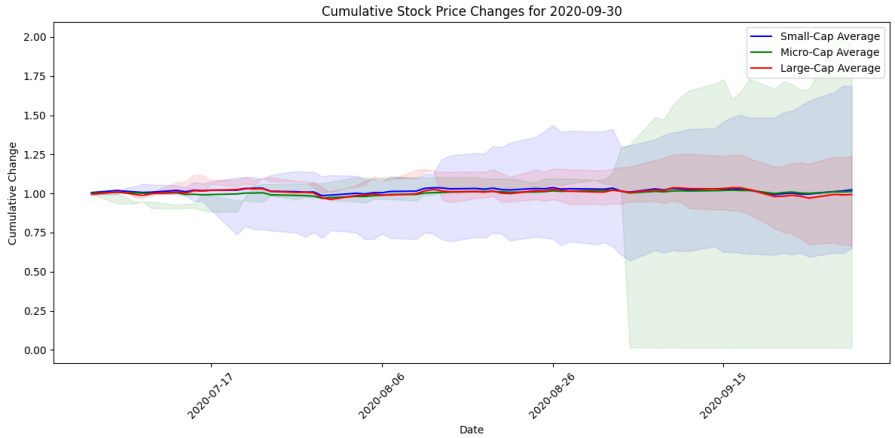
- no obvious differences between clusters in either graph
- more similarities with random walk
- hence **no additional information** to be gained

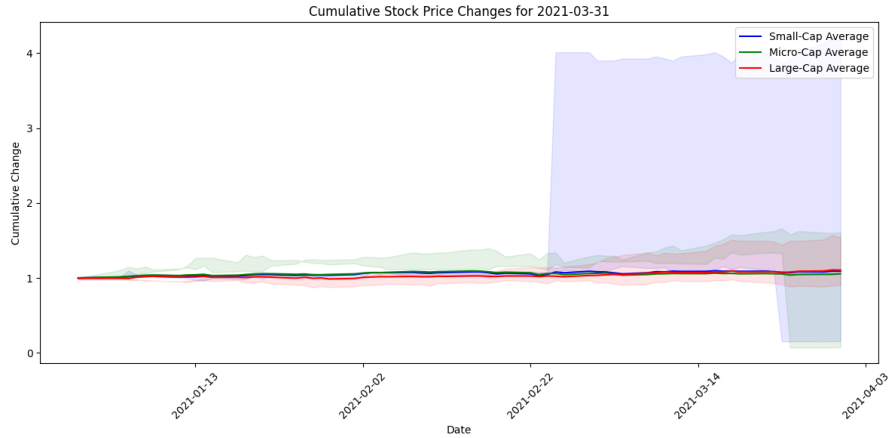
Size Effect

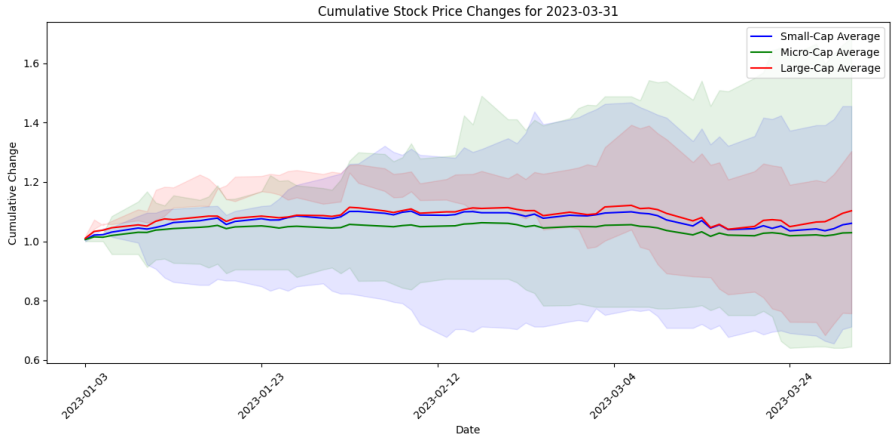
Quarter	Size Effect	No Size Effect
Growth		
2020-09-30		X
2021-03-31		X
2023-03-31		X
Loss		
2022-09-30		X

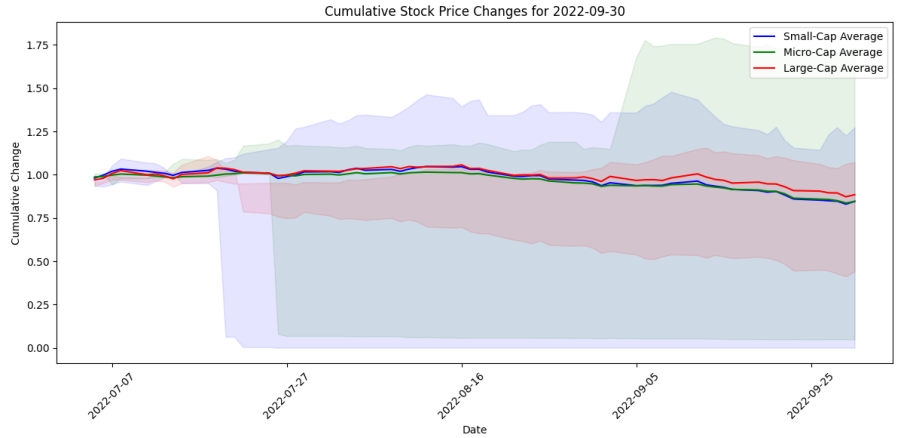
- evident that beneficial to invest in larger corporations in 4 out of 4 cases
- **no Size Effect measurable** under given criteria

Size Effect II









- no divergence for mean identifiable
- variance explodes for Small- & Micro-Cap

Size Effect III

Quarter	Large-Caps Sharpe Ratio	Small-Caps Sharpe Ratio
Growth		
2020-09-30	0.623	0.254
2021-03-31	0.589	0.743
2023-03-31	0.632	0.190
Loss		
2022-09-30	−1.137	−1.031

Table: Sharpe Ratios for Large-Caps and Small-Caps during Growth and Loss Periods

Sources

[1] Rolf W Banz. "The relationship between return and market value of common stocks". In: *Journal of financial economics* 9.1 (1981), pp. 3–18.

[2] Michael A Crain. "A literature review of the size effect". In: *Available at SSRN 1710076* (2011).

[3] E Dimson, P Marsh, and M Stuanton. "Investment style: Size, value and momentum". In: *Credit Suisse global investment returns sourcebook* (2011), pp. 41–54.

[4] Eugene F Fama and Kenneth R French. "Size, value, and momentum in international stock returns". In: *Journal of financial economics* 105.3 (2012), pp. 457–472.

[5] joqueka. *bf4py*. https://github.com/joqueka/bf4py. 2021.