

Construction of the Fama-French-Carhart four factors model for the Swedish Stock Market using the Finbas data

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Abstract: This document explains the construction of the four-factor model using stock price and accounting data of Swedish listed companies following the Fama and French (1993) and the Carhart (1997) four-factor model. It uses data from the Finbas dataset collected and distributed by the SHoF National Data Center Website from 1983 to 2019. The variables used to construct stock portfolios and risk factors are defined and explained in detail.

¹ For feedback and questions please contact the SHoF National Data Center.
(<https://support.data.houseoffinance.se/>)

Table 1. Swedish Stock Market Segments

Market Name	Description
ATORG	Aktieorget
EXTERN	SSE External List
FONDH	Swedish Securities Dealers Stock List
IM	Innovations Market
INOFF	Unofficial quotations list
NGM	Nordic Growth Market
NOROTC	NGM Nordic MTF
NYAMAR	SSE New Market
SSE	Stockholm Stock Exchange
SBI	SSE Information
SSEA2	SSE A2-List
SSEA2U	SSE Foreign stocks
SSEFN	SSE First North
SSELAR	SSE Large Cap
SSEMID	SSE Mid Cap
SSEOBS	SSE

Figure 1. Number of listed assets

2.2. Variables

This subsection explains the definitions of the variables used to construct the size, value and momentum factors. The variables defined below, excluding the risk-free rate and the market return, are computed for each stock separately.

We follow the methodology used in Asness et al (2013) for the construction of size, value and momentum portfolios. They refresh the size, book-to-market and momentum breakpoints every month and consistently rebalance the factor portfolio at the same frequency.³

Return on the asset ()

To compute the return on stock i we use the last bid price of that stock during a day, which we will call the bid price for brevity. The bid price is adjusted for corporate actions such as stock dividends and stock splits.

The daily, weekly and monthly return on the asset are computed as the difference between the bid price in the current period and the bid price in the previous period divided by the bid price in the previous period. For weekly and monthly returns, the last bid price in the last day of the week and the month are used. The following formula is used to compute the return on stocks:

$$R_{i,t} = \frac{P_{i,t} - P_{i,t-1}}{P_{i,t-1}}$$

and number of days in the month, respectively. The following formulas are used for the estimation of daily, weekly and monthly risk-free rate:

$$r_{i,t} = \frac{1}{360} \ln \left(\frac{P_{i,t} + \frac{C_{i,t}}{360}}{P_{i,t-1} + \frac{C_{i,t-1}}{360}} \right)$$

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Market Return ()

We use the SIX Return Index to compute return on the market. The index is a value-weighted index of all stocks listed at the Stockholm Stock Exchange and includes reinvested dividends. The daily, weekly and monthly market returns are computed as the difference between the index in the current period and the index in the previous period divided by the index in the previous period. For weekly and monthly market returns, the last index value of the week and the month are used. The following formula is used for the estimation of daily, weekly and monthly market return:

$$R_{i,t} = \frac{I_{i,t} - I_{i,t-1}}{I_{i,t-1}}$$

Market Equity (ME)

Market equity is computed as bid price times the number of shares, excluding treasury shares. From 2000, companies have been allowed to repurchase their own shares but repurchased shares, also called treasury shares, do not have the right to receive dividends and have no voting power. Therefore, they are excluded when market equity is calculated. When there are two classes of shares, as A and B shares, the number of shares for each class is calculated separately and then they are added together to calculate the total market cap of the company. Therefore, the total market cap of the company is the same across A and B shares. If a stock class (A or B) is not quoted on the exchange, the price for the most traded stock class is used instead. Preference shares are included in the market equity if the ordinary shares also are listed. If only the preference shares are listed, no market equity value is calculated. Market equity is computed at the end of each month.

Book Equity (BE)

Book Equity is taken from the annual or interim reports. Before 1993, book equity was not included in the annual report as a single value but its components (taxed reserves, untaxed reserves and equity), were reported separately. Therefore, before 1993, we compute book equity as:

$$BE_{i,t} = (S_{i,t} + R_{i,t} + U_{i,t}) - D_{i,t} - P_{i,t}$$

Starting from 1993, book equity is reported as a single value.

Book-to-Market ratio (BE/ME)

Book-to-Market ratio (BE/ME) is computed by calculating BE divided by ME at the end of each month. We use the most recent book values, from both annual and interim reports, with a minimum lag of six-months. We drop companies that do not have a book value in the previous calendar year.

One-year Return ()

For the one-year return used to form momentum portfolios, we follow Asness et al. (2013) and estimate it as the return over the prior 12 months, skipping the most recent month. We use the last non-zero price 12

Table2. Portfolio sorts and breakpoints

Set	Sort	Breakpoints
2 x 3 sorts	6 HML portfolios on Size and BE/ME	Size: 80 th percentile BE/ME: 30 th and 70 th percentiles
2 x 2 sorts	4 UMD portfolios on Size and 1-year Return	Size: 80 th percentile Return: 10 th and 90 th percentiles

4. Construction of Factors

In this subsection, we define how size, value and momentum factors are constructed.

The size (SMB) factor is the average return on the 3 small portfolios minus the average return on the 3 big portfolios:

$$\text{SMB} = (\text{SG} + \text{SN} + \text{SV}) / 3 - (\text{BG} + \text{BN} + \text{BV}) / 3$$

The value (HML) is the average return on the 3 value portfolios minus the average return on the 2 big growth:

$$\text{HML} = (\text{SV}_{\text{vw}} + \text{BV}) / 2 - (\text{SG} + \text{BG}) / 2$$

The momentum (UMD) is the average return on the 2 high return portfolios minus the average return on the 2 low return portfolios:

$$\text{UMD} = (\text{SW} + \text{BW}) / 2 - (\text{SL} + \text{BL}) / 2$$

